Regulatory Docket File

NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

CONSOLIDATED EDISON COMPANY OF
NEW YORK, INC.

(Indian Point Number 2)

Docket No. 50-247

Place - White Plains, New York

Date - Tuesday, 5 October 1976

Pages 72 - 294

Telephone:
(Code 202) 547-6222

ACE - FEDERAL REPORTERS, INC.

Official Reporters

415 Second Street, N.E.
Washington, D. C. 20002

NATIONWIDE COVERAGE

10452

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

\- - - - - - - - - - - - - - - - - - x

In the Matter of: :

CONSOLIDATED EDISON COMPANY OF : Docket No. 50-247

NEW YORK, INC. :

(Indian Point Number 2) :

\- - - - - - - - - - - - - - - - - - x

Westchester County Courthouse
Courtroom 100
111 Grove Street
White Plains, New York

Tuesday, 5 October 1976

Hearing was convened pursuant to notice in the above-entitled matter at 9:00 a.m.

BEFORE:

SAMUEL JENSCH, Esq., Chairman, Atomic Safety and Licensing Board.
R. BEECHER BRIGGS, Member.

FRANKLIN C. DAIBER, Member.

APPEARANCES:

MICHAEL GRAINEY, Esq., Nuclear Regulatory Commission, Washington, D. C.; on behalf of the Regulatory Staff.

SARAH CHASIS, Esq., on behalf of the Hudson River Fishermens Association, National Resources Defense Council, 15 West 44th Street, New York, New York.

APPEARANCES (Continued)

WERNER KUHN, Esq., on behalf of the New York State Atomic Energy Council, New York State Department of Environmental Conservation, 80 Wolf Road, Albany, New York.

EDWARD J. SACK, Esq., Consolidated Edison, 4 Irving Place, New York, New York; LEONARD J. TROSTEN and EUGENE FIDELL, LeBeouf, Lamb, Leiby & MacRae, 1757 N Street, N.W., Washington, D.C., on behalf of Consolidated Edison.

MS. DAVIS.

blt

C O N T E N T S

E X H I B I T S

P R O C E E D I N G S

CHAIRMAN JENSCH: Please come to order.

This proceeding is an evidentiary proceeding convened in accordance with an order to convene evidentiary proceeding which was issued September 24, 1976 setting this time and place for the convening of the proceeding.

The order convening this evidentiary hearing was given public distribution which included publication in the Federal Register on September 30, 1976, as reflected by Volume 41 of the Federal Register at page 43,256, continuing over to page 57.

The date selected generally is in accordance with a prehearing conference which was convened here in White Plains on September 22, at which time consideration was given to the possibility of hearing on October 6 or 7, but subject to the availability of the space.

There was no space available.

In view of the crowded court calendar at Westchester County, they provided for the use of this ceremonial courtroom on today, Tuesday, October 5.

All parties were immediately informed of that change in date from the 6th to the 5th.

The media were likewise generally informed by the public information section of the Nuclear Regulatory Commission.

This date was intended for two particular aspects.

One, the presentation of statements by way of limited appearance.

Second, presentation of evidence in support of the request by Consolidated Edison Company of New York, Inc., for the determination of the preferred alternative closed cycle cooling system.

Since our prehearing conference which was held on September 22, the Board has received a copy of the stipulation signed by the parties to the proceeding which stated that the license amendment requested by Consolidated Edison Company of New York, Inc., also designated as either the licensee or the Applicant, should be granted that license amendment sought. The determination of preferred alternative closed cycle cooling system as a natural draft wet cooling tower.

The stipulation also provided that the agreement reflected thereby is without prejudice to the right of the licensee to assert in other proceedings that the installation of any closed cycle cooling system would be justified or to seek other relief that might be appropriate.

The stipulation stated that the parties were not able to agree whether all governmental approval required to proceed with the construction of the closed cycle cooling system had been granted, what with the effect of the licensee's failure to have received all such approval by

jon

red

December 1, 1975, necessy for, if necessary, the scope of the monitoring program to record large episodic occurrences around the cooling tower should they occur.

I take it the document which was transmitted to the Board by the National Resoruces Defense Council, September 29, is the original of the stipulation and, therefore, probably should be transmitted directly to the Public Proceeding Branch of the Nuclear Regulatory Commission to be filed as an official document.

However, I think it would be helpful for the record -- it is a rather short document, four pages -- if the reporter would copy the document into the transcript at this place and then forward to the Chief of the Public Proceedings Branch for his filing of the official document in the proceeding.

(Document follows.)

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point Station, Unit No. 2)	Docket No. 50-247 (Selection of Preferred Alternative Closed-Cycle Cooling System)

STIPULATION FOR PARTIAL SETTLEMENT OF PROCEEDINGS AND IDENTIFICATION OF REMAINING ISSUES

WHEREAS the Nuclear Regulatory Commission (Commission) has recognized that the public interest may be served through the fair and reasonable settlement of particular issues in a proceeding or the entire proceeding (10 CFR Section 2.759); and

WHEREAS the parties to this proceeding (Hudson River Fishermen's Association ("HRFA"), the New York State Atomic Energy Council ("NYSAEC"), Consolidated Edison Company of New York, Inc. ("the Licensee"), and the NRC Staff ("Staff")) wish to settle particular issues and to identify other issues related to this proceeding.

IT IS HEREBY STIPULATED by and among the counsel for the above-identified parties that:

1. The license amendment requested by the Licensee, which would add a new subparagraph 2.3(5)[1] to

Facility Operating License No. DPR-26 ("the license"), should be granted. The parties are in agreement that, on balance, the preferred alternative closed cycle cooling system for installation at Indian Point Station, Unit No. 2 is a natural draft, wet cooling tower. This agreement is without prejudice to the right of the Licensee to assert (in other proceedings) that installation of any closed cycle cooling system would not be justified or to seek such other relief as may be appropriate.

2. The parties are at present unable to reach ag agreement on the following issues, which are related to the proposed license amendment:

a) whether all other governmental approvals required to proceed with the construction of the closed cycle cooling system have geen granted, as provided in subparagraph 2.E(1)(b)[2] of the license;

b) what is the effect of the Licensee's failure to have received all of such governmental approvals by December 1, 1975 on the date for cessation of operation with once-through cooling in accordance with subparagraph 2.E(1)(b) of the license; and

c) the necessity for and, if necessary, the scope of a monitoring program to record large episodic occurrences of bird mortalities around the cooling tower should they occur.

3. This stipulation shall be binding upon

a) any successor-in-interest to the Licensee or any future co-licensee who shall come to hold or have any interest whatsoever in the operating license and

b) any successor-in-interest to any of the parties hereto as if such successor-in-interest had been an original party hereto, and shall remain in effect among the parties hereto and their successors-in-interest regardless of the addition or substitution of parties to the proceeding.

4. This stipulation shall not be final and binding upon the parties hereto until it has been approved by the presiding Atomic Safety and Licensing Board.

[1] "(5) Subject to all of the foregoing provisions of this Paragraph 2.#., the Nuclear Regulatory Commission has determined, following review of the document entitled "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2" dated December 1, 1974, that a closed-cycle natural draft, wet cooling tower system is the preferred alternative closed-cycle cooling system for installation at Indian Point Unit No. 2".

[2] "(b) The finality of the May 1, 1979 date also is grounded on a schedule under which the Applicant, acting with due diligence, obtains all governmental approvals required to proceed with the construction of the closed-cycle cooling system by December 1, 1975. In the event all such governmental

approvals are obtained a month or more prior to December 1, 1975, then the May 1, 1979 date shall be advanced accordingly. In the event the Applicant has acted with due diligence in seeking all such governmental approvals, but has not obtained such approvals by December 1, 1975, then the May 1, 1979 date shall be postponed accordingly".

Signed:

Sarah Chasis, for Hudson River Fishermen's Association.

Michael Curley, Esq., by Werner P. Kuhn for the New York State Atomic Energy Council, on behalf of the New York State Energy Office.

Edward J. Sack, for Consolidated Edison Company of New York, Inc.

Stephen H. Lewis, for the NRC Staff.

Dated: Sept. 29, 1976.

CHAIRMAN JENSCH: Since the parties have stipulated in this regard, I think it is very helpful to a consideration of the matters we have in this proceeding.

There are some aspects, as the Board indicated at the prehearing conference, however, the Board would like to direct to the parties.

But, before doing that, I wonder if we may have a statement of appearances on behalf of the parties and, secondly, an announcement of people who are here who desire to make statements by way of limited appearance.

MR. SACK: Con Edison is represented by Edward J. Sack. My address is 4 Irving Place, New York, New York. And with me also is Ms. Joyce P. Davis of the same address.

Also representing Con Edison this morning is Mr. Leonard Trosten of the firm of LeBeouf, Lamb, Leiby & MacRae, 1757 N Street, N.W., Washington, D.C.

MR. GRAINEY: My name is Michael W. Grainey. I represent the Commission Staff. Our address is U. S. Nuclear Regulatory Commission, Washington, D.C. 20555.

MS. CHASSIS: My name is Sarah Chassis, and I represent the Hudson River Fishermens Association. My address is the Natural Resources Defense Council, 15 West 34th Street, New York, New York 10036.

CHAIRMAN JENSCH: Thank you.

Is there any other appearance on behalf of any

jon

party to the proceeding?

(No response.)

I hear no such request.

Are there any persons present here who seek to present statement by way of limited appearance?

(No response.)

I hear no request.

We requested the space today for the accommodation of many persons who indicated they might like to be present. The spaces are unoccupied except for seven or eight persons whom I believe are all associated with one or more of the parties to the proceeding.

If, during the course of the proceedings there are any persons present who seek to present statement by way of limited appearance, we will try to accommodate them.

That being the status of the proceedings for the moment, will the Applicant address matters that Applicant -- or, rather, the licensee believes should be considered at this proceeding?

CR9939
CRAIG
1
gin 2

Are there any persons present here who seek to present a limited appearance?

MR. SACK: First a different matter than originally thought we would have to address this morning.

At some point, maybe this is the appropriate point, I would like to eiscuss the forms of the Initial Decision which has been submitted by the parties.

We just received FRHA's Initial Decision the end of last week, and we saw the Staff's proposed Initial Decision this morning. In both cases they propose a form of order which is inconsistent with the form of the order to which they stipulated to in the stipulation.

As the Chairman correctly described the stipulation, it says that the parties agree that the license amendment requested by Con Edison should be granted; however, the order that has been proposed by both of these other parties is not the one requested by Con Edison but is a different form than they stipulated to.

This, I would submit, is a violation of the stipulation, and the appropriate remedy would seem to be that the Board should disregard entirely these recommendations by the Staff and FRHA in violation of the stipulation.

I appreciate the Board is not bound by the stipulation, but certainly the parties should be. And when the parties submit something inconsistent with that to which

blt 2

they agreed, the Board should disregard it.

I appreciate we have time to respond in writing to these proposed Initial Decisions, but that is one issue that might be clarified this morning.

In addition, in the proposed orders from the other parties, the proposed decisions, the other parties requested a detailed findings of environmental impacts. Now, as the stipulation notes, the parties are in agreement on the end result. We all agree that the preferred system is a natural draft cooling tower. On the other hand, there is considerable disagreement on the details of the environmental impacts.

For example, the HRFA proposal says there is no serious injury from salt damage from a natural draft tower. Well, Con Edison disagrees with that. Our analysis has shown that there will be some damage in periods of drought.

The Staff's proposed Initial Decision summarizes the Staff's Final Environmental Statement in great detail, and then has a provision that the Board adopt the Final Environmental Statement as its own.

As you will see in the Final Environmental Statement, Con Edison commented extensively that they disagree with the Staff on many of the details of the Staff's assessment of damage, so that if the Board feels that detailed findings of these environmental impacts are blt3

necessary in order to conclude that a natural draft is the preferred system, then I am afraid we will have to have an evidentiary hearing of some length because there is disagreement on these issues.

On the other hand, I think the better solution would be as is proposed in Con Edison's Initial Decision, simply make a finding that on the basis of all of the record the natural draft is the preferred system and not make findings on the details about which there is considerable disagreement.

CHAIRMAN JENSCH: Are there any other items besides the salt damage to which you point out --

MR. SACK: This is the only one that is in HRFA's assessment. In the Staff's there are a number of items. I went through and made several. And keep this in mind, Mr. Chairman, I just received this a half-hour ago, so this can't b3 considered detailed.

CHAIRMAN JENSCH: You will have an opportunity to expand it in your written response, but if you will just give us, if you can, some --

MR. SACK: I think the list is fairly complete.

First, on page 7 they say that wet-dry mechanical draft cooling tower is a viable alternative. We believe it is not a viable alternative.

They say a circular mechanical draft would be a

blt 4

viable option, and we believe that is not a viable option.

Item 8, two types of fan-assisted natural draft cooling towers are feasible. I believe our assessment was that these would not be feasible as a backfit for a large operating plant.

These are all in our comments on the Draft Environmental Statement.

As for -- then they discuss the major environmental impacts, and they propose the finding none of these factors are likely to be of sufficient magnitude to cause rejection of any of the cooling tower types. Now, that is different from the Con Edison analysis, which says that of the two types that we consider feasible, mechanical draft and natural draft, that salt and noise are both reasons for rejecting mechanical draft as an alternative.

Then there is a finding on page 11 that noise can be moderated by passive noise abatement methods such as vegetative screening and man-made barriers. Our sound experts say there is no way of abating noise that does not also at the same time reduce the cooling capacity of the tower.

The Staff on page 12, the Staff concluded that the major environmental impact of cooling towers, Indian Point site, is one of visual impact arising from the size of the structure and from the plume when it is visible. We

blt 5

believe that probably equally important is the salt damage, and our real estate appraisers thought that there were -- that there was a greater impact on property values from salt depositing than from aesthetics.

On page 13 there is a paragraph, reducing the amount of water withdrawn from the river will have long-term effect of maintaining or improving certain species. Well, that is not -- that gets into the biological side of the case, which is not part of this proceeding, and there is really nothing in the record to support that kind of statement except a bold assertion of that nature in the FES.

And also in the same page, the Staff concluded that the benefits to be derived from closed-cycle cooling system outweigh the potential impacts on the environment. That also is not supported by the record of this proceeding. There is nothing in the FES that contains a benefit-cost analysis to support that conclusion, and we believe that is not appropriate for this proceeding.

On page 16, at the last part of the sentence that -- the conclusions of law, they seek a conclusion -- the Board to make a conclusion of law that the closed-cycle cooling system which must be constructed by the Applicant to comply with the requirements of Subparagraphs 2.e.(1) and 2.e.(2) of Operating License DPR-26. There is nothing in the record of this proceeding that a closed-cycle cooling

blt 6

system must be constructed.

And then, when it gets to the order, instead of the order that Con Edison proposed, simply stating that the natural draft cooling tower is the preferred alternative, which is what they stipulated to, they say it is ordered that the Director of Nuclear Reactor Regulation is authorized to amend facility operating license DPR-26 to require the construction of a natural draft cooling tower in compliance with requirements of Subparagraph 2.e.(1) and 2.e.(2) of license DPR-26. As the Board well knows, there is nothing in license DPR-26 that has language saying that it requires the construction of a natural draft cooling tower.

In ALAB-188 the Appeal Board specifically declined to make that kind of statement, and there is certainly nothing in the record of this proceeding that justifies changing that.

If this proceeding were to get into the issue of whether a closed-cycle cooling system is required, that, of course, is a major issue that is still unresolved and would open up a very extensive proceeding; but that is not part of this proceeding, which is a limited proceeding under the license which required Con Edison to file the type of application we filed in December 1974, simply to designate which type of system is the preferred system after analyzing economic and environmental impacts of alternative

blt 7

closed-cycle cooling systems.

CHAIRMAN JENSCH: In other words, your thought is that the question of construction is still wide open, and the determination you seek is that if there were to be a closed-cycle cooling system the natural draft cooling system would be the preferred one to construct? Is that correct?

MR. SACK: That is correct. That is the sole purpose of this proceeding.

As to the necessity of the cooling tower, that is governed by ALAB-188 and the present license, which has a certain degree of ambiguity, I would admit, but it is not up to this proceeding to resolve that question.

End2

jon1

#3

CHAIRMAN JENSCH: Would the Regulatory Staff care to speak to that?

MR. GRAINEY: Yes, I do, Mr. Chairman.

There are a number of specific points with which I take issue with Mr. Sack.

I would like to give some background as to the Staff's position in this regard.

The first point is that in the Staff's view the ordering clause that we have suggested to the Licensing Board is both consistent with the stipulation and is consistent with the intent of the existing Unit 2 license.

Specifically, the parties have agreed, for whatever reasons, that the natural draft cooling tower is the preferred system for the Unit 2 site.

Now, as the counsel for the Applicant is aware, there were differences between the Staff and the Applicant in the reasons for the choice of the natural draft tower.

However, these do not go to the basic conclusion; both the Staff, for its own independent reasons, and the Applicant and the other parties to this proceeding agreed that the natural draft tower was the preferred alternative.

Consequently, I see nothing in the proposed findings which are inconsistent with that.

The proposed findings, rather, would reflect precisely what this hearing would reflect today if we go ahead with the evidentiary hearing, namely, the Applicant puts in his environmental report or application, the Staff puts in its final environmental statement.

Before this discussion, I did not intend to ask any additional questions. I anticipated the record would reflect difference of opinions between the Applicant and the Staff on these subsidiary points.

I don't know what questions any of the other parties or the Board had in mind to explore these differences, but I assumed that the purpose, one of the purposes of this hearing is not simply to rubber-stamp the stipulation, but for the Board to explore with the parties in an evidentiary manner the reasons to make sure that the public policy concerns which extend beyond the parties of interest and parties involved is adequately represented, just like this Board did in the Unit 3 proceeding and which procedure was explicitly approved by the Commission in affirming this Board's decision in the Unit 3 Case.

Consequetnly, I think that the proposed findings, both that I have filed and that Ms. Chassis has filed, are not only responsive and consistent with the stipulation, but I think are the type of searching -- what we would hope to be the result of the searching inquiry that this Board would make with regards to the stipulation itself and the reason for the choice of natural draft towers.

I would point out that the order that the Applicant has offered gives really no reasons at all for the choice of the natural draft tower other than that the parties have agreed to it.

I suggest that the Board, both under the National Environmental Policy Act and under the Commission's regulations, Part 51, once an evidentiary hearing has been convened, would have to do more than that, would have to explore the reasons.

In my findings and in Ms. Chassis' findings, we have offered our view of the reasons that this Board should adopt the stipulation that the parties have agreed to.

We recognize that the stipulation, being a stipulation, is a compromise of the parties' interests. And that not all the views that each of us have on subsidiary points are agreed to by the other parties.

But that is the purpose of a stipulation, and, as I always understood it when this Board went behind a stipulation it is required to make srue that public policy considerations are not being violated in any way, that these are the types of questions you would be asking and what we are looking for.

Secondly, I would like to go to the question of whether the ordering clause itself that I have proffered in my proposed initial decision is consistent with the license.

This, I think, is a very important point and I take issue with Mr. Sack on his interpretation of requirements of the Unit 2 license.

If I understand Mr. Sack correctly he is saying that the Unit 2 license does not require closed cycle per se, that Unit 2 license leaves that question open.

And he made specific reference to Appeal Board Decision 188.

I think, if you will recall, the subsequent Appeal Board Decision, Appeal Board Decision 287, also made that point, that that decision was left open.

If you will recall, when the Commission was reviewing that case, the Staff, and I believe the other parties as well, specifically objected to that characterization.

We argued that in fact that question was not open, under NEPA that question would not be left open, that you could not in effect grant an operating license for 40 years, but only do a cost/benefit analysis on the impact of fish and other aquatic impacts for only five years or six years and, in fact, the Commission specifically adopted that point in modifying ALAB 287.

I would like to point out two specific passages to the Board in that regard. This is from the Commission Decision, December 2nd, 1975.

jon5

First it refers to Appeal Board Decision 188.

It says: "Accordingly, the Appeal Board conditioned effectiveness of the operating license upon the installation of a closed cycle system by 1979. Subject to the Applicant's right to seek to reopen the question on the basis of the empirical data collected during once-through operation."

This is from page 836.

Further down that page it states, referring to the Unit 3 license and stipulation which was patterned on the Unit 2 license: "In essence the stipulation calls for installation of closed cycle cooling for Unit Number 3 after five years of operation, subject to possible reopening of that question pursuant to the stipulation and Commission's rules of practice. Unless the matter is thus reopened, there will be no further need to re-examine the question whether some form of closed cycle cooling is required by the stipulated deadline, now September 15, 1981."

The Commission explicitly held that both for Unit 2 and Unit 3, barring the Applicant coming in with new information, closed cycle question had been decided, it had been decided in favor of some type of closed cycle system.

This requirement is explicitly reflected in the Unit 2 operating license.

There are two paragraphs from that license I would like to read. One is Paragraph E sub 1 states: "Operation of Indian Point Unit 2 with once-through cooling system will be permitted during an interim period to a reasonable termination date which now appears to be May 1st, 1979. Then such interim operation is subject to the following conditions" -- which I will -- are not relevant to the immediate discussion.

The second paragraph I will read is from Paragraph E sub 2 which states: "Evaluation of the economic and environmental impacts of an alternative closed cycle cooling system shall be made by the licensee in order to determine the preferred system for installation. This evaluation shall be submitted to the Atomic Energy Commission by December 1st, 1974 for review and approval prior to construction."

Again the words I want to underline are "in order to determine preferred system for installation."

What we are involved with here is not an academic contest as to which type of cooling system in the abstract would be the preferred system for a site like Indian Point.

The Staff made the recommendation that closed cycle cooling had to be imposed at Indian Point.

Throughout the protracted hearings on Unit 2 and through the stipulation of Unit 3 it is clear that barring some new application by the utility with new data which they keep referring to that they hope to come in with, the closed cycle requirement which the Commission has proposed both on Unit 2 and Unit 3 is a requirement that is a standing requirement for the utility to comply with.

I think that is evident both from the stipulation in Unit 3 which was since incorporated in the license, and the Unit 2 license itself which indicates that if the Applicant does come in with an application for an exemption or such other additional extension of the once through operation such application by itself does not stay the effectiveness of the closed cycle cooling requirement.

In other words, it specifically recognizes that the Applicant as any utility can come in at any time and request an amendment to the license.

Because of the strong public policy considerations involved in this case, both the stipulation to Unit 3 and the Unit 2 license recognized that the other parties, regardless of what position the Staff would take, should have a right to a hearing. But that is all.

It does not state effectiveness of that condition in any way.

Consequently, the ordering clause that I have suggested for this Board, which states that the Director of Nuclear Regulation is authorized to amend facility operation licensed PR-26 to require the construction of natural draft cooling tower in compliance with requirements of subparagraphs 2(e)(1) and 2(e)(2) of licensed PR-26 is consistent with that intent.

Whether or not we used the specific words in the license which Con Edison proposed in thier application I think is irrelevant.

The Staff certainly has no objection to that wording.

We signed a stipulation. We will agree to that.

I think counsel for the Applicant is quibbling over words which are not important.

What is important is that the selection of the natural draft cooling system is not an academic exercise but then is a necessary requirement of the Unit 2 license, and barring affirmative action by this Commission in the form of either this Licensing Board or Commission in review of presumably a future request by the Applicant for an exemption, the Applicant must go ahead, and when it gets the decision of the Board with respect to the type of closed cycle system, it should go ahead and, in our review, beginning construction so that closed cycle operation in fact can begin at the time that it is required to under the license.

I would also like to address either at this point or at a later time if the Board would like two questions the Board indicated it would like briefs on. I prefer to respond to that orally. Namely the question of the failure to have all regulatory approvals by the end of 1975, what that does to the time delay for initiation of closed cycle cooling in question.

And the question of what regulatory approvals are required.

I could do that now or later.

CHAIRMAN JENSCH: Why don't you do that now.

MR. GRAINEY: All right. Fine.

In the Staff's opinion the only regulatory approvals that are required by 1975 and that are still pending is essentially this approval by this Board as to which type of closed cycle system must be imposed.

I think all else within the NRC as far as the Commission is concerned has been decided.

And with specific reference to the Commission decision I quoted earlier, I think it is clear that the Commission has decided that closed cycle cooling system must be imposed absent some affirmative action by the utility to demonstrate -- it must demonstrate first before there is a change of that requirement that closed cycle cooling would not be required.

Consequently, the only requirement still pending is this Board's decision on which type of preferred system and subsequent ratification by the Appeal Board and Commission.

Secondly, with respect to the question by the

Village of Buchanan, I do not believe there is in any way a pending matter which would bar initiation of construction vis-a-vis the Village of Buchanan.

On the question of zoning, as the Board is aware from the last prehearing conference, the Board of Zoning Appeals denied Con Ed's request for a variance and for permission to begin construction of a tower at the Con Ed site at the Indian Point 2 site.

That position was reversed by the Supreme Court for the County of Westchester, which is the first court of general jurisdiction in New York.

I would like to quote from the last paragraph of that decision because I think it is clear from that decision that it is not simply a remand to determine whether Consolidated Edison should have a permit.

The question is clear that the Village of Buchanan cannot under federal and state laws as interpreted by the Supreme Court of New York prohibit Con Ed from beginning construction.

And this is from the deicison of November 14, 1975 and that court states:

"Accordingly, it is the decision of this Court thaet the actions of respondents in requiring petitioner, in this case Con Ed, to seek a building permit and in attempting to regulate or porhibit construction of a closed cycle cooling system contravene the supremacy clause of the United States Constitution and are thus illegal and void. Petition is granted to the extent respondents, in this case the Village of Buchanan, are enjoined from enforcing or attempting to enforce provisions of the zoning code as against construction by petitioner of a closed cycle cooling system at its Indian Picnt Number 2 facility."

That is the law in the State of New York today. Granted it has been appealed to the Appellate Division.

In New York there are two potential reviews, Appellate Division and the Court of Appeals.

Nevertheless, that law is in effect. That order is in effect. There is no state pending appeal that has been granted to my knowledge.

I think the situation htere is precisely analogous to the situation where you have in many NRC licensing proceedings where a construction permit is authorized by an initial decisioin and then the parties file exceptions and appeal.

Ordinarily the utility in that case does not hesitate at all to begin construction while the appeal is pending.

In fact, the Commission's rules explicitly authorize the effectiveness of that license barring a stay issued either by the Licensing Board which granted the decision or by the Appeal Board.

Consequently I see no reason with respect to the Village of Buchanan, that question why Consolidated Edison cannot begin construction at this time, given the fact, if this Board approves the type of preferred closed cycle system.

blt 1
Begin 4

I suggest all other major approvals have been given to Con Edison to begin construction. One other possible question is the question of EPA approval. This may -- as the Board may or may not be aware, EPA in issuing Section 402 discharge permit, by the terms of that permit it required closed-cycle cooling be employed. Consolidated Edison, as pursuant to Section 316-A of the Federal Water Pollution Control Act appealed that determination, and the determinations are sustained pending resolution of the matters in dispute in an adjudicatory hearing, which as I understand it now the estimate is for approximately May of next year.

However, what that is is not a regulatory requirement in the Staff's view but rather what Con Edison attempted to do there is get a waiver from an existing requirement which would in fact require construction of closed-cycle cooling.

Consequently, there is no bar in terms of the EPA proceeding for Con Edison to begin construction. If Con Edison were to withdraw their request from EPA at this moment for an adjudicatory hearing in that matter, I can assure you that EPA would not raise any objection at all to Consolidated Edison beginning construction. There is no additional permit EPA would have to issue to authorize construction of the closed-cycle system.

Secondly, I would like to deal with the question

blt 2

of what does the phrase "postpone accordingly" mean in the stipulation and in the two licenses. I think it is clear from the pending of this proceeding itself that obviously all regulatory approvals were not received by the end of 1975. Does that mean that under the terms of the license the requirement for beginning closed-cycle cooling is postponed accordingly?

The question is, is that a day-for-day slip? Is it more? Is it less? I suggest that that is really an evidentiary question, a question that depends on the facts.

As I believe Mr. Sack indicated in a letter to the Licensing Board, in their opinion a delay of, say, 30 days could, in getting the regulatory approval, could actually result in a construction delay of possibly 60 days or more -- for example, if it occurred in bad weather. I think in the abstract that proposition is true. On the other hand, it is also true that it could work the other way, that because of the timing, if in fact the weather is good when the regulatory approval is finally reached and the initial construction schedules anticipate beginning construction during winter, then it is possible the regulatory delay would be less than the time that was actually involved in getting approval from the agency involved, in this case the NRC.

I think that is a question of fact that hopefully the parties could stipulate to. I think it is a question

blt 3

of fact that is reflected in the license condition itself, which indicated that in the process of getting the regulatory approvals if these were received before the 1975 deadline that the beginning of closed-cycle cooling would be advanced accordingly.

I think there is inherent flexibility there that depends on the factual situation. I would hope that this is something that the parties could stipulate to, that there would be no need for taking of evidence on, that as a result of when this Board's decision is given, once the parties have a clear date then as to when the last regulatory approval has been given, the parties can sit down and stipulate to how much time, additional time, is Consolidated Edison really entitled to. Is it day-for-day; is it more; is it less?

And I think this is something we could work out, consistent with the Unit 2 license, and that the Director of Regulation could then authorize in an amendment to the license.

If, however, the parties could not stipulate to that, I think that is a matter for this Board under its jurisdiction, under both this case and under the question of two-year extension of once-through operation, has jurisdiction. I think its authority is clear under 10 CFR 2.717(B) because the license involved is the Unit 2 license and it is

blt 4

a subject of both proceedings. I think it would be perfectly proper to either consider it in this proceeding if the proceeding is still pending or in the Unit 2 once-through two-year extension application.

Finally, with respect to the question of should this hearing be bifurcated, the Applicant has filed a motion objecting to the way this hearing is set up. The Staff believes that the Board acted properly in bifurcating the hearing the way it did. In fact, we would suggest additional bifurcation. We think this Board can decide after the hearing that begins today the question of what is the preferred closed-cycle cooling system that is required to meet the requirements of the Unit 2 license. Once that decision is made, I think that is the only decision you need decide in the context of the Final Environmental Statement and the license application that is pending before you.

I think the question of what regulatory approvals are required and what does the term "postpone accordingly," the interpretations of when the closed-cycle requirement begins and open-cycle operations ends, are questions this Board need not but can properly defer until the scheduling question of the once-through two-year extension application is brought before the Board. That will be brought before the Board presumably in the next few months. If you note, the Draft Environmental Statement has been issued. The

blt 5

Staff is in the process of preparing the Final Environmental Statement. I think from the nature of this proceeding, where it deals explicitly with possible extension of time from 1979 to 1981, an extension of open-cycle cooling, I think that is the type of proceeding where these questions of regultory approvals and scheduling are more appropriate. So that if this Board wanted to defer those issues to that hearing, I think it would make sense. On the other hand, I would not object if the Board simply continued the procedure you are doing now of possibly convening another session of this hearing after it is decided which system is the preferred closed-cycle system and treat the scheduling issues then.

I think you can treat it in either manner, but it seems from the Staff's point of view it makes sense to treat it in a second application that has to deal with the two-year extension of once-through cooling.

That concludes my remarks.

CHAIRMAN JENSCH: Very well.

VOICE: Mr. Chairman, I'm sorry I was a little bit late. I'm County Legislator Ed Gibbs, and I have a statement i would like to submit for the record. I won't take any more of your time. I would like to have these in writing.

CHAIRMAN JENSCH: If you will give them to the

CRAIG
blt

WESTCHESTER COUNTY BOARD OF LEGISLATORS
803 County Office Building
White Plains, New York 10601
(914) 682-2326
Edward M. Gibbs
Legislator, 1st District
25 No. Division Street
Peekskill, New York 10566
Chairman,
Committee on Legislation
Member, Committee on Community Affairs
October 5, 1976
Samuel W. Jensch, Chairman
Atomic Safety and Licensing Board
c/o Westchester County Court House
White Plains, New York 10601
Dear Chairman Jensch:

Please submit the following statement as part of the record of the evidentiary hearing on October 5, 1976, relating to the proposed closed cycle cooling system at Indian Point. The Westchester County Board of Legislators representing the nearly 900,000 people of Westchester County has, by unanimous resolution on two separate occasions, called for alternatives to the cooling towers being considered for the Indian Point Nuclear Plants 2 and 3 in Buchanan, New York.

blt 2

In addition, the Westchester County Board of Legislators has, by resolution, unanimously supported the NRC Staff position that construction be delayed until 1981 so that other alternatives may be further explored.

The objections raised by officials and citizens of Westchester County have not been addressed in the Final Environmental Statement of the NRC. No conclusive study was ever made to determine the potential health hazard created by the saline mist in relation to persons with respiratory problems. Further, the potential effect on the economics of this heavily populated area will be disastrous. Millions of dollars in property values will be lost producing an incalculable economic hardship which is difficult to balance against protecting fish which cannot be eaten because of the PCB content of the river's water.

The ultimate insult to the magnificent Hudson River would be the construction of 570-foot high towers which would spew saline mist into the atmosphere and change the ecological balance of the lower Hudson Valley.

I call on your honorable board to reject this proposal in the interests of equity, justice and, certainly, common sense.

Very truly yours,

Edward M. Gibbs (ss)

Edward M. Gibbs

CRAIG
blt 1

The Senate
State of New York
Albany 12224
Senator Bernard G. Gordon
37th District
Chairman, Committee on Judiciary
Legislative Office Building
N. Y. S. Capitol
Albany, New York 12224
518-427-2027
1019 Park Street
Peekskill, N. Y. 10566
914-PE 7-1100-1

October 1, 1976

Samuel W. Jensch, Chairman
Atomic Safety and Licensing Board
c/o Westchester County Court House
White Plains, New York

Dear Chairman Jensch:

By order dated September 24, 1976, an evidentiary hearing has been scheduled for October 5, 1976, to consider certain environmental factors concerning the preferred alternative closed-cycle cooling system at Indian Point.

I would like to reiterate my comments to this Board that the environmental statements submitted thus far

blt 2

are inadequate, particularly since they fail completely to consider possible alternative closed-cycle systems which might be available as more advanced technology is developed in this rapidly changing field.

The Final Environmental Statement prepared by the Nuclear Regulatory Commission fails to adequately answer my objections to natural draft cooling towers raised over one year ago. I urge this Board to reconsider its determination as to the preferred type of closed-cycle system to be used, or to defer requiring such a system until technological advances permit construction of a less costly, less unsightly and less environmentally unsound system.

Very truly yours,

(ss) Bernard G. Gordon

BERNARD G. GORDON

BGG/ms

blt 7

MR. KUHN: Your Honor, I apologize for being somewhat late to the hearing this morning. I wish to note the appearance on behalf of New York State. My name is Werner P. Kuhn, Associate Counsel with the New York State Department of Environmental Conservation.

CHAIRMAN JENSCH: The Hudson River Fishermens Association, do you desire to speak?

I take it your position, Mr. Grainey, is that the stipulation that has been submitted here is not to be considered solely on the terms presented, but in the entire context of the proceedings, including the previous decision as well as the license conditions?

MR. GRAINEY: Yes, sir, that is correct.

CHAIRMAN JENSCH: It would serve no purpose just to say if anybody -- in other words, you feel this determination is consistent with the previous indications and considerations by the parties and the Commission itself that require in your judgment construction of a cooling system, and this is the preferred system now being selected, and now all we have to do is go ahead?

MR. GRAINEY: Yes, sir, that is the Staff's position?

CHAIRMAN JENSCH: Ms. Chasis.

MS. CHASIS: I would like to speak for the Hudson River Fishermens Association.

blt 8

The Fishermen concur with the Staff's view of this proceeding as it arises in accordance with the license and would only like to add that in its decision of December 2, 1975, the Nuclear Regulatory Commission stated that:

"No further consideration of once-through versus closed-cycle question is necessary for either unit."

I think that that, in addition to the other language which Mr. Grainey quoted and the explicit terms of the Indian Point 2 license requirement, make clear that closed-cycle cooling is required for the Indian Point 2, absent a ruling on a license amendment proposed by Con Edison which would alter that license condition.

We agree that this proceeding is restricted to the question of what type of closed-cycle cooling, and the basic question of once-through versus closed-cycle cooling has not arisen therefore, and in that sense we concur with the licensee on that point.

Because of our position concerning what this proceeding deals with, it is our position that our proposed order contained in the proposed Partial Initial Decision we submitted to you is consistent with the license as it presently stands, and with the basic tenent of the stipulation entered into among the parties, which is that the natural draft wet cooling tower is the preferred alternative

blt 9

closed-cycle system.

So we take, we basically disagree with the licensee's characterization of our proposed order being out of line with the stipulation entered into by the parties.

CHAIRMAN JENSCH: That stipulation in your judgment obviates any consideration about mechanical draft cooling towers and the noise problems and so forth that other types may generate, that the stipulation, by suggesting a preferred natural draft cooling tower, just concentrates the entire attention to that one type. Is that correct?

MS. CHASIS: Yes, sir, we do agree with that. We feel that the Board, in order to adequately judge the adequacy of the stipulation, and make a determination as it is required to do that the stipulation is in the public interest, must consider the alternatives and environmental impacts of those alternatives, and that a lengthy evidentiary hearing is not required for such a determination to be made.

I believe that the situation that arose with respect to the Indian Point 3 stipulation is a good analogy. There was a lot of disagreement among the parties as to really whether or not closed-cycle cooling would ultimately be required. But the parties were able to agree on certain bottom-line conditions for the license. And the hearing that occurred in that proceeding was a restrictive

blt 10

one and really went to the question of what was in the public interest.

And I think that we can follow that kind of approach in this proceeding today. I will choose to address the question of whether or not all regulatory approvals required to proceed have been received by Con Edison in the brief which we intend to file next week.

I would only like to respond to Mr. Grainey's suggestion that perhaps the other issues which the stipulation indicated the parties had not reached agreement on be deferred to another proceeding. I would like to respond by saying that it is the Fishermens' position that the question of whether or not all regulatory approvals required to proceed should be decided by this Board, not as part of its Initial Partial Decision, but in a following decision. We take this position because we feel that in order to assure that there are no impediments which the licenses may raise to initiation of construction, such a decision by this Board is required, so that we would favor dealing with that second issue as soon as we have completed consideration of the question of the type of system when the Board has issued a decision on that question.

CHAIRMAN JENSCH: Very well.

I take it the State of New York didn't hear the A-plicant's position. Perhaps we would ask the

blt 11

Applicant if it would care to respond to some of the statements before we ask the State of New York to speak.

Are you prepared to do that, Mr. Sack?

MR. SACK: Well, first, I won't treat these in necessarily chronological order, but I'm really shocked at Mr. Grainey's statement that it is irrelevant to use the words of the stipulation.

Now, gentlemen, the Staff has signed this document. The document says the license amendment requested by the licensee which would add a new subparagraph 2.e.(5) to facility operating license No. DPR-26 should be granted. Then there is a footnote that sets forth the amendment we requested.

The idea that, having agreed that this amendment should be granted, they can now present a different amendment, and then say it is irrelevant --

End 4

CHAIRMAN JENSCH: I take it the term irrelevant may have been one of these hasty decisions in a private conversation.

It might have carried over to this public presentation.

As I understood Mr. Grainey, he was saying that really the controlling factors are the license conditions and the determination by the Commission, and insofar as any language of the stipulation may seem to be at some difference from those two, for instance, references that the Commission decisions of the license conditions should be construed --

MR. SACK: Let's hope irrelevant was just an unfortunate choice of words.

I would say any variation from this language, which they agreed is appropriate, is improper, is inconsistent with the stipulation.

If Mr. Grainey says it is simply a matter of words, very good, let's use the words we all agreed to.

CHAIRMAN JENSCH: Wait a minute. My thought there, Mr. Sack, it would really be up to the Board to decide what should be accepted from the stipulation and is the stipulation in the public interest.

So Mr. Grainey and the other partiss have signed a document that may be a little in conflict with the license conditions, you would expect, would you not, that the Board would guide itself by what it felt was the proper course by accepting the Commission's decisions and license conditions?

MR. SACK: That's correct. The Board is not bound by the stipulation. But we submit that Mr. Grainey is bound since it was signed by, I believe, his associate Mr. Lewis.

Let's look at how Con Edison structured the requested amendment.

Mr. Grainey read to you the license conditions. The amendment requested by Con Edison conformed precisely to the license conditions under which we filed the Application. And we requested the amendment that a wet cooling tower system is the preferred alternative closed cycle system for installation at Indian Point 2.

That is almost a precise paraphrase of the license and it is what this hearing is about.

Once you put in owrds like "required for installation," you are introducing another concept.

Now, if Mr. Grainey and Ms. Chassis feel that the Commission's decision in the Indian Point 3 Case has some bearing on this, and re some issues, very good, that decision speaks for itself. It means whatever those words mean. And there is no necessity to incorporate or to try to work that language somehow into the Indian Point 2 license.

I submit that the decision at Indian Point 3 was in a different docket, a different proceeding, and it cannot be used to reverse the Appeal Board decision in Indian Point 2 which remains the law of the case for the Indian Point 2 proceeding.

As far as the necessity for making detailed environmental findings, the regulations don't require such detailed findings, and the National Environmental Policy Act does not require getting into the details of each of these environmental impacts which are in contention among the parties.

If you follow Mr. Grainey's suggestion of saying what the Staff has found on these matters, then you would also have to say what the Applicant has indicated on these matters.

Once you have those two positions laid out in detail in the initial decision, you would have to reach some conclusion. You couldn't just leave them hanging unless the Board felt that it could just then make a finding that it was unnecessary to resolve these conflicts because there was general agreement that natural draft is the preferred system.

As far as the issue of regulatory approvals is concerned, the Board requested a brief on that subject. It was due tomorrow. And the brief will be submitted tomorrow. And that discusses Con Edison's positions in detail. And I believe there is any reason to get into that today except one point that I would like to mention is that Mr. Grainey kept mentioning the Licensing Board's decision, and, of course, as you are well aware, what we need is a license amendment which is issued by the Commission.

And so the key event in obtaining a regulatory approval is not the decision of the Board, it is the issuance of the amendment by the Commission.

I would like to reserve time to see if there are any other issues we have to pick up.

CHAIRMAN JENSCH: Would the State of New York care to speak to any of these matters?

MR. KUHN: Very briefly, your Honor.

Basically we agree with the characterization by the Fishermen and by the NRC Staff that this is the only regulatory approval that remains in order for Con Edison to go forward with the building of a closed cycle cooling system.

With respect to the question of whether or not -- what the date is to which the postponement should occur, I agree that that should be the subject of discussion among the parties.

I think that discussion could occur relatively rapidly in terms of going over schedules, building schedules.

As you know, we agree that it is not necessarily a day-for-day postponement, but, rather, that it is a postponement that would take into account the desire to have closed cycle cooling implemented as rapidly as possible while, on the other hand, to permit adequate time to construct the necessary facilities.

I am somewhat concerned by the NRC Staff's suggestion that this particular proceeding hold off determination on that date in order to permit action by this Board or another Board on the request by Con Edison to have a two-year delay in the date by which closed cycle cooling has to be implemented.

I have to be refreshed. Is it this Board that is going to be considering this question with certainty at this point? Is it before your Honors, that particular question?

CHAIRMAN JENSCH: I would only infer that the general assignment of this case to the Board would include all factors related to it.

MR. KUHN: I see.

For the following reason we have seen a considerable amount of delay with respect to this specific question of the type of closed cycle cooling with regard to the issuance of final environmental statements, draft environmental statements, and so on.

I think we are several months further down along the road than we thought we would be in terms of considering this question, based upon discussions with NRC STaff, for example, earlier this year as to whether the draft environmental statements would be out.

I would respectfully suggest that we not hinge any decisions that are required here on any future issuance of a Final Environmental Statement.

Your Honors may have seen comments by various parties on the draft environmental statement. I think it is fair to characterize those comments as pointing out certain substantive and substantial deficiencies at least from the commentor's point of view in that draft statement, and we have no way of knowing at this point how rapidly or how adequately the Staff is going to be able to address those deficiencies.

That being the case, I would suggest that we attempt in this proceeding to come to grips with the problem and to give Con Edison the guidance which it apparently requires to have a date certain as rapidly as possible in terms of the date by which Con Edison will have to implement closed cycle cooling, assuming that there will be a postponement in that date.

CHAIRMAN JENSCH: Excuse me. I have understood Mr. Grainey's position to be this -- correct me if I am in error, but he is suggesting that this proceeding for the matters presently under consideration go forward to a determination of whether the stipulated closed cycle cooling,

jon7

whether draft cooling tower is the preferred method, period.

That would presumably indicate to Con Edison that it should go forward with all due speed.

Now, if there is a further hearing, perhaps dependent upon the issuance of the FES, that may well determine -- I don't use this term in any derogatory sense, but that may well determine how Con Edison will -- I don't like the word -- drag it out, extend the time for completion of construction.

And they may not go forward in some phases of the procurement if they establish a later date.

But, until that has been determined, Con Ed should go right ahead as if there has been nothing to indicate any change.

Is that your position?

MR. GRAINEY: Yes, sir.

CHAIRMAN JENSCH: All right.

MR. KUHN: I misunderstood it.

There may be no need to set a terminal date at this time and it may be appropriate to await that further determination.

I think it is our concern that Con Edison move forward in implementing determination which your Honors will be making shortly concerning the type of closed cycle cooling system and be able to implement that in view of the various relevant orders.

In intering into the stipulation we were not at all certain whether all of the questions that are listed under Paragraph 2 on page 2 of that stipulation, and running over to page 3, are necessarily before your Honors.

That is the reason that it was stated in this way in terms of simply that these were questions that we did not reach agreement on and which are in some way related obviously to the proposed license amendment.

And in particular the question of whether or not all governmental approvals required to proceed with the construction of the closed cycle cooling system have been granted.

We think it would be very useful for your Honors to consider that question again as you have determined to do so but, again, we don't see it as being necessary in order to grant the requested license amendment.

Thank you.

MR. BRIGGS: I have a question for Mr. Grainey.

Could you tell us whether the Final Environmental Statement concerning extension of operation will be issued?

What is the status of that statement?

MR. GRAINEY: It is under review.

If I could have a moment, I could confer with my people and try to give you an estimate.

(Pause.)

We are estimating late November, December, for publication.

MR. BRIGGS: By the end of the year.

MR. GRAINEY: Yes, sir.

There is one point I believe I misspoke myself on earlier when I was addressing the question of regulatory approvals indicating that the decision by this Board is the one required; in the Staff's opinion the only remaining regulatory approval.

I believe I might have said that would have to be affirmed by the Appeal Board, Commission.

The Staff's view would be that while that is, of course, true over the long term, that the initial decision would be effective immediately and so unless that decision were explicitly stayed by this Board or Appeal Board, that that decision granting this, determining which type of closed cycle system, is the only outstanding regulatory approval required.

CHAIRMAN JENSCH: We so understood.

MR. SACK: Just one other point. I had wanted to pick up on this two-year, the idea of deferring consideration of the scheduling matter for the two-year extension proceeding, that this should be resolved as part of this proceeding, to delay it for what now appears to be an even longer time would leave Con Edison in a position where it would have to speculate and guess on resulution of issues, and that is neither proper nor what is required by the terms of the license.

CHAIRMAN JENSCH: May I interrupt?

I have had the impression that the parties have presented this matter in this sense. The present structure of the license conditions and the Commission's determinations is such that there is a requirement for the construction of a closed cycle cooling system and that selection of the kind will be made in a proceeding such as this.

And there is a specific date for determination of what cooling.

That is the present structure and, as I understand the parties, we go from there.

Now, if Con Edison believes facts exist to justify the extension of the termination of the once-through cooling, it is privileged to present an application and have a hearing to present facts to justify that change.

But the present structure does not require anything more than the immediate proceeding, a determination of what is the preferred closed cycle cooling.

So while apparently the FES will not be out for some time, if you desire to proceed prior to that, I presume you could, and present your application for an extension of time of the termination of the once-through cooling.

But that is kind of a burden and activity you will initiate. And that there isn't anything contengent in the entire structure to date other than what is the preferred closed cycle cooling system.

MR. SACK: Let me give what my views of the present structure are.

These are Con Ed's views.

The license, first of all, requires us to pursue -- well, first of all, it only requires termination of operation of once-through cooling.

It is silent on the question of requiring closed cycle cooling.

CHAIRMAN JENSCH: In other words, you would accept a shutdown at the termination of the once-through cooling unless it has been extended; is that your view?

MR. SACK: No, that is not my view. That is just what words of the license say.

Those words have to be read in context with the Appeal Board decision which , as ordered, and when you read that Appeal Board decision you have a requirement as I have described in other proceedings as requiring Con Edison to pursue two separate tracks simultaneously.

On one track I call the cooling tower construction program. And that is the analysis, the economic and

jon

environmental impacts of alternative closed cycle cooling systems, submitting the report to the Staff and to others, and getting the approval, and this proceeding is part of that track.

At the same time, the Appeal Board did look with considerable favor on our ecological study program, and that program is required as a condition of the license. and the Appeal Board showed great interest in that program, and we are required to pursue the ecological study program to determine whether closed cycle cooling system was necessary, was supported by adequate data.

Now, pursuant to that program we filed an application in June of 1975, over a year ago, for the two-year extension.

So we have filed that application, and we are very seriously concerned about this recent delay that was just announced here a few minutes ago because it is important to get that resolved at the same time we are resolving this question so that these two tracks will begin to come together.

Now, the effect of the first track, requiring termination of operation, the effect of requiring us on that track with the long delay that has occurred in processing these applications, the effect of that license provision is to require Con Edison to continue on the cooling tower construction program even perhaps to the point of commencing

jon

actual construction.

So the effect of the license provision is to have construction of the closed cycle cooling system even though it is not a specific requirement.

I think that is all.

Does that respond to your question?

CHAIRMAN JENSCH: What was the language Ms. Chasis read from the Commission decision on the stipulation of Indian Point 3, the last portion?

I think it referred to Indian Point 2 as well.

MS. CHASIS: I will read that again

Unfortunately I don't have the page citation.

CHAIRMAN JENSCH: That is all right.

MS. CHASIS: The Commission stated "No further consideration of the once-through versus closed cycle question is necessary for either unit."

CHAIRMAN JENSCH: Either unit referred to Indian Point 2 or Indian Pint 3; is that correct?

MS. CHASIS: That's correct.

MR. SACK: To the extent they mentioned Indian Point 2, that was highly improper. That was not before them in that proceeding.

CHAIRMAN JENSCH: Well, you understand the Commission's jurisdiction is quite pervasive.

Wasn't there some presentation that the stipulation of Indian Point 3 should be considered in the light of what the parties had already developed in Indian Point 2, so that because there had been such an extensive presentation on ecological matters in Indian Point 2, the parties decided to stipulate in Indian Point 3 because, and based upon, perhaps, what had transpired in Indian Point 2.

So the parties had interrelated the two cases somewhat themselves, and I take it the Commission built upon that premise presented by the parties.

MR. SACK: Well, no, sir. The parties didn't interrelate the proceedings. The idea was that it was -- it would have been a waste of time and effort on everyone's part to go into the environemntal issues in Indian Point 3 which had just been extensively litigated in Indian Point 2 and would probably reach the same result.

So the parties agreed to accept a license condition which paralleled very closely the license condition in Indian Point 2, with all of its possibly ambiguities in the license condition.

Then the Appeal Board, in reviewing that stipulation, said that they approved the stipulation and they added that they considered whether or not a closed cycle cooling system is required to be an open question.

CHAIRMAN JENSCH: I take it the Commission disagreed with that.

MR. SACK: Well, the Hudson River --

CHAIRMAN JENSCH: You didn't file any exception or call the attention of the Commission to this language to which Ms. Chasis has just referred; you didn't mention that to the Commission and say, "Mr. Commissioner, you keep out of Indian Point 2," you didn't say that?

MR. SACK: As you are aware, Mr. Chairman, we don't have the opportunity to comment after a decision is reached.

The only remedy is to go to the Court of Appeals.

CHAIRMAN JENSCH: I had the impression that some proceedings the paper work continues a bit even after licenses have been considered. And I think there have been several instances in which the Commission has been very receptive to suggestions if there was some modification needed or some change should be made.

In any event, specifically to my question, did you not call the attention of the Commission --

MR. SACK: We did not call the attention because it was obviously interdicted.

When the Appeal Board in Indian Point 3 now said that the closed cycle cooling was an open question, Hudson River Fishermen took great exception to that.

So the parties again got together and agreed in substance that it was not necessary to resolve that question in the context of the Indian Point 3 license.

So, again, we stipulated not to get into that issue, and all the parties agreed that that portion of the Appeal Board's decision could be vacated, not because it was wrong, but because it was unnecessary to the resolution of the issues in Indian Point 3.

CRAIG
blt 1
gin 6

The Commission accepted that, and therefore we did not argue at length whether cooling towers would be required. Then the Commission volunteered the statement which Ms. Chasis has read to you, but I submit if that is an interpretation of the Indian Point 2 license, then nothing more is needed in that regard in this proceeding.

CHAIRMAN JENSCH: Except for what is the preferred type? That is what we are doing here.

MR. SACK: That is correct. If the Board accepts that proposition, then they should accept the language Con Edison has proposed, because that is all we propose doing, is designating the natural draft cooling tower system within the confines of the precise language that is contained in the present license.

Our objection arises when you get out of the language of the present license and start inserting other words which raise other issues.

Before I finish, let me point out that I have just noticed that the mayor of the Village of Buchanan is here, and he may wish to make a statement when the Board feels the time is appropriate.

MR. TROSTEN: Mr. Chairman, at this point I would just like to add one comment concerning the other proceeding which is presently pending before the Board, that for a two-year extension of the period of once-through operation

blt 2

at Indian Point 2.

The Board is, of course, charged with that responsibility as well. I frankly am shocked at the suggestion by Mr. Grainey a moment ago that it would take until November or December for the Final Environmental Statement on this proceeding to issue. These proceedings are quite obviously interrelated. They should be running on a simultaneous track.

But on the basis of what Mr. Grainey has said, they appear to be varying far apart. As the Chairman knows, we served upon the Board on Friday -- I don't believe the other parties have yet received their copies -- a request for a prehearing conference to be held in this other proceeding. I strongly urge the Board to schedule this conference at the earliest possible date. It is quite obvious from the discussions this morning that there are proposals pending now before the Board which would attempt to tie these proceedings together. I think that the Board should schedule such a conference, and I think that they should schedule such a conference before taking any definitive action on these matters.

I think we might as well get these issues out on the table and have such a conference before we attempt to get into the Partial Initial Decisions or subsequent Initial Decisions or what-have-you.

blt 3

Of course, on the issue of whether or not we should have a Partial Initial Decision, we stand on our brief. We feel that we -- it is utterly wrong to do so and that ultimately, sir, we feel that it is going to have the effect that the Board does not wish and that no one wishes, which is to delay the Board's conclusion of this particular proceeding.

CHAIRMAN JENSCH: Let me say that I am sure the Board is mindful of the necessity of moving forward on all these matters as soon as possible. We have to take the tools for our procedure based upon what is presently before us.

All we have at the present time is this determination of what is the preferred type of closed-cycle cooling, within the context of the structure of the license outstanding.

Now, with all due respect to Mr. Sack, I don't think, perhaps I don't use the term correctly, but his minimizing what the Commission has done on the basis of the stipulation at Indian Point 3 is not really adequate recognition of the determination made by the Commission.

And, while I realize he objects to the language used by the Commission, it is a rather late date for him to be now asserting that a great wrong has been done and that things have been expounded that shouldn't be followed

blt 4

and that sort of thing.

But I think we have to take everything that is before us, and I think what Mr. Grainey is suggesting is that we deal with what really has been done in this proceeding, and that is to say that we are not just taking a determination of what is the preferred type of cooling system; it is because the Commission has said there shall be a closed-cycle cooling system installed, and this is now the one missing gap that will fill the present structure of license.

Con Edison is entitled to move for an extension of the time for once-through cooling, and we may proceed, I take it, when you feel that you can prepare your application. We will give consideration to the matter.

I think, as Mr. Trosten has just pointed out, that application was filed in July of 1975, and we have to hurry to get it in in 1976.

Just offhand, what date would you suggest for that subsequent determination?

MR. TROSTEN: Subsequent determination?

CHAIRMAN JENSCH: Yes.

MR. TROSTEN: Well, sir, realistically speaking, of course, it is essential under the Commission's regulations that the Staff's Final Environmental Statement be out before the Board can issue its Initial Decision.

blt 5

CHAIRMAN JENSCH: That is correct.

MR. TROSTEN: This is the reason why I'm so utterly dumbfounded, frankly, by this length of time. We are dealing with an extremely narrow issue, sir, and it, in my opinion, and I realize the pressures under which the Staff operates, I do not understand why it took the Staff as long as it did to produce the Draft Environmental Statement. And, given the narrowness of the issue involved, I cannot imagine why it should take this period of time for the Final Environmental Statement.

But with regard to your question, sir, unfortunately, sir, the hearing, because there are -- it is going to be a contested proceeding because of the fact that the Hudson River Fishermens Association is contesting the issuance of the extension. It is unfortunately going to take some time for the Board to resolve these questions after the Final Environmental Statement comes out.

My problem, sir, is this: We know what the positions of the parties are. It is perfectly obvious what the positions are. We ought to--we might as well get the issues defined in a prehearing conference and get going with this proceeding and then let the Staff get its Final Environmental Statement so we can get it out in 1976.

CHAIRMAN JENSCH: Would this be of help? You say all parties have asserted their positions.

blt 6

MR. TROSTEN: Yes, sir.

CHAIRMAN JENSCH: Would you propose in a written communication to the Board and the parties what you believe the issues would be in reference to your request for an extension of time for once-through cooling, submit it to the parties and let's see how they come out on the issues of what they believe, and maybe we can resolve this by an exchange of correspondence. Bearing in mind, as you have said, until the final FES is out on this matter, we couldn't issue a decision on the extension of time of once-through cooling.

But if you want to hear troubles, I'll tell you one. Mr. Grainey I think participated somewhat, or some associate of his has been calling at Denver at the United States Geological Society since I think last February as to when they are coming out with a report of a final review of the site matters out in the Puget Sound matter. It now is October, and I see nothing on the horizon to answer that inquiry.

The Applicant is rightfully asking questions, when is it going to occur. He says they don't know. The people are shocked; they are appalled, whatever words did you use? I think every one you used, they would apply.

So these things work pretty much so that you know we do the best we can with what we have. If the FES

blt 7

doesn't come out, we can't hit Mr. Grainey over the head with a ball bat. He isn't getting it out; he is just reporting what he has heard.

MR. TROSTEN: I'm afraid, sir, that the problem here is that we are dealing with a situation where Con Edison is put in a situation where it must make its judgment as to what the requirements are and when it is supposed to proceed, when irreversible and irretrievable commitments must be made, without being given the opportunity which it was afforded by the license granted to it to make the presentation of whether or not an extension should be given. That is the reason why delay is not only unfair to the licensee; it is unfair to the public and it is contrary to the Commission's regulatory process and contrary to the license, we would submit, sir.

Now, with regard to the matter of defining the issues, the normal process, we have here a situation where the Applicant has made its request. The Staff in its Draft Statement has recommended the granting of the request. We have one party that is opposing the request, and it seems --

CHAIRMAN JENSCH: Well, you get one guess on that, don't you?

MR. TROSTEN: I beg your pardon?

CHAIRMAN JENSCH: There is just one guess as to who that unidentified party is.

blt 8

MR. TROSTEN: We are perfectly willing to attempt to sit down with the other parties and attempt to work out for presentation at the prehearing conference what the issues are so that the Board can then issue its proposed -- its posthearing order, which would then define the process.

CHAIRMAN JENSCH: Don't you think this type of thing could really be handled by stipulation among the parties?

MR. TROSTEN: I hope it can.

CHAIRMAN JENSCH: Why don't you take a try at it? That will save some time.

We all have problems with schedules.

MR. TROSTEN: Yes, sir.

CHAIRMAN JENSCH: We do want to accommodate each Applicant, each licensee, each party to a proceeding. But if the parties can do a little more among themselves, I think they should try.

MR. TROSTEN: We will certainly do that, Mr. Chairman. We are delighted to do that.

I would just make the suggestion, sir, and that is this: I think it would aid the Board in the process, and the parties, if the Board would go ahead and do two things.

Number 1, to set the prehearing conference date now, because experience indicates that when this is done

blt 9

everybody moves toward that date and will be ready on that date.

The second thing, sir, is that I submit you ought to schedule the prehearing conference so you get a feeling for what these problems are before you consider taking action in this proceeding. I think you should do that.

CHAIRMAN JENSCH: I don't know what the Board will decide, but the Board may decide to issue a Partial Initial Decision based on the precise issue but within the context of the license, and then we will take up the suggestion from the parties as to their convenience for a prehearing conference, and bearing in mind that if there has been some further report that the Staff can expedite its FES on the extension of once-through cooling.

Dealing with this matter as a matter of reality, my guess is that every construction schedule related to nuclear power projects of the United States extends over the time projected on every indication. There has never been a construction schedule met in the life of the industry. So that if Con Edison started tomorrow to build and blast out the rock, whatever they need to do for a closed-cycle cooling system, it may well be that that type of activity will be so extensive that the once-through cooling system problem may kind of parallel the situation and there might

blt 10

be kind of a joint result after all.

But I don't believe that we need to stop doing what we are undertaking at the moment because there may be some extended time to be considered, at least for once-through cooling.

MR. TROSTEN: mr. Chairman, if I may just respond to that very briefly, I would think that it would be very wrong, and I believe contrary to the license, sir, to proceed to take actions of the sort that you just describe, because they could have the effect of making a mockery, sir, of the opportunity to request an extension of time and the opportunity that is afforded in the license and the requirement that is in the license that the Commission consider the question of whether or not the long-term ecological effects of once-through cooling are more harmful on balance on the basis of a NEPA cost-benefit balance than the effects of construction of a closed-cycle cooling system.

If you take these irretrievable commitments, if you start to blast out the rock or do other things of that sort, you are utterly tilting the NEPA balance in such a way that I think is inconsistent with the license and I believe is inconsistent with NEPA.

CHAIRMAN JENSCH: Well, I don't know that the amount of investment, I mean as I understood the discussion at the prehearing conference, it was Mr. Andrews, or somebody,

blt 11

was going to give some projection of how much time you had to negotiate with contractors, perhaps for six months before you even touched the pick to the rock out there, and maybe by that time the once-through cooling system consideration will be completed.

So that I don't think you are talking about denial of opportunity at all on the hearing for extension of time for once-through cooling by spending some time with contractors. Maybe if you did level the ground a bit, I don't think it would -- as I recall the investment steps that were originally projected, I think by one of the gentlemen from Con Edison years ago, that you would get so far before you would get any tilting.

MS. CHASIS: First, it is Con Edison that came in and requested the granting of the license amendment in issue here. It simply deals with the designation of the preferred type of system.

For them to now say that the Board should not act on that and await action on another license amendment which Con Edison has proposed is completely inconsistent with their own proceedings in this matter.

Secondly, the license I believe contemplates a decision on the type of preferred system. It contemplated I believe a decision earlier than this Board will be making that decision, and far in advance of the completion of the

blt 12

ecological studies by the Applicant. So I think that from the structure of the license itself it can be seen that this decision was meant to come quickly and not await any kind of subsequent consideration of the license amendment to delay or eliminate completely the type of closed-cycle system.

Third, to delay action in this proceeding because of the pendency of another proposed license amendment would undercut the basic rules by which the Commission operates, which is that until there is action on the license amendment, that filing of that proposed license amendment does not stay or affect any aspect of the license.

MR. SACK: I just would like to point out again that I think we have had a lot of discussion on the scheduling issues, and the Board requested a brief on that subject and an exchange of briefs. Many of these issues are addressed in greater detail in the brief that you required for tomorrow, and I will submit my brief tomorrow. Then we will have reply briefs from the other parties and then a response brief from Con Edison. And I think further discussion of that issue should await those briefs, as some of the issues are dealt with in detail.

As far as what Ms. Chasis has just suggested, I don't believe Mr. Trosten suggested that the Initial Decision await the end result of the two-year extension,

blt 13

just that it would be useful for the Board to have a pre-hearing conference before it issues that decision so it could see the developments in that proceeding.

CHAIRMAN JENSCH: I think what Ms. Chasis suggested is that the comment dealt with two proceedings. One would be delayed by the FES and the other had been apparently considered by the parties and resulted in a stipulation.

She is suggesting, as I understand it, that these two needn't be held up, but go forward as each one is ready for determination.

That, I take it, is the present status of the record. Let's accommodate the mayor of Buchanan.

I might say this, Mr. Grainey is ill and he may absent himself for a period of time. But the transcript will be available for Staff review at all times.

So will the mayor of Buchanan come forward; and other persons who are here, if any, who desire to present statements by way of limited appearance may do so following the mayor's presentation.

Do you have copies of the statement, Mr. Mayor?

MR. BEGANY: No, I don't.

I apologize for being late, but I was in Philadelphia for several days.

CHAIRMAN JENSCH: I understand some prize activities, first prize is one week in Philadelphia and

blt 14

second prize is two weeks.

(Laughter.)

xxxxxx

LIMITED APPEARANCE STATEMENT OF GEORGE V. BEGANY, MAYOR, VILLAGE OF BUCHANAN, NEW YORK:

MR. BEGANY: My name is George V. Begany, Mayor of the Village of Buchanan.

Mr. Chairman, the Village of Buchanan opposes any type of closed-cycle cooling and will continue to do so. In looking over the various reports from the NEAP --

CHAIRMAN JENSCH: What is the NEAP?

MR. BEGANY: NEPA. I'm sorry.

We don't agree with many of their reports. I know Con Edison doesn't and we support Con Edison fully on the two-year extension.

But I have here Docket No. 50-274, dated October 1, 1976. On page 11 they make reference to noise was found to be a limited consequence and feel it could be taken care of later on. Much noise comes from Con Edison, and I don't think much effort on their part, at least they are making an attempt. It is not being done, and we don't want anyone to have the idea that we are going to live with any kind of noise.

Another reason why I am late in coming here, I stopped off at the State Trooper Barracks over in Amesville just a short distance from the Point. In their bletter. September 22, Wednesday morning, at 12:20, Mrs. Elizabeth Petersen, Courton Street, if you have been up there you know that is the street you can see the whole plant over there, of Buchanan reports loud noises from the plant constantly causing annoyance to the village residents.

I don't know whether you are aware of complaints. I know Con Edison is aware of complaints on the noise, and so is the State lower Authority.

This new noise over there, it's been going on for about three weeks. It's what they call a hot penetration cooling system. Prior to previous shutdown, this system worked by drawing air into it. Now the air is being pushed out into the atmosphere.

Dependent on the temperatures, this tone, it is a 24-hour noise, this tone is real loud if the temperature gets real low. If the temperature gets cold it raises up.

Last Tuesday night we had people calling State Troopers, our own police. They thought the plant was going to blow up.

Another point is in some of these reports they refer to Buchanan as a blue collar worker. I don't know what they really mean by that. I mean, I think our fathers, our relatives are blue collar workers. These are the type of people that have pride in what they do more so than the

blt 16

rich guy who can go out and play golf every day and have somebody else take care of his problems.

I think the NEPA has led you to the wrong thoughts of Buchanan, of what we don't like or what we do like.

Further, getting on to their long-range EPA findings, long-range predictions on the fish life, I think what they have put in their reports is something like the five-day weather report -- the fouith and fifth days, forget it.

Another concern, I don't know what the latest cost of building these cooling towers will be, something like $90 million, a hundred .illion dollars, $30 million annual maintenance. Everyone in here who lives in Westchester County, we don't want another increase on our Con Edison electric bills.

By now industry is moving out. And the way it is moving out maybe fishing will be the major industry. I sure hope it isn't.

As far as the fish kill goes, the fish in the Hudson River, the catch has been fantastic. They are catching spike bass a half-mile from the plant, 30-some inches long; sturgeon, 200 pounds. So we can't understand what the Fishemens Association is trying to get at.

I think it is a political thing and someone wants

blt 17

to stick it to Con Edison.

Another report of the NEPA, they state the objective of their association is to assure for all Americans safe, healthful, productive and culturally pleasing surroundings. I don't think they have tried to fulfill their obligation and Buchanan would appreciate your consideration on granting Con Edison the two-year extension, which I think they are doing a great job finding out about the fish life in the river.

And that's all I have to say at this time. I will stay here if there are any questions to be asked. But if you have any more hearings that you would like to have in the future, we have a new village hall in Buchanan; and your dates, there would be no conflict. We would like to have you come there. In fact, I would like to have you come to Buchanan and hear that noise, because I know they can't pull the switch and shut it off that fast.

CHAIRMAN JENSCH: I suppose we might go and hear how it operates.

How large is your village hall? We had early hearings in Indian Point 2 in the fire hall, and we had an unfortunate occurrence. While the very soft-voiced witness was speaking, they had a fire call, and the trucks turned on their sirens and horns, and it was a little difficult for the Reporter to pick up those words.

blt 18

MR. BEGANY: You won't have that problem. We can seat a hundred people. it is brand new. it is nice.

CHAIRMAN JENSCH: Very good.

Well, thank you. We will give consideration to that, because this courthouse is very fine, we like it, but it is very crowded.

MR. BEGANY: We have free parking, also, up there.

CHAIRMAN JENSCH: The people here have been very gracious to us, and we appreciate the courtesy; but between trying to get a place to sleep and a place to hold a hearing it is getting a little complicated.

MR. BEGANY: We can find room. I would appreciate it if you could come up tonight. I would drive you up and back.

End 6

CHAIRMAN JENSCH: Thank you very much.

jon1

#7

MR. BRIGGS: You stated that you were opposed to any closed cycle cooling system and I understand that.

MAYOR BEGANY: Yes, sir.

MR. BRIGGS: But this proceeding is one to determine which is the preferred closed cycle cooling system.

As I look at it, one can have the mechanical draft towers which I assume will conform to the requirements of your zoning regulations with regard to height, and we are also looking at the natural draft cooling towers which are very tall. Yet the natural draft cooling towers have the advantage of spreading whatever salt they have over a large area at low concentration. The mechanical draft cooling towers cause the concentration to be much higher over a lesser area.

Now, which do you prefer? Do you prefer the large structures of the natural draft cooling tower, or the lower structures of the mechanical draft which spread more salt over the area?

MAYOR BEGANY: The mechanical spreads more salt?

MR. BRIGGS: The mechanical draft cooling towers discharge more salt.

MAYOR BEGANY: They -- in the immediate area?

MR. BRIGGS: They discharge more salt, total, according to the numbers that have been presented by the

Applicant and Staff.

MAYOR BEGANY: If Con Ed can collect the salt and keep the noise down, we will take the mechanical draft.

MR. BRIGGS: Well, they don't quite collect the salt. Itis spread over a smaller area at higher concentration. But it does go out into the community.

MAYOR BEGANY: All I can say to you in the area of Indian Point and on the opposite side of the river are a lot of dogwood and elm trees. I really think you have a problem. I think you should let them go along with the once-through.

MR. BRIGGS: I think we have a problem, too.

MAYOR BEGANY: The problem is we put Indian Point over there.

MR. BRIGGS: Well, I guess that is the basic problem, isn't it?

Now, the problem is one of what can one do about Indian Point 2?

MAYOR BEGANY: I think we get right down to the basis of what is more important, fish or people.

MR. BRIGGS: In the context of this proceeding it seems to be what is more important, the salt position or the view one has.

What do you consider more important, the view or the amount of salt deposited?

You don't really like either one, I guess.

MAYOR BEGANY: I would like to add one more thing.

Back about two years ago I started writing letters to the Governor and the President, our representatives in Washington, and Representative Fisch, he contacted someone in the NRC and, going through what we are just going through how, he was led to believe that the natural draft tower would be the best solution because the height of it would put the plume further from us.

Well, that is just that someone else is going to get it, we don't get it.

MR. BRIGGS: No. The height of it distributes the salt over a larger area.

MAYOR BEGANY: Right, so it affects more people.

MR. BRIGGS: And, accordingly, the numbers it puts out, less total salt.

MAYOR BEGANY: Don't you think that could change, too, during some draught season when we have much more salt up there in the Hudson?

MR. BRIGGS: It depends on the amount of salt.

MAYOR BEGANY: No one can predict when that is going to be.

MR. BRIGGS: In either event, the mechanical draft cooling towers put out more salt.

CHAIRMAN JENSCH: Which is the noiser?

MR. BRIGGS: Mechanical is noiser.

jon4

MAYOR BEGANY: In the report they also refer to the natural draft, that most of the noise from the draft would be over the cove.

We are finding out now the noise can be very low in the cove, not only back in the village, five miles away, they are hearing sounds you can't hear at the plant.

When this new noise came up three weeks ago, over at the plant they didn't know the noise was there.

I would like to have you gentlemen come up. Tonight would be a nice time. I think the air would be right and you could really hear it.

This is what we are going to live with for as long as those plants are over there.

CHAIRMAN JENSCH: That is like the problem that I guess society has to consider, like airports and things like that.

I don't know.

MAYOR BEGANY: We live in a rough society, that is true.

CHAIRMAN JENSCH: That's right. It is a determination that involves the consideration of many, many interests. If people are to be considered as you suggest, the people of New York City would probably say, "Well, Village of Buchanan, won't you kind of go along with us a little so we can have some electricity?" I don't know.

jon5

MAYOR BEGANY: The people up here don't want to make any sacrifices for New York City. I think enough have been made.

The whole state has sacrifices themselves for New York City.

CHAIRMAN JENSCH: I guess that is a problem that is not within the purview of this consideration at least.

I think these are problems society has and maybe we can have a bifurcated society in the determination. I don't know.

We always assumed Congress had determined many of these things establishing the Federal Aviation Administration and Civil Aeronautics Board to kind of locate the airports and other commissions to have radio towers and that sort of thing, television, unsitely obstructions to the beauty of the area. And now comes the Nuclear Regulatory Commission and they are to make a determination on cooling towers.

MAYOR BEGANY: You have to realize the people up here in the country are a little bit different from the people in the city.

CHAIRMAN JENSCH: Yes, I had that observation. I rode the subway some time ago. I had the impression there was some difference.

MAYOR BEGANY: A victory in New York City is getting a seat on the subway.

CHAIRMAN JENSCH: Well, we thank you for coming, Mr. Mayor.

Are there other persons here who desire to present statements?

Would you give your name, please?

MS. DONALDSON: I am Anne Donaldson and I am Executive Director of the Federated Conservationists of Westchester County.

CHAIRMAN JENSCH: Would you come over closer to the reporter. Perhaps if you could stand at the end of the table next to the lady.

As I understood, she was not addressed this morning and, as I understand, she is Dr. Davis.

Would you stand -- if you find it convenient to stand, I think we can hear you better.

Do you have copies of your prepared statement?

MS. DONALDSON: I have a copy, but I would prefer to send it to you tomorrow after I have had a chance to retype it.

CHAIRMAN JENSCH: YOu won't have to give it to us. The gentleman sitting at your right there will be glad to take it. If you are going to read it -- is it very long?

MS. DONALDSON: No, it is not terribly long.

CHAIRMAN JENSCH: All right. Proceed. You won't have to re-edit it.

LIMITED APPEARANCE OF ANNE DONALDSON, EXECUTIVE DIRECTOR, FEDERATED CONSERVATIONISTS OF WESTCHESTER COUNTY, INC., MERCY COLLEGE, DOBBS FERRY, NEW YORK 10522

MS. DONALDSON: Federated Conservationists is a coalition of environmental organizations in Westchester County and we deal with county issues of the traditional nature, solid waste, planting and parks and open space preservation.

CHAIRMAN JENSCH: Did you give your name?

MS. DONALDSON: Anne Donaldson, Federated Conservationists of Westchester County, Mercy College, Dobbs Ferry, 10522.

Our organization serves as well as an environmental clearing center and educational resource for the county.

WE have studied the environmental impact statements for both Indian Point 2 and 3 and evaluated them within the limits of our capability.

We are not really in a position to dispute the concliusions of the final environmental statement which are based on extensive studies by both the Staff and Consolidated Edison.

These impacts do appear to be within acceptable limits and do not appear to pose the catastrophic consequences

jon8

that have been foreseen for them.

Parenthetically I have got to say that we all, I think, have hoped that you would come up with a miracle which would be no cooling towers.

Obviously that miracle has not take place.

We are aware that the NRC decision to require the installation of closed cycle cooling both at Indian Point 2 and 3 was the result of years of hearings, research, and litigation, and that the key decision has been upheld on five separate occasions and was based on findings that a continuation of once-through cooling would present an unacceptable potential for the destruction of the Hudson River Fishery.

Despite this regard the municipalities most severely affected and their elected representatives and advisers are in effect continuing to suggest that once-through cooling is a viable alternative.

Cited as evidence in support of this conclusion are various reports which have been made available to us at our request and which we have reviewed.

They include a report by the Northeastern Legislative Energy Staff dated April 14, 1975, and a statement prepared by the Atmospheric Sciences Research Center, State University of New York at Albany, both prepared at the request of Senator Gordon and comments by William

jon9

Shuster of Rensselaer Polytechnic Institute.

While these reports were included in the FES dated August '76, they were not submitted as evidence in previous hearings.

It is our understanding that the village of Buchanan, despite its strong objections to the installation of cooling towers, has refused to intervene a full party of interest in the hearings and we would suggest that questions in the above-mentioned reports should be raised in the evidentiary hearings subject to cross-examination.

There the municipalities and there the elected represetntatives could conduct their own cross-examination of the NRC findings and validity of the rpeorts from which they derive their objections could be fairly examined by all parties.

Parenthetically, we would like to note that the Northeastern Legislative Energy Staff Report does make a very persuasive argument for consideration of a system which utilizes waste heat.

The FES deals with this alternative in a very cursory manner and we believe it is deserving of much fuller treatment.

In addition, we have requested information from the Department of Environmental Conservation concerning potential discharge of PCBs from the cooling tower.

The question raised by Dr. Shuster in a later report not included in the FES.

He based his analysis on concentration of PCBs in the Hudson of one part per billion.

The source of the figure is not clear.

As you are well aware, the DEC has been deeply involved in the PCB as has our organization as intervenor in recent years.

It is an area of concern which we believe should be appropriately pursued by the NRC Staff with the Department of Environmental Conservation.

WE have had as yet no response to our inquiry to them on their own testing and what the concentrations were which they would find in the area.

CHAIRMAN JENSCH: Excuse me. May I interrupt?

MS. DONALDSON: Yes.

CHAIRMAN JENSCH: There was something in the New York Times about this PCB situation up around Albany. Do you know whether there has been any testing of the waters down this far from Albany to determine the amount of PCB, if any?

MS. DONALDSON: This is what I was trying to find out from the Department.

I think Sarah probably could answer that question better than I.

It was our understanding they had done some testing in this area, but we did not get the answer from them and have not as yet.

CHAIRMAN JENSCH: Excuse me. Proceed.

MS. DONALDSON: We do wish to emphasize that we share the concern of the local municipalities in regard to the visual and other impacts of the cooling towers.

However, these impacts, unpalatable though they are, are local and are reversible, albeit within a lengthy time frame.

We are convinced, however, that difficult though the choice, these impacts are preferable to the irreversible destruction of a resource, the Hudson River Fishery, which is unique in nature and which serves the needs of the entire Eastern Seaboard in terms of future food supply and recreational uses.

I do not think, again, that this is an issue of fish versus people. This is kind of a traditional stone which is thrown at the environmentalists who wish to protect the resources of the region and I think we are dealing with the entire human environment, our food needs, our recreational needs.

And I would just like to make that one point clear.

We would suggest, then, that given the irrevocable decision to protect the Hudson River Fisheries resources through installation of closed cycle cooling, a decision which we support given the present technology, municipalities most severely affected should have a strong voice in the selection of the preferred system even if the system they prefer has a greater economic impact on the region.

They, after all, must live with the local impacts which provide for the protection of a regional resource.

Although the NRC Staff has concurred with Con Ed's choice of system, i.e., the natural draft cooling towers, the FES states that further investigation of fan-assisted natural draft and circular mechanical draft cooling towers would be worthwhile and that the impacts of all three are within an acceptable range.

A combination of systems, however, would allow a lower tower with a lessening of visual impact, though at a greater cost and loss of energy.

We, therefore, urge that the NRC in making its final selection work closely with the affected municipalities and heavily weight its decision as to the preferred system in favor of the alternative which the local municipalities find the lesser of the evils they face.

We appreciate this opportunity to comment on the problems before you for in varying degrees they are shared by every citizen of this county.

I do have a couple of questions.

The fan-assisted natural draft and the circular mechanical draft systems which the Staff recommended should be further studied. Also according to the Staff would require a year's extra time in design.

I don't quite understand what the Board's function is if the report from Consolidated Edison was before you two years ago basically, at that time if you had come to the decision that you really wanted more detail on these other two systems, could you not have asked for it and, in essence, it seems to me what is now happening is that the choice of these other two systems is really precluded by the intervenors' own desire to have the construction or various deadlines met, and the conclusion that continuation of once-through cooling will be destructive to the resources of the Hudson.

But in essence you have precluded a -- two options which seem to me would greatly lessen environmental impacts and give you a great deal more flexibility in solving the problems which the local municipalities face and which really the region faces as far as visual impact is concerned.

CHAIRMAN JENSCH: We do give consideration to that matter as you suggest.

MR. BRIGGS: We are not precluded from

considering those.

We have to disagree with the Applicant's evaluation of their practicality, but we are not precluded from considering them.

MS. DONALDSON: Had you done so earlier, wouldn't it have made it possible for the Applicant to come with the kind of detailed information which you say in the final impact statement is missing?

MR. BRIGGS: Of course we didn't prepare the final impact statement, and I believe the Applicant did not consider these two types in his environmental statement.

I haven't read his environmental report for a long time, but I don't recall their being included.

This is something new, as I look at it, the Staff has brought up.

MS. DONALDSON: Apparently from what I read in the final EIS, the August EIS -- Mr. Lorfick is here. He could more easily answer this than I.

Those two items were not included in their consideration because they thought there was not enough operating experience and experience with them.

But this is now two years later.

MR. BRIGGS: I do have a question about PCBs. I believe you mentioned they had been mentioned in the New York State Department of Environmental Conservation.

There are some numbers in the comments of the Department of Environmental Conservation's comments on the Staff's Environmental Statement, and I believe you indicated that additional information had been submitted.

Is that additional information in conflict with what is in the draft environmental statement?

MS. DONALDSON: I don't think Mr. Shuster's report -- there is one report in the final EIS from Mr. Shuster if I am not mistaken.

It does not deal --

MR. BRIGGS: On page B-47 of the Final Environmental Statement there is a table. It shows the concentration of airborne contaminants and includes PCBs. It is the last item on Table 2.

MS. DONALDSON: I missed this and I have to be perfectly candid with you, I wouldn't understand it.

MR. BRIGGS: As I see it, it says you could have a million times as high a concentration in the atmosphere before it would reach the limit that the health officials prescribe.

I wondered whether the other statement might have been in conflict with this.

MS. DONALDSON: My understanding was that it was possible that Dr. Shuster's concentration figures were too high.

MR. BRIGGS: I see. Thank you.

CHAIRMAN JENSCH: Is there anyone else who would like to make a statement?

MAYOR BEGANY: In regard to Dr. Shuster's report, it is complete. He estimated, 12 May, that through the tie of the Hudson, the PCB concentration would be in the area of Indian Point in ten years.

At present there is a ban on excessive catching of striped bass in the Hudson River.

Also GE is still pouring PCBs into the Hudson.

CHAIRMAN JENSCH: Is Dr. Shuster's statement -- was that basically before the settlement was made with GE on the PCB matter?

MAYOR BEGANY: Yes.

CHAIRMAN JENSCH: I guess there is some determination date on the --

MAYOR BEGANY: I think it is the first of '77.

MS. CHASIS: The Fishermen are parties to that proceeding and participated in the negotiations resulting in settlement.

General Electric has agreed to discontinue its use of PCBs in the manufacture of capacitors at its two plants by July 1, 1977.

In addition, it has agreed to pay $3 million to the State of New York directly and conduct a million dollars worth of research concerning cleanup of the upper Hudson River where the PCBs are concentrated at present, so that there is an effort going forward right now to deal with this problem and basically see if there is a way to clean up and remove PCBs presently in the Hudson.

MAYOR BEGANY: I think this is another case of putting the public off, spending three million, actually six million, three million by GE and three million by the state as to research how to clean it up.

I think they ought to know how to clean it up.

After six million is gone, it will still be in the river.

MS. CHASIS: That is not for research. The six million is for cleanup.

MR. KUHN: May I clarify a matter? Since the actions of the State of New York and particularly the New York State Department of Environmental Conservation have been discussed, we did indeed on the comments on the draft environmental statement raise the whole question of various tpes of heavy metals and toxic materials that might be distributed through the cooling tower plume and did provide a chart that you had indicated on page B-47.

We agree with Staff's conclusion found on page B-27, Number 42, concerning the -- they concur with the agency's assessment that airborne contaminants and toxic materials including PCB will not approach values normally applied to industrial hygiene.

So, besides the fact that New York State and Department of Environmental Conservation have acted vigorously to prevent any problems from PCBs, that is not a problem; in this particular case there is no problem we can foresee.

We would, of course, let your Honors know if we raised any information that PCBs at this point would be a problem.

CHAIRMAN JENSCH: Let's give the reporter a little recess. We haven't had a recess this morning.

At this time let's recess to reconvene in this room according to that clock at 11:25.

(Recess.)

CRAIG
blt 1
gin 8

CHAIRMAN JENSCH: Please come to order.

Do the parties desire to proceed with the presentation of evidence?

MR. SACK: Well, I just have two comments I would like to add in connection with the statements before.

One, in response to something Mr. Briggs said, a mechanical draft cooling tower would violate the terms of the zoning code. It would require variance. The height limitation of the Buchanan zoning code is 50 feet, and the mechanical draft cooling tower would be 70 feet.

There also is a prohibition against the dispersion of pollutants off-site, and we would need a variance from that provision. So we would need the same variances, although the height limitation is not as severe a violation, but the dispersion of pollutants off-site, as you correctly noted, would be more severe with mechanicals.

With respect to -- I would like to answer Ms. Donaldson's question about the fan-assisted and circular mechanicals. The cooling tower report which Con Edison submitted December '74 did address fan-assisted mechanical draft cooling towers. At that time they were under study, and I don't think in the United States, but in one other location, and we concluded that they were not a feasible alternative as a backfit for a large operating plant.

We did not address circular mechanicals because

blt 2

at the time that was not a recognized concept.

Mr. Newman, who will be here this afternoon, is prepared to address the question of the feasibility of these alternatives, if you desire to make any questions in that regard.

CHAIRMAN JENSCH: Thank you.

MS. DONALDSON: May I ask a question?

CHAIRMAN JENSCH: Will you stand up? I think we can hear you better.

MS. DONALDSON: We came across an old newspaper article which is 1971, which was an article about a system which has been designed by General Electric which was a combination of a natural draft cooling tower with a circular mechanical draft base.

Now, basically would you describe that as a fan-assisted natural draft?

MR. SACK: I think that is the circular. That is a fan-assisted circular? It is a fan-assisted circular mechanical, and that was not addressed in our December --

MS. DONALDSON: I understand there is one plant of this nature which has been built. I have the name of the General Electric man. It is presumptious of me to offer this kind of information to Consolidated Edison; I am sure you must have it. But, again, the plant has been built apparently, and there is this potential for combining the

blt 3

two systems and lessening the impacts of one area.

MR. SACK: Mr. Newman, I think, can address that this afternoon.

CHAIRMAN JENSCH: Will you be here this afternoon?

MS. DONALDSON: Yes, sir.

CHAIRMAN JENSCH: Perhaps this afternoon we could talk to the gentleman, or maybe Con Edison will propound questions to bring out the subject you have in mind and you can get it on the record.

Are the parties ready to proceed with the presentation of evidence?

Applicant?

MR. SACK: Well, as I mentioned before we started, Mr. Newman had a commitment this morning that he could not cancel in view of the short notice. Maybe the Staff could proceed first with its evidence.

CHAIRMAN JENSCH: All right.

MR. GRAINEY: I have no objection to that, Mr. Chairman.

CHAIRMAN JENSCH: All right. We will proceed.

MR. GRAINEY: The Staff would have one panel of four witnesses in response to the Final Environmental Statement. These are Dr. Robert Geckler, Dr. Jerry Kline, Mr. John Lehr, and Mr. Tom Sav. I would ask that all four

blt 4

of these gentlemen be sworn.

CHAIRMAN JENSCH: Will those gentlemen come up, please, and take chairs near the Reporter, because we are having a little problem with the accoustics here. We don't have our usual microphone system. It would be very helpful to us.

Before you sit down, would you stand and raise your right arm.

Whereupon,

ROBERT P. GECKLER,

JERRY R. A[illegible],

JOHN C. LEHR.

and

G. THOMAS SAV

were called as witnesses on behalf of the NRC Staff and, having been first previously sworn, were examined and testified as follows:

xxxxx

DIRECT EXAMINATION

BY MR. GRAINEY

Q Gentlemen, I would like to show you each a copy of a document entitled "Professional Qualifications."

MR. GRAINEY: For the information of the Board and parties, the witnesses are sitting, left to right, Mr. Lehr, Dr. Kline, Dr. Geckler, and Mr. Sav.

blt 5

BY MR. GRAINEY:

Q Mr. Lehr, is the document entitled "Professional Qualifications of John C. Lehr," was t at prepared under your direction and supervision?

A (Witness Lehr) Yes, it was.

Q Is that true to the best of your knowledge?

A Yes, it is.

Q Mr. Cline, the same question to you. Is that document prepared under your direction and supervision?

A (Witness Kline) Yes.

Q Is it true and correct to the best of your knowledge?

A Yes.

Q Dr. Geckler, the same question to you.

A (Witness Geckler) Yes, and it was.

Q And, Mr. Sav?

A (Witness Sav) Yes.

MR. GRAINEY: I would move into evidence, to be incorporated into the record as read, the professional qualifications of Mr. Lehr, Dr. Kline, Dr. Geckler and Mr. Sav.

CHAIRMAN JENSCH: Any objections?

Applicant?

MR. SACK: Con Edison has no objection to the document being placed in the record as the Final Environmental Statement.

blt 6

CHAIRMAN JENSCH: This is, first of all, just professional qualifications.

MR. SACK: No objection.

MR. KUHN: No objection.

MS. CHASIS: No objection.

CHAIRMAN JENSCH: There being no objection, the request of the Staff counsel is granted and the statements of professional qualifications of the four identified witnesses may be physically incorporated into the transcript as if orally presented and shall constitute evidence on behalf of the Staff.

MR. GRAINEY: Thank you.

(Professional Qualifications of Dr. Geckler, Dr. Kline, Mr. Lehr, and Mr. Sav follow.)

PROFESSIONAL QUALIFICATIONS

G. Thomas Sav

U. S. Nuclear Regulatory Commission

I am currently employed as a Cost-Benefit Analyst with the Regional Impact Analysis Section, Cost-Benefit Analysis Branch, Division of Site Safety and Environmental Analysis, Office of Nuclear Reactor Regulation, located in Bethesda, Maryland. My educational background and professional experience are as follows:

Education

B.A., Economics, Magna Cum Laude, University of West Florida, 1973
M.A., Economics, George Washington University, 1976

Presently I am enrolled at George Washington University for work leading to the Ph.d. degree in the field of Economics. My doctoral fields of study are microeconomic theory, macroeconomic theory, econometrics, and regional and urban economics. As a graduate student, I am a member of Omicron Delta Epsilon, the International Honor Society in Economics. Other academic societies in which I hold membership include Phi Kappa Phi and Brackenridge Scholars.

Experience

Since June 1975 I have been employed with the Regulatory Staff of U.S. Nuclear Regulatory Commission. As a Cost-Benefit Analyst, I am responsible for reviewing environmental reports to determine the adequacy of the environmental information and soundness of the conclusions therein, and assisting in the cost-benefit analysis for Environmental Statements. My duties also include the development of social and economic impact methodologies and data banks for cost-benefit analysis of design alternatives to reduce environmental impacts consistent with achieving benefits of activities. Primarily, I have been involved with alternative heat dissipation systems and need for power analysis on both a generic and case by case basis.

Prior to joining the Regulatory Staff, I worked as an Economist in the Environmental Department of Bechtel Power Corporation, beginning in September 1974. During my employment with Bechtel I was responsible for preparing the economic analysis section of Environmental Reports required for nuclear and fossil power plant construction and operation. I was primarily involved in land use analysis and development of methodologies to determine the economic impact of power plant activities.

From April 1973 to September 1974, I was employed as an Economist with the Institute for Applied Technology, National Bureau of Standards. Work at the Bureau involved specialized research assignments in the following areas: Economics of Natural Disasters; Economics of Energy Conservation; Building Codes; Rehabilitation of Housing; and Total Energy Systems. At the Bureau I was assigned major project responsibilities which included project leader over Economics of Natural Disasters. This project involved the application of cost-benefit analysis to the mitigation of losses from natural disasters and culminated in a publication authored by myself.

I have written numerous unpublished manuscripts in connection with my professional experience and formal education.

I am a member of the American Economic Association, Western Economic Association, and The Econometric Society.

ROBERT P. GECKLER

PROFESSIONAL BACKGROUND

SENIOR ENVIRONMENTAL PROJECT MANAGER

U. S. NUCLEAR REGULATORY COMMISSION

I joined the U. S. Atomic Energy Commission, (which became the Nuclear Regulatory Commission in January 1975) Directorate of Licensing in October, 1972, as an Environmental Project Manager. In July 1975, I was promoted to Senior Environmental Project Manager.

The Environmental Project Manager is responsible for managing the review of the applicant's environmental reports and the preparation of NRC Environmental Statements which meet the requirements of the National Environmental Policy Act and the requirements of 10 CFR, Part 51, in connection with applications to the Commission for construction permits and/or operating licenses for nuclear power reactors. The project manager also acts as the main point of contact between the Commission and the Applicant in matters involving environmental affairs.

The staff efforts required in conducting the above review and in developing the independent assessment of environmental impacts presented in Environmental Statements involve a wide variety of technical disciplines within numerous elements of the NRC Staff, including considerable technical assistance from one of the National Laboratories. The project manager serves as a focal point and is the key individual in directing and coordinating the multi-disciplined staff efforts with respect to an assigned environmental statement.

Upon receipt of an applicant's Environmental Report, a project manager conducts and coordinates an initial acceptance evaluation and is responsible for determining if the material submitted is sufficient in form and content to support the acceptance and docketing of an application. If accepted, the project manager initiates an in-depth staff review and makes arrangements for technical discussions, including a site visit, with the applicant and members of the staff to resolve questions raised during the review. The project manager then plans, supervises and coordinates the development of a Draft Environmental Statement and a subsequent Final Environmental Statement. This includes the ensurance that all components are submitted and reviewed on a scheduled basis; the resolution of problems and conflicts which may arise; the organization and editing of the Draft and Final Statements;

the evaluation, staff review and integration of comments received from Federal, State, and local government agencies and members of the public on the Draft Statement into the Final Statement; the determination of conclusions and recommendations of the licensing action to be taken; the sponsorship of the Final Statement and serving as a principal witness at public hearings; the development of environmental technical specifications to be appended to the license; and the periodic review of the licensed operation from an environmental standpoint.

I have held assignments in various capacities as EPM on the Bailly Nuclear Station, Indian Point, Farley, Brunswick, South Dade, Seabrook Nuclear Station, Calvert Cliffs, Hatch, Palisades and LaCrosse BWR. In addition, I have special assignments to work on generic problems in such areas as alternative siting, cost benefit analysis, monitoring requirements, workshops on biological significance and committee assignments on an interagency committee between EPA and NRC, evaluation of research proposals and review of internal staff documents.

Prior to joining the Commission, I spent approximately five years as a Senior Research Associate in the Biomathematics Program, Statistics Department, North Carolina State University, Raleigh, North Carolina.

As a faculty member and associate member of the graduate faculty, I taught courses in resource management and biology at the advanced undergraduate and graduate level, assisted in organizing and giving a short course in systems ecology, participated in graduate student guidance, program administration and research in prey-predation in an aquatic system (snails and marsh flies). I was also a member of the Nutrition Institute and the Air Pollution faculty. Outside consulting activities included general toxicology and toxicology of atmospheric pollutants.

Before joining NCSU, I was employed by Aerojet-General Corporation in California and Ohio for eleven years, three of which were with the company's nuclear division. While with the nuclear division, I had several assignments including those of Project Engineer for manufacture and assembly of nuclear training reactors and Administrative Reactor Supervisor. I held an AEC Reactor Operator License for Aerojet-General reactors.

In 1960, I transferred within the company to assist in establishing a life sciences activity. I participated in all phases of life sceinces programs and was responsible for the biological research in the corporation. Programs included establishing and operating an inhalation toxicology laboratory at Wright-Patterson Air Force Base, Ohio. I was Project Engineer during the early phases of design and fabrication and later Assistant Laboratory Director.

Other programs included systems studies of waste management systems, laboratory development of new and modified sewage treatment processes, the relationships between solid waste and disease, needs in solid waste research, water purification and microbial problems in desalination, river purification, recreational water quality criteria, various problems associated with manned space flight and life support systems (including the Manned Mars Mission), research and development leading to the fabrication of a photosynthetic gas exchanger and study of man in confinement. Special assignments were accepted as a life science specialist within the corporation. My final position with the company was Assistant Manager, Life Systems Division and Manager of the Advanced Biological Applications Department.

Before my employment with Aerojet, I spent one year in military operations research and more than four years with the AEC, Oak Ridge Operations Office, Isotopes Division and Research and Medicine Division as a Physiologist and Biologist.

From 1949 to 1951, I was a faculty member in the Biology Department at Vanderbilt University, Nashville, Tennessee, where I taught general biology, genetics and cytology and did research in protozoan genetics.

I received my B.S. in Chemistry and PhD in zoology from Indiana University in 1944 and 1949, respectively. I was granted an M.S. in Biological Chemistry from the University of Michigan in 1946. While in school, I held various positions as a research and teaching assistant.

I am author or co-author of more than 30 unclassified scientific papers, and co-holder of a patent on the use of concentrated carbon dioxide for growing algae and have been listed in American Men of Science since 1954. I am or have been a member of Sigma Xi, Phi Lambda Upsilon, the American Society of Naturalists, the American Society of Zoologists and numerous other scientific societies. I held a NIH Predoctoral Fellowship for two years (1947-49).

PROFESSIONAL QUALIFICATIONS
JOHN C. LEHR
U. S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C.

I am currently employed as an Environmental Engineer in the Office of Nuclear Reactor Regulation, Division of Site Safety and Environmental Analysis, in the Environmental Specialists Branch, USNRC. As a member of the Aquatic Resources Section of this branch, I have responsibility for the review of applicant's Environmental Reports at both the Construction Permit and Operating License Stages for completeness and environmental acceptability of proposed projects as they may affect natural water resources, existing water quality and use, water quality and usage goals as established by the responsible agency and other impacts on the aquatic environment. It is also my responsibility to provide written evaluation of water resource usage and quality for inclusion in both FES-CP and FES-OL Stages. Establishment and review of applicant's environmental technical specifications at the Operating License Stage for maintenance of physical and chemical water quality and control of aquatic effluent quality is another of my responsibilities. I act as a consultant to other NRC branches and provide analyses of water quality problems through technical assistance requests. I participate in technical conferences with and coordinate water quality related activities with the U. S. Environmental Protection Agency, the U. S. Army Corps of Engineers and other Federal, State and local agencies regarding implementation of the National Environmental Policy Act, the Federal Water Pollution Control Act and its amendments and the memoranda of understanding between NRC and EPA and COE. My work also involves the preparation of standard review plans, regulatory guides and staff position papers dealing with water resources. As an Environmental Engineer, I have among other tasks prepared an analysis of the compliance of the operation of the Brunswick Nuclear Plant with the provisions of the Federal Water Pollution Control Act Amendments of 1972, written the water quality and use sections for several NRC Draft and Final Environmental Statements, including the FES related to manufacture of Floating Nuclear Power Plants and participated in analyses of offsite noise levels at nuclear power plants including the Indian Point Unit No. 2 and the Vermont Yankee Nuclear Power Station.

I have a Bachelor of Science degree in Mechanical Engineering from Drexel Institute of Technology (1969) and a Master of Science degree in Environmental Engineering from Drexel University (1972) specializing in water associated problems in the environment. My academic background includes studies in water chemistry, domestic and industrial waste treatment, and water resources management.

From 1969 to 1972, I was a mechanical engineer at the U. S. Army Frankford Arsenal, Philadelphia, Pennsylvania. I was assigned as Project Manager of materials handling, and pollution control efforts for the Small Caliber Ammunition Modernization Program. I participated in the development of solid and liquid waste management and noise control programs for metal parts manufacturing facilities.

blt 7

BY MR. GRAINEY:

Q Gentlemen, I show you a copy of the Staff's Final Environmental Statement for the Indian Point Unit 2 proceeding as related to the preferred closed-cycle cooling system.

Dr. Geckler, would you explain to what extent you worked on this and what roles the other witnesses, members of the panel, played in the preparation of this document?

A (Witness Geckler) The document was prepared under my supervision and portions of it I wrote.

The other individuals contributed portions of the statement according to their specialties.

Q Would you gentlemen identify what those areas generally were of the Final Environmental Statement in which you participated?

A (Witness Lehr) I participated in preparation of portions of the Environmental Statement dealing with environmental sound levels.

A (Witness Kline) I wrote the sections on effects of salt drift.

Q Mr. Sav?

A (Witness Sav) I prepared portions of the Environmental Statement, specifically Chapter 6.

Q Dr. Geckler, with the exception of the comments that were received from other parties which is one of the

blt 8

appendices to the Environmental Statement, were the contents otherwise prepared under your general supervision?

A. (Witness Geckler) Yes.

Q. And are these contents true and correct to the best of your knowledge?

A. Yes.

MR. GRAINEY: Mr. Chairman, I would move that the Staff's Final Environmental Statement for Unit No. 2 relating to the preferred closed-cycle cooling system be admitted into evidence and incorporated in the transcript as if read.

CHAIRMAN JENSCH: Any objection by the Applicant, licensee rather?

MR. SACK: Con Edison has no objection to the document being inserted as the Staff's Final Environmental Statement, in support of Con Edison's application.

We do not think it can be introduced as to the accuracy or correctness of all the statements contained therein, and we are still, because of the state of this proceeding, which is quite unusual for this stage of the proceedings--we don't know whether the Board is going to get into those specifics. So if the Board does determine to get into the specific matters in the Final Environmental Statement which we described earlier, then we would reserve our rights to contest those matters.

blt 9

CHAIRMAN JENSCH: Well, you will also have the opportunity to make a motion to strike any portion with which you disagree.

At the same time, you will have to identify particularly those portions to which you do have objection. Otherwise, lacking such a motion we will accept the statement without objection, subject to motion at a later time.

State of New York?

MR. KUHN: Your Honor, we have no objection to having the Final Environmental Statement entered into the record of this proceeding. Indeed, we feel that it is important, as your Honors doubtless do, that you have a solid evidentiary basis for either accepting or rejecting the stipulation, and also for making an ultimate determination on the appropriate type of closed-cycle cooling system.

We intend to do some small amount of cross-examination of the NRC witnesses and possibly the Con Edison witness concerning some of the substantive matters contained in their analyses, but we feel it is important that a basis for your decision be provided.

CHAIRMAN JENSCH: The Fishermens Association?

MS. CHASIS: We have no objection.

CHAIRMAN JENSCH: Request of Staff counsel is granted, and the Final Environmental Statement identified by the four Staff witnesses may be physically incorporated

blt 10

into the transcript as if orally presented and constitute evidence on behalf of the Regulatory Staff.

(Identified Final Environmental Statement follows.)

final

NUREG-0042

environmental statement

related to selection of the
Preferred Closed Cycle
Cooling System at

INDIAN POINT UNIT NO. 2

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

AUGUST 1976

Docket No. 50-247

U. S. Nuclear Regulatory Commission • Office of Nuclear Reactor Regulation

Available from
National Technical Information Service
Springfield, Virginia 22161
Price: Printed Copy $10.75; Microfiche $2.25

NUREG-0042
August 1976

FINAL ENVIRONMENTAL STATEMENT

RELATED TO

SELECTION OF THE PREFERRED CLOSED CYCLE COOLING SYSTEM

AT

INDIAN POINT UNIT NO. 2

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

DOCKET NO. 50-247

SUMMARY AND CONCLUSIONS

This Environmental Statement was prepared by the U.S. Nuclear Regulatory Commission, Division of Site Safety and Environmental Analysis.

1. This action is <u>administrative</u>.

2. The proposed action is the issuance of an amendment to the Facility Operating License No. DPR-26 held by Consolidated Edison Company of New York, Inc. for Indian Point Unit No. 2 located in the State of New York, Westchester County, Village of Buchanan, 24 miles north of the New York City boundary line.

Under conditions of the operating license (Paragraph 2.E(2) of Facility Operating License No. DPR-26), the licensee is required to terminate once-through cooling at Unit No. 2 after an interim period, the reasonable termination date for which appeared at the time the license was issued to be May 1, 1979, and to operate thereafter with a closed-cycle cooling system, unless licensee can show that empirical data collected during this interim operation justifies an extension of the interim operation period or such other relief as may be appropriate. In accordance with this requirement, the licensee filed an Environmental Report dated December 1, 1974 in which various alternative closed cycle cooling systems were evaluated from an economic and environmental standpoint.

This statement considers the information provided by the licensee in the environmental report and amendments as well as other information developed by the staff in making its independent evaluation and analysis of alternative closed cycle cooling systems under NEPA.

3. Summary of environmental and economic impacts, including beneficial and adverse effects:

a. Visual or aesthetic impact comprised of the tower structure(s) and the visible plume.

b. There will be drift (0.002%) deposited in small amounts over a substantial area, resulting in increased salt concentrations. There is a small possibility that injury may occur occasionally to certain species of plants.

c. There may be a small increase (a matter of hours per year) in the amount of fogging and icing in the area; these are considered negligible.

d. During construction, noise levels and traffic will be increased; however, these are temporary conditions.

e. A monetary direct cost of approximately $224 million (present value) will be incurred by the licensee and the average annual plant capacity will be reduced by 25 MWe (3% of the total) while peak generating capability will be reduced by 69 MWe (8% of the total).

f. Water taken from the river for cooling purposes will be reduced to approximately one-tenth that taken for once-through cooling of Unit No. 2. This will reduce impingement and entrapment of aquatic species by a similar amount and, thus, aid in the maintenance of populations.

g. The increased tax base will provide additional monies to various communities.

4. The alternative closed cycle cooling systems considered were as follows:

a. Cooling ponds and lakes

b. Spray ponds and spray canals

c. Dry cooling towers

d. Wet-dry mechanical draft cooling towers

e. Wet cooling towers: Natural draft, linear mechanical draft, circular mechanical draft and fan-assisted natural draft.

5. The following Federal, State and local agencies and interested parties have been asked to comment on this Environmental Statement:

- Department of Agriculture (AGR)
- Department of Commerce (COM)
- Department of Health, Education, and Welfare (HEW)
- Department of the Interior (DOI)
- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- Federal Power Commission (FPC)
- Energy Research and Development Agency (ERDA)
- New York State Department of Environmental Conservation (DEC)
- Hudson River Fishermen's Association (HRFA)
- Save Our Stripers (SOS)
- Consolidated Edison Company of New York, Inc. (CONED)
- Federated Conservationists of Westchester County, Inc. (FCWC)
- Rockland County Conservation Association, Inc. (RCA)
- Environmental Defense Fund (EDF)
- North Brookhaven Sport Fishermen's Club, Inc. (NBSFC)
- Great South Beach Mobile Sportfishermen (GSBMS)
- West Branch Conservation Association (WBCA)
- Connecticut Coastal Anglers Association (CCAA)
- Village of Buchanan NY
- Westchester County NY

6. This Environmental Statement was made available to the Council on Environmental Quality, the public, the applicant, the above-mentioned agencies and interested persons in August 1976.

7. From review and evaluation of the applicant's Environmental Report and Supplements thereto, and from independent observations and analyses discussed in this Statement, the staff has reached the following conclusions concerning the environmental impacts of the applicant's proposed closed cycle system for Indian Point Unit No. 2.

a. The acceptable alternative closed cycle cooling systems for Unit No. 2 are natural draft, fan-assisted natural draft, and circular mechanical draft cooling towers.

b. Other alternatives are unacceptable environmentally or economically.

c. Major factors entering into selection of tower type are noise, drift and aesthetics. Although minor differences among the tower types considered were found, the techniques used in evaluation have varying degrees of uncertainty and subjectivity. The differences found do not warrant changing the applicant's selection of the natural draft cooling tower as the preferred system.

8. On the basis of the evaluation and analysis set forth in this Statement and after weighing the environmental, economic, technical, and other benefits against environmental costs and risks and considering available alternatives, the staff concludes that the action called for under the National Environmental Policy Act of 1969 (NEPA) and 10 CFR 51 of the Commission's regulations, is issuance of an amendment to the Facility Operating License No. DPR-26 authorizing construction of a natural draft cooling tower as proposed by the licensee and evaluated by the staff with the following condition:

a monitoring program will be established to determine the significance of drift and salt deposition and to detect botanical injury to sensitive plant species if it occurs.

In addition, routine monitoring will be performed about the cooling tower for the purpose of recording large episodic occurrences of bird mortalities should they occur.

The monitoring program established will be incorporated into the existing Environmental Technical Specifications for Indian Point Unit No. 2.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

LIST OF FIGURES (Cont'd)

LIST OF FIGURES (Cont'd)

LIST OF TABLES

LIST OF TABLES (Cont'd)

LIST OF TABLES (Cont'd)

FOREWORD

This environmental statement was prepared by the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation (the staff) in accordance with the Commission's regulation, 10 CFR 51, which implements the requirements of the National Environmental Policy Act of 1969 (NEPA) (P.L. 91-190, 83 Stat. 852).

The NEPA states, among other things, that it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice.
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Further, with respect to major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of the NEPA calls for preparation of a detailed statement on:

(i) the environmental impact of the proposed action;

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented;

(iii) alternatives to the proposed action;

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and,

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

An environmental report accompanies each application for a construction permit or a full-power operating license. Such a report may or may not be required in an application for an amendment to the construction permit or operating license, depending on circumstances. In determining such a requirement, the Commission shall be guided by the Council on Environmental Quality Guidelines, 40 CFR 1500.6. Where a report is required, prior to the staff preparation of an impact statement, pursuant to 10 CFR § 51.5b, a public announcement of the availability of the report is made. Any comments by interested persons on the report are considered by the staff. In conducting the required NEPA review, the staff meets with the applicant to discuss items of information in the environmental report, to seek new information from the applicant that might be needed for an adequate assessment, and generally to ensure that the staff has a thorough understanding of the proposed project. In addition, the staff seeks information from other sources that will assist in the evaluation and visits and inspects the project site and surrounding vicinity. Members of the staff may meet with state and local officials who are charged with protecting state and local interests. On the basis of all the foregoing and other such activities or inquiries as are deemed useful and appropriate, the staff makes an independent assessment of the considerations specified in Section 102(2)(C) of the NEPA and 10 CFR Part 51.

This evaluation leads to the publication of a draft environmental statement, prepared by the Office of Nuclear Reactor Regulation, which is then circulated to Federal, State and local governmental agencies for comment. A summary notice is published in the Federal Register of the availability of the applicant's environmental report and the draft environmental statement. Interested persons are also invited to comment on the proposed action and the draft statement. Comments should be addressed to the Director, Division of Site Safety and Environmental Analysis, at the address shown below.

After receipt and consideration of comments on the draft statement, the staff prepares a final environmental statement, which includes a discussion of questions and objections raised by the comments and the disposition thereof; a final benefit-cost analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects with the environmental, economic, technical, and other benefits of the facility; and a conclusion as to whether--after the environmental, economic, technical, and other benefits are weighed against environmental costs and after available alternatives have been considered, the action called for, with respect to environmental issues, is the issuance or denial of the proposed permit or license or its amendments with appropriate conditioning to protect environmental values.

Single copies of this statement may be obtained as indicated on the inside front cover. Dr. Robert P. Geckler is the NRC Environmental Project Manager for this statement. Should there be questions regarding the contents of this statement, Dr. Geckler may be contacted at the following address:

Division of Site Safety and Environmental Analysis
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Telephone: (301) 443-6951

1. INTRODUCTION

1.1 INTRODUCTORY REMARKS

On December 2, 1974, the Consolidated Edison Company of New York, Inc. (applicant) submitted to the Commission a report (three volumes) entitled, "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," in compliance with Paragraph 2.E(2) of Facility Operating License No. DPR-26 for Unit No. 2. The purpose of the report is to evaluate various alternative closed cycle cooling systems and their environmental and economic impacts and to determine which is the preferred closed cycle cooling system for installation at Unit No. 2. This evaluation is to be reviewed and approved by the Commission prior to construction of the preferred closed cycle cooling system at Unit No. 2. In addition to this report, the applicant applied at the same time for an amendment to the Facility Operating License No. DPR-26 which would include an additional Paragraph 2.E(5) that the Commission approve the applicant's determination that a closed cycle natural draft, wet cooling tower system is the preferred alternative closed cycle cooling system for installation at Indian Point Unit No. 2. The availability of the applicant's report and request for license amendment was published in the Federal Register on March 3, 1975 (40 FR 8855). The announcement for proposed issuance of this amendment with opportunity for a hearing was published in the Federal Register on July 23, 1975 (40 FR 30882).

On August 6, 1975, the licensee submitted Supplement Volume No. 1 to the report "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2." Additional information for Supplement Volume No. 1 was also submitted by the licensee on September 30, 1975. On October 6, 1975, the licensee submitted Supplement Volume No. 2. For convenience, this report and supplements will be designated as ER-CCC, IP-2,* for reference purposes.

1.2 BACKGROUND INFORMATION

The Indian Point Unit No. 2 is a nuclear generating plant, owned and operated by the applicant, and is located on a 239-acre site on the eastern bank of the Hudson River in an industrial area, about 24 miles north of the New York City boundary line, at Indian Point, Village of Buchanan, in the upper Westchester County, New York State. The site contains two other existing nuclear-power plants, Units Nos. 1 and 3. Unit No. 2 operates at a power level of 873 megawatts electrical (MWe); Unit No. 1, although presently shutdown for plant modifications, has a capability of operating at 265 MWe. The operating license for Unit No. 3 was issued in December 1975; it will operate at 965 MWe.

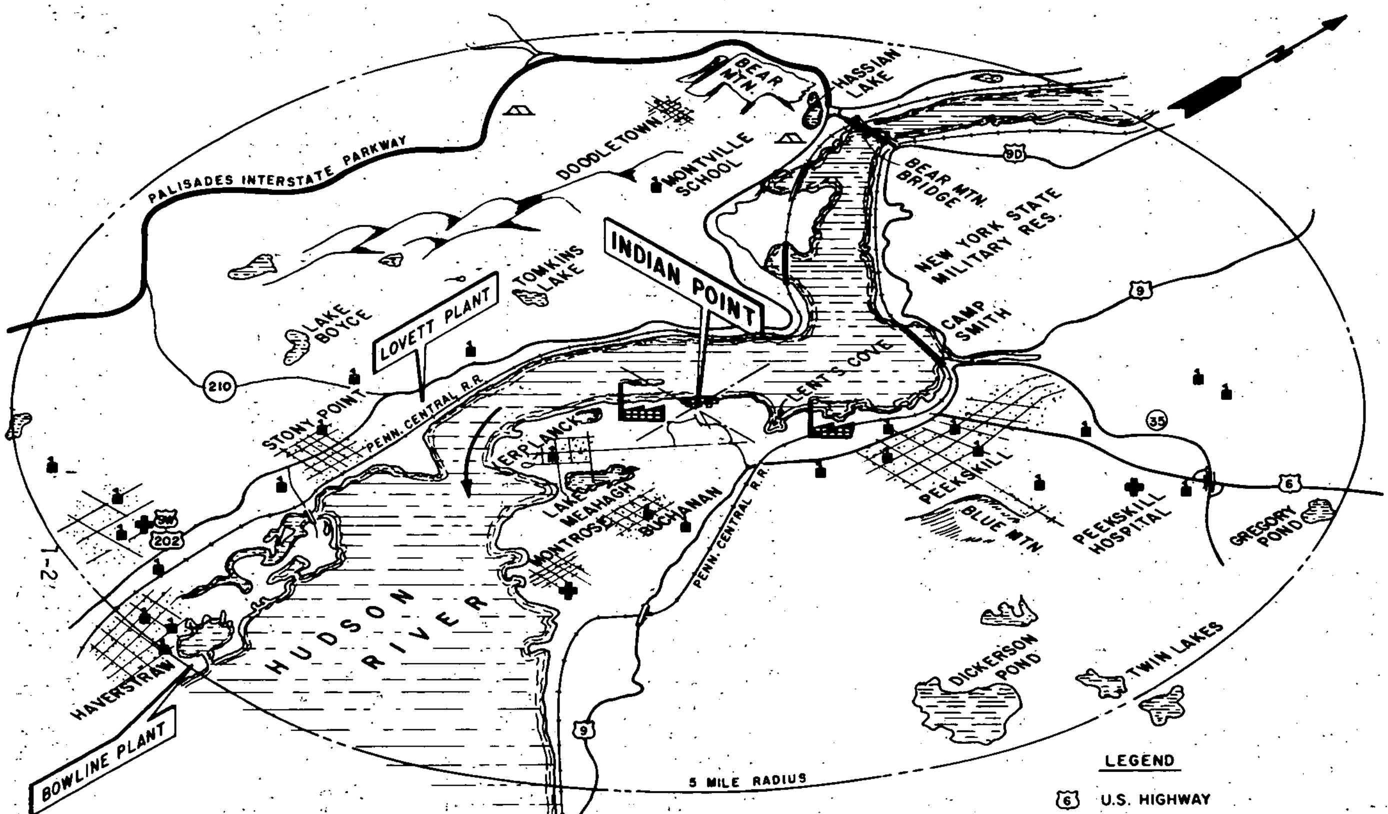
Figure 1-1 shows a five-mile area surrounding the Indian Point site and Figure 1-2 a picture of the plants as they presently exist. Details of the design, construction and operating characteristics of the three nuclear plants are presented in the staff's Final Environmental Statements for Unit No. 2, issued in September 1972 and for Unit No. 3 issued in February 1975. These documents will be referenced as FES, IP-2 and FES, IP-3, respectively, in this environmental statement.

Since 1970, the applicant submitted its Environmental Report with three supplements for Unit No. 2 (ER, IP-2) and the Environmental Report with 12 supplements for Unit No. 3 (ER, IP-3). These environmental reports as well as the staff's FES's for IP-2 and IP-3 also provide extensive details of the three units, their construction, operation, and impacts on the site and surrounding areas, including the need for power from the plants and the importance of electrical power from the plants to New York City and Westchester County which are within the applicant's service area, and New York State.

1.3 LICENSING ACTIONS

The applicant in its applications for construction permit and operating license for each of the three units initially proposed that each condenser cooling system operate with once-through cooling. See Section III in the FES for IP-3 for description of the details of the once-through cooling system presently existing for the three units.

*A list of acronymns and some abbreviations used in this statement may be found on page 8-23.



LEGEND

- U.S. HIGHWAY
- STATE ROUTE
- SCHOOL
- HOSPITAL
- RECREATIONAL AREA
- INDUSTRIAL AREA

Ref.: FES-IP-2, Fig. II-1

Fig. 1-1
Indian Point 5 Mile Area

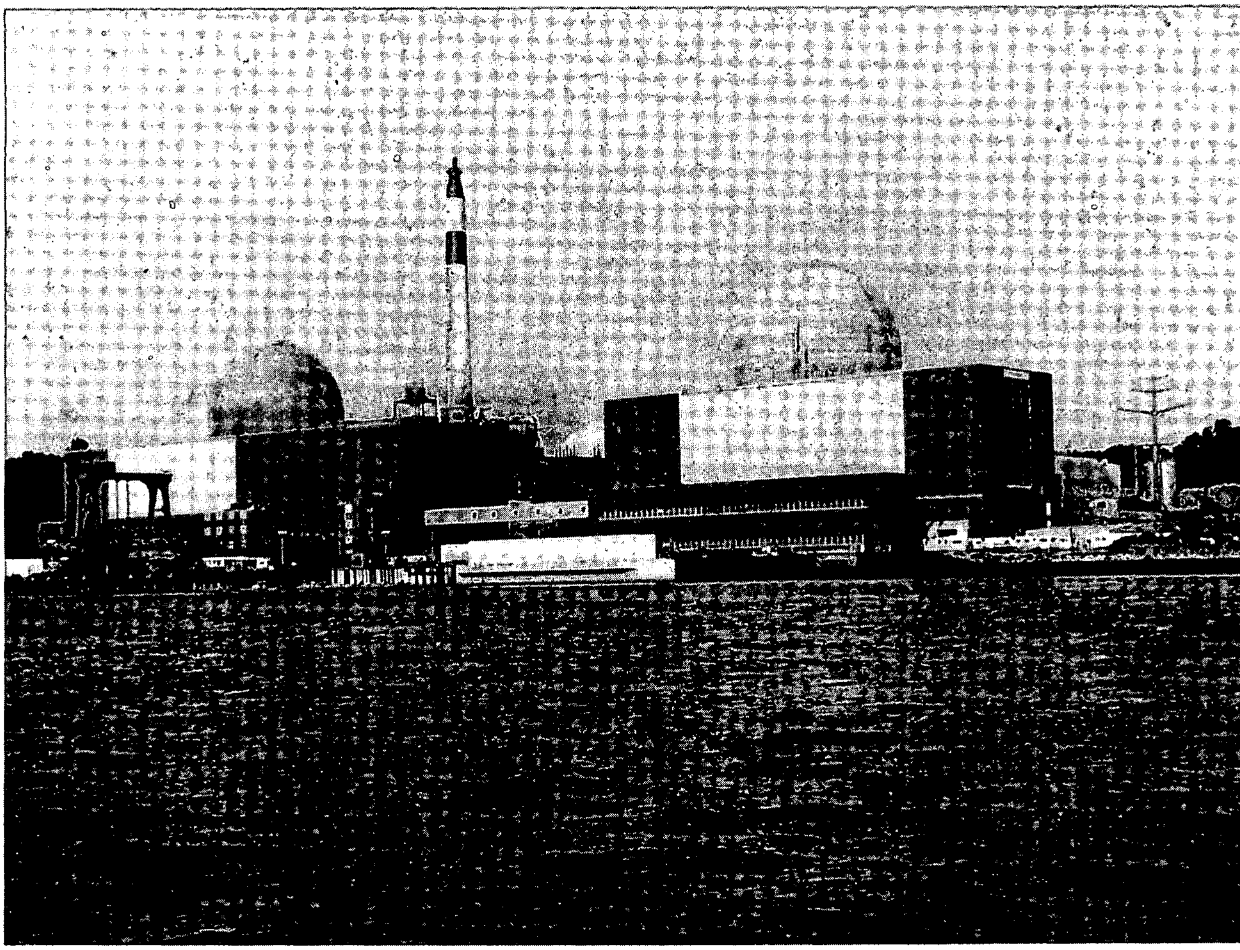


Fig. 1-2. Photograph showing the Indian Point Units Nos. 1, 2 and 3 on the Hudson River Estuary.

Ref.: FES-IP 3, Fig III-1

Section 102(2) of NEPA requires the Commission to study, develop and describe appropriate alternatives to recommend courses of action in any proposal which involve unresolved conflicts concerning alternative uses of resources; and to recognize the world-wide and long-range character of environmental problems. Based on this requirement and the consideration of benefit-cost analyses in the preparation of environmental statements, the Commission required the applicant to submit a benefit-cost analysis of alternate plant designs for Indian Point Unit No. 2. On February 15, 1972, the applicant submitted its Supplement No. 3 to the Environmental Report for Indian Point Unit No. 2. This supplement considered the economic and environmental impacts of the existing plant, natural draft and mechanical draft wet cooling towers and spray ponds each operating in the open cycle or closed cycle mode. The conclusion drawn by the applicant was that of the alternate systems considered, the closed cycle natural draft cooling tower option was chosen because of reduced environmental impacts from fog, drift and salt deposition.

In that FES, IP-2, based on the unacceptability of long-term impacts of entrainment and impingement on the Hudson River fishery, the staff recommended that once-through cooling of Unit No. 2 be terminated on January 1, 1978 and thereafter the plant be operated with a closed cycle cooling system. The staff also recommended that the applicant submit an evaluation of the economic and environmental impacts of alternative closed cycle cooling systems in order to select the preferred closed cycle cooling system for installation at Unit No. 2.

On December 4, 1972, an extensive hearing on environmental issues regarding the impacts from once-through cooling versus closed cycle cooling systems was initiated. On September 25, 1973, the ASLB issued its Initial Decision for the Unit No. 2 proceeding, resulting in issuance of Amendment No. 4 to the Facility Operating License No. DPR-26. This amendment allowed for full-term, full-power operation but cessation of once-through cooling on May 1, 1978, and thereafter operation with a closed cycle cooling system was required. Another condition of that license amendment was the requirement for submittal by the applicant of its environmental report on closed cycle cooling systems by March 1, 1974. Based on exceptions to the Initial Decision, the Atomic Safety and Licensing Appeal Board issued its memorandum and order (ALAB-174), dated January 29, 1974, resulting in issuance of Amendment No. 5 to the operating license in which the March 1, 1974 date was postponed to December 1, 1974 as the due date for submittal of the applicant's closed cycle cooling report to the Commission.

On April 4, 1974, the Appeal Board in ALAB-188 also ordered issuance of Amendment No. 6 to the Facility Operating License No. DPR-26 for Unit No. 2, which delayed the date of cessation of once-through cooling until May 1, 1979. Subsequent operation is to be conducted with an alternative closed cycle cooling system. The Appeal Board's Decision, ALAB-188, also required the staff to take a fresh look at certain of the staff's positions and reconsider portions (ecological sections) of the FES for Unit No. 2. Such a reassessment of the issues in contention relative to the staff's recommendations on closed-cycle cooling was made in the staff's preparation of the FES for Unit No. 3. The staff not only took a "fresh look" regarding the contentions on the impacts of once-through cooling on aquatic biota of the Hudson River but also considered in much greater detail the environmental and economic impacts of alternate closed cycle cooling systems at Unit No. 2 alone and Units Nos. 2 and 3 together than previously.

1.4 EXISTING PLANT WITH ONCE-THROUGH COOLING (OTC) SYSTEM

As mentioned above, the existing plants operate with once-through cooling in which the steam produced by means of the steam generator, once dissipated to create electrical energy, is condensed by means of cooling water from the Hudson River. Unit No. 1 has two circulating water pumps, each with 140,000 gpm capacity and six service water pumps for a total capacity of 38,000 gpm to cool the one condenser. Unit No. 2 and Unit No. 3 each have three condensers which are cooled by means of six circulating water pumps, each with 140,000 gpm capacity for a total flow of 840,000 gpm. Each unit also has six service water pumps of 5,000 gpm capacity. A total flow of 2,058,000 gpm of river water passes through the seven condensers to dissipate heat at the rate of 2.0×10^9 Btu/hr at Unit No. 1, 6.4×10^9 Btu/hr at Unit No. 2 and 7.3×10^9 Btu/hr at Unit No. 3, (based on the initial power rating of each unit).

The heated water is then discharged through 10 openings in the common discharge structure which is submerged such as to give a depth of 12 feet (center of port holes to the river surface).

Details of the intake-discharge structure are presented in Section III of the FES for Unit No. 3. Figure 1-3 also shows a schematic of this structure. Table III-1 in the FES for Unit No. 3 shows the power levels for the three plants and Table 1-1 in the applicant's ER-CCC, IP-2 indicates the design parameters for the Unit No. 2 once-through cooling system.

1.5 SUPPORTING ACTIVITIES RELATED TO COOLING TOWERS

In Appendix G of the FES for Unit No. 3, a description of the extensive research involving environmental effects of dry and wet cooling towers using fresh and salt water as makeup is outlined. The former Atomic Energy Commission (now the Energy Research and Development Administration (ERDA)) is supporting such work.

As mentioned in Appendix G, ERDA is partially supporting research work on the measurement of drift rates and deposition for a salt water natural draft cooling tower for Unit No. 3 built at the Chalk Point Plant owned by the Potomac Electric Company on the Patuxent River in Prince Georges County, Maryland. The study program of Chalk Point Cooling Tower Project was described in the proceedings of a symposium held at the University of Maryland on March 4-7, 1974. A discussion of this study program was held with the NRC staff during a site visit on May 29, 1975. Although the first natural draft tower went into operation about the middle of May, only preliminary results are available at this time.

1.6 SITE METEOROLOGICAL CHARACTERISTICS AND MEASUREMENTS PROGRAM

The plant site is located in a climatic region which, though primarily continental in character, is subjected to some modification by marine air which may penetrate to the site area.[1,2,3] The regional topography ranges from hilly to mountainous.

During most of the year, continental polar air masses originating in Canada predominate over southeastern New York. In summer, maritime tropical air masses from the Gulf of Mexico or Caribbean Sea become predominant. As a result, winters are relatively cold and occasionally severe while summer temperatures are modified by the maritime influences. Precipitation is uniformly distributed throughout the year, occurring mainly as showers and thunderstorms during the warmer months and as snow in winter. The Hudson Valley southward from Albany has the highest percentage of sunshine in the State.[1]

The site is on the Hudson River and lies within an elongated topographic "bowl", surrounded on almost all sides by higher ground which ranges in elevation from 500 to 900 feet above plant grade. Meteorological conditions in the valley are influenced by this topography in the following ways: (1) The orientation of the ridges channels the valley air flow; (2) wind speeds within the valley tend to be lower than in the open terrain; and (3) differential heating of the hillsides and the bottom of the valley creates local air circulation patterns. Since 1956, several meteorological studies of the site area have been made. The initial onsite meteorological measurements program was conducted during the years 1956 and 1957 for the site Safety Analysis Reports (FFDSAR). Another study was conducted in 1969 and 1970 primarily to describe the diurnal wind direction reversals in the Hudson River Valley. The original onsite measurements program consisted of wind speed and direction and air temperature measured on a 300-ft high tower. The 1969-1970 study utilized a 100-ft high tower at the same location as the original 300-ft tower as well as measurements at several other locations along the river within five miles of the site. During the period 1970-1972, additional data were collected onsite using the 100-ft high tower including wind speed and direction at the 100-ft level and vertical air temperature difference between the 95-ft and 7-ft above-ground levels. These data were used in the Final Safety Evaluation of Unit No. 3.[4]

The present onsite meteorological program consists of measurements on a 400-ft high tower located about 2600 feet south of the plant complex. Wind speed and direction are measured at the 33-, 125-, 280- and 400-ft levels, and temperature difference between the 400-ft and 33-ft levels and between the 200-ft and 33-ft levels. Dewpoint temperature is measured at the 33-, 200- and 400-ft levels. Solar radiation and ambient air temperature are measured at the 33-ft level. Precipitation and visibility measurements are also measured near the tower. Meteorological data collected using this system during the one year period from October 1, 1973 through September 30, 1974 as well as supplementary data measured at higher atmospheric levels using balloons, meteorological rockets and constant level balloons (tetroons) were provided by the applicant. Figures

ES-504

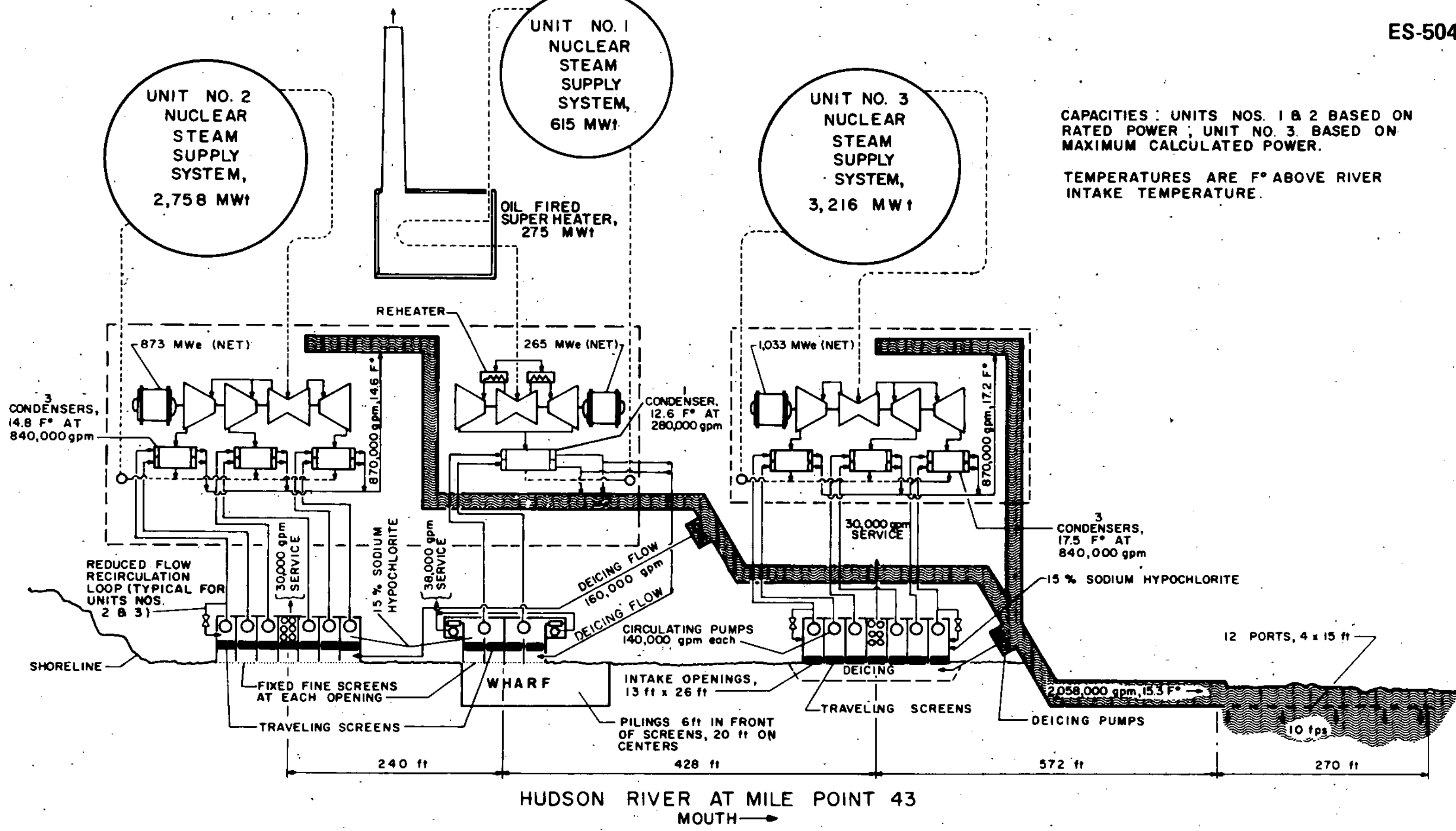


Fig. 1-3 Schematic representation of Indian Point Plant cooling water systems.

Ref.: FES-IP 3, Fig. III-2

1-4 and 1-5 show, respectively the relationship of the meteorological tower to other site structures and the array of meteorological instruments on the tower. All the meteorological instruments conform to the recommendations of Regulatory Guide 1.23.[5]

Tables 1-1 and 1-2 present long term climatological data from Albany and New York City.[1,2] Tables 1-3 and 1-4, based on meteorological data collected onsite during the one year period from October 1, 1973 through September 30, 1974, show the frequency distributions of wind speed and wind direction at the 33-, 125- and 400-ft levels on the site tower.[6] The frequency of occurrence of restricted visibility resulting from fog at the site is presented in Table 1-5, while Table 1-6 shows the results of a background, dust bucket sampling program for particulates and sodium concentrations in the site vicinity (ER-CCC, IP-2).

Additional and more detailed information concerning meteorological conditions at the site as well as the meteorological data sampling program is presented in Volume 1 and in Appendix A (Vol. 2) with Appendices A through N of the applicant's ER-CCC, IP-2.[6]

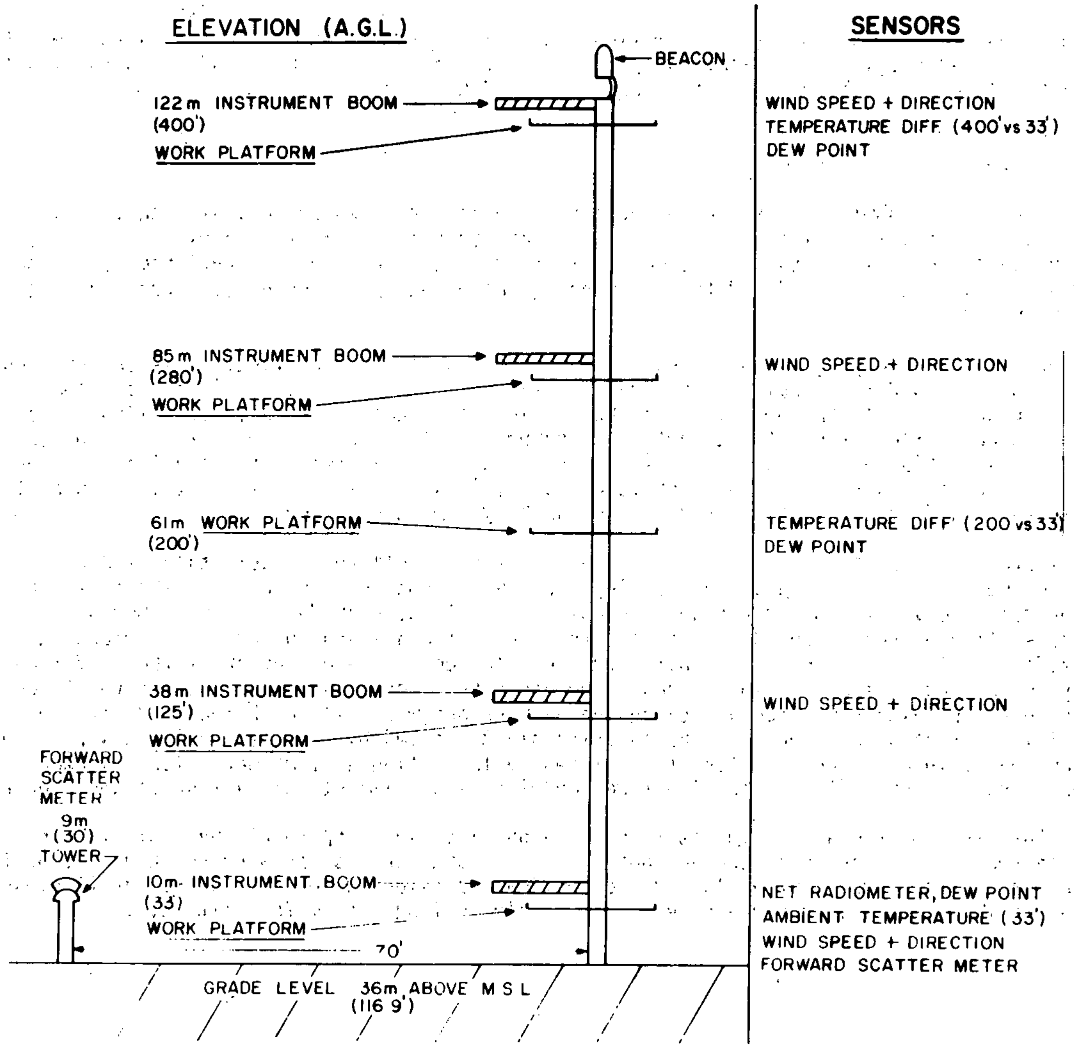
1.7 SCOPE OF THIS STATEMENT

The applicant submitted its closed cycle cooling report in which only alternative closed cycle cooling systems were discussed. The report was based on information derived from preliminary studies and on onsite studies and measurements to determine specific environmental impacts of what the applicant considered to be technologically feasible closed cycle cooling alternatives for Unit No. 2.

Specifically, the program indicated studies of air quality, acoustical emissions and aquatic effects of blowdown as well as considerations of the impact on land, air and the community during construction and operation of the feasible alternatives. Radiological safety considerations were also taken into account. An economic evaluation along with the environmental impacts were also included. On the basis of its economic and environmental evaluation, the applicant has determined that a single natural draft closed cycle wet cooling tower system would be the preferred closed cycle cooling system if any such system is required.

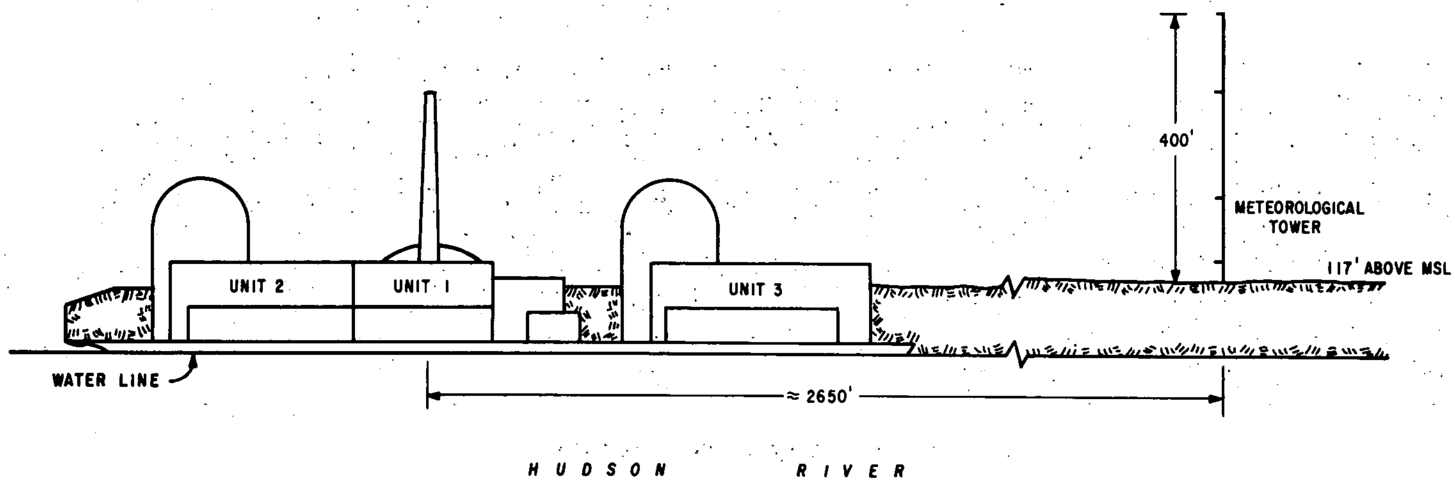
The staff has carried out an intensive review of the applicant's submittals, and has had a number of discussions with the applicant during the review process. In addition the staff has had several site visits to observe and discuss the applicant's study programs. During the visits, the staff had independent discussions with local officials and toured the surrounding area; the staff also flew over the areas that might be affected by the operation of the preferred closed cycle cooling system. An independent tree and vegetation survey was made. Several cooling tower vendors were also contacted and extensive discussions were held with them. Visits were made with utilities that have proposed to build power plants cooled by various cooling towers. Independent sources of information on alternative closed cycle cooling systems were also reviewed. The staff has also developed its own cooling tower model to study impacts of salt drift and fogging.

On the basis of the above, the staff carried out its own independent environmental and economic assessment as presented in the following sections and conclusions were reached (See Section 7) regarding the approval or denial of the applicant's selection of the natural draft closed-cycle wet cooling system as the preferred closed cycle cooling system for Unit No. 2.



Ref.: ER-CCC, IP-2, Fig. 6-4
(modified)

FIGURE 1-4
METEOROLOGICAL TOWER SCHEMATIC



Ref.; ER-CCC, IP-2 Fig. 6-3

FIGURE 1-5
PROFILE OF NUCLEAR FACILITIES WITH METEOROLOGICAL TOWER

Table 1-1

Meteorological Data For The Current Year

Station: ALBANY, NEW YORK   ALBANY COUNTY AIRPORT   Standard time used: EASTERN   Latitude: 42° 45' N   Longitude: 73° 48' W   Elevation (ground): 275 feet   Year: 1974

Month	Temperature °F: Averages: Daily maximum	Daily minimum	Monthly	Extremes: Highest	Date	Lowest	Date	Degree days Base 65 °F: Heating	Cooling	Precipitation in inches: Water equivalent: Total	Greatest in 24 hrs.	Date	Snow, Ice pellets: Total	Greatest in 24 hrs.	Date	Relative humidity, pct.: Hour 01	Hour 07	Hour 13	Hour 19 (Local time)	Wind: Resultant: Direction	Speed m.p.h.	Average speed m.p.h.	Fastest mile: Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days: Sunrise to sunset: Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F: Maximum: (b) 90° and above	32° and below	Minimum: 32° and below	0° and below	Average station pressure mb Elev. 292 feet m.s.l.
JAN	32.8	13.8	23.3	62	27	-14	18	1285	0	2.04	0.46	20-21	10.0	5.9	9	79	84	62	71	27	2.6	9.1	35	W	27	41	7.5	5	8	18	14	2	0	0	0	17	30	6	1010.2
FEB	31.8	10.8	21.3	57	22	-9	9	1216	0	2.12	0.81	22	12.4	6.3	6-7	72	75	53	63	30	4.8	10.9	40	NW	23	57	6.2	10	4	14	9	2	1	0	0	16	28	7	1004.7
MAR	42.0	22.7	32.4	63	6	7	29	1005	0	3.10	1.03	16-17	5.6	1.9	21	70	71	52	59	29	6.0	12.9	47	NW	10	54	7.2	5	8	18	16	2	0	1	0	3	28	0	1003.7
APR	60.7	35.5	48.1	84	29	20	7	511	11	2.80	1.09	8-9	11.3	10.7	8-9	74	73	49	56	28	3.8	11.3	29	NW	16	51	7.2	4	9	17	14	2	2	0	0	1	14	0	1003.7
MAY	65.1	43.0	54.1	88	22	29	5	343	12	3.47	1.47	12	0.0	0.0		76	72	55	60	23	3.3	10.0	45	NW	1	49	7.5	2	12	17	14	0	4	1	0	0	2	0	1003.4
JUN	76.9	53.0	65.0	92	10	38	13	54	59	3.31	0.85	21	0.0	0.0		89	85	56	66	18	3.1	8.3	30	NW	3	57	7.0	2	13	15	14	0	5	2	1	0	0	0	1004.4
JUL	81.4	57.1	69.3	92	4	45	21	17	157	4.84	2.01	29-30	0.0	0.0		89	83	55	68	24	3.0	7.7	28	NW	19	65	6.4	5	13	13	13	0	10	2	2	0	0	0	1004.7
AUG	79.9	55.9	67.9	88	21	47	26	14	111	3.53	0.97	28-29	0.0	0.0		93	91	59	74	20	2.6	6.8	24	NW	27	61	6.9	5	9	17	9	0	5	6	0	0	0	0	1007.8
SEP	69.2	47.3	58.3	86	13	28	24	227	35	5.37	1.36	20-21	0.0	0.0		93	93	62	85	23	1.9	8.2	38	W	13	44	7.0	5	10	15	14	0	4	7	0	0	1	0	1007.1
OCT	55.8	32.9	44.4	78	6	18	28	631	0	1.49	0.74	16	T	T	3	80	83	57	70	25	3.1	9.2	25	W	15	46	6.1	11	4	16	8	0	0	6	0	0	16	0	1011.9
NOV	47.5	29.7	38.6	77	1	14	28	786	1	3.83	0.97	12-13	2.2	1.8	25	83	84	65	76	30	2.3	9.2	26	NW	26	31	8.5	0	7	23	14	1	0	1	0	2	20	0	1006.1
DEC	36.0	21.8	28.9	56	8	0	26	1113	0	2.57	0.86	16-17	12.5	4.4	25	83	84	71	80	28	3.3	9.3	31	NW	4	20	8.6	2	3	26	9	4	0	0	0	7	29	1	1006.1
YEAR	56.6	35.3	46.0	92	JUL 4	-14	JAN 18	7202	386	38.47	2.01	JUL 29-30	54.0	10.7	APR 8-9	82	82	58	69	26	2.7	9.4	47	NW	MAR 10	49	7.2	56	100	209	148	13	31	26	3	46	168	14	1006.2

Normals, Means, And Extremes

Month	Temperatures °F: Normal: Daily maximum	Daily minimum	Monthly	Extremes Ø: Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F: Heating	Cooling	Precipitation in inches: Water equivalent: Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets: Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct.: Hour 01	Hour 07	Hour 13	Hour 19 (Local time)	Wind: Mean speed m.p.h.	Prevailing direction	Fastest mile: Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days: Sunrise to sunset: Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperatures °F: Max.: (b) 90° and above	32° and below	Min.: 32° and below	0° and below	Average station pressure mb. Elev. 292 feet m.s.l.
(a)				9		9					28		28		28		28		28		9	9	9	9	36	13	36	36		36	36	36	36	36	28	28	36	36	9	9	9	9	2
J	30.4	12.5	21.5	62	1974	-28	1971	1349	0	2.20	4.12	1958	0.73	1955	1.68	1953	28.8	1966	15.4	1964	78	79	63	73	9.8	WNW	57	W	1952	46	7.0	6	8	17	12	4	*	1	0	17	30	9	1008.5
F	32.7	14.3	23.5	57	1974	-21	1973	1162	0	2.11	4.14	1950	0.36	1968	1.42	1950	34.5	1962	17.9	1958	73	76	58	67	10.3	WNW	71	NW	1953	51	6.9	6	7	15	11	4	*	1	0	13	27	5	1007.6
M	42.6	24.2	33.4	77	1968	-10	1967	900	0	2.58	5.74	1953	1.07	1949	1.53	1964	34.7	1956	15.9	1956	72	74	54	62	10.5	WNW	55	W	1941	52	7.0	6	8	17	12	3	1	1	0	4	26	*	1005.8
A	58.0	35.7	46.9	88	1970	10	1965	543	0	2.70	4.71	1953	1.14	1963	2.20	1968	11.3	1974	10.7	1974	70	70	47	55	10.4	WNW	49	W	1954	53	6.9	6	8	16	12	1	1	1	0	*	15	0	1003.2
M	69.7	45.7	57.7	92	1970	26	1968	253	27	3.26	8.96	1953	1.22	1965	2.17	1968	1.4	1966	1.4	1966	78	74	52	60	9.1	S	50	W	1950	55	6.9	5	9	17	13	*	4	2	*	0	2	0	1002.7
J	79.4	55.6	67.5	98	1968	36	1967	39	114	3.00	7.36	1973	0.65	1964	3.48	1952	0.0		0.0		83	78	56	65	8.1	S	57	NW	1971	59	6.6	5	11	14	11	0	6	1	2	0	0	0	1004.8
J	83.9	60.1	72.0	98	1966	43	1969	9	226	3.12	5.89	1960	0.49	1968	2.70	1960	0.0		0.0		83	79	54	63	7.3	S	43	NW	1938	64	6.3	6	13	12	11	0	7	1	4	0	0	0	1004.7
A	81.4	57.8	69.6	93	1973	37	1965	22	165	2.87	7.33	1950	0.73	1947	4.52	1971	0.0		0.0		86	83	54	68	6.9	S	38	S	1950	61	6.0	7	12	12	10	0	5	3	2	0	0	0	1007.1
S	73.7	50.1	61.9	93	1973	28	1974	135	42	3.12	7.89	1960	0.40	1964	3.66	1960	0.0		0.0		87	87	57	75	7.3	S	48	S	1961	57	6.0	8	10	12	9	0	3	4	1	0	1	0	1007.5
O	62.8	40.0	51.4	84	1968	16	1969	422	0	2.63	8.83	1955	0.20	1963	2.66	1972	2.0	1952	2.0	1952	83	84	55	73	7.9	S	45	NW	1939	54	6.1	8	9	14	8	*	1	5	0	0	9	0	1009.9
N	48.1	31.1	39.6	77	1974	5	1972	762	0	2.84	8.07	1972	1.17	1960	2.01	1959	24.6	1972	21.9	1971	80	82	64	75	8.9	S	70	E	1950	36	7.5	4	7	19	12	1	*	2	0	2	18	0	1005.4
D	34.1	17.7	25.9	65	1970	-22	1969	1212	0	2.93	6.73	1973	0.64	1958	4.02	1948	57.5	1969	18.3	1966	81	82	68	77	9.1	S	54	W	1944	38	7.3	5	7	19	13	4	*	2	0	13	28	2	1007.0
YR	58.1	37.1	47.6	98	JUN 1968	-28	JAN 1971	6888	574	33.36	8.96	MAY 1953	0.20	OCT 1963	4.52	AUG 1971	57.5	DEC 1969	21.9	NOV 1971	79	79	57	68	8.8	S	71	NW	FEB 1953	53	6.7	72	109	184	135	16	28	24	8	48	156	17	1006.2

Ø For period February 1965 through current year.
Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 104 in July 1911; maximum monthly precipitation 13.48 in October 1869; minimum monthly precipitation 0.08 in January 1860; maximum precipitation in 24 hours 4.75 in October 1903; maximum snowfall in 24 hours 30.4 in March 1888.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Table 1-2

Meteorological Data For The Current Year

Station: NEW YORK, NEW YORK JOHN F. KENNEDY INTL AIRPORT Standard time used: EASTERN Latitude: 40° 39' N Longitude: 73° 47' W Elevation (ground): 13 feet Year: 1974

Month	Temperature °F Averages Daily maximum	Daily minimum	Monthly	Extremes Highest	Date	Lowest	Date	Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Total	Greatest in 24 hrs.	Date	Snow, Ice pellets Total	Greatest in 24 hrs.	Date
JAN	41.3	29.8	35.1	65	27	10	18	920	0	2.83	0.72	11	6.7	4.4	9
FEB	37.5	25.7	31.6	54	22	12	5	929	0	1.41	0.51	19-20	10.5	6.3	8
MAR	50.0	35.3	42.7	69	7	23	25	686	0	4.60	1.61	21	4.1	4.1	29
APR	60.6	44.4	52.5	82	29	29	10	373	7	2.33	1.09	8-9	T	T	10
MAY	66.6	52.5	59.6	89	17	42	2	183	24	2.69	1.15	9-10	0.0	0.0	
JUN	74.9	60.6	67.8	88	22	53	3	26	116	2.38	0.51	16-17	0.0	0.0	
JUL	85.0	68.1	76.6	97	9	60	26	0	366	1.29	0.75	5	0.0	0.0	
AUG	83.7	67.7	75.7	92	14	59	11	0	342	4.24	1.22	28	0.0	0.0	
SEP	74.4	59.4	66.9	88	13	43	24	47	111	5.97	1.56	3-4	0.0	0.0	
OCT	62.7	46.0	54.4	76	15	32	21	322	1	2.19	2.00	15-16	0.0	0.0	
NOV	54.8	41.0	47.9	76	1	26	27	508	1	1.10	0.59	12-13	0.2	0.2	25-26
DEC	45.5	34.1	39.8	56	7	26	5	775	0	6.07	2.46	16	T	T	31
YEAR	61.4	47.0	54.2	97	JUL 9	10	JAN 18	4769	968	37.10	2.46	DEC 16	21.5	6.3	FEB 8

Month	Relative humidity, pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Resultant Direction	Speed m.p.h.	Average speed m.p.h.	Fastest mile Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 22 feet m.s.l.
JAN	76	79	68	71	31	5.0	12.0	31	31	31		6.8	6	10	15	11	3	0	7	0	10	19	0	1020.0
FEB	65	69	59	64	33	6.6	15.0	37	28	23		5.8	9	10	9	12	3	0	1	0	9	24	0	1014.2
MAR	59	64	54	57	31	5.5	15.4	37	27	17		6.9	4	12	15	8	1	1	4	0	0	8	0	1013.9
APR	71	70	61	66	25	4.5	13.5	30	26	15		6.5	6	9	15	9	0	2	4	0	0	1	0	1014.6
MAY	75	67	58	67	20	2.0	12.0	37	18	12		6.1	8	12	11	9	0	1	4	0	0	0	0	1013.9
JUN	84	82	71	78	16	2.5	10.5	24	29	30		6.5	7	10	13	12	0	1	4	0	0	0	0	1014.6
JUL	72	69	53	64	25	3.1	11.0	29	29	5		5.6	9	14	8	5	0	1	0	9	0	0	0	1014.9
AUG	77	76	58	72	20	3.8	10.0	33	19	4		6.1	6	13	12	10	0	5	1	1	0	0	0	1018.0
SEP	79	77	60	72	27	1.7	11.1	28	19	3		5.8	10	8	12	13	0	5	1	0	0	0	0	1016.9
OCT	69	71	51	62	30	4.3	10.7	24	33	20		4.8	14	8	9	4	0	0	1	0	0	1	0	1022.0
NOV	71	72	55	66	29	6.3	13.1	36	25	21		5.3	10	10	10	8	0	0	2	0	0	8	0	1015.9
DEC	68	71	58	62	30	5.3	13.2	46	06	2		6.9	6	5	20	9	0	0	1	0	0	13	0	1015.9
YEAR	72	72	59	67	28	3.1	12.3	46	06	DEC 2		6.1	95	121	149	110	7	16	30	10	19	74	0	1016.2

Normals, Means, And Extremes

Month	Temperatures °F Normal Daily maximum	Daily minimum	Monthly	Extremes Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs. #	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs. $	Year
(a)				14		14					27		27		27		16		16	
J	38.0	24.8	31.4	65	1974	0	1968	1042	0	2.69	3.77	1949	0.21	1956	1.60	1958	17.4	1965	13.0	1964
F	39.1	25.2	32.2	65	1972	-2	1963	918	0	3.05	5.48	1960	1.41	1974	2.87	1958	25.3	1961	19.9	1969
M	46.5	32.1	39.3	72	1963	7	1967	797	0	3.77	7.93	1953	1.35	1966	2.27	1962	21.1	1960	8.1	1967
A	58.1	41.7	49.9	87	1973	26	1969	493	0	3.59	6.98	1973	1.12	1963	2.12	1971	3.2	1971	3.2	1971
M	68.4	51.1	59.8	99	1969	34	1966	188	27	3.54	6.14	1951	0.38	1955	2.88	1968	T	1967	T	1967
J	78.0	60.9	69.5	99	1964	45	1967	9	144	2.98	6.70	1972	T	1949	2.23	1973	0.0		0.0	
J	83.2	66.9	75.1	104	1966	55	1963	0	313	4.04	8.48	1969	0.46	1954	3.21	1969	0.0		0.0	
A	81.7	65.4	73.6	98	1973	46	1965	0	267	4.30	17.41	1955	0.42	1972	6.59	1955	0.0		0.0	
S	75.4	58.6	67.0	94	1961	40	1963	42	102	3.31	9.60	1960	0.70	1951	5.83	1960	0.0		0.0	
O	65.8	48.7	57.3	84	1967	25	1961	247	8	2.76	6.41	1958	0.09	1963	3.42	1972	0.5	1962	0.5	1962
N	53.7	39.3	46.5	76	1974	20	1967	555	0	3.90	9.51	1972	1.10	1974	4.09	1972	2.1	1967	2.1	1967
D	41.3	28.4	34.9	68	1962	5	1962	933	0	3.60	6.16	1969	1.46	1971	2.46	1974	16.4	1960	8.2	1960
YR	60.8	45.3	53.1	104	JUL 1966	-2	FEB 1963	5184	861	41.53	17.41	AUG 1955	T	JUN 1949	6.59	AUG 1955	25.3	FEB 1961	19.9	FFB 1969

Month	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperatures °F Max. (b) 90° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb. Elev. 22 feet m.s.l.
(a)	13	13	13	13	16		11	11			16	16	16	16	16	16	16	16	13	13	13	13	2
J	69	71	59	64	13.4		52	26	1966		6.1	8	9	14	10	2	*	3	0	9	23	*	1018.7
F	67	70	58	62	14.2		46	25	1967		6.3	7	8	13	10	2	*	3	0	6	22	*	1016.8
M	68	70	57	63	14.0		44	28	1971		6.2	7	10	14	11	1	1	4	0	1	13	0	1015.4
A	70	69	55	65	13.2		44	26	1970		6.2	7	10	13	11	*	2	3	0	0	2	0	1013.6
M	76	70	57	68	12.0		44	16	1973		6.1	7	12	12	11	0	3	3	*	0	0	0	1013.1
J	80	74	61	72	10.9		32	24	1972		6.2	7	11	12	10	0	4	4	2	0	0	0	1015.1
J	77	73	57	70	10.7		37	34	1969		6.1	7	12	12	9	0	5	2	5	0	0	0	1014.8
A	78	76	57	71	10.4		46	30	1965		5.7	7	14	10	9	0	4	2	2	0	0	0	1017.2
S	79	78	57	70	10.8		40	30	1970		5.4	10	10	10	8	0	2	1	1	0	0	0	1017.3
O	75	77	54	68	11.2		39	26	1967		5.2	12	9	10	7	0	1	3	0	0	*	0	1019.8
N	72	74	57	67	12.5		44	05	1968		6.3	7	9	14	11	*	*	2	0	0	5	0	1015.8
D	71	73	61	66	12.9		46	06	1974		6.4	8	8	15	11	1	*	3	0	4	19	0	1016.6
YR	73	73	57	67	12.2		52	26	JAN 1966		6.0	94	122	149	117	7	22	32	10	19	83	*	1016.2

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

$ Greatest calendar day through March 1969.
# Greatest calendar day August 1966 through March 1969.

Table 1-3

INDIAN POINT SITE
WIND DIRECTION DISTRIBUTIONS
OCTOBER 1, 1973 - SEPTEMBER 30, 1974

Direction	Frequency of Occurrence (%)		
	33 ft	125 ft	400 ft
N	5.9	8.6	7.3
NNE	12.7	12.9	13.5
NE	14.7	12.0	6.7
ENE	5.6	3.4	2.4
E	2.2	1.7	1.9
ESE	1.2	1.4	1.5
SE	1.4	1.7	2.0
SSE	2.2	3.2	2.3
S	6.9	10.2	10.7
SSW	9.3	8.1	9.2
SW	8.7	7.4	10.7
WSW	3.3	3.3	4.6
W	3.2	3.1	3.7
WNW	4.2	4.8	4.7
NW	8.2	10.3	10.7
NNW	6.2	7.7	8.0
CALM	4.1	0.2	0.1

Table 1-4

INDIAN POINT SITE
WIND SPEED FREQUENCY DISTRIBUTIONS
OCTOBER 1, 1973 - SEPTEMBER 30, 1974

Level	Frequency Distribution (%)					
	Wind Speed Category (mph)					
	0-3	4-7	8-12	13-18	19-24	24+
33 ft	51.4	34.6	12.2	1.7	0.1	0.0
125 ft	23.5	33.2	27.5	13.0	2.2	0.6
400 ft	15.8	26.9	25.7	21.8	7.4	2.4

Table 1-5

INDIAN POINT SITE
OCTOBER 1973 THROUGH AUGUST 1974

OCCURRENCE OF RESTRICTED VISIBILITY (FOG)
WHEN RELATIVE HUMIDITY EQUALS OR EXCEEDS 80%

MONTH	VISIBILITY			
	3/4 mi or less		5/16 mi or less	
	Hours	%	Hours	%
OCT	18	4.00	12	2.67
NOV	37	5.15	20	2.78
DEC	46	6.18	32	4.30
JAN	28	4.15	19	2.81
FEB	4	0.59	2	0.29
MAR	31	4.38	24	3.39
APR	26	3.61	15	2.08
MAY	15	2.09	7	0.97
JUN	20	3.27	13	2.12
JUL	0	0.00	0	0.00
AUG	9	1.21	2	0.26
Total	234	3.12	146	1.95

Total valid hours in sample = 7505 (93.4% of possible hours)

Table 1-6

DUST BUCKET AVERAGES
7/1973 - 8/1974

Sampling Station	Summer Average $mg/cm^2/mo.$	Winter Average $mg/cm^2/mo.$	Year Average $mg/cm^2/mo.$
	SETTLEABLE PARTICULATES		
IP3	0.6978	0.8195	0.7727
VER	0.4686	0.6157	0.5544
BUC	0.3862	0.3590	0.3695
CRO	0.4148	0.3190	0.3590
	SODIUM CONCENTRATIONS		
IP3	4.062×10^{-3}	7.909×10^{-3}	6.429×10^{-3}
VER	4.104×10^{-3}	4.396×10^{-3}	4.274×10^{-3}
BUC	4.384×10^{-3}	7.630×10^{-3}	6.382×10^{-3}
CRO	4.216×10^{-3}	6.121×10^{-3}	5.328×10^{-3}
CSM	3.328×10^{-3}	6.469×10^{-3}	5.261×10^{-3}

The five sampling stations which surround the Indian Point facility on the Eastern side of the Hudson River are:

IP3 - Located at the Indian Point facility next to a one hundred foot meteorological tower.

Verplanck - Located approximately one hundred and twenty feet east of the Hudson River.

Buchanan - Located approximately three hundred feet east of Route 9A (Albany Post Road).

Croton Point - Located approximately one hundred and fifty feet south of the northern tip of Croton Point.

Camp Smith - Located on the Camp Smith Military Reservation approximately 1750 feet WNW of the Peekskill traffic circle.

REFERENCES FOR SECTION 1

1. U. S. Department of Commerce, Environmental Data Service: Local Climatological Data, Annual Summary with Comparative Data - Albany, N.Y. Published annually.

2. U. S. Department of Commerce, Environmental Data Service: Local Climatological Data, Annual Summary with Comparative Data - New York, N.Y. (J. F. Kennedy Airport). Published annually.

3. U. S. Department of Commerce, Environmental Data Services: Local Climatological Data, Annual Summary with Comparative Data - New York, N.Y. (La Guardia Field). Published annually.

4. Directorate of Licensing, U. S. Atomic Energy Commission, Safety Evaluation of the Indian Point Nuclear Generating Unit No. 3, Docket No. 50-286, September 21, 1973 and Supplement No. 1, January 16, 1975.

5. Directorate of Regulatory Standards, U. S. Atomic Energy Commission, Regulatory Guide 1.23, "Onsite Meteorological Programs," Washington, D. C, 1972.

6. ER-CCC IP-2 Appendix A with Appendices A-N.

2. DESCRIPTION OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS

2.1 ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS CONSIDERED

In a closed cycle cooling (CCC) system, most (up to 99%) of the waste heat from the plant's condenser and service water cooling systems is transferred from the circulating water system directly to the atmosphere. The resulting cooled water is then returned to the condensers for reuse rather than as in once-through cooling. In evaporative cooling systems, a small fraction (1-3%) of the circulating water must be continuously purged from the system to prevent the buildup of dissolved materials in the system. The water purged is called "blowdown." A schematic of a typical CCC system is shown in Figure 2-1.

The staff has considered eight CCC systems for use at Indian Point Unit No. 2: (1) natural draft wet cooling towers (NDCT), (2) mechanical draft wet cooling towers (MDCT), (3) wet/dry mechanical draft cooling towers (W/D MDCT), (4) fan-assisted natural draft cooling towers (FANDCT), (5) circular mechanical draft cooling towers (CMDCT), (6) cooling ponds (CP), (7) spray canals (SC), and (8) dry cooling towers (DCT).

Except for dry towers, all of the available alternate cooling systems can also be operated in the open cycle (sometimes called "helper") mode of operation; that is, all of the cooling water is returned to its source without recirculation. This method of operation would reduce but not eliminate the heat load on the Hudson River. However, the volume of water flowing through the plant would not be significantly decreased. The staff concludes that the helper-cycle is not a viable option for this plant, as it would not reduce the rate of fish impingement or entrainment.

The primary process for heat transfer from the circulating water to the atmosphere in the first seven cooling options listed above is evaporation. New water must be continuously added to the circulating water supply to replace that lost by evaporation, blowdown, leaks and drift. Thus, the use of CCC does not eliminate the need for a reliable source of water and for an intake structure; however, it reduces but does not eliminate the environmental impacts of the makeup water system and the thermal and chemical effects of the blowdown.

Closed cycle cooling systems do not eliminate thermal pollution problems; they transfer the primary impact from the hydrosphere to the atmosphere. Because CCC systems transfer large amounts of heat and water vapor (except for DCT's) to the atmosphere from small areas, they have a potential to create adverse atmospheric effects. The atmospheric impacts of the CCC systems that could be used at Indian Point Unit No. 2 are discussed in Section 5.1. The terrestrial and aquatic impacts from the drift and blowdown are also discussed in Sections 5.2 and 5.4.

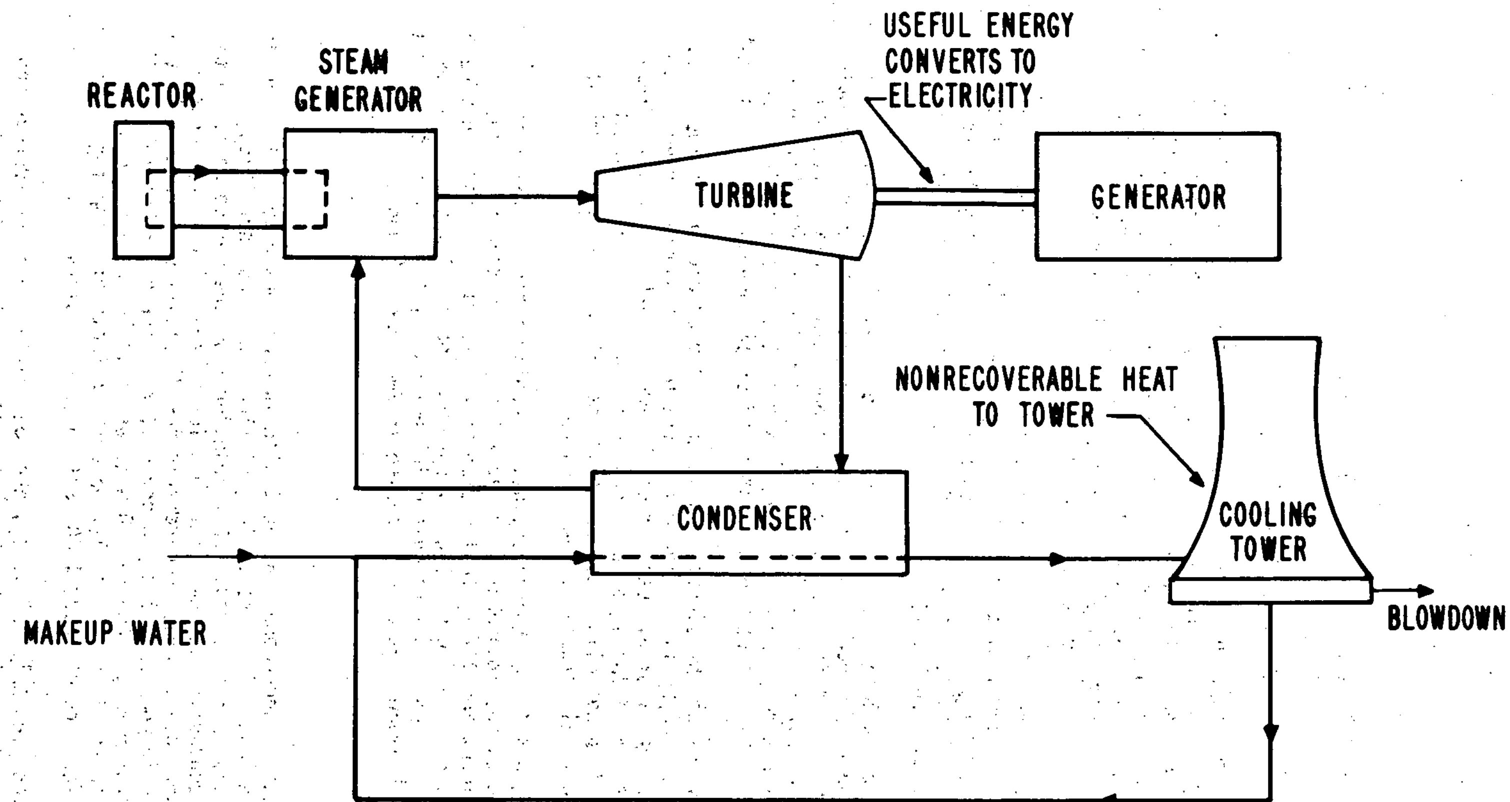
2.2 COOLING PONDS AND LAKES (CP)

The cooling pond is a proven, effective and economical heat sink in areas where sufficient level land can be purchased at reasonable cost. It operates in a similar manner as once-through cooling except the body of water used is restricted. Heat transfer from the heated water in the cooling pond occurs by radiation, conduction and evaporation prior to the water being recirculated from the pond to the condenser inlet. Area requirements for dissipation of waste heat via surface effects from a cooling lake or pond are of the order of 1 to 3 acres per MWe.[1,2] On this basis, an impoundment covering approximately 1,000 to 3,000 acres would be required to serve Unit No. 2. Additional land is required in order to eliminate the effects of steam fogs to off-site roads, buildings, etc. A buffer zone of about 1500 feet would be satisfactory.

Since the entire plant site area occupies only 239 acres, and considering that the surrounding terrain does not lend itself to the construction of a separate cooling pond of this size, the staff does not consider a cooling pond to be a viable cooling alternative for this site.

2.3 SPRAY PONDS AND SPRAY CANALS (SC)

The size of a cooling lake can be made much smaller, by a factor of up to 20 by use of sprays.[2] As with cooling ponds, however, a buffer zone of about 1000 to 1500 feet would be needed to confine fogging and drift effects to the site.



Ref.: ER-CCC, IP-2, Fig. 2-1

FIGURE 2-1
CLOSED-CYCLE COOLING SYSTEM

Heat dissipation to the atmosphere using spray ponds or spray canals is effected primarily through evaporation and conduction. However, spray ponds are similar to cooling ponds in that they depend upon local temperature, relative humidity and wind conditions. Therefore, their reliability is variable. In order to maximize cooling by reducing recirculation of air between sprays and to minimize fogging, spray modules are generally placed in a long meandering canal.[3] The efficiency and drift loss from spray modules are a function of the spray height and spray drop size, which are dependent on the design of the spray pump system. At higher pressures, the drops become very fine resulting in high heat transfer, but can be transported readily by the wind, causing more local fogging in the cooler months.

The applicant describes the two types of spray systems: the conventional fixed-pipe spray system and the relatively new "powered spray module". The applicant estimates that the fixed-pipe spray ponds require about 5% of the land used for natural cooling ponds but is about twice that of a powered spray-module spray canal. To add a powered spray-module system at Unit No. 2 would require about 55 acres (about twice that estimated in the ER, IP-2) and to add the fixed-pipe system would need about 100 acres at Unit No. 2.

Because of the lack of suitable level land on or near the site, the staff does not consider a spray canal or pond to be a viable cooling option, especially when contrasted with wet cooling towers.

2.4 COOLING TOWERS

Among possible alternatives to the once-through cooling water system are closed cycle systems that would utilize one or more cooling towers to dissipate the waste heat to the atmosphere. There are two basic types of cooling towers: the wet tower that carries away heat by evaporation and sensible heat transfer, and the dry tower that relies on air to carry away heat and, in principle, functions like an automobile radiator. The two types of wet cooling towers are mechanical and natural draft towers which differ in the method of inducing air flow from the heated water to the ambient air. These cooling towers can be designed as counterflow or crossflow towers. Counterflow towers maximize the air-water heat transfer time, thereby resulting in a thermally more efficient tower. Crossflow towers offer less resistance to air flow and therefore result in lower energy consumption for mechanical draft cooling towers.

When operated in the closed cycle mode, wet cooling towers require makeup water to compensate for losses sustained through evaporation and drift. As evaporation occurs, the natural salts in the cooling water become concentrated; to prevent buildup and deposition on the components of the system, they are continuously returned to the source of cooling water supply by blowdown. Chemicals used in treating the cooling water to prevent growth of algae, freezing, etc., are also discharged during blowdown, and their effect upon the ecology of the receiving waters must be taken into account (See FES, IP-2, Appendix XI-1).

The mechanical draft towers are relatively low structures and, as such, may cause fogging, misting, and icing that could be hazardous if highways, roads, or streets are nearby. Natural draft towers, on the other hand, are tall hyperbolic structures, about 500 ft high, which minimize the effects of drift and fogging at ground level. The plume behavior is governed by the ambient atmospheric conditions and its own heat and moisture content. However, when the wind is strong, the plume may be caught in the aerodynamic downwash surrounding the tower structure and be carried downwards. Observations at operating towers indicate that downwash rarely if ever brings the plume to ground level.[4-9] Isolated, detached puffs of the visible plume are occasionally observed downwind of a cluster of eight NDCT's in England.[5] Other factors to be considered such as visual impact, noise levels, chemical effects from blowdown, salt drift, increased generating costs, etc., are discussed in Sections 5 and 6.

The size of the cooling tower will depend upon certain design parameters, such as the cooling range (the decrease in temperature of the water passing through the tower), approach to wet-bulb temperature (difference in temperature between the water leaving the tower and the ambient wet-bulb temperature), and the amount of waste heat to be dissipated. Evaporation of 1 lb of water will transfer about 1000 Btu to the atmosphere.[10] In wet cooling towers, about 75% of the average annual heat transfer is due to evaporation, and 25% due to sensible heat transfer.[11] The fraction due to evaporation varies with weather conditions; values of 60% in winter and 90% in summer are typical.[11] Since about 7.35×10^9 Btu/hr of heat will be rejected to the atmosphere in the cooling tower for Unit No. 2, the average annual evaporation rate will be about 15,000 gpm. Evaporation of 1% of the water volume will result in a reduction of the water temperature by approximately 10 F°. Drift, the carryover of water droplets by air, accounts for a small loss of water, about 0.002% of the circulating water flow rate for an NDCT with the state-of-the-art drift eliminators.

Observations at operating cooling towers in Europe as well as the United States indicate that the primary environmental impacts of natural draft cooling towers are the visual impact of the structures and the generation of visible plumes that remain aloft.[4,5,12,13] See Section 6 for further discussion of the visual impact of NDCT.

2.4.1 Dry Cooling Towers (DCT)

Dry cooling towers remove heat from a circulating fluid through conduction to the air being circulated past the heat exchanger tubes. There is no direct contact between the circulating cooling water and the ambient air. Because of the poor heat-transfer properties of the metal-to-air interface, the dry tower's tubes are generally finned to increase the heat-transfer area. See Figure 2-7 in the applicant's ER-CCC, IP-2, p. 2-11 for an illustration of a DCT. The theoretical lowest temperature that a dry cooling system can achieve is the dry-bulb temperature of the air. The dry-bulb temperature is always higher than (or equal to) the wet-bulb temperature, which is the theoretical lowest temperature that a wet cooling tower can achieve. Turbine backpressures will be increased, as will the range of backpressures over which the turbines must operate. This will result in a reduced station capability for a given size reactor.

The advantage of a dry cooling tower system is its ability to function without large quantities of cooling water. Theoretically, this allows power plant siting without consideration of water availability, and eliminates thermal/chemical pollution of blowdown. In practice, some makeup water will always be required, so that power plant siting cannot be completely independent of water availability. From an environmental and cost/benefit standpoint, dry cooling towers can permit optimum siting with respect to environmental, safety and load distribution criteria without fogging or dependence on a supply of cooling water. When considered as a direct alternative to wet cooling towers, the advantages of dry cooling towers include elimination of drift, fogging and icing problems, and blowdown disposal.

The principal disadvantage of dry cooling towers is economics: for a given reactor size, plant capacity can be expected to decrease by about 5 to 15 percent, depending on ambient temperatures and assuming an optimized turbine design.[14] Bus-bar energy costs are expected to be in the order of 20% more than a once-through system and 15% more than a wet cooling tower system, assuming 1980 operation.[14] The environmental effects of heat releases from dry cooling towers have not yet been quantified; some air pollution problems may be encountered; noise generation problems for mechanical draft dry towers will be more severe than those of wet cooling towers because of increased air flow requirements; and the aesthetic impact of natural-draft dry towers, which would be much taller than a wet NDCT, will increase despite the absence of visible plume. Dry cooling towers now being used for European and African fossil plants are limited to plants in the 200-megawatt or smaller category in areas with cool climates and winter peak loads; the use of dry towers to meet the much larger cooling requirements of 1000-MWe-size nuclear stations with summer peak loads requires new turbine designs to achieve optimum efficiencies at the higher peak pressure and range required of this system.[15,16]

At Indian Point Unit No. 2, the applicant estimates that the backpressure on the turbine with a dry cooling tower in operation would be 11 inches of mercury which would be associated with "high condenser cooling water temperature." The optimum approach would be 35 F° and the range would be 30 F° for a dry cooling tower system at Unit No. 2. Because of limitations of the existing turbine at Unit No. 2, where backpressures cannot exceed 5 inches of mercury without causing severe thermal stresses on the turbine, dry cooling towers at Unit No. 2 do not appear to be feasible.

After weighing the overall advantages and disadvantages of dry cooling towers, and particularly when comparing their greater fuel use and the economic and engineering penalties associated with their use, the staff has concluded that dry cooling towers are not feasible for the Indian Point site.

2.4.2 Wet-Dry Mechanical Draft Cooling Towers (WDCT)

In this type of tower, a dry cooling section is added to a conventional evaporative cooling tower. Most design concepts and all operating units are of the mechanical draft type,[2,17-20] although a wet-dry natural draft tower is feasible.[21] The design is an attempt to combine some of the best features of both wet and dry cooling towers (little or no fogging in winter, lower consumptive use of water, more economical cooling in summer, etc.) with minimizing the disadvantages of each (especially the higher capital and operating costs of dry units for summer conditions).

Four basic water- and air-flow patterns are possible: air flow in series or parallel, and water flow in series or parallel. In one design, the hot water first passes through the dry section of the tower and then the wet; air flow is passed through either the wet or the dry section, or both, with adjustable louvers used to control the two air flows, as shown in Figure 2-2.[20] While other designs are possible, the one just described and shown in Figure 2-2 is the only one now in use. The two air flows mix inside the tower prior to discharge. The effluent air has a higher temperature and a lower absolute humidity than it would have from a standard MDCT, thus reducing the potential for fogging, icing and long plumes. The amount of reduction of fogging and plumes will depend on the relative sizes of the two cooling sections. Such towers can be designed to operate with "dry only" cooling below a design temperature, say 35 F°.[20] It is expected that such units would operate as "wet-only" units in summer. Thus water conservation would be obtained only in winter.

Since more cooling surface is required for a dry section than for wet surfaces of equal cooling capacity and since an excess of surface may be required to achieve a flexibility in the operating mode, wet-dry mechanical draft cooling towers would be larger in size than wet MDCT's and more costly to build and operate than either natural draft or mechanical draft units. Utilization of this combined wet-dry system can be of great advantage to those industries whose geographical location is such that the incremental contribution of cooling tower moisture to the atmosphere could increase the occurrence of fog in the vicinity of the cooling towers to an unacceptable degree.

The applicant has made an analysis of the feasibility and cost of this type of cooling for Indian Point No. 2 and concluded that four 7-cell cooling towers, each 340 ft long, 70 ft wide and 74 ft tall[22] would be needed. These wet/dry units would have the same thermal performance characteristics as a pure wet MDCT (See Section 2.4.3.2 below).

Experience with wet-dry towers is limited, as only a relatively few cells have been operational. A demonstration cell for a wet/dry cooling tower was built and put into operation during 1973 by the Westinghouse Electric Corporation for the Duke Power Company's Cliffside Station in North Carolina.[23] Marley[20] has reported a wet/dry cooling system in operation at a St. Joseph (Missouri) Light and Power Generating Station. Marley's parallel path wet/dry mechanical draft units offer control of visible plumes and water conservation capability.

Although experience is limited, wet/dry mechanical draft cooling towers would be a viable cooling alternative at Indian Point Unit No. 2.

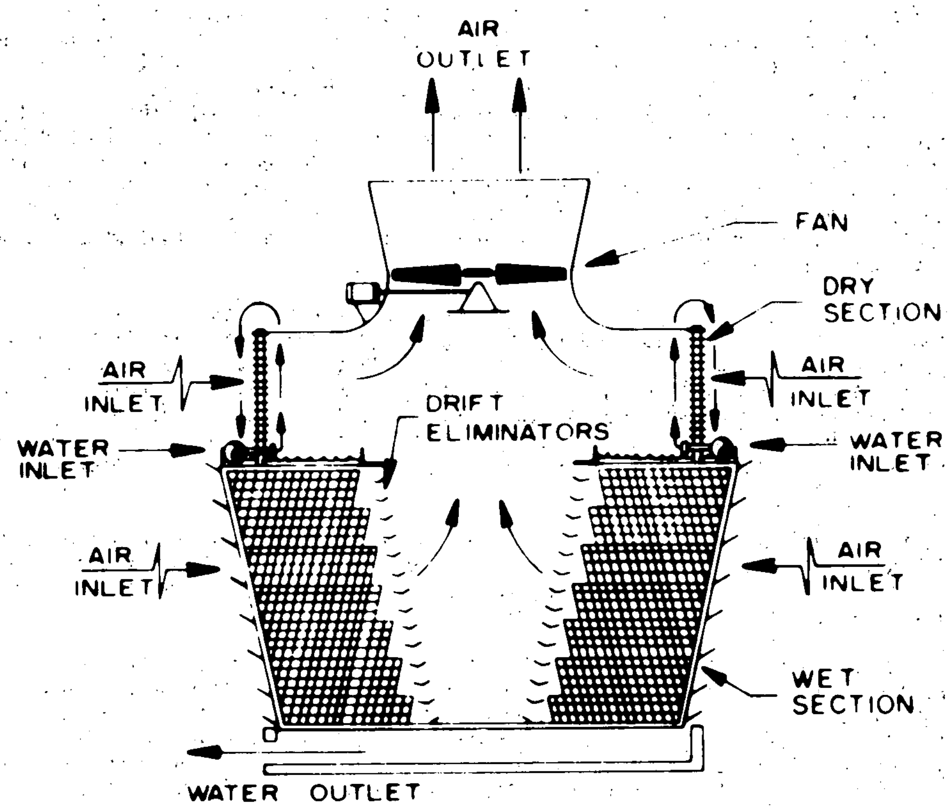
2.4.3 Wet Cooling Towers

2.4.3.1 Natural Draft Cooling Towers (NDCT)

A wet natural draft cooling tower consists of a large reinforced concrete chimney such as that indicated in Figures 2-3 and 2-4 which creates a chimney effect to induce an upward flow of air through falling drops of the water to be cooled. The chimney, or shell, is hyperbolic in shape to decrease resistance to air flow. The condenser cooling water is sprayed onto baffles, or fill material, where the water is cooled by evaporative and conductive heat transfer to the air. The differential density between the heated air inside the tower and the air outside creates the natural draft; the warm, vapor-laden plume will usually continue to rise for some distance after leaving the top of the tower due to its momentum and buoyancy. Two basic types of hyperbolic cooling towers are the crossflow (Fig. 2-3) and counterflow (Fig. 2-4). The first has fill in a ring outside the tower. Although this arrangement may seem to produce a lower water pumping head than the counterflow, fill inside the counterflow tower is spread out over a much larger area; thus, its depth is shallower and vertical water rises are shorter. Pressure drop through fill in the crossflow tower is less than in a counterflow tower. This leads to less resistance to air flow.[2] Selection of either tower will depend upon design conditions at the particular installation.

Important advantages of natural draft towers when compared to mechanical draft units are low operating cost since plant power is not required to move the air, noise levels are relatively low, and the discharge height above the terrain greatly reduces the possibilities of ground-level drift deposition, fogs, and icing problems. Major disadvantages are the relatively high capital cost and the fact that, from an aesthetic standpoint, the large structures and visible plumes tend to dominate the surroundings.

The operating parameters of any cooling system (flow rate, cold water temperature, and temperature rise across the condensers) must be closely matched with the rest of the plant (condensers,



Ref.: ER-CCC, IP-2, Fig. 2-8

FIGURE 2-2

MECHANICAL DRAFT WET-DRY COOLING TOWER

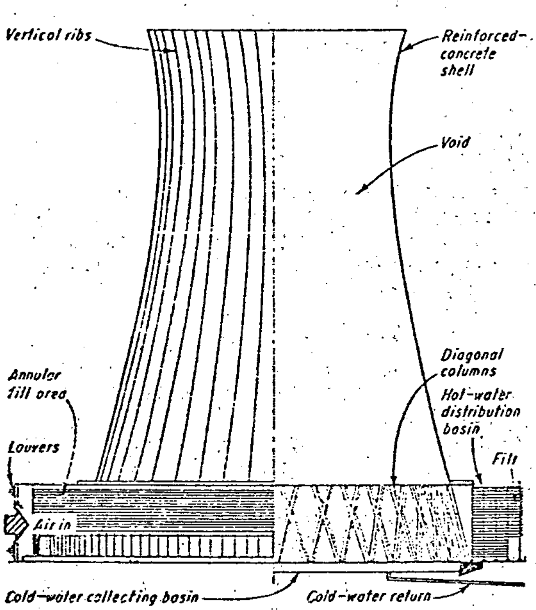


Fig. 2-3

Crossflow Natural Draft Cooling Tower

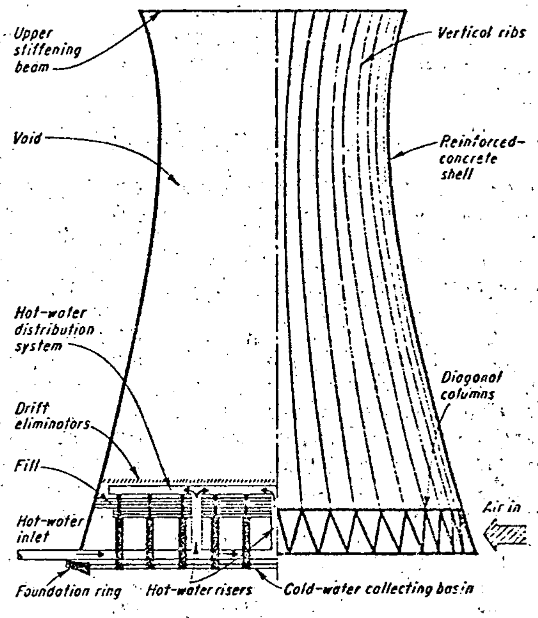


Fig. 2-4

Counterflow Natural Draft Cooling Tower

Ref.: Hansen and Cates[20]

turbine design, etc.) for optimal power production.[2] At Indian Point Unit No. 2, where the turbines and condensers are already in operation and optimized for once-through operation, the degrees of freedom for cooling tower options are reduced.

The applicant has made a study to determine the optimal design for a natural draft cooling tower for Indian Point Unit No. 2.[22] A 74 F° wet-bulb temperature, a value which is exceeded 5% of the time during the summer months, was used in developing the design of the natural draft cooling tower proposed by the applicant. This study concludes that the best combination of variables is a circulating water flow rate of 600,000 gpm, a cooling range of 25 F° and an approach of 16 F°.[22] The shell of a counterflow tower for this set of parameters would be 565 ft tall and have base and top diameters of 462 and 310 ft, respectively. A counterflow tower of the same capacity would be 40-50 feet shorter, but would have a larger base diameter.[2]

The staff considers the natural draft wet cooling tower to be one of the feasible alternative CCC systems for Indian Point Unit No. 2.

2.4.3.2 Linear Mechanical Draft Cooling Towers (MDCT)

Mechanical draft cooling towers and natural draft cooling towers operate on the same basic thermodynamic principle--that is, cooling takes place by evaporation and sensible heat transfer. In MDCT's, fans are used to pull air through the fill section. Although both cross and counterflow designs are in use, almost all are of the crossflow design. Figure 2-5 is a schematic cross section of a MDCT cell; Figure 2-6 shows other engineering features of a 3-cell unit.

MDCT's have been used for several decades for power plant cooling and are proven, reliable and economical heat sinks. They have several advantages when compared to natural draft units, such as lower capital costs, greater flexibility, greater control of cold-water temperature, and a lesser visual impact of the structure due to their lower profile. The primary disadvantage of mechanical draft cooling towers when compared to natural draft units is the increased potential for ground-level fogging and icing, especially in winter. This phenomenon is caused by the relatively low discharge point for the water vapor from the mechanical draft towers, with areodynamic downwash the primary cause of fogging at such towers.[25] Experience at such towers indicates that the fog either evaporates or lifts to become stratus clouds within about 1500 ft (0.5 km) of the towers.[11,25,26] Drift rates from such towers are somewhat higher than for natural draft units; however, almost all of the drift that strikes the ground will do so within 1000 ft or so of the towers.[12,27,28] The remaining drift droplets will evaporate to dryness and their salts remain airborne.

The applicant has indicated that two 13-cell mechanical draft cooling towers of conventional design (that is, linear) would be required for adequate cooling.[22] Each tower would be 520 ft long, 75 ft wide and 68 ft tall. The design optimization includes a cooling range of 25 F° and an approach of 17 F° for the design 74 F° wet bulb temperature.

The staff concludes that linear MDCT would be a feasible option for Indian Point Unit No. 2.

2.4.3.3 Circular Mechanical Draft Cooling Towers (CMDCT)

A variety of circular mechanical draft cooling towers exist. One design uses one very large fan (up to 85 ft in diameter) to pull air through fill similar to that in standard mechanical draft units. (Fig. 2-7) A large number of towers of this type are now in use in Europe, with unit sizes of up to 300 MWe-fossil per tower. Due to their tall stacks (up to 179 ft), some of the force pulling air through the tower is due to the natural draft effect. In fact, this type is sometimes called a fan-assisted tower.

Another design concept for a round or circular mechanical draft tower is to place the individual cells of the standard wet MDCT type into a circular array, and place the fans on the roof above the circular space inside the fill sections, as shown in Figure 2-8. An elevated stack can be added to the tower to increase the height of release of the effluent gases. One CMDCT is now in operation in the United States, a 13-fan unit at a 500-MWe fossil plant in Mississippi.[29] This tower became operational in March 1975, so experience with it is limited. A drift rate of 0.005% is possible with this unit. Table 2-1 lists the utilities which have plans to build CMDCT, including information on the rating and size of the CMDCT.

The primary advantage of circular towers over the standard MDCT layout is the better aerodynamic characteristics of the rounded structure, which reduces downwash (and therefore fogging and icing) and recirculation.[30,31]

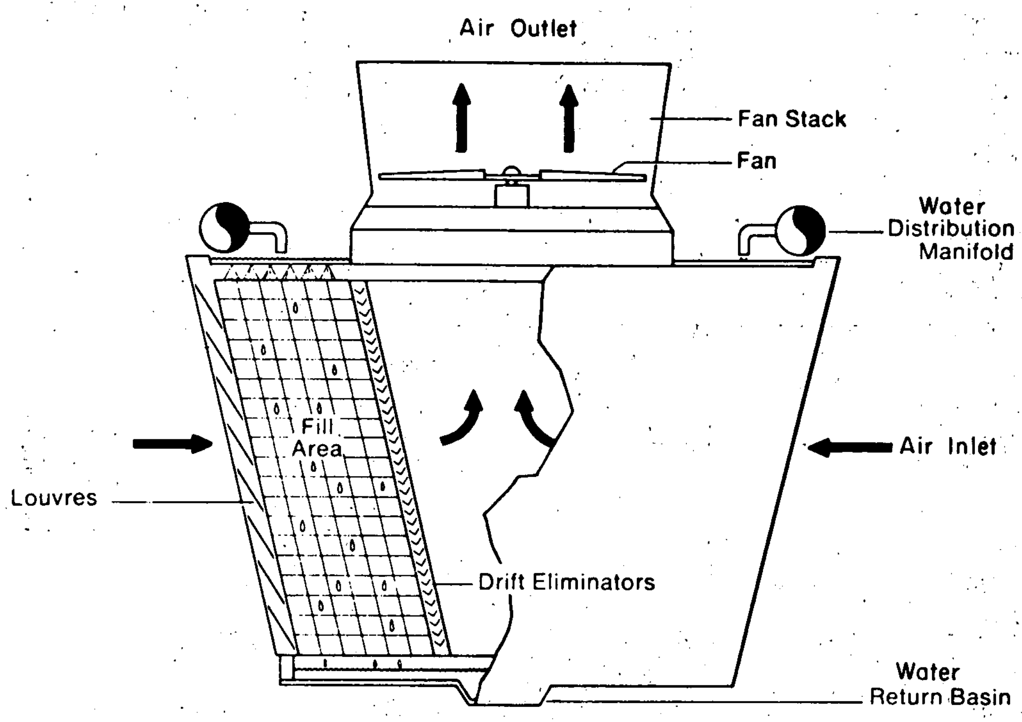


FIGURE 2-5

MECHANICAL-DRAFT WET COOLING TOWER
(CROSS FLOW)

Ref.: ER-CCC, IP-2, Fig. 2-5

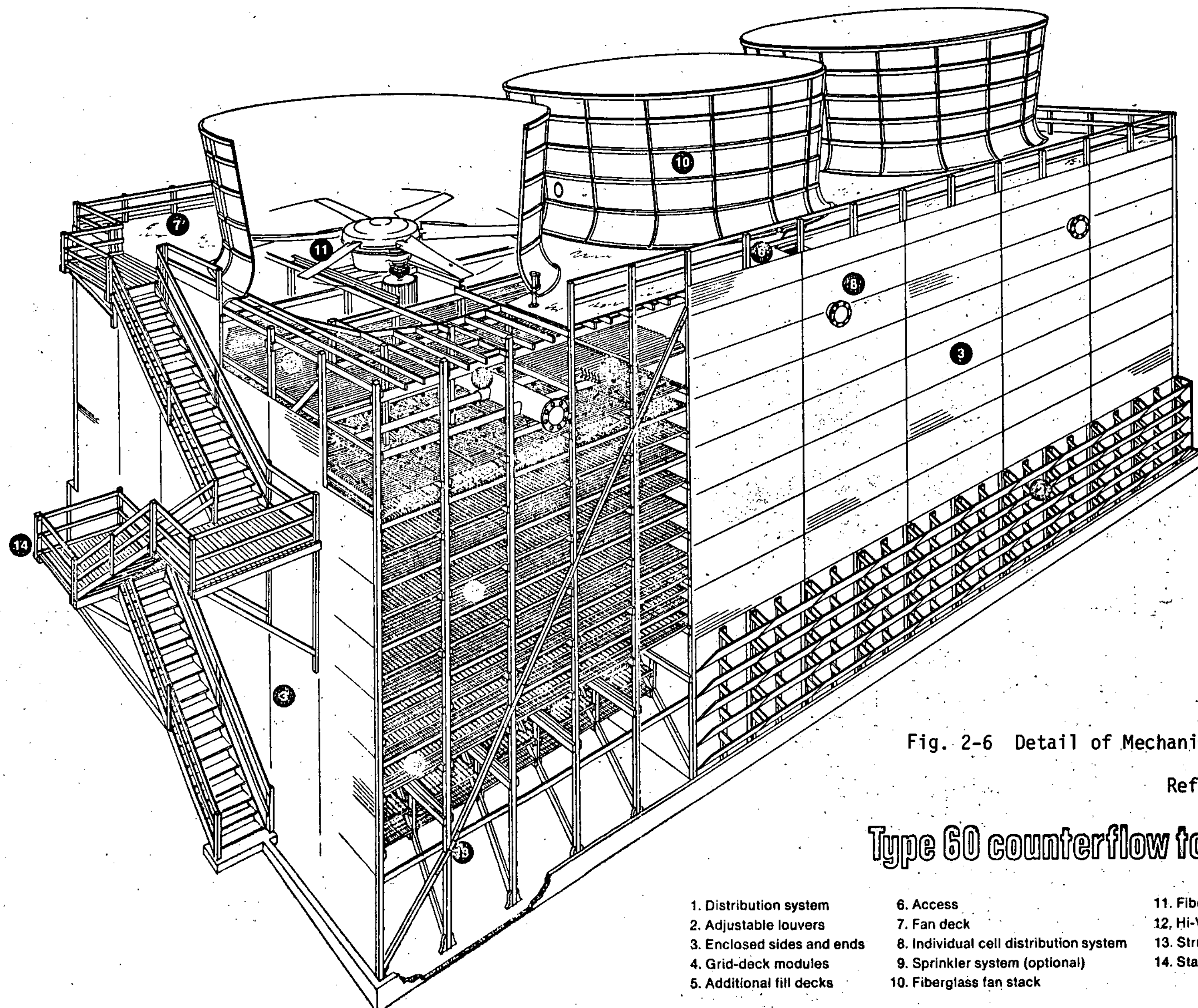


Fig. 2-6 Detail of Mechanical draft cooling tower

Ref.: Ecodyne Corporation

Type 60 counterflow tower

1. Distribution system
2. Adjustable louvers
3. Enclosed sides and ends
4. Grid-deck modules
5. Additional fill decks
6. Access
7. Fan deck
8. Individual cell distribution system
9. Sprinkler system (optional)
10. Fiberglass fan stack
11. Fiberglass fan, motor and speed reducer
12. Hi-V drift eliminator
13. Structural connectors
14. Stairway

1. Fan
2. Reinforced Concrete Tower Shell
3. Fan Rotor Housing
4. Drift Eliminators
5. Asbestos-Cement Fill Sheets
6. Vertical Fan Drive Shaft
7. Engine Room
8. Bevel Gear Hydraulic Coupling and Motor

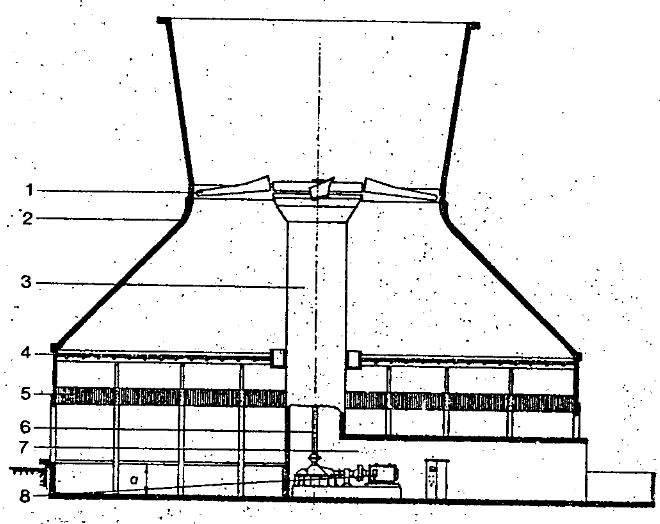


Fig. 2-7 Cutaway view of circular mechanical draft cooling tower.

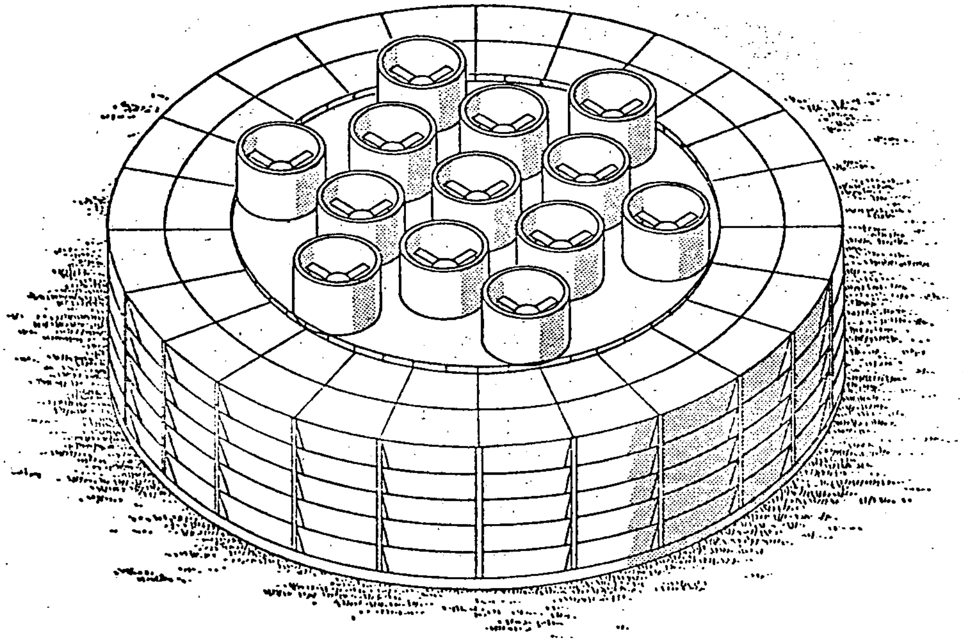


Fig. 2-8 Conceptual sketch of circular mechanical-draft cooling tower. (The tower is about 270 ft in diameter and 74 ft high.)

Ref.: Draft Environmental Statement, Cherokee Nuclear Station Units 1, 2 and 3. U. S. Nuclear Regulatory Commission, March 1975, Docket Nos. STN 50-491, 50-492 and 50-493.

TABLE 2-1

THE MARLEY COMPANY

ROUND TOWER INSTALLATION LIST

Owner	Engineer	Rating	Size & Type
Washington Public Power Supply System Hanford Unit 2 Richland, Washington	Burns and Roe	1100 MW (Nuclear) 570,000 GPM 104.3-76.3-60	Class 700 6 @ 6 Fans
*Mississippi Power Company Jack Watson Unit 5 Gulfport, Mississippi	Southern Services	550 MW 172,000 GPM 120-90-80	Class 700 1 @ 13 Fans
Gulf States Utilities Sabine Unit 5 Bridge City, Texas	Brown & Root	480 MW 254,915 GPM 112-91-81	Class 700 2 @ 7 Fans
Duke Power Company Catawba Unit 1 & 2 York, South Carolina	Duke Power	2 @ 1180 MW (Nuclear) 1,328,000 GPM 112-88-76	Class 700 6 @ 13 Fans
Kansas Power and Light Co. Energy Center-Units 1 & 2 Belvue, Kansas	Black & Veatch	2 @ 640MW 664,000 GPM 114-92.7-80	Class 600 4 @ 8 fans
Gulf States Utilities River Bend Station Units 1 & 2 West Feliciana Parish, La.	Stone & Webster	2 @ 934 MW (Nuclear) 1,109,580 GPM 118.5-93-81	Class 700 8 @ 7 Fans
Louisville Gas & Co. Millcreek Unit No. 3 Louisville, Ky.	Fluor Pioneer	425 MW 205,000 GPM 116-95-78	Class 700 1 @ 8 Fans
Gulf State Utilities Ray S. Nelson Station Unit No. 5 Lake Charles, Louisiana	Bechtel	550 MW 212,410 GPM 117.23-91-82	Class 700 1 @ 13 Fans

*Operational

Because these towers have better aerodynamic properties, resulting from combining the heat output of many cells of a conventional mechanical draft unit into one plume and discharged at higher elevations (up to 170 ft), the frequency of ground-level fogging will be reduced from that of pure MDCT's, but not as much as for NDCT's.

The staff considers the circular mechanical draft cooling tower to be a viable cooling option for Indian Point No. 2, despite the lack of data at operating units to validate computer modeling and wind tunnel tests.

2.4.3.4 Fan-Assisted Natural Draft Cooling Towers

A relatively new design concept, the fan-assisted natural draft cooling tower (FANDCT), could be used to cool the plant. In such towers, fans are used to augment the airflow through the tower and fill created by the buoyancy of air in the tower. While no FANDCT's are in use or are under construction in this country, a few are in use in Europe.[31-33]

A variety of FANDCT designs exist, including both cross flow and counterflow arrangements for the fill. In some plans, the multiple fans can be turned off on all but the warmest days and the unit operates as a natural draft tower. In others, the fans are used at all times for additive cooling capacity for a given size cooling tower. For example, in a typical English fossil-fired power plant, eight natural draft cooling towers (each about 374 ft tall with a base diameter of 302 ft) are used to cool a 2000-MWe fossil power complex.[4] The bulk of these towers and their visible plumes have created an aesthetic impact. In an effort to reduce this impact, a single FANDCT is now being built at the 1000-MWe fossil Ince power plant in England,[34,35] which will be able to do the cooling of the four NDCT's it will replace. In this design, the shell is unchanged but the fill will be outside in a typical cross flow arrangement in a circle 564 ft across; 35 fans will provide the necessary air flow. This tower is shown in Figure 2-9. The fans will use 0.6% of the plants electrical output.[34]

Another tower design consists of a concrete shell similar to, but shorter than that of a pure counterflow natural draft unit, with a circle of fans around the base to augment air flow, as shown in Figure 2-10. For a given heat load, these towers will be about half as tall and two-thirds the diameter of a natural draft unit.[2] Several such towers are now in use in Europe, two such towers, each 268 ft tall are used to cool the 1200 MWe Biblis-A nuclear plant.[33]

Computer model and wind tunnel tests for the Biblis-A FANDCT's in Germany indicated frequent fogging downwind from 170 (52 m) and 220 ft (67 m) units; a tower height of 268 ft (82 m) was required so that "ground touching plumes will be extremely rare.[34] It has also been stated that "although the assisted draught cooling towers gave higher ground impacts that the natural draught towers, their environmental influence can still be considered as being well within tolerable limits..."[32]

The drift rate from FANDCT's would depend in part on the effectiveness of the drift eliminators. However, due to higher exit air speeds, the drift rate could be greater than that of a natural draft tower. Tests made in a large test cell indicate that, with proper engineering of the drift eliminators, the drift rate is negligible.[34,35]

The staff considers the two types of FANDCT's discussed above to be feasible for Indian Point Unit No. 2.

2.5 SUMMARY OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS

The staff has reviewed the information of various alternative ACC systems which are feasible for construction and operation at Indian Point Unit No. 2 and has reached the following conclusions.

1. Because of insufficient level land on and near the site, the staff believes that cooling ponds or spray canals are not viable alternatives for the Indian Point site,

2. Due to engineering problems associated with much higher back pressures in the turbine and to high costs involved, the staff has rejected dry cooling towers as satisfactory cooling option for construction and operation at Indian Point,

3. In consideration of the environmental impacts, land area requirements, and costs, the staff believes that natural draft, fan-assisted, linear and circular mechanical draft and wet/dry cooling towers would be feasible for construction and operation at Indian Point. The details regarding the construction, land requirements, operation, and environmental and economic evaluations of each type are delineated in the following sections of this Statement. The applicant also considered the natural draft, linear mechanical draft and wet/dry cooling towers as feasible alternative systems for Indian Point Unit No. 2.

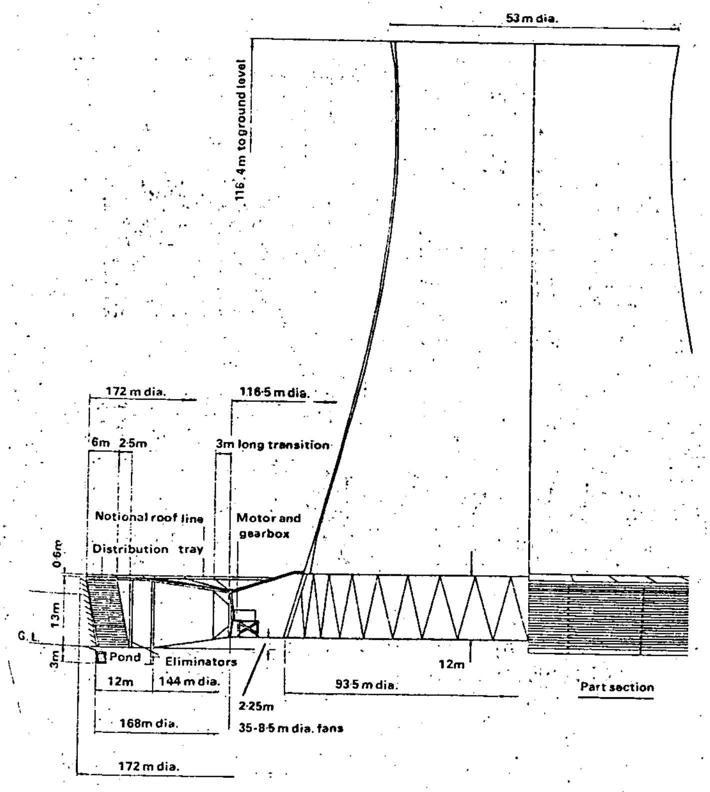


Fig. 2-9 Fan-assisted natural draft cooling tower.

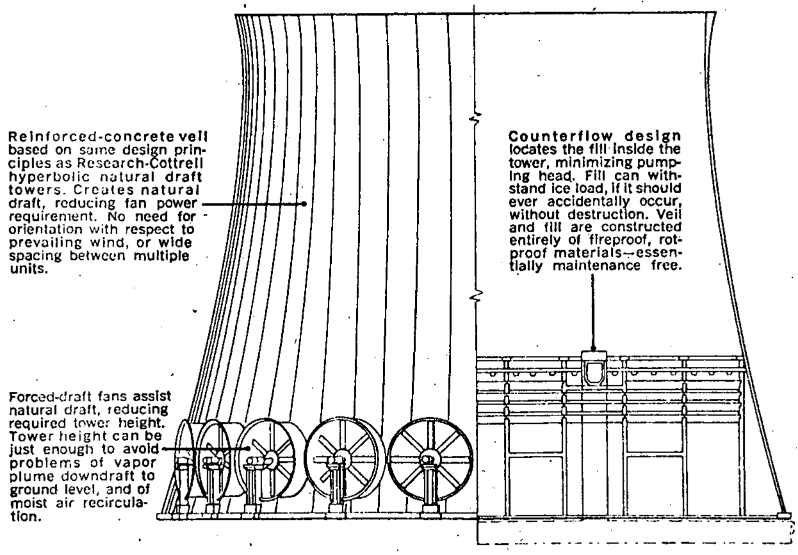


Fig. 2-10 Schematic of a counterflow fan-assisted natural draft cooling tower.

REFERENCES

1. W. H. H. Brutsaert et al., "Engineering Aspects of Thermal Discharges to a Stratified Lake," College of Engineering, Cornell University, February 1969.

2. Anon., "Cooling Towers," *Power*, 24 p., pp S-1 to S-24, March 1973.

3. A. M. Elgawhary, "Design Considerations and Thermal Performance of Spray Cooling Systems for Large Power Plants," Paper 74e, Am. Inst. Chem. Eng. 67th Annual Meeting, Washington, D.C., December 1974.

4. D. B. Leason, "Planning Aspects of Cooling Towers," *Atmospheric Environment*, 8:307-312, April 1974.

5. G. Spurr, "Meterology and Cooling Tower Operation," *Atmospheric Environment*, 8:321-324, April 1974.

6. W. C. Colbaugh et al., "Investigation of Cooling Tower Plume Behavior," in *Cooling Towers*, Chemical Engineering Progress, Am. Inst. Chem. Eng., New York, pp. 83-86, 1972.

7. C. L. Hosler, "Wet Cooling Tower Plume Behavior," In: *Cooling Towers* Chemical Engineering Progress, Am. Inst. Chem. Eng., New York, pp. 27-32, 1972.

8. D. J. Moore, "Recent CEGB Research on Environmental Effects of Wet Cooling Towers," in *Cooling Tower Environment-1974*, ERDA Symposium Series, CONF-740302, pp. 205-220, 1975.

9. R. C. Scorer, *Air Pollution*, Pergamon Press, London, 1968, p. 151.

10. R. D. Woodson, "Cooling Towers," *Scientific American* 223(5) (May 1971).

11. U. S. Environmental Protection Agency, *Reviewing Environmental Impact Statements-Power Plant Cooling Systems, Engineering Aspects*, Report EPA-660/2-73-016, National Environmental Research Center, Corvallis, Oregon, October 1973.

12. J. E. Carson, *"Meteorological Effects of Evaporative Cooling Towers-Research Needs,"* Paper 74-WA/HT-58, presented to Am. Soc. Mech. Eng. New York City, November 1974.

13. M. E. Smith et al., *Cooling Towers and the Environment*, Am. Elec. Power Corp., New York, October 1974.

14. K. A. Oleson et al., *Dry Cooling for Large Nuclear Power Plant*, Westinghouse Electric Corp. Power Generation Systems Report, Gen-72-004, February 1972.

15. E. S. Miliaras, *Power Plants with Air-Cooled Condensing Systems*, MIT Press, Cambridge, Mass., 237 pp., 1974.

16. G. J. Silvestri and J. Davids, "Effects of High Condenser Pressure on Steam Turbine Design," *Proc. Amer. Power Cong.*, 33:319-328, 1971.

17. E. P. Hanson, "Dry Towers and Wet/Dry Towers for the Indirect Power Plant Cycle," in *Dry and Wet/Dry Cooling Towers for Power Plants*, Am. Soc. Mech. Eng., November 1973.

18. R. D. Landon and J. R. Houx, "Plume Abatement and Water Conservation with the Wet/Dry Cooling Tower," *Proc. of the Am. Power Conf.*, 35:726-742 (1973).

19. K. A. Olesen and R. J. Budenholzer, "Economics of Wet/Dry Cooling Towers Show Promise," *Electrical World*, December 15, 1972.

20. E. P. Hansen and R. E. Cates, "The Parallel Path Wet-Dry Cooling Tower," Marley Co., Mission, Kansas, 1972.

21. P. Bøgh and N. Bhargava, "Combined Dry/Wet Cooling Towers: Their Environment Promise and Their Problems," Report, IAEA-SM-187/44, International Atomic Energy Agency, Vienna, pp. 45-62, 1974.

22. Consolidated Edison Company of New York, Inc., "Economics and Environmental Impacts of Alternate Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Vol. 1, New York, December 1, 1974.

23. Westinghouse Will Build Demonstration Wet/Dry Cooling Unit, *Electrical World*, April 15, 1973.

24. Consolidated Edison Company of New York, Inc., "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Supplement Volume No. 1, August 1975.

25. S. R. Hanna and S. G. Perry, *Meteorological Effects of the Mechanical-Draft Cooling Towers of the Oak Ridge Gaseous Diffusion Plant,* in *Cooling Tower Environment-1974,* ERDA Symposium Series, CONF-7430302, pp. 291-306, 1975.

26. Federal Water Pollution Control Agency, "Industrial Waste Guide on Thermal Pollution," National Thermal Pollution Research Program, Corvallis, Oregon, (Revised), p. 112, September 1968.

27. G. W. Wistrom, "Cooling Towers Overcome Polluter Image," *Electrical World,* pp. 36-37, May 1, 1974.

28. S. R. Hanna, "Fog and Drift Deposition From Evaporative Cooling Towers," *Nuclear Safety,* 15:190-196, 1974.

29. J. B. Dickey et al., "The Operating Debut of the Round Mechanical Draft Cooling Tower," Paper presented at Am. Power Conf., Chicago, April 1975.

30. J. F. Kennedy and H. F. Ordyce, "Plume Recirculation and Interference in Mechanical-Draft Cooling Towers," in *Cooling Tower Environment-1974,* ERDA Symposium Series, CONF-740302, pp. 58-87, 1975.

31. P. Bøgh et al., "A New Method of Assessing the Environment Influence of Cooling Towers as First Applied to the Kaiseraugst and Leibstadt Nuclear Plants," International Nuclear Industries Fair (Nuclex 72), October 1972.

32. P. Bøgh, *Experience with Combined Wind Tunnel/Plume Model Analysis of the Cooling Tower Impact, Cooling Tower Environment--1974,* ERDA Symposium Series, CONF-740302, 1975.

33. H. Frühauf, "Overall Plant Configuration-Biblis Nuclear Power Plant," *Nuclear Eng. Internat.,* 607-612, August 1975.

34. D. J. W. Richards, "Engineering Research Aspects of Assisted Draught Cooling Towers," *Atmospheric Environment,* 8:425-432, April 1974.

35. I. W. Hannah, "Civil Engineering Aspects Environmental Cooling Towers," *Atmospheric Environment,* 8:433-436, April 1974.

3. DESIGN, CONSTRUCTION AND OPERATING CHARACTERISTICS OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS

3.1 DESIGN AND DESCRIPTION OF FEASIBLE ALTERNATIVE CLOSED CYCLE COOLING (CCC) SYSTEMS

The design of the feasible alternative CCC systems is dependent on a number of factors, including the wet bulb temperature, the heat load, the cooling range and approach. A design wet bulb temperature that is too high can result in an oversized tower; and a design wet bulb temperature that is too low can result in inadequate tower capacity in summer. The applicant has selected the thermal design characteristics for three different feasible cooling towers as outlined in Table 3-1, using 74°F as the design summer wet bulb temperature. A circulating flow of 600,000 gpm through the closed cycle condenser cooling system is proposed for each different cooling tower the applicant has evaluated. This flow is reduced from 840,000 gpm that the applicant proposed in its April 9, 1973 testimony for its two natural draft cooling towers of 420 ft base diameter and 370 ft. high. In addition, the applicant has continuously been exploring the concept of a closed cycle natural draft cooling tower. After an optimization technique, the applicant also proposed a single hyperbolic structure with a 445 ft base diameter and 450 ft high capable of cooling 590,000 gpm of water at a 74°F design wet bulb temperature and 55 percent design relative humidity. This cooling tower design was described in Appendix G of the FES for Unit No. 3.

Since the approach value is the design criterion which can have the greatest effect on the size and costs of the cooling tower, the selection needs to be evaluated. For a given heat load, the size of the cooling tower increases with decreasing approach. The applicant has used this characteristic to design a single natural draft cooling tower 565 ft high with a 460 ft base diameter. The applicant has selected (in its ER-CCC, IP-2) 16 F° as the design approach. The approach selected in the FES for Unit No. 3 for the single 450 ft natural draft cooling tower described above was 21.5 F°.

To develop the variation in the dimension and costs of a natural draft cooling tower, the applicant received information from a vendor as shown in Table 3-2. For a 16 F° approach at a 74°F wet bulb temperature and 25.8 F° cooling range with 590,000 gpm flow, a single natural draft wet cooling tower would be smaller with shell height of 500 ft and overall base diameter of 510 ft. If the approach were increased to 22 F° (21.5 F° in the FES for Unit No. 3), the dimensions of the cooling tower would be reduced to 450 ft shell height and 440 ft overall base diameter. The applicant also reported that a natural draft, counterflow tower with a 25 F° approach, 17.5 F° range and a flow rate of 840,000 gpm would be 510 ft high and 410 ft base in diameter.

In addition, the applicant has selected the range of 25 F° for a power level of 3,217 MWt with the circulation of 600,000 gpm flow through the condenser and cooling tower. The total heat to be dissipated will be 7.35×10^9 Btu per hour. The excess heat from the service water system for the reactor and turbine-generator will be dissipated by once-through cooling regardless of which alternative cooling system is selected for the condenser.

In terms of the mechanical draft cooling tower, the applicant has used 17 F° for the design approach which requires two towers, each with 13 cooling cells. Each tower is about 520 ft long, 75 ft wide and 68 ft high.

Since the wet/dry cooling tower design is dependent in part on the ambient dry-bulb temperature in the winter (20 F° at a winter design relative humidity of 80%), the applicant has proposed that the wet/dry mechanical draft cooling tower system with a design approach of 17 F° should include 4 towers, each with 7 cooling cells. Each tower is about 340 ft long, 70 ft wide and 74 ft high.

The applicant, as stated on pp. 2-3 and 41-47 of the ER-CCC, Suppl. Vol. 1, IP-2, briefly discusses the reasons why fan-assisted natural draft cooling towers and circular mechanical draft cooling towers were rejected as feasible alternatives. Information pertaining to the number and size of these towers was provided the staff from cooling tower vendors. Two towers each would be required for Unit No. 2. Each fan-assisted natural draft tower (FANDCT) would be about 270 ft in base diameter and 210 ft overall height. A single FANDCT would require 24 fans which can be operated at two speeds (1800 rpm-400 hp and 1200 rpm-200 hp). Each circular mechanical draft cooling tower (CMDT) would have dimensions of 290 ft in base diameter and 70 ft overall height and each tower would have 13 fans.

TABLE 3-1

THERMAL DESIGN CRITERIA

	Natural-Draft Wet Cooling Tower	Mechanical-Draft Wet Cooling Tower	Mechanical-Draft Wet/Dry Cooling Tower	Fan-Assisted Natural Draft Cooling Tower*	Circular Mechanical Draft Cooling Tower*
Condenser Heat Load, 10^6Btu/hr	7,350	7,350	7,350	7,350	7,350
Cooling Water Flow, gpm	600,000	600,000	600,000	600,000	600,000
Cooling Range, F°	25	25	25	25	25
Tower Approach, F°	16	17	17	16	17
Design Summer Wet-Bulb Temp., °F	74	74	74	74	74
Design Summer Relative Humidity, %	55	55	55	55	55
Design Winter Dry-Bulb Temp., °F	--	--	20	--	--
Design Winter Relative Humdity, %	--	--	80	--	--

*These two cooling towers were not initially considered by applicant.

REF.: ER-CC 1P-2, Appendix B

TABLE NO. 3-2

Study For
Indian Point Station

NATURAL DRAFT COOLING TOWERS

Case #	GPM	Cooling Range	Approach @73wb	Approach @74wb	Approach @76wb	No. of Towers	Shell Height	O.A. Diam.	Pump Head	Current Installed Budget Cost
A-1	840,000	18	18.3	18	17.4	2	370'	405'	62'	$13,500,000
A-2	840,000	18	20.3	20	19.4	2	370'	395'	55'	$12,400,000
A-3	840,000	18	22.3	22	21.4	1	500'	505'	69'	$ 9,700,000
A-4	840,000	18	24.3	24	23.3	1	500'	465'	69'	$ 9,100,000
B-1	670,000	22.6	16.3	16	15.4	2	370'	380'	62'	$12,900,000
B-2	670,000	22.6	18.3	18	17.4	1	500'	505'	69'	$ 9,700,000
B-3	670,000	22.6	20.3	20	19.3	1	500'	455'	69'	$ 9,000,000
B-4	670,000	22.6	24.4	24	23.3	1	450'	445'	62'	$ 8,100,000
C-1	590,000	25.8	16.3	16	15.4	1	500'	510'	69'	$ 9,750,000
C-2	590,000	25.8	18.3	18	17.3	1	500'	450'	69'	$ 9,000,000
C-3	590,000	25.8	20.4	20	19.3	1	500'	455'	62'	$ 8,500,000
C-4	590,000	25.8	22.4	22	21.3	1	450'	440'	62'	$ 8,000,000
D-1	505,000	30	14.3	14	13.4	1	500'	505'	69'	$ 9,700,000
D-2	505,000	30	17.4	17	16.3	1	450'	445'	69'	$ 8,800,000

Notes:

1. All selections assume a design relative humidity of approximately 55%.
2. Prices include concrete cold water basin and riser piping.
3. Prices do not include excavation, pilings or caissons, backfilling, landscaping, underground piping, or future cost escalation beyond today's price level.
4. Time required to prepare quotation = approximately 8-10 weeks.
   Onsite Construction time = approximately 24 months for one tower;
   approximately 36 months for two towers.

John C. Hensley

THE MARLEY COMPANY 12-6-73

Based on the above dimensions and design criteria of these different cooling tower alternatives, the applicant showed in its Table 3-2 the reduced electrical capability of Indian Point Unit No. 2 resulting from total derating for each alternative cooling system for all auxiliary loads and effects on the backpressure of the turbine. For the peak ambient wet-bulb temperature of 74°F in the summer, the total derating due to each alternative closed cycle cooling system is estimated to be 63, 69, and 70 MWe for the natural draft, linear wet mechanical draft, and the wet/dry mechanical draft cooling towers, respectively. The two FANDCT and CMDCT would produce a total derating of 69 MWe each, according to staff calculations.

The plant net power rating for Unit No. 2 based on the derating at peak ambient temperatures would be 866 MWe for once-through cooling, 803 MWe for natural draft cooling towers, 797 MWe for linear mechanical draft cooling towers and 796 MWe for the wet/dry mechanical draft cooling towers. As shown in Table 3-3, the plant net heat rates are estimated to be 11,097, 11,269 and 11,282 Btu/kWh for each of the respective cooling towers.

3.2 PHYSICAL LOCATION OF COOLING TOWERS

The applicant has investigated the optimum location for erection of the towers with respect to engineering practicality, safety reasons, and economic justifications. The applicant has provided detailed drawings of the general arrangement of the natural draft, wet linear mechanical draft, and wet/dry cooling towers on the site. Because of a major item of expense of cost of piping and pumps to transfer water in the initial concept of laying out the cooling towers on the site, it was decided to locate the cooling tower as close as possible to the existing condenser system and yet far enough away to take into account safety reasons for locating the tower relative to the containment structure.

The outside edge of the natural draft cooling towers at the base is located 500 ft north from the outside wall of the Unit No. 2 containment building. This tower will have a base elevation of 45 ft above MSL (mean sea level) as shown in Figure 3-1. A service-access roadway would be built around the cooling tower basin. The location and size of this natural draft tower is similar to that shown in Figure G-6 in Appendix G of the FES for Unit No. 3.

In the case of the two types of mechanical draft cooling towers considered by the applicant, their locations are not so limited because of their height for safety reasons. Figures 3-2 and 3-3 show the general layout for these towers.

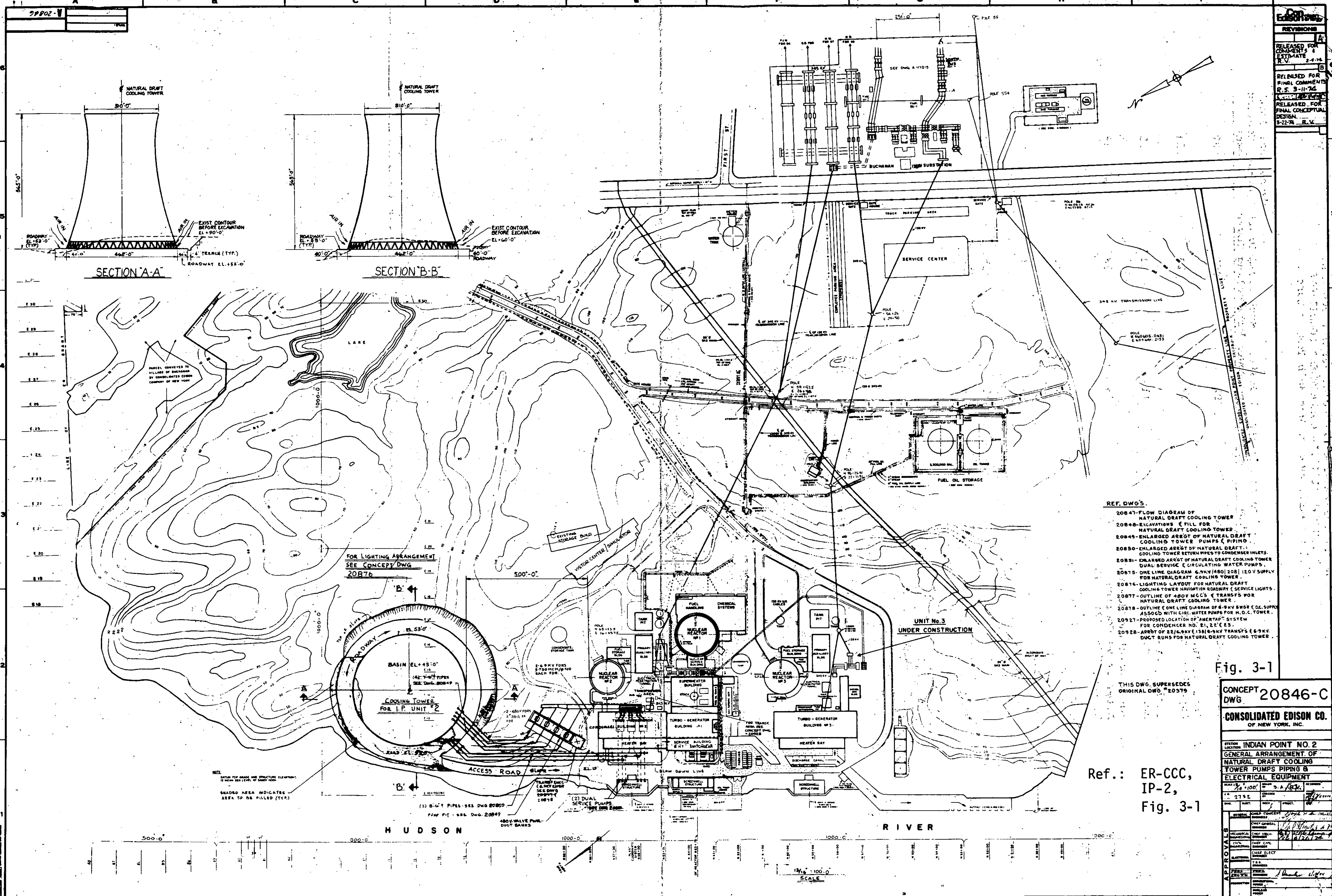
In addition to the location of towers themselves, the drawings show the layout of the piping and pumps. Further discussion of these is presented below.

For the FANDCT and CMDCT, exact details of the location of either tower system have not been provided by the applicant. However, the staff believes that sufficient space is available on the north side of Unit No. 2 to locate two units of either cooling tower design. Because of the shorter size, it is believed that either one can be located closer to the condenser at Unit No. 2 and save on the piping lengths without affecting the safety of the plant.

3.3 SITE PREPARATION AND EXCAVATION

Because of the topography of the site, extensive excavation will be required (1) to build temporary and permanent roads for access to the specific location where the preferred closed cycle cooling system is to be placed and (2) to level off the area needed prior to the building of the specific system required. Figures 3-1, 3-2 and 3-3 also show the existing contour of the land before excavation for the three cooling tower systems evaluated--natural draft, mechanical draft, and wet/dry mechanical draft cooling towers.

The applicant in his Table 3-4 (ER-CCC, IP-2) has estimated that the total amount of material to be excavated will be 350,000, 175,000, and 175,000 cubic yards of rock and material that will need to be removed prior to laying the tower foundation and the tunnel piping and pump pits for each of the respective towers. The natural draft tower will be located at the 45 ft elevation above MSL so that about another 45 ft of land above that elevation would have to be removed to obtain a level area. The elevation for the mechanical draft tower is 32 ft above MSL so that another 20 ft will need to be removed at the tower site. Room for air to flow in the towers must also be provided. The existing main plant road system would be used for access to the site both during construction and normal operation. A permanent road would be extended from the cooling tower to the existing Unit No. 2 screen-well area. However, temporary roads for construction purposes would also be needed to restrict traffic in the plant area.



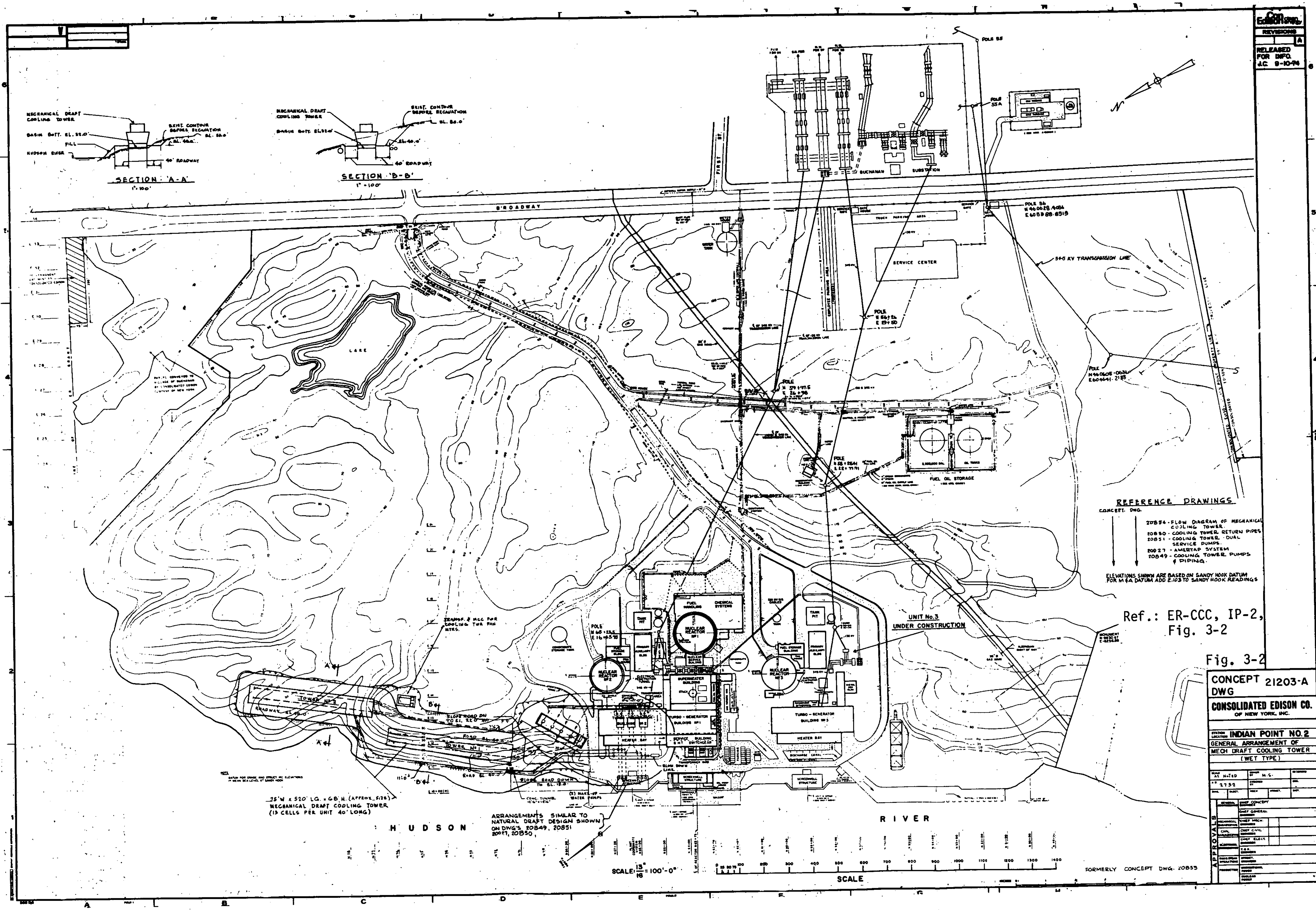
Ref.: ER-CCC, IP-2, Fig. 3-1

TABLE 3-3

CHANGE IN PLANT NET HEAT RATE OF INDIAN POINT UNIT NO. 2
TURBINE-GENERATOR OPERATED AT REACTOR POWER AT
2,758 MWt "INITIAL GUARANTEED" CONDITIONS
(under Yearly Average Wet-Bulb Temperature*)

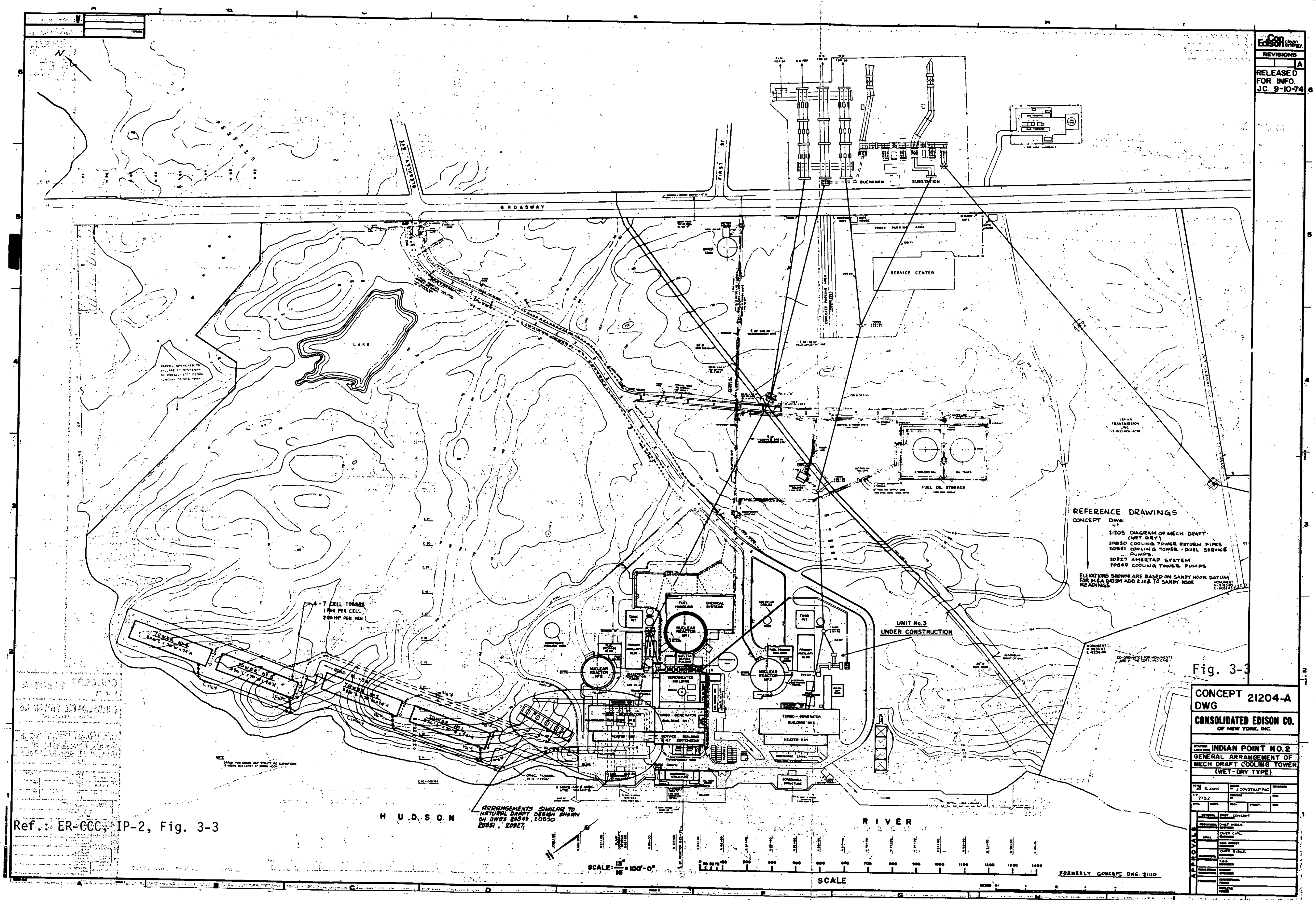
	Once-Through System	Natural Draft Wet Cooling Tower	Mechanical-Draft Wet Cooling Tower	Mechanical-Draft Wet-Dry Cooling Tower
1. Turbine Net, MWe	906	892	882	882
2. Loss of Turbine Capacity, Avg MWe	0	14	24	24
3. Cooling System Auxiliaries, MWe	0	11	14	15
4. Total Derating due to Alternative Cooling System, MWe, (2) + (3)	0	25	38	39
5. Normal Plant Auxiliary Load, MWe	33	33	33	33
6. Total Loss, MWe (4) + (5)	33	58	71	72
7. Plant Net, MWe 906 - (6)	873	848	835	834
8. Plant Net Heat Rate	10,781	11,097	11,269	11,282

* Annual Overall Derating
65F wet-bulb for a three-month summer
35F wet-bulb for a nine-month non-summer period

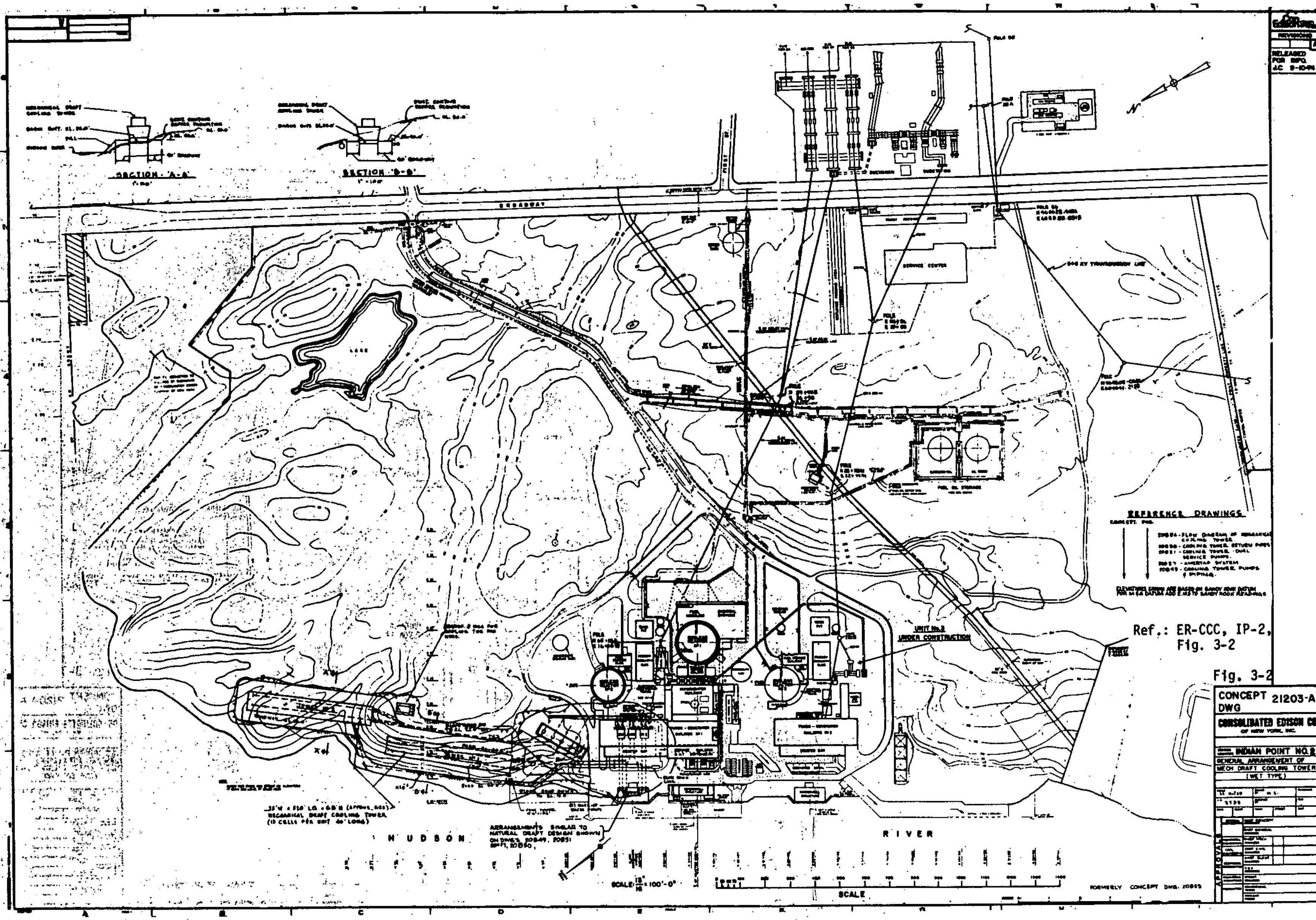


Ref.: ER-CCC, IP-2, Fig. 3-2

Fig. 3-2

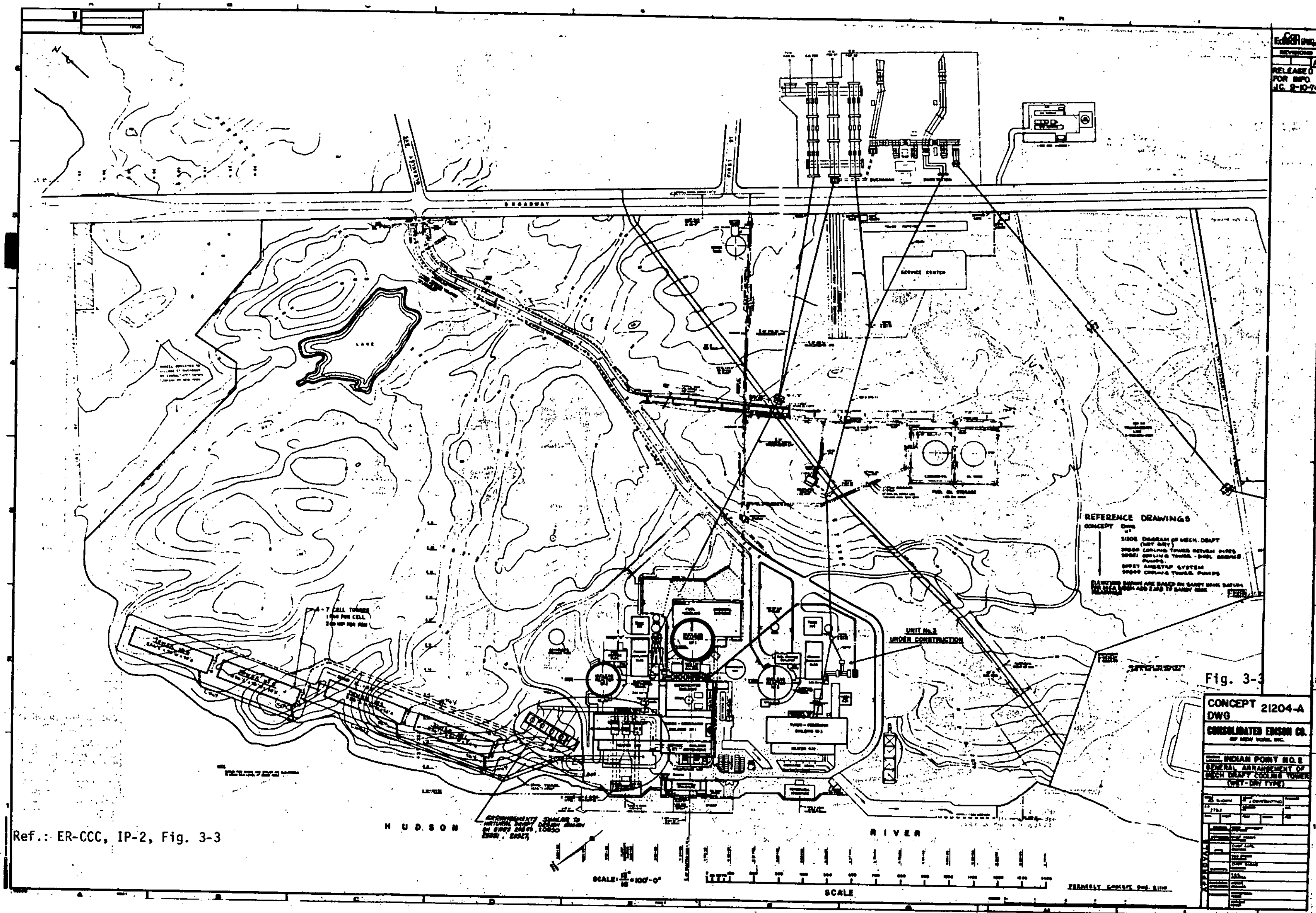


Ref.: ER-CCC, IP-2, Fig. 3-3



Ref.: ER-CCC, IP-2,
Fig. 3-2

Fig. 3-2



Ref.: ER-CCC, IP-2, Fig. 3-3

Disposal of the material excavated may also require another temporary road.

Proper procedures during blasting of the material to be excavated will have to be followed in order to have no effect on the operation of Unit No. 2 during excavation. The applicant discusses this part on page 3-14 of its ER-CCC, IP-2.

Excavation is estimated to take about 12 months as pointed out in Appendix G of the FES for Unit No. 3. Furthermore, according to the applicant, excavation is a major cost item in the capital cost of building the preferred cooling tower. The applicant has estimated the costs for excavation of about $15,000,000 for natural draft, $23,348,000 for mechanical draft and $24,182,000 for wet/dry mechanical draft cooling towers. An additional cost for excavation for fan-assisted natural draft cooling towers could amount to $8,900,000 and for the circular mechanical draft tower, $7,000,000. Discussions of costs are presented in Section 6 of this statement.

3.4 CONSTRUCTION CONSIDERATIONS OF THE FEASIBLE ALTERNATIVE CCC SYSTEMS

3.4.1 System Components and Piping Needed

Table 3-3 of the ER-CCC, IP-2 summarizes the physical description of the major components for construction of the closed-cycle cooling systems considered by the applicant. These include the number and size of circulating water pumps and makeup pumps, the dimensions of the piping from the pumps to the cooling tower and from the tower to the existing condenser, field lines, and the electrical power equipment such as transformers, motors and switch-gear breakers.

Flow diagrams of the natural draft, mechanical draft and the wet mechanical draft cooling towers are shown in Figures 3-4 through 3-6 in the applicant's ER-CCC, IP-2. Four horizontal centrifigal circulating water pumps of 150,000 gpm each (3,750 HP) will be used for the CCC-condenser system to pump the water from the condenser waterbox discharge side to the cooling tower hot water distribution system. The cooled water from the discharge side of the cooling tower would then flow by gravity back to the condensers via three new conduits. The existing vertical circulating water pumps located in the screenhouse would not be used during the closed-cycle operation but will be available for return to once-through cooling operation in order to maintain system flexibility. The applicant will be able to operate one or the other cooling system mode by proper operation of isolation valves installed in the cooling system.

Figures 3-7 through 3-14 in the applicant's ER-CCC, IP-2 present detailed drawings of the mechanical and structural engineering designs of various components of the closed-cycle cooling system.

The four circulating water pumps of 150,000 gpm would be located in a pump pit north of the Unit No. 2 turbine generator building and be at an elevation of 15 ft above MSL. This pump pit foundation would be on bedrock. A mobile crane would be available for servicing the pumps.

The two new makeup pumps each of 30,000 gpm capacity at approximately 500 BHP will have the capability of operating as makeup pumps for closed cycle operation and as circulating water pumps for once-through cooling operation. The existing reinforced concrete intake structure, which consists of six main intake channels for six circulating water pumps each with 140,000 gpm capacity and a divided intake channel with six smaller pumps, each with 5,000 gpm capacity, for the service water system, will be modified by the addition of the two makeup pumps. The reduction in flow because of a CCC system will cause the average water velocity passing through the fixed screens at a flow rate of 30,000 gpm to be reduced to 0.05 ft/sec (fps). The average velocity passing through the traveling screens at the same flow rate of 30,000 gpm will be 0.07 fps. The velocity through the fixed screens and the traveling screens under the present once-through cooling system can be as high as 1.3 and 2.0 fps, respectively. Figure 1-3 is a diagrammatic sketch of the existing intake structure discharge.

The existing discharge structure will not be modified. This structure consists of a discharge canal that serves all three of the Indian Point Units. The existing outfall structure at the end of the canal is 270 ft long. Heated water discharges through 10 ports, 4 ft high by 15 ft wide spaced at 21 ft centers. Two additional ports are closed but are available if needed for once-through cooling. The discharge ports are submerged to a depth of 12 ft (center to surface) at mean low water. The ports are equipped with adjustable gates and are designed to create mixing in such a way as to minimize water temperature differences in the river. The blowdown water from the cooling towers will be discharged through this system. See Section III of the FES for Unit No. 3 for additional discussion on the intake-discharge system.

The applicant reports that the circulating water will be circulated through cement-lined carbon steel conduits. The system piping will be both underground and above ground depending on the site terrain. For the underground installation, the piping would be generally placed in a compacted sand bed within excavated trenches. There may be a need for support saddles for the piping if the bearing material is unsatisfactory. Reinforced concrete construction will be used for the underground tunnel which extends beyond the Unit No. 2 turbine building. The condenser discharge pipes would have valves installed downstream of a mechanical tube-cleaning retrieval-fitting in order to divert flow through six new 6 ft diameter pipes. These in turn would lead into an underground tunnel as indicated in the applicant's ER-CCC, IP-2, Figure 3-7. From this common header or tunnel, four 9-1/2 ft diameter pipes would lead to the four circulating water pumps and from there to the tower.

The water from the cooling tower would flow through three 8-1/2 ft diameter pipes as shown in Figure 3-4. These pipes are bifurcated into 6 ft diameter pipes which are then connected to the existing 7 ft diameter pipes which feed water to each individual water box of the three condensers in Unit No. 2.

3.4.2 Special Facilities Needed

Certain facilities such as those needed for chemical treatment of the circulating water system are required. Sulfuric acid will be used to prevent scale formation from the bicarbonate in the cooling circuit. Chlorination treatment to prevent algae and biofouling growth will be intermittently used. However, the existing facilities for Unit No. 2 can be used. The applicant has reported that a new residual chlorine analyzer would be installed at the blowdown release point.

The 30-inch blowdown line would be taken off one of the cold circulating water lines before it enters the condenser. A valve in the line is sized to pass up to 15,000 gpm of blowdown. This valve is flow-controlled to a manually fixed set-point. The blowdown then would be piped into the Unit No. 1 discharge canal.

3.4.3 Materials of Construction

Although no specific information was provided by the applicant regarding the types of materials, except for the carbon-steel lined pipes, that would be used for the construction of the tower, the various cooling tower vendors use different materials which include pressure-treated lumber with casings and louvers of asbestos cement board. The fill is available as wood or polyvinyl chloride plastic. Certain components such as fan cylinders in mechanical draft towers use glass-reinforced polyster. Hyperbolic structures use steel crossbars for support with the cement and concrete used in the construction of the shell. The reason for the hyperbolic shape is aerodynamic and structural rather than thermodynamic. Less material is required for this shape and the shell is designed by membrane theory and results in thin sections, as little as 5 inches of reinforced concrete.

Because the feasible closed-cycle cooling systems would have to be operated with salt water for cooling purposes, the applicant would have to use due caution in selection of the material to be used in the construction of the tower. Salt water cooling towers have been built in Europe with very good results. The subject of such towers and the materials used has been addressed in several papers, including the one by Warner and Lefevre of Research Cottrell, entitled "Salt Water Natural Draft Cooling Tower Design Considerations," presented at the American Power Conference in Chicago, Illinois in April 1974. Another report sponsored by the former Atomic Energy Commission entitled, "The State of the Art of Saltwater Cooling Towers for Steam Electric Plants," published in February 1973, discusses the salt effects on the design, construction, and performance of the salt water cooling towers. On April 1975, this report was sent to the Licensing Board for their information. In addition,the staff visited the Chalk Point saltwater cooling tower which is a hyperbolic natural draft crossflow tower rising 400 ft above its base. A description of the tower is presented in several papers given at the University of Maryland Cooling Tower Conference on March 4-6, 1974.

One major component of the cooling tower system is the drift eliminators. Examples are the Marley's herring bone, sinusoidal-wave and duplex drift eliminators. See J. D. Holmberg's paper at the U. Maryland conference that discusses these different eliminators. With advances made in the design and construction of drift eliminators, drift can be controlled to 0.0025% of the circulating water flow of the closed cycle cooling system. This is the value used by the applicant in its calculation of drift for the natural draft cooling tower.

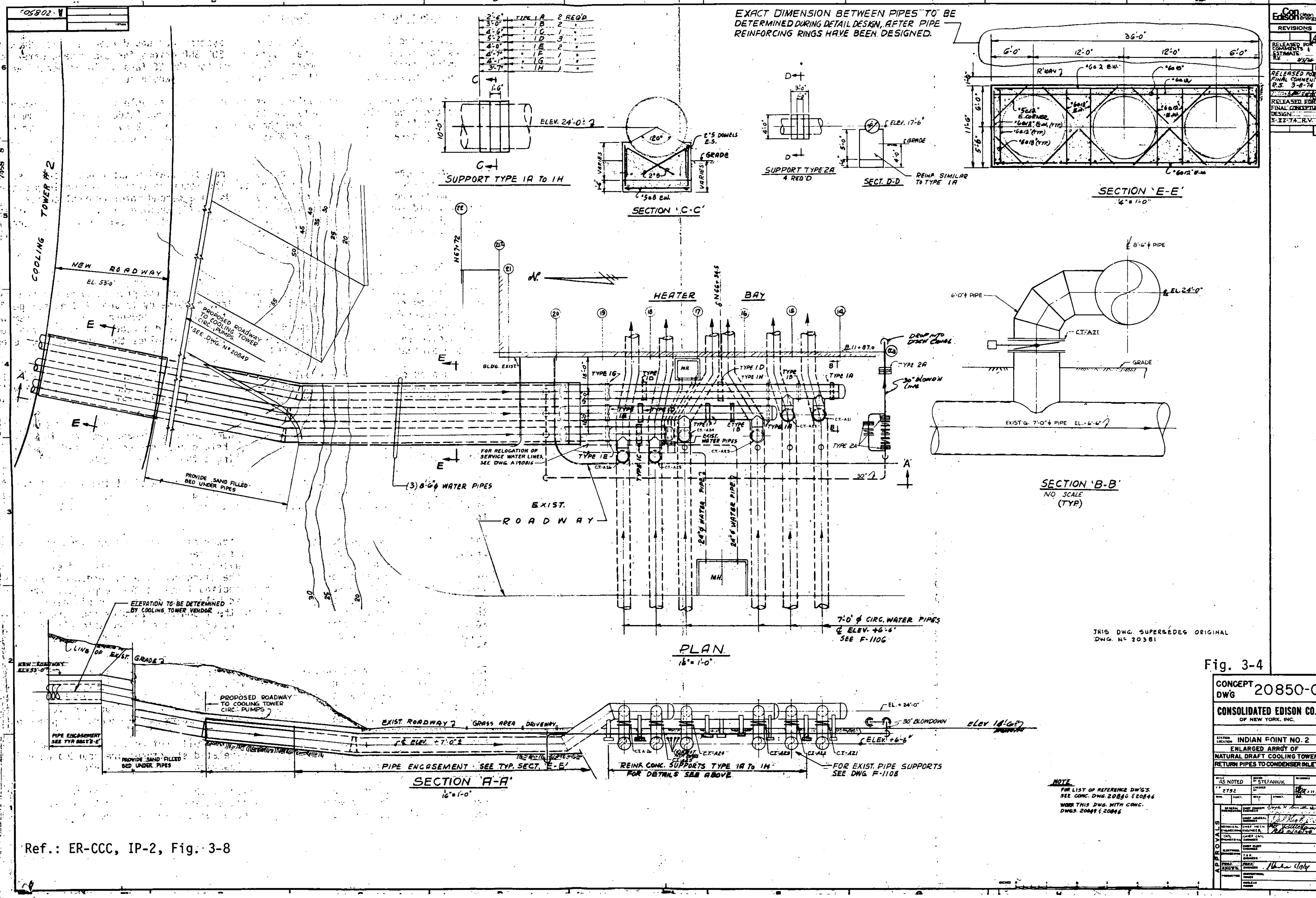


Fig. 3-4

Ref.: ER-CCC, IP-2, Fig. 3-8

3.4.4 Electrical System and Controls

The pumps used in the closed-cycle cooling system each would require 3,750 Brake Horsepower (BHP) motors for the circulating water pumps and 500 BHP motors for the makeup water pumps. For the mechanical-draft towers, 26 motors (200 BHP) for the 26 fans would be needed and for the wet/dry cooling towers, 28 motors (200 BHP) for the 28 fans would be needed.

Power for the closed cycle cooling system would be available from two independent sources each having the capability to supply the total new load. One feeder would be from the 138 kV/6.9 kV station auxiliary transformer and the other from a new 2.2 kV/6.9 kV transformer connected to the main generator loads. The 6.9 kV underground feeders would terminate in the 6.9 kV switch gear.

This switch gear could supply power to the new circulating water pumps and the 480 motor control center via the 6.9 kV/480 V transformers. The motor control center would provide power for large motor-operated valves and supply feeds to a second motor control center. This second center would supply auxiliary power to the aircraft warning lights on the cooling towers, roadway light, and other smaller electrically operated valves. See Figure 3-15 through 3-19 of the applicant's ER-CCC, IP-2 for the details.

3.4.5 Safety Considerations

The closed cycle condenser cooling system, as well as the present once-through cooling system, is only required for heat removal in the plant turbine cycle and it does not perform any essential safety-related functions. If the function of the condenser cooling system were lost, there would be a loss of condenser vacuum, a turbine trip and a reactor scram. This occurrence does not involve an unreviewed safety question since it involves the same chain of events as previously evaluated in the SAR and SER.

The proposed cooling towers would be located at least a tower height away from all safety-related structures or equipment on the Indian Point site. The tower location will, therefore, prevent any collapse of the cooling tower from endangering safety-related structures or equipment. The capability of the Unit No. 2 and Unit No. 3 structures to withstand tornado generated missiles has been previously evaluated by the Commission and found to be adequate. The Unit No. 2 cooling tower will, therefore, not introduce any new tornado problems for Unit No. 2 or Unit No. 3. The capability of Unit No. 1 to withstand any tornado-generated missiles will be evaluated in consideration of any future operating authority for Unit No. 1.

The postulated maximum flood would increase the water level at the Indian Point site to 14.5 ft above mean-sea-level. Since the proposed cooling tower basin would be located at an elevation of about 45 ft above MSL, the postulated maximum flood will have no effect on the integrity of the cooling tower.

The potential of a rupture of the cooling tower circulating water lines does not affect the probability of flooding of safety related features at the Indian Point site. The existing circulation water piping in the turbine building will remain unchanged except for the addition of two valves and added connections from the discharge of each condenser waterbox to the circulating pumps. If these valves or the connecting lines to the pumps fail, the circulating water would flow into the discharge canal located below the lines. The discharge canal would direct the water out of the turbine building and the flooding hazard of the safety-related equipment would, therefore, not be increased. Failure of the circulating water lines outside the turbine building would only cause a flow of water to the river because of the natural contour of the land.

The applicant has stated that it will establish limits on the use of explosives during cooling tower construction to assure that there will be no damage to safety-related structures or equipment. The applicant has carried out a controlled geotechnic investigation to determine the appropriate restrictions on blasting operations. A monitoring program for such blasting will be conducted and any required modifications will be made as the excavation proceeds.

Excavation activities for the new cooling tower will not result in any damage to safety-related structures due to dewatering. The safety-related structures are founded on rock and, therefore, will not settle because of any temporary lowering of the water table.

The applicant also described the relocation of the service water piping system of Unit No. 2 because of interference with the new piping systems designed for the closed cycle cooling system. The modifications to the two service water supply lines and the single discharge line will be accomplished in two phases. Each supply pipe will be modified at a time when the other line is available for cooling auxiliary equipment. After the work is completed on one supply line, then work will begin on the others. In that manner, some of the service water flow will always be available for needed cooling of safety-related equipment. During the modification of the single discharge line, the reactor, however, will be required to be shutdown for a four-day alteration period since the service water system will have to be secured during this phase of the work.

3.5 OPERATING CHARACTERISTICS

3.5.1 Chemical Treatment of Circulating Water System

Chemicals have to be used for treatment of the closed-cycle cooling system to reduce scale and to inhibit growth. See Appendix XI-1 in the FES for Unit No. 2 on the details of chemicals used for such purposes.

As stated above, sulfuric acid will be added at a feed rate of about 1/4 gpm to the circulating water to control scaling from the bicarbonate in the water.

Although the applicant has not specified the concentration to be used, the staff requires that the pH of any acidic discharge to the Hudson River be controlled in such a manner as to be within State water quality limits. The subject of the use of sulfuric acid was addressed on page G-22 of the FES for Unit No. 3.

Growth in the cooling circuit will be controlled by chlorinating the circulating water. The applicant will be required to maintain residual chlorine in the blowdown of less than 0.5 ppm in accordance with the State water quality standards. The applicant has also proposed to use Amertap balls as an alternative to cleaning the tubes in the condenser. This was recommended by the staff on page XI-16 of the FES for Unit No. 2 and page XI-53 of the FES for Unit No. 3 to reduce the effects of residual chlorine discharges on the Hudson River biota.

About 15,000 gpm of water from the circulating water circuit will be discharged as blowdown resulting from reconcentration by a factor of two of the solids dissolved in the circulating water system compared to the makeup water concentration. All chemical discharges in the blowdown will be required to meet State water quality requirements. The 30,000 gpm from the service water system and, if Unit No. 1 pumps are in operation, another 318,000 gpm from Unit No. 1 of river water would be available for additional dilution of the chemical discharges. Tables 6-2 and 6-3 in the applicant's ER-CCC, IP-2 show the chemical composition of the blowdown discharges with and without this dilution.

3.5.2 Cooling Tower Blowdown

A maximum of about 7.35 x 10^9 Btu/hr of waste heat is presently rejected by the condensers of Unit No. 2 to the Hudson River. With the addition of the alternate closed-cycle cooling system, this heat will be rejected mainly to the atmosphere. Blowdown to the Hudson River will dissipate a maximum of 120 x 10^6 Btu/hr during the winter months and a yearly average of about 110 x 10^6 Btu/hr. The service water system will continue to supply the cooling needs of the remainder of the plant and will reject an average of about 100 x 10^6 Btu/hr. This gives a total yearly average of 120 x 10^6 Btu/hr of waste heat rejected to the Hudson River. This is comparable to the value of 130 x 10^6 Btu/hr waste heat rejected as presented on page XI-31 of the FES for Unit No. 2. This would result in less than 1.0 acre of water within the 4 F° isotherm.

3.5.3 Evaporation and Drift

The applicant has estimated that there will be about 15,000 gpm of the makeup water evaporated and 15 gpm of drift (0.0025%) carried over from the cooling tower. This corresponds to the amounts described on p. XI-38 of the FES for Unit No. 2 and on p. G-22 of the FES for Unit No. 3.

3.5.4 Makeup Water and Water Inventory

With a blowdown rate of 15,000 gpm and 15,015 gpm of evaporation and drift, the total amount of makeup water required is estimated to be about 30,000 gpm which corresponds to the capacity of one makeup pump.

3.6 SUMMARY OF DESIGN, CONSTRUCTION, AND OPERATION OF FEASIBLE CLOSED CYCLE COOLING SYSTEMS

The staff has reviewed the detailed information provided by the applicant regarding the design, construction, and operation of feasible natural draft, wet mechanical draft and wet/dry mechanical draft cooling towers and to a limited extent information on fan-assisted natural draft and circular wet mechanical draft cooling towers and concludes that from a design, structural, electrical and mechanical engineering point of view, any one of these cooling towers listed above could be built on the Indian Point site and operated without affecting the safety of the plant.

The size of the cooling towers proposed by the applicant appears to be reasonable, except for the natural draft cooling tower. Smaller sizes for the natural draft towers could be possible for the site.

One potential problem to consider is the corrosive attack of the saltwater on the cooling tower structural materials. The applicant will be required to pay special attention to areas exposed to wetting and drying in order to provide methods to protect metals from corrosion. Materials of construction such as plastic will have to be selected to avoid the problem of corrosion.

To minimize the salt drift effects, the applicant will be required to build the preferred cooling tower system with good drift eliminators which will reduce drift to 0.0025% or less.

Another consideration is that this construction involves backfitting the cooling tower to the plant. The applicant appears to have considered every detail in the design and intertie of the cooling tower alternative to the existing condenser system. The applicant will have the capability of operating the plant with once-through cooling or with the closed cycle cooling system.

4. SCHEDULE AND PERMITS

4.1 SCHEDULE FOR CONSTRUCTION AND INITIATION OF OPERATION WITH THE PREFERRED CLOSED CYCLE COOLING SYSTEM

As stated in Section 1 of this statement, the Atomic Safety and Licensing Appeal Board in its Decision (ALAB-188) of April 4, 1975 established the conditions in the Facility Operating License No. DPR-26 (Amendment No. 6) which determine the schedule for construction and operation of Indian Point Unit No. 2 with a closed cycle cooling system. The present date for termination of once-through cooling is May 1, 1979 and the expected date for startup of the preferred CCC system is December 1, 1979. The major milestones for this "NRC Schedule," (Schedule A) as the applicant calls it, are listed below:

	Major Milestones	Event or Action Item
(1)	December 1, 1974	Submittal of the economic and environmental evaluation report to the NRC;
(2)	December 1, 1975	Receipt of regulatory reviews and approvals required for the construction of the CCC system;
(3)	June 1, 1976	Commencement of excavation;
(4)	June 1, 1977	Commencement of construction;
(5)	May 1, 1979	Commencement of cutover to CCC system;
(6)	December 1, 1979	Completion of construction of CCC system and commencement of operation of the CCC system.

A detailed schematic of the NRC construction schedule as shown in Figure 4-1 is in Appendix G of the FES for Unit No. 3 and repeated below:

1.	Initiation of design study of criteria of cooling tower.	November 1, 1972 C
2.	Start of environmental study of cooling tower impact.	September 1, 1973 C
3.	Submittal of environmental report on cooling tower to AEC and other governmental agencies (ALAB-174).	December 1, 1974 C
4.	Completion of NRC and agency evaluation and issuance of permits.	December 1, 1975
5.	Finalization of engineering design of cooling towers and incorporation of agency comments.	March 1, 1976
6.	Award of contracts for cooling towers.	May 1, 1976
7.	Contractor input into engineering design completed.	August 1, 1976
8.	Completion of mobilization of work force.	June 1, 1976

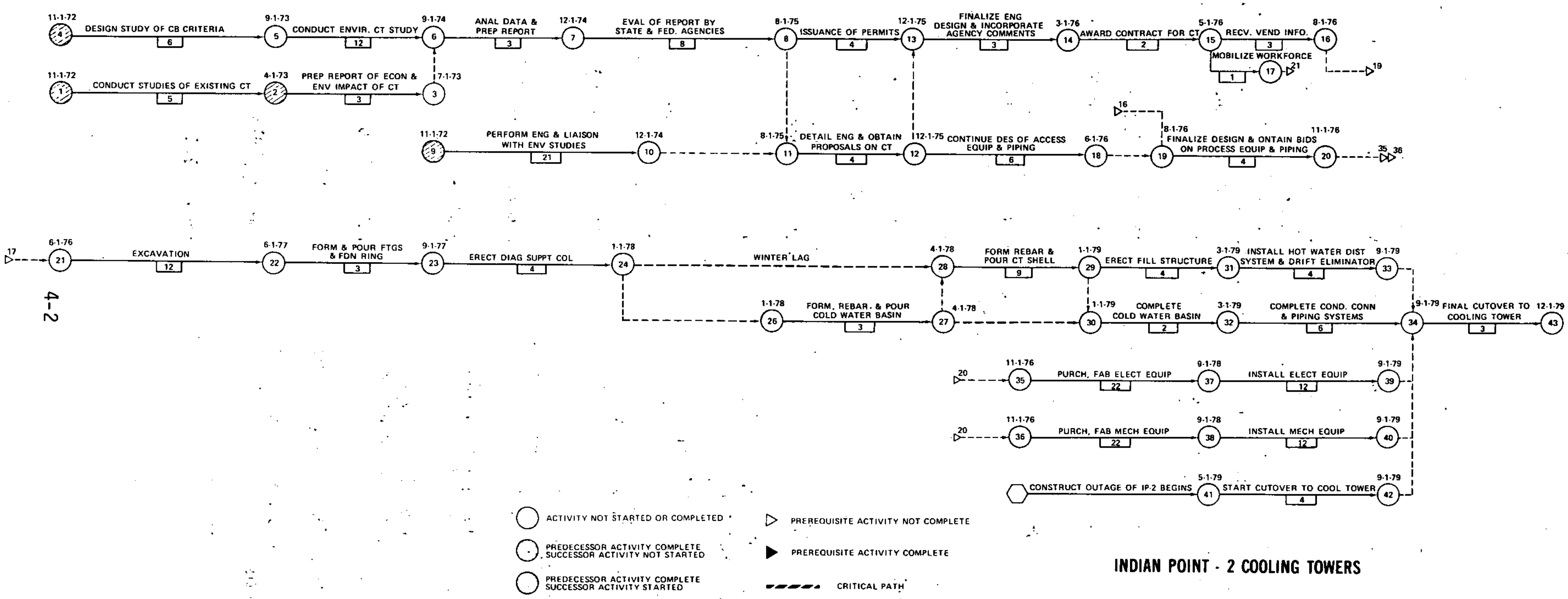


Fig. 4-1 Construction Schedule

9.	Start of excavation.	June 1, 1976
10.	End of excavation.	June 1, 1977
11.	Completion of cooling tower foundation.	September 1, 1977
12.	Completion of erection of cooling tower column, shell, and fill structure.	April 1, 1979
13.	Completion of forming and building of cold water basin.	March 1, 1979
14.	Order of electrical and mechanical equipment placed.	November 1, 1976
15.	Completion of installation of electrical and mechanical equipment and condenser connections and piping systems.	September 1, 1979
16.	Start of outage of Unit No. 2 and cutover of tower into plant.	May 1, 1979
17.	Completion of final cutover of tower to plant and plant startup with cooling tower.	December 1, 1979

In the proceeding for Unit No. 3, a stipulation was signed by the parties. As stated in Section 1, the stipulation has recently been approved by the Commission based on its Memorandum and Order of December 2, 1975. The FES for Unit No. 3 contains this stipulation. In this agreement, a schedule calls for termination of once-through cooling at Unit No. 3 by September 15, 1981 and includes the conditions (2(i)) that simultaneous excavation or outage for construction of the CCC systems at Unit No. 2 and Unit No. 3 would not be permitted.

The "May 1, 1979" date (Schedule A), however, is subject to acceleration or delay depending on the various conditions permitted in Amendment No. 6 to the Facility Operating License DPR-26. One condition, 2.E(1)(b), points out that "the finality of the May 1, 1979 date is grounded on a schedule under which the applicant, acting with due diligence, obtains all governmental approvals required to proceed with the construction of the closed cycle cooling system by December 1, 1975. In the event all such governmental approvals are obtained a month or more prior to December 1, 1975, then the May 1, 1979 date shall be advanced accordingly. In the event the applicant has acted with due diligence in seeking all such governmental approvals, but has not obtained such approvals by December 1, 1975, then the May 1, 1979 date shall be postponed accordingly."

Since the December 1, 1975 date for completion of all regulatory approvals is impossible due to the time required for detailed staff evaluation, the May 1, 1979 date is postponed accordingly. On December 3, 1975, the HRFA filed a petition for leave to intervene in the present proceeding and an order granting intervention was issued on December 23, 1975. However, no hearing date has been established as yet.

4.2 PERMITS AND REGULATORY APPROVALS

Shortly after its preparation the applicant submitted its ER-CCC, IP-2 to various Federal, State, and local agencies for their review, requesting comments on the report and approval through a permit or certificate to build and operate the preferred CCC system. The following summarizes the status of progress of each permit as submitted by the applicant in its ER-CCC, IP-2 and Supplement Volume No. 1, August 6, 1975:

(1) <u>U.S. Nuclear Regulatory Commission</u>

The applicant is seeking approval of its selection of a NDCT as the preferred CCC system. This statement will reflect the staff's position as to the NRC approval or denial of the applicant's request for a license amendment. In addition, if approved at the time the plant is ready to operate with an alternate CCC system, a change in Appendix A and B Technical Specifications involving a license amendment will be issued.

(2) U.S. Corps of Engineers

If any excavated material resulting from construction of an alternative CCC system is disposed of by dumping the material into the river, the applicant will be required to file an application with the U.S. Corps of Engineers. Otherwise, the applicant will dispose of the excavated materials in a land-fill location. The applicant reports that neither method has been selected; therefore, no application had been filed. However, the applicant plans to file for a permit to the Corps of Engineers with the intent of receiving the permit on June 1, 1976.

(3) U.S. Environmental Protection Agency

On March 31, 1975, the applicant received a Section 402 permit from the EPA requiring closed-cycle cooling operation of Unit No. 2 after May 1, 1979. This requirement which was based on the license schedule described in Section 4.1 has, in accordance with EPA's regulations, been suspended pending an adjudicatory hearing.

(4) State Air Contamination Source Permit (received April 26, 1976).

(5) Water State SPDES permit or modification of existing NPDES permit and attendant 401 Certification (PL92-500).

(6) Disposal of excavated material - Protection of Water Permit and 401 Certification to obtain Section 404 permit (Corp of Engineers) if subaqueous disposal is selected.

(7) Modification or construction of docks (suggested in section 3.3) would also require Protection of Water Permits and permits of the Corps of Engineers.

(8) Building permit from the Village of Buchanan. In State appellate court appeal.

5. ENVIRONMENTAL IMPACTS OF FEASIBLE ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS

The staff has carried out an intensive review of the environmental effects and impacts of those cooling towers discussed in detail by the applicant, namely, the natural draft, wet mechanical draft and wet/dry mechanical draft towers. Since the applicant has selected the natural draft cooling tower as the preferred closed cycle cooling system, the staff carried out its own independent assessment of the impacts of the natural draft cooling tower. In addition the staff has under consideration the fan assisted natural draft cooling tower and the circular mechanical draft cooling tower for which the applicant supplied very limited information. The reasons that the applicant did not consider these two closed cycle cooling systems as feasible are pointed out on pp. 42-43 of Supplement Volume 1 to its ER-CCC, IP-2. In essence the applicant has reported that at the time of preparation of the applicant's ER-CCC, IP-2, no data on either construction, erection, operation, or maintenance of FANDCT and CMDCT were available for a comprehensive evaluation on the economic and environmental impacts. The applicant is continuing to seek additional information on these two and other developing alternative cooling systems for further evaluation. However, the applicant has not provided the staff with any detailed engineering designs of these two additional systems. The staff has found that the relative merits of the two additional closed cycle cooling systems warrant further investigation. Whenever feasible, the staff has made its own independent assessment of the impacts of these two additional systems.

In the following sections are discussed the effects on the environment of construction and operation of five alternative closed cycle cooling systems.

5.1 ATMOSPHERIC EFFECTS

5.1.1 Cloud and Precipitation Formation

5.1.1.1 Natural Draft Cooling Tower (NDCT)

The visible plume from a cooling tower is in fact an artificial cloud. The extra heat and water vapor can under proper meteorological conditions create cumulus clouds. Aynsley,[27] Spurr,[2,9] Smith, et al.[6] and others have observed that, if meteorological conditions are proper, the updraft from a NDCT can create cumulus clouds after the initial visible plume has evaporated. Aynsley concludes that this is a "rare occurrence," and that these man-made clouds only precede natural cloud formation. Experience in England indicates that natural draft cooling towers do create clouds but not precipitation.[1,3,4,8,28] The state-of-the-art in cloud physics is such that meteorologists cannot now say with any degree of certainty that there will or will not be an increase in rainfall amounts due to cooling tower plumes.[29-32] It is possible that the plume from a cooling tower could somehow trigger an existing atmospheric instability and create extra cumulus congestus clouds and precipitation miles downwind of the release point.

Although there are many examples of cloud generation from natural draft cooling tower operation, no cases of showers of precipitation being generated by the plume have been observed and reported in the literature. It is quite possible that a cooling tower will modify the pattern of rainfall in the area, but not the total amount for the region, as the vapor flux from the tower is very small compared to natural fluxes. It is also possible that the rainfall amount could be somewhat higher below a cooling tower plume because of falling drops collecting water from the visible plume than in areas removed from the plume. A numerical model study indicates that the amount of extra moisture is of the order of 10 mm/year, or a 1% increase over natural rainfall.[33] This model also predicts a decrease in summer sunshine of less than 4 minutes/day except for areas within one mile of the tower.[33] This is a conservative estimate of shadowing, since periods with natural cloud cover were not subtracted from the computer results.

The climatological data before and after the installation of a complex of eight NDCT's serving a 2000-MWe power station in England showed no detectable changes in total rainfall, hours of bright sunshine, or incidence of morning fog during the four-year period after the station became operational.[34]

5.1.1.2 Mechanical Draft Cooling Towers (MDCT)

Hanna and Perry[21] report that, on rainy days, the plume sometimes forms a stratus-type cloud that may extend for tens of kilometers below the natural overcast layer, and that a cumulus cloud can form in the updraft created by a cooling tower plume after the initial plume has evaporated completely. In the Oak Ridge study, it was concluded that some form of cloud development was initiated on 10% of all days. Very light snow caused by a MDCT discharge has been observed in Tennessee[35] and Indiana.[36]

5.1.1.3 Summary and Conclusions

The visible plume from wet cooling towers is a cloud that will reduce sunshine in the offsite area by at most an average of a few minutes per day. Cumulus clouds will sometimes form from the vertical updraft created by the plume; this type of cloud formation will usually occur on those days in which cumulus clouds will form due to natural processes. Increases in precipitation, if any, will be quite small and not detectable in the natural variability of climatological conditions.

5.1.2 Ground Level Fogging and Icing

5.1.2.1 Natural Draft Cooling Tower (NDCT)

Most reports written more than a few years ago on NDCT's state that they have the "potential" to cause ground level fogging and icing; however, observations at such towers indicate that they rarely if ever do. The warm, moist plume enters the atmosphere at heights of 375 ft or more above ground level and either evaporates or merges with a natural cloud layer before reaching ground level. In England, it has been observed that two or three times per year "a few detached fragments" of visible plume were observed touching the ground; this condition occurs only when strong winds create aerodynamic downwash downwind of a complex of eight closely-spaced, relatively short (375 ft) NDCT's.[3]

There have been no cases of visible plumes reaching the ground during the five years of operation of the 2250-MWe steam plant at Paradise, Kentucky.[10] According to observers of meteorological conditions in the vicinity of the Keystone, Pennsylvania, Power Plant (1800-MWe) no surface fogs or icing have been observed in four years of operation. The same conclusions have been reported in England,[1,3,8,12] Switzerland,[4,38] and the United States.[5,9-11] Hosler does report one occasion on which the visible plume from a natural draft cooling tower did reach the ground in a mountaneous terrain area; however, this is the only reported case.[37]

The Central Electricity Generating Board of Great Britain reported its findings on the environmental effects of cooling towers[28] in which no measurable change in relative humidity was detected downwind. The visible plume sometimes persisted for a number of miles downwind, altering sunshine in the area. No drift was observed from the towers. They reported that cumulus clouds were sometimes formed but that no cases of showers or precipitation being generated by the plumes have been observed. More recent observations in England, Europe and the United States confirm these conclusions.

Photographs taken at cooling tower sites sometimes show ground level fog completely separate from the rising plume from the towers.[27,38] The surface fog is caused by natural processes, such as nocturnal radiation; the rivers and reservoirs used to supply makeup water to the towers aid in its formation.

Thus, observations at operating NDCT's show that the NDCT does not cause fogging and icing in level-terrain areas.

a. Applicant's Analysis of Fogging and Icing from a NDCT

The applicant has reported in Appendix B of the ER-CCC, IP-2, that the results of the mathematical model used to compute plume dispersion indicate that since the visible portion of the plume is not expected to reach ground level for sustained periods, ground fog due to a natural draft tower operation would be rare. Only one hour of predicted ground fog resulted from the computer runs. The terrain was accounted for in these runs. The staff agrees with the conclusions reached by the applicant and concurs that there would be no safety hazard on highways or to boating on the river. The applicant reported that about 79 hours of natural fog (defined as visibility less than 1/4 mile at the 33 ft level) were measured at the meteorological tower.

This represents an annual frequency of about 1-2%. The applicant also reported the increase in ground level relative humidity (RH) and found that about 99% of all hours had an incremental increase of less than 1% RH. The staff concurs that the NDCT will cause minimal impact on the surrounding environment with respect to increased RH.

The conclusions reached by the applicant regarding minimal induced fogging effects and RH increases from NDCT are similar to those reached by the staff in the FES for Unit No. 3. In the FES for Unit No. 3, the staff found only a small increase of 4 hr per year resulting from fogging from the NDCT. The staff also found that downwash effects of the plume from the NDCT would be very rare and occur only with wind speeds in excess of 21 mph.

The applicant also discusses the probability of ice and frost formation due to the plume from the NDCT and found that the potential for ice accumulation on structures located in the plume path is negligible. The staff also pointed out in Appendix G of the FES for Unit No. 3 that condensation of the cooling tower plume in cold weather causes the plume to rise to much higher elevations, an effect that tends to reduce local icing. Thus the staff agrees with the applicant that there will be very small impacts from fogging and icing from the NDCT.

With regard to precipitation, the applicant also found that incremental increases in snowfall or rainfall from the plume during periods of naturally occurring snowfall or rain would be negligible or very localized. The staff concurs with this finding as had been previously pointed out in Appendix G of the FES for plant No. 3 by Overcamp and Houll.[39] Any contribution of the operation of the NDCT to the precipitation in the Indian Point area would be much below the natural variability of precipitation. Thus, the staff expects that there will be no precipitation effects on the environment from operation of the NDCT.

b. Staff's Analysis

See Section 5.1.3.3 for staff's analysis of fogging and icing from a NDCT.

5.1.2.2 Mechanical Draft Cooling Towers

The fog potential from shorter forced-ventilation MDCT's is much greater than for NDCT's for the following reasons:

(1) MDCT's release their water vapor at a much lower elevation (50 to 80 ft compared to 350 to 500 ft) where winds are weaker, the saturation deficit is less, and the surface nocturnal inversion frequently prevails.

(2) The plumes are frequently trapped in building eddies due to aerodynamic downwash.

(3) Much higher entrainment rates are generated owing to smaller exit diameters, higher exit speeds, and additional turbulence created by the fan.

Although wet MDCT's have been used to cool power plants for decades, there is very little quantitative data available on the water droplet plumes which they generate, and even fewer references on significant adverse impacts due to their operation. Several studies have reported light, friable rime icing from cooling tower operation but there are no known reports of severe icing on adjacent roads or structures as the result of the operation of modern mechanical draft cooling towers. The primary cause of surface fogging and icing near mechanical draft cooling towersis aerodynamic downwash, which brings the plume to the ground very near the tower.[21,22,40] A recent study of the plumes from the Oak Ridge, Tennessee, induced draft towers (about 2000 MWt) indicates that during a seven-month period (December 1972 through June 1973), downwash was observed on 65% of all days (the photographs were taken during the afternoon) and occurred whenever the wind speed was more than 3 meters per second (mps) and wind direction was more than 10° from the long axis of the towers. This fog either evaporated completely or lifted due to its buoyance once it escaped the tower cavity region, or about 100 meters downwind. With the wind direction along the long axis of the towers (within ±10°), no downwash was observed with winds up to 5 mps. The greatest distance over which fog was observed at Oak Ridge was 0.5 km.[27] EPA studies indicate "Mechanical draft towers may cause problems, but in most cases fogging and icing would be onsite (i.e., within 1000-2000 ft of the tower)."[25]

Fog affects the environment because of wetting, icing, and reduced visibility. The impact of cooling system fog on most human activities (such as highway traffic) depends primarily on horizontal visibility. Unfortunately, the term "fog" means different things to different people. To some, fog exists only when "one cannot see his hand in front of his face." The international definition of fog, and the one used by the U.S. National Weather Service (NWS), is a condition consisting of a visible aggregate of minute water droplets or ice crystals suspended in the atmosphere near the earth's surface which reduces visibility to less than one kilometer (0.62 mile). If horizontal visibility is one kilometer or more, the condition is mist. The NWS uses these definitions in its synoptic (six-hourly) weather codes, and "dense fog" for conditions in which the visibility is less than 0.25 mile. Contrary to international usage, the NWS in its hourly (airways) weather observations describes the condition of visibility of six miles or less due to water drops or ice crystals as fog; the exact reduction in visibility is given in another portion of the weather report. The "fogging" effects discussed in the literature on cooling systems seem to refer to any reduction of horizontal visibility due to thermal discharges, including those which would have only a very minor effect on man's activities. If the air temperature is below 32°F, this fog is supercooled and will be deposited mostly on vertical surfaces as rime ice with a very low density and little structural strength. Wetting of structures and biota downwind of cooling towers can be caused by both drift deposition and drops in the visible plume. This wetting can cause damage or corrosion to structures as well as generate disease to plants.

See staff comments in Subsection 5.3.1.2 regarding the applicant's results on the use of its model to estimate fogging and icing effects. For the period of October 1973 through September 1974 the applicant found that the plumes from the MDCT's would induce a total of 82 hours of fog. Details of the results of the applicant's analysis of MDCT's effects are presented in Appendix C to the ER-CCC, IP-2. The frequency of occurrence of fog for each month was reported in the applicant's Figures 5.4.1 through 5.4.12 for the October 1973-September 1974 period when the possibility of fog formation is the greatest. The applicant also reported the occurrence of 97 hours of induced icing during the period October 1973 through April 1974. (See the applicant's Figures 5.5.1 through 5.5.5 in Appendix C of the ER-CCC, IP-2 for the frequency of occurrence of icing.)

The staff also investigated the frequency of occurrence of fogging from the MDCT's described in Appendix G in the FES for Unit No. 3 with MDCT's at both Units No. 2 and 3. The increase in fogging is estimated to be a maximum of 66 hr/year about two miles north of the site. The meteorological data for these calculations however, were those supplied by the applicant in the FFDSAR for Unit No. 3 and discussed in Appendix E in the FES for Unit No. 3 and thus were different than those obtained from the 400 ft meteorological tower during the October 1973 through September 1974 period. See Section 5.1.3.3 for discussion of the staff's analysis of fogging and icing, using the data from the 400-ft meteorological tower.

5.1.3 Drift and Salt Deposition

In each alternative closed cycle cooling system, water is evaporated and the vapor released as the plume from the top of the specific wet cooling tower unit under consideration. In addition, entrained water in the form of small droplets called "drift" also exits from the top of a wet or wet/dry cooling tower. The salts and other chemicals dissolved in the drift, particularly when brackish water is used as circulating cooling water, will therefore be carried out of the top of the tower and the water droplets may deposit on the local surrounding area.

The applicant used 0.0025% as the drift level for its NDCT, 0.008% for the MDCT's in its calculations on salt deposition and salt aerosol concentration from the three cooling towers considered. These values are consistent with the reported drift rates from modern, well-maintained cooling towers.

As described in Appendices B and C of the ER-CCC, IP-2, the applicant has performed an analysis of saline drift deposition and has estimated effects from NDCT and wet and wet/dry linear MDCT's at the Indian Point site. Models which consider drift particle size, accretion, evaporation, settling, turbulent dispersion, aerodynamic effects and topographic effects were used for the estimation of drift deposition. Two cycles of concentration were assumed in both the NDCT and MDCT models. Weather data for the models were obtained from the site during the period October 1973 through August 1974. The model also used field data on plume growth by an empirical correlation derived from photographic observations of the plume from the Paradise Plant NDCT obtained in a cooperative program with the Tennessee Valley Authority.

The applicant also carried out field studies to estimate the ambient salt deposition in the surrounding area. The ambient salt deposition ranges from 38 to 366 Kg/Km^2/mo (0.36 to 3.4 lbs/acre/mo) with a mean value of 160 Kg/Km^2/mo (1.4 lbs/acre/mo). In comparison, eleven-month average values of the salt deposition from NDCT are 896 Kg/Km^2/mo and those from a MDCT range from 50 Kg/Km^2/mo (spring) to 4000 Kg/Km^2/mo (fall).

During the eleven-month sampling period the ambient salt concentration (as sodium chloride aerosol) ranged from 0 to 6.15 $\mu g/m^3$ and averaged approximately 1.0 $\mu g/m^3$.

5.1.3.1 Applicant's Analysis of Drift from NDCT

The analysis of drift deposition was based on an assumed makeup water salinity of 7200 ppm and with two cycles of concentration, the salinity of the circulating water would be 14,400 ppm. Using these parameters it was calculated that the tower would emit 39.2 Kg salt/hr on a year round basis. Use of high river salinity on a year round basis results in an over estimate of drift relative to that which would probably be deposited since river salinity is much less than the assumed maximum value for much of the year.

Based on the above salinity the applicant calculated that average aerosol concentration would be 5.6 $\mu g/m^3$ in air and that the maximum drift deposition would be 896 Kg/Km^2/mo occurring at 1.24 miles southeast of the tower.

Conventional units for drift deposition are Kg/Km^2, Kg/Ha* or lbs/acre. The unit "lbs/acre" is more understandable to non-technical readers. The units are interconvertible as follows: 896 Kg/Km^2 = 8.96 Kg/Ha = 8.0 lbs/acre.** Thus the applicant's conservative estimate of drift deposition suggests that about 8 pounds of salt per acre per month will be deposited annually from a NDCT in the area of highest deposition. Five miles downwind of the tower the predicted deposition is 12.5 Kg/Km^2/mo or about 0.1 lbs/acre/mo.

Estimates of average annual drift deposition are not sufficiently detailed for estimating biological effects since much of the deposition takes place during late fall, winter or spring when most vegetation is normally dormant and not strongly susceptible to damage from salt. Estimated monthly salt deposition has been provided by the applicant for 11 months of the year. Most critical of these are the months of July through October since these are the months when high river salinities occur, vegetation is fully developed, and long periods without rain are possible. Drift isopleths for the month of October are given in Figure 5-1 reproduced in this statement as an example of the applicant's results. Maximum drift amounts to about 600 Kg/Km^2 (∿6 lbs/acre) because of high river salinities and occurs about 1.2 miles south of the tower. In July and August maximum values range from 300 to 500 Kg/Km^2 (∿3-5 lbs/acre) in the area of peak deposition. The staff concludes that the applicant's results showing high drift rate in the winter and spring months (Table 3-1, ER-CCC, IP2) are in error because of the failure to adjust salinity downward to more realistic levels in the model for these months. Staff estimates of monthly and annual deposition for a NDCT are given in Table 5-1.

Deposition falls off rapidly with distance from the tower. In all cases during the critical four months it is equal to or less than 100 Kg/Km^2 (0.9 lb/acre) at or beyond 2 miles from the tower in all directions. During the remaining eight months of the year the values range downward from those indicated.

5.1.3.2 Applicant's Analysis of Drift from MDCT's

Drift modelling for the mechanical draft case was based on 45-year records of monthly river salinities and on an assumed drift rate of 0.008% of the circulating water flow. Two cycles of concentration were assumed and site weather data (October 1973 - August 1974) were used. (Omission of September 1974 weather data has no important effect on conclusions regarding drift deposition.)

Model results show that monthly maximum salt drift would amount to 4,000 Kg/Km^2/mo (36 lbs/acre/mo) during autumn, 2,000 Kg/Km^2/mo (18 lbs/acre/mo) in winter, 50 Kg/Km^2/mo (0.4 lbs/acre/mo) in spring and 2600 Kg/Km^2/m (23 lbs/acre/mo in summer.

The most critical time of the year for potential botanical damage from saline drift occurs during the months of July through October since vegetation is normally in full maturity, river salinities are maximum and extended rainless periods are likely during this time. During this critical period the applicant estimated that maximum saline deposition as high as 45,000 Kg/Km^2/mo (402 lbs/acre/mo) would be possible from wet mechanical draft towers.

Deposition of this magnitude is predicted to occur close to the tower and would largely be confined to the site. It would occur only if relative humidity exceeded 90% for the entire month. In the more likely case of relative humidity between 50 and 90% maximum salt deposition during the critical intervals could reach 1600 Kg/Km^2/mo (14 lbs/acre/mo) but it would not be confined to the site. Certain small areas of Verplanck to the south and Peekskill to the north could receive in the range of 400 to 1600 Kg/Km^2/mo (4-14 lbs/acre/mo) from mechanical draft towers under normal humidity conditions.

---

*Ha = hectare.

**Kg/Ha x 0.89 = lbs/acre.

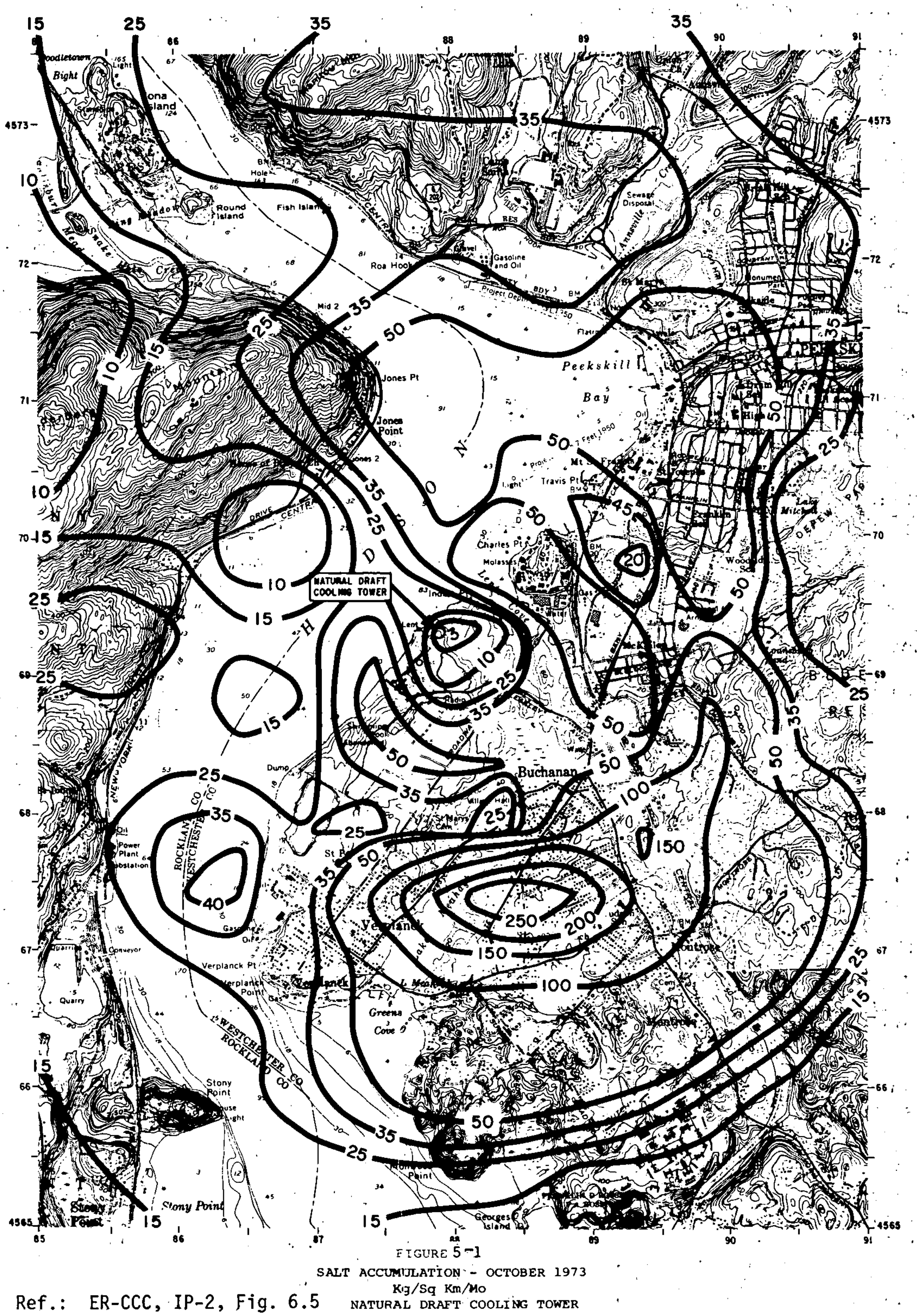


FIGURE 5-1
SALT ACCUMULATION - OCTOBER 1973
Kg/Sq Km/Mo
NATURAL DRAFT COOLING TOWER
DRIFT SALINITY : 7200 PPM

Ref.: ER-CCC, IP-2, Fig. 6.5

TABLE 5-1

MAXIMUM CUMULATIVE DRIFT DEPOSITION FOR NATURAL DRAFT COOLING TOWERS

	Maximum			Maximum at One Mile		Maximum at Two and One-Half Miles	
Period	Kg/Ha	lb/acre	Distance (miles)	Kg/Ha	lb/acre	Kg/Ha	lb/acre
Year	22	20	.25 mi.	6.0	5.3	2.5	2.2
Oct.	1.6	1.4	.63 mi.	1.2	1.1	.28	.25
Nov.	.086	.077	.5 mi.	.084	.075	.026	.023
Dec.	.29	.26	.25 mi.	.098	.087	.026	.023
Jan.	.18	.16	.38 mi.	.12	.11	.033	.029
Feb.	.25	.22	1.0 mi.	.25	.22	.093	.083
March	.00073	.00065	.63 mi.	.00060	.00054	.00015	.00013
April	.000018	.000016	.75 mi.	.000016	.000014	.0000048	.0000043
May	.021	.019	.25 mi.	.0098	.0088	.0023	.0021
June	.14	.12	.25 mi.	.49	.43	.11	.094
July	3.3	2.9	.25 mi.	1.5	1.4	.27	.24
Aug.	9.6	8.6	.25 mi.	3.7	3.3	.93	.83
Sept.	10.	9.3	.25 mi.	2.5	2.2	.76	.67

It is highly unlikely that humidity in excess of 90% would persist for an entire month and it is therefore unlikely that the highest deposition quoted would occur. The lower values are the more realistic ones. An example of the predicted August deposition for mechanical draft towers is given in Figures 5-2 and 5-3 reproduced from applicant's ER-CCC IP2 for both the 50-90% and over 90% and of humidity cases. Because of the geographical position of Indian Point Unit No. 2 and the prevailing winds of the area much of the total saline emission is predicted to fall into the Hudson River to the south or in Peekskill Bay to the north. The heaviest terrestrial deposits are likely to occur on or near the shoreline of the river and bays.

5.1.3.3 The Staff's Model Predictions of Fog, Icing and Salt Deposition and Aerosol Concentration

The staff has performed an independent assessment of potential salt drift deposition and increased hours of fogging for NDCT and circular MDCT for Indian Point Unit No. 2. The applicant's predictions of fog and drift for conventional MDCTs have been accepted as representative state-of-the-art calculations by the staff. (See Appendix C of the ER-CCC, IP2.) Wet/dry MDCT effects from drift have been assumed to be the same during the critical months (July, August, September and October) as those of the linear MDCT since the wet-only mode would be operable during these months. Reduced visible plume during operation in the wet-dry mode in the winter months would be an advantage for the wet dry towers. An independent assessment was made of the potential fog and drift for the NDCT since this is the applicant's preferred closed cycle system. The CMDCT effects were also analyzed since they represent a relatively new design for which no onsite evaluation has yet been made available to the staff. It was assumed that the fan-assisted towers (FANDCT) would have improved drift characteristics with respect to CMDCT although not as good as a NDCT. The fogging potential for FANDCT was assumed to be similar to the levels predicted for NDCT.

The staff's analysis used ORFAD,[41] a predictive mathematical model based on the empirical plume rise equations of Briggs,[42] as modified by Hanna[43] and by Briggs[44] to account for the increased buoyancy effect of multiple plumes. The program was modified to allow the calculations to be performed by month so that the effects of seasonal variations in river salinity could be accounted for in the evaluation of potential biological damage. A further modification was incorporated so that data from the 400-ft high meteorological tower on site could be utilized since a full year of these data (October 1973 thru September 1974), taken at hourly intervals, were available. Prior staff calculations, shown in Appendix G of the FES for Unit No. 3 for Indian Point, used surface weather data for Newburgh, New York,which were obtained from the National Weather Records Center.[45] It became evident that despite the much longer period of record for Newburgh (at least ten years), the valley effects at Indian Point dominated the wind patterns and therefore, the predicted fog and drift patterns obtained from the Newburgh data would not be credible. Subsequent calculations on the CMDCT using 400 ft and 125 ft wind speed and direction information indicated that the variation of wind speed and direction with height could also have a significant effect on the predicted fog and drift patterns. Since the Newburgh data had only surface wind speed and direction this was also viewed as a shortcoming for this particular case.

The choice of onsite data caused some further complications. The onsite meteorological program does not record the natural incidence of fog nor does it provide the information on cloud cover used by ORFAD in determining atmospheric stability classes. The natural fog incidence was resolved by arbitrarily assigning an hour of natural fog whenever the visibility was less than one-fourth of a mile. (The applicant defined natural fog as visibility of less than 1/4-mile at the 33-ft level.) The stability class was determined by using the temperature difference between 33 feet and 400 feet and tables from Regulatory Guide 1.23. When utilizing NOAA data, ORFAD determines the rate of temperature change with height by using an average value for each stability class. For the calculations presented here the actual temperature change as measured on the met tower was used.

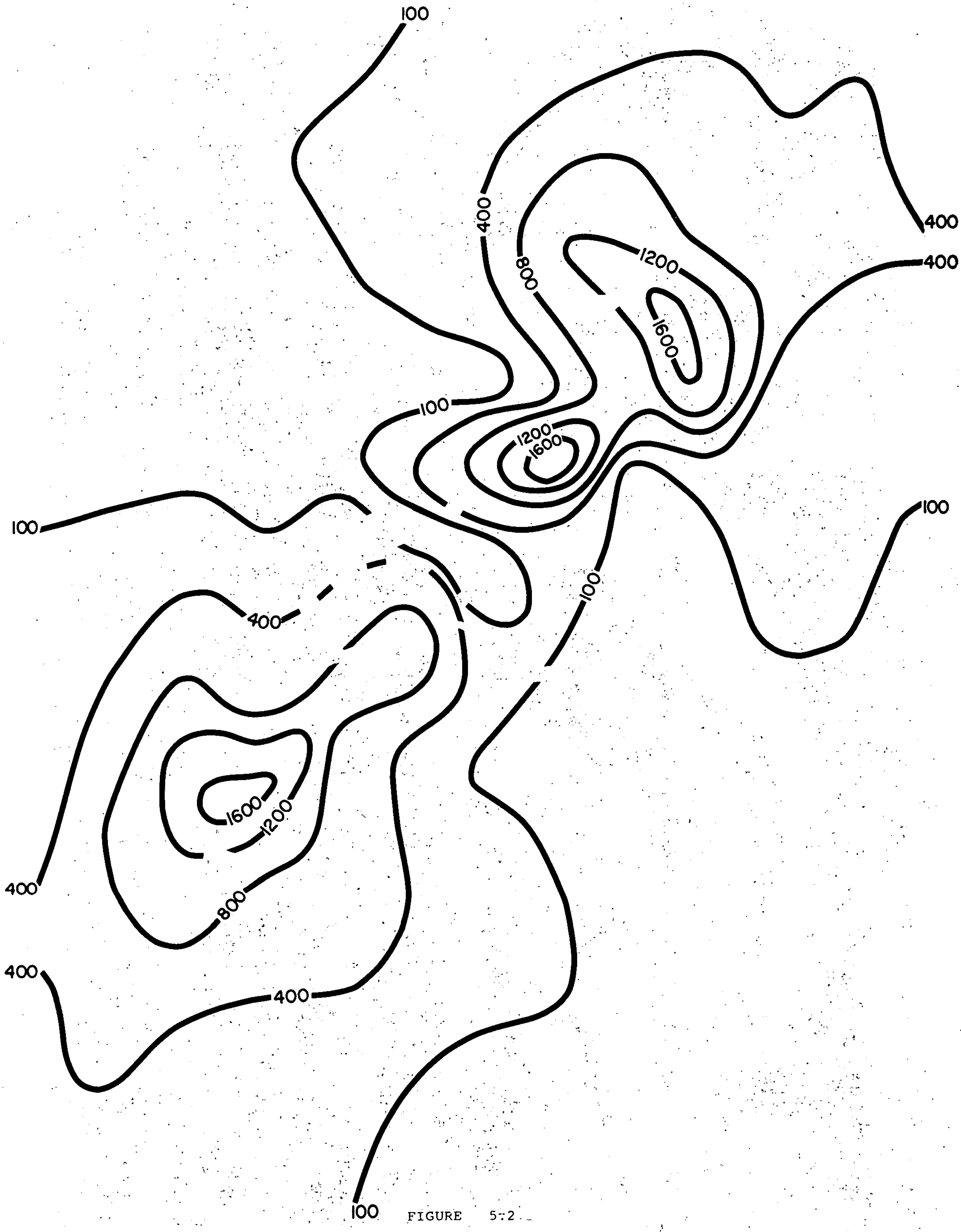


FIGURE 5-2

AVERAGE SALT DEPOSIT - AUGUST 1974
Kg/Sq Km/Mo
AMBIENT RELATIVE HUMIDITY 50-90%
(MECHANICAL-DRAFT COOLING TOWERS)

Ref: ER-CCC, IP-2,
App C, Fig. 5.2.15

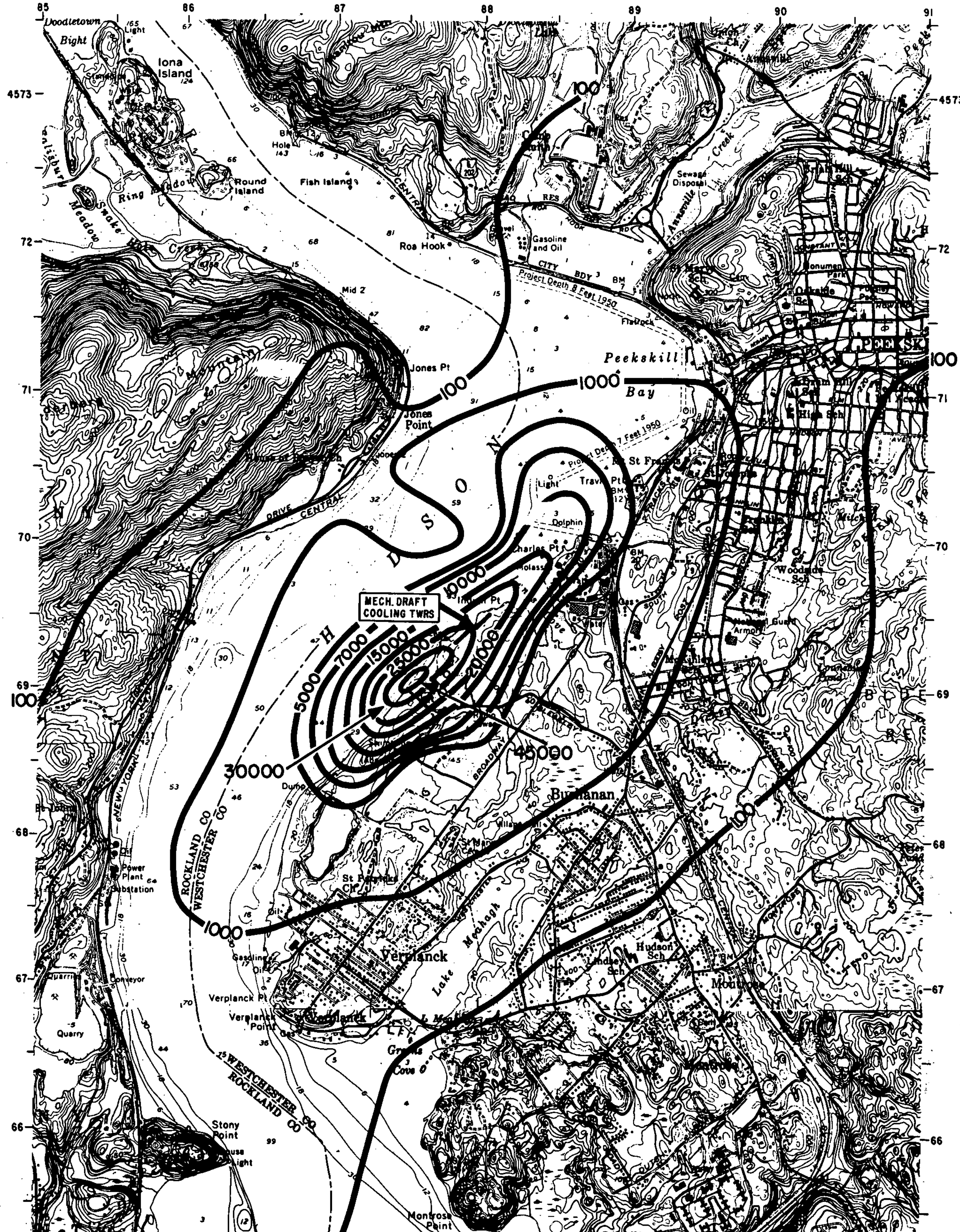


FIGURE 5-3
AVERAGE SALT DEPOSIT - AUGUST 1974
Kg/Sq Km/Mo
AMBIENT RELATIVE HUMIDITY OVER 90%
(MECHANICAL-DRAFT COOLING TOWERS)

Ref.: ER-CCC, IP-2.. App C
Fig. 5.2.16

a. The ORFAD Program

ORFAD is a computer program written at the Oak Ridge National Laboratory (ORNL) to estimate the amounts of fog and drift deposition that could result from operation of wet cooling towers. The program produces reasonable estimates rather than exact values. Elaborate analyses cannot be justified for practical applications, since the numerical parameters necessary to a complete description of fog and drift phenomena are still but poorly known and inadequate for a firm basis in theory. Of the procedures currently available, empirical relationships are widely accepted as the most reliable and best adapted for analyses using reasonable amounts of computer time.

The primary inputs to the program are the tower dimensions, operating parameters, and hourly meteorological data taken onsite.

The model assumes that the effluent from a wet cooling tower consists of a plume containing pure water vapor and droplets containing salts (primarily NaCl) in solution initially in the same concentration as in the water in the cooling tower basin. The density of the water vapor is assumed to have a Gaussian distribution around the centerline of the plume. Computations are made for 16 azimuthal sectors corresponding to the points of the compass and for selected distances downwind of the towers. The surrounding terrain is assumed to have a uniform elevation above sea level. The wind speed is assumed to be independent of altitude, and the horizontal transport rate for the effluent is taken to be that of the mean ambient wind speed. For the case in hand, Indian Point Unit No. 2, it was possible to select from the onsite data the wind speed and direction most appropriate for the tower height. For the NDCT this was the 400 ft wind data and for the CMDCT it was the 125 ft wind data.

Because of its excess temperature above ambient and its water vapor content, the plume emerging from the top of the cooling tower will be buoyant and will rise, be caught and bent over by the wind, and travel for relatively long distances downwind, either as a visible or invisible plume. The method of calculating the plume rise consists of determining the flux buoyancy parameters from a single cooling tower using the relationships of Briggs,[17] as modified by Hanna[43] to represent the effects of latent heat given up by condensing moisture in the plumes. (Although this modification is included in the ORFAD program, this study did not take credit for the increased buoyancy effect.) The method of Briggs[44] is then used to account for the additional buoyancy forces from the combined plumes of multiple cooling tower installations. (Again, this refinement was not utilized in the present analysis.)

Shear forces along the edges of a plume cause surrounding air to be drawn into it and the plume then expands both horizontally and vertically, with the moisture in the plume being cooled and diluted by the entrained ambient air. The concentration of water vapor in the plume can be expressed as a function of the mass evaporation rate in the tower, the height of the plume above the ground, wind speed, and the plume dimensions. To provide an estimate of the amount of fogging (hours per year) that would occur at ground level due to operation of the towers, the program first checks the taped data to see if ground fog is naturally occurring. For Indian Point Unit No. 2 this is accomplished by selecting the hours for which the visibility was less than one fourth of a mile and classifying those hours as having naturally occurring fog. If visibility was greater than one-fourth of a mile, the moisture content of the centerline of the plume at the groundlevel is calculated and compared to the saturation deficit of the ambient air, based on the dewpoint and dry bulb temperature readings. If the amount of water vapor that must be added to the ambient air to cause saturation is less than the concentration of moisture added by the plume, fogging is assumed to occur. Since the tape of meteorological data for Indian Point reports the temperatures only to the nearest 0.1F°, however, when the ambient dry bulb and wet bulb temperatures are reported as being equal, the saturation deficit is calculated to be zero, and any moisture added by the plume, no matter if insignificantly small, under the above outlined procedure would be tallied as additional fog (even though none were occurring naturally). In the staff's view, this results in more hours of fog being counted than would probably actually exist. A further consideration is that since the fogging probability is estimated beneath the centerline of the plume, and the plume width normally does not extend over the 22.5° of the compass sector which serves as a basis for reporting the results, the hours of fog at each location are multiplied by the fraction that the plume width is of the sector width at that point.

Drift particles of finite size will fall toward the ground as well as being swept along by the plume, and they will assume a trajectory below the centerline of the plume that is dependent upon the particle diameters. The trajectory is very sensitive to the drop size, with the very large drops striking the ground close to the towers and the smaller drops being carried to great distances. Observed distributions of percent mass versus particle diameter (in μ) are used to assign drops to classes, or fraction of the total. A separate calculation of the trajectory is made for each class, and proper weights are given to each to obtain the total drift deposition at ground level. The procedure used by ORFAD is a modified version of the Hosler et al.,[46] method which divides drops into three classes: (a) those that do not evaporate, (b) those that evaporate to a saturated solution, and (c) those that evaporate to dryness. The falling velocity of the evaporating droplet is initially described as a value dependent on the drop diameter, and a final uniform value for the velocity after a given fall distance. This distance is thus dependent on the initial diameter and the ambient relative humidity. Empirical relationships are used to provide the fall velocities of the three regimes mentioned above in various relative humidity ranges. The method of calculating drift deposition in the ORFAD program is not based on a Gaussian plume but on the notion that all drift particles of a certain original size will fall to earth at nearly the same distance. This distance is that at which the total fall of the drop just equals the plume rise, and, of course, depends on the original drop size. When the relative humidity is greater than 76%, the drop is assumed to fall at constant velocity; when the humidity is less than 76%, an iterative solution is required to determine the diameter of a drop falling a given distance. For simplicity, evaporating particles are assumed to strike the ground with terminal velocities of saturated or dry droplets, even though they may not have fallen far enough to attain their final state.

The concentration of solids deposition is expressed as a function of the distance downwind. The ORFAD program has been arranged to "smear" the drift concentration calculated directly beneath the centerline of the plume over a 22.5° sector, since the wind direction given for each sector can be realistically envisioned as meandering back and forth across the sector.

b. Staff's Analysis of Drift from a NDCT

The input parameters for the NDCT calculations are presented in Table 5-2. These are tower parameters as reported by the applicant[3] or as derived from the reported information. The salinities in the cooling tower basin were obtained from monthly average river flows and salinity measured as a function of river flow as shown in Table 5-3. The drop size distribution used as shown in Table 5-4 was that measured by F. M. Shofner, et al., for the Hornaing cooling tower.[47] Redundant calculations were made using the applicant's drop size distributions but this did not substantially affect the results.

TABLE 5-2

INPUT FOR NATURAL DRAFT COOLING TOWER DRIFT AND FOG CALCULATIONS

Height (meters)	172.00
Range (F degrees)	25.00
Water/Air Ratio	1.44
Inner Radius (meters)	44.80
Efflux Speed (m/s)	3.80
Heat Out (megacal/s)	525.00
Drift Fraction	0.000020
Latitude	41.27
Longitude	73.95
Elevation (feet)	45.00
Aerosol Height (meters)	4.00

TABLE 5-3

MONTHLY VARIATION IN DISSOLVED SOLIDS IN COOLING TOWER DRIFT AT INDIAN POINT UNIT NO. 2 AS USED IN STAFF'S ANALYSIS OF A NATURAL DRAFT COOLING TOWER

Month	Monthly Average Flow in River, cfs[a]	Salinity at Indian Point, ppm[b]	Dis. Solids in Drift, ppm[c]
Jan.	14,900	270	540
Feb.	11,300	1,100	2,200
Mar.	27,500	1.8	3.6
Apr.	37,500	0.05	0.1
May	21,000	23	46
June	11,000	1,250	2,500
July	8,000	4,000	8,000
Aug.	6,500	5,000	10,000
Sept.	7,200	4,500	9,000
Oct.	9,200	2,400	4,800
Nov.	14,500	300	600
Dec.	15,600	200	400

[a]ER, IP-3, App. I, Fig. 2.
[b]ER, IP-3, Appl I. Fig. B-5.
[c]Based on concentration factor of 2.

TABLE 5-4

DROP SIZE DISTRIBUTION CURRENTLY USED IN STAFF'S ANALYSIS OF NATURAL DRAFT COOLING TOWER AT THE INDIAN POINT UNIT NO. 2

25 μ	19 % of mass
75 μ	34 %
125 μ	18 %
175 μ	11.8 %
225 μ	7.7 %
275 μ	4.6 %
325 μ	2.6 %
375 μ	2.3 %

F. M. Shofner et al., "Measurement and Interpretation of Drift Particle Characteristics" in Cooling Tower Environment - 1974, ERDA Symposium Series, CONF-74 0302 pp 427-454, March 1974.

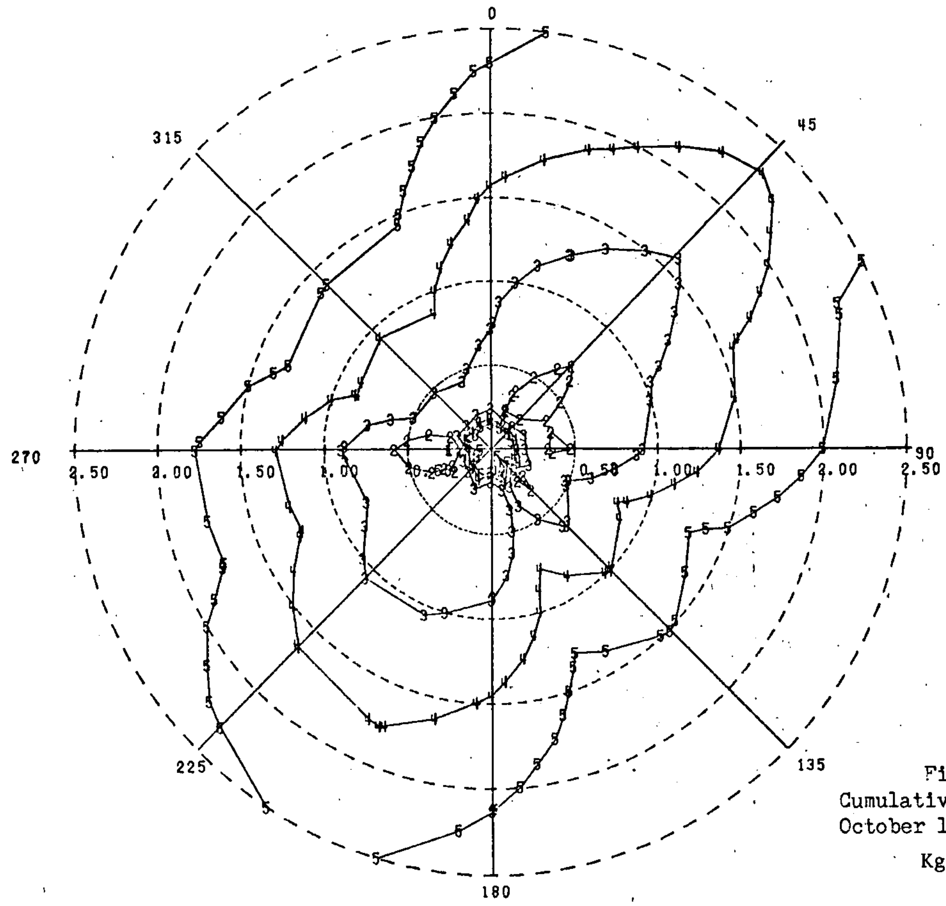
The results of the staff's calculations for the full year of onsite data and for the critical months of July, August, September, and October for drift deposition are presented in Figures 5-4 through 5-8. It is evident that these drift patterns and levels are dominated by the valley effect and the river salinity. It is interesting to note that the highest level for the full year is very close to the sum of the highest levels for the four critical months. See Table 5-1 for the levels of salt drift deposition. Although these maxima are not all at the same location, the dominance of the critical months is definitely established by close comparison of these figures. These predictions are in reasonable agreement with those of the applicant in spite of the fact that the applicant's calculations included the influence of the local topography, a different drop-size distribution and different salinities. They do differ substantially in all but the critical months because the applicant's NDCT calculations did not allow for the reduced salinity of the makeup water.

The results of the staff's calculations for the full year of onsite data for additional hours of fog are presented in Figure 5-9. The ORFAD calculation, using a visibility less than one fourth of a mile criterion, excluded about 105 hours from consideration for additional hours of fog or ice and classified them as naturally occurring periods of restricted visibility. Using a slightly different criterion, i.e., visibility less than 1500 ft and relative humidity greater than or equal to 80 percent, the applicant classified 146 hours as naturally occurring fog. During the month of October the visibility sensor was inoperative for approximately 295 hours out of 712 otherwise analyzable hours. Eleven hours were classified as fog by ORFAD and twelve hours by the applicant for the hours when the sensor was in operation. Projecting fog occurrence to the unknown hours would add about 8 hours to the reported fog for the month of October and bring the yearly total to approximately 110 hours by staff estimate. The additional fogging predicted for October was less than one tenth of an hour. Adjusting this figure to account for the missing data would still yield an insignificant amount of additional fog. The staff predictions are judged to be extremely conservative estimates of possible tower-induced fog; i.e., an overestimate of the number of hours of induced fog from the NDCT operation. The staff's estimate of naturally occurring fog is also judged to be conservative. Allowing the visibility criterion to relax from visibility less than one fourth mile to visibility less than one half mile would increase the naturally occurring fog to approximately 180 hours. The conservative tower-induced-hours-of-fog estimate (about 20 hours) is thus less than the variation which would be caused by relaxing the criterion. In fact the induced fog estimate is less than the difference between the applicant's estimate of hours of naturally occurring fog (146 hours) and the staff's estimate (110 hours).

The staff's icing calculations for the full year are presented in Figure 5-10. The criteria for ice are additional fog and temperatures at or below 32°F. Half of the staff-predicted fog (10 hours) thus occurs during freezing conditions in the winter. The contribution to icing from drift is probably more significant but would be restricted to onsite areas within a few thousand feet of the tower.

The staff's predictions of aerosol salt concentrations in micrograms per cubic meter ($\mu g/m^3$) are presented in Figure 5-11. These values are significantly lower than any recorded values that are known to have caused damage to plants.

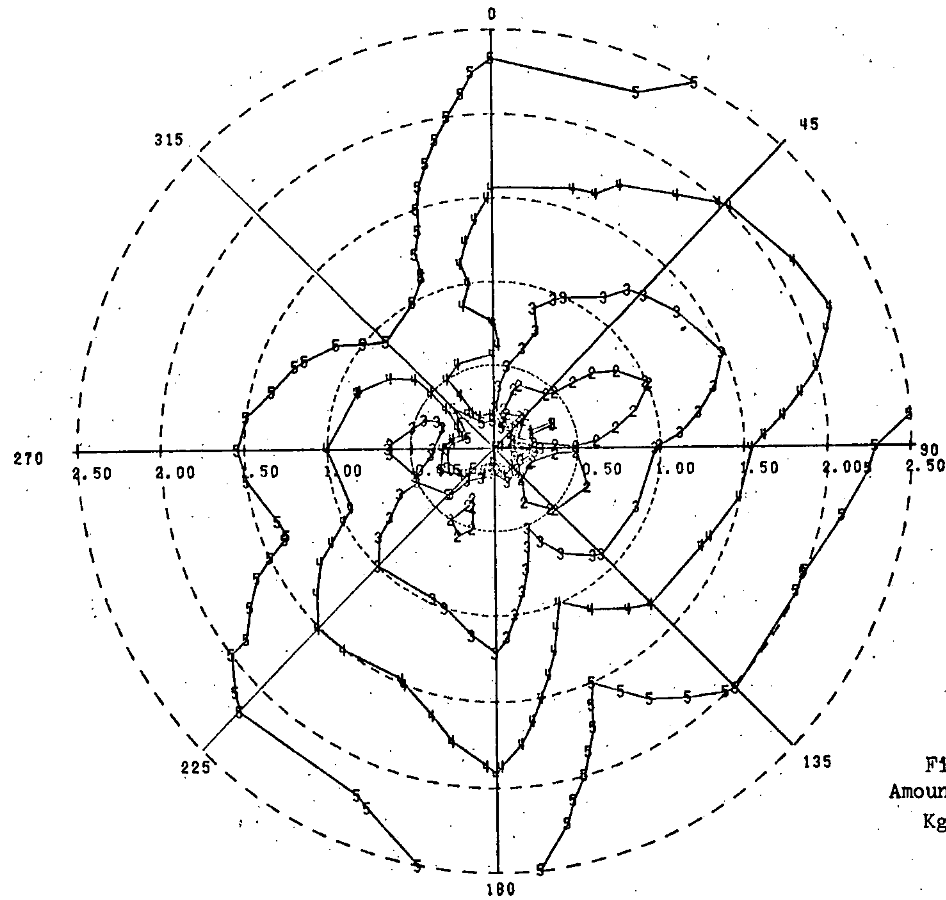
The complete set of calculations on salt drift, salt aerosol concentration and fogging and icing for NDCT are presented in Appendix A to this statement.



1 22.0
2 11.0
3 5.5
4 2.75
5 1.37

Figure 5-4 NDCT
Cumulative amount of drift
October 1973 - September 1974

Kg/Ha



1 3.00
2 1.50
3 0.75
4 0.37
5 0.19

Figure 5-5 NDCT
Amount of drift - July
Kg/Ha

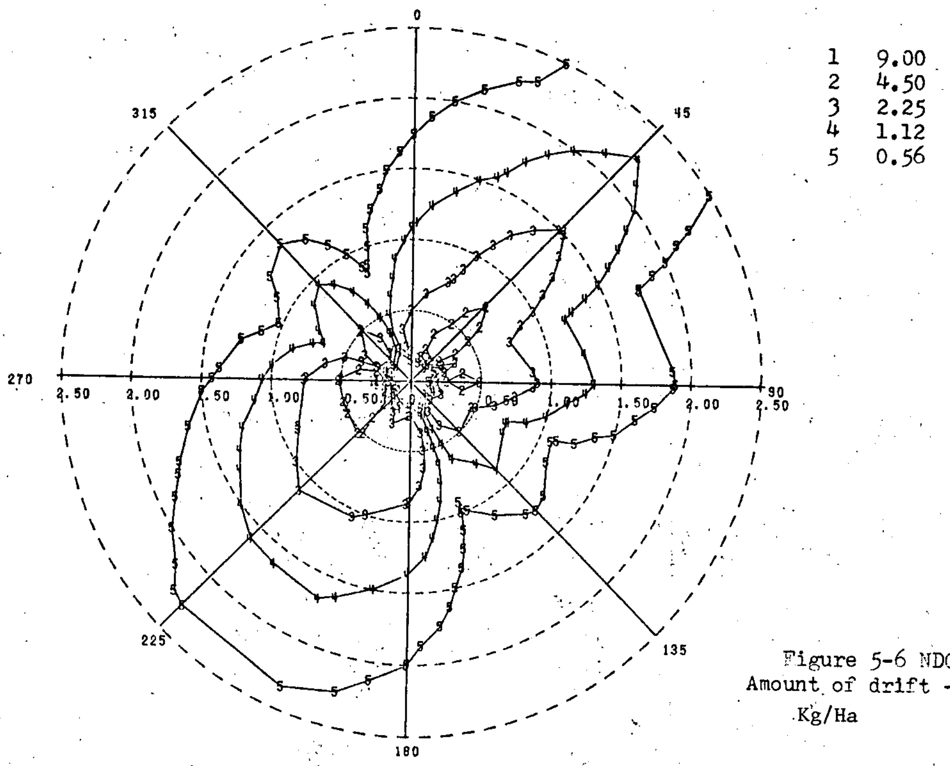


Figure 5-6 NDCT
Amount of drift - August
Kg/Ha

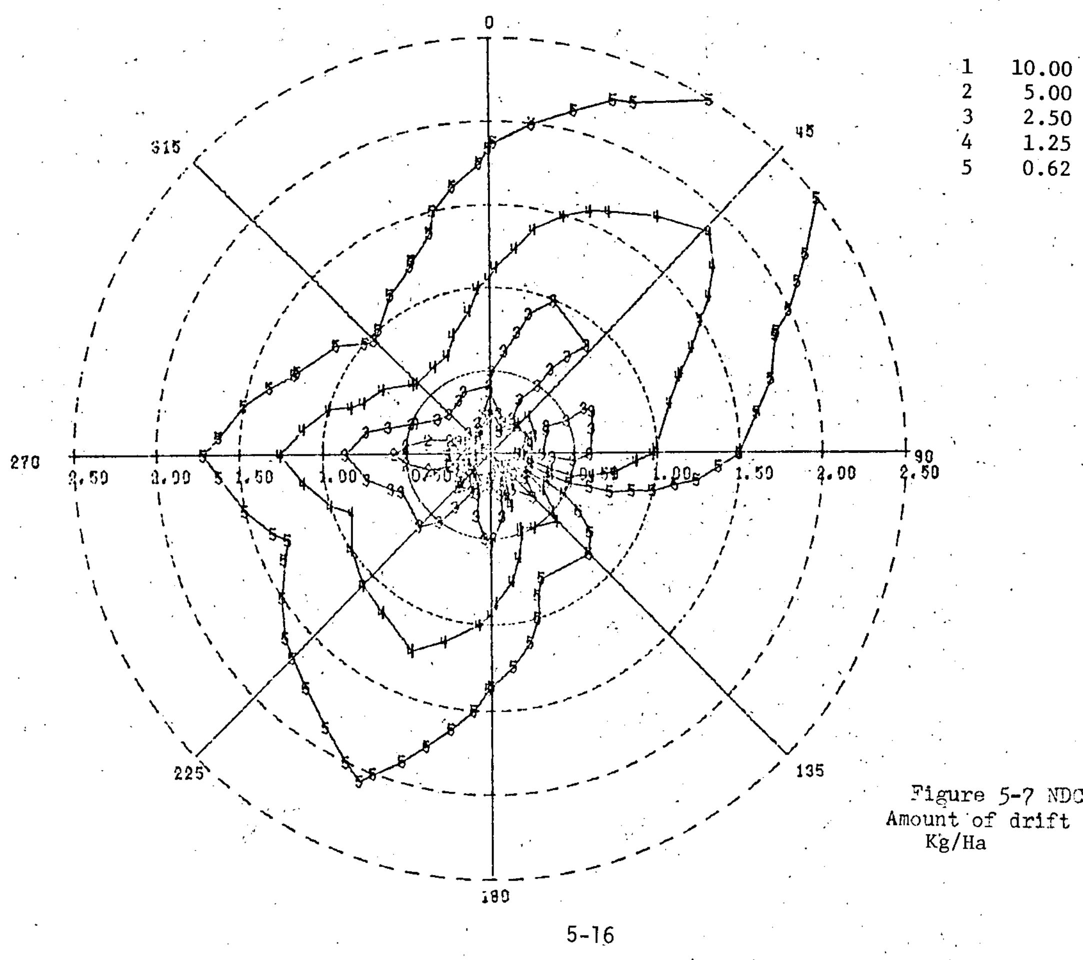


Figure 5-7 NDCT
Amount of drift - Sept.
Kg/Ha

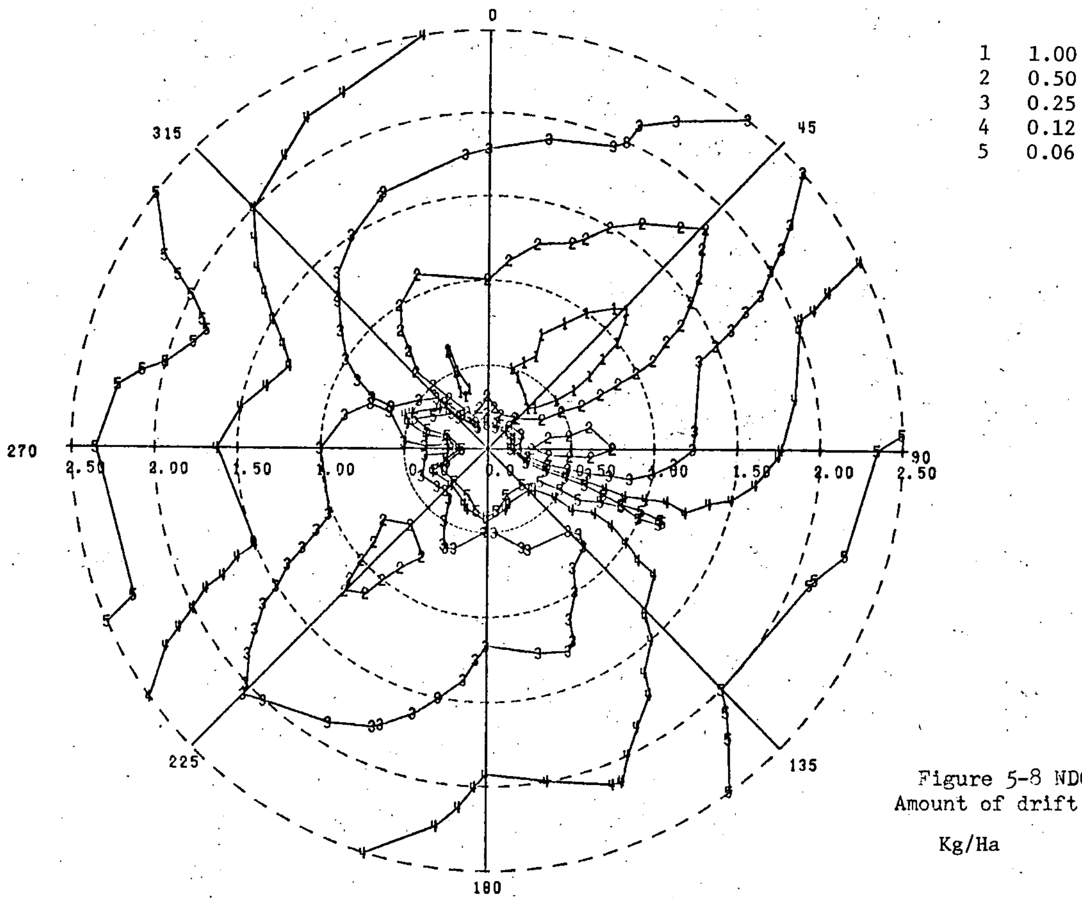


Figure 5-8 NDCT
Amount of drift - Oct.

Kg/Ha

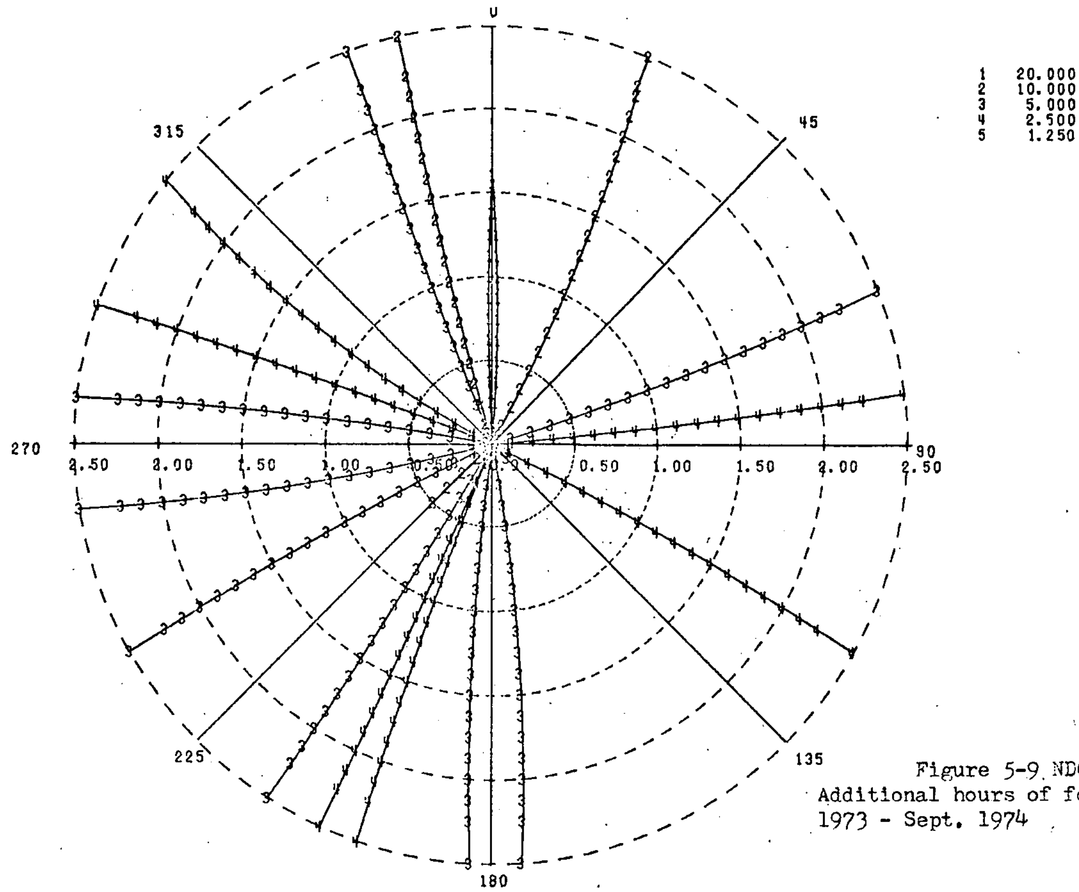


Figure 5-9 NDCT
Additional hours of fog Oct. 1973 - Sept. 1974

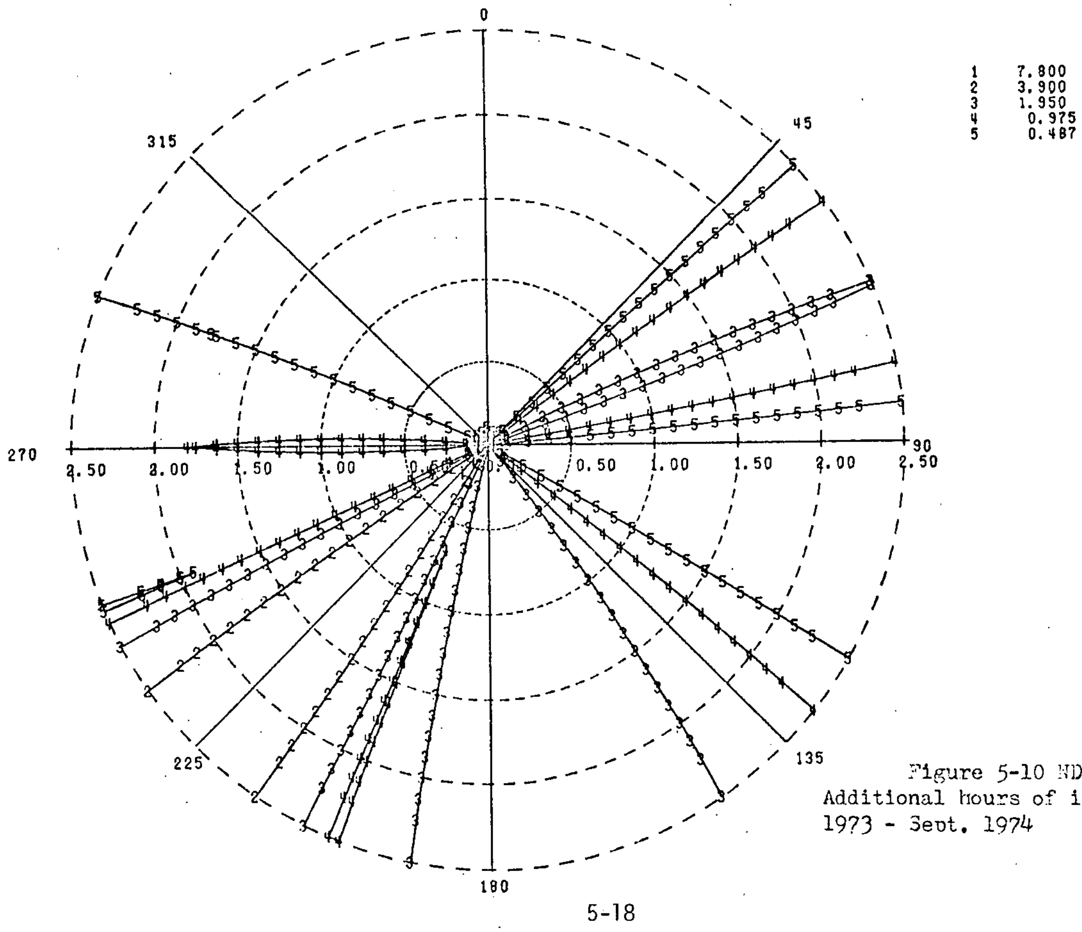


Figure 5-10 NDCT
Additional hours of ice Oct. 1973 - Sept. 1974

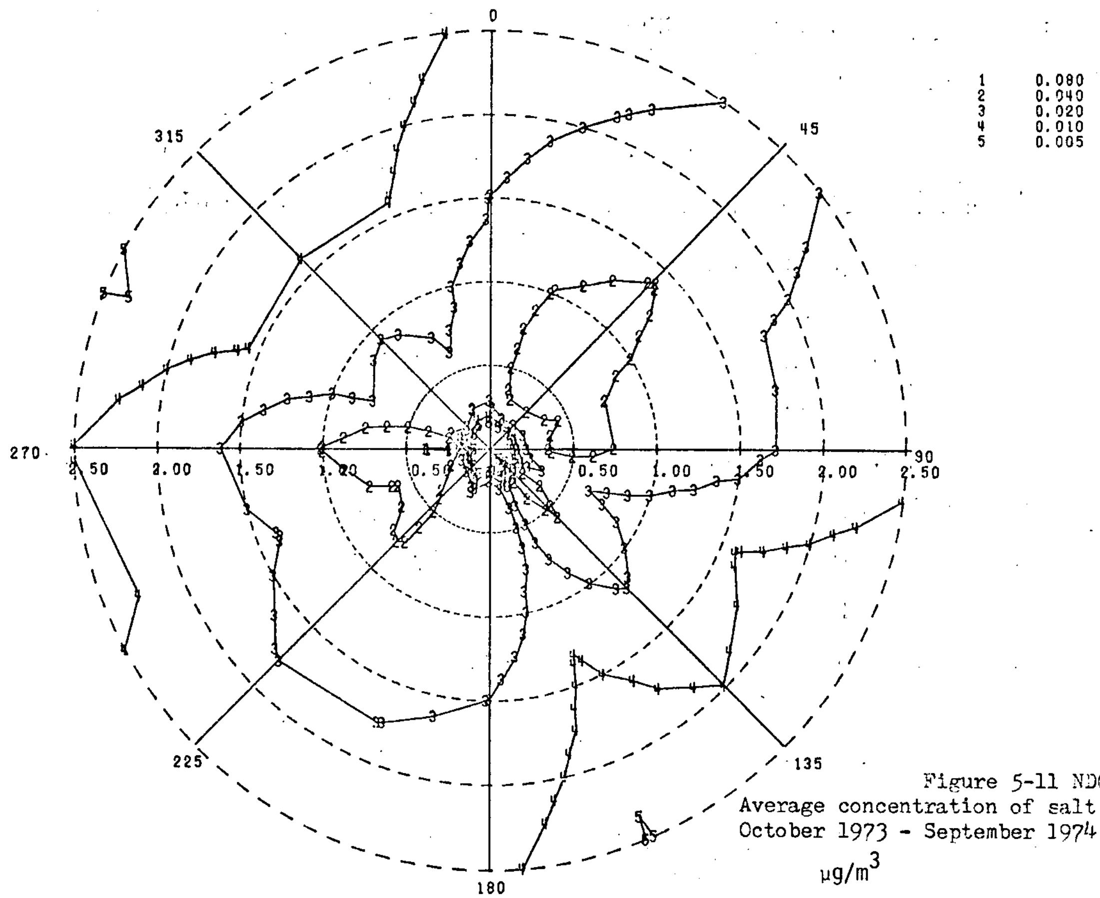


Figure 5-11 NDCT
Average concentration of salt in air
October 1973 - September 1974
$\mu g/m^3$

c. Staff's Analysis of Drift from MDCT's

The input parameters for the CMDCT calculations are presented in Table 5-5.

TABLE 5-5

INPUT FOR CIRCULAR MECHANICAL DRAFT COOLING TOWER DRIFT AND FOG CALCULATIONS

Height (meters)	21.00
Range (F degrees)	25.00
Water/Air Ratio	1.41
Inner Radius (meters)	18.03*
Efflux Speed (m/s)	11.90
Heat Out (megacal/s)	262.50**
Drift Fraction	0.000020
Latitude	41.27
Longitude	73.95
Elevation (feet)	45.00
Aerosol Height (meters)	4.00

*Effective radius for thirteen fans, each with a 10-m diameter.

**Heat for one tower, total heat = 525 megacal/sec.

Detailed information was not obtained from the applicant; these parameters represent the best information available to the staff. The basic assumption is two cooling towers with thirteen fans each. For calculational purposes a single tower with twice the salt concentration (as presented in Table 5-3) in the basin was used. Since the circular towers can be located with a one-radius separation from each other it was assumed that a single tower located midway between the two with a doubled salt concentration would adequately represent the drift source characteristics and that the conservative relative humidity threshold for fogging would give a small but acceptable error in the calculation of additional hours of fog. The tower radius was assigned by equating the area for a single aperture to that of the total exit area of thirteen fan cylinders. The drop size distribution used is shown in Table 5-6.

TABLE 5-6

DROP SIZE DISTRIBUTION CURRENTLY USED IN THE STAFF's ANALYSES OF CIRCULAR MECHANICAL DRAFT COOLING TOWERS[a,b]

0	60 μ	50 % of mass
60	125 μ	22 %
125	180 μ	5 %
180	225 μ	4 %
225	325 μ	8 %
325	425 μ	6 %
425	525 μ	5 %

[a]Performance Data for CCW Cooling Towers, ER Table 3.4.0-2, Perkins Nuclear Station Environmental Report, Amendment 2, January 1975, Docket Nos. STN 50-488/489/490.

[b]As provided by the Marley Company.

The results of the staff's calculations for the full year of onsite data and the the critical months of July, August, September and October for drift deposition are presented in Figures 5-12 through 5-16. The lower wind speeds at the 125-ft level are responsible for concentration of the isopleths around the towers. The calculations using 400 ft wind data demonstrated greater dispersal of the deposited salts. The pattern of deposition is again dominated by valley effects. The comparison of peak values for the year with the sum of the peak values for the four critical months again demonstrates the dominance of the four critical months in determining the annual drift deposition as shown in Table 5-7. The patterns and levels are in substantial agreement with those which the applicant predicted for conventional mechanical draft cooling towers although the onsite levels are higher and the offsite levels lower.

The results of the staff's calculations for the full year of onsite data for additional hours of fog and ice are presented in Figures 5-17 and 5-18. The maximum predicted is approximately 26 hours of additional fog to the south and southwest of the tower. This again falls within the differences between staff's and applicant's classifications of naturally occurring hours of fog but is greater than hours of NDCT-induced fog. The applicant's maximum predicted fogging for MDCT towers was approximately 80 hours of additional fog. The circular towers achieve the reduced fogging through a more buoyant plume which is achieved by clustering the fan cylinders. Hours of additional plume-induced icing are increased because the plume is closer to the ground than for NDCT, in spite of the increased buoyancy due to clustering. Drift-induced icing near the towers would be more severe for the CMDCT than for the NDCT due to the lower height of the tower.

The staff's predictions of average aerosol salt concentrations in $\mu g/m^3$ for the full year of onsite data are presented in Figure 5-19. These values are significantly lower than any recorded values that are known to have caused damage to plants.

The complete set of calculations for the CMDCT are presented in Appendix A to this Statement.

5.1.3.4 Effects of Cooling Tower Drift on Exposed Surfaces

Deleterious effects may result from the saline drift from the cooling tower alternative on onsite electrical equipment and structures by inceasing corrosion attack on exposed surfaces. The rate of corrosion is dependent on the types of structural materials and the amount of salt accumulated on their surfaces. The amount of salt deposition from each cooling tower alternative was discussed in Section 5.1.3. In addition, the distance from the source, the wind speed and direction, the time the droplets remain upon the surface, the relative humidity and the amount of precipitation also influence the rate of corrosion of exposed surfaces. The information available about the adverse effect of salt drift upon structures is based upon experimental data and experience.[54] The AEC report prepared by Westinghouse discusses such experience with existing saltwater cooling towers.

The corrosion rate caused by natural sea drift falls off rapidly with increasing distance from the sea. Studies[70] show that in coastal areas, the corrosion rates of iron, stainless steel and aluminum decrease by factors of 10, 3 and 21, respectively, as the distance increases from about 25 m (80 ft) to about 250 m (800 ft) inland. High precipitation rates tend to wash off the salt and thus reduce the corrosion rate, but high humidity and fog keep the surface wet and enhance corrosion. Structures in warm areas, with long periods of exposure to sunshine, experience less corrosion due to the fast evaporation of the droplets.

In the case of saltwater cooling towers, the incremental adverse effects of salt deposition at distances greater than about 0.5 km (0.3 miles) downwind are expected to be insignificant. Some adverse effects are expected only in the immediate proximity of the tower and within the boundaries of the plant. These effects are due to localized phenomena, e.g., blowout in the case of counterflow towers and the wake effects. Blowout consists of a spray of droplets removed from the water falling into the tower basin, and is carried out by air movement in the lower portion of the tower. Hence, metal structures, high-voltage power lines and buildings must be protected by suitable coatings, as reported by saltwater cooling tower users. Metal, concrete, wood, painted and asphalt surfaces in the vicinity of the cooling tower should be properly protected to avoid saline damage. Also, parking lots should not be placed at short distances downwind of the tower.

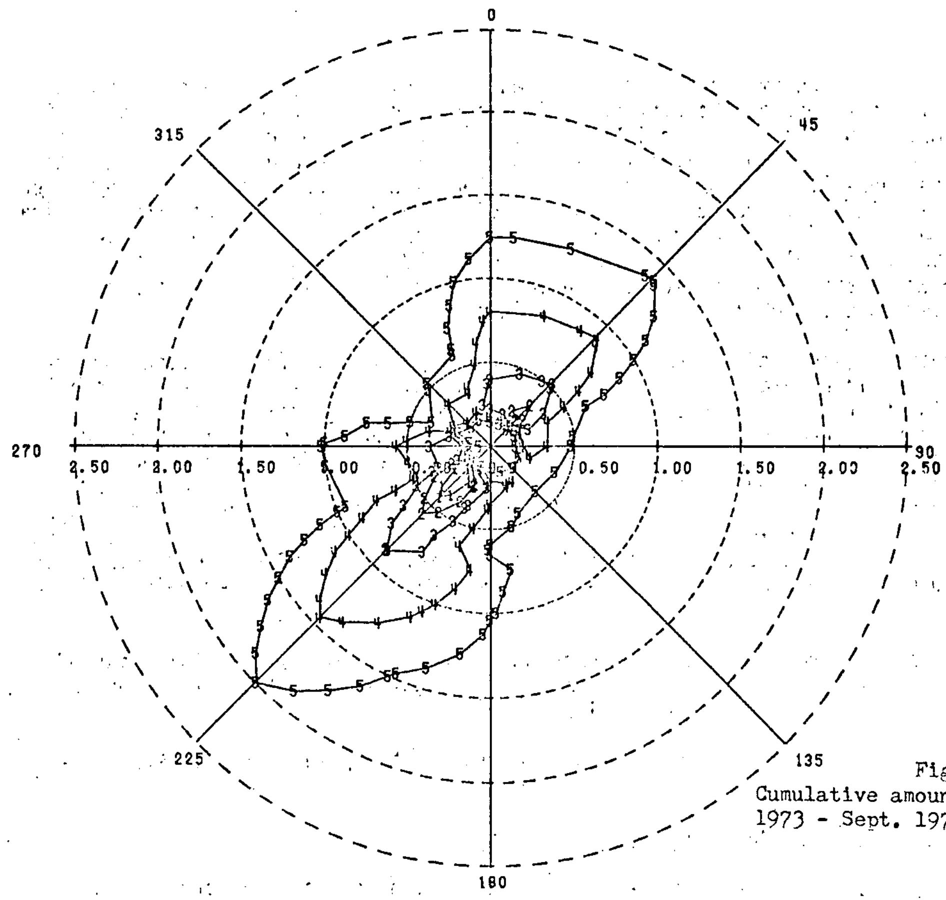


Figure 5-12 CMDT
Cumulative amount of drift Oct. 1973 - Sept. 1974. Kg/Ha

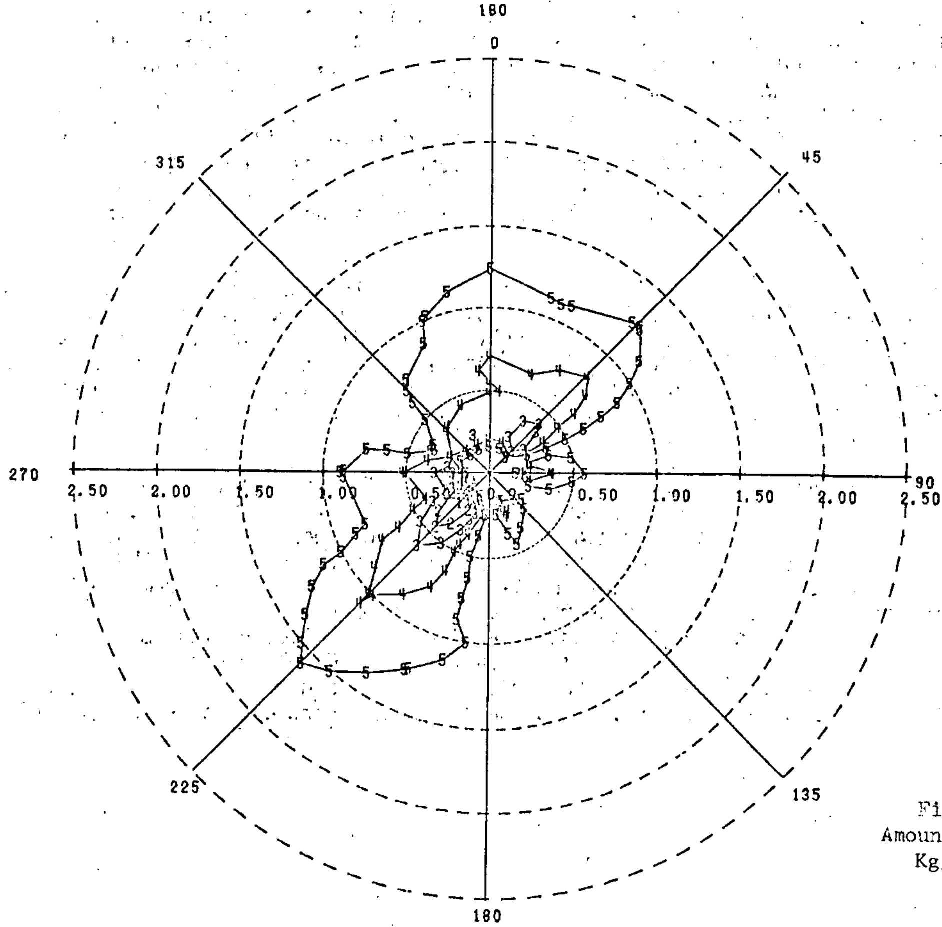
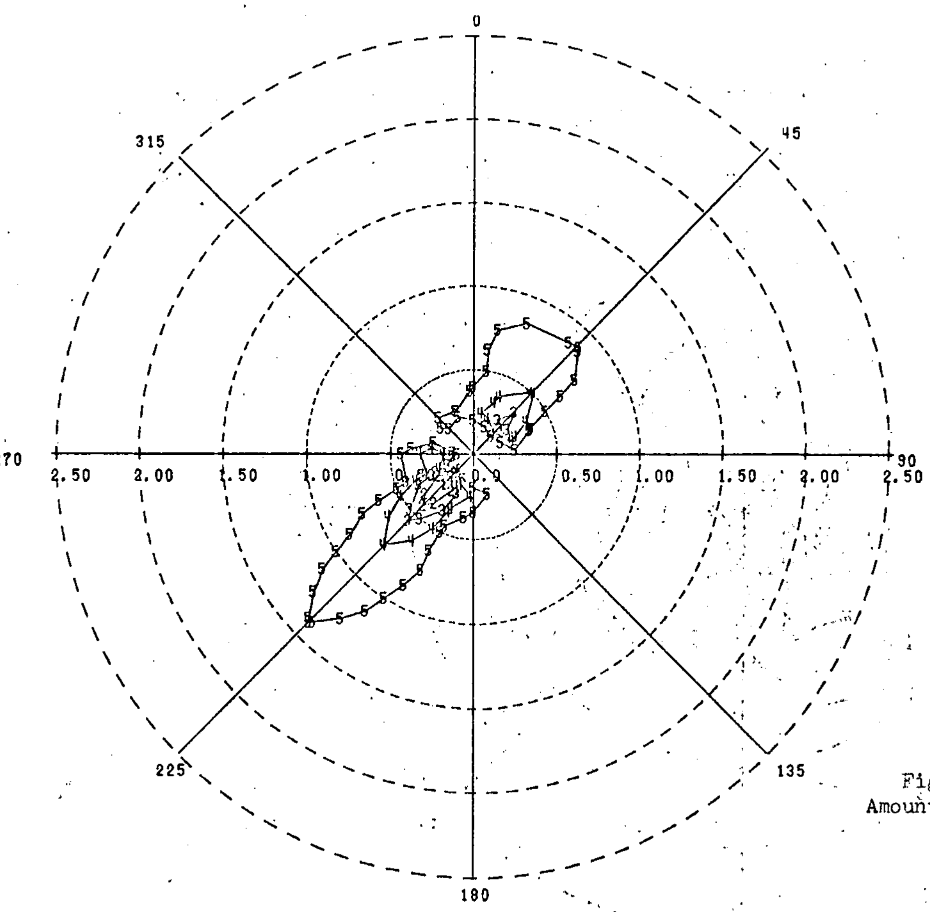
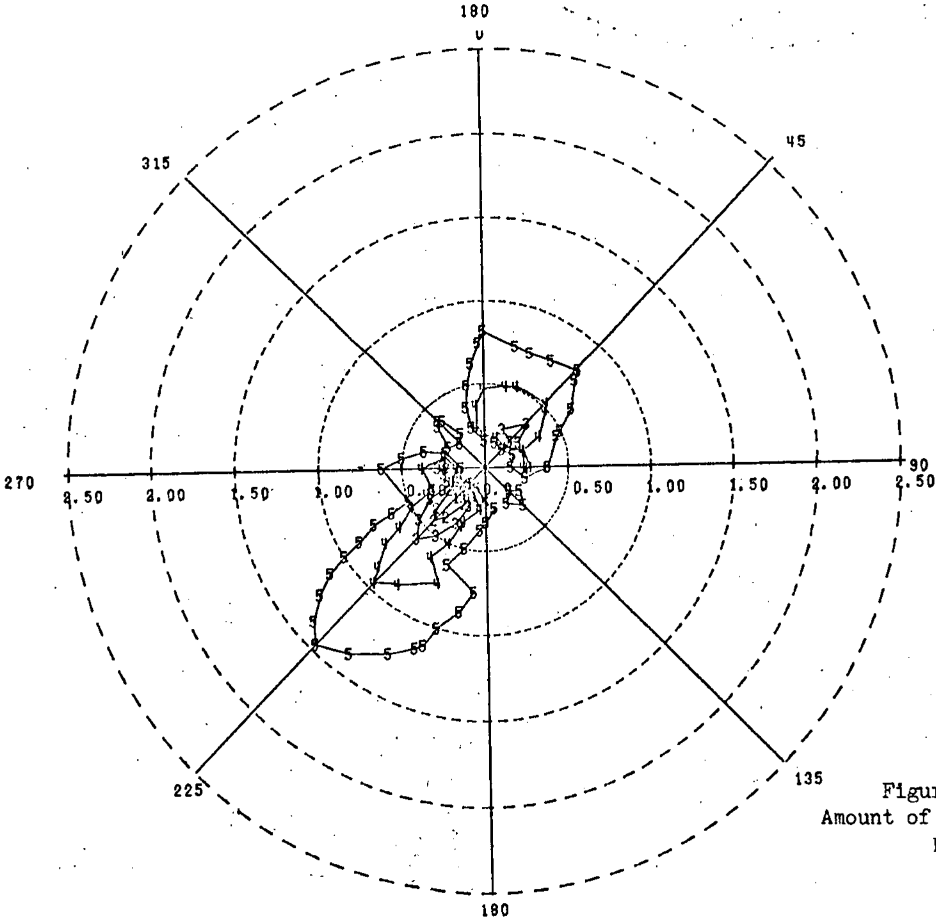


Figure 5-13 CMDT
Amount of drift - July
Kg/Ha



1	81.000
2	40.500
3	20.250
4	10.120
5	5.060

Figure 5-14 CMDT
Amount of drift - August
Kg/Ha



1	54.000
2	27.000
3	13.500
4	6.750
5	3.370

Figure 5-15 CMDT
Amount of drift - September
Kg/Ha

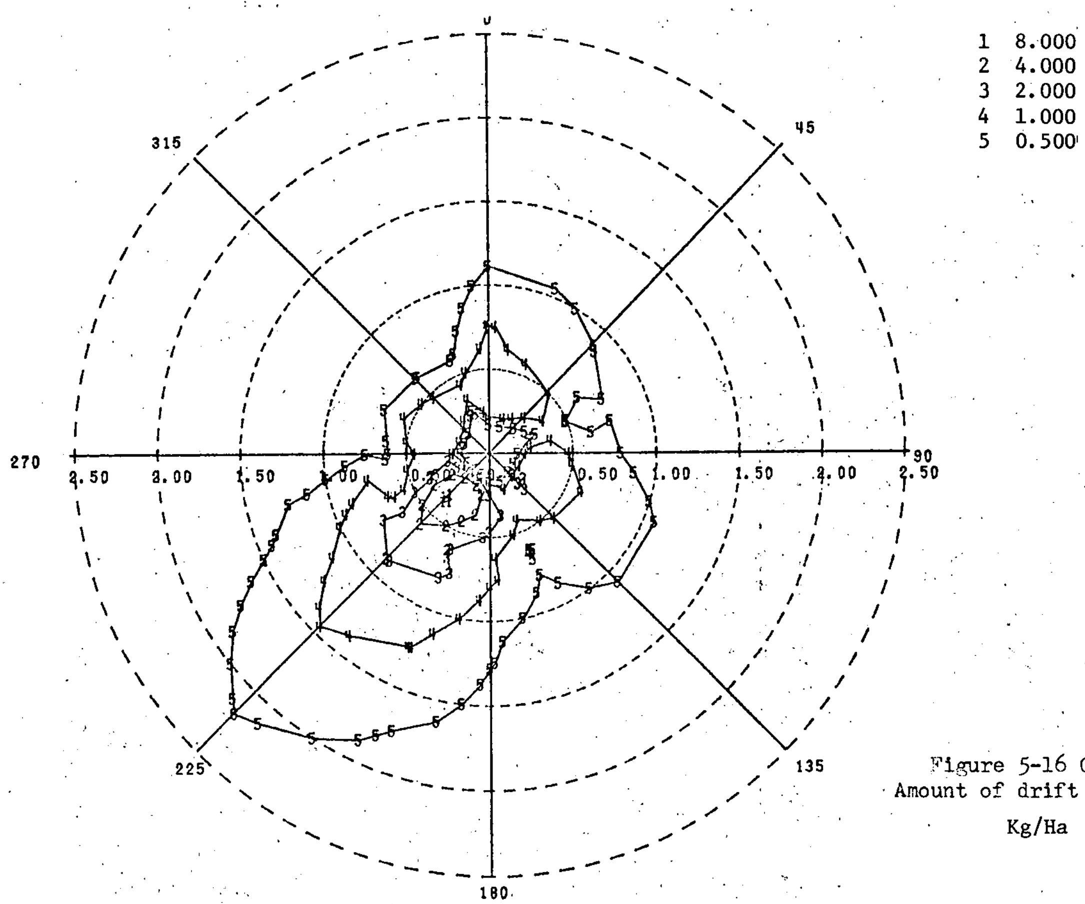


Figure 5-16 CMDT
Amount of drift - October
Kg/Ha

TABLE 5-7

MAXIMUM CUMULATIVE DRIFT DEPOSITION FOR CIRCULAR MECHANICAL DRAFT COOLING TOWERS

Period	Maximum Kg/Ha	Maximum lb/acre	Maximum Distance (miles)	Maximum at One Mile Kg/Ha	Maximum at One Mile lb/acre	Maximum at Two and One-Half Miles Kg/Ha	Maximum at Two and One-Half Miles lb/acre
Year	190	170	.25	21	19	4.0	3.6
Oct.	8.7	7.7	.38	1.6	1.4	.38	.33
Nov.	.31	.28	.25	.084	.075	.017	.015
Dec.	.67	.60	.25	.12	.11	.014	.013
Jan.	1.0	.90	.25	.18	.16	.032	.028
Feb.	2.5	2.2	.25	1.1	1.0	.14	.13
March	.0036	.0032	.25	.00039	.00035	.00011	.00010
April	.00012	.00011	.38	.000028	.000025	.0000056	.0000050
May	.086	.077	.25	.014	.013	.0020	.0018
June	8.4	7.5	.25	1.2	1.1	.19	.17
July	23	21	.25	2.9	2.6	.53	.48
Aug.	82	73	.25	7.6	6.8	1.5	1.3
Sept.	54	48	.25	6.4	5.7	1.1	1.0

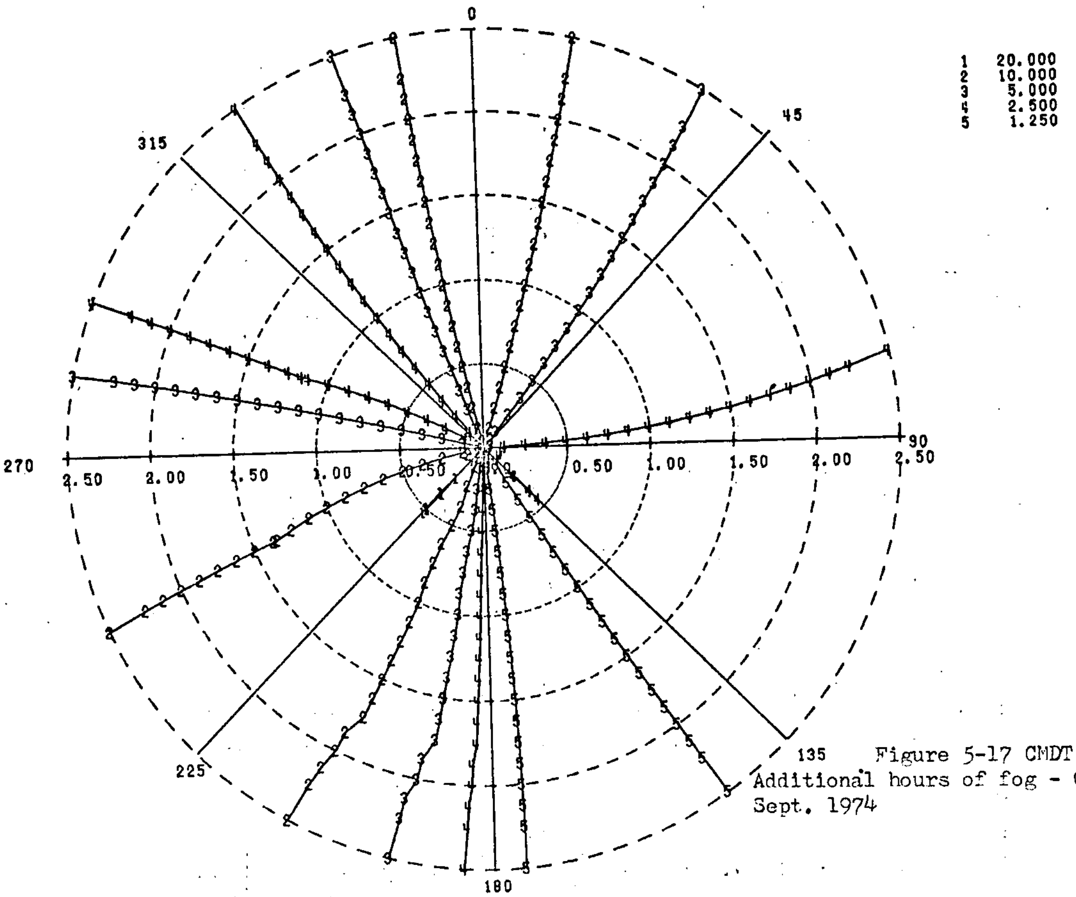


Figure 5-17 CMDT
Additional hours of fog - Oct. 1973-Sept. 1974

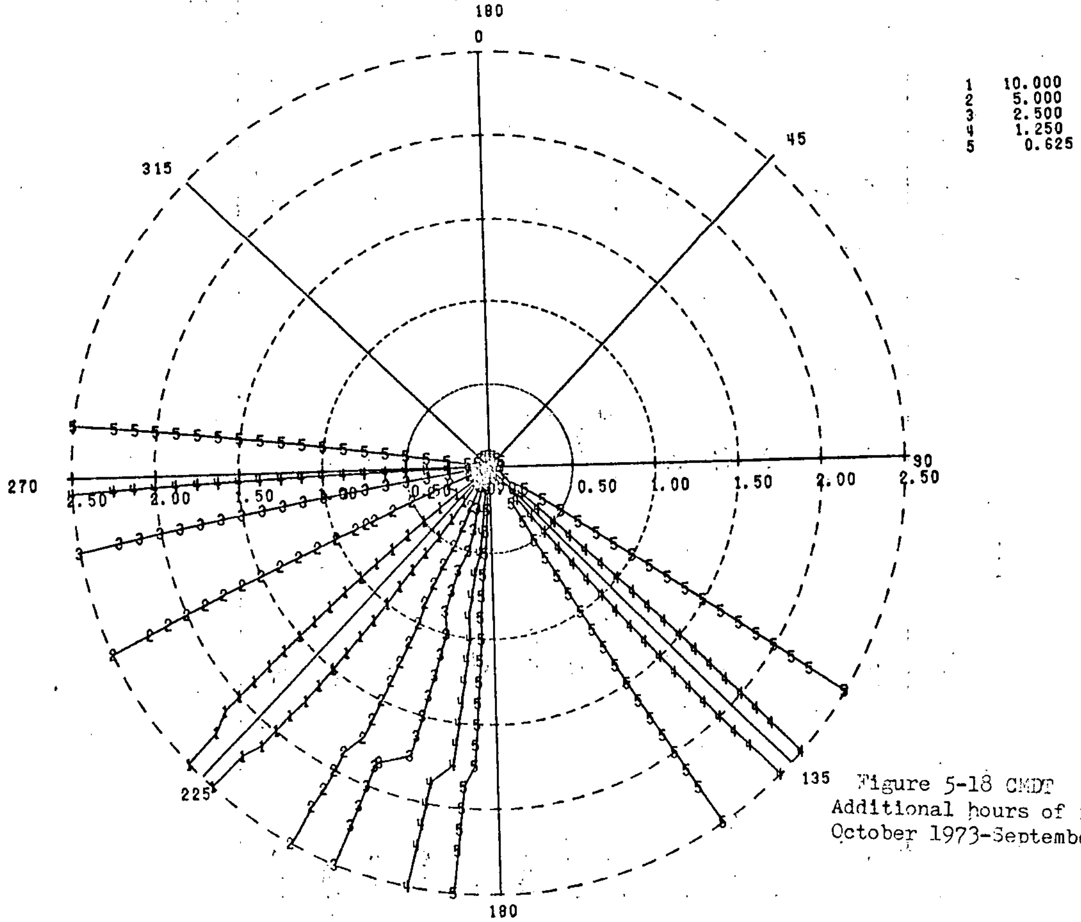


Figure 5-18 CMDT
Additional hours of ice
October 1973-September 1974

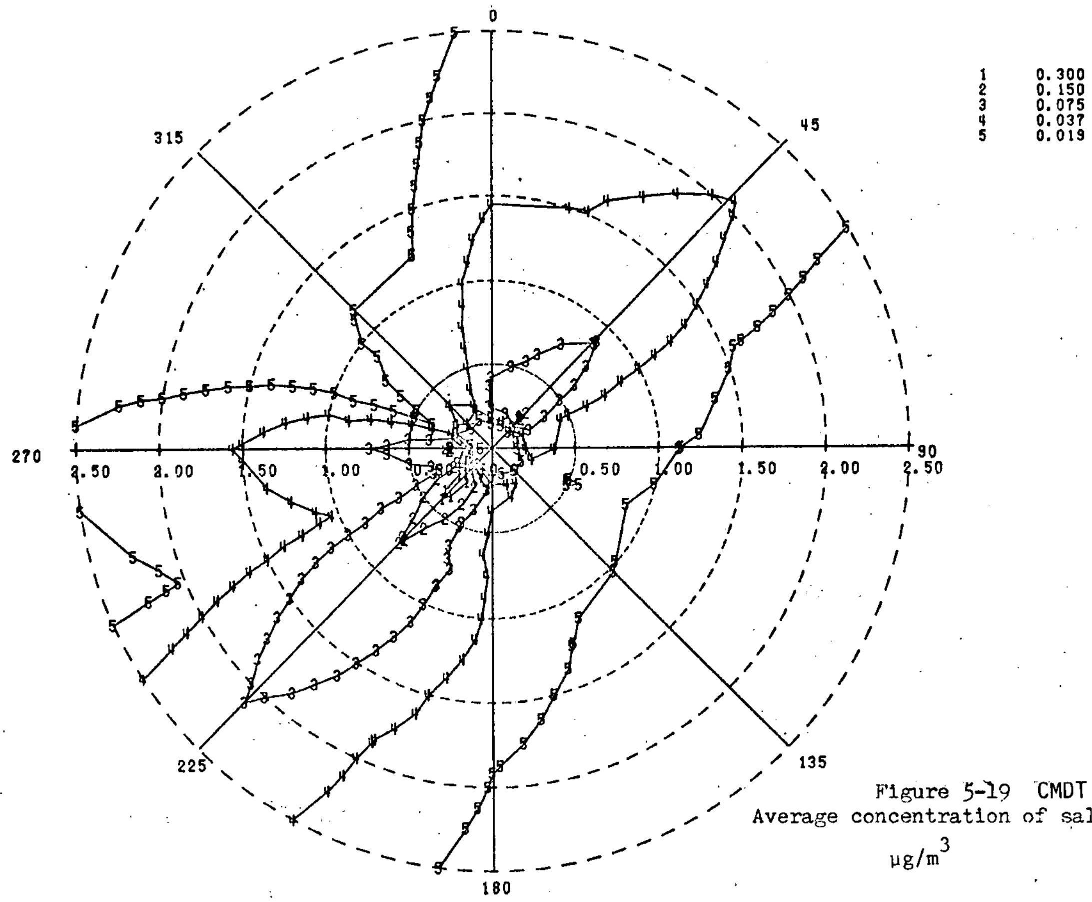


Figure 5-19 CMDT
Average concentration of salt in air
$\mu g/m^3$

5.2 TERRESTRIAL IMPACTS AND LAND EFFECTS

5.2.1 Effects of Excavation, Grading and Construction on the Local Plant Communities and Wildlife

Construction of cooling towers at the Indian Point site requires grading and excavation for tower support structures and piping. The nature of the limestone substrate would require a certain amount of blasting. Portions of the area proposed for tower siting are presently wooded and located in the forested park area north of Unit No. 2. A roadway is presently close to where the cooling tower would be located and would be used during construction. Some additional clearing would be required for siting and construction access. Areas to be cleared consist primarily of well-developed mixed oak and eastern hemlock stands. These areas contain wildlife, including squirrels, chipmunks, various types of woodland birds common to deciduous forests of the eastern United States (e.g., red-eyed vireo, redstart, eastern wood peewee) that have become accustomed to the nearby long-term construction activities at the site.

The slight reduction of local plant communities due to cooling tower construction will not cause unacceptable damage to wildlife populations because there are adequate areas of similar habitat to be found in the surrounding areas including the large, county-owned, Blue Mountain Reservation area, approximately one mile east of the site.

5.2.2 Effects of Drift on Surrounding Plant Communities and Wildlife from CCC System Operation

5.2.2.1 Botanical Effects of Drift

The botanical consequences of saline deposition depend on the amounts deposited and on the distribution of salt-tolerant and intolerant plant species. It is accepted by both the applicant and staff that salt deposition from drift in the amounts expected at Indian Point will not create saline soils and that botanical damage because of soil contamination is unlikely. The only significant pathway for potential botanical injury is by direct foliar interception of drift particles from the atmosphere.

The difference between the two pathways is important since, if soil contamination were important, it could lead to a chronically deteriorating biota over the life of the plant while foliar contamination could result in a series of damaging episodes which were largely independent of one another. In many such cases, foliar recovery could take place between episodes. The situation would not be a progressively deteriorating one unless the damaging episodes were repeated in sufficiently rapid succession to prevent foliar recovery in the intervals.

Damaging episodes could occur during periods of high relative humidity, high river salinity and extended drought periods. These conditions might be fulfilled simultaneously during late summer and early autumn months. The frequency of rainfall is important because rain washes salt from leaves preventing foliar injury.

The applicant has evaluated the salt tolerance of a variety of plant species which occur in the vicinity of the Indian Point Station. Results of screening indicate that only three species are sufficiently intolerant of foliar salt deposition to be considered potentially endangered from cooling tower saline drift. These species are white ash, flowering dogwood, and Eastern hemlock. Hemlock appears to be the most sensitive of the species tested.

The criterion of damage used by the applicant to judge salt tolerance was the appearance of leaf lesions, marginal necrosis in leaves of broad leaf plants or needle yellowing and loss in hemlock and other conifers. The appearance of such symptoms does not imply that the affected plant will necessarily die but only that an observable effect has been produced. Death of affected vegetation becomes likely if repeated complete or partial defoliation takes place in rapid succession. Two or more episodes of complete defoliation in any one year would likely result in death of susceptible plants but this is unlikely to occur. A single episode of extended rainless periods occurring during the months of high salinity could result in "brownout" and partial defoliation of the susceptible species. (The applicant has suggested 14 days without rain as a reasonably possible period.) Such an event occurring in late summer or early autumn would be aesthetically objectionable; however, it is likely that production of new leaves would be normal the following spring since drift deposition will be minimal at this time.

The staff has conducted a survey of sensitive tree species in the areas of Verplanck and Buchanan which are most likely to receive the largest saline deposits from either natural draft or mechanical draft towers. Results of the survey which covered 87 homes are shown in Table 5-8.

TABLE 5-8

SUMMARY OF STATISTICS ON SALT-SENSITIVE VEGETATION IN THE TOWNS OF BUCHANAN AND VERPLANCK, NEW YORK

Total properties observed	87
Total properties having at least 1 individual of the salt sensitive tree species	39
Percentage	44.8%
Number of lots having dogwood	27
Percentage	31.0%
Number of dogwood on 87 lots	53
Average/lot	0.61
Number of lots having hemlock	18
Percentage	20.6%
Number of hemlock on 87 lots	45
Average/lot	0.52
Number of lots having ash	4
Percentage	4.6%
Number of ash on 87 lots	4
Average/lot	0.046
Number of lots having both dogwood and hemlock	7
Percentage	8.0%
Number of lots having at least one tree	81
Percentage	93.1%
Number of trees on 87 lots	480
Average/lot (all lots)	5.5
Average/lot (with trees)	5.9
Percent of total trees; dogwood	11.0%
Percent of total trees; hemlock	9.4%
Percent of total trees; dogwood and hemlock	20.4%
Number of lots having hemlock hedges (row plantings of hemlock consisting of many individuals trained in the shape of a hedge rather than the typical open grown shape)	2
Percentage	2.3%

More than 44% of the properties surveyed have at least one of the salt sensitive species. Dogwood and hemlock are the most prominent while ash occurred in only four lots in the survey. Dogwood constitutes 11.0% of the total number of ornamental trees in the Verplanck and Buchanan areas and hemlock constitutes 9.4%.

The staff survey which was performed on August 25, 1975 found that some vegetation in the area including hemlock and dogwood showed signs of foliar necrosis resembling "salt burn" in the absence of any cooling tower drift. Damaged trees were scattered at infrequent intervals throughout the survey area. Cause of the damage is unknown. Preoperational surveys would be required prior to cooling towers being constructed in order to separate pre-existing damaged trees from drift-related damaged trees after operation with the cooling tower began. A vegetation survey was conducted by the applicant in the summer of 1973. (See Appendix D to the ER-CCC, IP-2.)

5.2.2.2 Applicant's Estimates of Damage Thresholds

As described in Appendix E of the applicant's ER-CCC, IP-2, the Boyce Thompson Institute under contract to the applicant has estimated threshold rates of saline deposit which will cause foliar lesions or other observable foliar symptoms on a variety of plants grown in the environs of Indian Point. Studies were conducted in closed chambers using seedlings of various species. Saline aerosol was sprayed into the chambers which contained plants and the aerosol was exhausted continuously for treatment periods of 4-6 hours per experiment. Salt deposition inside the chambers was measured with collecting plates covered with parafilm which were placed near the bottom of the chambers. After an experimental run, the parafilm was removed and rinsed and the total chlorine deposited was determined by chemical analysis. Results were expressed in units of $\mu g/cm^2$. It was assumed that leaves intercepted the same amount of deposit as the collectors.

The chamber experiments served to establish the rank order of salt sensitivity of plant species and provided estimates of the amounts of salt required to produce visible foliar damage. It was established that foliar damage was a function of ambient relative humidity both during the time of exposure and afterward. About twice the damage for the same amount of salt is caused when humidities above 90% exist as compared with the situation when humidities in the range 50-90% prevail.

The experiments served as the basis for estimating thresholds of salt damage in the field around cooling towers although the experimental conditions differ in some important ways from field conditions. Within the experimental chambers, for instance, the background aerosol content of the air approached or exceeded 1500 $\mu g/m^3$ of salt while in the field it is expected from staff modelling that aerosol concentrations on the order of 0.1 to 0.4 $\mu g/m^3$ would prevail in the vicinity of natural draft cooling towers and concentrations of 0.5 to 2.1 $\mu g/m^3$ would be found in the vicinity of mechanical draft towers. During the chamber experiments, the amounts of salt actually deposited on surfaces was within the range expected in the field. It is a commonly encountered difficulty with chamber experiments that chamber conditions often cannot be simultaneously adjusted to resemble field conditions.

Another difference between the chamber experiments and expected field conditions was that the experiments were carried out utilizing acute doses of salt which were delivered over 4-6 hour intervals to approximate field conditions where continuous but smaller dose rates are expected.

Based on the chamber experiments, the applicant has estimated that the threshold of salt damage to hemlock foliage is in the range of 40-100 Kg/Km^2 (0.36-0.89 lbs/acre) and 100-600 Kg/Km^2 (0.89-5.3 lbs/acre) for dogwood and ash. These estimates require the assumptions that: (1) high background concentration of non-deposited aerosol which prevailed in the chambers has no effect in causing visible foliar damage; and (2) the dose rate of salt to leaves is insignificant in comparison to the total dose as a factor in producing visible damage to leaves.

Failure of either or both assumptions would lead to the conclusion that the actual field threshold level of salt damage to vegetation is higher than determined in the chamber experiments. Thus, the applicant's estimates of damage thresholds are highly conservative and revision or refinement of the estimates would in all probability lead to higher threshold values.

Neither the applicant nor the staff has tested the validity of the assumptions and, therefore, the question remains open. Evidence provided by Cassidy[48] suggests the strong possibility that aerosol salt particles enter plants through stomata (small pores in the leaf which function in gas and water exchange). Thus, it is possible that plants may be contaminated not only by gravitational deposition of particles on leaf surfaces but also by entry of particles into stomata. In view of these findings, the possibility exists that the plants were contaminated by two pathways instead of one in the chamber experiments and that the true salt dose to the plants was higher than the nominal dose. While the magnitude of added dose due to stomatal entry cannot be estimated from the existing experiments, it is evident that the high aerosol concentrations cannot be discounted. It, therefore, seems likely that the threshold dose for damage to foliage has been underestimated. Other reports indicate that vegetational damage occurs in the range of aerosol concentrations from 10 $\mu g/m^3$ to 100 $\mu g/m^3$ of salt.[50-52,54]

The relative effect of dose rates as opposed to total dose has not been resolved in the technical literature. Plants, however, are known to have the capability for translocation of ions taken up by foliar absorption and in some cases even to excretions of excess ions from the roots. This suggests that a given amount of salt applied slowly over a period of a month could have lesser effects than the same amount applied instantaneously since the instantaneous (or short term) dose would not permit time for plant translocation or excretion mechanisms to operate before visible damage emerged.

5.2.2.3 Estimate of Botanical Injury from a NDCT

a. Applicant analysis

The applicant has prepared a map of potential botanical injury due to NDCT drift based on threshold rates measured in the Boyce Thompson experiments (Figure 6.9 in the applicant's ER-CCC, IP-2 reproduced in this statement as Figure 5-20). Threshold contours on the maps closely follow the 100 and 200 Kg/Km^2 drift contours from the computer model. It was indicated by the applicant, however, that threshold values were selected from experimental results which were obtained at a humidity which would maximize injury (85%). This is probably unnecessarily conservative since most ambient humidities fall in the range of 50% to 90% where salt effects are at least a factor of two less than the maximum.

b. Staff analysis

Allowing for a factor of two as an overestimate of potential damage, the drift contours of damage compress to include only the area enclosed by the 200 Kg/Km^2 (1.8 lbs/acre) contour of Figure 5-1. Considering further the low probability having 14 rainless days, the ability of vegetation to survive foliar injury and partial defoliation, and the probable conservative thresholds established by the chamber experiments, the staff believes it is likely that no permanent damage to vegetation will occur due to saline drift from a natural draft cooling tower. Symptoms of foliar salt burn could occur occasionally within the 200 Kg/Km^2 contour in some years.

The staff has modelled the Unit No. 2 drift field for NDCTs using the ORFAD model. Results are similar to the applicant's with respect to distribution and deposition rates of salt. See Figures 5-4 through 5-8. The agreement between the models is adequate for the environmental assessment. The staff model also shows that the salt deposition levels do not exceed reasonable threshold levels for damage to vegetation offsite except in very localized areas. The staff model confirms the conclusions based on the applicant's model that no permanent damage to vegetation will occur with operation of a NDCT.

5.2.2.4 Estimate of Botanical Injury from MDCT

Potential botanical injury from linear MDCT and wet/dry MDCT is more likely than for a NDCT because the drift particles fall closer to the towers at higher rates of deposition than is the case for a NDCT. There is no difference in the staff estimates of risk from MDCT's and WDMDCT's since the latter are most likely to be operated in wet mode during the critical months (late summer-early fall). When wet/dry MDCT's are operated in all dry or partially dry modes, salt drift is reduced; however, this will occur primarily during periods of plant dormancy and low river salinities.

a. Applicant analysis

The applicant's prediction of potential botanical injury takes in a large area of Peekskill, Buchanan and Verplanck. (Figure 5-21). It also includes substantial areas of park land on the west side of the Hudson River. In the applicant's assessment the area of potential damage is enclosed by the 100 Kg/Km^2 (1 lb/acre) contour (Figure 5-2).

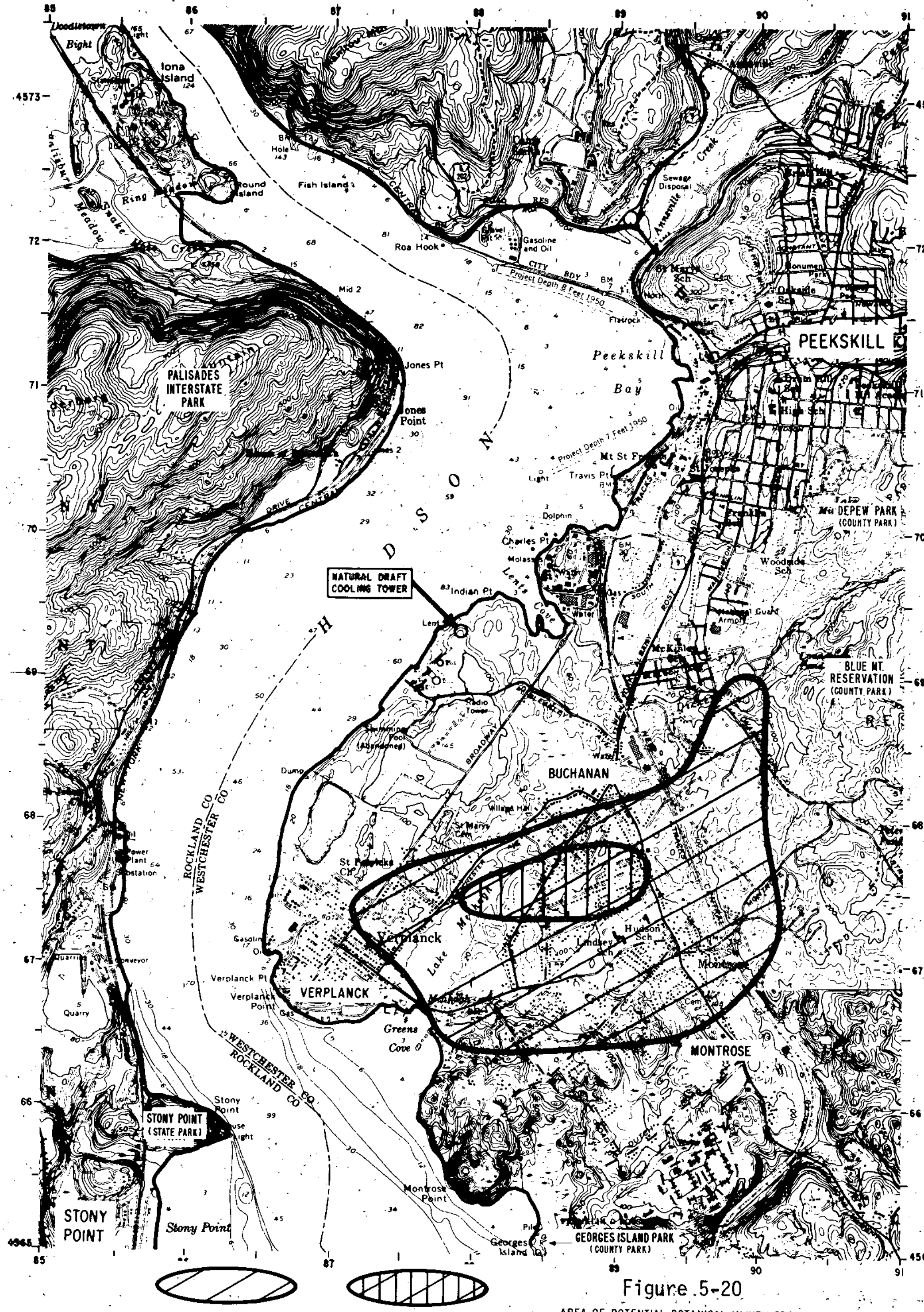


Figure 5-20

AREA OF POTENTIAL BOTANICAL INJURY FROM A NATURAL DRAFT COOLING TOWER IN THE EVENT OF 14 CONSECUTIVE RAINLESS DAYS.

Ref.: ER-CCC, IP-2, Fig. 6.8

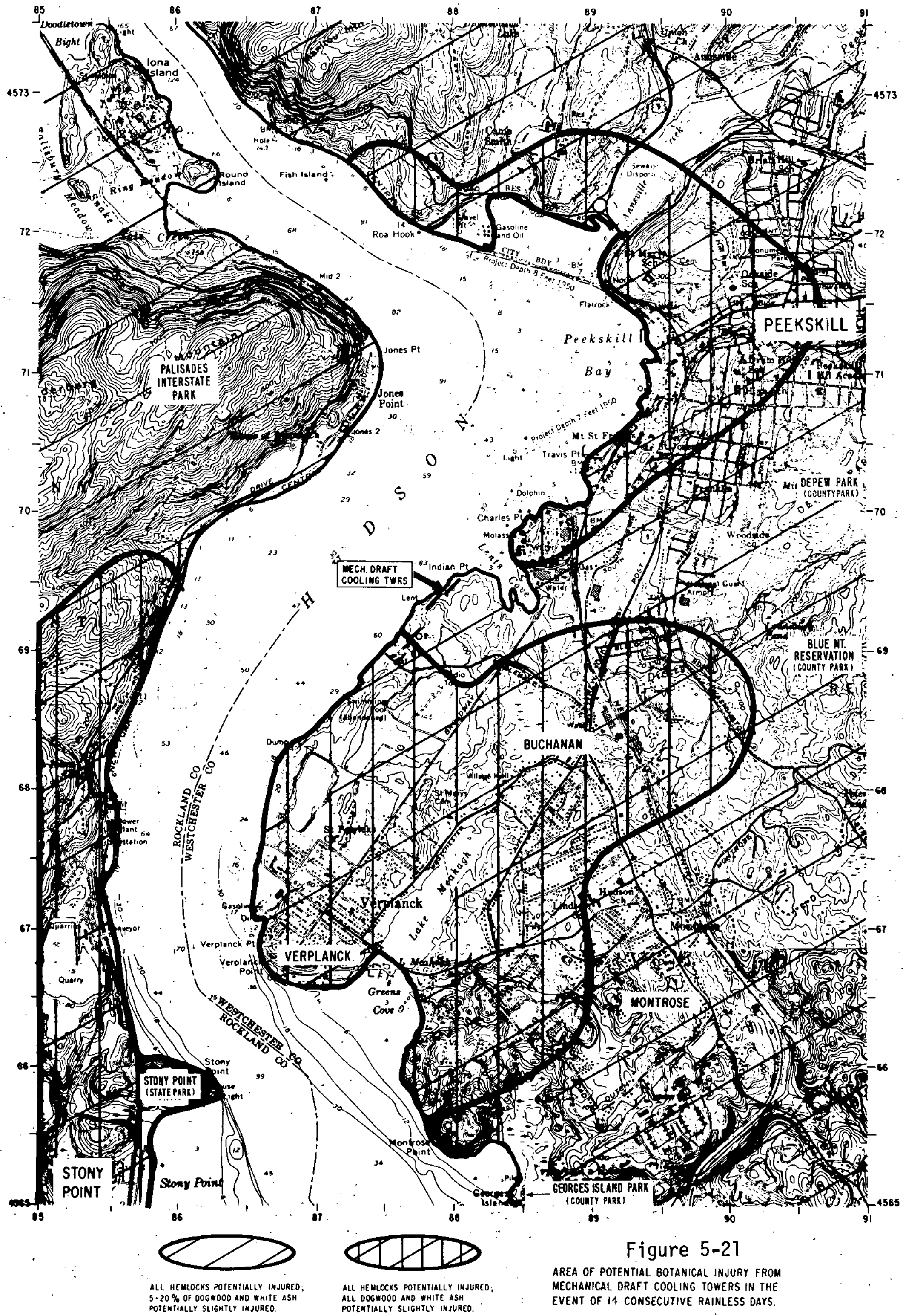


Figure 5-21

AREA OF POTENTIAL BOTANICAL INJURY FROM MECHANICAL DRAFT COOLING TOWERS IN THE EVENT OF 14 CONSECUTIVE RAINLESS DAYS.

Ref.: ER-CCC, IP-2, Fig. 6.11

b. Staff analysis

The threshold chosen appears unnecessarily conservative in the staff's view. The staff believes that thresholds for the appearance of foliar symptoms will occur at levels of salt deposition from 2 to 10 times higher than the 1 lb/acre level for reasons stated in the analysis of botanical injury.

The prediction of actual damage cannot be made with great precision but the staff believes that if foliar symptoms occur, they will be found within the area enclosed by the 200 Kg/Km^2 contour. This does not imply that the vegetation of the entire enclosed area will be affected but only that symptoms are more likely within the area than outside of it.

The drift contours greater than 200 Kg/Km^2 tend to cluster parallel to the east bank of the Hudson River because of the prevailing winds in the river valley. Any foliar symptoms which might occur will most likely be confined to land areas close to the river and extending perhaps 1 mile above and 1 mile below the location of the towers.

The vegetation at risk within this area is primarily flowering dogwood and hemlock. The land use within this area consists of single family residences, and manufacturing plants interspersed with scattered wood lots with forest to the west. In the staff survey of vegetation in the potentially affected areas it was found that approximately 11% of the ornamental trees were dogwood and 9% were hemlock. White ash was a minor component of the vegetation. There were about 550 ornamental trees per 100 homesteads in this area but only the dogwood and hemlock are at risk from drift. Thus there are about 60 individual dogwood trees and 52 hemlocks per 100 households in the area of potential damage. Cost of replacement of a single tree 4 inches in diameter and 20 feet tall was found to be about $300. The total replacement value of the trees at risk would therefore be $18,000 for dogwood and $15,600 for hemlock per 100 households in the drift area.

The replacement cost would be incurred only if all of the sensitive trees in the affected area actually died. This is unlikely in expected weather conditions. The applicant has indicated, and the staff concurs, that damage symptoms (leaf scorch, or needle yellowing in hemlock) would most likely be observed during periods of extended drought (14 or more rainless days in the applicant's analysis during August or September. These symptoms in themselves do not signal the imminent death of the tree, however. Most species of trees have substantial ability to recover from damaging episodes and the staff expects that most trees will put forth new normal leaves in the spring following such an episode.

Death of trees will occur if repeated severe damage or defoliation takes place in a single season or if severe drought persists for several seasons. Two 14-day rainless episodes in one year or a single month long episode carries with it the significant probability of death for some trees. Long term weather records for the vicinity of Indian Point indicate that a single 14-day rainless period has a probability of occurrence of 0.4 in any one year and that the longest rainless period on record is 27 days. (ER-CCC, Supp. Vol. 1, IP-2, p. 30.)

The staff concludes that during years of normal weather no significant effects of drift from mechanical draft cooling towers will be observed. During years which have extended rainless periods (2 weeks in duration) such as during August or September symptoms of damage could be found on dogwoods and hemlocks within the 200 Kg/Km^2 contour. This would appear to an observer as scattered "brownout" of the affected species. Recovery of most trees would be observed the following spring. On a much less frequent schedule, periods of long extended drought or successive years of drought or insect or disease interactions could result in the death of some trees. This could happen on the order of once or twice at most during the remaining life of the plant if linear MDCTs of either the wet or wet/dry design were selected (ER-CCC, Supp. Vol. 1, IP-2, p. 30).

The staff, therefore, does not expect wholesale destruction of vegetation or denuding of the environment in the vicinity of MDCT. The situation is likely to be much more subtle with occasional brownouts and infrequent death of a few trees taking place. Replacement of affected trees is both technically and monetarily feasible since the number of trees involved is relatively small.

The risk of serious damage to vegetation from drift emitted from MDCT is finite but confined to the immediate area of the towers. Damage to hemlocks, dogwoods and other species onsite could occur. The level of risk on an annual basis to offsite vegetation is small although death of some trees could occur in infrequent episodes. Potential drift effects would therefore not prohibit the utilization of MDCTs at the Indian Point site if there were adequate provision for monitoring of drift and vegetation and for restoration of damage that actually occurs.

The risk of offsite vegetation damage from these towers is nevertheless greater than would be incurred with a NDCT. In the interest of preventing damage to vegetation as opposed to the possible necessity of carrying out small restorative actions the staff concludes that NDCTs are preferable to wet or wet/dry MDCT on the Indian Point site with respect to the single factor of vegetative injury from drift.

5.2.2.5 Estimate of Botanical Injury from Fan-Assisted Natural Draft (FANDCT) and Circular Mechanical Draft (CMDCT) Towers

The staff feels that the assessment of a NDCT and MDCT's effectively envelopes the effects of drift which might be expected from FANDCT's and CMDCT's. No drift effects from the latter towers are expected to fall outside the upper and lower bounds of risk estimates for the former types.

FANDCT's would be similar in impact to a NCDT because release of drift particles and plume would take place at sufficiently high altitude (250 to 300 feet or more) to permit some evaporation of drift particles and strong dispersion before particles reach the ground. The principal difference in performance is that drift from a FANDCT would be expected to fall somewhat closer to the tower at a somewhat higher deposition rate than for a NDCT. It is doubtful that any area would receive even as much as a factor of two increase of drift in comparison to a NDCT. Considering the conservatism used by the applicant in assessing biological effects, the staff believes that the somewhat increased localized drift levels associated with a FANDCT would not be important. A FANDCT like the NDCT would be essentially without biological consequences and would be almost as acceptable for the Indian Point site as the NDCT.

Impacts of circular mechanical draft towers would be similar to but possibly somewhat less than ordinary MDCT's because of somewhat greater plume buoyancy with CMDCT's.

The staff has performed a detailed analysis of drift deposition for CMDCT using the computer program ORFAD. The analysis was based on the assumption that two CMDCTs of 13 fans each would be used for Unit No. 2. Results for July through October which are the critical months of interest and overall annual deposition patterns are given in Figures 5-12 through 5-16. The predicted patterns of deposition are similar to those obtained by the applicant in its assessment of MDCT's. Most of the saline drift will be deposited either in the river or along its east bank for a short distance inland.

Rates of salt deposition may exceed 91 Kg/Ha (81 lbs/acre) on site in August which is the month with the largest salt deposition. This exceeds the threshold for potential visible damage to most onsite species. Deposition diminishes to 22 Kg/Ha (20 lbs/acre) in less than 1/2-mile from the tower and falls off rapidly thereafter (Figure 5-14). Offsite damage to vegetation would most likely occur in the northeast-southwest corridor shown by the isopleths but is unlikely elsewhere. The area at risk is about 1 mile up and down the river from the towers and extends less than 1/2-mile inland from the river.

The staff concludes that the risk of environmental damage from CMDCT's is similar to that for MDCT's on the Indian Point site. During years of normal precipitation, the staff expects limited damage to offsite vegetation. If prolonged drought occurred during the critical months, lasting on the order of two weeks, symptoms of "salt scorch" or "brownout" might appear on dogwood and hemlock needles may yellow and fall. Recovery would in most cases be expected the following spring. If extremely protracted drought or several successive years of drought took place, death of some trees could be expected.

The results from the staff model for CMDCT's show that the area of risk is similar to that for MDCT's. The number of trees within the area amounts to about 60 dogwoods and 52 hemlocks per 100 households. As with MDCT's there is essentially no risk of wholesale destruction of offsite vegetation or denudation of even small portions of the offsite environment if CMDCT's are selected. Substantial replacement of onsite vegetation with more salt-tolerant species could be expected.

Considering that there are relatively few offsite trees actually at risk, that available estimates of damage thresholds for saline deposits probably are conservative and that restoration at low cost is feasible, the staff concludes that the possibility of damage to offsite vegetation would not in itself prohibit the selection of CMDCT's for Indian Point Unit No. 2. Because some risk exists, however, the staff would require a thorough monitoring program and provisions by the applicant for restoration of irreversible damage to vegetation if CMDCT's were selected.

5.2.2.6 Effects of Drift Aerosols on Human Populations

Release of aerosols on local populations have been predicted by the staff to obtain maximum monthly values (August) for CMDCT of 1.9 $\mu g/m^3$ and 0.4 $\mu g/m^3$ for NDCT. The highest offsite annual values for CMDCT and NDCT were calculated by the staff to be 0.4 $\mu g/m^3$ and 0.08 $\mu g/m^3$, respectively. This aerosol consists predominately of NaCl. Dautrebande and Capps report that NaCl aerosols by themselves appear to be competely devoid of irritant action on mammalian respiratory systems. NaCl aerosols can interact synergistically with SO_2 and other similarly irritating substances to enhance the effects of these irritating substances. The action of NaCl with this substance is nonspecific and other inert particulates have been found to have the same action.[55,56]

The staff calculates the NaCl represents 1.6% of the total settleable particulate at the site prior to the cooling tower operation (CCC-ER, IP-2, Appendix A, Table 14.2). Operation would increase NaCl by 0.4 $\mu g/m^3$ in the air for the highest monthly value. CMDCT operation is predicted to increase NaCl by 1.9 $\mu g/m^3$ for a similar period. This will result in a maximum increase of the total settleable aerosol particulate of 4.6%. The staff concludes that this is a minor increase in the total particulate inventory in the atmosphere. Considering that the action of NaCl is nonspecific in respiratory irritations, no increases in human respiratory irritations are expected.

The average offsite incremental relative humidity (RH) due to NDCT was found to be about 0.01% (in %RH above ambient RH) (CCC-ER, Appendix B, Section 2.3). The ambient RH for the site sharply fluctuates on a daily and monthly basis. Often the changes range from 50-90% (RH). The staff concludes that the contributions of moisture from any type of cooling tower operation will be insignificant in comparison to the daily fluctuations in the local moisture regime.

5.2.2.7 Summary of Drift Effects of Cooling Towers

The staff has assessed five cooling tower designs as possible alternatives to once-through cooling for Indian Point Unit No. 2 with respect to the possible damage to vegetation. These include natural draft, fan-assisted natural draft, circular mechanical draft, linear mechanical draft, and wet-dry mechanical draft cooling towers. Major conclusions of the assessment are the following:

(1) None of the five cooling tower options incur the risk of wholesale destruction of offsite vegetation or denudation of the environment.

(2) None of the five cooling tower options will produce progressive long term deterioration of vegetation due to cumulative salinization of soils.

(3) If any damage to offsite vegetation occurs, it is likely to be episodic and noncumulative.

(4) The critical months for risk of vegetative damage are July, August, September and October of each year because of the possible simultaneous occurrence of factors necessary for damage. These factors are: (a) high river salinities, (b) fully developed, actively metabolizing vegetation, and (c) possibility of extended drought.

(5) Visible damage to offsite vegetation is expected to be slight or nonexistent for any of the five cooling tower options during years of normal frequency and amounts of rainfall. In years of moderate late summer drought, leaf scorch might be observed for any of the mechanical draft options. Such damage would be reversible and spring recovery would be expected. Death of dogwoods and hemlocks and possibly other species could occur in the offsite vicinity of both linear and circular mechanical draft towers in years of prolonged drought or if severe drought occurred in successive years.

(6) The total number of trees at risk is relatively small and replanting of trees after a severe damaging episode would be both technically and financially possible.

(7) Although none of the cooling tower options carry the risk of catastrophic offsite damage, there are differences in damage potential among them. The staff ranks the options as follows in order of the least to greatest risk of foliar damage from drift:

(a) Natural draft

(b) Fan-assisted natural draft

(c) Circular mechanical draft

(d) Mechanical draft and wet/dry mechanical draft.

Units Nos. 2 and 3 Considered Together

The effect of cooling towers for both Units Nos. 2 and 3 can be reasonably approximated by simply doubling the drift levels calculated for Unit No. 2 alone. The consequences of drift from both units would be to increase the environmental area at risk and to increase the frequency of the appearance of foliar symptoms.

With two towers of similar design, the drift contours of Figures 5-1 and 5-2 and 5-3 would be assumed double their indicated values. Most of the land enclosed by these contours, however, is within the range of uncertainty in the prediction of damage thresholds. The drift contours should, therefore, be interpreted in a manner somewhat equivalent to a statistical confidence interval. Any damage which might occur would most likely be found within the bounds of the contour. It is not valid to suggest that damage, however, will occur on the entire area of the contour.

Most of the staff assessments for the Unit No. 2 case would remain valid for both Units Nos. 2 and 3 with the exceptions noted. Even with both units,no catastrophic offsite damage is expected with any of the alternatives. The staff ranking of the alternative designs with respect to potential damage to vegetation remains the same. Natural draft towers for both units would have the least risk of biological damage and linear wet or wet-dry mechanical draft towers would have the greatest risk of damage.

The staff, therefore, concludes that from the standpoint of potential damage from saline drift, natural draft towers for both units would have the least biological effect and would, therefore, be the preferred choice. Fan-assisted natural draft towers for both units would have only slightly greater risks and would, therefore, be nearly as acceptable as NDCT's with regard to the single factor of drift.

Circular or linear mechanical draft towers would create a zone of risk extending one to two miles above and below the location of the cooling towers along the river and extending inland to cover most of Verplanck, the western half of Buchanan and most of Peekskill. Some risk of vegetative damage would also exist on the western bank of the river.

The risk is not of catastrophic dimensions; nevertheless, late summer browning of some leaves and occasional death of plants is possible within the zones specified. In zones of highest deposition along the river, damage could include other species as well as dogwood and hemlock. Circular mechanical draft towers could have somewhat less severe consequences than linear towers. Localized episodic damage and death of sensitive plants could be expected within the zone of risk with CMDCTs. The level of risk to vegetation is not sufficient in the staff's view to rule out the use of any of the mechanical draft designs for both Units at Indian Point although the use of NDCT's would give the greatest assurance of freedom from injury to vegetation.

5.2.2.8 Summary of Aerosol Effects of Cooling Towers

The natural ambient aerosol salt background for the eleven-month sampling period at the Indian Point site ranged from 0 to 6.15 $\mu g/m^3$ and averaged approximately 1.0 $\mu g/m^3$. The staff agrees with the applicant's evaluation that the predicted aerosol salt concentrations for NDCT represent a very conservative assessment of saline aerosol values (ER-CCC, IP-2, p. 6-15). The applicant's model estimates that the highest annual aerosol concentration for NDCT will be 5.6 $\mu g/m^3$, about 1.24 miles southeast of the towers. The staff estimated highest monthly values for NDCT and CMDCT of 0.38 $\mu g/m^3$ and 1.9 $\mu g/m^3$, respectively. The average annual values are significantly lower as shown in Figures 5-11 and 5-19. Estimations for linear mechanical draft towers are believed to be somewhat higher than values predicted for CMDCT. If a two-fold difference is assumed, the highest monthly aerosol concentration for linear mechanical draft would be less than 5 $\mu g/m^3$. The fan-assisted natural draft and wet-dry mechanical draft options were assumed to produce aerosol salt concentrations within the range of natural draft and linear mechanical draft towers. Aerosol salt values for all types of cooling towers appear to peak over a period of time during the summer and early fall.

It has been reported that the minimum monthly long-term average level of airborne salt needed to affect the distribution and growth of plants is approximately 10 $\mu g/m^3$.[56-60] Based upon the applicant's and staff's predicted aerosol values, salt damage to biota from operation of any type of cooling system would not appear to be a problem. However, it is apparent that predictions based upon salt deposition methods do indicate a potential for damage to certain types of flora under certain conditions as discussed in the preceding section.

5.2.3 Effects of Excess Moisture on the Biota

5.2.3.1 Induced Fog

The staff estimates that the NDCT may add a maximum annual average of about 20 hours of ground fog (Figure 5-9) directly north of the towers in an area primarily over the Hudson River. This value is considered to be an overestimate of what could be reasonably expected (Section 5.1.3.3). The linear MDCT's are predicted by the applicant to increase the annual fog occurrence by 82 hours (Section 5.1.2.2). The CMDCT's are predicted to add similar amounts of ground fog as those predicted for the staff's NDCT estimates (Figure 5-17). The staff estimates that wet/dry MDCT would add the least amount of additional hours of fog of all options considered. The FANDCT's were assumed to have additional fog occurrence values similar to a NDCT and CMDCT's. The applicant states that the natural fog occurrences at the Indian Point site are less than 2 percent annually (ER-CCC, IP-2, p. 6-13). The natural ground fog is not known to adversely affect plant or animal species found in the area. Increases in moisture due to added periods of ground fog may, however, trigger increases in the incidences of plant disease. Since the period of record of onsite meteorological data represents only one year, the staff cannot determine the natural background variation or "noise" for ground fog occurrences. The staff cannot accurately ascertain whether the predicted increases in fog occurrence from the various cooling options fall within or significantly exceed the natural background "noise". Based on these uncertainties, the staff concludes that there is some risk of increases in plant diseases to onsite vegetation and to a lesser degree to offsite vegetation. MCDT's would have the greatest risk, but the risk to vegetation is not sufficient in the staff's view to rule out the use of any MDCT's for both units. The use of a NDCT would have the greatest assurance of freedom of injury to vegetation from excess moisture. It is the staff's position that potential increases in plant disease will occur primarily during the spring months of March, April, and May when most plants commence active growth. The areas most likely to receive the highest additions of excess moisture and, therefore, the greatest potential for plant disease, are located primarily onsite.

5.2.3.2 Icing

The staff calculated the additional number of hours of ice attributed to the NDCT and CMDCT's systems (Figures 5-10 and 5-18). The applicant submitted predictive calculations on icing for the NDCT and CMDCT. A MDCT system may cause up to 40 hours of icing during the month of February onsite. Circular MDCTs are estimated by the staff to cause a maximum annual average of 26 hours of icing (winter months only) which would be restricted primarily to the onsite environs. The staff estimated that a NDCT would add an average of 11 additional hours of icing on an annual basis.

The staff concludes from these data that some damage may occur to vegetation from operation of linear MDCT's and circular MDCT's. The NDCT, FANDCT, and wet/dry MDCT were assumed by the staff to have the least risk of biological damage from icing.

The extent of the damage attributed to icing from the linear MDCT and circular MDCT options will be limited to areas south of the towers and primarily to onsite vegetation. Such damage will consist of losses through breakage of branches and limbs of vegetation. This 'pruning' action will be selective since weak and diseased parts of vegetation will be most likely the first to break under the strain of ice loading. Since vegetation is relatively dormant during the winter, such 'pruning' action will not seriously hinder the affected flora's survival chance. The staff believes that none of the cooling tower options will cause unacceptable offsite damage due to icing.

5.2.4 Land Required for Each Cooling Tower

The applicant has submitted estimated land requirements for various alternative cooling system designs. The staff has calculated a conservative range of land requirement values for two additional closed cycle cooling tower alternatives, FANDCT and circular MDCT. Based upon the range of these values (Table 5-9), the staff does not consider the utilization of these acres for cooling tower siting as having an unacceptable impact on total land use for the entire site. Some of the land needed for the cooling tower will impact part of the 80 acres of land planned for use as a natural park area on the site.

TABLE 5-9

LAND REQUIREMENTS OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS FOR INDIAN POINT UNIT NO. 2[a]

Type of Alternative Closed Cycle Cooling System	Land Area-Order of Magnitude Estimates (Acres)
Wet Natural Draft Cooling Tower	16[a]
Wet Fan-Assisted Natural Draft Cooling Towers (1 Tower/Unit)	10-16[b]
Wet Linear Mechanical Draft Cooling Tower	11[a]
Wet Circular Mechanical Draft Cooling Tower (2 Towers/Unit)	24-30[b]
Wet/Dry Mechanical Draft Cooling Towers	12[a]

[a]Adapted from the applicant's "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Vol. 1, p. 2-21.

[b]Range of values calculated by staff.

5.2.5 Noise Impacts of Alternative Closed Cycle Cooling Systems

5.2.5.1 Existing Conditions

The applicant conducted a sound level survey in the vicinity of the Indian Point Unit No. 2 during the month of December 1973. The purpose of this survey was to sample the existing sound levels at a variety of locations in Buchanan, Verplanck, Peekskill and on the western side of the Hudson River opposite the Indian Point site. From the samples recorded at the various sampling stations, sound level isopleths were to be estimated for the area. This estimation procedure would allow the applicant to approximate the existing acoustic environment in the site vicinity and thereby establish the baseline conditions against which the altered acoustic environment due to the operation of various closed cycle cooling systems at the Indian Point Unit No. 2 could be compared.

The applicant selected a total of eleven sampling sites, including three sites on the western bank of the Hudson River (See Figure 5-22). These sampling locations are all within approximately 7200 ft. of the area where the cooling system structures would be located for Unit No. 2. Each location was sampled continuously for approximately 10-15 minutes during each

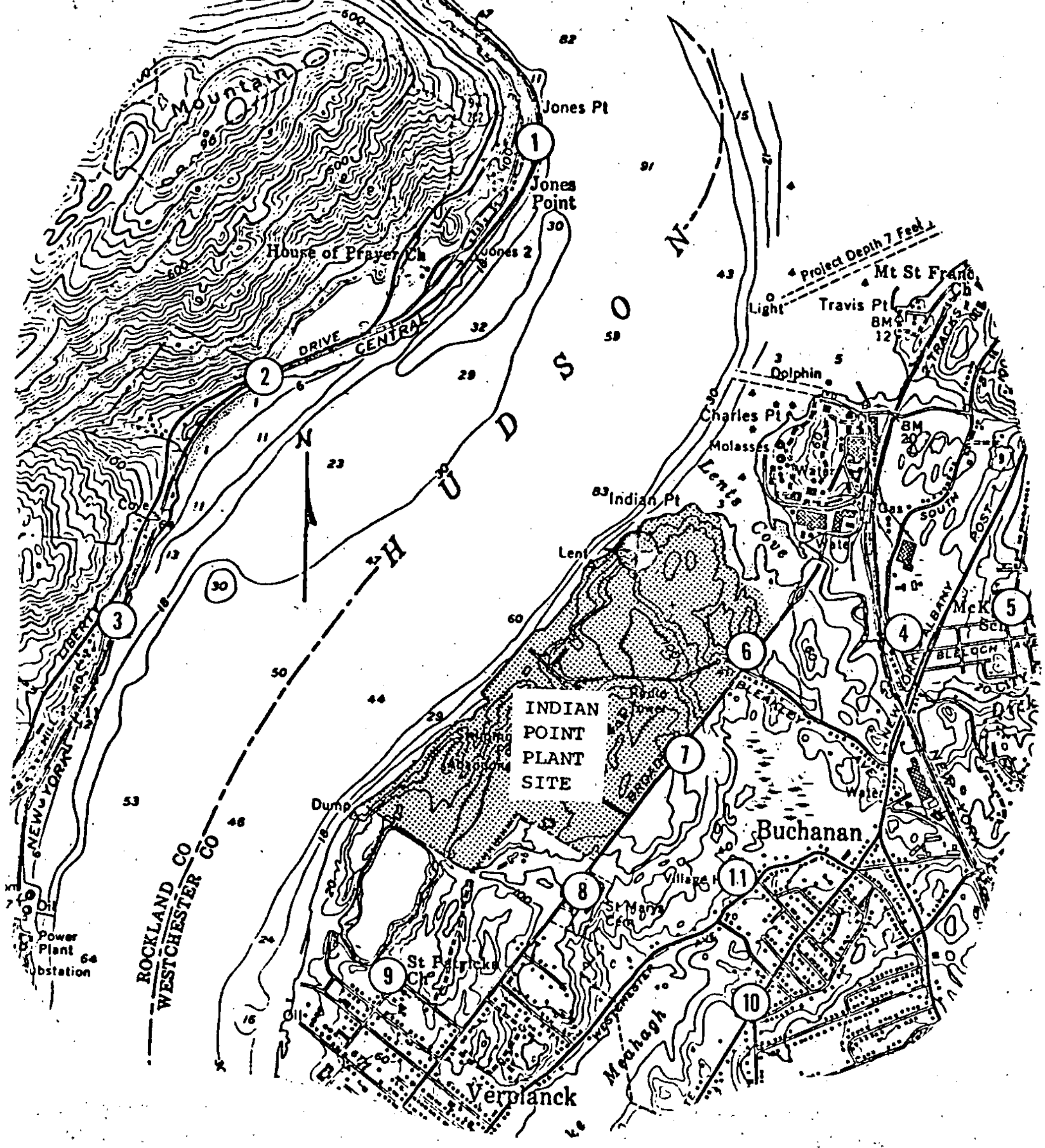


Fig. 5-22 Location of the eleven measurement sites for existing community noise evaluation

Ref.: ER-CCC, IP-2, App. G, Fig. 1

measurement. All measurements were accomplished on December 4 and 5, 1973 and December 11 and 12, 1973. A total of 43 "daytime" (i.e., between 7 A.M. and 10 P.M.) and 24 "nighttime" (i.e., between 10 P.M. and 7 A.M.) measurements were made during which every location on the east side of the Hudson River was sampled at least twice during daytime and nighttime periods. Those stations on the west side of the Hudson River (i.e., those opposite the generating facility) were sampled at least three times during daytime periods, but only once during nighttime periods. Although the data gathered from the locations are based on multiple samples, these samples are generally only from a single daytime or nighttime period with that period not being one and the same for all sampling locations. Only stations 9, 10 and 11 yielded data for more than a single nighttime period, that period again not being one and the same for each sampling location.

The collected data were statistically analyzed by the applicant and the A-weighted ambient sound levels which were exceeded 10, 50 and 90% of the time (i.e., L_{10}, L_{50} and L_{90}) were estimated for each sampling location. In addition, the A-weighted 24-hour equivalent sound levels and the A-weighted day-night equivalent sound levels were determined for each sampling location.[57] These levels are shown in Table 5-10.

The applicant then used these data to construct day-night equivalent sound level isopleths for the site and the general vicinity. The resultant diagram, which the applicant considers to represent the ambient acoustic environment of the area, is presented as Figure 5-23.

An earlier sound level survey was conducted by the applicant in connection with the environmental studies for the Environmental Report for the Indian Point Unit No. 3. (See Section 4.2.1 of Supplement 2, September 1972 of ER, IP-3.) This sound level survey was conducted during the period of January 20-21, 1972. A total of eight locations, which included both sides of the river, were sampled during daytime ambient conditions. Procedures during this survey were similar to those followed during the survey described above with the individual samples lasting 5 to 10 minutes each. The staff made a comparison between the sampling points chosen for the two surveys. It was found that the following sampling station locations were very nearly identical:

1/20/72 Survey Sampling Location No.	12/5/73 Survey Sampling Location No.
1	6
2	7
6	9
7	2

The statistical parameters (i.e., L_{10}, L_{50} and L_{90}) for the daytime sound levels were compared for the two surveys. Considerable variation exists between the two survey results. The stations along the southeastern site boundary (Broadway Avenue) exhibit lower sound levels in the more recent survey, while those stations off of this main artery are exhibiting higher sound levels in the later survey. One reason for this could be the reduction of truck traffic as the construction on Unit No. 3 progressed. Also, it should be noticed that all measurement locations were on or within the area of influence of major transportation rights-of-way (i.e., either near or along roads or railways). Inasmuch as the sampling periods were of relatively short duration and that the statistical parameters presented are simply estimates of the actual continuing conditions at the sample locations, variations such as those exhibited by the data could be expected despite the time lapse between the two surveys. The staff will use the statistical description of the acoustic environment developed during the later survey as a basis for determining the possible acoustic impacts due to operation of a closed cycle cooling system at Indian Point Unit No. 2.

The staff has analyzed the methodology employed during the recent survey. Information provided by the applicant's consultant concerning the techniques used in data gathering, equipment selection, handling and calibration, and data reporting and analysis indicate conformance with the intent of the following American National Standards Institute Standards (ANSI):

S1.2 - 1962 <u>American Standard Method for the Physical Measurement of Sound</u>

S1.4 - 1961 <u>American Specification for General Purpose Sound Level Meters</u>

S1.6 - 1967 <u>USA Standard Preferred Frequencies and Band Numbers for Acoustical Measurements</u>

S1.8 - 1968 <u>American National Standard Preferred Reference Quantities for Acoustical Levels</u>

TABLE 5-10

AMBIENT SOUND LEVELS IN THE INDIAN POINT UNIT NO. 2 AREA, DECEMBER 1973

Sampling Location No.	Time Period	Sound Level, dBA re 2 x 10^{-5} N/m2				
		L_{10}	L_{50}	L_{90}	L_{eq}	L_{DN}
4	Day	65	59	56	64.5	63.5
	Night	56.5	54	47.5	51.0	
5	Day	65	56	52	64.5	63
	Night	50.5	45.5	42.5	46	
6*	Day	65.5	56	48.5	62.5	61.5
	Night	53	46.5	44.5	49	
7*	Day	68	51	44	63	62
	Night	48	42	40	49	
8*	Day	67.5	57.5	44.5	62.5	65.5
	Night	60.5	44	38.5	58	
9	Day	50	46	44	47.5	50.5
	Night	47	41	37	43.5	
10*	Day	61.5	46.5	41.5	57	58
	Night	66	54	50.5	49.5	
11*	Day	52	46	40	49	52
	Night	48	43.5	37	44.5	
1, 2, 3	Day	59.5	49.5	43	52.5	55
	Night	49.5	46.5	26.5	47	

*Denotes sampling location within the limits of Village of Buchanan.

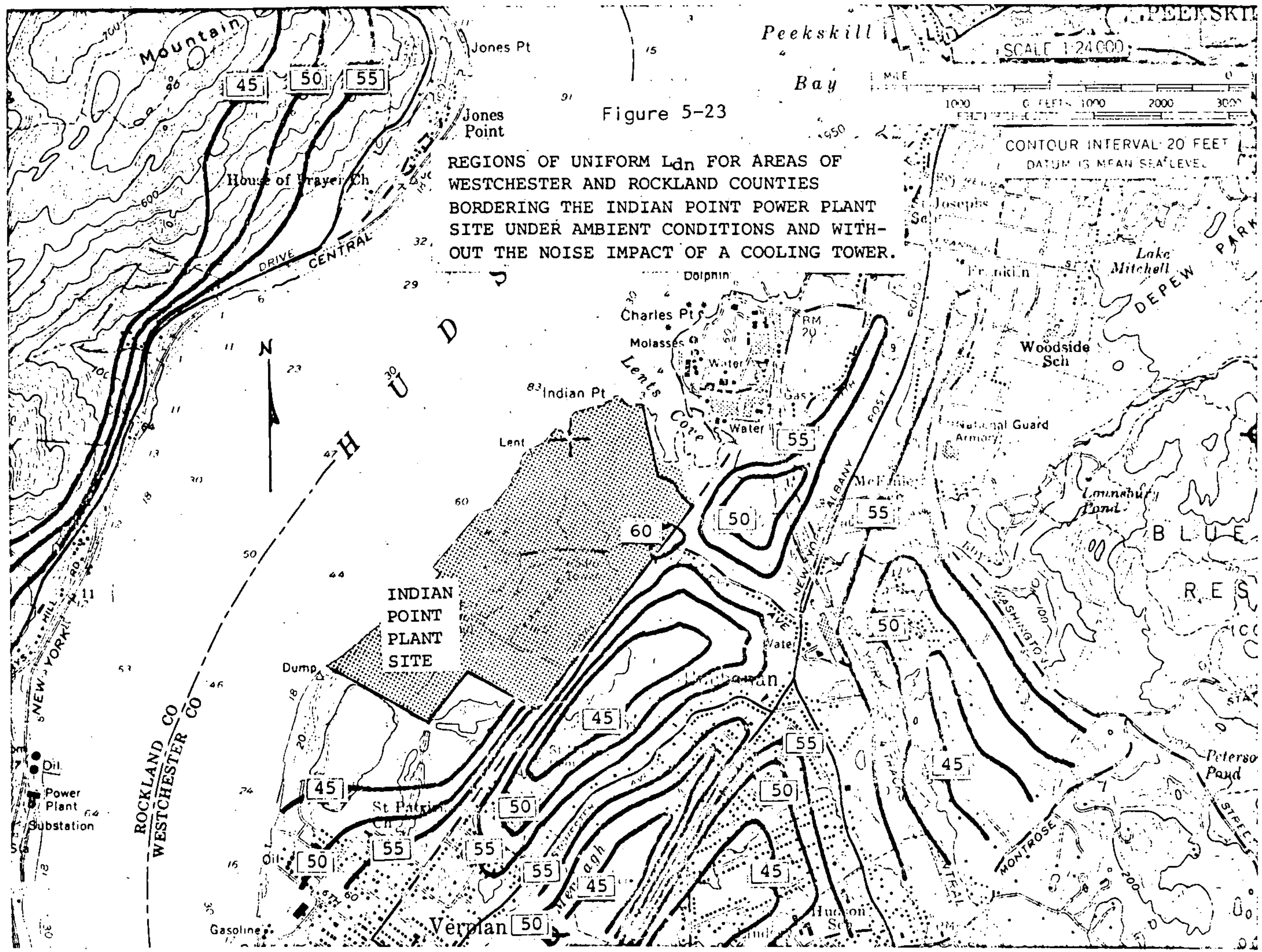


Figure 5-23

REGIONS OF UNIFORM L_{dn} FOR AREAS OF WESTCHESTER AND ROCKLAND COUNTIES BORDERING THE INDIAN POINT POWER PLANT SITE UNDER AMBIENT CONDITIONS AND WITHOUT THE NOISE IMPACT OF A COOLING TOWER.

Ref.: ER-CCC, IP-2, App. G, Fig. 10 a

S1.11 - 1966 American Standard Specification for Octave, Half Octave and Third Octave Band Filter Sets

S1.13 - 1971 American National Standard Methods for the Measurement of Sound Pressure Levels

The staff has considered the appropriate meteorological conditions which existed at the site during the 1973 survey. No unusual conditions (such as rain, snow or high winds) which would influence the ambient sound levels as reported by the applicant were found to exist on the dates in question.

The staff believes that the results presented by the applicant are reasonable and representative of the acoustic conditions which could be expected to exist in and around the Indian Point Unit No. 2 site. It should be noted, however, that the sample data do not necessarily represent an actual unique acoustic condition which existed at a specific instant around the site. Instead, these data represent a composite of a number of different actual conditions which existed at the specific sample locations. The estimation of the statistical sound level values presented by the applicant is considered acceptable to the staff, although variations in these levels and in the isopleth diagrams for the general area of Peekskill and Buchanan could and should be expected.

The ambient acoustic environment has been compared for illustrative purposes to the limits on sound emanation from any facility or activity as established by the Buchanan Zoning Ordinance,[62] Parts 54-22.E(2)(b) and 54-22.F(3), dated November 1970. These limits are specifically applicable to point source noise as opposed to non-point source noise (e.g., noise due to transportation activities). However, their effect would be to place a control on noise levels in the community. Therefore, a comparison of ambient noise levels with the zoning ordinance limit is informative. The allowable limits, in terms of the sound level measured in various octave bands, are given in Table 5-11. The original limits were specified in terms of octave band frequencies no longer preferred by the American National Standards Institute. (See ANSI S1.6-1967 and ANSI S1.11-1966.) The sound levels corresponding to the newly preferred octave band center frequencies are also given in Table 5-11 along with the allowable unweighted and A-weighted overall sound levels. It can be seen from Table 5-10 that all sampling locations within Buchanan (i.e., locations 6, 7, 8, 10 and 11) have daytime ambient equivalent sound levels in excess of those of the zoning ordinance. From inspection of similar data for the remaining sampling locations, it is seen that these levels are typical for the area. Further inspection of the data indicates that, in the immediate vicinity of the site (i.e., sampling locations 6, 7 and 8), the daytime sound levels are in excess of the zoning ordinance levels for more than 50% of the period. The residential areas of Buchanan (sampling locations 10 and 11) have sould levels in excess of the zoning ordinance levels for more than 10% of the daytime period. Nighttime equivalent sould levels are in excess of the zoning ordinance levels for all locations within Buchanan except location No. 11. However, only one location within Buchanan experiences nighttime sound levels in excess of the zoning ordinance levels for more than 50% of the period.

TABLE 5-11

ALLOWABLE AND PREFERRED SOUND LEVELS

Octave Band Limits - Hz	Allowable Sound Levels, dB re 2×10^{-5} N/m^2	Preferred Octave Band Center(1) Frequencies, Hz	Allowable Sound Levels, dB re 2×10^{-5} N/m^2
20 - 75	65	31.5	(2)
75 - 150	55	63	62.5
150 - 300	50	125	54
300 - 600	45	250	49
600 - 1200	40	500	44
1200 - 2400	40	1000	40
2400 - 4800	35	2000	39
4800 - 10000	35	4000	35
		8000	35

Overall Allowable Sound Level - 65.5 dB or 48 dBA (computed from octave band levels) re 2×10^{-5} N/m^2

(1)See ANSI 51.6-1967 USA Standard Preferred Frequencies and Band Numbers for Acoustical Measurements.

(2)This value is subject to interpretation due to the large range of the originally specified octave band limits.

If a 24-hour equivalent sound level is computed for the sampling locations, without weighting the nighttime readings, none of the locations would be below the level of the zoning ordinance. The staff believes that, in general, ambient acoustic conditions in Buchanan are above the level given in the zoning ordinance. From the information presented, non-point sources (i.e., roads, railroads) appear to be the reason for this condition.

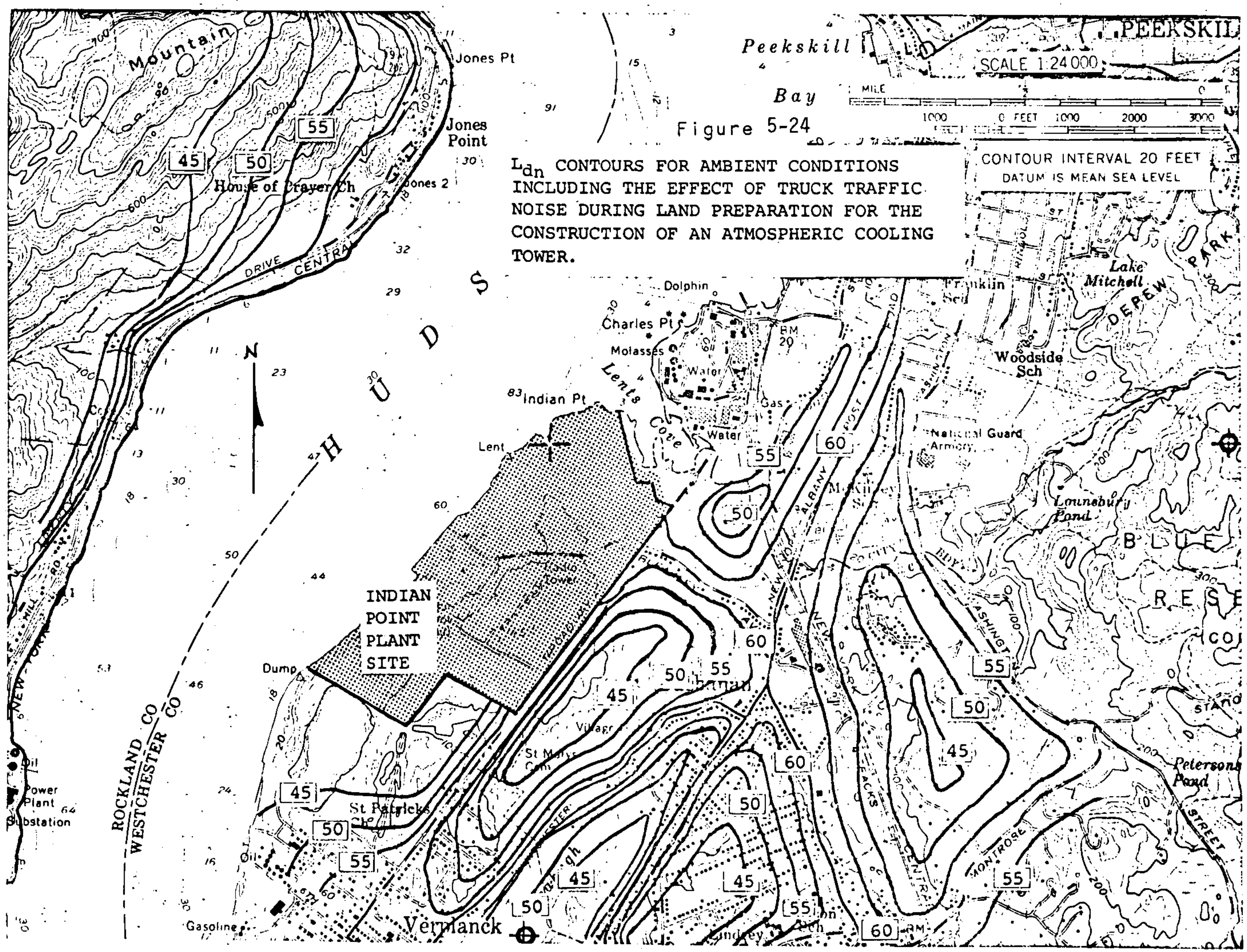
5.2.5.2 Construction Phase Acoustic Environment

The staff has analyzed the predicted sound levels expected at the site boundary during the construction phase. Although the exact types and amounts of equipment operating at any one time is difficult to estimate, the approach taken by the applicant is considered reasonable by the staff. The sound levels at 50 ft from the equipment types are within the range normally expected, as taken from available data.[59] Similarly, the estimates given by the applicant for sound generation by truck traffic to and from the site during construction are judged to be reasonable.

The staff considers offsite acoustic impact associated with the construction of a closed cycle cooling system at the Indian Point site to be temporary, and not of such magnitude so as to affect the existing ambient equivalent sound levels in areas around the site away from transportation routes. There would be unavoidable increases in sound levels along the transportation arteries to and from the site, such as Bleakley Avenue, Broadway Avenue, and New York-Albany Post Road due to increased truck traffic. The applicant's estimate of day-night equivalent sound levels during construction is presented in Figure 5-24. The staff believes these impacts will not be unacceptable if the applicant takes the following precautions:

Figure 5-24

L_{dn} CONTOURS FOR AMBIENT CONDITIONS INCLUDING THE EFFECT OF TRUCK TRAFFIC NOISE DURING LAND PREPARATION FOR THE CONSTRUCTION OF AN ATMOSPHERIC COOLING TOWER.



Ref.: ER-CCC, IP-2, App. G, Fig. 29

1. Equips all equipment used at the site during the construction phase with the required necessary noise suppression equipment according to federal and state regulation and procedures.

2. Limits blasting activities to the minimum necessary and schedules such activities between the hours of 8 A.M. and 5 P.M. during normal work days. Short duration deviations from this practice are permissible due to unusual manpower or equipment scheduling problems.

3. Limits all other noise producing activities to the minimum necessary.

5.2.5.3 Operational Phase Acoustic Environment

The applicant has considered the design and operation of various cooling towers sufficient to serve the needs of Indian Point Unit No. 2. The applicant specifically evaluated crossflow and counterflow natural draft wet towers and linear mechanical draft wet cooling towers. The applicant also indirectly considered linear wet/dry mechanical draft towers by assuming that the sound generation from the latter two towers is sufficiently similar to not produce noticeably different offsite sound levels. The staff agrees with this assumption.

The methodology used by the applicant in predicting the sound levels at various offsite locations due to the towers alone consists of techniques widely used in the industry.[60,61] These techniques have been subjected to field tests in the past and have been found to be accurate, with the exception of one technique which has recently been said to overestimate sound levels from natural draft towers.[62] The staff believes that the natural-draft cooling tower sound level analysis as presented by the applicant is conservatively high. The staff believes that the applicant has employed the analytical techniques correctly.

The combined effects of attenuation via atmospheric absorption, attenuation due to barrier effects and ground cover, effects due to humidity and the existing ambient acoustic environment were considered by the applicant to produce estimates of the resultant acoustic environment under operation of the cooling towers at the site. The staff has reviewed the techniques employed and finds them to be in accordance with recommended procedures which have been used in field verification programs.[63,64] The staff, therefore, believes that the resultant acoustic environment predicted by the applicant to be a reasonable approximation to the actual conditions to be experienced under system operation.

Figures 5-25, 5-26 and 5-27 provide the applicant's estimates of the various cooling system offsite sound emission contours adjusted for attenuation without consideration of the ambient sound levels around the site.

5.2.5.4 Offsite Acoustic Effects from Operation

The figures presented in the previous section depict the acoustic environment resulting from a constant and continuous sound power source in the absence of the ambient sound power sources. These levels represent the 24-hour equivalent sound levels offsite due to the cooling towers alone. Table 5-12 shows the predicted 24-hour equivalent sound levels resulting from the operation of the cooling tower options considered by the applicant without the ambient sound power sources accounted for. These may be combined with the ambient 24-hour equivalent sound levels at the various sampling locations to produce the resultant overall 24-hour equivalent sound levels. For those locations within the Village of Buchanan, comparison may be made with the Zoning Code to determine compliance. The only predicted violation in a residential zone would occur in the case of operation of linear mechanical draft cooling towers at sampling location No. 6. The non-residentially zone park and land northeast of the site would also experience noise above the zoning ordinance limits. This comparison would also be of interest at location No. 11 where the sound levels of the zoning ordinance are not presently exceeded. No violation due to a cooling tower point source operation is predicted. Table 5-13 presents the ambient and the resultant 24-hour equivalent sound levels for the various sampling locations and cooling tower types after addition of the ambient sound conditions. Examination of the difference between the ambient and the operational conditions indicates an overall maximum increase in 24-hour L_{eq} of 2.1dB with a maximum increase of 0.9dB for any sampling location on the east side of the Hudson River. Because the data in Table 5-12 represent constant and continuous cooling tower operation, these levels also represent the nightime equivalent sound levels of the towers alone (L_N). A comparison of the ambient and operational case L_N is made in Table 5-14. A maximum change in the nighttime period equivalent sound level of 4.1dB is predicted by these calculations.

Ref.: ER-CCC, IP-2, App. G, Fig. 16

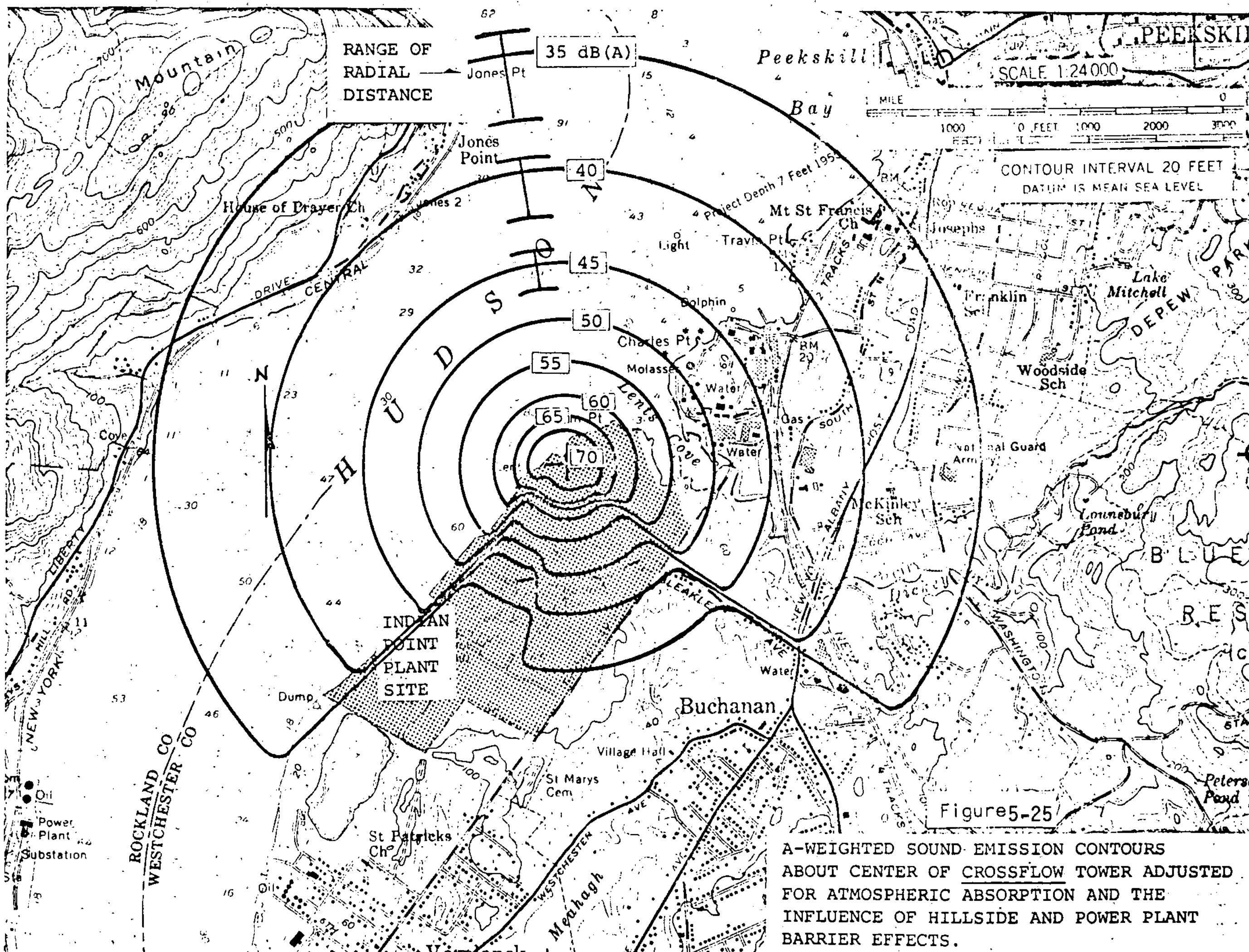


Figure 5-25

A-WEIGHTED SOUND EMISSION CONTOURS ABOUT CENTER OF CROSSFLOW TOWER ADJUSTED FOR ATMOSPHERIC ABSORPTION AND THE INFLUENCE OF HILLSIDE AND POWER PLANT BARRIER EFFECTS.

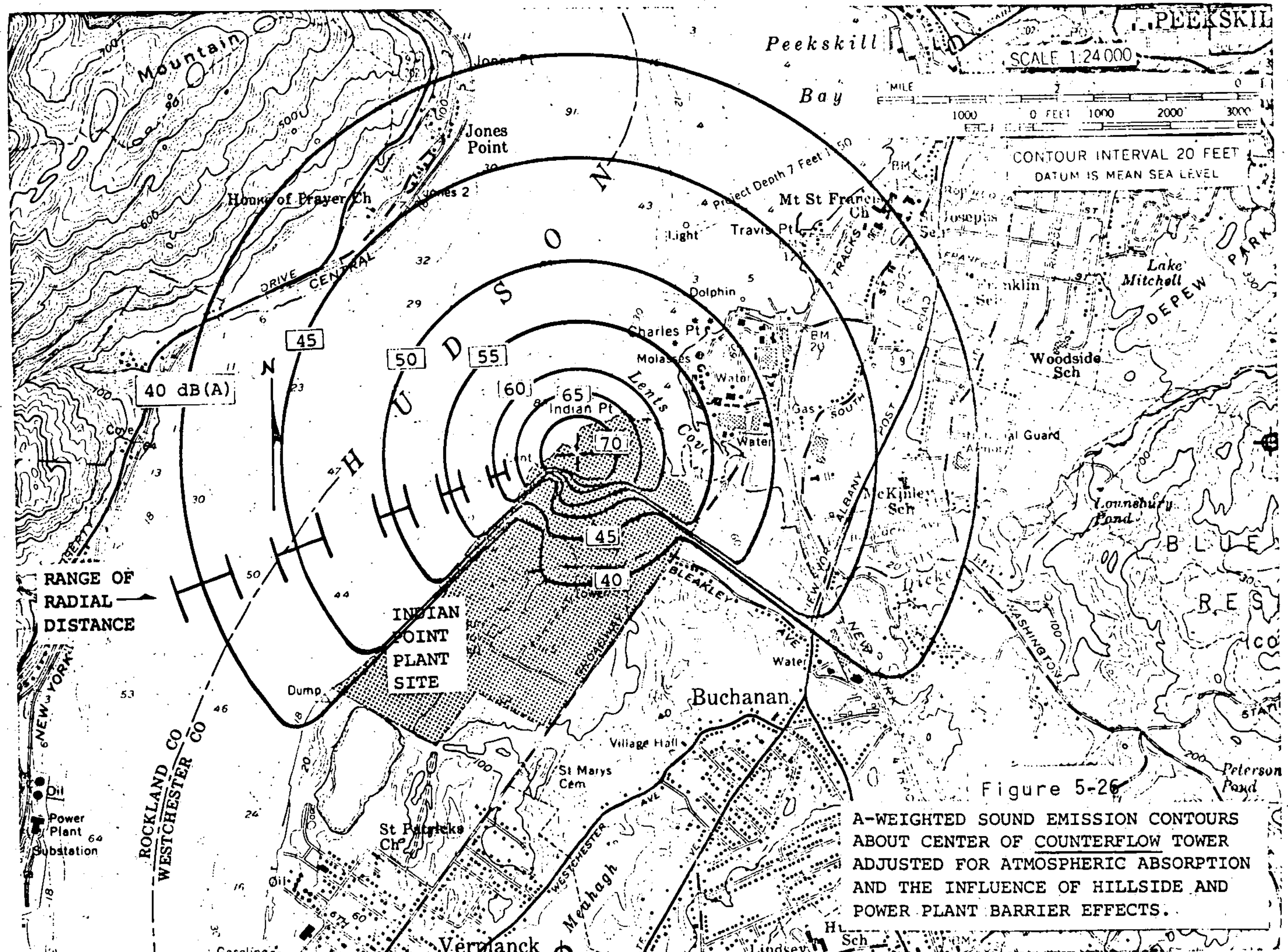


Figure 5-26

A-WEIGHTED SOUND EMISSION CONTOURS ABOUT CENTER OF COUNTERFLOW TOWER ADJUSTED FOR ATMOSPHERIC ABSORPTION AND THE INFLUENCE OF HILLSIDE AND POWER PLANT BARRIER EFFECTS.

Ref.: ER-CCC, IP-2, App. G, Fig. 21

Ref.: ER-CCC, IP-2, App. G, Fig. 23

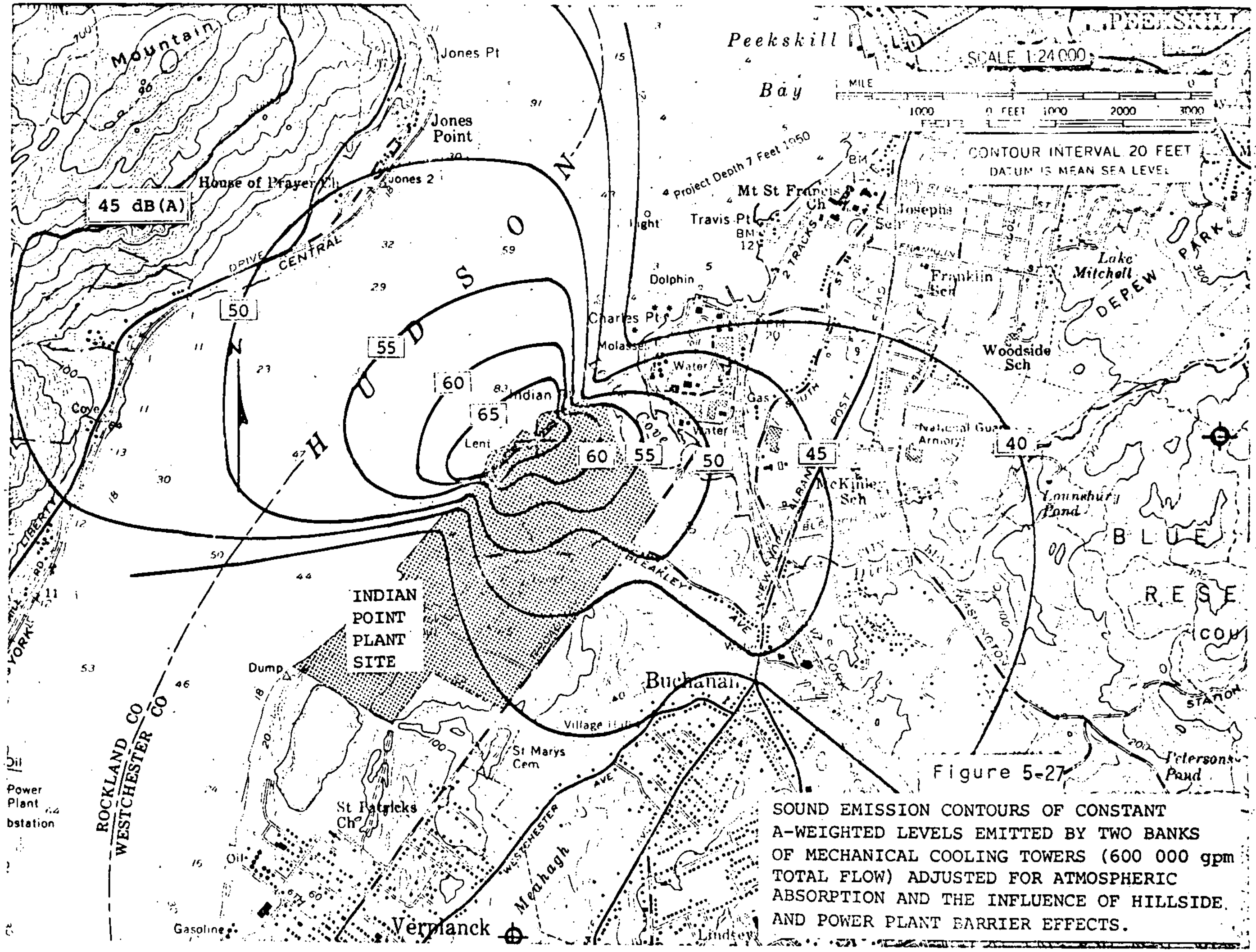


Figure 5-27

SOUND EMISSION CONTOURS OF CONSTANT A-WEIGHTED LEVELS EMITTED BY TWO BANKS OF MECHANICAL COOLING TOWERS (600 000 gpm TOTAL FLOW) ADJUSTED FOR ATMOSPHERIC ABSORPTION AND THE INFLUENCE OF HILLSIDE AND POWER PLANT BARRIER EFFECTS.

TABLE 5-12

PREDICTED RANGE OF OPERATIONAL 24-HOUR SOUND LEVELS
FOR VARIOUS COOLING TOWER OPTIONS

	24 hr L_{eq} Range, dBA re 2×10^{-5} N/m^2 [1]		
Sampling Location No.	Cross Flow Nat. Draft	Counter Flow Nat. Draft	Linear Mech. Draft
1	34 - 37	40 - 42	49
2	34 - 37	39 - 42	49
3	30 - 34	< 40	45
4	40 - 43	45 - 47	47
5	35 - 40	40 - 44	45
* 6	38 - 44	< 40 - 41	50 - 51
* 7	34 - 40	40 max	45 - 46
* 8	< 35	< 40	< 40
9	< 35	< 40	<< 40
*10	<< 35	< 40	<< 40
*11	<< 35	< 40	40

[1]Data obtained from predicted sound level isopleths. Data assumes continuous and constant cooling tower operation.

*Sampling location within the limits of the Village of Buchanan.

TABLE 5-13

COMPARISON OF AMBIENT AND OPERATIONAL 24-HOUR EQUIVALENT SOUND LEVELS IN THE INDIAN POINT UNIT NO. 2 AREA

Sampling Location No.	Ambient 24-hr L_{eq}, dBA re 2×10^{-5} N/m^2	Operational[1] 24-hr L_{eq}, dBA re 2×10^{-5} N/m^2		
		Cross Flow Nat. Draft	Counter Flow Nat. Draft	Linear Mech. Draft
4	62.6	62.6	62.7	62.7
5	62.5	62.5	62.5	62.5
6	60.6	60.7	60.6	61.1
* 7	61.1	61.1	61.6	61.2
* 8	61.3	61.3	61.3	61.3
9	46.4	46.7	47.3	47.3
*10	55.4	55.4	55.5	55.5
*11	47.8	48	48.4	48.4
1,2,3	51.1	51.3	51.6	53.2

[1]Derived by combining the maximum predicted 24-hr L_{eq} for each tower type from Table 5-12 with the calculated ambient 24-hr L_{eq}.

*Sampling location within the limits of the Village of Buchanan.

TABLE 5-14

COMPARISON OF AMBIENT AND OPERATIONAL NIGHTTIME EQUIVALENT SOUND LEVELS IN THE INDIAN POINT UNIT NO. 2 AREA

Sampling Location No.	Ambient L_N, dBA re 2×10^{-5} N/m^2	Operational L_N,[1] dBA re 2×10^{-5} N/m^2		
		Crossflow NDCT	Counterflow NDCT	Linear MDCT
4	51.0	51.6	52.4	52.4
5	46	47.0	48.1	48.6
* 6	49	50.2	49.6	53.1
* 7	49	49.5	49.5	50.8
* 8	58	58	58	58
9	43.5	44.1	45.1	45.1
*10	49.5	49.5	50.0	50.0
*11	44.5	44.9	45.8	45.9
1,2,3	47	47.4	48.2	48.2

[1]Derived by combining the maximum predicted L_N for each tower type with the calculated ambient L_N.

*Sampling location within the limits of the Village of Buchanan.

It has been reported[65] that the threshold for the detection by the human ear of a change in sound level is approximately 1dB. Therefore, it is questionable whether or not the operational acoustic environment would be judged by residents to be more noisy. In addition, Stevens,[66] cites practical experience in stating that a change in the noise patterns in an area of less than 5dB would not likely result in a change in the community reaction to the noise.

The existing environment in the vicinity of the Indian Point Unit No. 2 has an L_{DN} range of 52 to 65.4dBA with a difference between the daytime and nighttime equivalent sound levels ranging from 3.5 to 18.5dBA. These data indicate an acoustic environment similar to that found in other residential communities with heavy traffic.[57] It should be noted, however, that there are two distinct areas in the survey region with respect to acoustic characterization: (1) the region encompassing sampling locations Nos. 9, 10 and 11 is typical of the "normal suburban residential" category and (2) the region encompassing the remaining sampling locations on the east side of the Hudson River (i.e., locations no. 4 through no. 8) are typical of the "noisy urban residential" category.

Further classification of the existing environment around the Indian Point Unit No. 2 is possible by considering the Department of Housing and Urban Development (HUD) non-transportation related "guidance criteria" for outdoor noise levels in residential areas.[67] The existing daytime acoustic environment for locations Nos. 4 through 8 have equivalent sound level readings in the "normally unacceptable" range (i.e., L_{eq} > 62 dBA), while the remaining stations fall into the "normally acceptable" or "clearly acceptable" categories. (See Figure 5-28.) All locations fall into the aforementioned "acceptable" categories when the nighttime equivalent sound levels are considered. The 24-hour equivalent sound levels calculated for ambient conditions indicate a pattern similar to the daytime situation except that locations Nos. 6, 7 and 8 are no longer in the "normally unacceptable" category, but are now in the "normally acceptable" category. Inspection of the data of Tables 5-13 and 5-14 indicates that the operational acoustic environment will not result in any changes in the acceptability rating as established by these "guideline criteria" for any sampling location when considering either the 24-hour equivalent sound level or the nighttime equivalent sound level. This result is consistent regardless of tower type considered.

Precise consideration of the speech interference characterisitics of the ambient and operational offsite acoustic environment is difficult in the absence of frequency spectra information. However, the Environmental Protection Agency (EPA) reports[57] that 95% speech intelligibility between conversers two meters apart using normal vocal effort is possible in varying "urban community noise" whose equivalent level is somewhat in excess of 60dBA. Therefore, present outdoor verbal communication under the previously mentioned conditions may be degraded below 95% intelligibility for sampling locations nos. 4 through 8.

A consideration bearing on the likely interference with offsite speech by cooling towers is the frequency spectrum typical of the tower types involved. Speech acoustic energy is found mainly between 100 and 6000 Hz[68] with the most important cue bearing energy falling between 500 and 2000 Hz. Generalized spectra reported by Dyer and Miller[60] for mechanical draft cooling towers indicate that their acoustic energy is found mainly below this frequency range. For this reason and the anticipated similarity between the ambient and predicted operational offsite acoustic conditions, the degradation of offsite speech intelligibility is expected to be low for mechanical draft cooling towers. On the other hand, natural draft cooling towers have a considerable fraction of their overall acoustic energy output in the frequency range important in human speech communication.[61] Attenuation of sound by the atmosphere is partially dependent on the frequency of the generated sound. High frequencies are attenuated to a greater extent than low frequencies under identical physical and meteorological conditions and distance traveled by the sound wave. The distances involved between the cooling tower and the offsite environment, the sound power level of the cooling tower and the existing background noise for the Indian Point area are such that little degradation of offsite speech intelligibility is expected from the operation of this tower type. The operational presence of cooling towers can be expected to smooth out the variations in overall nearby offsite sound levels. This would tend to maximize the interference properties of the noise with respect to verbal communication. However, based on the difference between the ambient and predicted operational day-night equivalent sound levels and on information present by EPA[61] (See Figure 5-29), the staff believes that the offsite speech intelligibility would decrease by 5% or less in any offsite area with the exception of the area immediately beyond the northeast site boundary bounded by Lents Cove. This area could experience a speech intelligibility degradation of 5 to 10% for a crossflow natural draft tower, 15 to 18% for a counterflow natural draft tower and 15 to 25% for mechanical draft wet towers.

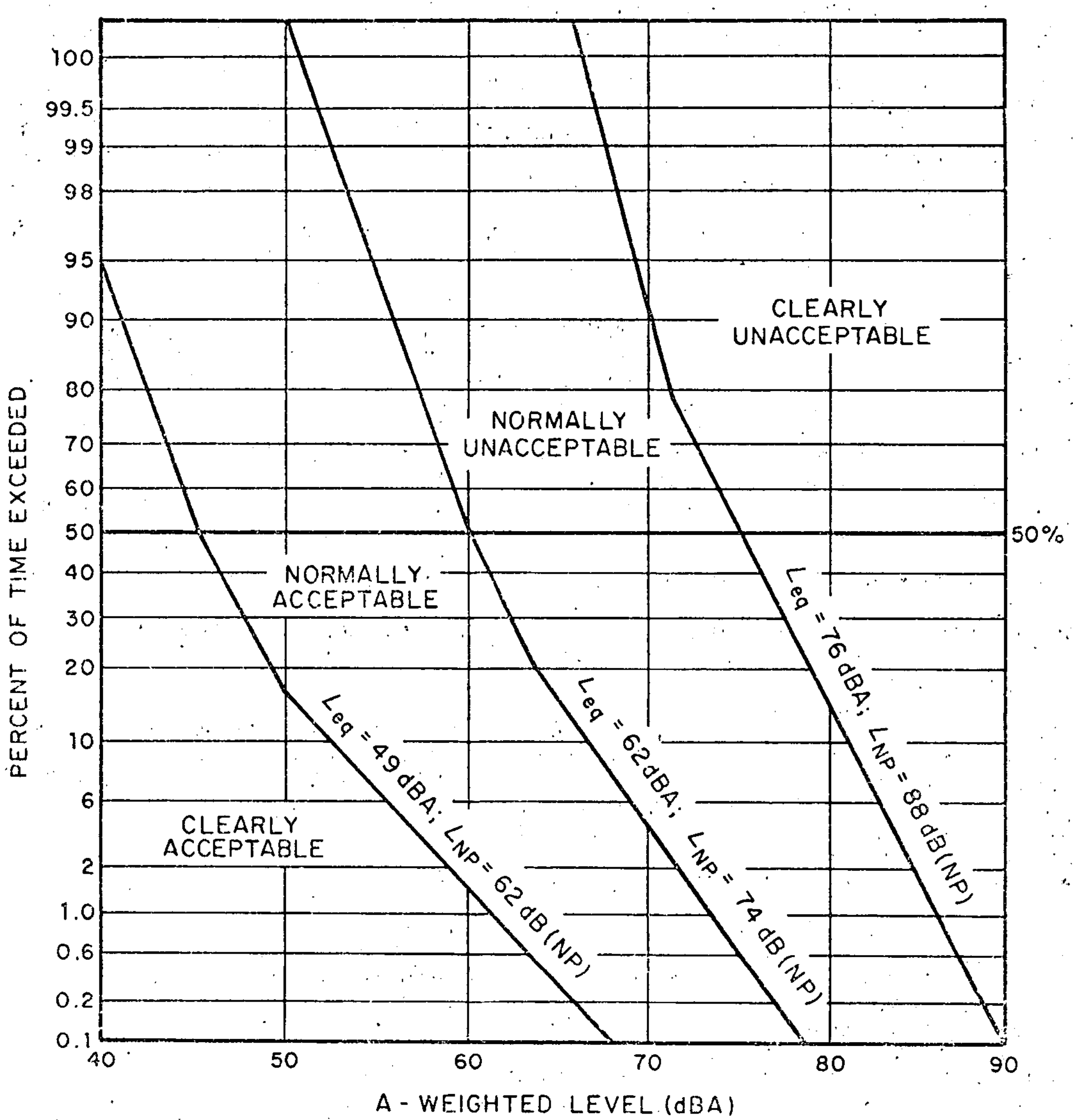
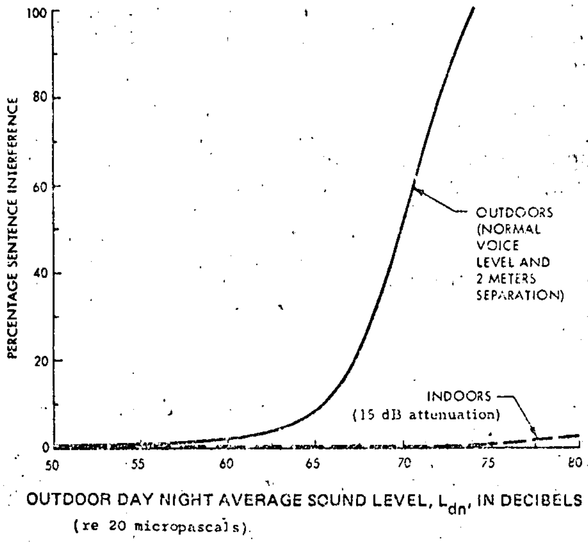


FIG. 5-28 PROVISIONAL CRITERIA RELATING NPL TO COMMUNITY NOISE ACCEPTABILITY

Ref.: T. J. Schultz, "Technical Background for Noise Abatement in HUD's Operating Programs," BBN Report 2005, September 1970.



NOTE: Percentage interference equals 100 minus percentage intelligibility, and L_{dn} is based on $L_d + 3$.

Figure 5-29 Maximum percentage interference with sentences as a function of the day/night average noise level.

Ref.: U.S. Environmental Protection Agency "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." U.S. EPA 550/9-74-004, Appendix D, March 1974.

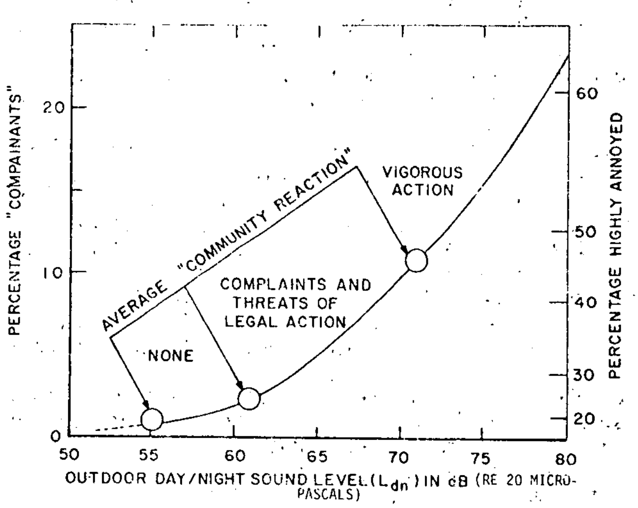


Figure 5-30 Summary of annoyance survey and community reaction results.

Ref: as above.

The staff has also considered the ambient and predicted offsite acoustic environment in terms of the EPA defined day-night equivalent sound level, L_{DN}.[57] This descriptor has been used by the applicant for the Indian Point case. The staff believes that the following two factors will combine to make the L_{DN} determination for the Indian Point vicinity a conservatively high estimator of the operational offsite sound levels.

1. Ambient data inspection reveals that the residentially zoned areas have nighttime (i.e., 10 P.M. - 7 A.M.) sound levels below, but within 10dB of the daytime levels. Because the L_{DN} calculational scheme adds a weighting of 10dB to the nighttime readings, the results would be expected to be noticeably influenced by the nighttime readings.

2. The cooling towers at Indian Point Unit No. 2 are assumed to operate in a constant and continuous mode. Because ambient offsite sound levels are lower during the nighttime period than during the daytime period, the operational acoustic environment will show the influence of cooling tower operation more during the nighttime period than the daytime period.

When comparing the offsite sound levels under this criterion (i.e., L_{DN}) to any recommended limits or other criteria, any violations would necessarily result in an "around-the-clock" type of corrective action. The EPA has established an "identified level" necessary to protect public health and welfare with an adequate margin of safety.[57] This level does not consider technical feasibility or economic costs for its achievement. It has been set at a maximum L_{DN} of 55dBA for outdoor activity interference. The presence of this outdoor level would estimate a maximum indoor L_{DN} of 45dBA after allowing for a typical attenuation via structure walls of from 10 to 15dB. The Buchanan Zoning Ordinance calculated limit of 48dBA would result in a maximum allowed outdoor L_{DN} of 54.6dBA.

Table 5-15 presents the calculated ambient L_{DN} and operational L_{DN} for each tower type based on the predicted sound levels for each measurement location. The maximum increase in L_{DN} on the east side of the Hudson River is predicted for location No-9 and is as follows:

Crossflow NDCT	0.5dB
Counterflow NDCT	1.5dB
Linear MDCT	1.4dB

The largest overall increase in L_{DN} is predicted for the linear mechanical-draft case and would occur on the west side of the river. This increase is predicted to be 3.2dB. (The exact location for this increase is unclear due to grouping of the original data for this side of the river, these data being used as a computational base for the predicted acoustic environment.) These increases will not result in either of the two ambient measurement locations, which do not exceed the EPA "identified level" of L_{DN} = 55dBA, to exceed this limit under operational conditions.

Because much of the existing acoustic environment is above the EPA "identified level" of 55dBA, it is helpful to examine the predicted L_{DN} with respect to various community response criteria. The EPA has prepared a summary of annoyance surveys and community reaction surveys which relate these factors to the day-night equivalent sound level.[57] The basis for the results of the summary was "the disturbance of essential daily activities". The results are reproduced in Figure 5-30. The data indicate that at an L_{DN} = 55dBA there would be less than 1% household complaints but 17% of the people may feel highly annoyed by the noise; that at an L_{DN} = 60dBA 2% of the households may complain and 23% of the people may be highly annoyed; and a L_{DN} above 65dBA could mean that 5% of households may complain and 33% of the people would be highly annoyed.

In another study reported by EPA, an L_{DN} of 62dBA was the average of values reported for community reactions described as follows: "sporadic complaints", "widespread compaints or single threat of legal action", and "several threats of legal action or strong appeals to local officials to stop noise". A mean L_{DN} value of 55dBA was characterized by "no reaction". The data are presented in Figure 5-31. If the Indian Point sampling locations are divided into groups according to the type of environment experienced, the quieter residential areas (i.e., "normal suburban residential" locations nos. 9, 10 and 11) would be placed in one group and the more noisy locations (i.e., "noisy urban residential", those near major transportation arteries, since this is the dominant noise source along with industrial activities; locations Nos. 4 through 8) would be placed in another group. The ambient average L_{DN} for the "normal suburban" areas is 53.5dBA and the operational average L_{DN} ranges from 53.8dBA to 54.4dBA. The ambient average L_{DN} for the "noisy urban" areas is 63.1dBA and the operational average L_{DN} ranges from 63.3dBA to 63.6dBA. These data indicate that widespread changes in community reactions to the operational environment would not be expected.

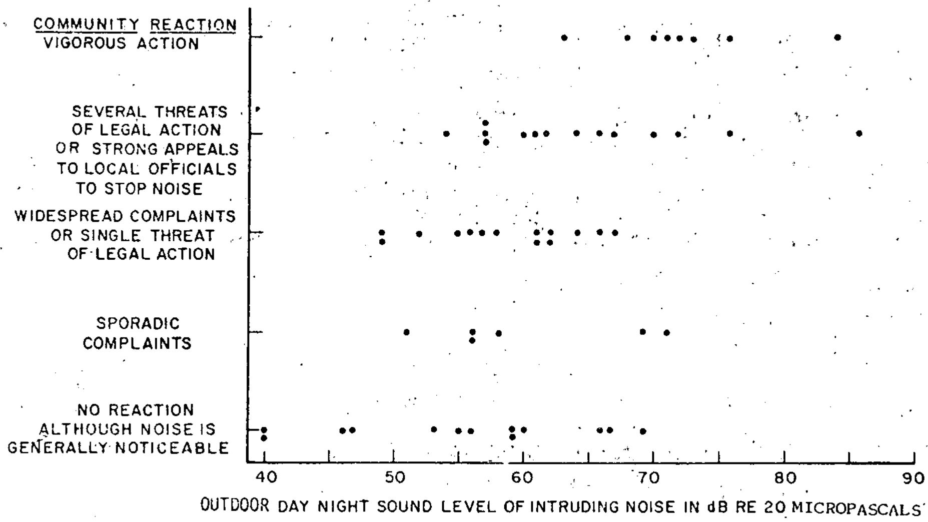


Figure 5-31 Community reaction to intensive noises of many types as a function of the outdoor day/night sound level of the intruding noise

Ref.: U.S. Environmental Protection Agency "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." U.S. EPA 550/9-74-004, Appendix D, March 1974.

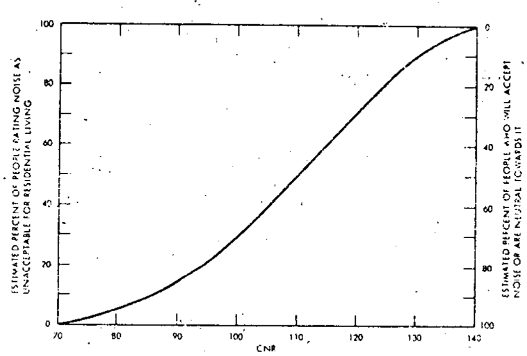


Figure 5-32 Estimates of attitudes to be expected from nonfear provoking noise in residential living areas.

Ref.: K.D.Kryter, The Effects of Noise on Man, Academic Press, 1970.

On the basis of this summary for the Indian Point site area, it is seen that the levels of the ambient and operational acoustic environments are both characterized by "complaints and threats of legal action." The next plateau of adverse community reaction generally occurs at L_{DN} of 70dBA or greater. The predicted operational acoustic environments will in no case cause the landward offsite areas to exceed this criterion.

Finally, a relationship between the Composite Noise Rating (CNR) and the percentage of people rating the noise as unacceptable for residential living has been presented by Kryter.[69] This relationship is presented as Figure 5-32. According to EPA, there is a simple approximation between L_{DN} and CNR: L_{DN} = CNR-35. Using this relationship, inspecting the data from Table 5-15 and using the average L_{DN} figures given above for the normal and noisy sampling locations, the increase in unacceptability, as indicated by Figure 5-32, is approximately 3-5% for any location.

TABLE 5-15

COMPARISON OF AMBIENT AND OPERATIONAL DAY-NIGHT EQUIVALENT SOUND LEVELS IN THE INDIAN POINT UNIT NO. 2 AREA

Sampling Location No.	Ambient L_{DN}, dBA re 2×10^{-5} N/m^2	Operational L_{DN},[1] dBA re 2×10^{-5} N/m^2		
		Crossflow NDCT	Counterflow NDCT	Linear MDCT
4	63.5	63.7	63.9	63.9
5	63	63.1	63.2	63.3
* 6	61.5	61.9	61.7	62.8
* 7	62	62.1	62	62.4
* 8	65.5	65.5	65.5	65.5
* 9	50.5	51.0	52.0	51.9
*10	58	58	58.3	58.3
*11	52	52.4	53.0	53.0
1,2,3	55	55.3	55.8	58.2

[1]Derived by combining the maximum predicted day-night equivalent should level (L_{DN} = 24-hr Leg + 6.4) for each tower type at each sampling location with the respective calculated ambient day-night equivalent sound level.

*Sampling locations within the limits of the Village of Buchanan.

5.2.5.5 Staff's Conclusions on the Assessment of the Offsite Sound Levels

For those locations where reliable data have been collected (i.e., sampling locations Nos. 1 through 11), there are small increases in the various equivalent sound levels predicted for the operational environment, regardless of which cooling tower type is selected. These predicted increases range from below to slightly above the threshold of detectability between the sampling locations of two sounds under practical conditions.[65,70] All of the predicted increases, however, are below the amount considered likely to cause a change in community reaction to environmental noise.[66] A specific activity interference characteristic of the predicted operational acoustic environment has been considered: speech interference. The staff believes that overall, degradation of outdoor verbal communications under normal (as previously defined) conditions will be limited. However, one specific area, the land immediately northeast of the site boundary (previously donated to the Village of Buchanan by the applicant for a recreational park) and bounded by Lents Cove could be impacted to a much greater degree.

Both the applicant's and the staff's analyses predict that the greatest change in offsite acoustic environment would occur in the area immediately northeast of the site boundary, on the Hudson River west of the plant and along the western shore of the Hudson River. These areas are not as heavily populated as other areas around the site and therefore may not be as impacted as other areas.

The staff believes that it is important to note that the possible noise impacts, changes in acoustic environment and changes in resident reactions discussed in this section are not absolute quantities, but are experiential norms and are subject to variation. (Responses to environmental noise are subjective.) The studies referenced in this discussion are generally applicable. However, these surveys were conducted in different locales, with different background environmental noises. Therefore, variations from the exact predicted results should not be considered unusual. The staff believes that the following factors will be important in the community reaction to the operational acoustic environment:

(a) Character of the sound; the cooling tower sound will be audible offsite as "white sound"; that is, it will have a broad spectrum, be free of beats and impulses, will be constant in level and will be continuous. This type of sound can often serve as a mask against other inconstant intruding sounds and can easily blend into the background sounds and be easily acclimated to.

(b) Prior experience with environmental noise; the site is characterized by relatively high ambient sound levels. In addition, major transportation arteries, industrial development and the continuing construction taking place at Indian Point site contribute to the community's noise exposure. Increases in environmental sound levels are often more easily tolerated by communities with previous exposure to high sound levels than those communities with no such experience.

(c) Prior experience with the noise generator; as mentioned above, the construction at the Indian Point site has continued over a substantial period of time. The relationship between the applicant and the community in the past (due to such activities) could greatly influence the future reactions and could cause a reaction to be out of proportion with the relative change in acoustic environment.

(d) Value of the noise source and its alternatives to the community; the community's reaction to the operational acoustic environment versus the reduced effects on the Hudson River fishery will be important in the degree and nature of community reaction.

None of these factors can be analyzed with certainty as to their effect on variations in the community reactions predicted by the staff.

Previous staff experience with the operation of cooling towers at a power plant where an extensive operational sound survey has been carried out is provided by the Vermont Yankee case (NRC Docket No. 50-271). In this situation, an elementary school, located approximately 1300 ft from and facing the louvered face of linear mechanical draft wet cooling towers (2 eleven-celled towers oriented one behind the other in line-of-site from the school), has interior sound levels of 51 to 62dBA regardless of window position, with the school not in session and the plant and towers fully operational. This acoustic environment was in excess of the recommended levels of noise criterion NC-25 of the <u>Industrial Noise Manual</u>, in excess of the "identified level" for this classification for the prevention of activity interference (L_{DN} = 45dBA)[57] and was in excess of the recommended acceptable noise levels for educational classrooms proposed by previous investigators.[57] However, when questioned, the school principal indicated that the cooling tower noise had never been reported as a problem at the school with regard to activity interference. The case history illustrates the variation possible when predicting response to a change in acoustic environment under various criteria.

In summary, the staff analysis has shown that both the ambient and predicted operational acoustic environments are such that a sizeable fraction of the people exposed should judge both environments as unacceptable and would be highly annoyed at such environments. "Complaints and threats of legal action" would also be expected in both environments. The staff is not aware of and the applicant has not indicated the existence of such complaints and dissatisfaction. One possible explanation for this apparent discrepancy is the fact that the environmental noise is essentially non-point source in nature and is what may be considered as "normal" background noise.

The staff analysis indicates that the operational acoustic environment will be less desirable than the ambient acoustic environment. The linear mechanical draft wet towers are predicted to have a slightly greater effect on the offsite sound levels than either the crossflow or counterflow natural draft towers. This effect is expected to be sufficient to make complaints likely in the park land immediately northeast of the site boundary and in the vicinity of Bleakly Avenue (see Figures 5-34, 5-35 and 5-36). The staff does not have any data available describing the sound levels to be expected from the operation of linear mechanical draft wet/dry towers or circular mechanical draft wet towers. However, the staff believes that the offsite sound levels from operation of these towers at Indian Point would not differ greatly from those predicted for the linear mechanical draft wet towers.

5.3 PLUME VISIBILITY AND INTERACTION

5.3.1 Plume Visibility

Since all evaporative systems add large quantities of heat and water vapor to the atmosphere from limited areas per unit of time (the flux density from cooling towers is three orders of magnitude greater than that for once-through cooling systems), they have a higher potential to alter local weather conditions than does a once-through cooling system.

5.3.1.1 Natural Draft Cooling Towers (NDCT)

The primary atmospheric effect created by the operation of NDCT is the generation of visible plumes aloft.[1-13]

Observations at operational NDCT's indicate that the visible plume usually begins inside the tower itself due to condensation of water vapor into the effluent air stream, a process not discussed in most papers and models on cooling tower plumes. The warm, saturated air leaving the tower mixes with cooler, drier ambient air. Because of the nonlinear relationship between saturation vapor pressure and air temperature, the mixture of these two bodies of air will be super saturated and the excess moisture will continue to condense in the form of an elevated visible plume. Because of its vertical momentum and buoyancy, the visible plume usually continues to rise well above the top of the tower where it either disappears due to evaporation or merges with an existing cloud layer.

The size and extent of the visible plumes are dependent on the meteorological conditions and the operating characteristics of the cooling tower. Under certain weather conditions (low temperature, high humidity, moderate wind speed, and a stable atmosphere), the visible plume from a cooling tower may extend several miles. Colbaugh et. al.[10] have measured plumes extending 10 miles (16 km) in Kentucky. Even longer plumes (up to 20 miles) have been observed in Ohio.[6,7] The plume finally becomes invisible after the plume mixes with the drier air in the atmosphere.

The length and other dimensions of the plume such as its plume rise, width, depth, and height of base above ground will depend primarily on existing weather conditions (air temperature, saturation deficit, wind speed, and atmospheric stability). Because the tendency of water vapor to condense increases with lower temperatures, the plumes will be most pronounced during the winter season. Bierman et. al.[13] published the first report on the climatology of plume lengths. They measured the length of the plume from a cooling tower complex for an 1800 MWe fossil plant in Pennsylvania for six months in 1969 (January 31st through July). These pictures were taken during the early morning hours, normally the time of day with the longest visible plumes. It was found that the plumes evaporated completely on 81.5% of all days during the period of study. Of these, 87.3% disappeared within five stack heights or 1625 ft. of the tower, and only 2.6% extended more than 15 stack heights or 4875 ft. The plume merged with an existing overcast on 16.5% of all days. On the remaining days (2.0%), the plumes were classified as "special cases", such as cloud-building. Smith et. al.[6] made 244 plume rise and length measurements at three power plants (Ohio and West Virginia), November 1973 through August 1974. Of these, 163 or 65% disappeared within a half-mile of the plant. Only 16 or 6.5% extended to distances greater than two miles. Later data indicate one plume extended 20 miles.[7]

Ref.: ER-CCC, IP-2, App. G, Fig. 26

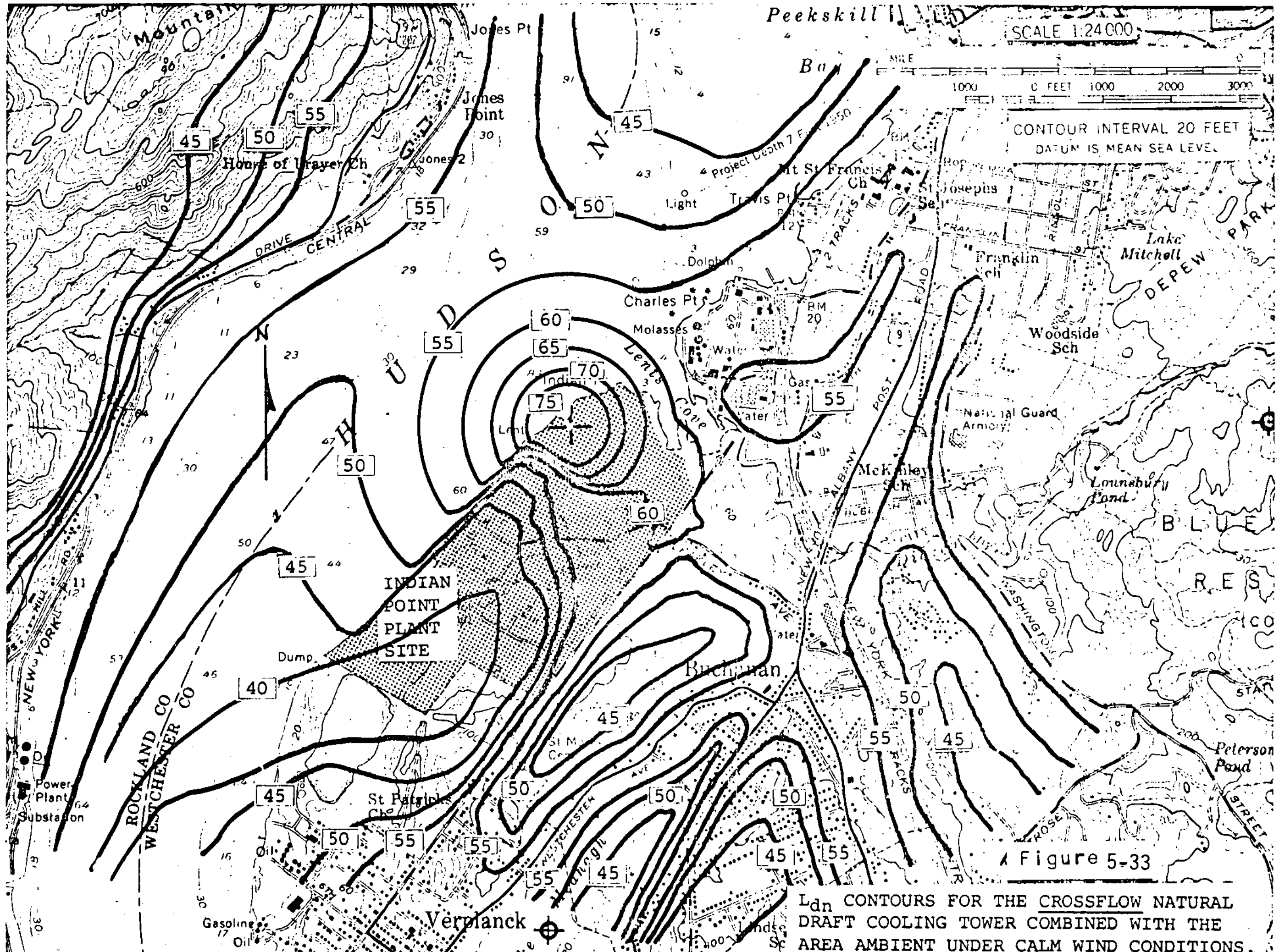


Figure 5-33

L_{dn} CONTOURS FOR THE CROSSFLOW NATURAL DRAFT COOLING TOWER COMBINED WITH THE AREA AMBIENT UNDER CALM WIND CONDITIONS.

Ref.: ER-CCC, IP-2, Fig. 6-14

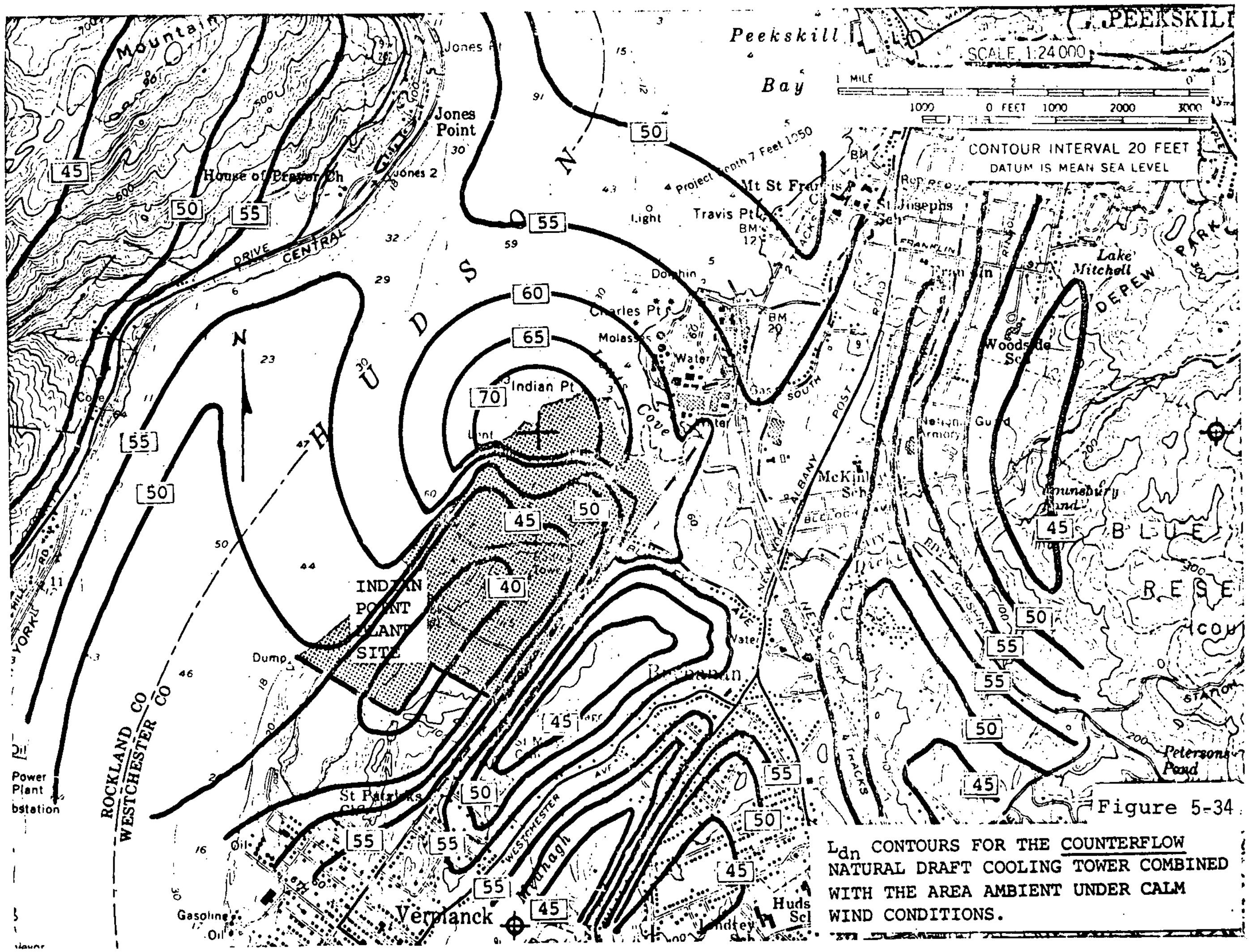


Figure 5-34

L_{dn} CONTOURS FOR THE COUNTERFLOW NATURAL DRAFT COOLING TOWER COMBINED WITH THE AREA AMBIENT UNDER CALM WIND CONDITIONS.

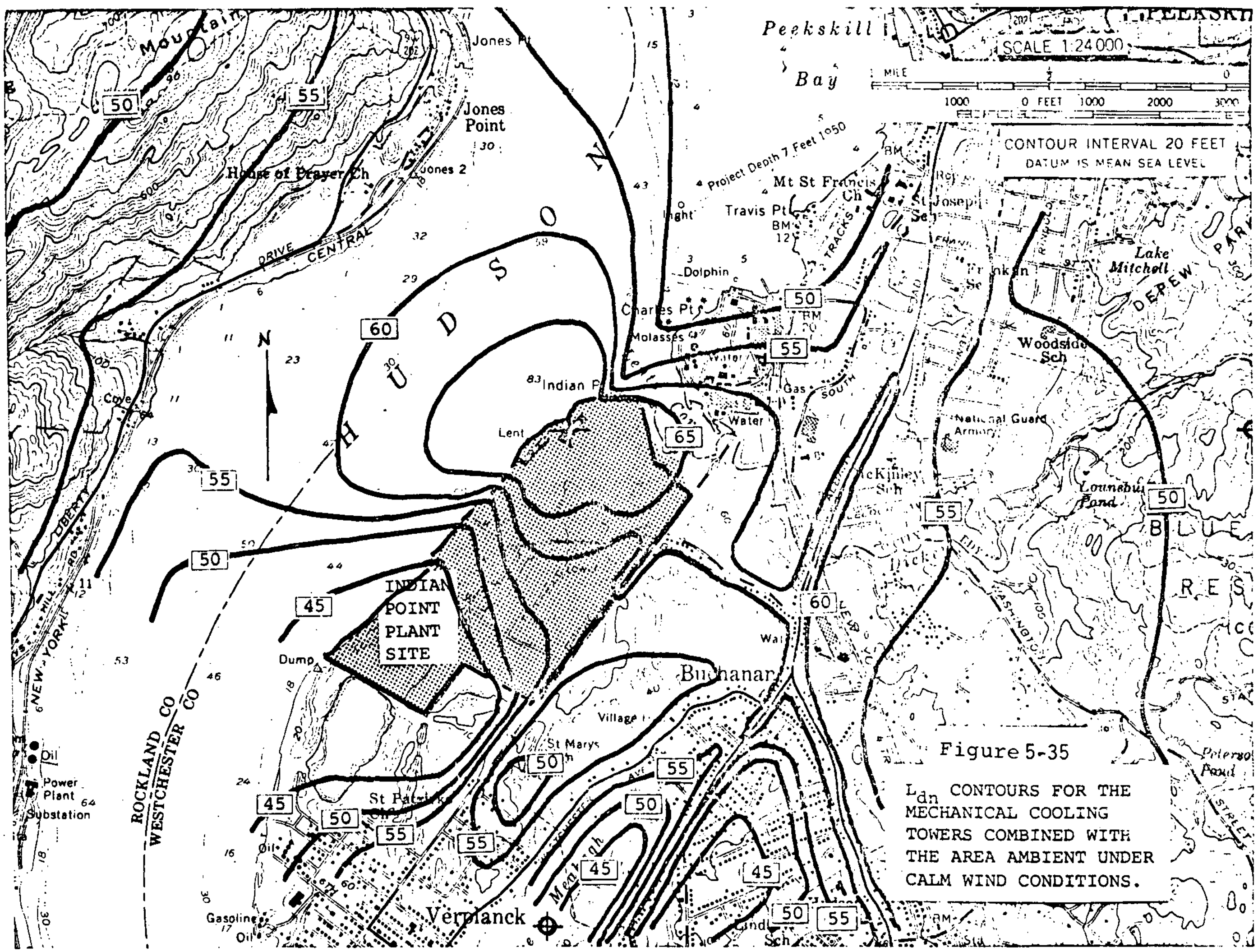


Figure 5-35

L_{dn} CONTOURS FOR THE MECHANICAL COOLING TOWERS COMBINED WITH THE AREA AMBIENT UNDER CALM WIND CONDITIONS.

Ref.: ER-CCC, IP-2, Fig. 6-16

A more complete climatology of plume lengths was made at the coal-fired plant at the Ratcliffe-on-Soar power plant in England.[8,14] This plant uses eight towers to cool four 500-MWe fossil units. Photographs were taken three times (about 0900, 1400 and 1700 local time) each day for one year (Some of the photographs were not usuable due to a variety of problems, including fog and merging of the cooling tower stack plumes). The plume length measurements were subdivided into three length classes and by relative humidity class. On a seasonal basis, 50% of the measured plumes were persistent (that is, longer than 900 meters) in winter, but only 10% in summer. Persistent plumes were not observed at high wind speeds (10 meters per sec (mps) or higher), but neither were high humidities. Moore[8] concludes that relative humidity (measured at 12 meters) is as good a predictor of plume length as can be determined by a complicated equation given in Reference 14.

a. Applicant's Analysis of Plumes

The applicant has used a computer model as described in Appendix A of Appendix B of the ER-CCC, IP-2 to estimate the climatology of plume lengths from the proposed natural draft cooling tower for Unit No. 2.[15,16] Initial plume rise was computed using Eq 4.32' from Briggs.[17] The model used the Halitsky non-condensing plume model for that portion of the plume from the tower exit downwind to the distance where the jet effect disappears.[18] Beyond this point, moisture and heat are dispersed using the usual gaussian dispersion equations. Eleven months (October 1, 1973 through August 31, 1974) of onsite meteorological data plus the design characteristic curves for the proposed tower (Figs. 1a and 1b in Appendix B of Ref. 22) were used in the calculations. This is the same model as that used to compute the frequency of surface fog (see Sec. 5.1.4, below).

The results of these calculations are given in Figs. 2-1 and 2-2 of Appendix B of the applicant's ER-CCC, IP-2 and reproduced here as Figures 5-36 and 5-37 and show the frequency in hours as isopleths of visible plumes extending to distances of 3 and 10 miles, respectively. The figures show that long plumes will be most frequent SSW of the towers, over the bank of the Hudson River.

b. Staff's Analysis of Plumes

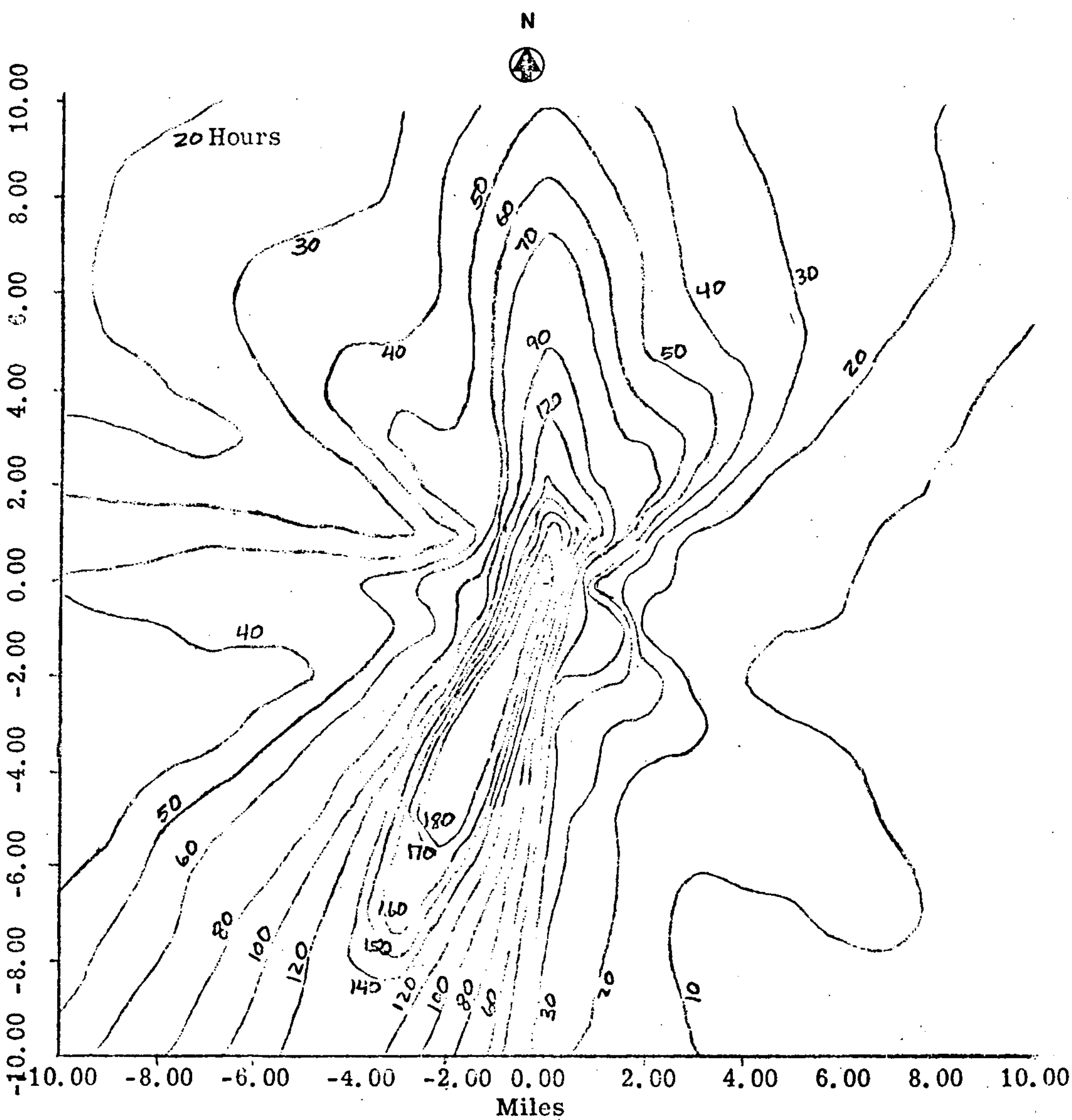
The staff has examined the model and finds that it is a reasonable one, consistent with the state-of-the-art in plume modeling.[19] Based on observed plume lengths in England[2] and in the United States[6,7,10,13] the staff concludes that the model tends to overestimate plume lengths. However, the staff does agree with the applicant that the plumes will never reach the ground and cause surface fogging, that long plumes will frequently occur with periods of natural precipitation or cloud cover, will not have significant adverse effect on the biota of the region, and will not interfere with aircraft flying. The visual impact of the tower and their visible plumes will be the primary adverse impact. See Section 6 for discussion of the visual impact of the tower and plume.

5.3.1.2 Linear Mechanical Draft Cooling Towers (MDCT's)

Mechanical draft cooling towers (MCDT's) are also able to produce long visible plumes.[20-22] As with natural draft towers, the length of the visible plume created by MDCT's will depend on plant factors as well as local weather conditions (including orientation of the long axis of the tower with wind direction). Hanna and Perry[21] report that plumes from a MDCT in Tennessee frequently "formed a stratus deck just below the main stratus deck, and that the man-made cloud could be seen extending tens of kms to the horizon. It would be interesting to see if rainfall were increased beneath this cloud." Under most meteorological conditions, the water droplets in the visible plume will evaporate within a few hundred feet of the towers. Under other conditions (especially periods with low air temperatures, high humidity, perhaps light rain or drizzle, moderate wind speeds and stable atmosphere) the visible plume may extend for several miles. Other than the appearance of an extended plume, the main impact of the elevated plume is the reduction of sunshine reaching the shaded area. The decrease in incoming radiation at ground level is not expected to be significant because of the shifting shadow, the small area affected, and natural conditions (long plumes will frequently occur during periods of natural cloud cover). Visible plumes will be more frequent and longer in winter than during the other seasons, and the minimum size and the lowest frequency of long plumes will occur in summer. On the daily cycle, plumes will be longest just before and after sunrise, and shortest in mid-afternoon.

Figure 5-36

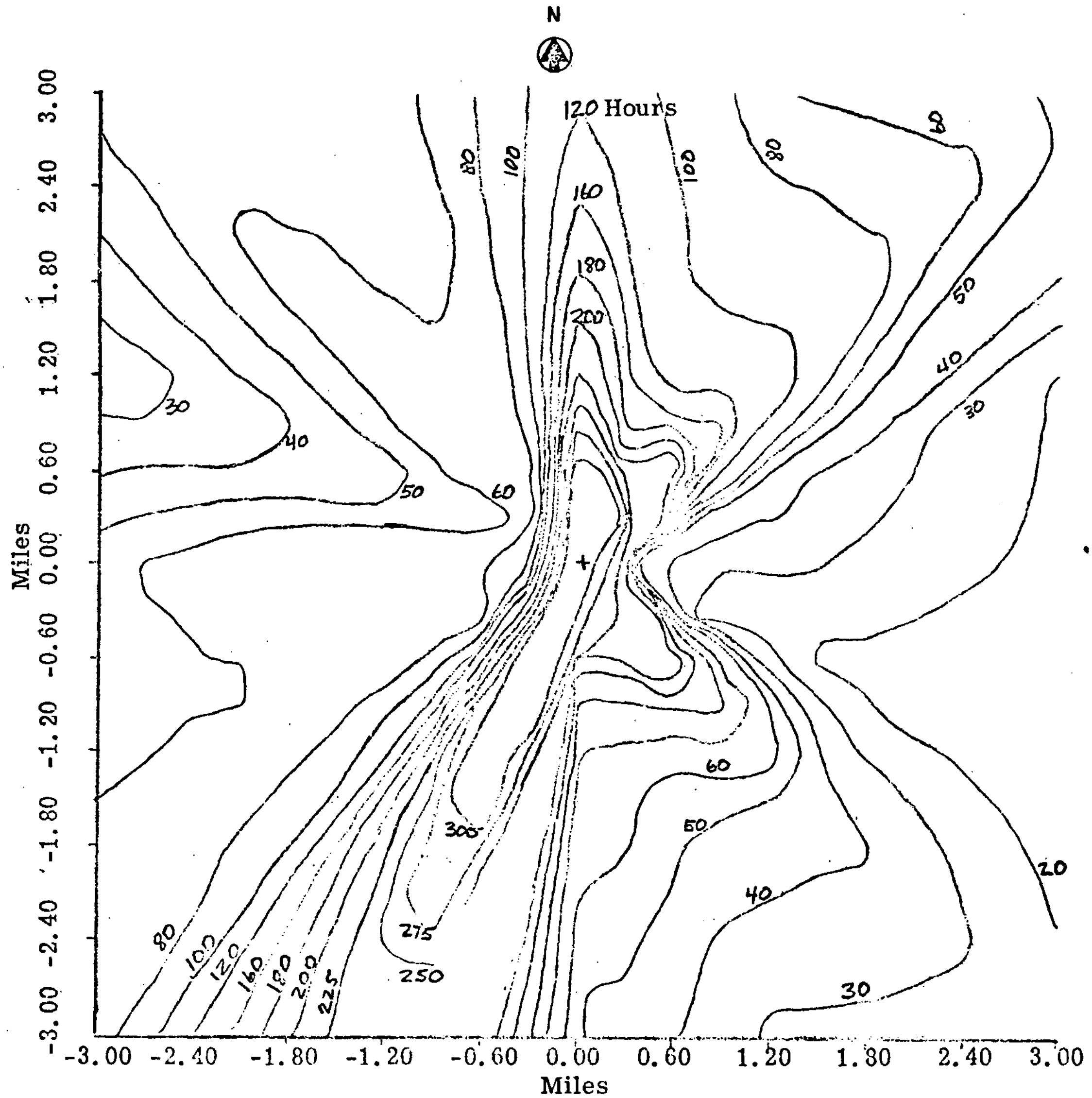
Isopleth of Number of Hours Visible Plume
Extends Distance Downwind in Each Direction
(0-10 miles)
(Period of Record-October 1, 1973 through August 31, 1974)



Ref.: ER-CCC, IP-2, Fig. 2-2, App. B

Figure 5-37

Isopleth of Number of Hours Visible Plume
Extends Distance Downwind in Each Direction
(0-3 miles)
(Period of Record-October 1, 1973 through August 31, 1974)



Ref.: ER-CCC, IP-2, Fig. 2-1, App. B

a. Applicant's Analysis of Plumes

The applicant has developed its own computer model[23] for predicting certain plume effects such as fogging, icing, and drift rates; however, the fogging part of the model also does not compute expected plume lengths. The fogging part of the model uses the Briggs plume rise equation[17] to calculate initial plume rise and the standard Gaussian dispersion equations to compute the increases of surface humidity. The staff considers that the fogging and plume length portions (but not the drift portion) of this model are unrealistic in that aerodynamic effects, the primary cause of surface fog, are ignored. The model also incorrectly assumes that ice and not fog will occur whenever surface temperatures are below freezing and the moisture added by the tower exceeds the saturation deficit. Dense fog is produced under these weather conditions.[24]

b. Staff Analysis of Plumes

The staff has not computed the extent of the visible plume from MDCT's at Indian Point Unit No. 2. However, the staff does expect that visible plumes aloft will be common outside the plant boundary, but these plumes would be shorter and lower and the long plumes would be less frequent that those from NDCT's.

5.3.1.3 Wet/Dry Mechanical Draft Cooling Towers (W/D MDCT's)

The extent of the plume from the wet/dry MDCT will be small compared with a wet MDCT. During weather conditions when a plume will form, the dry section of a wet/dry tower would be in operation. Thus the plume would not be visible upon exit of the warm air from such a cooling tower.

5.3.1.4 Circular Mechanical Draft Cooling Towers (CMDCT)

Longer and higher plumes are expected from circular mechanical draft cooling towers (CMDCT) than from MDCTs of a conventional layout, due to their better aerodynamic shape (less downwash) and more concentrated initial state (less entrainment). The plumes would be shorter and lower than those from NDCTs.

5.3.1.5 Fan-Assisted Natural Draft Cooling Tower (FANDCT)

The plume from a FANDCT would extend approximately the same distances as from a NDCT except the plume would be lower since the FANDCT is shorter than the NDCT. Since the fans would force the plume to rise faster, the plume would tend to rise to higher elevations than those from NDCTs.

5.3.2 Plume Interaction

It has been argued on theoretical grounds that the water droplets in a visible cooling tower plume interact with ambient SO_2 or merge with fossil-fueled stack gases, that sulfuric acid would be formed, and that this "acid mist" would fall to the ground and cause damage to people, vegetation and structures.

Hundreds of wet cooling towers, both natural draft and mechanical draft, have been operating at fossil-fired power plants for decades both in the United States and Europe without any reports of significant adverse impacts due to "acid mist" from cooling tower plumes.[11,25] While the lack of reports of damage is certainly not proof that the phenomenen does not occur (since no systematic observations have been made) the problem is probably a minor one at most. This conclusion is in agreement with a recent EPA report[25] and studies in England.[8]

The statement above does not mean that acid rain or mists due to the use of high-sulfur fuels do not occur or are not a problem. The real question is "How does the presence of a cooling tower plume <u>alter</u> the SO_2 cycle in the atmosphere?" The stack gases from a fossil plant already contain <u>all</u> of the ingredients needed to cause acid droplets and acid rain. In other words, the problem of cooling tower plume interactions is the effect of a perturbation on an existing chemical process that goes on at all fossil-fueled plants, with or without cooling towers. Limited data collected in England indicate the acid droplets observed aloft in a NDCT plume were due mostly to ambient SO_2 entrained into the plume and not due to merging of the plant's stack and tower effluents.[26] Acid drops with pH values between 2 and 3 have been observed in the visible plume (but not at the ground) from a natural draft cooling tower in Pennsylvania.[27]

The nearest large SO_2 source is the oil-fired superheater for Indian Point Unit No. 1, which uses about 0.3% sulfur fuel. The stack gases are discharged from a 390-ft MSL stack. The applicant in its ER-CCC, Suppl. 2, IP-2 has concluded that the plume from the superheater will only infrequently merge with the plumes from either mechanical draft or natural draft cooling towers due to differing heights of release and expected plume rise. The staff agrees with this analysis.

The staff expects no significant changes in the SO_2 cycle as a result of adding wet cooling towers to Indian Point Unit No. 2.

5.4 HYDROLOGIC AND AQUATIC EFFECTS

5.4.1. Depletion of Surface Water and Ground Water Resources

The operation of the cooling towers at Indian Point Unit No. 2 would require a total makeup water supply of about 30,000 gpm which includes about 15,000 gpm for blowdown and 15,000 gpm for evaporation and drift. This supply will come from the Hudson River which has tidal flows of 180,000 gpm. Another 30,000 gpm is used for the service water system. The use of a total amount of 60,000 gpm is more than an order of magnitude lower than the total amount of 870,000 gpm used for the once-through cooling and service water system. As stated on page V-49, of the FES for IP-3 the once-through cooling system involves only a negligible consumption of water within the Indian Point facilities. Although there will be evaporation of 15,000 gpm from the tower, there should be no significant depletion of surface water during operation of Indian Point Unit No. 2 with cooling towers.

Intrusion of salts from the cooling towers drift at Indian Point Unit No. 2 into the surrounding groundwater is considered to be highly improbable. The only public water supply served by wells averages about 550 gpm. A few wells, serving private homes, are still in use along the fringes of the area. Both the Stoney Point system wells and private wells are in unconsolidated deposits with depths ranging from 35 to 50 feet. However, on both sides of the river the ground elevations are considerably higher than at the plant site, and groundwater would flow directly to the river. See page XI-49 of the FES for Unit NO. 2 for further details.

5.4.2. Water Quality Effects

The major change in quality of plant effluent will be the concentration of dissolved substances due to evaporation in the 600,000 gpm of circulating water system. The applicant has tentatively selected a cooling system blowdown rate of 15,000 gpm which would limit the blowdown concentration to twice the intake concentration (concentration factor of two). The purpose is to limit the building of solids in the circulating water and to reduce deterioriation and corrosion of the cooling tower structure. The applicant has shown in its Table 6-2 and 6-3 (ER-CCC, IP-2) the chemical composition of the Hudson River, blowdown with no dilution and blowdown with dilution from the service water system and with 318,000 gpm of the once-through cooling system water from Unit No. 1.

Sulfuric acid, which may be added at a rate of 0.5 gpm (of 66° Baume concentration) for control of scaling in the circulating water system, will increase the sulfate ion concentration in the blowdown by an additional amount which represents about five percent of the total blowdown concentration. This amount is 890 ppm maximum concentration and 254 ppm average concentration of sulfate ion. This increase is negligible relative to variations in ambient concentrations. The ptt of the blowdown will be regulated such as to be kept within applicable water quality standards.

The proposed chlorine concentration of the blowdown (less than 0.5 ppm free available chlorine) is higher than that permitted by the existing Environmental Technical Specifications for the facility (0.5 ppm maximum total residual chlorine concentration). However, the total amount of total residual chlorine released will be much smaller for closed cycle operation. Issuance of a NPDES permit for the new discharge will require that the permitting authority determine whether a limitation which is more stringent that the EPA Effluent Guidelines and Standards, in accordance with 40 CFR Part 423, is necessary to protect aquatic life. The applicant proposes to discharge chemicals at average concentrations for 9 months of the year with only intermittent chlorination treatment. However, during the three summer months, discharges of maximum concentrations of total residual chlorine are expected. Sulfuric acid would also be used primarily during the summer months. See Tables 5-16 and 5-17 for the maximum and average chemical composition of all discharges to the Hudson River along with dilution with the service water and the Unit No. 1 circulating cooling water.

TABLE 5-16

CHEMICAL COMPOSITION VALUES OF BLOWDOWN
CORRESPONDING TO MAXIMUM CHEMICAL CONCENTRATION
OF HUDSON RIVER *1

(Blowdown Rate: 15,000 gpm)

	Conc., mg/l or ppm of X			
Chemical, X	Hudson R.	Blowdown (No Dilution)	Diluted Upper Limit*2	Blowdown Lower Limit*3
Bicarbonate	82	78	81	82
Calcium	82	164	109	85
Chloride	3,020	6,040	4,027	3,145
Magnesium	184	364	245	192
Potassium	60	120	80	62
Silica	4	8	5	4
Sodium	1,700	3,400	2,267	1,770
Sulfate	420	890	577	439
Residual Chlorine	---	< 0.5	< 0.17	< 0.02

*1 Chemical treatment includes intermittent chlorination and sulfuric acid feed of about 1/4 gpm.

Hudson River maximum chemical concentrations is assumed to occur during three (3) summer months.

*2 Dilution flow is 30,000 gpm service water from Indian Point #2.

*3 Dilution flow is 30,000 gpm service water from Indian Point #2 together with 318,000 gpm circulating water from Indian Point #1.

TABLE 5-17

CHEMICAL COMPOSITION VALUES OF BLOWDOWN
CORRESPONDING TO AVERAGE CHEMICAL CONCENTRATION
OF HUDSON RIVER *1

(Blowdown Rate: 15,000 gpm)

	Conc., mg/l or ppm of X			
Chemical, X	Hudson R.	Blowdown (No Dilution)	Diluted Upper Limit*2	Blowdown Lower Limit*3
Bicarbonate	67	134	89	70
Calcium	36	72	48	37
Chloride	74	148	99	77
Magnesium	46	92	61	48
Potassium	17	34	23	18
Silica	--	--	--	--
Sodium	40	80	53	42
Sulfate	127	254	169	132
Residual Chlorine	--	< 0.5	< 0.17	< 0.02

*1 Chemical treatment includes intermittent chlorination. Hudson River average chemical concentrations is assumed to occur nine months annually.

*2 Dilution flow is 30,000 gpm service water from Indian Point #2.

*3 Dilution flow is 30,000 gpm service water from Indian Point #2 together with 318,000 gpm circulating water from Indian Point #1.

5.4.3 Blowdown Impacts

5.4.3.1 Biotic Effects

The results of the applicant's bioassay studies winter and summer conditions of the chemical concentration of the blowdown to be discharged to the Hudson River are given in Appendix F of the ER-CCC, IP-2. The applicant's evaluation of cooling tower blowdown effects on the striped bass and white perch indicates that river salt concentrations of three to four times would be necessary before acute or chronic effects of the blowdown, prior to dilution, could be detected in these species. For both species the incipient LC_{50}, the concentrations at which lethal toxicity to the average fish ceases on chronic exposure, was also 2.8 - 3.6 times the maximum discharge concentration range from the cooling tower. The applicant's plans to operate the cooling tower with a concentration factor of two plus dilution of the blowdown of at least the service water of 30,000 gpm prior to discharge to the river should provide an adequate margin for environmental protection of the aquatic biota in the Hudson River.

By limiting the discharges of total residual chlorine and the pH due to the sulfuric acid added to the circulating water system to be within applicable effluent guidelines on water quality standards, no significant impact on the aquatic biota in the Hudson River would be expected.

5.4.3.2 Thermal Discharges

The blowdown water upon discharge will contain a certain amount of heat which is the product of the flow rate of the blowdown and the enthalpy difference between the blowdown and the river water. The yearly average temperature increase of the blowdown of 15,000 gpm is estimated to be about 14.7F°. Thus, the total heat from the blowdown and from the service wastes amounts to 110 million Btu per hour and 100 million Btu per hour,respectively. In comparison, the once-through cooling dissipates about 7350 million Btu per hour.

5.4.4 Biological Effects of Impingement and Entrainment

Backfitting of the existing once-through cooling system at Indian Point Unit No. 2 to closed cycle operation will require the installation of two new pumps in one of the six existing intake bays to provide a tower makeup flow of about 30,000 gpm (3.5% of open cycle flow). The makeup intake system will be similar to the existing service water system (30,000 gpm) which will remain intact. Predictions based on service water flow indicate that the average velocity through the outer fixed screens and traveling screens for the makeup system would be 0.28 and about 0.43 ft/sec, respectively. For closed cycle operation, if impingement occurs, it will occur at the fixed screens and the traveling screens of the makeup and service water systems. Limited observations to date indicate that impingement is negligible at the service water intake. Because of the similarities of the two systems and the smaller volume of water used and lower screen velocities relative to open cycle cooling, the staff believes that fish loss resulting from closed cycle operation will not result in an unacceptable impact on the river fishery.

Organisms capable of passing through the 3/8-inch mesh screens will be entrained in the makeup and service water systems. Phytoplankton, zooplankton and fish eggs and larvae entrained in the condenser cooling system will experience mortalities approaching 100% because of the extreme temperature and chemical stresses of the condenser cooling system. Some survival of service water entrained organisms is expected. Even 100 percent mortality of entrained organisms including striped bass larvae in both systems would result in absolute losses below levels of concern relative to once-through cooling. The staff concludes that current entrainment and impingement problems associated with once-through operation will be reduced to acceptable levels due to the smaller intake water requirements of cooling tower operation.

5.5 RADIOACTIVE RELEASE EFFECTS

5.5.1 Radioactive Liquid Releases

With the incorporation of the modified radioactive waste treatment at Indian Point Unit No. 2 in February 1975, the total amount of liquid radioactive wastes released to the environment is limited to 5 curies per year from each Unit, excluding tritium. The amount of tritium released is estimated to be 350 curies per year. These values are about half those provided by the applicant in its ER-CCC, IP-2, namely, 9.58 curies per year of liquid radioactive releases, excluding tritium and 608 curies per year of tritium. Without Unit No. 1 in operation, the applicant estimated the percentages of 10 CFR Part 20 limits for tritium releases to be about 0.37% and for other liquid radioactive effluents to be about 9%, assuming dilution from the cooling tower blowdown ranging from 11,847 gpm to 14,111 gpm plus 30,000 gpm service wastes. However, if one uses the staff's calculated annual release of 5 curies of radioactive liquid effluents and the 30,000 gpm of service water and 15,000 gpm of blowdown for dilution, for either Units No. 2 or Unit No. 3 the radiological dose to an individual from fish consumption is estimated to be about 0.82 millirem per year since the annual radiological doses from liquid effluents described in Section V.E.2 of the FES for IP-3 were based on the assumption that only water flows of about 100,000 gpmwere available for dilution in the discharge canal. Dose estimates for swimming in the Hudson River were also found to be less than 0.01 millirem per year for an individual assuming he would swim in the river 1% (1 hr/day for 3 months each year) of the year. Thus all radionuclide concentration will be within the requirements of 10 CFR Part 20 and doses to individuals from ingestion of fish and swimming in the Hudson River resulting from such concentrations will be negligible in comparison with the background levels of radioactivity.

5.5.2 Radioactive Gaseous Releases

Since there will no change in the dilution of the radioactive gaseous releases because of the operation of the cooling tower, there will be no change in the concentration of the radioactive gases released compared with what had been estimated previously. See Section V.E. from the FES for IP-3 for complete discussion of the radioactive effluents released to the environment and the corresponding radiological doses.

5.6 CONCLUSION

Drift

The staff concludes that effects of saline drift on local vegetation are unlikely to have major consequences for any of the cooling towers considered. Risk of damage exists with some towers but it is not of sufficient magnitude or extent to rule out further consideration of any tower type. Differences, nevertheless, exist among tower designs with respect to potential injury to vegetation. In general, the mechanical draft options which include rectangular, circular and wet/dry types have greater risk of damage than the natural draft configurations. The staff ranks the alternatives with respect to the single factor of saline drift in order of least to greatest risk of vegetation damage as follows:

1. Natural draft
2. Fan-assisted natural draft
3. Circular mechanical draft
4. Linear and wet/dry mechanical draft

The risk to vegetation from either of the natural draft towers on or offsite is sufficiently low to be considered negligible. Damage to sensitive onsite vegetation by drift from any of the mechanical draft towers, however, is probable. Small increases in the frequency of natural mortality of sensitive plant species are also possible offsite in a corridor about one-half mile to the east of the river and extending about a mile to the northeast and to the southwest of the mechanical draft tower location. A gradual shift in species composition from salt sensitive to nonsensitive plants within this corridor is a possible long-term effect anticipated. The staff concludes that the natural draft tower is the preferred alternative with respect to the single factor of minimizing risk to vegetation from saline drift but that the magnitude and extent of risk from the other types is not sufficient to rule them out of consideration.

Weather Modification

The staff concludes that the potential for fogging and icing is not sufficiently large to cause rejection of any of the towers considered. Differences among types exist, however, and the staff ranks the towers in the order of least to highest probable effect as follows:

1. Wet/Dry Mechanical Draft

2. Natural Draft

3. Fan-Assisted Natural Draft

4. Circular Mechanical Draft

5. Linear Mechanical Draft

The differences in potential effect among the first three types are sufficiently small to be considered negligible. Only relatively few additional hours of ground fog and ice are expected annually from alternatives 4 and 5.

On the basis of the single factor of fog and ice, the wet/dry mechanical draft tower is the preferred alternative; however, the advantages are not sufficient in the staff's view to override environmental or cost advantages of other tower types.

Noise

When considering the offsite sound levels of various cooling tower options for the Indian Point site alone (i.e., without accounting for ambient noise conditions), the ranking of tower types in order of increasing sound level is as follows:

1. crossflow natural draft cooling towers

2. counterflow natural draft cooling towers

3. linear mechanical draft cooling towers

NOTE: No operational data on sound levels from circular mechanical draft cooling towers or fan-assisted natural draft towers is available to the staff. However, the staff believes that circular mechanical draft cooling towers would be ranked with linear mechanical draft towers and that the fan-assisted natural draft towers would be ranked between the mechanical draft and the other natural draft tower types. No further qualification is presently possible.

Under the criterion mentioned above, all three tower types would violate the provisions of the Buchanan Zoning Ordinance along the northeast site boundary (i.e., along the park boundary). Only the mechanical draft cooling towers would exceed the provisions of the Buchanan Zoning Ordinance at location #6 (Broadway and Bleakley Avenues). The EPA "identified level"[61] for outdoor activity interference of L_{DN} = 55 dBA would be exceeded for all three tower types listed above for the offsite area northeast of the site beyond Lents Cove and encompassing a portion of the Standard Brands property. This "identified level" would also be exceeded in the mechanical draft cooling tower case only, at the intersection of Broadway and Bleakely Avenues, along a portion of Bleakley Avenue and along the west bank of the Hudson River near and to the south of Jones Point.

When the criterion of ambient sound levels plus the operational cooling tower sound levels is applied to the eastern shore of the Hudson River at the sampling locations used by the applicant, no ranking of tower types can reasonably be made, since sound levels are not expected to be noticeably different between tower types. This is true when comparing either the unweighted 24-hr L_{eq} or the weighted L_{DN} equivalent sound level.

Applying the same criterion to the remaining offsite areas yields a ranking of tower types, in order of increasing sound levels as follows:

1. natural draft cooling towers

2. linear mechanical draft wet cooling towers

This ranking was dictated because of higher offsite operational sound levels for the mechanical draft tower on the western shore of the river opposite the site and in the area immediately northeast of the site extending beyond Lents Cove into the Standard Brands property. Although natural draft towers will have lower sound levels in these areas, no further distinction can be made between natural draft tower types.

The EPA "identified level" for outdoor activity interference was equalled or exceeded under ambient conditions for all but two sampling locations. None of the tower types will cause this level to be exceeded in either of the locations where it is not already exceeded. This level is equalled under ambient conditions on the western shore of the river. All three tower types will cause this level to be exceeded on the western shore. Only the mechanical draft tower is expected to noticeably increase the sound level on the western shore of the river.

A threshold for change in community reaction to environmental noise has been estimated by Stevens[70] to be 5dB. Using this criterion for the operational cooling tower case and considering all offsite areas, mechanical draft wet cooling towers would be ranked at or slightly above the threshold and natural draft tower types would be ranked below the threshold. When this criterion is applied to residential areas only, no tower type would be ranked above the threshold.

Environmentally Preferred Alternatives

Major potential environmental effects of cooling towers which were considered are deposition of salt, noise, and fogging and icing. Detailed consideration of these factors in relation to five cooling tower designs leads to the conclusion that none of these factors are likely to be of sufficient magnitude to cause rejection of any of the cooling tower types.

In the interest of minimizing over all environmental impact, however, the staff finds that the natural draft or fan-assisted natural draft towers are the preferred choices. There is little basis for selection between the two alternatives on environmental grounds and the choice could logically be based on engineering, cost, or aesthetic considerations. Any of the low profile mechanical draft towers could be used with only small reductions in overall environmental quality relative to the natural draft designs if engineering, cost, or aesthetic factors presented appreciable advantages over the natural draft types.

REFERENCES FOR SECTION 5

1. D. B. Leason, "Planning Aspects of Cooling Towers," *Atmospheric Environment*, 9:307-312, April 1974.

2. G. Spurr, "The Magnitude of the Problem of Thermal Discharge from Nuclear Power Plants," Report PL. SP/EG/3/72, Great Britain Central Electricity Generating Board, September 1972.

3. G. Spurr, "Meteorology and Cooling Tower Operation," *Atmospheric Environment*, 8:321-324, April 1974.

4. P. Bøgh, "Experience with Combined Wind Tunnel/Plume Model Analysis of the Cooling Tower Impact," In: *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp 265-290, 1975.

5. F. W. Decker, "Probabilities of Cooling System Fogging," In: *Cooling Towers*, Chemical Engineering Progress, New York, Am. Inst. Chem. Eng., pp. 91-93, 1972.

6. M. E. Smith et al., "Cooling Towers and the Environment," Am. Elec. Power Corp., New York, October 1974.

7. M. L. Kramer et al., "Cooling Towers and the Environment," Paper 75-17.3, Air Poll. Cont. Assoc., Boston, Mass., June 1975.

8. D. J. Moore, "Recent CEGB Research on Environmental Effects of Wet Cooling Towers," In: *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp. 205-220, 1975.

9. R. W. Zeller et al., "Report on Trip to Seven Thermal Power Plants," prepared for Pollution Control Council, Pacific Northwest Area, 1969.

10. W. C. Colbaugh et al., "Investigation of Cooling Tower Plume Behavior," in *Cooling Towers*, Chemical Engineering Progress, New York, Am. Inst. Chem. Eng. pp. 83-86, 1972.

11. J. E. Carson, "Meteorological Effects of Evaporative Cooling Towers--Research Needs," paper presented to Am. Soc. Mech. Eng., New York City, November 1974, (Preprint available).

12. R. C. Scorer, *Air Pollution*, Pergamon Press, London, 1968, p. 151.

13. G. F. Bierman et al., "Characteristics, Classification, and Incident Plumes from Large Natural-Draft Cooling Towers," Proc. Am. Power Conf., 33:535-545, 1971.

14. F. R. Barber et al., "The Persistence of Plumes from Natural Draught Cooling Towers," *Atmospheric Environment* 8:407-418, 1974.

15. R. V. Calabrese et al., "Prediction of Temperature and Moisture Distributions in Cooling Tower Plumes," Proc. Am. Meteor. Soc. Symposium on Atmospheric Diffusion and Air Pollution, Santa Barbara, California, pp. 400-407, September 1974.

16. Consolidated Edison Company of New York, Inc, "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Volume No. 2, Appendix B - December 1, 1974.

17. G. A. Briggs, "Plume Rise", AEC Critical Review Series, TID-25075, U. S. Atomic Energy Commission, Washington, D. C., 1969.

18. J. Halitsky, "A Method for Estimating Concentrations in Transverse Jet Plumes," *Air & Water Pollution Int. J.*, 10:821-843, 1966.

19. G. E. McVehil and K. E. Heikes, "Cooling Tower Plume Modeling and Drift Measurement," Report to Am. Soc. Mech. Eng., Contract G-131-1, March 1975.

20. J. H. Meyer et al., "Mechanical-Draft Cooling Tower Visible Plume Behavior: Measurements, Models, Predictions," In *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp. 307-352, 1975.

21. S. R. Hanna and S. G. Perry, "Meteorological Effects of the Cooling Towers at the Oak Ridge Gaseous Diffusion Plant. I. Description of Source Parameters and Analysis of Plume Photographs and Hydrothermograph Records," ATDL Contribution No. 86, Atmospheric Turbulence and Diffusion Laboratory, Oak Ridge National Laboratory, December 1973.

22. S. R. Hanna, "Meteorological Effects of the Mechanical-Draft Cooling Towers of the Oak Ridge Gaseous Diffusion Plant," In: *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp. 291-306, 1975.

23. Consolidated Edison Company of New York, Inc. "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Volume No. 2, Appendix C, December 1, 1974.

24. J. E. Carson, "The Atmospheric Effects of Thermal Discharges Into a Large Lake," *J. Air Poll. Cont. Assoc.*, 22:523-528, 1972.

25. U. S. Environmental Protection Agency, "Development of Document for Prepared Effluent Limitation Guidelines and New Source Performance Standards for the Steam Electric Power Generating Point Source Category," Washington, D. C., March 1974, (see page 562).

26. A. Martin and F. R. Barber, "Measurement of Precipitation Downwind of Cooling Towers," *Atmospheric Environment*, 8:373-381.

27. E. Aynsley, "Cooling-Tower Effects: Studies Abound," *Electrical World*, 42-43, May 11, 1970.

28. Great Britain Central Electricity Generating Board, "Pollution of the Atmosphere by Humidity from Cooling Towers," Report 23/63, 1968.

29. F. A. Huff, "Potential Augmentation of Precipitation from Cooling Tower Effluents," *Bull. Am. Meteor. Soc.*, 53:639-644, July 1972.

30. E. W. Hewson, "Moisture Pollution of the Atmosphere by Dry Cooling Towers and Cooling Ponds," *Bull. Am. Meteor. Soc.*, 51:21-22, January 1970.

31. W. P. Lowry, "Environmental and Effects of Nuclear Cooling Facilities," *Bull. Am. Meteor. Soc.*, 51:23-24, January 1970.

32. F. A. Huff et al., "Effect of Cooling Tower Effluents on Atmospheric Conditions in Northeastern Illinois," Circ. 100, Illinois State Water Survey, Urbana, 1971.

33. A. Junod et al., "Meteorological Influences on Atmospheric Cooling Systems as Projected in Switzerland," in *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp. 239-264, 1975.

34. A. Martin, "The Influence of a Power Station on Climate - A Study of Local Weather Records," *Atmosphere Environment*, 8, 395-400, 1974.

35. W. M. Culkowski, "An Anomalous Snow at Oak Ridge," Tennessee, Monthly Weather Rev., 90(5):194-196, May 1962.

36. E. M. Agee, "An Artifically-Induced Local Snowfall," *Bull. Amer. Meteor. Soc.*, 52, 557-560, 1971.

37. C. L. Hosler, "Wet Cooling Tower Behavior," in *Cooling Towers*, Chemical Engineering Progress, Am. Inst. Chem. Engr., New York, pp. 27-32, 1972.

38. M. E. Smith, et al., "Cooling Towers and the Environment," Am. Elec. Power Corp., New York, October 1974.

39. T. J. Overcamp and D. P. Hoult, "Precipitation in the Wake of Cooling Towers," *Atmospheric Environment*, 5:751-765, 1971.

40. S. R. Hanna, "Fog and Drift Deposition from Evaporative Cooling Towers," *Nuclear Safety*, 15:190-196, 1974.

41. J. V. Wilson, "ORFAD, A Computer Program to Estimate Fog and Drift from Wet Cooling Towers," Oak Ridge National Laboratory, ORNL-TM-4568, January 13, 1975.

42. G. A. Briggs, "Plume Rise", U. S. Department of Commerce, National Bureau of Standards, TID-25075, April 1970.

43. S. R. Hanna, "Meteorological Effects of Cooling Tower Plumes," NOAA Research Laboratories, Oak Ridge, Tenn., ATDL Contribution No. 48, January 1971.

44. G. A. Briggs, "Plume Rise from Multiple Sources," Environmental Research Laboratories, Oak Ridge, Tenn., ATDL Contribution No. 91, March 1974.

45. National Weather Records Center, Federal Office Building, Ashville, North Carolina, 28801.

46. C. L. Hosler, J. Pena, and R. Pena, "Determination of Salt Deposition Rates from Drift from Evaporative Cooling Towers," Dept. of Meteorology, Pennsylvania State University, University Park, Pa., May 1972.

47. F. M. Shofner, et al., "Measurement and Interpretation of Drift Particle Characteristics," in *Cooling Tower Environment--1974*, ERDA Symposium Series, CONF-740302, pp. 427-454, 1975.

48. N. G. Cassidy, "Cyclic Salt and Plant Health," *Endeavour* 30:82(1971).

49. N. G. Cassidy, "The Effect of Cyclic Salt in a Maritime Environment. II The Absorption by Plants of Collodial Atmospheric Salt," *Plant and Soil*, XXVIII (3):390 (1968).

50. J. C., Devine, Jr, "The Forked River Progam: A Case Study in Saltwater Cooling," In: *Cooling Tower Environment--1974.* ERDA Symposium Series, CONF-740302, pp. 509-557, 1975.

51. P. R. Edmonds, H. K. Roffman and R. C. Maxwell, "Some Terrestrial Considerations Associated with Cooling Tower Systems for Electric Power Generation," In: *Cooling Tower Environment--1974.* ERDA Symposium Series, CONF-740302, pp. 393-407, 1975.

52. B. C. Moser, "Airborne Sea Salt: Techniques for Experimentation and Effects on Vegetation," In: *Cooling Tower Environment--1974,* ERDA Symposium Series, CONF-740302,. pp. 353-369, 1975.

53. C. L. Mulchi, and J. A. Armbuster, "Effects of Salt Sprays on the Yield and Nutrient Balance of Corn and Soybeans," In: *Cooling Tower Environment--1974,* ERDA Symposium Series, CONF-740302, pp. 379-392, 1975.

54. H. Roffman, et al. "The State of the Art of Saltwater Cooling Towers for Steam Electric Generating Plants," Westinghouse Electric Corporation, WASH-1244, page 123, 1973.

55. L. Dautrebande and R. Capps, "Studies on Aerosols IX: Enhancement of Initiating Effects of Various Substances on the Eye, Nose, and Throat by Particulate Matter and Liquid Aerosols in Connection with Pollution of the Atmosphere," Arch. Int. Pharmacodyn. LXXXII(4), 1950.

56. L. Dautrebande, J. Shaver and R. Capps, "Studies on Aerosols XI: Influence of Particulate Matter on Eye Irritation Produced by Volatile Irritants and Importance of Particle Size in Connection with Atmospheric Pollution," Arch. Int. Pharmacodyn. LXXXV, No. 1-2, 1951.

57. U. S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requiste to Protect Public Health and Welfare with an Adequate Margin of Safety," EPA Report No. 550/9-74-004, March 1974.

58. *Code of the Village of Buchanan: Chapter 54 Zoning;* November 1970.

59. U. S. Environmental Protection Agency "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances," USEPA Report No. NTID 300.1, December 31, 1971.

60. I. Dyer and L. N. Miller, "Cooling Tower Noise," *Noise Control,* May 1959.

61. R. M. Ellis, "Cooling Tower Noise Generation and Radiation," *Sound and Variation,* Vol. 14, No. 2, 1971.

62. G. A. Capano and W. E. Bradley, "Radiation of Noise from Large Natural-Draft and Mechanical-Draft Cooling Towers," ASME Publication 74-WA/HT-55.

63. L. L. Beranek, *Noise and Vibration Control*, McGraw Hill Book Co., 1971.

64. *Aerospace Recommended Practice, ARP-866*, Society of Automotive Engineers, Inc., August 31, 1964.

65. R. B. Perry, "A Computer Technique for Predicting Noise Levels Inside Large Enclosures," U. S. Army Material Cmd, AD-771-107, December 1972.

66. K. N. Stevens, et al, "A Community's Reaction to Noise: Can It Be Forecast?", *Noise Control*, January 1955.

67. T. J. Schultz, "Technical Background for Noise Abatement in HUD's Operating Programs," BBN Report No. 2005, September 1970.

68. U. S. Environmental Protection Agency, "Effects of Noise on People," USEPA NTID 300.7, December 1971.

69. K. D. Kryter, *The Effects of Noise on Man*, Academic Press, 1970.

70. R. J. Schmitt and E. H. Phelps, "Corrosion Performance of Constructional Steels in Marine Applications," *Journal of Metals*, 22(3): 97-55, March 1970.

71. M. E. Warner and M. R. Lefevre, "Salt Water Natural Draft Cooling Tower Design Considerations," Research Cottrell, Paper presented at Am. Power. Conf., Chicago, Illinois, April 1974.

6. SOCIO-ECONOMIC ANALYSIS OF CLOSED-CYCLE COOLING SYSTEMS

6.1 SCOPE

This chapter summarizes the staff evaluation of direct project costs and social and economic impacts on surrounding communities for the five alternative closed-cycle cooling systems selected for further evaluation. Evaluation of direct project costs considers both front-end capital costs and operation and maintenance costs over the life of each alternative system. Front-end capital costs include all labor, materials, equipment, escalation and financing costs as well as the cost of replacement energy and replacement capacity during down time required to cut-in a cooling tower. Costs over the operating life of each alternative include maintenance and other operating expenses, carrying cost of capital, replacement of deficient energy due to system derating and the carrying cost of capital for replacement capacity needed because of system derating. The evaluation considered likely technical performance and reliability of each system. The analysis of direct project costs is based on information from three sources; the applicant in the ER-CCC, IP-2, vendors of cooling towers, and other operating utilities.

An assessment of potential social and economic impacts from construction and operation of the several closed cycle cooling systems is also presented in the following sections. These potential impacts are associated with modifications in terrestrial or aquatic ecology, physical disruption of human activity during construction and operation, visual aesthetics of towers and plumes, and changes in private and public finances. Impacts have been evaluated in terms of economic and social stress or disruption caused within the surrounding communities.

6.2 DIRECT PROJECT COST AND PERFORMANCE OF ALTERNATIVE SYSTEMS

6.2.1 Overview of Direct Project Costs and Cost Assumptions

The staff's method of computing direct project costs is to evaluate the major costs attributed to alternative CCC towers for IP-2 on both a present discounted value and an annualized value basis. Project costs consist of four major factors: (1) capital cost, (2) annual operating cost, (3) cost of replacing loss of peak generating capability and average annual loss of generating capability, and (4) downtime cost from cooling system tie-in.

1. Capital cost includes the cost of the basic cooling tower components, site preparation, overhead charges, and escalation and contingency factors. Carrying charges (sometimes referred to as an annual fixed charge) on capital investment are incurred over the lifetime of the facility.

2. Annual operating cost is composed of parts replacement, overhaul, labor, etc., associated with the maintenance of efficient cooling system operation.

3. Cost of replacing loss of peak generating capability and average annual loss of generating capability is the capital cost (carrying charges) of additional generating capability (e.g., gas turbines, fossil fired generators, etc.) and the incremental cost of an alternative source of energy required to replace any reduction of net plant capability below its rated capability.

4. Downtime cost from cooling system tie-in is the cost of providing replacement energy during the outage of the generating facility as required in order to switch over from an existing cooling system. Replacement capacity may be required if the outage lowers system generating reserves to an unacceptable level. Downtime cost from cooling system tie-in is unique to IP-2 where a closed cycle cooling system is to be retrofitted to the existing plant.

The staff's methodology for determining the total project costs of alternative cooling towers is to discount the above costs to a present value (i.e., to the year in which the project is to commence) and compute their sum. In addition, it is the staff's policy to express each cost, as well as total project cost, as an annualized value representing a constant stream of revenue requirements over the estimated useful life of the facility. The general formulation of present discounted value and its mathematical relationships to annualized value are as follows:

Present Value:

a. the present value of a future revenue or expenditure, say x, incurred t years from today is

$$x \cdot e^{-rt},$$

where r is the appropriate discount rate or opportunity cost of capital.

b. the present value of a uniform series of future revenues or expenditures, Y, incurred continuously over t years is

$$\int_0^t Ye^{-rt}dt,$$

where r is the appropriate discount rate or opportunity cost of capital.

Annualized Value:

the future series of continuous revenues, over t years, which will recover a present value PV is

$$PV \left(\int_0^t e^{-rt}\, dt\right)^{-1},$$

where r is the appropriate discount rate or opportunity cost of capital.

The staff's current policy is to use a discount rate of 10% in environmental statements for investor-owned utilities based on an average rate of return on new investments.[1]

In the following sections of this Statement the staff presents its cost analysis of alternative closed cycle cooling systems of IP-2. The analysis differs in several respects from the applicant's analysis as presented in its environmental report. Differences primarily arise from the use of different discount rates, years over which costs are discounted and annualized, and costs included in the analysis.

6.2.2 Natural Draft Cooling Tower (NDCT)

6.2.2.1 Highlights of Design Features And Scheduling Important To Cost-Benefit Analysis

See Section 2.4.3.1 for a description of the NDCT.

Significant advantages of NDCT's include: (1) energy from the power plant is not required to move air through the tower, hence, there is no decrease in net plant generating capability resulting from fan operation; (2) noise emanating from the tower is lower than evaporative towers employing mechanically induced draft; and (3) plume discharge high above the base terrain reduces environmental impacts related to increased fogging, icing, humidity, and salt deposition. Significant disadvantages of NDCT's include relatively high capital costs compared to other wet evaporative cooling towers; and visual intrusion on surrounding landscape due to the height and mass of the tower.

The applicant has selected the NDCT as its preferred alternative closed cycle cooling system for IP-2 based on economic and environmental evaluations of linear mechanical draft wet cooling towers, wet-dry cooling towers, and a NDCT. In order to satisfy IP-2 cooling requirements, a single NDCT has been designed by the applicant to meet the following thermal criteria:

Condenser Heat Load	$7,350 \times 10^6$ BTU/hr
Cooling Water Flow	600,000 gpm
Cooling Water Range	25°F
Cooling Tower Approach	17°F
Design Summer Wet-Bulb Temperature	74°F
Design Summer Relative Humidity	55%

The single tower would be 565 feet high and have a base diameter of 460 feet.

A construction schedule for the IP-2 NDCT is shown in Section 4. Planned construction activity is scheduled to begin with excavation on June 1, 1976 and end with completion of closed-cycle cooling system tie-in on December 1, 1979. Seven months outage of IP-2 =rom May 1, 1979 to December 1, 1979 is allowed for cutover from once-through cooling to closed cycle cooling.

6.2.2.2 Cost Estimates

a. Capital Cost

Shown in Table 6-1 is the applicant's estimated capital cost of a NDCT for IP-2. The total estimated capital cost at completion of construction on December 1, 1979 is $84,000,000. The figure was derived by the applicant using an escalation factor of 28.5% for the period 1974 through 1979. The computation of the escalation factor is based on two assumptions concerning the average annual increase in labor and material costs for the six year period. During the years 1974 and 1975, it was estimated that these costs would increase at an average annual rate of 9% and 7% during the ensuing years, 1976 through 1979.[2]

The two major costs associated with the installation of a NDCT at IP-2 are the cooling tower structure itself and the excavation required for the tower and tunnels. Together they account for nearly 29% of the total capital cost, while excavation alone comprises more than 16% of the total $84,000,000. The applicant estimates that excavation for the tower foundation will require the removal of 230,000 cubic yards of soil and rock and an additional 120,000 cubic yards for tunnel piping and sump pits associated with the tower.[3]

Annual carrying charges as a percent of cooling tower capital costs were estimated by the applicant and are provided in Table 6-2. Using an annual carrying charge of 17.7%, the staff calculated the present value capital cost (1976) of a NDCT as follows:

$$e^{-0.10(4)} \int_0^{24} (\$84,000,000 \times 0.177)e^{-0.10t}\, dt = \$90,622,000$$

The corresponding annualized cost is:

$$\$90,622,000 \left(\int_0^{28} e^{-0.10t} dt \right)^{-1} = \$9,651,000$$

b. Annual Operating Cost

Once the closed cycle cooling system is operational, ongoing annual expenditures (annual operating costs) are required to maintain efficient system operation. For a NDCT, these costs are primarily due to the need of maintaining the fill. Based on 1974 industry experience, these costs were estimated by the applicant to be $150,000 per year. Escalating at 5% per year continuous compounding, 1980 annual operating costs were estimated by the staff to be $191,400.

The present discounted value of the annual operating costs for a NDCT is determined by the staff as follows:

$$e^{-0.10(4)} \int_0^{24} \frac{\$191,400\ e^{0.05t}}{e^{0.10t}}\, dt = \$1,794,000$$

The annualized cost of operating expenditures is:

$$\$1,794,000 \left(\int_0^{28} e^{-0.10t} dt \right)^{-1} = \$191,999$$

c. Cost of Replacing Loss of Peak Generating Capability and Energy from Plant Derating

Table 6-3 compares the IP-2 peak generating capability for the present once-through cooling and the proposed NDCT closed cycle cooling system after allowing for increased turbine exhaust

TABLE 6-1

CAPITAL COST ESTIMATE OF
CLOSED CYCLE NATURAL DRAFT WET COOLING TOWER, IP-2

DESCRIPTION	INSTALLATION COMPANY	INSTALLATION CONTRACTOR	MATERIAL	TOTAL
Install cooling tower		10,372,000		10,372,000
Amertap clean system		3,112,000		3,112,000
Furn. install piping (Mech. Sys.)	17,600	2,652,400	4,973,400	7,643,400
Struct., Excavation for tunnels, tower, etc.	20,700	13,778,500		13,799,200
Struct., Excavation for roads, sump pits, etc.		1,020,000		1,020,000
Struct., Excavation for elect. work & assoc.		86,100		86,100
Elec. work assoc. w/tower		620,500	370,300	990,800
Elec. work assoc. w/substation		362,200	815,900	1,178,100
Elec. work lighting power		23,600	140,000	163,600
PROJECT MANAGEMENT & INSPECTION	1,136,800			1,136,800
OTHER DIRECT COST	82,100		110,100	192,200
TOTAL DIRECT COST	1,257,200	32,027,300	6,409,700	39,694,200
12 % ENGINEERING & SUPERVISION				4,763,300
2.75 % ADMINISTRATION & SUPERVISION				1,222,600
26 % PAYROLL TAXES & PENSIONS				1,565,300
15.75 % INTEREST DURING CONSTRUCTION				7,441,200
TOTAL PROJECT COST				54,686,600
28.5 % ESCALATION				15,585,700
20 % CONTINGENCY				13,727,700
TOTAL ESTIMATED COST				84,000,000

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 5-1.

TABLE 6-2

ANNUAL CARRYING CHARGES AS A PERCENT OF CAPITAL COST, NDCT

ITEM	Cooling Tower (At Indian Point No. 2)	Gas Turbine (At Indian Point)
Return[1,2]	7.8120	7.8120
Depreciation[1]	4.1667	4.1667
Federal Income Tax[1]	1.6197	1.3780
Allowance for Replacements	0.5000	0.5000
Insurance	0.3000	0.1000
Property Taxes	2.2000	2.2000
Sub Total	16.5984	16.1567
Gross Revenue Taxes	1.0783	1.0496
Total Fixed Charges	17.6767	17.2063
Total Fixed Charges Rounded	17.70	17.20

NOTES:

1. 24 Year Recovery Period to allow recovery coincident with 30 year book life of Indian Point No. 2.
2. 11.0% discount factor based on Con Edison's estimate of current cost of new capital.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 5-9.

TABLE 6-3

INCREMENTAL REDUCTION OF IP-2 MWe CAPABILITY DURING SUMMER PEAK CONDITIONS[a], NDCT

	Once-Through Cooling	Closed Cycle Natural Draft Wet Cooling Tower
Turbine Exhaust Pressure inches Mercury absolute	1.88	3.6
Net Turbine Capacity, MWe	899	847
Normal Plant Auxiliary Load, MWe	33	33
Incremental Cooling System Load, MWe	0	11
Net Generating Capability, MWe	866	803
Incremental Reduction of Peak Generating Capability, MWe	0	63

[a]Operated at initial guaranteed conditions with a 75°F ambient wet-bulb temperature for closed-cycle cooling and a 75°F river water temperature for once-through cooling.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 3-2.

pressures at elevated cooling water temperatures and consumption of additional energy due to cooling system load. A natural draft cooling tower will result in an incremental reduction of peak generating capability on the order of 63 MWe.

Because the incremental loss of peak generating capability occurs during peak summer demands the applicant believes it poses a potentially adverse effect on system reliability at peak load. In order to maintain system reliability, the applicant has proposed the installation of gas turbines at an estimated cost of $315 per kw in 1979.[4]

For the NDCT alternative, the cost of replacing 63 MWe peak generating capability in mid year 1979 is $19,845,000. Using the carrying charges reported in Table 6-2 for gas turbines, the staff determined the present value (1976) capability cost for a NDCT as follows:

$$e^{-0.10(3.5)} \int_{0}^{24.5} (19,845,000 \times 0.172)e^{-0.10t}dt = \$21,978,000$$

Alternatively, the annualized cost is:

$$\$21,978,000 \left(\int_{0}^{28} e^{-0.10t}dt\right)^{-1} = \$2,341,000$$

The applicant's ten-year planned capacity, load and reserve margins for summer peaks are shown in Table 6-4. Table 6-4 also shows planned reserve margins with and without a CCC system for IP-2. As is indicated, the incremental reduction of IP-2 peak generating capability for any of the five proposed cooling towers (alternative cooling towers are discussed in subsequent sections) results in less than a one percentage point decline of generating reserves. Moreover, reserves remain near 25% of peak load and in 1979 and 1983 above 30% of peak load.

Planned capability, load and reserves for the New York State Interconnected Systems, of which the applicant is a member, are shown in Table 6-5. Relatively high reserve margins during summer peaks indicate that the New York system is prepared to maintain a reliable supply of electricity during individual system peak loads, as well as coincident peak loads.

The staff believes that the applicant's proposed installation of gas turbines to replace reduced peak generating capability (due to CCC) is an uneconomically large commitment of resources. The basis for the staff's conclusion is that the absence of 63 MW to 70 MW of peak generating capability would not lower the reserve to an unacceptable level.

In addition to the loss of peak generating capability, a closed cycle cooling system alternative for IP-2 will cause an average annual loss of generating capability below that which is available with once-through cooling. Average annual loss of generating capability is the result of (1) high turbine exhaust pressures associated with the heat transfer mechanism of closed cycle cooling systems designed for IP-2 and (2) consumption of additional energy to operate closed cycle cooling system equipment. The applicant's estimates of lost generating capability for the proposed NDCT closed-cycle cooling system under annual average wet-bulb temperatures are shown in Table 6-6.

The energy cost is the cost of an alternative source of energy to replace the average annual loss of generating capability. Additional electric energy was reported to be available from within the applicant's system, through the operation of oil-fired steam generators at an incremental system cost of 25 mills per KWH for fuel in 1980.[5] Since this cost is an annual cost incurred over the remaining life of the facility, it is expected to increase with increasing fuel costs. Based on a 1974 summer forecast of fuel prices, the applicant estimates that the cost of number 6 oil will rise at an average annual rate of 4.8%, or approximately 5%, between 1975 and 1980.[6] Thus, an annual escalation rate of 5% was used in deriving the 1980 fuel costs of 25 mills per KWH and for estimating the annual fuel costs for each year thereafter.

TABLE 6-4

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
PLANNED CAPACITY, LOAD, AND RESERVE - SUMMER PROGRAM
(MW)

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Existing Installed Capacity	9936	10159	11032	10898	11090	11130	11096	11082	11019	10899
New Capacity and Retirements										
Indian Point No. 1	-257			257						
Indian Point No. 2					160					
Roseton Nos. 1 and 2	480				-120				-120	
Indian Point No. 3		873		92		68				
Cooling Tower Deratings						-63		-63		
Retirements and Cold Standby			-134	-157		-39	-14			
Total Installed Capacity	10159	11032	10898	11090	11130	11096	11082	11019	10899	10899
Purchased Capacity										
PASNY Astoria No. 6			800	800	800	800	800	800	800	800
PASNY Breakbeen							500	500	500	500
Hydro-Quebec			605	605	605	605	605	605	605	605
PASNY Fitzpatrick	251	186	175	172	161	150	139	128	117	
PASNY MTA Plant 1								700	700	700
PASNY MTA Plant 2									1200	1200
Other - Firm	243	34								
Total Purchases	494	220	1580	1577	1565	1555	2044	2733	3922	3805
Total Capacity Resources	10653	11252	12478	12667	12696	12651	13126	13752	14821	14704
Steam Derating	-106	-94	-101							
New Capacity Resources	10547	11158	12377	12667	12696	12651	13126	13752	14821	14704
Estimated Peak Load	8600	8800	9100	9400	9700	10075	10450	10825	11175	11650
Reserve - MW	1947	2358	3277	3267	2996	2576	2676	2927	3646	3154
- %	22.6	26.8	36.0	34.8	30.9	25.6	25.6	27.0	32.6	27.3
Reserve with Largest Unit Delayed One Year - MW	1947	1485	2477	3010	1963*	2508	2176	2227	2446	3154
- %	22.6	16.9	27.2	32.0	20.2*	24.9	20.8	20.6	21.9	27.3

TABLE 6-4 (Continued)

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
PLANNED CAPACITY, LOAD, AND RESERVE - SUMMER PROGRAM
(MW)

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
% Reserve with incremental reduction of peak generating capability due to CCC										
NDCT (63 MWe)					30.2	24.9	25.0	26.5	32.1	26.8
FANDCT, RMDCT, CMDCT (69 MWe)					30.2	24.9	24.9	26.4	32.0	26.7
WDCT (70 MWe)					30.2	24.9	24.9	26.4	32.0	26.7

*Reserve with Indian Point Unit No. 2 removed from service for cooling tower cut-in.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Systems For Indian Point Unit No. 2, Supplement, Volume No. 1, Table S1-2.

TABLE 6-5

NEW YORK STATE INTERCONNECTED SYSTEMS
PLANNED CAPABILITY, LOAD, AND RESERVE, SUMMER (MW)

Maximum Installed Net Capability	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Thermal (Oil-Fired)	13158	13158	14410	14253	15103	15103	15089	15089	15063	15063	14479	14479	14279	14079	13879	13679
Thermal (Coal-Fired)	3263	3263	3263	3570	3570	3570	5120	5120	5120	5105	5005	5755	5655	6405	6305	6205
Thermal (Cimer)	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32
Thermal (Gas Turbine)	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897
Thermal (Diesel)	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74
Thermal (Nuclear)	2774	3647	3904	3996	4816	5044	5044	7294	9644	11994	11994	13194	15794	17094	19694	22294
Hydro (Conventional)	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026	4026
Hydro (Pumped Storage)	1000	1000	1000	1000	1000	1000	2000	2000	2000	2000	3000	4000	4000	4000	4000	4000
Total Controlled Sources	28192	29065	30574	30848	32518	32746	35282	37532	39556	42191	42707	45457	47757	49607	51907	54207
Capacity Purchases	57	51	811	807	803	800	800	800	800	800	800	800	800	800	800	800
Capacity Sales	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Total Cap. for Load of Area	28099	28966	31235	31505	33171	33396	35932	38182	40506	42841	43357	46107	48407	50257	52557	54857
Coincident Peak Load	21100	22180	23250	24230	25300	26360	27540	28720	29980	31160	32380	33600	34880	36130	37430	38770
Gross Margin	6999	6786	7985	7275	7871	7036	8392	9462	10526	11681	10977	12507	13527	14127	15127	16087
Gross Margin % of Load	33.2	30.6	34.3	30.0	31.1	26.7	30.5	32.9	35.1	37.5	33.9	37.2	38.8	39.1	40.4	41.5

SOURCE: 1975 Report of member electric corporations of the New York Power Pool and The Empire State Electric Energy Research Corporation pursuant to Article VIII, Section 149-b of the Public Service Law, Volume 2, Appendix D.

TABLE 6-6

AVERAGE ANNUAL LOSS OF IP-2 GENERATING CAPABILITY[a], NDCT

	Once-Through Cooling	Closed Cycle Natural Draft Wet Cooling Tower
Net Turbine Capacity, MWe	906	892
Normal Plant Auxiliary Load, MWe	33	33
Cooling System Load, MWe	0	11
Net Generating Capability, MWe	873	848
Average Annual Loss of Net Generating Capability, MWe	0	25

[a]Operated at initial guaranteed conditions with yearly average conditions determined by a 65°F wet-bulb temperature during a three month summer and a 35°F wet-bulb temperature during the remainder of the year.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume 1, December 1, 1974, Table 3-3.

The staff's calculations of the present value (1976) and annualized energy cost associated with a natural draft cooling tower for IP-2 are given below. A plant capacity factor of 76.2% was used based on 8 weeks scheduled maintenance and a mature outage of 10%.[7]

Present value energy cost:

$$e^{-0.10(4)}\int_{0}^{24} (25{,}000 \text{ kw} \times \$0.025 \text{ kwhr} \times 8760 \text{ hrs.} \times 0.762)\ \frac{e^{0.05t}}{e^{0.10t}}\ dt$$

$$= \$39{,}085{,}000$$

Annualized value energy cost:

$$\$39{,}085{,}000 \left(\int_{0}^{28} e^{-0.10t}dt\right)^{-1} = \$4{,}162{,}000$$

d. <u>Downtime Costs From Cooling System Tie-in</u>

The applicant anticipates a seven month outage of IP-2 from May 1, 1979 to December 1, 1979, as a result of the tie-in to closed-cycle cooling. Since IP-2 requires two months annually for refueling, the staff concludes that by utilizing the tie-in period for refueling, the operating loss is actually five months or 3,672 operating hours. Since IP-2 is currently rated at 873 MWe, net plant generating capability, the maximum loss of power due to the IP-2 five month outage is 873 MW X 3,672 hr. or approximately 3,206 X 10^6 kWh.

Replacement energy is reported by the applicant to be available through the operation of existing base load capacity on the Consolidated Edison system in combination with purchased power from neighboring systems. Average cost of replacement energy is reported to be 25 mills per kWh. The incremental production cost of replacing the lost energy takes into account the operating cost savings realized with IP-2 out of service. The total cost of replacement energy is determined by the staff as follows:

Maximum energy loss: 873 MW x 3,672 hr.

Incremental production cost - $/kWh

Average cost of replacement energy	$0.02500
IP-2 operating cost	0.00273
Incremental cost (rounded off)	$0.0223

Total cost of replacement energy

$$873 \text{ MW} \times 3,672 \text{ hr} \times \$0.0223 = \$71,487,000$$

Present value (1976)

$$\$71,487,000 \, e^{-0.10\,(3.5)} = \$50,680,000$$

Annualized value (1976 - 2003)

$$\$50,680,000 \left(\int_0^{28} e^{-0.10t}\, dt\right)^{-1} = \$5,396,000$$

In addition to replacement energy, the applicant maintains that the outage of IP-2 poses a potentially adverse effect on system reliability and proposes the installation of additional capacity equivalent to IP-2 capacity. With IP-2 out of service for tie-in to closed cycle cooling, the applicant reports that its planned generating reserve margin for the 1979 summer will decrease from 30.9% to 20.2% of estimated peak load (See Table 6-4). As a conservative estimate of the replacement capacity cost, the applicant considers the installation of 900 MW of gas turbines at \$315 kW (installed in 1979); this includes the installation of gas turbines to replace the loss of peak generating capability due to operation of a closed cycle cooling system (See Section 6.2.2.2(c)). The applicant's estimated cost of replacement capacity is \$265,000,000, including escalation.

The applicant also considers purchased power as an alternative to replacement capacity, but dismisses it as a feasible alternative based on the uncertainties and contingencies associated with such a large amount of capacity purchases.

The staff disagrees with the applicant's assessment of the need for replacement capacity during the 1979 summer tie-in. Reliability studies conducted by the New York Power Pool (NYPP), of which the applicant is a member, "determined that a reserve margin of approximately 18% on an individual company basis..." is necessary to maintain its one day in ten year loss of load criterion. Therefore, based on the NYPP reserve criterion of 18% and the applicant's reported 20.2% reserve margin, the staff does not support the applicant's proposed installation of replacement capacity during the IP-2 outage. Although the staff recognizes the significant decrease in planned generating reserves as a result of the outage, it believes that such a large commitment of resources to meet a relatively short-term outage is not economically warranted and should not be included as a cost of tie-in to closed cycle cooling.

The staff also considers the possibility that the construction schedule, hence tie-in period, for a closed-cycle cooling system may be postponed to allow for a winter outage of IP-2 (See Section 4.1 for a discussion of licensing actions). A winter tie-in would still require replacement energy as discussed above; it would not require replacement capacity. The applicant's system is a summer peaking system which maintains high reserve generating capacity during the winter months. For example the applicant reports planned generating reserves above 80% of its winter load for the years 1978 through 1984. However, the applicant reports that a winter tie-in could adversely affect the performance of some generating units if the IP-2 outage requires maintenance delays.

6.2.3 Fan-Assisted Natural Draft Cooling Tower (FANDCT)

6.2.3.1 Highlights of Design Features and Scheduling Important to Cost-Benefit Analysis

In the applicant's assessment of alternative closed cycle cooling systems for IP-2, a FANDCT was briefly discussed but excluded as a technically feasible alternative for detailed economic and environmental evaluation. The staff investigated FANDCT's, and concluded that they had potential economic and environmental advantages over alternative closed cooling systems. The applicant, in response to a staff request,[8] submitted a supplement to its cooling tower report which included preliminary estimates of the dimensions, costs, and operating performance of a FANDCT applicable to IP-2.[9] The applicant also indicated a continuing effort to obtain additional information leading to a more complete evaluation of a FANDCT. However, since the information was not yet available through the applicant, the staff obtained additional information from electric utility personnel and vendors experienced in the engineering design, economic analysis and environmental analysis of alternative cooling systems for electric generating facilities.

See Section 2.4.3.4 and references 10 and 11 for description of the FANDCT.

Relative to linear and circular mechanical draft cooling towers, the FANDCT's high velocity discharge of the plume above the base terrain eliminates problems associated with recirculation and interference and reduces environmental effects related to salt-deposition, increased ground-level fogging and icing.

In order to meet IP-2 cooling requirements, the staff estimated that a single FANDCT, roughly 280 feet high and 300 feet in diameter at the base, would be needed. The tower location could be similar to the proposed natural draft cooling tower location, but because of its lower profile, closer proximity to the safety related structures would be possible. Fewer construction materials and less excavation involved in a FANDCT may also lead to potential savings in construction time as compared to a natural draft tower. However, the applicant estimates that approximately one year would be required for engineering design and, in effect, total time to operation of a FANDCT might be longer than for a NDCT.

6.2.3.2 Cost Estimates

a. Capital Cost

The staff's capital cost estimate for a single FANDCT is shown in Table 6-7 using the parameters and methodology employed by the applicant for a natural draft cooling tower (Table 6-2). If the same construction schedule as a natural draft tower could be realized, the staff's evaluation shows a total estimated cost to be $75,018,000, where the tower structure cost was estimated to be approximately $6,000,000. All direct costs, except the cooling tower structure, were assumed to be the same as a natural draft cooling tower. However, since the base diameter of FANDCT is about 2/3 the natural draft tower base and closer proximity to safety related structures is possible, there exists potential savings with regard to excavation, piping, and electrical work over that shown in Table 6-7. Without detailed engineering estimates, these potential savings cannot be quantified.

The present discounted value (1976) of the FANDCT capital cost was determined by the staff to be $80,932,000. The appropriate annualized value is $8,619,000.

b. Annual Operating Cost

Annual operating costs for a FANDCT are expected to be considerably higher than a comparable natural draft tower because maintenance of multiple fans in addition to maintenance of tower fill is required. The staff estimated that a FANDCT for IP-2 would contain 28, 138 horse-power, motor-driven fans around the periphery of its base. The 1974 annual operating costs were approximated to be $262,000, of which $150,000 is due to maintenance of the tower fill and $112,000 for fan maintenance or $4,000 per fan per year. Annual operating costs at the outset of closed cycle cooling operation on December 1, 1979 were calculated using a 5 percent rate of escalation and found to be $336,000. The present discounted value (1976) and annualized value of annual operating costs over the facility's lifetime are $3,152,000 and $336,000, respectively.

c. Cost of Replacing Loss of Peak Generating Capability and Energy From Plant Derating

FANDCT's incremental reduction of IP-2 peak generating capability due to increased turbine exhaust pressure and cooling system auxiliaries is estimated by the staff to be 69 MWe; 55 MWe due to loss of turbine capacity and 14 MWe due to cooling system auxiliaries. Replacement of lost IP-2 capability by installing gas turbines at $315 per KW in 1979 results in an incremental capital cost of $21,735,000. The present value (1976) and annualized capability cost attributed to the FANDCT are $24,071,000 and $2,564,000,respectively.

Annual average derating of IP-2 for a FANDCT was reported by the applicant in its supplement, August 6, 1975, to be 30 MWe. Thirty MW's are capable of being replaced by the additional operation of oil-fired steam generators within the applicant's system at incremental generating costs of 25 mills per KWH in 1980. Using a 76.2 percent plant capacity factor and a 5 percent rate of escalation on fuel costs, the staff determined the FANDCT present value (1976) energy costs to be $46,902,000. The annualized energy cost is $4,994,000.

TABLE 6-7

CAPITAL COST ESTIMATE OF CLOSED CYCLE FAN ASSISTED
NATURAL DRAFT COOLING TOWER, IP-2

Component Description	Cost Estimate
Cooling tower structure, installed	6,000,000[a]
Amertap clean system, installed	3,112,000
Piping, installed	7,643,000
Excavation for tunnels, tower, roads, sump pits, elect. work, etc.	14,905,300
Electrical work associated with tower	990,800
substation and lighting power	1,341,700
Project management and inspection	1,136,800
Other direct costs	192,200
Total direct costs	35,321,800
12% engineering and supervision	4,239,000
2.75% administration and supervision	1,086,000
26% payroll taxes and pensions	1,384,000
15.75% interest during construction	6,620,000
Total project costs	48,650,000
28.5% escalation	13,865,000
20% contingency	12,503,000
Total estimated cost	75,018,000

[a]Staff's estimate based on the cost of two smaller FANDCT's (210 feet high and 270 feet in base diameter) reported by the applicant, Supplement, Volume No. 1, August 6, 1975, p. 43.

d. Downtime Costs from Cooling System Tie-In

Except for a later construction start-up time, the construction schedule for a FANDCT could be similar to the natural draft cooling tower schedule outline in Section 4. It appears improbable for the IP-2 summer outage during 1979 to be avoided if the FANDCT were to become operational on December 1, 1979. Therefore, the seven-month IP-2 outage resulting from the tie-in of a closed-cycle FANDCT system would result in a downtime cost for replacement energy similar to that reported for a natural draft cooling tower in Section 6.2.2.2(d).

6.2.4 Linear Mechanical Draft Cooling Tower (LMDCT)

6.2.4.1 Highlights of Design Features and Scheduling Important to Cost-Benefit Analysis

A rectangular mechanical draft cooling tower (LMDCT) is a low profile tower composed of linear fan modules that are constructed of either concrete or specially treated wood. Like the natural draft cooling towers, LMDCT's cool condenser cooling water by evaporative and convective heat transfer to the air. However, unlike the natural draft cooling towers, LMDCT's depend on motor-driven fans to force air through the tower structure. The number and size of fans contained in a LMDCT determine the size of the tower and depend on the particular cooling duties required of the tower. For IP-2 cooling requirements and the thermal criteria listed in Table 6-8, the applicant has evaluated two LMDCT's, each measuring 520 feet long, 75 feet wide, and 68 feet high and containing 13 fans with 200 horsepower motors. See also Section 2.4.3.2 for a description.

TABLE 6-8

THERMAL DESIGN CRITERIA FOR LINEAR MECHANICAL
WET AND WET-DRY COOLING TOWERS, IP-2

Condenser heat load	$7,350 \times 10^6$ BTU/hr
Cooling water flow	600,000 gpm
Cooling tower range	25° F
Cooling tower approach	17° F
Design summer wet-bulb temperature	74° F
Design summer relative humidity	55%
Design winter dry-bulb temperature	20° F
Design winter relative humidity	80%

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 3-1.

Advantages of the LMDCT's, relative to a single natural draft cooling tower, include: (1) small visual changes in surrounding landscape due to its low profile, (2) lower capital costs and (3) less dependence on ambient wet-bulb temperatures for cooling tower performance, hence, better thermal control than natural draft cooling towers. Important disadvantages associated with LMDCT's are (1) relatively high maintenance expenses, (2) appreciable power consumption due to fan operation, (3) greater plant deratings resulting from increased turbine exhaust pressures, (4) noise emissions generated by fan blade movement and fan motors, (5) reduced thermal performance due to the occurrence of recirculation and interference under certain meteorological conditions, and (6) more potential environmental problems related to increased ground-level fogging, icing, and humidity and greater salt deposition rates.

The applicant estimates that construction of two LMDCT's would take approximately three years; six months less than the applicant's proposed single natural draft tower. However, the applicant has indicated that in the event LMDCT's are recommended, construction activity could not commence until December 1, 1976, 6 months later than construction start-up for a natural draft tower. Thus, in allowing time to tie-in LMDCT's into the IP-2 facility, the applicant would be ready to operate with closed-cycle LMDCT's on December 1, 1979 (see construction schedule for a natural draft cooling tower listed in Section 4 for comparison).

6.2.4.2 Cost Estimates

a. Capital Costs

Estimates for the capital cost of two linear mechanical draft cooling towers for IP-2 were provided by the applicant and are shown in Table 6-9. Of the total estimated cost of $80,000,000, $7,000,000 is attributed to the two cooling tower structures and $15,546,000 is due to excavating work for towers, tunnels, electrical work, etc. Excavation is estimated to involve the removal of 175,000 cubic yards of rock and soil, where 75,000 cubic yards are required to be excavated for the tower foundation and 100,000 cubic yards for tunnel piping and sump pits. The present discounted value (1976) of the capital cost estimate is determined by the staff to be $86,307,000. The annualized value is $9,192,000.

TABLE 6-9

CAPITAL COST ESTIMATE OF CLOSED CYCLE LINEAR-MECHANICAL DRAFT WET COOLING TOWERS, IP-2

DESCRIPTION	INSTALLATION COMPANY	INSTALLATION CONTRACTOR	MATERIAL	TOTAL
Install cooling towers		7,000,000		7,000,000
Install Amertap clean system		3,112,000		3,112,000
Furn., install piping (mech sys)	27,000	2,812,400	4,963,300	7,802,700
Struct., excavation for tunnels, tower, roads, sump pits, etc.	20,000	15,164,000		15,184,000
Struct., excavation for elect. work & assoc.		362,000		362,000
Elect. assoc. w/tower		831,500	496,200	1,327,700
Elect. work assoc. w/substation		485,300	1,093,300	1,578,600
Elect. work lighting power		31,600	187,600	219,200
PROJECT MANAGEMENT & INSPECTION	975,000			975,000
OTHER DIRECT COST	177,100		141,400	318,500
TOTAL DIRECT COST	1,199,100	29,798,800	6,881,800	37,879,700
12 % ENGINEERING & SUPERVISION				4,545,600
2.75 % ADMINISTRATION & SUPERVISION				1,166,700
26 % PAYROLL TAXES & PENSIONS				1,493,600
13.5 % INTEREST DURING CONSTRUCTION				6,086,600
TOTAL PROJECT COST				51,172,200
30.41 % ESCALATION				15,561,500
20 % CONTINGENCY				13,266,300
TOTAL ESTIMATED COST				80,000,000

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 2, December 1, 1974, Table 5-2.

b. Annual Operating Cost

Annual operating costs for two LMDCT's each containing 13 cells were estimated by the applicant to be $442,000 per year in 1974.[12] Maintenance of the fill was reported to cost $13,000 per year per cell, while maintenance of fan motors is $4,000 per year per cell.

The present discounted value of operating costs is calculated by the staff to be $5,317,000, allowing a 5% rate of escalation on materials and labor. Annualized operating cost for two LMDCT's is approximately $566,000.

c. Cost of Replacing Loss of Peak Generating Capability and Energy from Plant Derating

Table 6-10 shows the applicant's estimated loss of IP-2 peak generating capability due to two LMDCT's to be 69 MWe; 55 MWe resulting from increased turbine back pressures during high ambient wet-bulb temperatures and 14 MWe due to incremental cooling system load. The replacement of lost capability through the installation of 69 MWe of gas turbines at $315 per kW in 1979 results in an incremental capital cost of $21,735,000. The present discounted value (1976) capability cost attributed to LMDCT's is estimated to be $25,071,000. The corresponding annualized cost through the year 2003 is $2,564,000.

Average annual loss of IP-2 generating capability as estimated by the applicant is shown in Table 6-11. The loss of 38 MWe is assumed to be replaced by the additional operation of existing oil-fired steam generators within the applicant's system at an incremental generating cost of 25 mills per kWh in 1980. Using a 76.2% capacity factor and a 5% rate of escalation on fuel costs, the present value (1976) and annualized energy cost are calculated by the staff to be $59,409,000 and $6,326,000, respectively.

d. Downtime Costs From Cooling System Tie-In

Downtime costs due to the tie-in of two LMDCT's into the IP-2 system are identical to the natural draft alternative discussed in Section 6.2.2.2(d).

6.2.5 Circular Mechanical Draft Cooling Tower (CMDCT)

6.2.5.1 Highlights of Design Features Important to Cost-Benefit Including Discussion of Limitations of Information Base

The applicant did not consider the feasibility of circular mechanical draft cooling towers (CMDCT) as an alternative closed-cycle cooling system for IP-2. An investigation by the staff to determine the feasibility of CMDCT's for IP-2 indicated that in addition to the three alternatives considered by the applicant, CMDCT's and fan assisted natural draft cooling towers (discussed in Section 6.2.3) are viable alternatives which need to be examined more closely. In response to a staff request[13], the applicant submitted a supplement to its environmental report which provided preliminary estimates as to the dimensions, costs, and operating performance of CMDCT's for IP-2.[14] The staff conducted an independent analysis—incorporating the data submitted by the applicant along with its own data base. The staff discussed CMDCT's with a vendor of CMDCT's and electric utility personnel experienced in the engineering design, economic analysis, and environmental analysis of alternative cooling systems for electric generating facilities.

The CMDCT is a relatively new design among evaporative closed cycle cooling systems, incorporating (1) the round or circular shape of the hyperbolic natural draft cooling tower, and (2) the mechanically induced draft characteristic of the linear mechanical draft cooling tower. The CMDCT fan cyclinders are not unlike the fan cyclinders used in the linear mechanical draft tower. The distinguishing feature of the CMDCT, however, is the physical arrangement of fans into a circular cluster (See Section 2.4.3.3). While maintaining a low profile, the CMDCT design offers operating features similar to the natural draft cooling tower as well as several advantages over the linear mechanical draft cooling tower.

TABLE 6-10

INCREMENTAL REDUCTION OF IP-2 MWe CAPABILITY DURING SUMMER PEAK CONDITIONS, LMDCT's[a]

	Once-Through Cooling	Linear Mechanical Draft Cooling Towers
Turbine Exhaust Pressure inches Mercury absolute	1.88	3.7
Net Turbine Capacity, MWe	899	844
Normal Plant Auxiliary Load, MWe	33	33
Incremental Cooling System Load, MWe	0	14
Net Generating Capability, MWe	866	797
Incremental Reduction of Peak Generating Capability, MWe	0	69

[a]Operated at initial guaranteed conditions with a 75°F ambient wet-bulb temperature for closed cycle cooling alternatives and a 75°F river water temperature for once-through cooling.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 3-2.

TABLE 6-11

AVERAGE ANNUAL LOSS OF IP-2 GENERATING CAPABILITY, LMDCT's[a]

	Once-Through Cooling	Rectangular Mechanical Draft Cooling Towers
Net Turbine Capacity, MWe	906	882
Normal Plant Auxiliary Load, MWe	33	33
Cooling System Load, MWe	0	14
Net Generating Capability, MWe	873	835
Average Annual Loss of Net Generating Capability, MWe	0	38

[a]Operated at initial guaranteed conditions with yearly average conditions determined by a 65°F wet-bulb temperature during a three month summer and a 35°F wet-bulb temperature during the remainder of the year.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 3-3.

The primary advantage of the CMDCT is the result of the circular clustering of fans which produces a concentrated buoyant plume rising to an altitude similar to the natural draft cooling tower plume before dispersing. Moreover, two or more nearby towers reinforce the combined plume rise.

Because of its plume characteristics, the CMDCT's, like the natural draft cooling towers, offer significant environmental advantages over the linear mechanical draft cooling towers, including reduced ground level fogging and icing. Also, compared to linear mechanical draft cooling towers, CMDCT's offer greater operating efficiency because recirculation and interference are reduced. As a result, CMDCT's can be placed as near to one another as 1-1/2 diameters on center line or one tower radius between tower structures. As compared to the natural draft cooling tower, the CMDCT's low profile design presents less aesthetic impact. In addition, the CMDCT low profile allows it to be located nearer to safety related structures. These location factors offer potential savings over natural and other mechanical draft cooling tower with regard to piping, wiring, and excavating costs.

A vendor of CMDCT's estimated that two such towers would be required to meet IP-2 cooling requirements and the thermal criteria specified by the applicant for two linear mechanical draft cooling towers (Table 6-12). Each tower would be approximately 300 feet in diameter and 68 feet high, where the height is composed of 50 feet to the top of the fan deck and 18 feet from fan deck to fan cylinder tops. An individual tower would contain 13 fan cylinders, each 33 feet in diameter.

TABLE 6-12

THERMAL DESIGN CRITERIA FOR CMDCT'S, IP-2

Condenser Heat Load	7,350 x 10^6 BTU/Hr
Cooling Water Flow	600,000 g.p.m
Cooling Tower Range	25°F
Cooling Tower Approach	17°F
Design Summer Wet-Bulb Temperature	74°F
Design Summer Relative Humidity	55%

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 3-1.

6.2.5.2 Cost Estimates

a. Capital Cost

The staff's estimated cost for two CMDCT's assuming completion of construction on December 1, 1979, is shown in Table 6-13. Of the $67,510,000 total estimated cost, $7,700,700 is attributed to the two cooling tower structures and basins and $8,905,000 to excavation for towers, tunnels, electrical work, etc. As noted in the table, these latter two costs are based on vendor estimates obtained by the staff, while the remaining cost components are assumed to be the same as those reported by the applicant for two linear mechanical draft cooling towers. In the absence of detailed engineering estimates and based on CMDCT cost estimates reported for other electric generating facilities, the staff believes that this methodology results in reasonably accurate cost estimates of CMDCT's for IP-2.

TABLE 6-13

CAPITAL COST ESTIMATE OF CLOSED CYCLE CIRCULAR MECHANICAL DRAFT WET COOLING TOWERS, IP-2

Component Description	Cost Estimate ($)	
Two cooling towers and basins installed[a]	7,700,700	
Amertap clean system, installed[b]	3,112,000	
Piping, installed[b]	7,802,700	
Excavation for tunnels, tower, roads, sump pits, electrical work, etc.[a]	8,905,300	
Electrical work associated with tower[b]	1,327,700	
Electrical work associated with substation[b] and lighting power	1,797,800	
Project management and inspection[b]	975,000	
Other direct costs[b]	318,000	
Total direct costs		31,939,700
12 % engineering and supervision[c]	3,832,764	
2.75 % administration and supervision[c]	983,743	
26 % payroll taxes and pensions[c]	1,252,292	
13.5 % interest during construction[c]	5,131,147	
Total project costs		43,139,600
30.41 % escalation[c]	13,118,766	
20 % contingency[c]	11,251,682	
Total estimated cost		67,510,000

[a]Based on vendor estimates.

[b]Cost assumed to be the same as the cost reported by the applicant for two linear mechanical draft cooling towers (see Table 6-9).

[c]Percentages assumed to be the same as the percentages reported by the applicant for two linear mechanical draft cooling towers (see Table 6-9).

Excavation costs for CMDCT's are approximately 60 percent of the excavation costs reported by the applicant for one natural draft cooling tower. These savings are possible with CMDCT's because their low profile enables them to be located nearer to safety related structures than the proposed 560 feet high natural draft cooling tower. CMDCT's also offer excavation cost savings over the linear mechanical draft cooling towers.

Because of the two location factors mentioned above, the staff has found that CMDCT's offer potential savings over natural draft and linear mechanical draft cooling towers with regard to piping and wiring costs. However, without detailed engineering concepts, designs, and layouts, the savings cannot be quantified. Therefore, they are not reflected in the staff's capital cost estimate for CMDCT's shown in Table 6-13. Consequently, that estimate overstates the true capital cost of CMDCT's for IP-2 to some degree.

The present discounted value (1976) capital cost was determined by the staff to be $72,832,000. Expressed as an annualized cost over the years 1976 to 2003 the cost is $7,757,000.

b. Annual Operating Cost

The annual operating cost associated with two CMDCT's for IP-2 is due primarily to maintenance of fill materials and tower fans. Each of the 26 fans is driven by a 200 HP motor and can be operated at full speed or half speed. At half speed operation, each fan is reduced to 50 HP.

Although comprehensive estimates for CMDCT operating costs are not available, the staff agrees with the applicant's assumption that operating costs for a CMDCT are comparable to the operating costs for a linear mechanical draft tower.[15] Based on the applicant's estimate of annual operating costs for two linear mechanical draft cooling towers, the staff determined the present discounted value (1976) and annualized value of operating costs for two CMDCT's to be $5,317,000 and $566,000 respectively (see Section 6.2.4.2b for the appropriate derivations).

c. Cost Of Replacing Loss Of Peak Generating Capability And Energy From Plant Derating

The staff's analysis shows that the incremental loss of IP-2 peak generating capability due to the operation of two CMDCT's is the same as that determined by the applicant for two linear mechanical draft cooling towers. However, average annual loss of IP-2 generating capability for CMDCT's was found to be approximately 2.2 MW less than that reported for the linear mechanical draft towers containing the same number of fans per tower. CMDCT's incremental reduction of IP-2 peak generating capability due to increased turbine exhaust pressure and cooling system auxiliaries is estimated by the staff to be 69 MWe; 55 MWe due to loss of turbine capacity and 14 MWe due to cooling system auxiliaries. The replacement of this lost capability by installing gas turbines at $315 per kW in 1979 results in an incremental capital cost of $21,735,000. Present value (1976) capability cost and annualized capability cost attributed to two CMDCT's are $24,071,000 and $2,564,000 respectively.

Average annaul loss of IP-2 generating capability is determined by a yearly average wet-bulb temperature. This was reported by the applicant to be characterized by a 65°F wet-bulb temperature during a three-month summer period and a 35°F wet-bulb temperature during the remainder of the year (see footnote "a" of Table 6-11). Under these average conditions, CMDCT's increase the turbine exhaust pressure and consume energy to operate associated water pumps on a basis comparable to the rectangular mechanical draft towers. However, the staff understands that with a 15°F reduction in the design ambient wet-bulb temperature, CMDCT's can handle IP-2 full load cooling requirements while fans are operated at half speed. Based on the above yearly average temperatures this mode of operation would be possible nine months of the year (on the average). Using this information, the staff found that the annual average loss of IP-2 generating capability due to CMDCT's would be 35.8 MWe; 24 MWe due to loss of turbine capacity and 11.8 MWe due to cooling system load.

The loss of 35.8 MWe is assumed to be replaced by the additional operation of oil-fired steam generators within the applicant's system at an incremental generating cost of 25 mills per kWh in 1980. Using a 76.2 percent plant capacity factor and a 5 percent rate of escalation on fuel costs, the present value (1976) energy cost and annualized energy cost for CMDCT's would be $55,969,000 and $5,959,000,respectively.

d. Downtime Costs From Cooling System Tie-In

Information compiled by the staff indicates that CMDCT's could likely be constructed in substantially less time than a natural draft cooling tower. Time savings of six months to one year can be realized through (1) the use of precast concrete structural members which are cast offsite, and (2) reduced requirements for excavation.* The applicant has indicated that construction of a mechanical draft cooling system could not commence until December 1, 1976. It is therefore possible that the CMDCT's could be completed and tied in by June 1, 1979, thus avoiding a summer outage. A tie-in by June 1979 assumes, of course, that the CMDCT could be constructed one year earlier than the natural draft alternative. For each month construction is delayed, there is a corresponding delay for system tie-in.

6.2.6 Wet-Dry Mechanical Draft Cooling Towers (WDMDCT)

6.2.6.1 Highlights of Design Features and Scheduling Important to Cost-Benefit Analysis

See Section 2.4.2 for a description of the WDMDCT)

Compared to completely wet evaporative cooling towers, the most significant advantages of WDMDCT's includes: (1) less dense, less visible plume discharged from the fan cylinders; (2) reduced potential environmental effects related to increased ground-level fogging, icing, and salt deposition; and (3) less visual change of surrounding landscape due to its less visible plume. Disadvantages of WDMDCT's include:(1) high turbine exhaust pressures, hence, greater plant deratings; and (2) high maintenance costs. Disadvantages of the WDMDCT's compared to natural draft cooling towers include: (1) greater noise emissions resulting from fan operation; (2) higher capital costs; and (3) greater power consumption.

WDMDCTs were considered by the applicant to be a feasible alternative closed cycle cooling system for IP-2 and were retained for detailed economic and environmental evaluation. In determining the number and size of these towers needed to meet IP-2 cooling requirements, the applicant used the same thermal criteria as specified for linear mechanical draft cooling towers. Based on these criteria, four MWMDCTs would be required for IP-2. Each tower would be 336 feet long, 70 feet wide, and 74 feet high and contain seven fans rated at 200 horsepower each.

The construction schedule for four WDMDCTs was reported to be the same as two linear mechanical draft cooling towers. Actual construction would begin on December 1, 1976 and be completed on December 1, 1979, allowing seven months from May 1, 1979 to December 1, 1979 for cutover from once-through cooling to closed cycle cooling.

a. Cost Estimates

Table 6-14 shows the applicant's capital cost estimate of four mechanical draft WDMDCT's for IP-2. The total estimated cost is $89,000,000. Major cost components include $10,000,000 for the cooling tower structure and $15,334,000 of excavation work for tunnels, tower, roads and sump pits. Physical excavation of rock and soil for tower foundation, tunnel piping, and sump pits is estimated to be 175,000 cubic yards.

The present value (1976) capital cost is estimated by the staff to be $96,016,000. The annualized value is approximately $10,226,000.

*See Section 7.4 concerning increased design time required.

TABLE 6-14

CAPITAL COST ESTIMATE OF CLOSED CYCLE
MECHANICAL DRAFT WET/DRY COOLING TOWERS, IP-2

DESCRIPTION	INSTALLATION COMPANY	INSTALLATION CONTRACTOR	MATERIAL	TOTAL
Install cooling towers		10,000,000		10,000,000
Amertap cleaning system		3,112,000		3,112,000
Furn. install piping (mech. sys)	27,000	2,918,000	5,541,000	8,486,000
Struct., excav. for tunnels, tower, roads, sump pits, etc.	20,000	15,314,000		15,334,000
Struct., excav. for elect. work and assoc.		362,000		362,000
Elect. work assoc. w/tower		881,000	529,600	1,410,700
Elect. work assoc. w/substation		514,400	1,166,000	1,680,000
Elect. work lighting power		33,700	200,200	233,900
PROJECT MANAGEMENT & INSPECTION	975,000			975,000
OTHER DIRECT COST	189,500		146,000	336,100
TOTAL DIRECT COST	1,211,500	33,135,200	7,583,400	41,930,100
12 % ENGINEERING & SUPERVISION				5,031,600
2.75 % ADMINISTRATION & SUPERVISION				1,291,400
26 % PAYROLL TAXES & PENSIONS				1,623,200
13.5 % INTEREST DURING CONSTRUCTION				6,733,300
TOTAL PROJECT COST				56,609,600
30.41 % ESCALATION				17,215,000
20 % CONTINGENCY				15,175,400
TOTAL ESTIMATED COST				89,000,000

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1974, Table 5-3.

b. Annual Operating Cost

Annual operating costs for four WDMDCT's each containing 7 cells was estimated by the applicant to be $560,000 or $20,000 per cell per year in 1974.[16] In order to evaluate the annual operating costs at the outset of operation on December 1, 1979 and each year thereafter through 2003, the staff used a 5% rate of escalation compounded continuously over the 5-year interim and over the 24-year estimated useful life of the facility. The annual operating cost expressed as a present discounted value (1976) is $6,736,000 and annualized value is $717,000.

c. Cost of Replacing Loss of Peak Generating Capability and Energy From Plant Derating

Shown in Table 6-15 is the estimated loss of IP-2 peak generating capability due to the operation of four WDCT's. Of the total 70 MWe derating, 55 MWe is due to increased turbine exhaust pressure and 15 MWe is due to incremental cooling system load. The capital cost of replacing 70 MW of lost capacity by the installation of gas turbines at $315 per kW in 1979 is $22,050,000.

TABLE 6-15

INCREMENTAL REDUCTION OF IP-2 MWe CAPABILITY DURING SUMMER PEAK CONDITIONS[a], WDMDCT's

	Once-Through Cooling	Mechanical Draft Wet-Dry Cooling Towers
Turbine Exhaust Pressure inches Mercury absolute	1.88	3.7
Turbine Capacity, MWe	899	844
Normal Plant Auxiliary Load, MWe	33	33
Incremental Cooling System Load, MWe	0	15
Net Generating Capability, MWe	866	796
Incremental Reduction of Peak Generating Capability, MWe	0	70

[a]Operated at initial quaranteed conditions with a 75°F ambient wet-bulb temperature for closed-cycle cooling alternatives and a 75°F river water temperature for once-through cooling.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," Volume 1, December 1, 1974, Table 3-2.

The staff determined the present discounted value (1976) capability cost to be $24,420,000 and an annualized value capability cost to be $2,601,000.

The average annual loss of IP-2 generating capability due to the operation of WDMDCT's is shown in Table 6-16 to be 39 MWe. As was discussed in Section 6.2.2.2(c), make-up energy for IP-2 average annual derating is expected to be available from within the applicant's system at an incremental generating cost of 25 mills per kWh in 1980. By using a plant capacity factor of 76.2% and a fuel escalation rate of 5%, the staff's calculation of present discounted value (1976) energy cost is $60,972,000. The corresponding annualized value of the energy cost associated with the wet/dry cooling system is $6,492,000.

TABLE 6-16

AVERAGE ANNUAL LOSS OF IP-2 GENERATING CAPABILITY[a], WDMDCT's

	Once-Through Cooling	Mechanical Draft Wet/Dry Cooling Towers
Net Turbine Capacity, MWe	906	882
Normal Plant Auxiliary Load, MWe	33	33
Cooling System Load, MWe	0	15
Net Generating Capability, MWe	873	834
Average Annual Loss of Net Generating Capability, MWe	0	39

[a]Operated at initial guaranteed conditions with yearly average conditions determined by a 65°F wet-bulb temperature during a three-month summer and a 35°F wet-bulb temperature during the remainder of the year.

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume 1, December 1, 1974, Table 3-3.

d. Downtime Costs from Cooling System Tie-In

Downtime costs from mechanical draft wet/dry cooling system tie-in are identical to the natural draft alternative discussed in 6.2.2.2(d).

6.2.7 Summary of Project Costs and Performance of Alternatives

A cost summary of the five closed cycle cooling tower alternatives for IP-2 is tabulated in Table 6-17. Capital cost, annual operating cost, capability cost, energy cost, and downtime cost are shown for each alternative as a present value (1976) and annualized value (1976 through 2003). Total project cost is also derived for each alternative by summing over the five cost categories.

As is shown in Table 6-17, the least costly closed cycle cooling tower in terms of total project cost is the NDCT alternative, followed closely in ascending order by the FANDCT and then CMDCT, LMDCT, and the WDMDCT alternative. In comparing the FANDCT, CMDCT and LMDCT alternatives to the NDCT, it can be seen that the lower capital cost advantages are completely offset by higher annual operating costs, capability costs, and energy costs. WDMDCT's do not offer any cost advantages over a NDCT or any other alternative shown in Table 6-17.

TABLE 6-17

COST SUMMARY OF CLOSED CYCLE COOLING TOWER ALTERNATIVES
($1,000)

	Natural Draft Cooling Tower		Fan-Assisted Natural Draft Cooling Tower		Linear Mechanical Draft Cooling Towers		Circular Mechanical Draft Cooling Towers		Wet-Dry Mechanical Draft Cooling Towers	
	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value
Capital Cost	90622	9651	80932	8619	86307	9192	72832	7757	96106	10226
Annual Operating Cost	1794	191	3152	336	5317	566	5317	566	6736	717
Capability Cost (incremental loss of peak generating capability)	21978	2341	24071	2564	24071	2564	24071	2564	24420	2601
	(63 MWe)		(69 MWe)		(69 MWe)		(69 MWe)		(70 MWe)	
Energy Cost (Average annual loss of generating capability)	39085	4162	46902	4994	59409	6326	55969	5959	60972	6492
	(25 MWe)		(30 MWe)		(38 MWe)		(35.8 MWe)		(39 MWe)	
Downtime Cost from Cooling System Tie-In: replacement energy from existing capacity and purchased power	50680	5396	50680	5396	50680	5396	50680	5396	50680	5396
TOTAL COST	204159	21741	205737	21909	225784	24044	208869	22242	238824	25432

The staff discussed the reliability impact of incremental losses of peak generating capability due to alternative CCC systems in Section 6.2.2.2 c. The staff concluded that adequate generating reserve margins (during peak demands) would most likely be maintained within the applicant's system in the absence of 63 MW to 70 MW of peak generating capability and the applicant's proposed installation of gas turbines to replace this capability would not be economically warranted. As such, the capability cost for each alternative in Table 6-17 would not be incurred and the total project cost would be lower by the appropriate amount. For example, total project cost for a NDCT would be approximately $182 million, present value. However, the staff does not believe that the absence of capability costs in Table 6-17 significantly affect the relative economic ranking of cooling system alternatives as discussed above.

6.3 EXTERNAL SOCIAL AND ECONOMIC IMPACTS OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS

6.3.1 Description of the Impacted Communities

6.3.1.1 Physical Ambiance-landscape, Weather, etc.

The Indian Point site is surrounded on all sides by high ground ranging from 600 to 1,000 ft. above sea level. Along the winding Hudson River are steep, wooded slopes of the Dunderberg on the west bank and West Mountains to the northwest and Buckberg Mountain to the west-southwest. On the east side of the river where the site is located, the peaks are lower but include Spitzenberg and Blue Mountains. The site itself is hilly, rising to about 150 ft. above river level with no unique environmental values such as natural wildlife sanctuaries, caverns, rare and/or endangered species of plants or wildlife, etc. The Indian Point site is characterized by species of eastern deciduous hardwood.[17]

The dominant overstory species on site and in surrounding areas are mixed-oak and eastern hemlock, hickory-oak, with some white pine, black cherry and maple. Understory species common to all areas include yellow poplar sassafras, sumac, and catalpa.

The area immediately around and including Indian Point is zoned for heavy industry. The industries nearest the plant are a wall board factory and a yeast plant. Surrounding areas also include stone quarries, water reservoirs, parklands, recreational facilities, the New York Military Reservation (Camp Smith), and residential areas flanking the site, including Buchanan, Verplanck,Montrose and Peekskill. The deep valley location of the Indian Point site causes local micrometeorological and climatogical conditions to be different within the valley than on the higher, surrounding ridges. At river level and 100 and 200 ft above river level, the winds are upstream by day and downstream by night more than a third of the time. Precipitation averages 46 in/year and is rather uniform month by month. Because of greater evaporation and soil retentiveness in summer and because of snow in winter, the flow of the Hudson River is not uniform through the year but is high in spring and low in late summer. Mean ambient air temperature near Indian Point varies from 28°F in January to 75°F in July.

6.3.1.2 Municipalities and Other Government Organizations in the Area

The region surrounding Indian Point considered for potential socio-economic impacts includes the municipalities of: Buchanan and Croton-on-Hudson, the Town of Cortlandt, and the City of Peekskill, in Westchester County, New York; and the own of Stony Point, and the Villages of Halverstraw, and West Halverstraw in Rockland County, New York. The four Westchester County communities, in addition to being geographically close-in to the site, fully constitute Westchester County's Legislative District No. 1. The three Rockland County municipalities are situated just across the Hudson River within a few miles of the proposed cooling tower. In addition the southwest portion of Putnam County and the southeast portion of Orange County were considered for visual impacts.

6.3.1.3 Population and Existing Land Use Patterns

The seven municipalities either in or around Indian Point reported a population in 1970 of 83,137. Table 6-18 presents 1970 population data and 1980 projected population figures by community. The four municipalities in Westchester County are expected to grow at a relatively low (0.7 percent) rate per year while those in Rockland County are anticipating an annual growth rate of approximately 3.9 percent.

Land use along the Hudson is varied. The area surrounding Indian Point is zoned for heavy industry and many industrial facilities are located near the proposed site (see Section 6.3.1.4). Good limestone has led to many quarries along the banks and an inactive one is presently adjacent to the site. Tracts of land fronting the Hudson River are also used by a number of institutions. The Veterans Administration Hospital at Montrose, the New York State Military Reservation (Camp Smith), and the West Point Military Academy are all within 10 miles of the site. Recreational outlets on the river are also present with several sections of the Palisades Interstate Park on the west bank, and parks and beaches on the east bank. Marinas, boat ramps, and fishermen's landings are also available. The City of Peekskill is one of the major landowners along the Peekskill Bay waterfront and is presently considering several proposals to develop and revitalize the area. Plans call for increased recreational, residential, and industrial use of the waterfront property.[18] The Penn Central Railroad and U.S. Highway 9 serve both banks of the river.

TABLE 6-18

POPULATION - 1970 AND 1980 (PROJECTED) FOR MUNICIPALITIES SURROUNDING INDIAN POINT

Municipalities		1970	1980
Westchester County[a]			
Buchanan		2,110	2,100
Cortlandt		24,760	27,900
Croton-on-Hudson		7,523	7,100
Peekskill		19,283	20,300
	Total	53,676	57,400
Rockland County[b]			
Halverstraw		8,198	10,000
Stony Point		12,705	20,000
West Halverstraw		8,558	11,000
	Total	29,461	41,000
TOTAL		83,137	98,400

SOURCE: Interpolation of data from "Westchester's Population: 1975 - 85 Changing Profile."

[a]Westchester County Department of Planning, August 1975. Table 6, p. 9.

[b]1974 Rockland County Data Book, Rockland County Planning Board, New York, 1974, p. 20.

Electric power stations represent an important component of the industrial use of the Hudson River shoreline. Within ten miles of the cooling tower site there are a total of eight power stations either operating, in construction, or planned.

The Hudson River itself services both commercial and recreational interests. About 600 to 800 commercial ships and barges pass the Indian Point site each year. The cargo consists largely of petroleum products, dry goods, and molasses. Pleasure boating and sport fishing are also prevalent in the area.

The majority of the land to the east and to the west of the river within five miles of the site is zoned for parks and residential use. For example, on the west bank of the Hudson, Stony Point, Halverstraw and West Halverstraw incorporate approximately 20,000 acres of which 56.5 percent are used for public parks and recreation, 20 percent are vacant, and 13 percent are zoned residential. The Palisades Interstate Park crosses through the town of Stony Point and contributes greatly to this region's parks and recreation land use.[19] The total land area of the four Westchester County communities on the east side of the Hudson is 29,060 acres. The overall population density (number of persons per square mile) of this area is 1,235 which is slightly more than half the average density per square mile for all of Westchester.[20] However, this region is more densely populated than the west bank communities (955 per square mile) and slightly more committed to residential, commercial, and industrial land use.

6.3.1.4 Economic Activity

Economic activity around Indian Point includes heavy manufacturing, power generation, stone quarries, a fairly strong recreational sector, and commercial activity primarily emanating from Peekskill and its environs. Table 6-19 presents a list of major industrial employers and estimated number of employees for the seven municipalities. For the Rockland County communities, totals for all industrial employment are available.[21] As of 1971, Stony Point reported seven plants with 613 employees and the town of Halverstraw which includes the villages of Halverstraw and West Halverstraw contained 37 plants and 4,007 employees.

Industrial and commercial growth in the Westchester communities has generally been quite slow in recent years. However, there is currently considerable retail construction planned or in progress in the Route 6 area of Cortlandt, and in the Peekskill urban renewal area. Future industrial growth in Rockland county is not expected to be of any significant importance in the villages of Halverstraw and West Halverstraw, and the town of Stony Point.[22] Rather, industrial growth is anticipated to occur away from village centers and onto major highways and industrial park complexes.

6.3.1.5 Labor Force and Employment

The three Rockland County communities reported a labor force as of 1970 of 11,166 of which 3.8% were unemployed. This labor force was 62% male and 38% female. The vast majority of these workers, 77%,are employed within Rockland County. Other important places of work are Manhattan 8%, and Westchester County 5%. Distribution of the labor force is given in Table 6-20.

Data on the 4 Westchester County communities indicate that most of their work force is employed within the county proper. In Buchanan and Peekskill, six percent and four percent,respectively of the male labor force works in Manhattan. For Croton-on-Hudson and Cortlandt,the figures are 23 and 11 percent,respectively. In general, the population within these municipalities is more heavily oriented to blue collar employment than is the population of the county as a whole. Of the male labor force of the county, 40 percent is employed in professional, technical, or managerial occupations. Comparable figures for the sub-region are; Peekskill 25%, Cortlandt 37%, Croton-on-Hudson 47%, and Buchanan 25%.

Employment in the four Westchester communities totalled 12,500 in 1972. This figure excludes self-employed and domestic workers. Median family income for the county was estimated at $17,400 for 1973, making it one of the highest in the country. Of the four communities, only Croton-on-Hudson and Cortland approximate this value. Peekskill was estimated to have the lowest median family income in the county at $14,200 and Buchanan, at $15,400,was about 11% below the county's median family income level.

6.3.1.6 Tax Revenues and Community Services

The basic support of local government is the combined county-town levy which is used to meet county and town legislative, judicial, and administrative costs. Among the major categories financed are public safety, parks and recreation, public works, debt redemption, and certain drainage and highway costs. In addition, county revenues support health and social services and the community college. Special purpose districts, such as those established to meet educational needs, fire protection, and sewer projects have their own tax rates, which are typically collected at the town level.

The Village of Buchanan has experienced a dramatic tax windfall as a result of the nuclear plants located within its boundaries. The village reports for the 1975-76 period total assessed real property of approximately $75 million. Almost $72 million, or 95 percent, is attributed to real property owned by Consolidated Edison. This has effectively lowered the local citizens' taxation rate to $1.70 per $100 based on an equalization rate of 32 percent.

TABLE 6-19

MAJOR EMPLOYERS AND ESTIMATED NUMBER OF EMPLOYEES BY MUNICIPALITY

Employers	Estimated Number of Employees
Buchanan	
Consolidated Edison, Indian Point	700
Georgia-Pacific Corporation	120
Wedco Corporation	700
Cortlandt	
Leonore Doskow, Inc.	60
Croton-on-Hudson	
Croton Time Corporation	75
Prompt Maintenance Service, Inc.	200
Penn-Central	NA[a]
Peekskill	
Caldor, Inc.	200
The Ednalite Corporation	150
Geringer & Sons Manufacturing Corporation	130
Nan-Flower Lingerie, Inc.	100
Peekskill Star Corporation	75
Standard Brands, Inc.	150[b]
Wheeldex, Inc.	75
White Plains Iron Works, Inc.	160
Stony Point	
Kay Fries Chemicals, Inc.	180
Gabriel Manufacturing Company	72
U.S. Gypsum Corporation	180
West Halverstraw	
Modern Dust Bag Company	150
Label Products Company	80
Halverstraw	
Forte Manufacturing	70
New City Sportswear	100
Empire State Chain Company	110
Canvas & Leather Bag Company	75
Martin Marietta	107
Ward Pavement, Inc.	200
Colonial Sand & Stone Company	85
Louis Hornick & Company	300

SOURCE: Legislature Profile, Westchester County, p. 2, and 1974 Rockland County Data Book, pp. 60-67.

[a]Employment figures unavailable.

[b]Estimate provided by Standard Brands, Inc. during telephone inquiry on June 1, 1976.

TABLE 6-20

DISTRIBUTION OF ROCKLAND COUNTY'S LABOR FORCE BY EMPLOYMENT CATEGORY - 1970

Employment Category	Number of Jobs	Percentage
Service Trades	27230	34
Manufacturing & Mining	18160	23
Retail & Wholesale Trade	15648	19
Transportation & Community	5992	7
Construction	4874	6
Government	4705	6
Financial Service	4252	5
TOTAL	80861	100

SOURCE: Rockland County land use plan, Rockland County Planning Board, New York City, New York, 1973, p. 62.

6.3.1.7 Recreational Facilities

Much of the land within 15 miles of the site is presently used for parks and recreation; consequently, a wide choice of recreational activity is available to local residents and visitors.

Certainly the most important recreational complex in the area is the Palisades Interstate Park Region which encompasses 17 state parks and several historic sites. Several of these facilities are situated either in or close to the towns of Stony Point and Halverstraw. These include the Bear Mountain State Park (5,068 acres), Harriman State Park (46,181 acres), Halverstraw Beach State Park (73 acres), Hightor State Park (511 acres), Hook Mountain State Park (661 acres), and the Stony Point Reservation (87 acres). Activities available throughout the park system include skiing, camping, hiking, golf, fishing, roller and ice skating, swimming, boating, tennis, and bicycling. In 1974, attendance figures suggest that approximately 5-1/2 million people visited the parks' New York State facilities. Figures for those parks close to Indian Point are incomplete, but Table 6-21 lists results for those where data are available.

The local communities also maintain park areas and recreational programs. These facilities are for the most part open only to town and village residents. For example, Stony Point has two developed town parks which offer scenic areas with picnic and play facilities. Halverstraw has two major town parks and the villages of Halverstraw and West Halverstraw also maintain village parks. Similar developments prevail on the Westchester side of the Hudson with considerable future expansion anticipated.

The total municipal park acreage within the four Westchester municipalities is 497 acres. Adding state and county facilities produces an overall park acreage of 3,072 acres with the following distribution by town: Buchanan 28; Cordlandt 2,047; Croton-on-Hudson 547; and Peekskill 450. Table 6-22 lists and describes the county parks and recreational facilities in this region.

Another important recreational aspect of the area is the opportunities presented by the Hudson River. Yacht clubs and marinas service many boating enthusiasts on the river and sport fishing is likewise important. Presently, the city of Peekskill is considering the establishment of a riverfront park and beach for its shore front.

TABLE 6-21

1974 ATTENDANCE FOR SELECTED STATE PARKS IN
PALISADES INTERSTATE PARK COMPLEX

State Park	Attendance
Bear Mountain	2,160,000
Harriman	1,933,000
Stony Point	27,450
Hightor	31,000

SOURCE: Attendance data provided by Palisades Interstate Park Commission.

TABLE 6-22

COUNTY AND STATE PARKS AND RECREATIONAL FACILITIES
ON WESTCHESTER SIDE OF IMPACT AREA

County Park	Acres	Facilities
Blue Mountain Reservation	1.586	Target range, trap and skeet, beach picnicking, hiking and nature study, ice skating, horsebackriding, fishing, refreshments, archery.
Colabaugh Pond (part of Briarcliff-Peekskill Parkway)	50	Undeveloped
Croton Gorge	97	Hiking and nature study, fishing, skiing, sledding.
Croton Point	504	Beach, picnicking, ball fields, family camping, fishing, refreshments, music and art camp.
George's Island	176	Picknicking, hiking and nature study, boating, fishing, boat launching.
Oscawana Island	161	Hiking and nature study.
State Park		
Old Croton Trailway	--	Hiking.

SOURCE: Profile Legislative District Number 1, Westchester County Department of Planning, p. 4.

The Indian Point site itself has also experienced shifts toward recreational land use. Consolidated Edison, the present owner, has transferred 14 acres at the northern edge of the site to the Village of Buchanan for development as a marina. Also, there are plans to maintain an 80-acre forested area and small lake for recreation in the northern portion of the site. However, the availability of onsite land will be reduced for future recreational development depending on the type of cooling tower installed (see Table 5-9).

6.3.1.8 National and Historic Points of Interest in the Area

Relying on the applicant, the National Register of Historic Places has identified 40 historical places in the vicinity of Indian Point, 15 of which are designated National Historical Landmarks.[23] The closest of these are the Stony Point Battle Reservation on the west bank of the river about two miles downstream, the Palisades Interstate Park, west of the Stony Point area, and the Van Cortlandt Manor in Croton-on-Hudson. More distant important visitor attractions of significant historic and national interest include Hyde Park National Historic Site, West Point Military Academy, and Vanderbilt Mansion National Historical Site. In 1973, approximately 3 million people visited these places of interest.

The New York State Parks and Recreation Division for Historic Preservation provided the applicant with a listing of sites listed in the National Register of Historic Places.[24] The sites were divided into three categories and are given below.

Sites in the lower Hudson Valley from which the project is likely to be most visible:

St. Peter's Church, Van Cortlandtville, Westchester County
Van Cortlandt Manor, Croton-on-Hudson, Westchester County
Lyndhurst, Tarrytown, Westchester County
Washington Irving House, Tarrytown, Westchester County
Hyatt-Livingston House, Dobbs Ferry, Westchester County
Jasper F. Cropsey House and Studio, Hastings, Westchester County
Dutch Reformed Church, Tarrytown, Westchester County
First Baptist Church, Ossining, Westchester
Site of Old Croton Dam, Ossining Vicinity, Westchester County
Philipsburg Manor, Upper Mills, Westchester County
Philipse Manor, Yonkers, Westchester County
John Bond Trevor House, Yonkers, Westchester County
Untermyer Park, Yonkers, Westchester County
West Point Foundry, Cold Spring, Putnam County
Palisades Interstate Park, Rockland County and Orange County
Stony Point Battlefield, 9W, Rockland County
Terneur-Hutton House, West Nyack, Rockland County
Ft. Montgomery, Bear Mountain, Orange County
Ft. Montgomery Site, south of Ft. Montgomery, Orange County
New Windsor Cantonment, Temple Hill Road, Orange County
Dewint House, Tappan, Rockland County
Haskell House, New Windsor, Orange County
David Crawford House, Newburgh, Orange County
Dutch Reformed Church, Newburgh, Orange County
Mill House, Newburgh, Orange County
Montgomery-Grand-Liberty Streets Historic District, Newburgh, Orange County
Washington's Headquarters, Newburgh, Orange County
U.S. Military Academy, West Point, Orange County
Francis Hoyer House, W. Haverstraw, Rockland County

Sites beyond the Hudson Valley but in the general vicinity of the project:

John Jay Homestead, Katonah, Westchester County
Joseph Purdy Homestead, Purdys, Westchester County
Elephant Hotel, Somers, Westchester County
Bedford Village District, Bedford, Westchester County
Chappaqua Historic District, Chappaqua, Westchester County
Henry Garner Mansion, Garnerville, Rockland County
Delaware & Hudson Canal, Orange County
Sloat House, Sloatsburg, Rockland County

Sites beyond the Hudson Valley and not in the vicinity of the project:

St. Paul's Church, Mount Vernon, Westchester County
John Stevens House, Mount Vernon, Westchester County
Thomas Paine Cottage, New Rochelle, Westchester County
Caleb Hyatt House, Scarsdale, Westchester County
Reid Hall, Purchase, Westchester County
Old Croton Aqueduct Trailway, Westchester County
Square House, Rye, Westchester County
Westchester County Courthouse, White Plains, Westchester County
Bolton Priory, Pelham, Westchester County
Historic Track, Goshen, Orange County
Harriman Estate, Harriman, Orange County
Southfield Furnace Ruin, Tuxedo, Orange County
Knox Headquarters, Vails Gate, Orange County
Dutchess Quarry Cave Site
William Bull House, Campbell Hall, Orange County
Jackson Bull House, Campbell Hall, Orange County
1841 Goshen Courthouse, Goshen, Orange County
Ft. Decker, Pt. Jervis, Orange County
Quaker Meetinghouse, Smith Clove, Orange County

The staff has considered the potential visibility of an NDCT from historic sites located within 10 miles of IP. As a practical matter it was not feasible to consider plume visibility in this portion of the staff anaylsis. It was determined that the tower will not be visible from nearly all sites. The degree of visibility from the few sites from which the tower may be visible will be minor. The degree of visibility from the First Baptist Church in Ossining and from the Francis Harper House in West Halverstraw has not been confirmed but is thought to be slight or nonexistent in both cases. The tower will be effectively obstructed from view from all sites, not including the two questionable sites, by intervening topology or vegetation. Even Stony Point Battlefield will be insignificantly impacted because of its heavily wooded condition. This site is 2.5 miles SW of the proposed tower site on the opposite bank of the Hudson River. In reaching its conclusions concerning visual impact on historical sites the staff depended on the viewshed map prepared by Jones & Jones, a viewshed map submitted by the applicant, other maps of the area, and personal inspection of a sample of sites by the staff.

The staff concludes that any visual impacts on the sites listed above will not cause any change in the quality of their characteristics that qualifies them under the National Register criteria.

Only two archaeologic sites in Westchester County are mentioned by Ritchie.[25] "Most of the sites spared by construction or other modern activities have been heavily molested by relic collectors over a very long period and relatively few have received attention from competent... archaeologists." For many years before its acquisition by the applicant, the Indian Point area itself was a commercial amusement park.

6.3.1.9 Future Development and Planning Objectives of the Local Communities

Each municipality sets its own planning and zoning policy through the preparation of an overall land use plan, adoption of a zoning ordinance map, and enforcement of all pertinent codes and regulations. Basically, all development that occurs within each community is regulated by policy and administrative decisions made at the local level. The County Planning Boards assist many of the municipalities in the preparation of their master plans and zoning ordinances. Several of these communities now have their own planning staffs or planning consultants. The County Planning Board's main planning function is one of review and to assure compatibility with county and state plans. Table 6-23 presents the status of planning and zoning activity for the seven municipalities most directly impacted by the proposed cooling tower.

The Village of Buchanan has a Planning Board and has used the services of planning consultants since 1951. Preparation of a Village master plan was authorized in 1964, but never completed. The Village's zoning map, prepared in 1969, serves as the master plan. Consolidated Edison and Georgia-Pacific own the major portion of undeveloped land in the Village of Buchanan. Ultimate use of the remaining undeveloped land will determine criteria for future subdivision and planning. The remaining six communities have already adopted master plans and have either retained planning consultants or developed internal planning staffs.

TABLE 6-23

STATUS OF PLANNING AND ZONING ACTIVITY IN SEVEN MUNICIPALITIES SURROUNDING INDIAN POINT - 1974a

Community	Master Plan	Zoning Ordinance	Site Plan Review	Subdivision Regulations
Buchanan	--	1969	--	XX
Cortlandt	1967	1968	--	1969
Croton-on-Hudson	1970	1970	--	1968
Peekskill	1967	1960	--	1960
Stony Point	1973	1961	--	XX
Halverstraw	1970	1972	XX	XX
West Halverstraw	1970	1972	XX	XX

a "--" denotes either none exists or unknown.
"XX" denotes existence but date of preparation unknown.

SOURCE: Profile Legislative District Number 1, Westchester County Department of Planning, p. 6, and 1974 Rockland County Data Book, Rockland County Planning Board, New York.

The most active planning effort in the region appears to be occurring in the city of Peekskill. Here, development projects and proposals to revitalize the city are actively underway. Urban Renewal and Neighborhood Development projects effecting 340 acres have either recently been completed or are approaching completion. In addition, Peekskill has been the recipient of "701" funds for studies on zoning ordinances and the revitalization of the city's waterfront district.

It is difficult to generalize on the overall goals inherent in the master plans and development plans of the region. However, it appears that rapid growth is not anticipated in these communities and it is their hope that satisfactory controls can be imposed such that any growth that does occur will not be of a disruptive nature. Major emphasis is also placed on expanding the recreational base as well as preserving the physical amenities of the region.

6.3.2 Impacts During Construction

6.3.2.1 Impacts on Aquatic Biota

With adequate protection against erosion on and around the construction site during the period of construction any impact on aquatic biota will be minimal and thus will have no economic or social consequence.

6.3.2.2 Impacts on Terrestrial Biota

All closed cycle cooling tower alternatives will cause the alteration of various amounts of site acreage, up to 22 additional acres, now covered primarily by eastern hemlock and other species characteristic of eastern deciduous hardwood forests. None of the alternative cooling tower systems will totally eliminate this existing 80-acre forest. There have been no rare or endangered plant or animal species identified on the Indian Point site. The resulting reduction of forest habitat will be the primary impact to on-site wildlife. Cooling tower construction activities may cause some wildlife species inhabiting the remaining forested areas of the site to temporarily seek refuge in areas less influenced by human activity. Therefore, there may be some reductions in existing on-site wildlife populations due primarily to the reduction of habitat.

The staff believes the socio-economic consequences of the biota impacts during construction of any of the alternative closed cycle cooling systems will be minimal. Aside from cutting off visitor center pedestrian access to forested areas on site, little or no impact on human activity is anticipated in the region due to disruptions of terrestrial biota at the IP site during the construction period.

Expected socio-economic consequences are so slight that it is not possible to compare consequences of the several alternative cooling systems.

6.3.2.3 Impacts on the Human Environment

a. Stress on community services

The major potential sources of stress on community services are associated with the number of and activities of the construction workers and with the physical and financial impacts directly associated with construction activity. Although no estimates of the number of construction workers required for each alternative system is currently available the number will probably range between 100 and 200. These workers will be drawn mostly from the New York City metropolitan area and thus will commute to the site daily. The relatively small number of workers involved and the likelihood that few construction workers would relocate to one of the communities surrounding the facility indicates that the impact of construction workers on the community services will be insignificant except, perhaps, for an additional burden on the local streets and highways at the beginning and end of shifts. Construction activity will directly demand certain public services. There is, however, little chance of the local communities not being able to meet these demands.

b. Highways and traffic

Increased truck and automobile traffic is expected during the construction period. The applicant estimates that 100 to 150 trucks per day will be required to move excavated material from the cooling tower site throughout the first year of construction.[26] The applicant points out that the increased volume of traffic will have to be handled to limit the congestion on vehicular arteries both on and off site. While the complete route to be taken by the 100 to 150 trucks is dependent upon the final decision of where to dispose of the spoils, crossing of Broadway and use of Bleakley Avenue to State Route 9 will likely constitute part of the route. The applicant should confer with the village of Buchanan in determining the final truck route so that the village might evaluate the adequacy of streets involved as well as the adequacy of traffic controls to maintain disruption from additional traffic at acceptable levels.

A sound emission impact study by Ostergaard Associates for the applicant indicates that the only construction-related noise of potential off-site concern is that of truck traffic along Bleakley Avenue and Route 9. There will be a noticeable increase in sound levels from truck traffic for a period of six months to a year, depending on which alternative cooling system is adopted.[26] The Ostergaard report points out the necessity of a 24-hour continuous pour of concrete for the tower basins requiring a continuous delivery of ready-mix by trucks.[28] In the case of the natural draft and mechanical draft basins, the pour would continue for 92 hours. Complaints from residents along Bleakley Avenue are anticipated and the applicant will require trucks to comply with New York State vehicle noise emission regulations.[29]

c. Tax revenues

Real estate taxes from the Indian Point Nuclear Station accrue to seven taxing jurisdictions: the Village of Buchanan, Town of Cortlandt, County of Westchester, State of New York, Verplanck Fire Protection District, School District Number 3, and the Water District. Real estate taxes are assessed on the value of plant (structure) in place each taxing period. The staff has not estimated the possible flow of tax revenues during the construction period. A more detailed discussion of tax revenues during the operating period is provided in Section 6.3.3.3. There is, however, a question of whether a closed cycle cooling system will be ruled tax exempt as a pollution control device. The applicant has yet to apply to the State for a ruling on this matter.

d. Employment and income benefits

The staff anticipates that construction workers will not number more than several hundred and nearly all will commute from their present residences within the greater New York Metropolitan area. The number of skilled workers required is a small fraction of the total number available in the region; thus, little impact is anticipated on the total labor market. Wages will be distributed over the region in the same pattern as workers. Little of the payments to labor will go into the surrounding communities. Also, construction of a closed cycle cooling system will follow the much higher construction employment of IP-3.

e. Impact of aesthetics on recreation, land uses, and plans for land and water use

Aesthetic impacts during the construction period will be mainly confined to the site. Construction activity will be visible from the river but hidden by trees from land locations outside of the applicant's property.

f. Summary comparison of impacts of alternative systems

Community and regional impacts during construction of a closed cycle cooling system will be quite limited no matter which alternative system is chosen. Although differences in community impacts do exist among the alternatives, these differences are not considered of major importance in the cost-benefit balancing of the alternatives. Construction time of 3.5 years for the natural draft tower and the much greater volume of excavation material and concrete and reinforcement bars will result in heavy truck traffic over a longer period of time than the other alternatives. The fan-assisted natural draft tower, having the second greatest volume of concrete, can be expected to rank second in terms of duration of traffic associated with delivery of concrete and other materials. The differences in noise duration among these two alternatives and the remaining three alternatives considered are of minor consequence relative to existing and past noise levels.

6.3.3 Impacts During Operation

6.3.3.1 Impacts on Aquatic Biota

The staff finds that operation of any one of the alternative closed cycle cooling systems will not result in unacceptable adverse impacts upon the aquatic environment (see Sections 5.4.3 and 5.4.4);therefore, the staff finds the socio-economic consequences of such impacts to be of little consequence, and no additional measures are required to mitigate biotic impacts. Because of the limited level of biotic impacts, the staff has not attempted to differentiate among the alternative closed cycle cooling systems.

6.3.3.2 Impacts on Terrestrial Biota

Potential damage to terrestrial biota which may arise from operation of a closed cycle cooling system would be attributable to one or more of the following: salt drift, aerosol salt, and increased moisture including induced fogging and icing. Each of these potential sources of damage to terrestrial biota has been evaluated by the staff--see Sections 5.2.2 and 5.2.3. Botanical injury and mortality from salt drift of dogwood and hemlock on site immediately surrounding the cooling tower is assessed to be possible during the operating life of the mechanical draft alternative closed cycle system. The level of damage from the NDCT and the FANDCT is assessed to be essentially nonexistent, both onsite and offsite. Offsite, the major source of potential damage to terrestrial biota would be salt drift from the mechanical draft alternatives. Even with the use of what the staff believes to be conservative assumptions and estimates which are biased toward showing damage, the staff analysis shows an extremely small potential for severe damaging episodes for terrestrial biota over the life of a cooling system. However, the licensee should monitor the drift and salt deposition in the surrounding area and determine its significance; further, sensitive species of plants should also be monitored, as appropriate, to detect changes.

The staff concludes there is little possibility of botanical injury, having social or economic consequence, from operation of any of the cooling system alternatives. Among the five alternatives the greatest potential for damage was found for the MDCT and W/D MDCT. The area of potential risk was identified as approximately defined by the 200 kg/km^2 drift contour for August and September. This area is defined by a roughly eliptical shape with a major axis running through the cooling towers, parallel to the river in a SW-NE direction, extending 0.75

miles upstream and 1.0 miles downstream, and a 0.5 mile minor axis perpendicular to the major axis. Most of the area included is comprised of the applicant's property, the property of Georgia Pacific Corporation to the south, and the property of Standard Brands to the north. Potential impact on residential landscaping is confined to seven houses on Bleakley Avenue near Broadway and one house on Broadway just south of Bleakley Avenue. The probability of botanical injury on these properties over the life of a mechanical draft system is very small and would be confined to hemlock and dogwood which might be on the properties. The potential for botanical damage from the other cooling systems is even less than for mechanical draft.

6.3.3.3 Impact on the Human Environment

a. Aesthetics

The staff believes that the visual change resulting from construction and operation of a closed cycle cooling tower is potentially the most socially and economically consequential of the various possible environmental impacts. During two visits to the area, the staff found strong local concern over the visual impact of the proposed natural draft tower and its plume (Also see comments in Chapter 8 submitted by Village of Buchanan, City of Peekskill, City of Peekskill Planning Commission, and Senator Gordon). A reconnaissance of the surrounding area indicated that although the NDCT might have the greatest visibility, each of the alternative towers would be visible to some degree from a number of neighborhoods in Peekskill, Buchanan, and across the Hudson River. The accompanying plume would tend to extend the range of visibility considerably. In addition to the concern expressed over the impact on the quality of the view from existing neighborhoods, concern was also expressed over the impact on the development potential of the Peekskill waterfront. In its analysis of aesthetic impacts, the staff has been guided by two underlying questions. What will be the relative impact of each of the alternatives on the quality of the view scope as perceived by the viewing public? What will be the economic impact of each alternative in terms of real estate values in the various visually impacted neighborhoods and the development potential of the Peekskill waterfront? While the answers to these questions remain incomplete due to the inadequacy of analytical techniques, nevertheless, the staff has evaluated the alternatives and concluded that of the three lowest cost alternatives, CMDCT, FANDCT, and NDCT, the CMDCT has an advantage over FANDCT and NDCT and that FANDCT has an advantage over NDCT.

The staff has taken an eclectric approach to evaluation of potential visual impacts. First hand experiences and observations of a number of staff members on a number of closed cycle cooling systems in this country and Europe were compiled. Hundreds of photographs of various cooling towers and plume conditions were examined. Several days were spent reconnoitering the vicinity of IP by automobile, foot, and light aircraft. In addition, the services of a landscape architectural and environmental planning firm (Jones & Jones, Seattle, Washington) were engaged to apply, on a limited experimental basis, a technique which had previously been developed to assess the visual change in a viewscope resulting from manmade intrusions to the landscape including nuclear power plant siting and transmission line routing.[30-40] The study examined the relative visual impact of the three alternatives CMDCT, FANDCT, and NDCT on a high visibility day with a severe plume configuration.[41] An evaluation was made for the three alternatives at Unit 2 alone and for Unit 2 and Unit 3 together. A team from Jones & Jones surveyed and photographed the Indian Point area during late August, 1975. A viewshed map was constructed on the USGS 1:24,000 quadrangles for Peekskill and Halverstraw--Figure 6-1. Figure 6-1 shows those locations within six miles of the proposed Indian Point Unit No. 2 tower from which the top of a natural draft tower at 600 feet above sea level is visible assuming foreground trees and buildings do not obstruct the view. The viewshed map was used to identify areas from which to select representative viewpoints. The team visited nearly every heavily populated street and prominent viewpoint within the viewshed and within a six-mile radius of the proposed Unit No. 2 tower site. About sixty photographs were taken and screened on the basis of population density, distance, direction of view, observer position, and clarity of visual context. The ten viewpoints finally selected for evaluation are shown in Figure 6-1. Enlarged color prints of each viewpoint were made and retouched by a professional artist to depict the alternative cooling towers. The plumes depicted are severe and would more likely be observed during cold winter months than in milder months. The artist rendition of plumes superimposed on the photographs will likely occur considerably less than two percent of the hours of the year. The depicted plumes would most likely occur early on cold winter mornings under conditions of high relative humidity and moderate to high wind conditions. Plumes with the depicted degree of visibility are very unusual during other than winter conditions. Even during the winter the slight warming of the air as the sun rises in the sky may slightly decrease the relative humidity of the air and the visibility of the plume. A sample of the photographs used for the evaluation are reproduced in black and white as Figures 6-2(a) through 6-2(c).

FIGURE 6-1 VIEWSHED OF INDIAN POINT VICINITY FROM RIM OF 565 FEET NATURAL DRAFT COOLING TOWER

Source: Jones & Jones

miles upstream and 1.0 miles downstream, and a 0.5 mile minor axis perpendicular to the major axis. Most of the area included is comprised of the applicant's property, the property of Georgia Pacific Corporation to the south, and the property of Standard Brands to the north. Potential impact on residential landscaping is confined to seven houses on Bleakley Avenue near Broadway and one house on Broadway just south of Bleakley Avenue. The probability of botanical injury on these properties over the life of a mechanical draft system is very small and would be confined to hemlock and dogwood which might be on the properties. The potential for botanical damage from the other cooling systems is even less than for mechanical draft.

6.3.3.3 Impact on the Human Environment

a. Aesthetics

The staff believes that the visual change resulting from construction and operation of a closed cycle cooling tower is potentially the most socially and economically consequential of the various possible environmental impacts. During two visits to the area, the staff found strong local concern over the visual impact of the proposed natural draft tower and its plume (Also see comments in Chapter 8 submitted by Village of Buchanan, City of Peekskill, City of Peekskill Planning Commission, and Senator Gordon). A reconnaissance of the surrounding area indicated that although the NDCT might have the greatest visibility, each of the alternative towers would be visible to some degree from a number of neighborhoods in Peekskill, Buchanan, and across the Hudson River. The accompanying plume would tend to extend the range of visibility considerably. In addition to the concern expressed over the impact on the quality of the view from existing neighborhoods, concern was also expressed over the impact on the development potential of the Peekskill waterfront. In its analysis of aesthetic impacts, the staff has been guided by two underlying questions. What will be the relative impact of each of the alternatives on the quality of the view scope as perceived by the viewing public? What will be the economic impact of each alternative in terms of real estate values in the various visually impacted neighborhoods and the development potential of the Peekskill waterfront? While the answers to these questions remain incomplete due to the inadequacy of analytical techniques, nevertheless, the staff has evaluated the alternatives and concluded that of the three lowest cost alternatives, CMDCT, FANDCT, and NDCT, the CMDCT has an advantage over FANDCT and NDCT and that FANDCT has an advantage over NDCT.

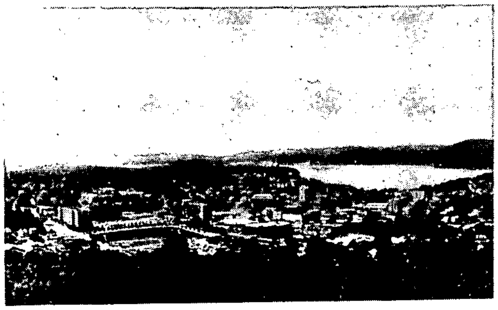
The staff has taken an eclectric approach to evaluation of potential visual impacts. First hand experiences and observations of a number of staff members on a number of closed cycle cooling systems in this country and Europe were compiled. Hundreds of photographs of various cooling towers and plume conditions were examined. Several days were spent reconnoitering the vicinity of IP by automobile, foot, and light aircraft. In addition, the services of a landscape architectural and environmental planning firm (Jones & Jones, Seattle, Washington) were engaged to apply, on a limited experimental basis, a technique which had previously been developed to assess the visual change in a viewscope resulting from manmade intrusions to the landscape including nuclear power plant siting and transmission line routing.[30-40] The study examined the relative visual impact of the three alternatives CMDCT, FANDCT, and NDCT on a high visibility day with a severe plume configuration.[41] An evaluation was made for the three alternatives at Unit 2 alone and for Unit 2 and Unit 3 together. A team from Jones & Jones surveyed and photographed the Indian Point area during late August, 1975. A viewshed map was constructed on the USGS 1:24,000 quadrangles for Peekskill and Halverstraw--Figure 6-1. Figure 6-1 shows those locations within six miles of the proposed Indian Point Unit No. 2 tower from which the top of a natural draft tower at 600 feet above sea level is visible assuming foreground trees and buildings do not obstruct the view. The viewshed map was used to identify areas from which to select representative viewpoints. The team visited nearly every heavily populated street and prominent viewpoint within the viewshed and within a six-mile radius of the proposed Unit No. 2 tower site. About sixty photographs were taken and screened on the basis of population density, distance, direction of view, observer position, and clarity of visual context. The ten viewpoints finally selected for evaluation are shown in Figure 6-1. Enlarged color prints of each viewpoint were made and retouched by a professional artist to depict the alternative cooling towers. The plumes depicted are severe and would more likely be observed during cold winter months than in milder months. The artist rendition of plumes superimposed on the photographs will likely occur considerably less than two percent of the hours of the year. The depicted plumes would most likely occur early on cold winter mornings under conditions of high relative humidity and moderate to high wind conditions. Plumes with the depicted degree of visibility are very unusual during other than winter conditions. Even during the winter the slight warming of the air as the sun rises in the sky may slightly decrease the relative humidity of the air and the visibility of the plume. A sample of the photographs used for the evaluation are reproduced in black and white as Figures 6-2(a) through 6-2(c).

Monastery: 5-3/8 Miles N.E. of Proposed Tower

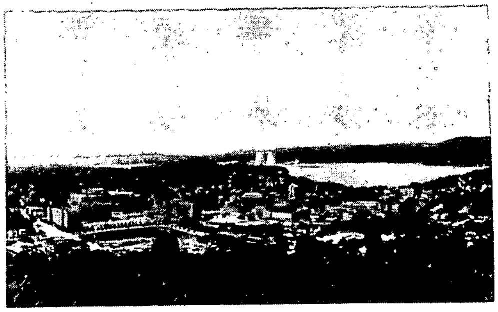
Before

Natural Draft — Both Units 2 & 3

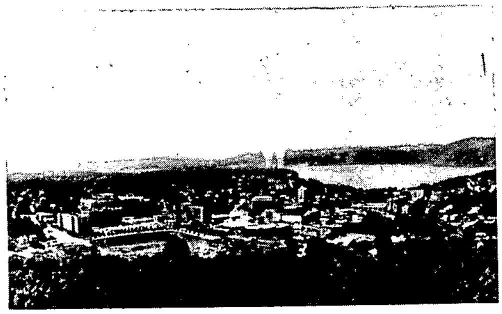
Hudson Overlook Apts.: 2-1/2 Miles N.E. of Proposed Tower



Before



Natural Draft — Units 2 & 3



Fan Assist Natural Draft — Units 2 & 3

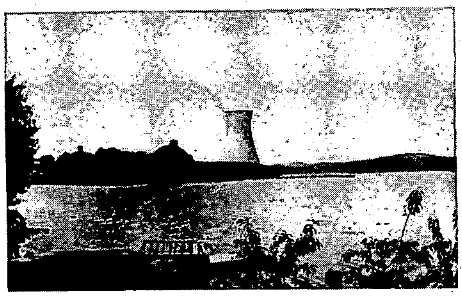
Circular Mechanical Draft — Units 2 & 3

FIGURE 6-2(A) ARTIST RENDITION OF ALTERNATIVE CLOSED-CYCLE COOLING SYSTEMS AND SEVERE PLUME FROM VARIOUS LOCATIONS IN THE INDIAN POINT VICINITY

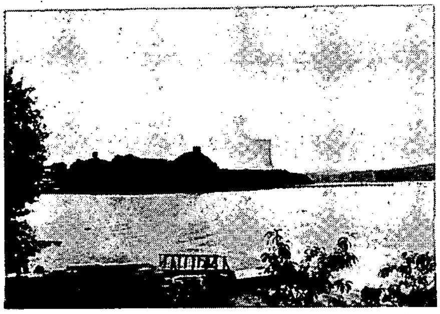
Source: Photography and Retouching from Jones & Jones

Peekskill Waterfront: 7/8 Mile N.E. of Proposed Tower

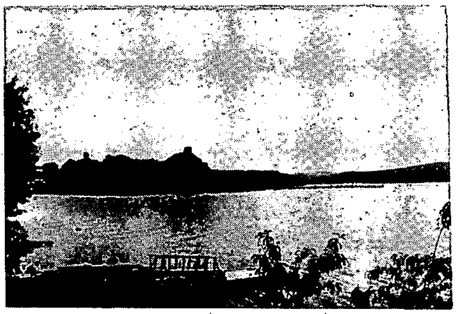
Before



Natural Draft – Unit 2



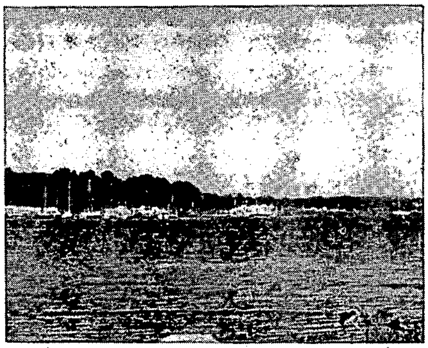
Fan Assist Natural Draft – Unit 2



Circular Mechanical Draft – Unit 2

Stony Point Marina: 3-3/8 Miles S.S.W. of Proposed Tower

Before

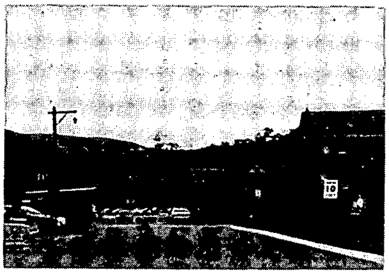


Natural Draft – Units 2 & 3

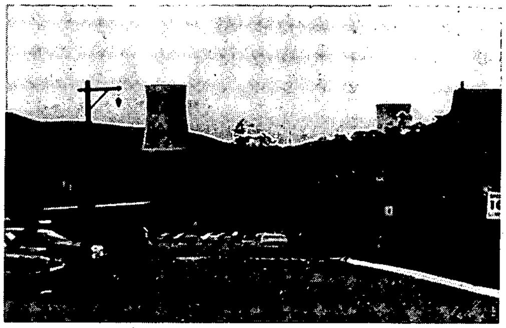
FIGURE 6-2 (B) ARTIST RENDITION OF ALTERNATIVE CLOSED-CYCLE COOLING SYSTEMS AND SEVERE PLUME FROM VARIOUS LOCATIONS IN THE INDIAN POINT VICINITY

Source: Photography and Retouching from Jones & Jones

Verplanck Apts.:
1-1/2 Mile S. of Proposed Tower



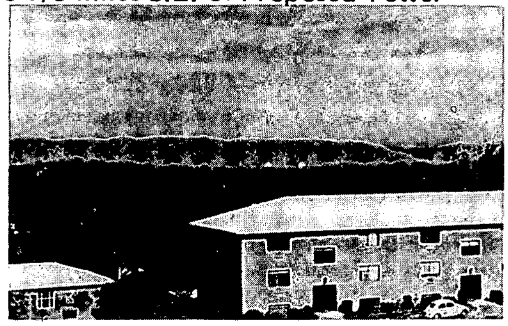
Before



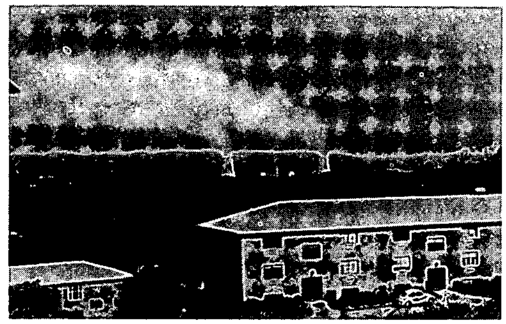
Natural Draft – Units 2 & 3

Circular Mechanical Draft – Units 2 & 3

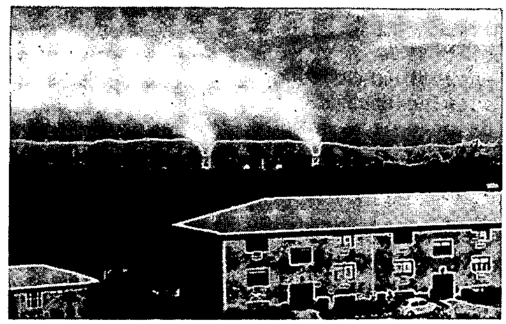
Baltic Apts.:
3-7/8 Miles S.E. of Proposed Tower



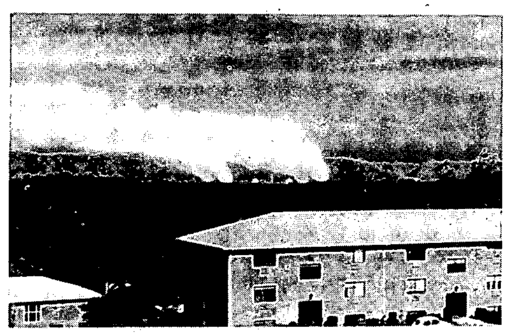
Before



Natural Draft – Units 2 & 3



Fan Assist Natural Draft – Units 2 & 3



Circular Mechanical Draft – Units 2 & 3

FIGURE 6-2(C) ARTIST RENDITION OF ALTERNATIVE CLOSED-CYCLE COOLING SYSTEMS AND SEVERE PLUME FROM VARIOUS LOCATIONS IN THE INDIAN POINT VICINITY

Source: Photography and Retouching from Jones & Jones

Through previous testing and research it was determined that for evaluating change in visual quality, three components of visual quality are important: (1) the memorability of a scene, (2) its wholeness, and (3) the harmony of its parts.[42] These criterion elements are termed "vividness," "intactness," and "unity." By carefully defining and scaling these elements, Jones & Jones, using a panel of experts, is able to objectively index the visual quality of an overall landscape type or a given scene. Overall visual quality and its individual components are scored from 1 (very high quality) to 100 (very low quality). Standards to be used in scoring are well defined.[43]

The Jones & Jones study indicates that the visual characteristics of plumes must be an important component in the total evaluation of the aesthetic impact of cooling towers. The severe plumes when the CMDCT is hidden from view were found to reduce the visual quality of viewscapes more than did the taller visible towers with severe plumes. Because of the reaction of the panel of design experts to the severe plume, the CMDCT was rated behind the NDCT and the FANDCT by the panel. Due to the more modest size of the FANDCT it was rated slightly less detracting from the quality of the viewscapes than the NDCT. The study did not explore the tendency for viewers to adjust their perception of a new element (plumes) as a negative element in the viewscape over time nor did the study explore change in the quality of viewscapes with less severe plumes. A complete evaluation of visual impact would then require an understanding of the difference in visual impact of various configuration of plumes each having different dynamic behavior and degree of visibility. Both the visual quality index evaluations of a given scene before towers and with towers would be expected to vary according to the existing meteorological conditions. A given view without towers would rate higher on a clear day than on a very hazy or rainy day, but the reduction in visual quality from towers and plumes, with given characteristics, would likely be greater on the clearer day because of the greater contrast between plume and ambient atmospheric conditions. On rainy or hazy days, not only is the viewing distance reduced, but the plume and background conditions also tend to merge. A more thorough analysis requires the following steps: specification of several dozen categories of plume conditions defined on the visual impact density and length of plume; develop a frequency distribution for the percentage of time each category would occur annually; evaluate a sample of viewpoints from the region for each of the categories; and the weighting of results by the value placed upon the quality of viewing conditions by local residents and visitors. This justification for this weighting is based on the assumption that greater value is placed upon the viewing experience during periods when visibility is greater and during non-winter months. This assumption would also imply that interest in scenery and viewing experienced is diminished during periods when visibility is poor.

Applicant's analysis of frequency of visual plume for one natural draft tower shows the vast majority of the time the plume will be running SSW toward the Georgia Pacific property and the west side of Verplanck. The second most frequent direction would be directly north over the river.[45] The analysis indicates that a visible plume will extend over the developed areas of the City of Peekskill and the Village of Buchanan only infrequently. The applicant's representation of frequency of visible plume is reproduced here in Figures 6-3 and 6-4. Although the appearance, including shape, rise, and length of a cooling tower plume is constantly changing as a response to the dynamics of the atmosphere, observations of these plumes over long time periods show that general configuration categories can be established for various atmospheric conditions.

Table 6-24 shows the frequency of occurrence for various combinations of wind speed and relative humidity from data collected at the 400-foot level at Indian Point. Figure 6-5 shows the schematics of the general types of visual plumes that might be expected to occur with these combinations. The longest and largest visible plumes would be expected when wind speeds are moderate and the atmosphere is very moist. However, as shown in Table 6-24, such conditions occur only 3 percent of the time at the site. The smallest and shortest plumes occur when the atmosphere is relatively dry. Such conditions exist 85 percent of the time at Indian Point. Light wind speeds and very moist atmospheric conditons usually indicate the presence either of fog or low stratus clouds which would visually obscure either the plume or both the plume and cooling tower. Therefore, no schematic is presented for the visual plume under these conditions.

Only slight modification of the findings for a single natural draft tower are needed to accommodate an additional natural draft tower or other alternative systems under consideration. The most important change in plume appearance and behavior with an additonal natural draft tower for Unit 3 would be the increased diameter of a single plume if both plumes merge, or occasionally, the parallel coexistence of two single plumes which do not merge. Plume rise or length will not, however, be noticeably affected. Plumes from mechanical draft towers tend to be considerably lower and shorter than from natural draft towers. Plumes from circular mechanical draft towers would have a rise between mechanical and natural draft and the length would tend to be close to that from the natural draft tower. Plumes from the fan-assisted natural draft towers would behave much the same as plumes from the natural draft towers.

TABLE 6-24

FREQUENCY OF OCCURRENCE FOR WIND SPEED AND HUMIDITY CONDITIONS AT THE INDIAN POINT SITE

Relative Humidity	Wind Speed Conditions		
	Light (< 7 mph)	Moderate (8 - 18 mph)	High (> 19 mph)
Dry (< 85%)	28%	43%	14%
Moist (> 85% - 95%)	3%	3%	1%
Very Moist (> 95%)	4%	3%	1%

Source: Based on meteorological data collected onsite at the 400-ft level during the period 8/73 - 7/74.

Figures 6-6 through 6-7(b) show a series of photographs of various plume conditions from several electric power stations in the United States and Germany. Figure 6-6 shows the plume from a single circular mechanical draft tower located in Gulfport, Mississippi, over the course of a day in September from 8:30 a.m. to 4:30 p.m. At 8:30 a.m., under high humidity conditions, low to moderate wind speed, and a low cloud cover, the plume was visible for several miles running just below the cloud cover at roughly 1,000 feet above ground level. From a mile distance, the plume was noticable but did not present an overly strong contrast with the cloud cover. By 12:00 noon, the cloud cover had risen to considerably higher than 1,000 feet and visibility had increased to 15 miles. The plume continually varied in direction with a strong tendency to rise rapidly into the cloud cover with a slight SW bend. At 3:30 p.m., from a distance of three miles the plume was barely distinguishable from the cloud cover even though ground level visibility was 15 miles. At 4:30 p.m., under conditions of low to moderate humidity and a broken cloud cover over 2,000 feet the plume appears small and dissipates almost completely before reaching the cloud cover. Figure 6-7(a) shows several plume conditions from large natural draft towers located at Paradise, Kentucky, and Keystone, Pennsylvania. The Keystone pictures show the dense highly visible plumes typically existing during cool/high humidity winter conditions. Short, quickly dissipating plumes are shown to exist detached from the lower ground fog at the Paradise station. Figure 6-7(b) shows plumes associated with mechanical draft and smaller natural draft towers located at Michigan City, Indiana; Montour, Pennsylvania; Centralia, Washington; and Schmehausen, Biblis, and Bochum, West Germany. The plumes are all pictured on a heavily overcast or hazy day. Under such conditions plumes tend to be less obtrusive blending in with background conditions. It is observable from these pictures that even under conditions of low cloud and haze, plumes have considerable buoyancy and,therefore, contribute little or nothing to ground level fog or haze.

In three staff studies (Three Mile Island, Arkansas and Zimmer) examining the regional impact of nuclear plant construction, the question of the aesthetic perception of cooling tower by local residents was investigated. Each facility has a hyperbolic natural draft tower. Three Mile Island has two 370 foot towers each for Units 1 and 2. The towers for unit 1 were in operation during the staff visit. The natural draft tower for Arkansas Unit 2 is 475 feet high and the tower for Zimmer Unit 1 is 479 feet high. Both towers were completed but not in operation at the time of the staff study. In all three cases, no local opposition to the aesthetics of the towers was found. The towers at first are an object of intense curiosity but gradually become accepted as part of the landscape.

On the basis of the evidence presently available on visual impacts of alternative closed cycle cooling systems for the Indian Point site, the staff believes the circular mechanical draft alternative generally superior to the four other alternatives. For any of the alternatives, the plume taken alone will be a quite moderate visual intrusion a large percentage of the time. The tower structures, on the other hand, will show less change in visual appearance; the degree of

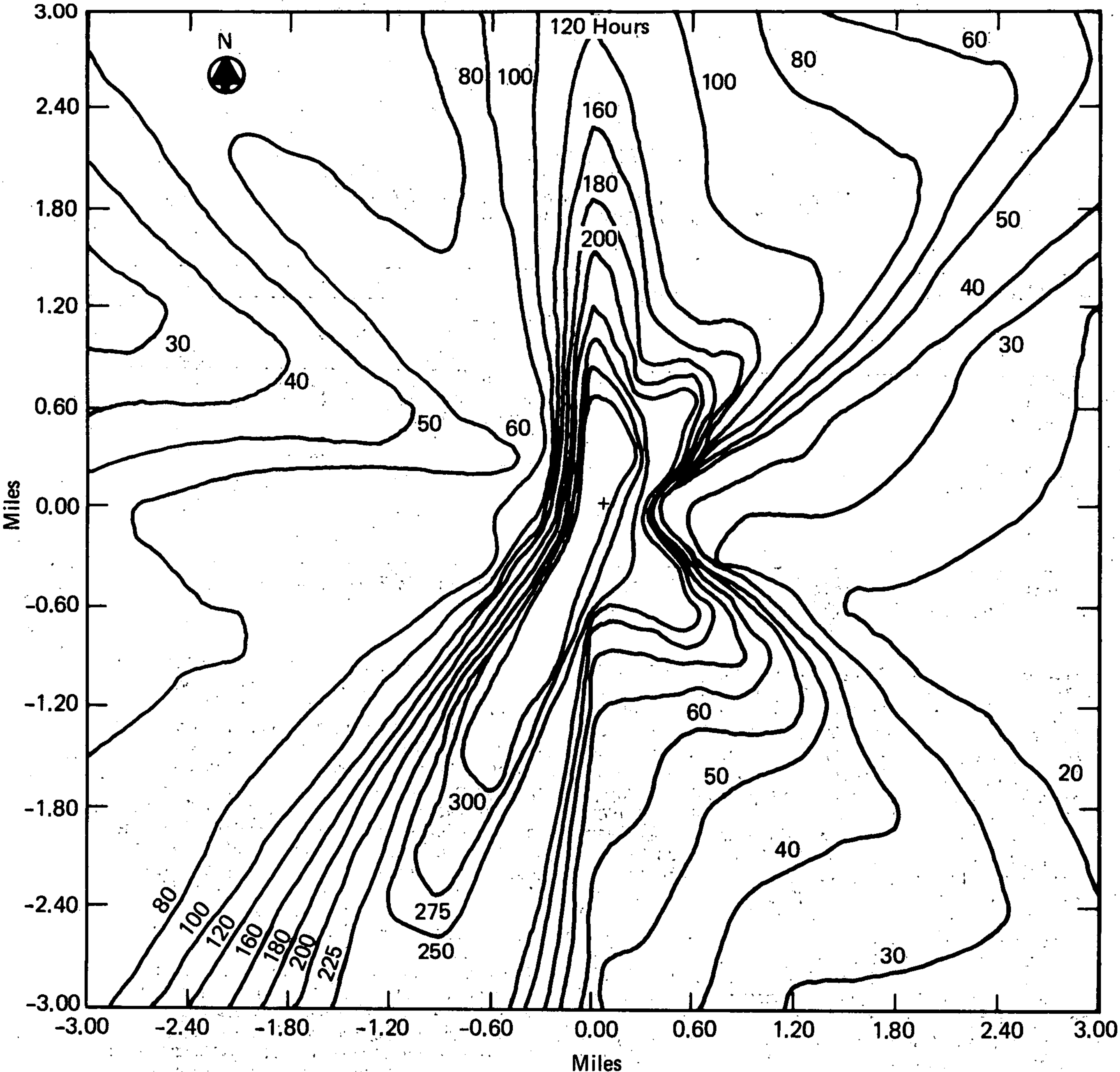


FIGURE 6-3 ISOPLETH OF NUMBER OF HOURS VISIBLE PLUME EXTENDS DISTANCE DOWNWIND IN EACH DIRECTION (0-3 MILES) (PERIOD OF RECORD – OCTOBER 1, 1973 THROUGH AUGUST 31, 1974)

SOURCE: Consolidated Edison Company of New York, Inc., Economic And Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 2, December 1, 1974, Figure 2-1

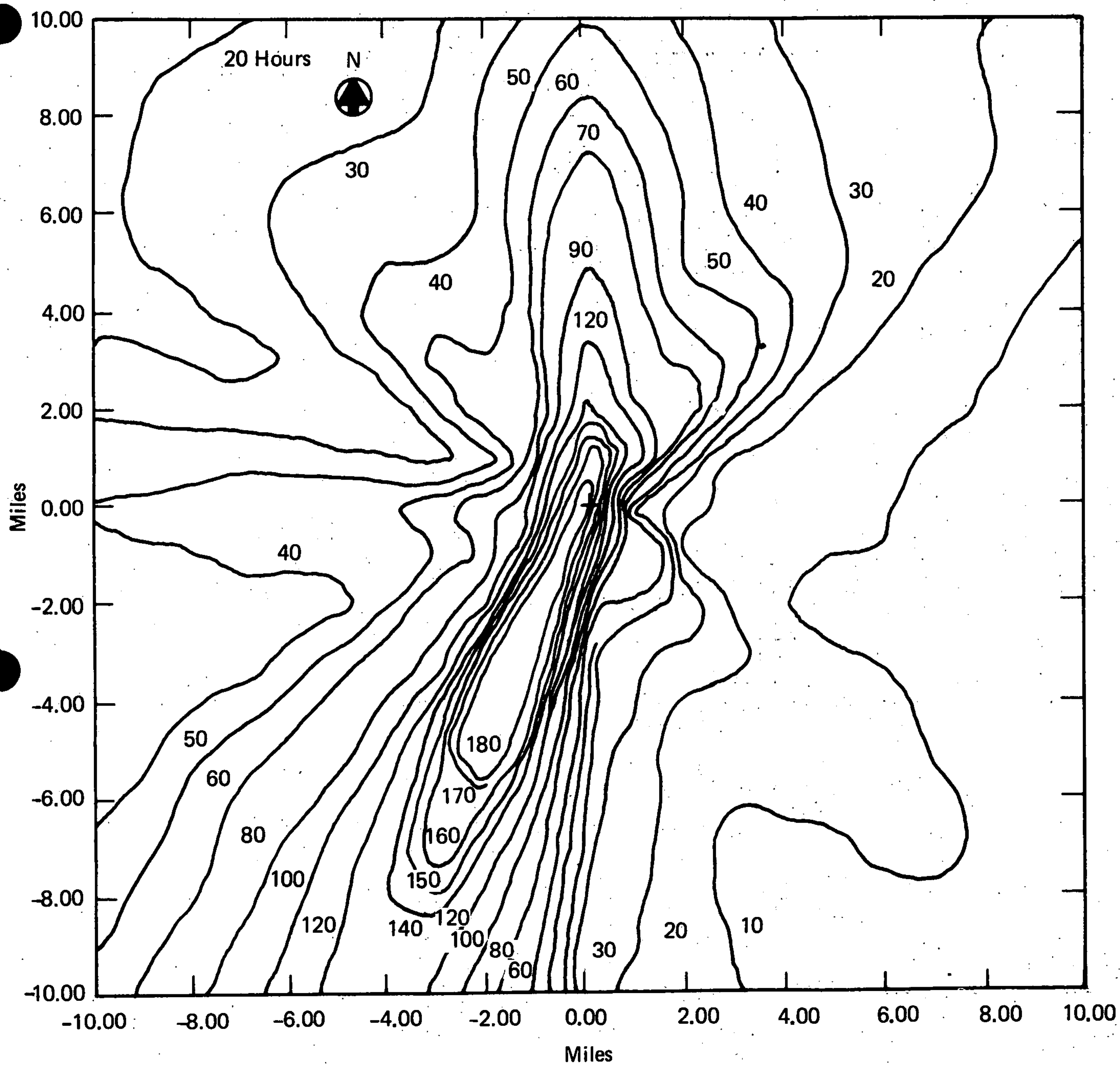


FIGURE 6-4 ISOPLETH OF NUMBER OF HOURS VISIBLE PLUME EXTENDS DISTANCE DOWNWIND IN EACH DIRECTION (0-10 MILES) (PERIOD OF RECORD – OCTOBER 1, 1973 THROUGH AUGUST 31, 1974)

SOURCE: Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 2, December 1, 1974, Figure 2-2.

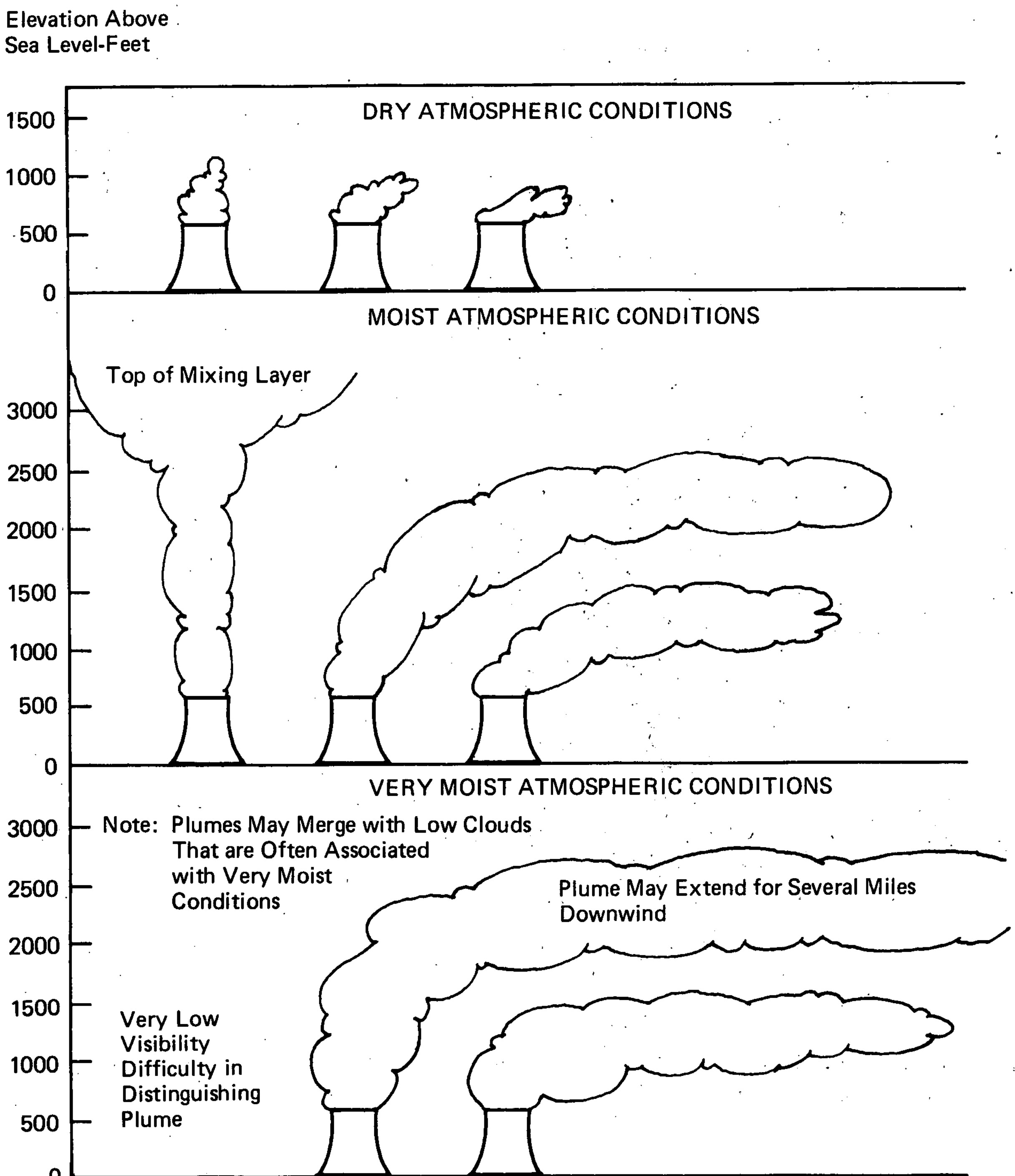
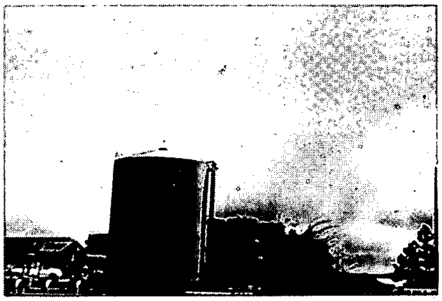


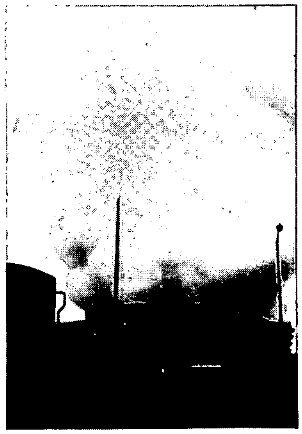
FIGURE 6-5 SCHEMATIC OF COOLING TOWER PLUME CONFIGURATIONS UNDER VARIOUS METEOROLOGICAL CONDITIONS

8:30 A.M./96% Rel. Humidity/73°F/Wind 6+ Knots ENE/4+ Miles Visibility

Looking N. Approx. 1 Mile From Cooling Tower

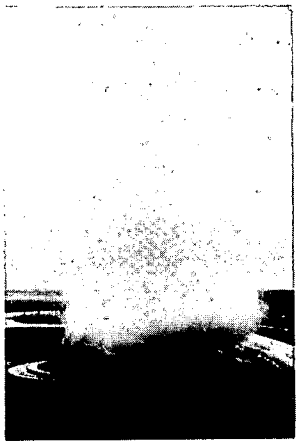


Looking S.E. Approx. 200 Yds From Cooling Tower

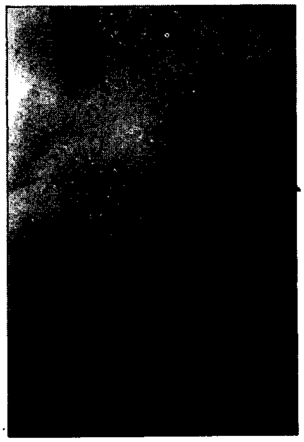


12:00 Noon/87% Rel. Humidity/76°F/Wind 12 Knots NNW/15 Miles Visibility

Looking Down on Tower From Roof of Turbine Building Spray Pond to Right



Continuation of Plume



3:00 P.M./79% Rel. Humidity/77°F/

Wind 12 Knots NNW
15 Miles Visibility
Plume in Center
Above Treeline
3 Miles Distant

3:45 P.M./74% Rel. Humidity/79°F/

Wind 12 Knots NNW
15 Miles Visibility
Plume Slightly
Right of Center
View From
Airplane 3.5
Miles Distant
After Takeoff

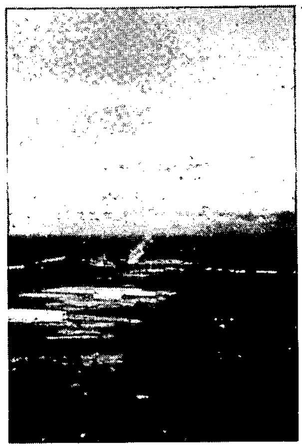


FIGURE 6-6 PLUME VARIATIONS FOR THE CIRCULAR MECHANICAL DRAFT COOLING TOWER BACK-FITTED TO MEET THE COOLING REQUIREMENTS OF A 500 MWe COAL FIRED GENERATING PLANT AT THE JACK WATSON STATION OF THE MISSISSIPPI POWER CO., GULFPORT, MISSISSIPPI, SEPTEMBER 12, 1975

Paradise, Kentucky

Light Plume Above Ground Fog
Viewed From 1000 Ft Above
Ground Level, September

Moderate
Plume
January

Keystone, Pennsylvania

Aerial View of Very Severe
Winter Plume

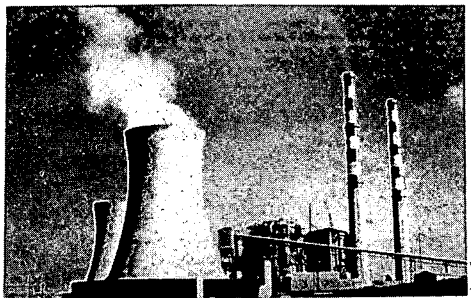
Aerial View of
Very Severe
Winter Plume

Aerial View of Moderate Plume

Moderate Plume

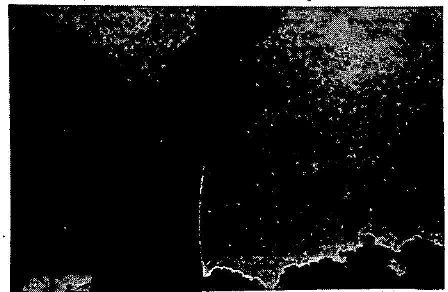
FIGURE 6-7(a) COOLING TOWER PLUME VARIATIONS UNDER A WIDE RANGE OF METEOROLOGICAL CONDITIONS

Montour, Pennsylvania



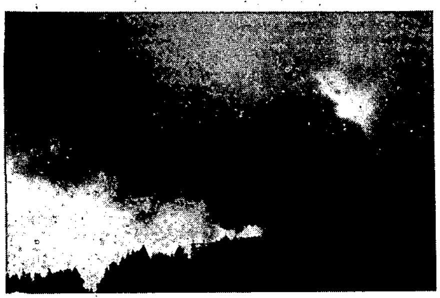
Slight Plume and Clear Sky, October

Michigan City, Indiana



Slight Plume and High Overcast, July

Centralia, Washington



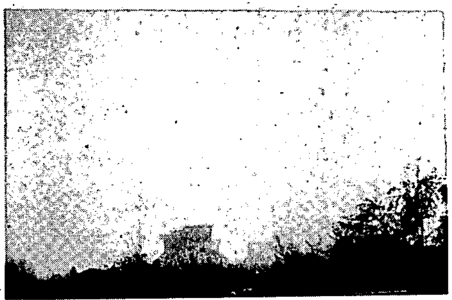
Moderately Heavy Plume and Low Clouds, April

FEDERAL REPUBLIC OF WEST GERMANY

Schmehausen

Hazy, Mid-afternoon, Moderate Plume, Early November

Bochum



Hazy, Early Afternoon, Moderate Plume, Early November

Biblis

Foggy, Thermal Inversion, Noon, Moderate Plume Blending With Fog, Early November

FIGURE 6-7(b) COOLING TOWER PLUME VARIATIONS UNDER A WIDE RANGE OF METEOROLOGICAL CONDITIONS

visibility is principally due to the level of haze at the time of viewing. An obvious trade-off exists between the tall tower alternatives which provide an identifiable plume source and a large structure visible over a wide area much of the time and the short tower alternative which provides a less identifiable plume source and a much less visible structure. If the assumptions that local residents will adjust to a considerable degree to occasionally viewing heavy plumes with no observable source and that the lighter more frequent plume would not be disturbing because of the lack of observable source are valid, then the short tower alternative will have the advantage. Where the linear mechanical draft and the circular mechanical draft are visible, the circular mechanical draft presents a more compact and pleasing design. It is not clear that everyone would penalize the tall structures as a completely unwelcome visual intrusion, especially relative to the alternative of plumes from an unseen source. Some undetermined percentage of the population would find the tall tower alternatives and especially the natural draft towers interesting or even pleasant to observe.

The staff investigated the potential for a change in visual quality resulting from alternative cooling systems to have adverse impacts on the local economy, especially the real estate market and the opportunity for residential, commercial, and industrial development. On the basis of reconnaissance of the surrounding communities, discussion with local officials, review of local planning documents, assessment of visual change, and knowledge of aesthetic impacts of cooling towers in other communities, the staff finds little evidence to support the position that existence of a closed cycle cooling system at Indian Point would have a perceptible impact on real estate values. In the three staff studies previously mentioned, no evidence was found to indicate that real estate values had been adversely impacted by existence of the plants or towers. No adverse impact on real estate values is known to have occurred in the case of the Schmehausen and Biblis stations. On the other hand, the Bochum station in West Berlin was placed within a densely settled residential area and did depress the value of abutting property according to plant officials.

The staff initially identified several established areas of Buchanan and Peekskill and the Peekskill waterfront, which is targeted for redevelopment, as potentially sensitive. These areas have relatively unobstructed views of the Indian Point site and are roughly within one to two miles of it. Some discontent among existing residents who will be impacted is highly probable, but the staff believes that the visual change from any of the alternative cooling systems will not be sufficiently severe to result in a relative deterioration of values or marketability of properties presently developed. The most significant potential impact involves the southern part of the Peekskill waterfront redevelopment area, what is now the Standard Brands property. Residential reuse is called for by the redevelopment plan. The most ambitious plan calls for luxury housing and marina development on this property. This development would be within three-tenths to seven-tenths of a mile from the Unit 2 cooling tower. A natural draft tower would be a considerable visual intrusion to the site. A fan-assisted natural draft would be less of an intrusion, but still out of proportion with other elements of the viewscape. The structure of the circular mechanical draft towers would likely be in proper proportion to both structures at the Indian Point facility and other elements of the viewscape, as would linear mechanical draft towers, but the circular mechanical draft towers have a more attractive design than do the linear mechanical draft towers. Plumes from the Indian Point site would be reduced when the plumes are moving in a southerly direction. On the basis of visual impact on the residential redevelopment of the Standard Brands property, either the fan-assisted natural draft tower or the circular mechanical draft tower would be preferred.

For the IP area generally, the staff believes, of the three lowest cost alternatives, the CMDCT presents less of a visual intrusion and, therefore, is aesthetically preferred.

b. Noise

Staff evaluation of onsite and offsite noise levels for alternative cooling tower systems is presented in Section 5.2.5. With the exception of the area immediately to the northeast of the site boundary and the river and opposite shore to the west and northwest, the increase in noise level offsite is expected to be quite small and not perceivable by local residents. A small but perceivable increase in noise level is anticipated from the intersection of Bleakly Avenue and Broadway northeast to Lents Cove. This area could experience a speech intelligibility degradation of 5 to 10 percent for a crossflow natural draft tower, 15 to 18 percent for a counterflow natural draft tower and 15 to 25 percent for mechanical draft wet towers. The staff believes that the offsite sound levels from operation of linear mechanical draft wet/dry towers or circular mechanical draft wet towers would not differ greatly from those predicted for the linear mechanical draft wet towers. The west shore of the river is thinly settled and not likely to be further developed for residential use.

The area of greatest potential audio impact, including Bleakly Avenue near Broadway, the 14-acre site deeded to the Village of Buchanan by the applicant, and part of Charles Point north of Lents Cove, is all within one-half mile of where the cooling towers would be located for Unit 2. The Village of Buchanan expects to intensively develop the site over a period of years and may spend up to two million dollars.[46] One of the first steps would be construction of a boat ramp at Lents Cove. Cooling tower noise will detract from the quality of this development, but the existence of athletic playing fields and boat ramps will result in an increased noise level in the park which will diminish the impact of noise from cooling towers. Roughly 30 to 50 percent of Charles Point, identified as a potential redevelopment area within the Peekskill waterfront, lies within one-half mile of the future cooling tower(s). The potential for future adverse noise impact on this location, if it is used for residential buildings, has been examined by the staff which concluded that the distance from the cooling tower(s) and the expected level of noise generated from within the area itself would preclude impact from the cooling tower(s).

c. Drift and local weather modifications

Offsite corrosion from saline drift is not expected to be a problem for any of the alternative towers--see Section 5.1.3. The number of hours of fog is expected to increase somewhat directly north of the tower(s) over the Hudson River--see Section 5.2.3.1. The natural draft cooling tower will induce fog about 20 hours per year, whereas linear mechanical draft cooling towers will induce fog 82 hours per year. Induced fog will tend to occur during periods of relatively low visibility and early in the morning; thus, the visual impact of additional fog will be quite small. Hindrance to boating in the area would also be quite minor. Because of the insignificance of the occurrence of induced fog, this is not an important consideration in selection of an alternative cooling system.

The staff has considered the potential for injurious effects of drift aerosol and humidity from the cooling tower on human health and finds no basis for concern. Release of aerosols on local populations has been predicted by the staff to obtain maximum monthly values (August) for CMDT of 1.9 $\mu g/m^3$ and 0.4 $\mu g/m^3$ for NDCT. The highest offsite annual values for CMDT and NDCT were calculated by the staff to be 0.4 $\mu g/m^3$ and 0.08 $\mu g/m^3$, respectively. This aerosol consists predominately of NaCl. Dautrebande and Capps[47] report that NaCl aerosols by themselves appear to be completely devoid of irritant action on mammalian respiratory systems. NaCl aerosols can interact synergestically with SO_2 and other similiarly irritating substances to enhance the effects of these irritating substances. The action of NaCl in this instance is non-specific and other inert particulates have been found to have the same action.[48]

The staff calculates that the NaCl represents 1.6% of the total settleable particulate at the site prior to the cooling tower operation (CCC-ER, Appendix A, Table 14). NDCT operation would increase NaCl by 0.4 $\mu g/m^3$ in the air for the highest monthly value. CMDT operation is predicted to increase NaCl by 1.9 $\mu g/m^3$ for a similar period. The staff concludes that this is a minor increase in the total particulate inventory in the atmosphere. Considering that the action of NaCl is non-specific in respiratory irritations, no increase in human respiratory irritations is expected.

The average offsite incremental relative humidity (RH) due to NDCT was found to be about 0.01% (in % RH above ambient RH) (CCC-ER, Appendix B, Section 2.3). The ambient RH for the site sharply fluctuates on a daily and monthly basis. Often the changes range from 50-90% (RH).

The staff concludes that the contributions of moisture to the total moisture regime from any type of cooling tower operation will be insignificant in comparison to the daily fluctuations in the local moisture regime.

d. Tax revenues

Real estate taxes on the Indian Point station are paid to seven governmental jurisdictions and special tax districts: Village of Buchanan, Town of Cordlandt, County of Westchester, Montrose School District, Water District (Verplanck) and Fire Protection District (Verplanck). Any additional taxes paid on the closed cycle cooling system would vary among alternatives in proportion to the total contract construction cost. Estimated taxes paid by jurisdiction are shown in Table 6-25. A CMDCT is shown to have the lowest tax obligation. Taxes on FANDCT are 11 percent higher and on NDCT are 24 percent higher.

e. Summary comparison--impacts of alternative systems

The staff has evaluated the possible impacts of operation of the five alternative closed cycle cooling systems on the human environment. Four areas of potential impacts investigated are visual aesthetics, noise, drift and local weather modifications, and tax revenues. Visual aesthetics was found to be the most consequential category of impacts in regard to both the

TABLE 6-25

ESTIMATED ANNUAL REAL ESTATE TAXES ON CLOSED-CYCLE COOLING SYSTEM ALTERNATIVES DURING OPERATION
($1,000)

ITEM	TOWER				
	NDCT	FANDCT	LMDCT	CMDCT	WDMDCT
Full Valuation of Alternative Cooling Towers[a]	56,307	50,286	53,626	45,253	59,658
Town of Cortlandt Taxes Assessed Valuation (Equalization rate = 18.29%[b])	10,299	9,197	9,808	8,277	10,911
Taxes Collected by Town for:					
State of New York, $.80 per M	8	7	8	7	9
Town of Cortlandt, $4.34 per M	45	40	43	36	48
County of Westchester, $32.58 per M	336	300	320	270	355
Fire protection district (Verplanck), $1.22 per M	13	11	12	10	13
Water district, $9.49 per M	98	87	93	79	104
School district No. 3 (Montrose) $76.97 per M	793	708	755	637	840
Total	1,293	1,153	1,231	1,039	1,369
Village of Buchanan Assessed valuation (Equalization rate = 17%)[c]	9,572	8,549	9,116	7,693	10,142
Taxes, $17 per M	163	145	155	131	172
Total Taxes	1,456	1,298	1,386	1,170	1,541

[a]Full valuation of alternative cooling towers is estimated to be the present value (1976) capital cost of the cooling tower excluding carrying charges. The present discounted value capital cost as shown in Table 6.2.7 includes direct costs (cooling structure, Amertap clean system, excavation for tower, tunnels and electrical work, etc.) and indirect costs (engineering and supervision, administration, payroll, escalation, contingency, etc.).

[b,c]Equalization rate for 1976.

absolute level of impact and the differing characteristic of impacts among the five alternatives. Noise was found to be of more limited consequence and can be moderated by passive noise abatement devices such as vegitative screening and man-made barriers. Any of the five cooling systems would be a visual intrusion in the viewscape from many locations in a wide radius around the Indian Point site. The visual intrusion would be more in a number of residential neighborhoods one to two miles from the location of the applicant's proposed natural draft tower. The most consequential impact would be on the development potential of Charles Point for luxury high rise apartments. There is a trade-off among the various alternatives between the physical characteristic of the tower, height and diameter, and plume behavior and resultant visual perception. The staff ranks the aesthetic impacts of the alternatives from lowest to highest: wet/dry linear mechanical draft, circular mechanical draft, linear mechanical draft, fan-assisted natural draft, and natural draft.

REFERENCES FOR CHAPTER 6

1. United States Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, Docket No. 50-286, February 1975, p. xi-60.

2. Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume No. 1, December 1, 1974, Table 5-4.

3. Ibid. Table 3-4.

4. Ibid. P. 5-22.

5. Ibid. P. 5-21.

6. Telephone conversation between Dr. M. B. Spangler, NRC, and Mr. M. Scott, Consolidated Edison on August 5, 1975.

7. United States Atomic Energy Commission, Directorate of Licensing, Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 2, Docket No. 50-247, September 1972, p. xi-21.

8. Letter from George W. Knighton, Chief, Environmental Projects Branch No. 1, Division of Reactor Licensing, United States Nuclear Regulatory Commission, to William J. Cahill, Jr., Vice President, Consolidated Edison Company of New York, Inc., July 10, 1975.

9. Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Supplement, Volume No. 1, August 6, 1975.

10. "Cooling Towers" Power Magazine, McGraw Hill Publishing Company, March 1973.

11. Research-Cottrell, "Research-Cottrell widens your choice in cooling tower selection," Bound Brook, New Jersey.

12. NRC staff meeting with Consolidated Edison officials, August 19, 1975.

13. Letter from George W. Knighton, Chief, Environmental Projects Branch No. 1, Division of Reactor Licensing, United States Nuclear Regulatory Commission, to William J. Cahill, Jr., Vice President, Consolidated Edison Company of New York, Inc., July 10, 1975.

14. Consolidated Edison Company of New York, Inc., Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Supplement, Volume No. 1, August 6, 1975.

15. Ibid.

16. NRC staff meeting with Consolidated Edison staff, August 19, 1975.

17. Consolidated Edison Company of New York. 1974, "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2." Appendix D.

18. Summary Report - 701 Waterfront & Uplands Study, Peekskill, New York, Raymond, Parish & Pine, Inc., March 1975, pp. 7-8.

19. 1974 Rockland County Data Book, Rockland County Planning Board, New York City, New York, 1974, p. 13.

20. Profile Legislative District #1 - Westchester County Department of Planning, p. 1.

21. Rockland County Land Use Plan, Rockland County Planning Board, New York City, New York, 1973, p. 64.

22. Ibid. PP. 36-39.

23. ER, Table 6-12.

24. Letter to Mr. Carl L. Newman, Consolidated Edison from Diane S. Waite, Division for Historic Preservation, New York State Parks and Recreation, dated August 1, 1975.

25. Ritchie, W. A., The Archaeology of New York State, Natural History Press, 1965.

26. ER Vol. I, p. 6-71.

27. ER, Appendix G, pp. 16-17.

28. Ibid. P. 22.

29. ER Vol. I, p. 6-53.

30. J. B. Burnham, et al., A Technique for Environmental Decision Making Using Quantified Social and Aesthetic Values, BNWL-1787, Pacific Northwest Laboratories, Richland, Washington, February 1974.

31. P. L. Hendrickson, et al., "Measuring the Social Attitudes and Aesthetic and Economic Considerations Which Influence Transmission Line Routing," BNWL-1837, Pacific Northwest Laboratories, Richland, Washington, July 1974.

32. G. R. Jones, et al., "A Method for the Quantification of Aesthetic Values for Environmental Decision Making," paper presented at the Conference on Nuclear Power Plant Siting, American Nuclear Society, Portland, Oregon, August 25-28, 1974.

33. G. R. Jones, "Preliminary Report for Classification and Evaluation of Visual Landscapes," Landscape Architecture Research Office, Graduate School of Design, Harvard University, 1966.

34. G. R. Jones, "Techniques for Assessing and Quantifying Environmental, Aesthetic and Recreational Values and Impacts," Proceedings of a Conference on Recreation Planning for Federally Licensed Hydroelectric Projects, sponsored by The Bureau of Outdoor Recreation, the Pacific Northwest Utilities Conference Committee and the Federal Power Commission, Portland, Oregon, May 2-3, 1974.

35. G. R. Jones, et al., "A Method for the Quantification of Aesthetic Values for Environmental Decision Making," Nuclear Technology, Volume 25, No. 4, pp. 682-713, April 1975.

36. Jones & Jones, An Assessment of the Effects of the Bradley Lake Hydro-Power Project upon the Environmental, Aesthetic and Existing Recreation Resources of its Region, prepared for the Department of the Army, Corps of Engineers, Alaska District, Contract No. DACW85-73-0042, August 1975.

37. Jones & Jones, Scenic and Recreational Highway Study, State of Washington Legislative Transportation Committee, Olympia, Washington, 1975.

38. Jones & Jones, "Scenic Resources of the Upper Williams Fork Basin," Technical Report H of Preliminary Environmental Evaluation of Expanding Upper Williams Fork Basin Water Diversion System, for Denver Board of Water Commissioners by CH2M Hill, Project No. D8715.0, Volume II, Denver, Colorado, December 1974.

39. Jones & Jones, "Visual Impact Assessment," in Draft Environmental 4(f) Statement, Administrative Action for Project I-90 - 1(35)16, Coeur d'Alene ro Wolf Lodge Bay, Idaho Department of Highways, Boise, 1973.

40. Jones & Jones, "Visual Impact Assessment," in Foothills Project Environmental Impact Statement, 2 Volumes, Board of Water Commissioners, Denver, April 1974.

41. Jones & Jones, Visual Impact Study: Statement of Findings Alternative Closed-Cycle Cooling Systems Indian Point Nuclear Generating Plant, prepared for United States Nuclear Regulatory Commission, Seattle, November 1975.

42. Ibid., p. 14.

43. Ibid., p. 14-29.

44. Ibid., p. 60.

45. Economics and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Volume 2, Consolidated Edison Company, New York, December 1, 1974, Appendix B, pp. 26-27.

46. Summary Report 701 Waterfront & Uplands Study, Peekskill, New York, Raymond Parish & Pine, Inc., March 1975.

47. Dautrebande, L. and R. Capps, 1950. Studies on aerosols. IX. Enhancement of irritating effects of various substances on the eye, nose, and throat by particulate matter and liquid aerosols in connection with pollution of the atmosphere. Arch. int. Pharmocodyn. LXXXII, No. 4; 505-527.

48. Dautrebande, L. J. Shauer and R. Capps, 1951. Studies on aerosols XI. Influence of particulate matter on the eye irritation produced by volatile irritants and importance of particle size in connection with atmospheric pollution. Arch. int. Pharmocodyn LXXXV. No. 1-2; 17-47.

7. EVALUATION OF PROPOSED ACTION

7.1 ENVIRONMENTAL EFFECTS

The major environmental impact of cooling towers at the Indian Point site is one of visual impact or aesthetics as discussed in Section 6.3.2.3. The visual impact arises from the size of the structure or structures and from the plume, when it is visible. The plume will present a more variable impact, depending on meteorological conditions.

A secondary environmental impact is the drift (and salt contained therein) produced by the cooling tower and distributed over the surrounding area. In the case of mechanical draft towers much of the drift would be deposited on and near the site in relatively high concentrations. Conversely, drift produced by a natural draft tower would be distributed over a larger area at lower concentrations.

Other possible adverse environmental effects of tower operation are considered to be negligible.

During construction, there will be increased traffic and noise.

The environmental impact on terrestrial biota will be minimal and,because the tower is to be constructed onsite, no additional land will be required.

7.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

On the time scale reaching several generations into the future, the useful life of the nuclear station and the proposed cooling tower is considered short-term. The resources are dedicated to the production of useful electrical energy during the anticipated life-span. Except for a small decrease in electrical energy produced, the cooling tower will not change the productivity.

Reducing the amount of water withdrawn from the river (hence, reducing impingement and entrapment of biota) will have the long-term (as well as short-term) effect of maintaining or improving certain species.

The staff concludes that the benefits to be derived from the closed cycle cooling system outweigh the potential impacts on the environment.

7.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No special materials (such as uranium) are required for the cooling system. Much, if not all, of the materials to be used are "more of the same" that have already been used at the site.

No additional land, over that already committed to the site, needs to be taken.

The other resources required are human skill, talent and labor and money required to design, build and operate the tower. These are small fractions of the resources already committed to the Indian Point site.

7.4 COST-BENEFIT BALANCE

On the basis of the foregoing analysis, the staff finds that the choice of an alternative CCC system for IP-2 reduces to a consideration of drift, noise and visual aesthetics. All other potential sources of either adverse or beneficial impacts are found to be small.

From a drift standpoint, the ranking of the three most likely alternatives (from best to worst) was natural draft, fan-assisted natural draft and circular mechanical draft tower. In terms of noise, the same ranking occurred. When the visibility of the plume is considered, the ranking was in the reverse order; visibility of the structure also results in the ranking of circular mechanical draft, fan-assisted natural draft and natural draft towers. The ranking of total cost is natural draft, fan-assisted natural draft and circular mechanical draft tower, although the range of cost is only 3%. The engineering design of both the circular mechanical draft and fan-assisted natural draft would take up to a year's additional effort compared to the natural draft cooling tower.* Since all of the techniques used in determining these rankings have varying degrees of uncertainty and subjectivity, the relatively small differences found do not warrant changing the applicant's selection of the natural draft cooling tower as the preferred system. Direct cost and the more important indirect economic and social impacts analyzed by the staff are summarized in Table 7-1.

*See Section 6.2.5d concerning construction time required.

TABLE 7-1

SUMMARY OF CONSEQUENTIAL ENVIRONMENTAL IMPACTS AND COST OF ALTERNATIVE CLOSED-CYCLE COOLING SYSTEMS FOR INDIAN POINT UNIT NO. 2

Tower Alternative	Present Value Direct Costs	Indirect Economic and Social Impacts: Aesthetics	Noise	Salt Drift	Other Community Impacts
Circular Mechanical Draft	209	Lowest overall impact, low profile, reasonably attractive design--plume occasionally disturbing.	Similar to LMDCT	Moderate on-site. No important impact off-site.	Minor
Fan-Assisted Natural Draft	206	Impact less than NDCT. Structure less overwhelming and plume similar to NDCT.	Between LMDCT and NDCT.	Minor to moderate on-site. No important impact off-site.	Minor
Natural Draft	204	Greatest impact. Structure overwhelming even though plume removed from low-level view.	Least noise.	Minor on-site. No important impact off-site.	NDCT would have greatest volume of truck traffic during construction but disruption would be temporary and no greater than has been experienced during other IP construction.
Linear Mechanical Draft	226	Slightly worse than CMDCT. Structures not as attractive, take up more space and plume slightly more offensive.	Most noise.	Moderate on-site. No important impact off-site.	Minor

TABLE 7-1 (continued)

SUMMARY OF CONSEQUENTIAL ENVIRONMENTAL IMPACTS AND COST OF ALTERNATIVE CLOSED CYCLE COOLING SYSTEMS FOR INDIAN POINT UNIT NO. 2

Tower Alternative	Present Value Direct Costs	Indirect Economic and Social Impacts			
		Aesthetics	Noise	Salt Drift	Other Community Impacts
Wet/Dry Mechanical Draft	239	Competitive to CMDCT, structures have slightly greater impact than RMDCT. Plume same in summer--lighter in spring/fall--very light in winter.	Noise somewhat less than MDCT because fans do not operate all the time.	Moderate on-site No important impact off-site.	WDMDCT would generate more local tax revenue than any other alternative.
General Comments	NDCT cost is: 1% less than FANDCT 2% less than CMDCT 10% less than LMDCT 15% less than WDMDCT	Tall massive structure way out of proportion with other visual elements of local viewscapes. Visual impact of plumes varies over course of days and seasons.	Traffic impact confined to Bleakly Avenue--not a serious problem. Operating noise can be baffled at additional expense.	Any damage will be confined to on-site vegetation and metallic surfaces.	Neither differences in volume of truck traffic nor differences in tax revenues is considered consequential for choice of system. Other impacts minor.

8. RESPONSES TO COMMENTS

8.1 INTRODUCTION

Pursuant to 10 CFR 51, the Draft Environmental Statement (DES) was transmitted in February 1976, with a request for comment, to the Federal, State, and local agencies listed in the Summary and Conclusions at the beginning of this Final Environmental Statement (FES). In addition, the AEC requested comments on the DES from interested parties by a notice published in the Federal Register on April 26, 1974.

Comments in response to these requests were received from the agencies and interested parties shown in the following list.

Consolidated Edison Company of New York, Inc.
U. S. Environmental Protection Agency
Federal Power Commission
Department of Housing and Urban Development
United States Department of the Interior, Office of the Secretary
United States Department of Commerce
United States Department of Agriculture, Forest Service,
Soil Conservation Service
Department of Transportation, United States Coast Guard
Energy Research and Development Agency
New York State Department of Environmental Conservation
State of New York Department of Law
Palisades Interstate Park Commission
Village of Buchanan
City of Peekskill, City of Peekskill Planning Commission,
Mayor of Peekskill, Town of Cortland
Hudson River Fishermen's Association
Bernard G. Gordan
Hamilton Fish

8.2 RESPONSES

8.2.1 Responses to Comments by Con Edison

8.2.1.1 General Comments

1. No response needed

2. The statement that FANDT and CMDCT "warrant further investigation" was meant to convey the idea that the two additional cooling systems appeared to be viable alternatives, based on available information. It was not intended to imply that, at this point, Con Edison should be required to undertake additional engineering studies on them, particularly in view of the staff's recommendation of a NDCT.

3. Village of Buchanan

The staff is, of course, aware of not only the concern of the Village of Buchanan but that of other local residents as well. It is agreed that more discussion is warranted. This has been accomplished by changes in the text, other responses to comments and in the summary and conclusions (see Summary and Conclusions and Sections 6.3.3.3, 8.2.13, 8.2.17 and 8.2.18).

4. Deficiencies in the staff's cost analysis

The staff has revised its analysis of downtime costs in Section 6.2.2.2(d) to incorporate the applicant's comment regarding the two concepts of replacement capacity. However, it is the staff position that the replacement capacity proposed by the applicant is an uneconomically large commitment of resources in view of the relatively high reserve margins on the Consolidated Edison system with IP-2 out of service from May 1, 1979 to December 1, 1979 (see Section 6.2.2.2(d) for a more detailed discussion).

In regard to the applicant's comments on discount factor and capital cost estimates, see staff responses to Con Edison's specific comments 6-3 and 6-8, respectively.

5. Environmental Analysis

See responses to specific comments

6. Schedule for Implementing Cooling Tower Construction Program

See response to Hudson River Fishermen's Association comments

7. Impact of Natural Draft Tower on Property Values

The applicant's comment provides new and additional information to the staff which is being submitted for the first time. The staff recognizes the possibility that cooling towers may have an adverse economic impact on some property values in the Indian Point area (see Section 6.3.3.3). However, the staff believes that the extent or magnitude of the impact cannot be determined at this time with any degree of reliability in view of the inadequacy of analytical techniques available for forecasting such impacts. There are also tax benefits which accrue to local communities as a result of the nuclear plant and cooling towers which need to be considered (See Sections 6.3.1.6 and 6.3.3.3(d)). Taxing jurisdictions in which IP is located will receive tax benefits from the installation of a cooling tower at IP-2 (unless ruled tax exempt; see response to comment No. 53 from the New York State Department of Envionmental Conservation). The latter benefits need also be considered in any assessment of property value impacts.

8.2.1.2 Specific Comments

0-1 Description of licensing condition is misleading.

The appropriate change has been made on p iii.

0-2 Advisory Council on Historic Preservation and the Village of Buchanan should be asked to comment on the DES.

Although these two organizations are not listed on p iv, they were sent copies of the DES but comments only from the Village of Buchanan were received.

0-3 Monitoring of deposition of salt drift.

There is no inconsistency between a finding a minor or negligible expected impact from drift and a requirement to monitor the environment. The staff has framed its analysis in the language of risk (statistical uncertainty arising from natural variance) which acknowledges that a bounded margin of error exists in the analysis. Further analysis establishes that the consequences of error would not be unmanageable. Monitoring could serve the useful purpose of establishing a basis for minor restorative actions if needed.

1-1 Footnote is in error.

The footnote has been deleted and the text updated.

1-2 Reference 5a is not documented.

The text and references have been corrected.

2-1 CMDCT is not a viable alternative at this time.

Although there is less experience with the CMDCT, particularly in the United States, the CMDCT has characteristics which warrant its consideration. Recognizing the difficulties of adopting relatively new technology, the staff maintains that the CMDCT is a viable alternative.

2-2 FANDCT's are not viable alternatives at this time.

See response to comment 2-1 above.

3-1 The staff has misinterpreted information about deratings.

The deratings for the FANDCT and CMDCT were not previously given by the applicant; the staff estimated them at 69 MWe each (Table 6-17) but erred on page 3-4 in reporting the deratings as 30 and 38 MWe. The figures should be 65 MWe for the FANDCT and 69 MWe for the CMDCT.

3-3 Clarification of tower size.

The staff adopts the proposed clarification. With the added information available in Appendix B, the text was not changed.

4-1 Clarification of status of Section 402 permit.

The staff adopts the clarification.

4-2 List of permits and regulatory approvals is incomplete.

Based on the information from Con Edision and the State of New York, additions have been made in the text.

5-1 The staff used a higher salinity value for drift than Con Edison in assessing botanical injury.

5-2 Uniform elevation assumption in ORFAD

For the NDCT calculation the elevation of the release point (565 ft) plus the plume rise should make the detectable effect of terrain on the drift isopleths extremely small. Wind variations and the normal inaccuracies related to mathematical modeling are probably more significant. It must be emphasized that state-of-the-art drift calculations are estimates involving average point source meteorological parameters with a wide natural variation and mathematical models which employ many assumptions for calculational convenience and to reflect the limitations in the data base. Only approximate values with reasonable directional characteristics can be claimed by the most intricate of such calculations. The staff feels that the ORFAD predictions using on site data which include the dominant valley effect on the meteorological parameters represent a reasonable approximation of the magnitude and direction of drift from the NDCT.

For the CMDCT the lower elevation of the release point makes the uneven terrain a more important factor. The staff assessment of the drift effects for this tower type, however, are not altered by assuming that the calculations underestimate the drift since the predicted levels on site already indicate that impact is possible. A more important point for these calculations is the relative uncertainty in the drift rate and drift drop size class distribution which are attainable for this new tower type. A recent submittal for Surry Power Station[1] has claimed a 0.001 percent drift rate and a size class distribution with 80 percent of the mass in drops of less than 60 microns in diameter. If these characteristic levels are attainable, then the staff predictions substantially overestimate the drift depositon for CMDCT. The uneven nature of the terrain is again judged to be a minor factor with respect to other parameters which could have a much more profound effect on the magnitude of the drift deposition predictions.

5-3 Water/Air Ratio = 1.44

The water/air ratio effects the fog and drift calculations through the plume rise. The height of the plume obviously effects fog prediction by determining where and if the plume strikes the ground. The drift calculations are affected because the distance of fall is calculated with respect to the plume centerline. Neither of these calculations is sensitive to the tower exit velocity, exit area and effluent density compared to the water flow. Previous calculations for Indian Point-3 (FES) had used values of approximately 1.5. Test cases have been run using both values that show no significant differences in the model predictions. Natural variations in operating conditions may be exepcted to yield even larger variations in the value of this parameter.

5-4 Suggest use of ER, IP-3, Appendix EE, Figure 7 Salinity Values

The information presented in Figure 7 of Appendix EE to the ER for IP-3 is based on the same data as that in Figure B-5 of Appendix I which the staff used. There does not appear to be any compelling reason to use one set of projections over the other. The critical decision to be made is whether monthly salinities should be used in the drift calculations and the results confirm that this refinement is necessary for realistic calculations.

5-5 Ten Feet Diameter For Fan Cylinders

The fan cylinder diameter used in the calculations was ten meters. The ten feet diameter indicated in the footnote to Table 5-5 was in error and has been corrected.

---

(1) Modifications to the Circulating Water System to Incorporate Clustered Mechanical Draft Cooling Towers. Surry Power Station - Units 3 & 4, Virginia Electric and Power Company, March 1976.

5-6 The staff staff has seriously underestimated potential botanical injury as a result of erroreous assumptions and misinterpretations.

Paragraph 1

The staff has not made the assumption stated. The licensee submitted his analysis for mechanical draft cooling towers which included 50-90% and over 90% humidity categories. The staff assumed that these categories were derived from the chamber experiments.

Paragraph 2

The staff has not made the assumption stated. The data would support the conclusion that there is a continuous relationship between ambient humidity and plant response under salt stress. For the purpose of coherent discussion, however, it is convenient to create ranges over the continuum within which effects can be considered sufficiently similar to serve the purpose of decision making. The staff assumed that the licensee did this in his presentation of mechanical draft tower results. This is a useful technique when used prudently and the staff took no issue with it.

Paragraph 3

The substance of the staff analysis of aerosol is that 1500 $\mu g/m^3$ of Cl^- is a higher concentration than is expected in the field. It seems immaterial whether this high airborne concentration of salt is termed background or not. In the staff's view, however, this aerosol is properly termed background since it is a variable which is a consequence of the experimental design but not a part of the central purpose of the experiment which was the measurement of effects of deposition.

Paragraph 4

The staff concludes that progressive long term deterioration of vegetation <u>due to salinization of soils</u> will not occur (Section 5.2.2.7, paragraph 2).

The licensee has stated that in his view injury to dogwood and ash will be limited to leaf spotting and marginal necrosis (ER, page 6-34). These effects are most likely during periods of extended drought occurring in late summer. These factors taken together with the low salt environment in the spring support the view that the effects which could be observed would be predominantly episodic and transient in nature.

Paragraph 5

The deduction that damage thresholds would be higher than reported if two pathways of exposure exist instead of one is clearly not false if one of the possible pathways has not been considered, as appears to be the case in the chamber experiments. The staff has not assumed that a stomatal pathway exists but proposes this possibility to account for the reported results which indicate that some alternate uptake mechanism exists. The experimental finding that chambers had a lower concentration of aerosol in the presence of plants than in their absence is the central fact which remains unexplained (Cooling tower ER, Section 4.2.1, Volume 3). Plant uptake by some mechanism whether or not stomatal appears to be an appropriate inference. If this mechanism exists and has not been accounted for, then actual doses would be higher than nominal doses and damage to thresholds would be set too low. This conclusion is valid whether or not the actual mode of entry is through stomata.

5-8 - Staff assertion that saline drift injury will not lead to progressive deterioration is incorrect.

See response to comment 5-6, paragraph 4 above.

5-8 - Light precipitation could increase injury by making the deposited salt soluble.

The staff agrees with this comment.

5-9 - Other species may also be susceptible to some extent.

The staff agrees with this comment.

5-10 - Partial or premature defoliation does adversely affect subsequent growth.

The staff agrees with this comment.

5-11 - Usefulness of the statistics in Table 5-8 is questionable because...

The staff survey was performed in two areas: (1) in the populated area of Verplanck as shown on Figure 6.8 of the DES and (2) roughly within the singly cross hatched area of Figure 6.8 which constitutes the applicant's predicted area of possible damage to vegetation.

Flowering dogwood was the only species of dogwood considered. The staff did not distinguish between common species of ash in the survey.

5-12 - A preoperational survey might be of limited usefulness.

The staff's analysis indicates that salt drift could cause some increase in the frequency of foliar symptoms which already exist from causes unrelated to nuclear power plant operation. A change in frequency of symptoms on commencement of cooling tower operations could be one of the few reliable measures of the impact of salt drift. Both base line and operational data on these frequencies would, therefore, appear to be useful.

5-13 - It is more accurate to describe the position of the...plates in the chamber as at a height close to the tops of the trees.

The staff agrees with this comment.

5-14 - The staff asserts that about twice the damage for the same amount of salt is caused when humidity above 90% exists.

See staff response to comment 5-6, paragraphs 1 and 2 above.

5-15 - Experimental difficulties are, in fact, constraints...//...Statements appear to imply that there was a high background saline aerosol concentration...there was no background....

The experimental difficulties with chamber experiments are not unique to this case but are widely recognized. The staff pointed them out to indicate that caution is required in attempting to utilize experimental laboratory results for field predictions.

The discussion of aerosol "background" centers primarily on an acceptable definition of the term "background". Differences of opinion undoubtedly exist as to how this term should be defined, however, this is not the most substantive aspect of the matter.

In the staff's view the substantive experimental and computational facts are the following: (1) the empty chambers would have air concentration of 2000 $\mu g/m^3$ of Cl, (2) the chamber with plants have air concentration of 1500-1700 $\mu g/m^3$ and (3) air in the field will have less than 1 $\mu g/m^3$ of salt near a natural draft cooling tower. These facts support the conclusions that (1) the plants could have acted as an agent of removal for aerosol which may not have been measured by plates which passively collect deposited particles and (2) the chamber conditions were substantially different from expected field conditions. Further deductive results from these facts are that the plants received higher than the nominal exposures to salt and that thresholds for salt damage were thereby set lower than necessary for accurately estimating field damage.

5-16 and 5-17 - Comments dealt with background aerosol concentrations and pathways of salt entry into leaves.

See response to comment 5-15 for a more complete discussion of pathways of salt entry into plants. The staff generally agrees with the physiological discussion as presented. Passage of salts through the cuticle and epidermous is a possible pathway of entry.

The size distribution of particles in the chamber experiments does not necessarily rule out stomatal entry, however. Pisek[1/] et al., have tabulated stomatal measurements for temperate zone species which show widths over the range of 15-50 μm and lengths of from 16-55 μm for stomatal apertures in the open state among various species. Apertures of this size would admit a portion of the particles generated in the chamber experiments. If only 1-5% of the particles generated

[1/] Pisek, Arthur Von, Herbert Knapp and Josef Ditterstorfer. 1970. Maximale Offnungsweite und Bau der Stomata, mit Angaben uber ihre GroSe und Zahl. Flora, Bd. 159, 459-479.

were of appropriate size the chamber atmosphere would contain 15-75 $\mu g/m^3$ of Cl (1500 x .05) from such particles. This is within the range of reported levels of salt (10-100 $\mu g/m^3$) which causes foliar damage.[2/],[3/],[4/]

The staff's conclusion is that this is a realistic source of possible error which cannot be discounted and should have been ruled out experimentally. The consequences of such error if it exists is that the thresholds for damage would be higher than projected not lower. The analysis is, therefore, conservative.

5-18 - Because the dose rate in the chambers was approximately equivalent to that expected in the field, less injury should not be expected....

This comment does not distinguish between the concept of "dose rate" and "dose". In a laboratory experiment designed to simulate conditions in the field, it is plainly impossible to fix both dose rate and dose at field conditions if the experiment is of different duration than the period of interest in the field. One must be selected at the expense of the other for experimental purposes. A one month accumulation of salt in the field can be simulated in a 4 - 6 hour laboratory experiment with respect to dose, for example, but in doing so the dose rate must be greater in the laboratory than in the field. Converse, if the dose rates are the same in laboratory and field, then the total dose cannot be the same in the chamber after 6 hours as it is in the field after one month.

In the applicant's response to this question (QIII.13, Volume I, Supplement), it is asserted that the rates being simulated included the deposition rate for both natural and mechanical draft towers. The rate stated for NDCTs was 36 $Kg/Km^2/Hr$. The monthly accumulation from this rate would be 24192 kg/Km^2 which is much higher than any values reported by the applicant on computer simulation for NDCTs. Actual monthly field values range up to (for example) 250 Kg/Km^2 (2.5 Kg/Ha) as estimated by the applicant (DES, Figure 5-1) or up to 1 Kg/Ha as estimated by the staff (DES, Figure 5-8).

The staff, therefore, concludes that the dose rates given in Q 111.13 were about a factor of 100 higher in the chamber than would be expected in the field. Such dose rates could saturate whatever homeostatic mechanisms the plants may have for salt removal and result in damage symptoms in the laboratory which would not be observed in the field.

An analogy with animal physiology may help to make clear the significance of dose rate. A hypothetical animal owner may elect to provide a salt free diet to his pet for some lengthy period and then make up for the cumulative deficit by administering the missing salt in a single dose at the end of the trial. The results would be fatal. In so doing, the owner would commit a disastrous error by considering only the dose which would be the same whether delivered a little at a time or all at once and neglecting rate which is important because the animal's homeostatic mechanisms would be overwhelmed by a single feeding. The animal, therefore, dies of acute salt poisoning even though the same amount of salt a little at a time is necessary to its health.

The lowest dose rates used in the plant chamber experiments had no such disastrous effect on the plants but produced foliar necrosis called salt burn. Since the rates used appear to be much higher than expected in the field, however, it is reasonable to suppose that the results from the chamber overestimate the results to be expected in the field. This element of conservatism exists in addition to the conservatism introduced by a possible unevaluated alternate pathway of exposure which is discussed in staff response to comment 5-15.

5-19 - Statement that threshold values were selected from 90% humidity experiments is incorrect....

The applicant has reported that: "The lowest exposures were conducted at the relative humidity level which had been found to maximize the injury from saline aerosol". (Cooling tower, ER Volume 1, p. 6-23). The correct value of this humidity is 85% and not 90% and has been corrected in the text. The staff conclusions are not altered by this change.

[2/] J. C. Devine, Jr., "The Forked River Program: A Case Study in Saltwater Cooling," In: Cooling Tower Environment - 1974. ERDA Symposium Series, CONF-740302, pp. 509-557, 1975.

[3/] P. R. Edmonds, H. K. Roffman and R. C. Maxwell, "Some Terrestrial Considerations Associated with Cooling Tower Systems for Electric Power Generation," In: Cooling Tower Environment - 1974. ERDA Symposium Series, CONF-740302, pp. 393-407, 1975.

[4/] B. C. Moser, "Airborne Sea Salt: Techniques for Experimentation and Effects on Vegetation," In: Cooling Tower Environment - 1974. ERDA Symposium Series, CONF-740302, pp. 353-369, 1975.

Point 1 - Most plant species indigenous to the Indian Point environs have not been tested for saline drift susceptibility.

The staff agrees that other salt sensitive species not evaluated might exist in the Indian Point vicinity. The present analysis, however, has been done for the most sensitive known species which is a conservative approach. Decisions based on the present analysis are not likely to have consequences worse than presently visualized even if a new sensitive species were to become known.

Point 2 - Injury should influence growth and flowering over a period of years.

The staff generally agrees that second order effects could be significant physiologically to trees suffering from salt damage.

The staff has listed several factors in the referenced section each of which suggest that the actual effects of salt drift will be less than projected. The factors taken together support the conclusion that significant effects would require from 2 to 10 times more salt than projected in order to become important. This would appear to be an adequate safety factor.

The staff concludes from its analysis that damage to vegetation from salt drift will be minor or negligible in its overall impact, particularly if natural draft towers are selected. It is acknowledged, however, that some incremental risk exists which could be expressed as a somewhat increased frequency of adverse aesthetic effects and loss of individual trees within small areas. These effects and losses, if they occur, will not be borne by society at large but could be brought to focus on a relatively few property owners. Undoubtedly some of these individuals will judge their potential burden to be unacceptable, particularly if no remedial action is planned. The staff has pointed out in the FES that restorative actions would be technically feasible although there would probably be no need for them. In addition the staff has indicated that monitoring programs should be undertaken. These could establish whether a need for restorative actions exists after commencement of operations. A technical foundation is, therefore, established which could aid in the resolution of future conflicts if they arise.

5-20 - Plant dormacy is unlikely to mitigate effects of drift.

Dormacy itself will not mitigate injurious effects already incurred. During the winter months, however, injurious effects will not be enhanced because plants are not actively metabolizing or translocating substances and also because salt drift will be very low. In the spring drift will be at the low point of the annual cycle and dormancy will be broken with no saline barrier to normal growth.

5-21 - Certain statements made about foliar symptom distribution and the staff survey appear inconsistent and misleading.

Paragraph 1

The staff survey is meaningful because it provides the first estimate of the actual quantity of vegetation which is at risk. The applicant's alternative plan would be useful but it is not clear how results so different as to compel different conclusions could be obtained if the proposal were implemented.

Paragraph 2

The data obtained are adequate to establish the magnitude of possible consequences of salt damage for the purpose of decision making. Feasibility of restoration is all that is established by the data. The cost data are not adequate nor are they intended to be for detailed financial planning.

Paragraph 3

See staff response to comment 5-19, point 2.

5-22 - Replacement of ornamentals should be related not only to mortality, but also diminished plant aesthetic values and abnormal growth.

The staff has not ruled out the possibility raised in this comment.

5-23 - The applicant disagrees with the assertion that injury...will occur only within the 200 Kg/m^2 isopleth....

The staff's reasons for choosing the 200 Kg/Km^2 isopleth have been discussed in the FES and responses to comments.

The staff believes that most hemlock will recover but that some may not for reasons previously stated.

5-24 - Individual owners are likely to be adversely affected and the damage may not be readily seen by the public.

See staff response to comment 5-19, point 2.

5-25 - Applicant disagrees with the assertion that risk of injury is confined to the immediate MDCT area.

A summary of the staff analysis for mechanical draft towers is presented in section 5.6, pages 5-72. The staff does not conclude that potential injury is confined to the immediate MDCT area. A corridor of risk is defined in the referenced section.

The staff agrees that there would be areas where restoration of hemlocks was either not feasible or even desirable. In such cases, if the need arises, other means of rehabilitation or compensation could be found.

5-26 - Cumulative effect may well be reduced flowering, altered growth, and other abnormal effects over a period of years.

See response to comments 5-16 and 5-17.

5-27 and 5-28 - The applicant diagrees that the staff survey is necessarily useful and with the assertions concerning number of trees at risk and other.

See response to comment 5-21, paragraph 2.

5-29 - The applicant disagrees with the conclusion that if any damage to offsite vegetation occurs, it is likely to be episodic and noncumulative.

The staff has considered the frequency of drought lasting 14 days in its analysis. Drought is considered to be a factor in enhancing botanical injury, however, the influence of this factor should not be overstated. The heaviest drift deposition offsite predicted by the staff amounts to only 2.5 Kg/Ha for the entire month of September for a NDCT (Figure 5-7, FES). Total foliar accumulation for a 14 day dry period is, therefore, only slightly greater than 1 Kg/Ha before rainfall at the end of the drought washes the leaves. For reasons previously stated the staff does not consider 1 Kg/Ha of NaCl to be a threshold level for damage. The true threshold could be a factor of 10 or more higher than this. Thus, a single drought episode of 14 days does not in itself signal the onset of unacceptable consequences. The significance of drought is that it is simply one of the interacting factors in this analysis. If drought periods occur more than once in a season or if a series of dry years occurs, the stress naturally increases. This factor interacts with others, however. If mechanical draft towers were selected, for example, higher drift levels combined with successive or extended drought episodes would increase the risk to vegetation and widen the area at risk.

5-30 - Applicant disagrees with the conclusion concerning critical months for risk of vegetative damage.

The correct quote from the referenced section is: "Visible damage to offsite vegetation is expected to be slight or nonexistent for any of the five cooling tower options <u>during years of normal frequency and amounts of rainfall</u>." The conclusion specifies the additional risks involved if drought occurs and mechanical draft towers are selected.

5-31 - Applicant disagrees with the conclusion that the number of trees at risk is relatively small and replanting of trees after a severe episode would be both technically and financially possible.

Restoration, rehabilitation, or compensation are mechanisms which present a feasible array of responses for dealing with possible problems of salt drift if needed. The staff analysis shows that no unmanageable damage will be likely to occur and that if natural draft towers are selected no management response at all would be expected to be necessary. All parties should be aware, however, that cooling towers should not be held to an unrealistic standard which assumes that they can or ought to be installed with the expectation of no consequences whatever. This is not possible. A logical consequence of accepting cooling towers of any design is the concurrent acceptance of some bounded risk. The staff analysis has placed reasonable bounds on the risk associated with each tower option in the FES. Within those bounds it is reasonable to expect that the specified contingency will be fulfilled on occasion since risk is a probabilistic concept. The staff expectation of no damage with NDCTs is, therefore, not negated by the prudent allowance for a margin of error. Further analysis yields the conclusion that the consequences of error do not exhaust opportunities for maintaing a high quality environment since restoration or rehabilitation would be possible. In cases where individual losses were sustained in inconvenient locations, (such as a hemlock within a wood lot) restoration might not be needed to meet the requirements of a high quality environment. Simple compensation of the owner could be an adequate response to this situation. The actual costs of restoration, rehabilitation or compensation could properly be considered as costs of building cooling towers. The data in hand are not adequate for detailed cost estimation of possible restoration programs and the data specified in the comment would be of additional value in this regard. The staff believes, however, that the data which have been analyzed are sufficient to form the basis for deciding which tower to construct and for estimating the magnitude of risks associated with the decision.

5-32 - Noise ordinance is not applicable to regulating other noise sources, such as vehicular traffic.

The staff agrees with the licensee's interpretation of the objective of the Buchanan Zoning Ordinance Parts 54-22.E(2)(b) and 54-22.F(3). The staff presented the comparison of allowable and measured sound levels as a means to characterize the existing acoustic environment. The manner and conditions under which the data were collected necessarily precluded the separation of transportation activity noise from that generated by activities expressly covered by the Zoning Ordinance at facilities adjacent to the sampling locations. The staff believes that the measured noise levels contain a contribution from latter activities, although the amount is difficult to determine. Although the noise restrictions do not apply to transportation activities, the underlying objective is to place a limit on a portion of the noise sources in the community and thereby effect a control on the overall noise levels in the community. The measured noise levels reflect these overall levels and, therefore, the comparison is believed to be illustrative in portraying existing community acoustic conditions.

This paragraph has been clarified to indicate that the comparison is for illustrative purposes.

5-33 - The staff does not present a noise analysis to justify restrictions recommended.

The limitations on noise producing activities recommended by the staff are believed to be the normal steps to be taken by responsible contractors in reducing noise to the minimum necessary commensurate with good construction practices at the site.

Similar commitments and staff requirements to control blasting by limiting events to small multiple charges, conducting blasting, pile driving and other impulse noise producing activities during daytime hours whenever possible or to generally minimize noise producing activities are found in the following Construction Permit Environmental Statements: Douglas Point Nuclear Generating Station, Units 1 and 2 (50-448 and 50-449); Clinch River Breeder Reactor Plant (50-537); Hartsville Nuclear Plants (50-518 through 50-521); Palo Verde Nuclear Generating Station (50-528 through 50-530); Callaway Plant (50-483 and 50-486); Davis Besse Nuclear Power Station, Units 2 and 3 (50-500 and 50-501); Pilgrim Nuclear Power Station Units 2 and 3 (50-471 and 50-472); Bellefonte Nuclear Plant Units 1 and 2 (50-438 and 50-439); and Marble Hill Nuclear Generating Station, Units 1 and 2 (50-546 and 50-547).

These commitments are judged by the staff to represent the normal construction practices experienced during construction of nuclear facilities and, as such, form the basis for the staff's recommendations. The staff has modified the blasting limitation to allow such activities at other times due to scheduling or economic considerations.

5-34 - The applicant does not believe the staff noise analysis is sufficiently objective and refers to his analysis.

The staff analyzed the licensee's methodology and results in prediction of the various offsite sound levels from operation of cooling towers at the Indian Point Unit No. 2 site. The techniques are similar to those that would be used by the staff and they are believed to be employed correctly. Therefore, the staff has not disagreed with the predicted operational sound level isopleth diagrams submitted by the licensee and has used them in the DES. Likewise, the baseline sound level survey data and isopleth diagram have been accepted as representative of the ambient site acoustic environment and used as a basis for the operational phase computation in DES Tables 5-13 and 5-15.

The staff's approach in the acoustic environment analysis is centered on the characterization of the ambient acoustic environment and how it compares to the operational acoustic environment. In making the characterization and providing specific comparisons between ambient and operational phases, the staff chose to use those points where actual data on ambient sound levels have been recorded. Because the ambient survey utilized locations all around the site, including sampling locations in close proximity to the site, and the proposed cooling tower location, the staff believes that the comparisons at these discrete points are sufficient to generally illustrate the existing environment and the expected change. The staff has also considered specific areas not represented by sampling locations, such as the Lent's Cove and Standard Brands property areas because these appear to be the most seriously affected areas. Other areas beyond the discrete sampling locations were not specifically evaluated because the attenuating affects of vegetation and buildings and the consideration of other localized noise sources could not be reliably accounted for.

The statement concerning violations of the Buchanan Zoning Ordinance noise limits was made with regard to the specific sampling locations in residential areas. The staff has indicated elsewhere in this section that the park land northeast of the site (in a planned industrial zoning category) is predicted to receive higher sound levels under tower operation. This section has been changed to clarify the relation between these levels and the Buchanan Zoning Ordinance.

5-35 - Comment deals with the use of LDN as a noise descriptor.

The staff agrees with the licensee's observation that the day-night equivalent sound level is the appropriate descriptor for evaluation of effects that the closed cycle cooling system operation will have on the existing acoustic environment around the site. For the sampling locations where the nighttime sound levels are within 10dB of the daytime levels, L_{DN} increases above the L_D up to 3dB are experienced, while for the remaining locations, L_{DN} decreases of up to 1.5dB are experienced. The 3dB increase is above the reported threshold of detectability for differences between two sounds of the same frequency.

The staff has changed the chacterization of this influence to "noticeable" rather than "strong".

5-36 - That the issuance of a new NPDES may require review of chlorine discharges is not necessarily the case.

The staff agrees with this comment.

6-1 - Cost of replacing <u>deficient energy</u> and <u>capacity</u>.

See text Section 6.2.1

6-2 - Downtime cost.

See Text Section 6.2.1 Item 4

6-3 - Discount factor used is invalid.

The staff's current policy is to use a discount rate of 10% for environmental statements for investor-owned utilities, based on an average rate of return on new investments. To derive this rate, the staff computed a weighted average of returns on (1) bonds and preferred stocks and (2) common equity (common stock and retained earnings). These rates not only vary from utility to utility, but also through time for an individual utility. Therefore, they are believed to provide a reasonable (1) approximation to the average return and (2) basis for discounting future costs to present values.

6-4 - Recommendation that the staff's estimates should be done on the identifical time frame used by Con Edison.

See Text Section 6.2.2.2

6-5 - The staff suggests that the loss of 63 MW of capacity should not be considered.

The staff does not suggest that the loss of 63 MW of capacity at peak should not be considered. A cost for replacing this loss of capacity is included in the staff's analysis. However, the staff believes (based on the applicant's projected summer capacity, load, and reserve for the years 1975-1984 and the N.Y. State Interconnected Systems planned summer capability, load, and reserve for the years 1975-1990) that this replacement capacity is an uneconomically large commitment of resources, since reserves would not be lowered to an unacceptable level.

6-6 - It is extremely doubtful that firm purchases would be available.

See Text Section 6.2.2.2 d.

6-7 - The staff should be more specific on the referred "winter outage scenario".

See Text Section 6.2.7.

6-8 - A revised cost estimate made by Con Edison should be used.

The application for extension of operation with one-through cooling constitutes a separate licensing activity - not a revision or supplement to accompany the environmental report related to alternative closed cycle cooling systems for IP-2. The application for extension neither discussed or presented cost estimates for alternative cooling tower options comparable to that which was presented in the environmental report submitted December 1, 1974.

6-9 - Table 6-17 Derivation of cost of installing gas turbines is unclear for Case 2.

See Text Table 6-17.

6-10 - The planned 80-acre recreation on the site will be reduced considerably if a closed cycle cooling system is implemented.

The staff agrees with the applicant's comment that a closed cycle cooling system will reduce the availability of onsite acreage for future recreational development. Land requirements of alternative closed cycle cooling systems (see Table 5-9) indicate a range of 11 to 30 acres of onsite land will be required for cooling towers, depending on the type of cooling tower installed.

6-11 - It is highly speculative to generalize that "during the winter the slight warming of the air as the sun rises in the sky will decrease the relative humidity sufficiently to greatly reduce the visibility of the plume."

See Text Section 6.3.3.3a.

6-12 - The viewshed map is unclear and has no key.

Fig. 6-1 has been modified and replaced.

6-13 - The staff's reference to cooling tower noise abatement is unwarranted.

See Text Section 6.3.3.3e.

7-1 - The Statement fails to reflect the limited "proposed action" involved.

The U.S. Nuclear Regulatory Commission is required to assess the potential environmental effects related to the construction and operation of a nuclear power station in order to assure consistency with the national environmental goals, as set forth by the National Environmental Policy Act of 1969 (Pub. Law 91-190, 83 Stat. 852). In order to fulfill these requirements and be comsistent with the national environmental goals, the staff is obligated to go beyond the limited proposed action involved in Con Edison's December 2, 1974 application. That is, the staff feels that is is essential to consider the cumulative environmental, economic, and social impacts of a closed cycle cooling system at IP-2 and not to limit the concern to a closed cycle cooling system in isolation.

7-2 - Statement about irreversible and irretrievable commitments is inappropriate.

The staff concurs with the applicant in that the purpose of the statement is to select a preferred closed cycle cooling system on the basis of a cost-benefit analysis of alternative closed cycle cooling system. It is not the purpose of the statement to weigh the costs and benefits of closed cycle vs the present once-through cooling system. Since the latter is not addressed in this Statement, the staff agrees with the applicant that the referenced statement should be deleted and has done so.

7-3 - Con Edison believes that the range of cost is substantially greater than 3%.

Costs of alternative cooling towers as determined by the staff were based on information supplied by the applicant in its environmental report (December 2, 1974), the subsequent supplement to that report (August 6, 1975), and additional information obtained from electric utility personnel and vendors experienced in the engineering design and economic analysis of alternative cooling systems for electric generating facilities. As explained in the cost estimates for each cooling tower in this Statement, the staff either used the cost figures supplied by the pplicant or adopted the methoodology and parameters used by the applicant to derive its own estimates. The staff feels it was consistent with the applicant in its cost estimates and allowed for escalation and contingency factors. Calculations led to a range of cost estimates on the order of 3% for the three referenced cooling towers.

8.2.2 Responses to comments by the Environmental Protection Agency

1. Radiological dose estimates

Radiological dose estimates should be compared with 10 CFR 50 (Appendix I).

This is in the process of being done and the Technical Specifications will be modified to reflect the design basis objectives of Appendix I. The applicant is required to meet applicable radiological regulations and standards.

2. Noise impacts

a. The discussion of ambient noise levels should include descriptions of instrumentation and methodology.

A descriptive list of the equipment used in conducting the ambient level survey is presented in the licensee's Appendix "B" of Appendix "G" to the Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Dec. 1, 1974. Appendix "G" is entitled Sound Emission Impact from Operation and Construction of Cooling Towers at Indian Point Nulcear Station dated Sept. 19, 1974.

The methodology for the determination of ambient noise levels is described in Section III of Appendix "G" above and in the licensee's response to question III.8 in Supplement No. 1 dated Aug. 6, 1975 to the above named basic report.

The description of sampling locations for the ambient noise level survey is contained in Figures 1 through 10 of the above mentioned Appendix "G".

The area is characterized by predominantly transportation related noise and the distances to nearby roadways or the railroad tracks are identified in the above mentioned figures. The only dominant point noise source identified was the power plant at Tomkins Cove on the Hudson River. The influence of this plant was included in results for sampling location Number 3. Its influence was not detected at any other sampling location. Construction related noise was not identified as influencing any of the readings during the survey.

b. Conditions under which the Buchanan Zoning Ordinance is applicable should be identified. Relevant noise measurements should be made in the absence of non-point sources.

The comparison of the ambient noise levels at various locations around the site with the limits of the Buchanan Zoning Ordinance was presented for illustrative purposes only, particularly to indicate how the existing levels in residential zones compare to the zoning ordinance limitations. This section has been revised to indicate that many of these levels are in excess of these limits since they are not technically in violation of these limits.

c. Methods used to estimate construction noise impacts should be included.

The methodology used by the applicant to predict the noise levels generated by onsite construction activity and by offsite construction traffic is explained in Section IV and Section V of Appendix "G", Sound Emission Impact from Operation and Construction of Cooling Towers at Indian Point Nuclear Station, Sept. 19, 1974 contained in the Licensee's report entitled Economic and Environmental Impacts of Alternative Closed Cycle Cooling Systems for Indian Point Unit No. 2, Dec. 14, 1974. The calculated technique for estimating noise levels for offsite construction traffic is presented in Appendix "F" of the above mentioned Appendix "G".

The basis used by the licensee for estimating the noise levels of the construction equipment at the source (i.e., at the construction site) and the calculational method for estimating construction traffic noise levels are from literature references acceptable to the staff and are themselves derived from field measurements.

The onsite construction activity noise level estimates presented by the licensee represent worse case estimates in that the equipment noise levels used as a basis were those regarded as not having noise control features added.[1] Estimates of noise levels for the ground clearing phase and the foundation preparation/construction phase have been prepared using this basis. An L_{eq} for the work day period at Broadway and Bleakley Avenue was found to be 56 dBA and 53 dBA respectively. These levels do not exceed the L_{50} (i.e., the sound level exceeded 50% of the time) for this area and will result in an increase in the daytime equivalent sound level of less than 1 dBA at this location. According to a study by EPA[1], a successful noise reduction strategy for ground clearing, excavation and foundation phases and one readily attainable is to reduce the noise level of the noisiest equipment while maintaining the remaining equipment at their present levels and distances from the receptors. This result was based on a 10dB reduction for the noisiest equipment, a level attainable by the use of mufflers on engine and pneumatic equipment exhaust and by use of enclosures around impact tools such as rock hammers for work tool interaction noise. These sources were identified as being the most important sources of noise to consider in a program to reduce noise with feasible noise controls.[1]

An additional consideration making the predictive results conservative is lack of consideration of excess attenuation of construction noise by the forested areas onsite. This attenuation would further reduce the noise levels experienced offsite toward the residential area of Broadway and Bleakly Avenues below the predicted levels.

The staff has recommended that noise control devices, including mufflers be placed and properly maintained on all construction equipment at the site.

The staff does not have any estimates on the duration of blasting activities proposed by the licensee. Because these impulse noises will be of very short duration and will be infrequent, they will not affect the offsite energy equivalent sound levels. The staff has recommended that blasting activity be limited whenever possible to the normal work days and to daylight hours. The applicant has stated that blast mats will be used at the site. This will attenuate noise to some extent as well as control dust and flying debris.

d. A map showing land use would be helpful.

The present surrounding land use is depicted in the various sound emission contour drawings shown in DES Figures 5-24 and 5-25 through 5-27. A general depiction of land use around the Indian Point site is given in DES Figure 1-1. The land uses immediately surrounding the site and the ambient sound level survey sampling locations are shown and described in the licensee's Appendix "G" to the report, Economic and Environmental Impacts of Alternate Closed Cycle Cooling Systems for Indian Point Unit No. 2, Dec. 1, 1974.

3. Impact on birds

The staff has analyzed data on bird impaction from operating plants located near or along migratory flyways. From the data collected and analyzed, the staff finds no evidence to conclude that cooling towers and meteorological structures present a hazard to bird population. However, the staff still requires that routine monitoring of tall structures such as cooling towers and meteorological towers be undertaken for the purpose of recording large episodic occurrences of bird mortalities, if they occur at all. The staff believes it is prudent to monitor for verification of the analysis even though serious effects are not expected.

4. Economic Impacts

1) Projected incremental plant and system costs should be determined in mills per kilowatt hour and compared to total plant and system generating costs. This comparison would allow the economic impact to Con Edison rate payers to be determined.

The staff estimates an incremental plant cost (i.e., IP-2 alone) of 3.2 mills/kWh for a natural draft cooling tower, fan-assisted natural draft cooling towers, and circular mechanical draft cooling towers. For the linear mechanical draft cooling towers and wet-dry cooling towers, the cost increases to 3.5 mills/kWh and 3.7 mills/kWh, respectively.

Projections of incremental system costs are considerably more speculative since they depend on projections of annual electricity requirements, type of generating capacity available, and dispatch of available capacity. Without considering the two latter problems or the rate schedule applicable to different customers, an incremental system cost can be approximated for a particular year based on projected electricity requirements (or Con Edison sales) for that year. For example, the

[1] Data taken from Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, Dec. 31, 1971, USEPA NTID 300.1

applicant projects (1976 Report of Member Electric Systems of New York Power Pool) total electricity sales for 1980 to be 27,950 million kWh. Based on this projection, the staff's estimated incremental system cost for the NDCT, FANDCT, and CMDCT is approximately 0.8 mills/kWh incremental system cost for the LMD and WD cooling towers is estimated to be 0.9 mills/kWh.

These estimates represent the average cost per kWh consumption to Con Edison customers for alternative closed cycle cooling towers. They are extremely rough approximations in that they do not consider the factors mentioned above, they are based on current projections of future electricity consumption, and they disregard the different rate structures for different customer classes and the declining block rates within classes.

2) The capital cost of gas turbines appears to be greatly overestimated. For example, NRC's final impact statement on Indian Point Unit No. 3, dated February 1975, estimates a cost of $215/Kw in 1981 dollars while this draft statement uses a 1979 cost of $315/Kw. The reason for this difference should be explained.

In its environmental report for closed cycle cooling systems for IP-2, the applicant reports a $315/Kw capital cost of gas turbines installed in 1979.

Although the staff accepted the applicant's estimate and subsequently used it in their cost analysis, the staff believes that estimate to be an upper bound estimate. The staff does not feel that $315/Kw for gas turbines in 1979 is a "greatly overestimated" figure, depending as it does on future demand and supply conditions and the uncertainty involved in forecasting future capital equipment costs.

In the FES for IP-3, the staff used a capital cost estimate of $213/Kw (not $215/Kw) for gas turbines installed in 1981. This estimate was derived by the staff using a 5% escalation rate and a $167/Kw cost reported by the applicant for gas tubines installed in 1976 (Benefit-Cost Descriptions of Alternative Plant Designs for Indian Point Unit No. 3, September 1972). The $167/Kw cost projection for 1976 was made during 1972. For the IP-2 CCCS EIS, the staff used the applicant's more current estimate of $315/Kw provided in its environmental report, submitted in support of the natural draft alternative December 1, 1974. The applicant has more recently submitted an environmental report in which it estimates capital costs of gas turbines at $285/Kw, installed in 1979 (Envionmental Report to Accompany Application for Facility License Amendment for Extension of Operation With Once-Through Cooling for Indian Point Unit No. 2, June 1975). The applicant has not provided an explanation for the differences in costs or basis for estimating costs.

The staff concludes that the different assumptions concerning capital costs of gas turbines in 1979 ($213/Kw, $300/Kw, or $315/Kw) would not alter any of the conclusions of the cost-benefit analysis in this Statement. Total estimated costs (present value, 1976) for the five alternative cooling towers as presented in Table 6-17 under the assumptions of $213/Kw and $300/Kw would appear as follows:

TOTAL PRESENT VALUE COST
($1,000)

Capital cost of gas turbines	NDCT	FANDCT	LMDCT	DMDCT	WDCT
$213/Kw	196,658	197,522	217,569	200,654	230,489
$300/Kw	202,571	203,997	224,044	207,129	237,044

3) The draft impact statement states that Con Edison anticipates that Unit 2 would not operate during the seven-month downtime period (5/1/79 - 12/1/79) required for the tie-in of closed-cycle cooling system. According to EPA sources, plant downtime for the cooling system tie-in should not exceed 2-3 months, including the 2 month refueling outage. The need for a seven-month downtime should be explained.

Installation of a closed-cycle cooling system for IP-2 is considerably different than the installation of cooling systems at other nuclear generating facilities. At IP-2, a closed cycle cooling system is to be retrofitted to the existing plant as opposed to the normal procedure of simultaneous construction of a nuclear plant and cooling system. Retrofitting requires tie-in and switchover of cooling water piping, electrical wiring, etc. presently designed to accomodate a once-through cooling system. The applicant estimates that the cooling tower tie-in procedure will require seven months of effort (from May 1, 1979 to December 1, 1979) at which time IP-2 will be out of operation. This is an engineering estimate which the staff feels to be based on sound judgment and has accepted it for use in its own analysis.

4) The draft statement includes property and gross revenue taxes in its estimates of annual carrying charges. However, the Atomic Safety and Licensing Board, in its Initial Decision for Indian Point Unit No. 2, dated September 9, 1973, determined that taxes should not be used in determining carrying charges on capital, since such taxes represent transfers within the economy. This situation should be corrected and explained.

Exclusion of property taxes, federal income taxes, and gross revenue taxes from the applicants annual carrying charges (as reported in Table 6-2) decreases carrying charges on cooling towers and gas turbines to 12.8% and 12.6%, respectively. The revision affects the staff's present value and annualized value capital cost and capability cost estimate for each cooling tower alternative; it does not affect annual operating cost, energy cost, or downtime cost estimates as presented by the staff in the DES. Appropriate cost revisions have been calculated by the staff and are presented in the accompanying Table 8-1, which is a cost summary comparable to Table 6-17 of the DES and this FES. When taxes are excluded from annual carrying charges, the total present value and annualized value cost estimate of each alternative cooling tower is decreased on the order of 13% to 15%.

The Statement referring to the Atomic Safety and Licensing Board decision on carrying charges for IP-2 cooling towers is correct. However, taxes are included in Con Edison's rate base and subsequently passed on to the consumer as reflected in the applicable rate schedule. To exclude taxes from annual carrying charges is to misrepresent the cost of alternative closed cycle cooling systems to Con Edison's customers. And although it is true that these monies are returned to the public for other use (hence the term transfer payments), not all consumers who pay for the taxes in the form of higher electricity rates receive tax benefits. This is particularly true of property taxes which primarily benefit a few local communities in the locale of IP-2 but which are paid for (cost) by all of Con Edison's customers.

The staff concludes that the presentation of both cost aspects (i.e., inclusion and exclusion of taxes in carrying charges) contribute to a better public understanding of the cost-benefit balance. Inclusion or exclusion of taxes in carrying charges does not alter any of the staff's conclusions regarding the preferred closed cycle cooling system for IP-2 presented in this Statement.

5) Annual average and peak unit deratings are based upon the unit's present capacity of 873 MWe net, whereas cooling tower design parameters are based on a future capacity uprating to 1033 MWe net (using a once-through cooling system). We recommend that all pertinent cooling system parameters be based on the same capacity.

Alternative cooling systems are designed (sized) to meet the maximum calculated operating conditions of IP-2. While IP-2 is presently licensed to operate at a thermal output of 2,758 MW(t) and electrical output of 873 MW(e), the applicant plans to apply for a license amendement allowing operation at 3,217 MW(t) and 1033 Mw(e). The uprating, however, will be subject to NRC review and approval and will constitute a separate licensing action. Thus, annual average and peak deratings of IP-2 resulting from closed cycle cooling system operation should be and were based on the present license to operate at 2,758 MW(t). Deratings based on future capacity upratings of IP-2 are considered in any licensing action related to such upratings at that time.

8.2.3 <u>Responses to comments by the Federal Power Commission unavailability of Unit No. 1, reserve margin and winter tie-in treatment of downtime costs.</u>

The staff has revised its treatment of downtime costs in Section 6.2.2.1(d) in order to consider the potential reliability impact resulting from a seven-month summer outage of IP-2 during 1979 and the possibility of postponing the outage to a winter period; refer to the referenced section for the staff's conclusions and position.

Consideration was not given to the unavailability of Indian Point No. 1 in the staff's analysis, since the applicant reported it as planned capacity and anticipates it returning to service in 1978. However, the staff concurs with the FPC comment that Con Edison would be unable to meet the NYPP reliability criterion of 18% reserve margin if both IP-1 and IP-2 were unavailable during the 1979 summer, based on the applicant's 1975 ten year plan for capacity, load, and reserve reproduced in Table 6-4. This ten year plan was developed by the applicant, submitted to the New York State

TABLE 8-1

COST SUMMARY OF CLOSED-CYCLE COOLING TOWER
ALTERNATIVES, EXCLUDING TAXES FROM ANNUAL CARRYING CHARGES
($1,000)

	Natural Draft Cooling Tower		Fan-Assisted Natural Draft Cooling Towers		Linear Mechanical Draft Cooling Towers		Circular Mechanical Draft Cooling Towers		Wet-Dry Cooling Towers	
	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value	Present Value	Annualized Value
Capital Cost	65535	6978	58527	6232	62414	6646	52670	5608	69436	7393
Annual Operating Cost	1794	192	3152	336	5317	566	5317	566	6736	717
Capability Cost	16100	1714	17633	1877	17633	1877	17633	1877	17889	1905
Energy Cost	39085	4162	46902	4994	59409	6326	55969	5959	60972	6942
Downtime Cost (replacement energy)	50680	5396	50680	5396	50680	5396	50680	5396	50680	5396
Total Cost	173194	18442	176894	18835	195453	20811	182269	19406	205713	21903

Public Service Commission, and published in the 1975 NYPP 149-b report. The applicant has since revised its ten year plan and it is available in the latest 1976 NYPP 149-b report. It is also reproduced in this FES in response to New York State Department of Environmental Conservation (NYSDEC) comment No. 49.

The applicant's 1976 ten year plan contains new and important information relevant to the staff's analysis and to FPC's comments. First, planned capacity during the 1976 to 1985 period does not include IP-1 return to service nor ownership of IP-3 capacity (as IP-3 has been purchased by PASNY with an agreement of sales to Con Edison; see staff's response to NYSDEC comment No, 51). Second, Con Edison's revised summer peak load is considerably lower (on the order of 20% for the years 1979 and 1980) than reported in the 1975 NYPP 149-b report. Third, planned summer reserve margins for the applicant's system are estimated to be 41.7% and 36.8% of peak load during 1979 and 1980, respectively.

Based on the applicant's revised ten year plan, the staff concludes that with both IP-1 and IP-2 unavailable during the 1979 or 1980 summer, the applicant's reserve margin is sufficiently high (28.4% for 1979 and 24% for 1980) to meet the NYPP reliability criterion of 18% reserve margin for individual utilities. This supports the staff's conclusion that the applicant's proposed installation of additional capacity (gas turbine peaking units) to replace the short-term outage of IP-2 (for closed cycle cooling system tie-in) is economically unwarranted for reliability purposes.

An alternative to the 1979 summer tie-in of a closed cycle cooling system for IP-2 is considered by the staff in its revised treatment of downtime costs in Section 6.2.2.1(d). A winter tie-in, hence IP-2 outage, may be possible according to conditons permitted in Amendment No. 6 to the IP-2 operating license DPR-26 (see Sections 4.1 and 6.2.2.1(d)).

8.2.4 Responses to comments by the Department of Housing and Urban Development

1. Has the cumulative effects of three cooling systems been assessed? It is unlikely that a closed cycle cooling system will be required for Unit 1; thus, the impacts from three cooling systems has not been assessed. Cooling systems for both Units No. 2 and No. 3 are considered in Section 5.2.2.7. The cumulative impacts will be discussed in more detail in the DES for selection of the preferred closed cycle cooling system for Indian Point Unit No. 3 which is in preparation.

2. Are there any particular requirements critical to the siting of multiple cooling systems that should be considered at this time?

The location of the tower for Unit No. 1 is shown if Figures 3-1. One of the most important factors in locating the tower is that of safety, i.e., assurring that no safety-related structures would be at risk should the tower collapse. Other considerations, such as foundations, ease and amount of excavation are secondary to safety but are considered in locating the tower.

3. Has the shadow effect cast by the sun been determined?

The shadow effect of the towers and plumes have not been determined for Indian Point. However, studies at other sites indicate that the time of duration and percent of area covered by shadow is relatively small on an annual basis.

4. Use of waste heat.

See response to NY Dept. of Environmental Conservation, comments 18, 19, and 20.

5. Can a cooling system be devised that shares the impact of disposing of waste heat on both the river and the land-atmosphere?

All of the closed cycle cooling systems provide for sharing the thermal releases between the water and atmosphere to a degree. Approximately 15,000 gpm of heated effluent is discharged as blowdown. Heat is also released to the atmosphere by the evaporation of water in the tower. The sum of blowdown, evaporative and drift loss is estimated to be 30,000 gpm; this quantity must be withdrawn from the river as make-up. (See section 3.5). Thus, the cooling tower system requires only about 4% of the quantity required for once-through cooling. This reduction in water use provides for the mitigation against biotic losses due to entrainment and impingement (See FES IP-2 for detailed discussion of this topic).

While cooling systems could be designed say, for the thermal discharges equally to the water and atmosphere, the increased water requirement would defeat the original purpose, i.e., mitigation of aquatic effects.

8.2.5 Responses to comments by the U.S. Department of Interior, Office of the Secretary

1. It would seem appropriate for the final statement to indicate to what extent these viewscapes have been made available for local comment.

The Draft Environmental Statement was transmitted with a request for comment to various local governmental organizations and representatives; refer to the detailed list in the introduction to Chapter 8. In addition, the NRC solicited comments from interested persons by a notice published in the Federal Register. General and detailed comments received are reproduced in Appendix B of this FES according to the procedures outlined in the introduction. Further, copies of the DES were placed in the local Public Document Room. Other requests for copies, either verbal or written are honored, although no record is made of the requests.

2. Suggest for discussion of impacts by proceeding radially outward from the cooling towers.

The staff feels that its assessment of potential impacts of the proposed project on parks, recreation areas, and historic sites is adquately presented in the DES and that the suggested modification would not generate additional information which would materially alter the staff's present assessment. Rather than discuss the visibility of every site by proceeding radially outward from the cooling towers, the staff assessed each site with the aid of topographical maps and by confirmation of the assessment using a sample of sites.

National and historic points of interest in and beyond the lower Hudson Valley from which the project is likely to be most visible are discussed in Section 6.3.1.8. Recreational facilities in the vicinity of Indian Point are discussed in Sections 6.3.1.7 and 6.3.3.3. The latter section contains the staff's appraisal of the aesthetic impact of alternative closed cycle cooling systems at IP-2 on the human environments.

3. Need for additional studies to ascertain reliability of threshold values for salt damage to vegetation.

The staff pointed out that the applicant's choice of field threshold values for salt damage to vegetation may be unnecessarilly low because relevant variables in the experiments may not have been taken into account. The practical consequences of this choice, if the staff assessment is accurate, would be that the actual magnitude and extent of damage to vegetation would be less than the applicant's projections. In no case would actual damage be worse than projections. The applicant's analysis is therefore, conservative, perhaps to an unnecessary degree. Nevertheless, the applicant concludes from its analysis and the staff from its independent analysis that significant damage to vegetation is unlikely if natural draft towers are selected. Further experimental refinement of damage threshold values though generally desirable would be unlikely to modify the above conclusion for this case since added work would in all likelyhood demonstrate that less damage would occur than is now predicted. The staff therefore does not recommend further experimental botanical studies for the purpose of resolving the issues in this case.

4. Cultural resources.

National and historic points of interest in and beyond the lower Hudson Valley from which the project is likely to be most visible are discussed in Section 6.3.1.8. Recreational facilities in the vicinity of Indian Point are discussed in Sections 6.3.1.7 and 6.3.3.3. The latter section contains the staff's appraisal of the aesthetic impact of alternative closed cycle cooling systems at IP-2 on the human environments.

5. Disposal of excavated materials.

See response to comments 25 and 26 by the NY Department of Environmental Conservation.

6. Ground water.

Accidental releases to groundwater at the plant site will end up in the Hudson River and should not affect nearby wells because of the higher elevation of these wells. Only one municipal water supply within a 5-mile radius of the site utilizes groundwater. Because of the topography of the landscape, all releases along with the groundwater will flow to the river rather than to other land areas. Furthermore, no lowering or raising of groundwater levels is expected due to plant operation, because no well water on the site is available and no excess water from the facilities is expected to flood any local areas. All water would drain into the Hudson.

7. Fish and Wildlife.

See section 4.1 and the recently published (July 1976) DES for Facility License Amendment for Extension of Operation with Once-Through Cooling for Indian Point Unit No. 2 (NUREG-0080).

In brief, the schedule has slipped an estimated nine months in accordance with the stipulation signed by all parties. Further, the staff concluded that, on balance, a two year extension of once-through cooling is appropriate (NUREG-0080).

8. Recommendation against the use of asbestos in cooling towers.

Asbestos would only be used in the construction of the cooling tower in the standard form of asbestos boards, which is a common construction material in use throughout the United States. A prohibition of the use of this material for cooling tower construction prior to any finding by an appropriate governmental body that its use is hazardous and should be discontinued would be highly discriminatory. Such a variance from standard construction practice would substantially increase the cost of construction.

9. Use of amertap balls to clean the condenser tubes.

This system is supplemental to chlorination and would not constitute a complete replacement. This applicant will comply with EPA guideline effluent limitations for chlorine discharges.

10. Use of ORFAD model.

The staff agrees with the suggestion for additional runs. In addition, the NRC has recently established a contract with Environmental Systems Corp. to perform additional studies with a more sophisticated model which will provide independent verification for the ORFAD results. The results of these studies should be available later in 1976.

11. Figures 5-4 and 5-19 are confusing and difficult to read.

The staff agrees with this comment. Unfortunately, the copy from which the figures were made was not of the best quality and the computer code was set up in a way that now appears to lead to confusion. These defects could not be corrected in the time available, but the staff is making attempts at improving the manner of presentation of data in the future.

12. The staff has pointed out that the applicant's experimentally determined threshold...may be in error for two reasons.

See responses to comments 5-16 and 5-17 by Con Edison and to responses to comments by the Village of Buchanan.

8.2.6 Responses to Comments by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration

1. Environmental Data Service - Evaluation would be aided by inclusion of data on inversion frequencies at the site.

The stability class frequency in hours from the onsite weather tape is as follows:

Class	1	2	3	4	5	6 & 7
Temp. Grad. °F/100 m	<-3.42	<-3.06	<-2.7	<0.9	<2.7	≥2.7
No. hr.	22	67	163	4220	3450	614

2. National Marine Fisheries Service - no response needed.

8.2.7 Responses to Comments by U.S. Department of Agriculture

8.2.7.1 Soil Conservation Services

1. Disposition of excavated materials.

See response to comments 25 and 26 by the NY Department of Environmental Conservation.

2. A statement of the impact of drift on grasses and legumes would improve the statement.

The staff has performed its analysis of drift based on risk to the most sensitive known species This analysis also identified and evaluated several instances of conservatism in the applicant's analysis. The staff's conclusion, based on these conservatisms, is that the risk is negligible, even to the salt-sensitive species, if natural draft towers are selected. This conclusion is inclusive of other vegetation of similar or less sensitivity than the species considered. There is no evidence that grasses and legumes are more sensitive than the species which have been considered. Some grasses, for example, are among the surviving species in the harsh seacoast environment which eliminates salt-sensitive species.

8.2.7.2 Forest Service

It is not clear what steps would be taken if botanical injury occurred from salt deposition.

Replacement of damaged or killed vegetation is the most obvious way to compensate for losses. Although the staff believes that the likelihood of damage is small,the suggestion to replace plants by more tolerant plants if any damage occurs warrants consideration.

8.2.8 Responses to Comments by the Department of Transportation, United States Coast Guard

No response needed.

8.2.9 Responses to Comments by the Energy Research and Development Agency

Changes suggested have been incorporated into Section 1.5.

8.2.10 Responses to Comments by the New York State Department of Environmental Conservation

1. Decommissioning should be discussed.

No specific plan for the decommissioning of the Indian Point Units (including cooling towers) has been developed. This is consistent with the Commission's current regulations which contemplate detailed consideration of decommissioning near the end of a nuclear facility's useful life. The licensee initiates such consideration by preparing a proposed decommissioning plan which is submitted to the NRC for review and approval. The licensee will be required to comply with Commission regulations then in effect, and decommissioning of the facility may not commence without authorization from the NRC.

The degree of dismantlement of the Indian Point facility would be determined by an economic and environmental study involving the value of the land and scrap value versus the complete demolition and removal of the complex. In any event, the operation will be controlled by rules and regulations to protect the health and safety of the public that are in effect at the time.

Decommissioning of the Indian Point facility was evaluated by the staff in the Final Environmental Statement (FES) related to operation of Indian Point Unit No. 3 (Docket No. 50-286, February 1975). In the IP-3 FES, the staff discussed the experience, to date, with decommissioning of civilian nuclear power reactors. Estimated costs of decommissioning were, at the lowest level, $1 million plus an annual maintenance charge of about $100,000. Estimates vary from case to case because of the different assumptions regarding the level of restoration. Complete restoration, including regarding, has been estimated to cost $70 million. This usually amounts to about 1% of the original cost of a nuclear facility when the $70 million is appropriately discounted to a present value cost.

In the IP-3 FES, the staff reported the applicant's estimated decommissioning cost of the facility to be $3,000,000 in 1973 dollars. This estimate was based on 1973 technology and nine months time for decommissioning. The staff does not have separate estimates of the decommissioning costs of cooling towers, but believes that they will be of a small magnitude when compared to the decommissioning costs of the reactor. Moreover, the present value cost of decommissioning the IP-2 cooling towers is expected to be a small portion of the estimated construction costs of the towers, probably around 1%.

The staff concludes that the economic and environmental assessment of alternative closed cycle cooling systems for IP-2 would not be appreciably affected by the explicit consideration of decommissioning of the cooling towers. The cost-benefit balance and relative ranking of alternatives as presented in the staff's environmental statement would, for all practical purposes, remain unchanged.

2. The draft statement should include a discussion of the seismology and geology of the site.

The geology and seismicity relating to the site are included in the Safety Evaluation Report and are currently the subject of public hearings. The proposed cooling tower is not a safety-related structure and, once it is determined that they will not impact a safety-related structure, no further environmental analysis is needed.

3. Impact of a NDCT on birds.

See Response 8.2.2.3 above.

4. Seven month tie-in period.

See response 8.2.2.4.3 above.

5. No response needed.

6a. Additional evaluation of visual impact should be presented.

The referenced document, Visual Impact Study: Statement Of Findings Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant (November 1975), was prepared by Jones & Jones (Landscape Architects and Environmental Planners located in Seattle, Washington) for NRC under contract to Battelle Northwest Laboratories. Services of Jones & Jones were engaged to apply, on a limited experimental basis, a technique which had previously been developed to assess the visual change in a viewscape resulting from manmade intrusions to the landscape (see Chapter 6 for appropriate references). The staff found the study useful in its impact assessment of alternate closed cycle cooling systems on the human environment and therefore presented an overview of the technique and sample of photographs used in the study. However, the staff felt that the methodology, thus conclusions, of the study contained several deficiencies which precluded complete reliance on the study (refer to Section 6.3.3.3(a)). Although the staff used portions of the study which it felt relevant, an independent assessment was conducted by the staff and used as the basis for the conclusions presented in the DES and FES.

For the reasons stated above, the Jones & Jones study was not reproduced as part of the DES nor this FES. Moreover, it has not been the staff's general practice to reproduce referenced documents and lengthy reports as part of the DES or FES as it feels it is impractical to do so. In response to this comment, however, the staff provides (in addition to the material presented in Section 6.3.3.3(a)) a brief summary of the Jones & Jones study below and responses to specific comments (a) and (b).

The Visual Impact Study evaluated the potential changes in the visual quality of a landscape resulting from the introduction of six different cooling tower options from both IP-2 and IP-3 nuclear generating plants. Options considered were as follows:

1.a. Two 565' high x 452' natural draft towers, one for IP-2 and one for IP-3.
1.b. One 565' natural draft tower for IP-2.

2.a. Two 370' high x 230' fan-assisted natural draft towers, one for IP-2 and one for IP-3.
2.b. One 270' fan-assisted natural draft tower for IP-2.

3.a. Four 74' high x 300' circular mechanical draft towers, two each for IP-2 and IP-3.
3.b. Two 74' circular mechanical draft towers for IP2.

The method employed to evaluate the potential changes in the visual quality of landscape used a special competence group of design professionals to evaluate visual quality of each option, as pictured on ten selected viewscapes. Each viewscape was presented as it currently appears (a "before scene") and as it would appear with closed cycle cooling tower options (an "after" scene). Before and after options were than rated according to four indicator components of visual quality: intactness, vividness, unity, and visual importance. A ratio of change in visual quality was determined from the ratings assigned the before and after viewscapes. By multiplying this ratio by the number of population exposed to a view of this tower,(as determined from the viewshed map shown in Figure 6-1) an index of aesthetic impact was formed. As the final step, all options were then compared and ranked in order of relative severity of changes in visual quality.

Response to (a):

Construction of the viewshed map took into consideration those areas within six miles of the proposed IP-2 cooling tower from which the top of a natural draft tower at 600 feet above sea level would be visible in winter (if foreground trees and buildings do not obstruct the view). The visibility of the tower from some of the upper storey windows of structures is also taken into account by the viewshed map. Through its own independent analysis, the staff believes that the viewshed map accurately depicts an upper limit of areas from which a natural draft tower will be visible under the assumed conditions.

Each viewscape considers the totality of the scene. To the extent that nearby man-made structures were captured in the viewscape, the visual compatibility of the towers and structures were considered.

Recreational uses within the visual impact area were identified and several recreational sites were selected as representative viewscapes for detailed analysis. Photographs which would be representative of the view from recreational use areas and included in the staff's environmental statement were the Peekskill Waterfront and Stony Point Marina (see Figure 6-2(B)). Visual compatibility of the tower(s) from these viewscapes were rated according to the four indicator components of visual quality used by Jones & Jones.

Regional landforms are a major element in the totality of any viewscape and are considered in the Jones & Jones study to the extent which they are captured in a particular viewscape. The inherent visual quality of the lower Hudson Valley and its environs in the vicinity of IP-2 was also a factor considered in the staff's visual impact assessment. Photographs from the Monastery and Hudson Overlook Apartments (Figure 62(A)) are representative samples which the staff included in its environmental statement.

Response to (b):

In regard to decommission of the Indian Point facility, see staff's response to NYSDEC comment No. 1 (8.2.10.1 above).

7. Statement should have further addressed the construction activity and associated acoustical impact.

The staff has analyzed the offsite construction traffic-related noise levels around the site, as predicted by the licensee. The staff has reviewed the sources of the licensee's sound generation estimates for various classes of construction equipment and the source used for the calculational methodology of construction traffic-related noise. This basis for the licensee's predictions has been examined and found to be similar to that that would be used by the staff in its own analysis and, therefore, the accuracy of the results have been judged to be reasonable. The staff has recognized the unavoidable increases in noise level along the transportation routes used by construction delivery vehicles for the duration of construction. The magnitude of the increase can be estimated by comparison of DES Figures 5-23 and 5-24.

Onsite generated construction noise has been analyzed by the licensee. The staff has reviewed the bases and calculational techniques utilized and found them acceptable. See response to EPA Comment #3.

8. Statement should address the alternative that the Unit No. 1 wharf could be used for delivery of construction materials and removal of excavated materials.

Based upon subsequent analysis and review of the licensee's response to Question III.7, found in Supplement No. 1 to Economic and Environmental Impacts of Alternative Closed Cycle Cooling Systems for Indian Point Unit No. 2, August 6, 1975, the utilization of the Unit No. 1 barge dock and the beach at Lent's Cover for delivery and removal of construction related materials is not considered a feasible alternative to land based delivery and removal. Reference to this mode of delivery and removal has been deleted from Section 3.3.

9. Separation of service cooling system from main system.

The service water system is separate from the main system for reasons of safety and reliability. Service water is not used as a source for makeup. It should be noted that the quantity of water withdrawn from the river for makeup is small when compared to that needed for once-through cooling.

10-11 Effects of Cooling Tower Drift on Settleable and Suspended Particulate Levels and Applicable State Ambient Air Quality Standards

The staff concurs with the New York State Department of Environmental Conservation that natural draft cooling towers will not contravene the New York State ambient air quality standard for settleable particulates of 0.3 mg/sq. cm./month. The staff wishes to note, however, that it is not clear whether this standard was intended to include the deposition of highly soluble particles (identical to those which occur naturally) such as atmospheric droplets containing salts contained in Hudson River water from which makeup water for cooling towers is taken (Power Authority of the State of New York - Comments on DES for Greene County - Docket No. 50-549 - Attachment No. 2, May 6, 1976).

The staff further concurs with the New York Department of Environmental Conservation's assessment that State and Federal primary suspended particulate concentations will be met throughout the predicted drift field of the cooling tower.

12-13 No response needed.

14. Justification of staff conclusion that Con Edison's estimates with regard to plume length and duration are conservative.

See section 5.3.1.1.b. References 2, 6, 7, 10, 13 of section 5 contain the bases for the staff conclusion regarding conservatism.

15. Suspended particulates.

See response to comments 10 and 11 above.

16. Include a list of acronyms used in the statement.

The list follows.

IP-1	Indian Point Unit No. 1
IP-2	Indian Point Unit No. 2
IP-3	Indian Point Unit No. 3
ER-CCC	Environmental Report "Economic and Environmental Impacts of Alternative Closed Cycle Cooling Systems for Indian Point Unit No.2."
DES	Draft Environmental Statement - Prepared by the NRC staff
FES	Final Environmental Statement - Prepared by the NRC staff
ER	Environmental Report - Prepared by the applicant
FFDSAR	Final Facility Description and Safety Analysis
CCC	Closed Cycle Cooling System
NDCT	Natural Draft Cooling Tower
MDCT	Linear Mechanical Draft Cooling Tower
W/D MDCT	Wet/Dry Mechanical Draft Cooling Tower
FANDCT	Fan-assisted Natural Draft Cooling Tower
CP	Cooling Pond on Lake
SC	Spray Pond or Canal

DCT	Dry Cooling Tower
MWt	Megawatt thermal power
MWe	Megawatt electric power
SAR	Safety Analysis Report - prepared by the applicant
SER	Safety Evaluation Report - prepared by the NRC staff
ORFAD	Computer program at Oak Ridge National Laboratory used to estimate amounts of fog and drift deposition from operation of wet cooling towers.

17. Recommendations to include additional information on salt drift effects.

The staff analysis shows that new information, if it were obtained would result in upward revision of botanical damage thresholds as estimated by the applicant. This would result in downward projections of the extent and magnitude of actual botanical damage. Staff projections based on current information for natural draft towers conclude that botanical damage is unlikely. New information would not alter but would reinforce these conclusions and would therefore, be unnecessary.

Applicant and staff agree that some botanical damage is possible with mechanical draft towers but disagree on the extent and magnitude. Additional threshold information could be needed to resolve these problems if a mechanical draft option were selected.

18, 20. Use of waste heat.

Both comments deal with use of waste heat from the nuclear power plant. There are few known applications for the use of such low grade heat. Process applications generally require higher temperatures than exist in the discharge stream. There has been some agricultural applications using the warm discharge streams for irrigation or for warming the soil by means of a buried pipe system. Such agricultural use does not appear to be feasible at Indian Point because of the nature of the terrain and land use. Con Edison has considered the use of waste heat from Indian Point and concluded that its use is impractical.

19. Use of waste heat for aquaculture.

Although in principle development of aquaculture techniques appears promising, there are several problems in attempting it at Indian Point. Because the river is heavily travelled and the ship channel is on the Indian Point side, there is some question as to whether or not such activities could be physically accommodated close to the plant. This would force the activity to be located at some distance away. This does not appear to be practical.

21. A negative conclusion is reached on the suitability of the powered spray module system based on lack of suitable land at or near the site.

Sufficient useful land is not available onsite because of pre-existing uses of the site and constraints imposed by topography. Additional problems are evident in attempting to use an area of the river near the plant (See response to comment 19 above). In addition, the spray ponds would cause increased fogging and icing near and on the river. The reliability of spray modules, expecially in a brackish environment, is also of concern. Recent reports of experience with spray modules indicate that they not be as reliable as predicted.

22. Are turbine back-pressure the same for various wet cooling systems?

Generally, the turbine back-pressures may be considered the same among wet cooling systems, which are based on cooling by the evaporative process. On the other hand, dry cooling systems would have significantly higher turbine back-pressures.

23. Typical noise levels emitted for each wet cooling tower option and for wet-dry and dry towers should be presented.

Sound level emissions for various wet cooling tower options sized for the capacity necessary to serve the Indian Point Unit No. 2 under experienced meteorological conditions are shown in Figures 5-25 through 5-27. These figures illustrate the sound level contours as a function of distance from the plant in question and are much more informative than giving "typical" values as measured at other sites. The bases for determining the isopleths shown in the Section 5 figures have been field verified by researchers through measurements at a number of operating similar towers.

As stated in Section 5.2.5.5 and Section 5.6, the staff does not have operational data for the wet/dry mechanical draft cooling tower option. However, the noise levels from this tower option are believed not to differ greatly from that predicted for the wet linear mechanical draft tower type.

As stated in Section 2.4.1, dry towers are not considered feasible for Indian Point Unit No. 2 for reasons other than noise generation. Therefore, this option was not considered in the staff's analysis of cooling tower noise levels.

24. Explain how the 500 ft. distance from the natural draft cooling tower to the wall of the Unit No. 2 containment was determined.

At various places in the DES both 500 ft. and 565 ft. are mentioned as the height of the NDCT and distance away from the containment wall. The use of two different numbers is an error. The most recent information is that the tower is to be 565 ft. high; it will be located no closer to the containment than 565 ft. The principle involved is that the tower should be located a minimum of one tower height away from the containment.

25, 26. The possibility of disposing of the excavated material at the quarry on Con Edison's Verplanck site.

Although the staff understands that the excavated material is to be used to construct a road north of the site along the waterfront, the possibility of using the quarry should receive attention; this is particularly true if there be excavated material in excess of that used for the road.

27. Safety implications of siting a 565 ft. cooling tower 500 ft. from the containment building.

See response to comment 24 above.

28. Page 3-9, Section 3.4.1

The maintenance of once-through operating capability, as noted on page 3-9, is a useful adjunct to the proposed system. Although capital costs of this "redundancy" are greater, the dollar and fuel savings which result (when such operation is possible in terms of aquatic impacts) appear to far exceed the incremental cost of making provision for such alternative operation where the once-through capability is already in place. Moreover, "once-through whenever possible" has environmental advantages in terms of air quality, terrestrial, ecology, acoustics and aesthetics.

The applicant reports that the existing vertical circulating water pumps located in the screen-house will be retained. Isolation valves installed in the cooling system would permit cooling system flexibility by allowing changeover from a closed cycle cooling mode of operation to a once-through cooling mode if necessary.

Based on the information available, the staff agrees with NYSDEC's comment that there are potential economic and environmental benefits would appear to justify the proposed maintenance of once-through cooling to allow for system flexibility. The staff, however, does not have sufficient information to assess the costs and benefits of the proposal, although only minor modifications (such as the installation of isolation valves) seem necessary.

29. Section 3.4.5 should present the amount of various materials necessary to construct each of the alternative cooling systems.

Materials used in construction of cooling systems are common materials of construction (concrete, steel, wood, etc.) and represent only a small fraction of those used in the construction of the plant. No precious metals or materials in short supply will be used. Some of the materials (such as copper and steel) would be potentially recoverable.

30. Proposed cooling tower would be located at least a tower height away from all safety-related structures.

See response to comment 24 above.

31. It is not clear why the total heat rejection will be 120 x 10^6 Btu/hr rather than 220 x 10^6 Btu/hr use of service water as makeup. A typographical error was made. A total of 220 x 10^6 Btu/hr will be released.

See also response to comment 9 above.

32. Required permits and approvals.

The text of Section 4.2 has been revised.

33. Section 5.1.3.4 should address incremental adverse effects of salt deposition.

The staff believes that the discussion in this section adequately addresses this topic in view of the conservatism inherent in information used in its preparation. The Westinghouse report (ref. 54), for example, deals with existing saltwater towers ($\sim$ 30-35,000 ppm seawater). The corrosion studies reported in reference 70 also deals with seawater. On the other hand, the Hudson River in the vicinity of Indian Point is highly variable and may be only as high as 12-14,000 ppm with a seawater incursion and less at other times. Thus, the impacts discussed in this section are based on seawater salinity and the staff's conclusions are conservative.

34. Increased consideration should be given to the changes that the forested area will undergo because of drift.

The staff has stated in its conclusions (DES 5-72) that gradual replacement of sensitive species by more salt tolerant species is possible onsite and in a narrowly confined corridor along the east bank of the Hudson River both above and below the plant if mechanical draft options are chosen. Such effects are unlikely for natural draft towers because of much greater salt dispersion. The ranking of options on page 5-72 (DES) reflects this conclusion.

The interaction of drought and potential vegetation damage has been examined by the staff (DES 5-34). Enhanced effects of salt during drought are an acknowledged possibility particularly if mechanical draft towers are selected and successive or prolonged droughts occurs. The area of greatest risk to vegetation is a relatively narrow corridor along the east bank of the river. In the staff's view, the magnitude and extent of risk does not rule out the use of mechanical draft towers. Selection of a low profile tower would, however, require acceptance of the risk as described which the staff considers both bounded and manageable.

The staff has not found serious defects in the experiments performed by the applicant which establish the rank order of plant sensitivity to salt damage. The species identified as most sensitive have, therefore, been accepted as correct by the staff. The analyses performed for the most sensitive plants were performed under the assumption that it was inclusive for other less sensitive but nevertheless susceptible species. Decisions which protect the most sensitive species will necessarily protect all others. The staffs ranking of cooling towers with respect to the effects of drift (DES 5-73) was partly conditioned by this consideration.

The staff agrees that plant species distributions are conditioned by salt deposition near the seacoast. The situation is somewhat similar for this case and the staff has concluded that a gradual shift from salt sensitive to salt tolerant species on site and in a corridor along the river is a possible, though not certain, consequence of mechanical draft towers (DES 5-72). This is an identified risk and not a certainty since salt deposition at the site will be seasonal and usually much lower then at the seacoast.

While additional information would be useful, it is not required for decision making in this case since a refinement of existing information would lead to estimates of less damage than is currently projected.

35. Closed-Cycle Cooling System impacts on unique individual vegetation.

The staff has found no evidence from data on the Indian Point region of any unique <u>individual</u> vegetation which may be affected by the various CCC-systems considered.

36. In view of existing necrosis resembling "salt burn", additional study is needed.

The staff agrees that it could be desirable to carry out preoperational surveys of existing plant pathological symptoms in the projected drift field of cooling towers. Control areas should also be surveyed.

37. Alternative designs to reduce noise impacts.

Consideration has been given to the installation of sound mitigating modifications to the various cooling tower options evaluated. See licensee response to staff Question III.3 in Supplement No. 1 to Economic and Environmental Impacts of Alternative Closed Cycle Cooling Systems for Indian Point Unit No. 2, August 6, 1975. The feasibility of these devices has not been proven through operation of existing cooling towers so equipped. The staff has contacted various cooling tower manufacturers concerning sound mitigating procedures. It was reported that none are in use. Therefore, the staff concurs with the licensee's position that these measures do not presently represent feasible alternatives and they received no further consideration.

Exterior sound attenuation is provided onsite by the existing vegetation. Additional screening has been judged as not practical because of possible interference by the barriers with successful operation of the cooling towers at their design level. This interference could lead to increases in tower size or capacity to account for losses in efficiency due to barrier interference. Because of the presence of natural barriers onsite and the lack of space for additional artificial barriers, no further consideration of these attenuation devices was made.

38. Noise impacts from Units No. 2 and 3.

The combined noise effects and resultant impacts will be considered in a separate DES to be prepared by the staff in consideration of the preferred closed cycle cooling system for Indian Point Unit No. 3.

39. The State does not concur that the construction acoustic impact during approximately two years of construction is a temporary impact.

The staff does not believe that the acoustic impact for the relative short period involved to present a hazard to the public health, particularly at the noise levels anticipated.

40. The statement in Section 5.8.5.2 implies that the acoustical impact during construction could be reduced to a level of acceptability if the applicant takes three precautions.

The precaution in question contained a typographical error. It should read "...and state regulations and procedures." Because the date for the commencement of construction activity is in the future and is not firmly established and of existing uncertainty in New York State law regarding noise limitations, the specific applicable federal laws, EPA regulations and state and local ordinances governing the allowable noise levels from construction equipment and activities and the necessary noise control devices to be used cannot be established with complete accuracy. Therefore, the staff has made clear its intent by generally referring to federal and state procedures.

See the staff response to EPA Comment #3 for a discussion and reference on the consequences of requiring these noise suppression devices.

41. Specific conclusions should be included about acoustical impact (Section 5.2.5.5)

The conclusions reached by the staff in this section are directed toward the long term operational phase acoustic environment. The shorter term construction phase was reviewed and a staff position and conclusion were presented in DES Section 5.2.5.2.

42. Section 5.3 should consider the potential of dispersing heavy metals and other potentially toxic material.

The staff has analyzed the data submitted to it by New York State Department of Environmental Conservation (NYDEC - Comments on DES-CCC, April 15, 1976, Table 2) and concurs with the agency's assessment that airborne metal contaminants and potentially toxic chemicals, (e.g., chromium, PCB's) will not exceed nor even approach threshold limit values normally applied to industrial hygiene.

43. Potential interaction of the cooling tower plume with SO_2 effluents from nearby fossil fired plants should be addressed.

Experience at existing cooling towers has not shown any evidence that such problems exist. Predictive calculations such as those made for the Bailly Nuclear One on the shore of Lake Michigan in Indiana also lead to the conclusion that effects from plume interaction with SO_2 (including "acid mist" rains) are extremely unlikely or minor. At the Bailly site, there is an existing fossil staion and a nuclear unit is under construction. The nuclear unit will have a natural draft cooling tower located SW of the stack of the fossil unit. Because of the sensitive ecology in the Indiana Dunes National Lakeshore adjacent to the site, potential effects of plume-stack interaction were anlyzed in detail. It was concluded that such interaction would have no detectable effects on the Lakeshore. Thus, no detectable plume interactions with stack effluents would be expected at Lovitt, Bowline and Danskimmer, especially since they are remote when compared with the Bailly fossil nuclear proximity. Another factor mitigating against plume interaction is the differences in height of the natural draft towers and the fossil unit's stack and their plumes. Generally, towers are taller and the plumes rise to higher altitudes so that the plumes rarily mix.

44. Quantification of current entrainment and impingement problems should be provided (Section 5.3.4).

Pertinent parts of the Summary and Conclusions from the FES for Indian Point Unit No.2 are quoted below.

> "e. About 2,650 cubic feet per second* of water for once-through cooling and service water systems will be withdrawn from the Hudson River and increased in temperature by about 15°F during passage through the steam condensers and heat exchangers of Units Nos. 1 and 2. This heated water from both Units will be combined in a common discharge canal and released into the Hudson River at a velocity of about 10 feet per second via a 270-foot long, submerged multiport discharge structure.
>
> f. The applicant's conclusion that the thermal discharges from Units Nos. 1 and 2 will meet the New York State thermal standards throughout the entire year has not been confirmed by the staff's review and evaluation. Although the staff's assessment shows that the thermal discharges will result in a temperature of less than 90°F at the river surface, even during the summer months, and thus meet part of the New York thermal standards, the staff finds that the New York State standards for surface area and cross-sectional area enclosed within the 4°F isotherm may not be met. Under the severest anticipated operating conditions, the staff's evaluation indicates that the area included within the 4°F isotherm will be on a tidal average basis less than 50% of the vertical cross-sectional area of the river, but the increase in temperature at the surface of the river may be a tidal average basis more than 4°F for more than two-thirds of the surface area of the river and may even extend across the whole width of the river. Under transient peak conditions of the tide, which are not analyzed by the applicant, the results are expected to be more severe than the average conditions mentioned.
>
> *****
>
> j. A detailed staff assessment of the biological impact of the once-through cooling system of Indian Point Units Nos. 1 and 2, using available information on the hydraulics and biota of the Hudson River estuary, shows that:
>
> 1) Unless the applicant finds better means of preventing fish from entering the intake structure, fish, numbering between two to five million annually based on present population levels and composed mostly of young-of-theyear striped bass and other fishes of about two inches in length wil be killed by impingement on the intake structure;
>
> 2) Aquatic organisms including phytoplankton, planktonic crustaceans, larval stages of benthic invertebrates and eggs and larvae of many of the estuarine fishes such as striped bass, alewife, blueback herring, tomcod, American shad, bay anchovy, smelt, and white perch will be subject to entrainmentin the cooling water and thereby exposed to mechanical, thermal, and chemical (chlorine) effects. The staff has estimated that during the summer months, an average of about 25% of those organisms passively

*1 cubic foot per second (cfs) is equivalent to about 450 gallons per minute (gpm).

drifting downstream will be entrained. The staff analysis further indicates that during June and July of most years from 30 to 50% of the striped bass larvae which migrate past Indian Point from upstream spawning areas are likely to be killed by entrainment. There is a high probability that the combined effects of entrainment and impingement will also result in a similar decrease in recruitment to the adult population of striped bass in the New York, New Jersey, and New England regions. The operation of Units Nos. 1 and 2 with once-through cooling beyond 5 years could result in cumulative effects that would cause the population to decline further.

*****

b. The existing information is insufficient to predict accurately the long-term impact on all aquatic organisms. For some species this impact could be quantified by long-term field studies, but by that time irreversible damage may have been incurred.

c. The operation of Units Nos. 1 and 2 with the present once-through cooling system has the potential for a long-term environmental impact on the aquatic biota inhabiting the Hudson River which would result in permanent damage to and severe reduction in the fish population, particularly striped bass, in the Hudson River, Long Island Sound, the adjacent New Jersey coast, and the New York Bight. The potential impact is due to impingement of aquatic biota on the intake structure and entrainment of fish eggs, larvae, and plankton in the cooling water system resulting in exposure to severe mechanical, chemical (chlorine) and thermal stresses.

d. Alternatives to the applicant's proposed method of operation are available for nearly complete reduction of long-term aquatic environmental impacts without jeopardizing the needed new base-load capacity and the reliability of the applicant's service in the New York area.

*****

7. On the basis of the evaluation and analysis set forth in the Statement and and after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, the staff concludes that the action called for is the issuance of an operating license authorizing operation of Indian Point Unit No. 2 subject to the following conditions for the protection of the environment:

   a. Operation of Indian Point Unit No. 2 with the once-through cooling system will be permitted until January 1, 1978 and thereafter a closed cycle cooling system shall be required.

   b. Evaluation of the economic and environmental impacts of an alternative closed cycle cooling system shall be made by the applicant in order to determine a preferred system for installation. This evaluation shall be submitted to the Atomic Energy Commission for review by July 1, 1973.

   c. After approval by the Atomic Energy Commission, the required closed cycle cooling system shall be designed, built and placed in operation no later than January 1, 1978.

   d. Non-radiological as well as radiological, monitoring programs and limits on effluent releases will be incorporated as a requirement in the Technical Specifications to the Operating License No. DPR-26. The monitoring program as well as a study will be conducted by the applicant and will include determination of the following:

      1) The nature and extent of the entrainment mortality and damage of aquatic organisms, after passage through the condenser;

      2) The nature and extent of the impingement mortality by counting the number, types, and sizes of fish collected on the screens and trash racks of the intake structure;

3) Concentrations of residual chlorine, free and combined, during each chlorination period, and effects of chlorine residuals on biota;

4) Concentrations of dissolved oxygen in the discharge water and the thermal plume;

5) The size, shape, and location of isotherms of the thermal plume with different fresh water flows during differnt seasons;

6) Any changes in aquatic life in the Hudson River from operation of the plant with the once-through cooling system.

f. A plan of action for plant operation to minimize detrimental effects on aquatic biota will be developed by the applicant by July 1, 1973. This plan should include means of reducing to a practical minimum fish kills from cold shock, impingement on the intake structure, entrainment of fish eggs, larvae and plankton, and provide for corrective measures such as aeration of the cooling water during periods when concentrations of dissolved oxygen in the thermal plume are reduced below 4.5 ppm. After approval by the Atomic Energy Commission, such a plan shall be implemented so as to eliminate or substantially reduce such effects as are revealed by the monitoring program prior to installation of a closed cycle cooling system.

8. The applicant will assess and evaluate the environmental monitoring and study programs outlined in this Statement and in the Technical Specifications accompanying the operating license. In addition, the applicant may, if it so desires, consider the impact of an effective restocking program as well as expand the data which now exists in support of once-through cooling. Whenever the applicant believes it has accumulated information which can clearly demonstrate that the operation of Unit No. 2 in conjunction with Unit No. 1 with the once-through cooling ssytem will not result in an unacceptable, long-term, irreperable damage to aquatic biota, the applicant may file an appropriate application for amendment of the operating license. The Commission will take appropriate action in accordance with the provisions of 10 CFR Part 2.

*****"

45. Section 5.5 should indicate whether the radiological effluents will meet Appendix I guidelines and also the EPA proposed standards 40 CFR 190.

See response to comment 1 by the Environmental Protection Agency.

46. Section 5.5.2 should indicate whether the various CCC systems would have an impact on present circulation patterns of gaseous effluents and the locations where effluents such as I-131 settle out.

The potential for disturbing such patterns significantly is small; the staff does not usually attempt to determine alterations due to cooling tower plumes. The normal release points, e.g., the containment vent, are lower than the tower and plume. Thus, mixing of gaseous effluents and plumes does not readily occur. Further, if mixing did occur, the gaseous effluents would be dispersed more rapidly, i.e., dispersion would be aided, because of the dynamics of the thermal plume.

47. The cost ($/year) to the average Con Edison customer of the various CCC systems considered should be clearly presented.

See response to United States Environmental Protection Agency comment No. 1 under Economic Impacts (Section 8.3.2.2.4).

48. In the Socio-economic Analysis of Closed-Cycle Cooling Systems, the energy implications have not been directly considered.

Energy implications of alternative cooling towers are treated by the staff under the general heading "Cost of replacing loss of peak generating capability and average annual loss of generating capability due to operation of alternative closed cycle cooling systems and discussed in subsection c of Cost Estimates (Chapter 6) for each alternative.

49.It is important to note that the NRC staff believes that the applicant's proposed installation of gas turbines to replace reduced peak generating capability is an uneconomically large commitment of resources.

The staff concurs with the supporting assessment (see Section 6.2.2.2c). A revised projection or planned capacity, load, and reserve on Consolidated Edison's system as referenced (1976 Long Range Plan of NY Power Pool) in the comment is attached as Table 8-2. The data presented in the document was not published on a timely basis for incorportaion into the text of the DES or this FES.

50. Potential impact of multiple power stations with cooling towers on the Hudson River.

The question of effects of multiple power plants, including both fossil and nuclear, on the Hudson River is being addressed in a separate study by the Environmental Protection Agency which has responsibility in this area. To the extent appropriate, the NRC contributes to this program by making available information which it develops and provides technical assistance.

51. Page 6-7, Table 6-4.

This table indicates that Indian Point No. 3 will be a new capacity addition for Con Edison. Since the Power Authority now owns Unit 3, an explanation of the PASNY sales to Con Edison should be presented. Also, the acronym for the Power Authority of the State of New York is PASNY, not PASHY.

The following excerpt from the 1976 REPORT OF MEMBER ELECTRIC SYSTEMS OF THE NEW YORK POWER POOL (Volume 1, page 66) explains the arrangement of sales between PASNY and Con Edison:

"Under a program authorized by the New York Legislature in 1974, Con Edison sold two power plants to the Power Authority of the State of New York (PASNY). The sale included Astoria Unit No. 6, an oil fired plant with capacity of 787 MW, and Indian Point Unit No. 3, a nuclear plant with initial capacity of 873 MW.

These plants have been acquired by PASNY and 75% of their capability will serve the public authority sector in New York City and Weschester County. The remainder will be sold to Con Edison for resale to its remaining customers. Major components of the load to be transferred will include the Metropolitan Transportation Authority, New York City public buildings and street lightings, the World Trade Center, the Housing Authority, the Port of New York Authority, state, federal and Westchester County government customers, and the Triboro Bridge and Tunnel Authority.

It is estimated that Indian Point No. 3 will be in commercial operation June 1, 1976, at which time PASNY expects to supply part of the public authority sector's load. PASNY expects Astoria No. 6 to be in commercial operation by September 1, 1976. At that time, PASNY can allocate capacity to serve additional public authority customers.

Between June 1, 1976 and September 1, 1982, when PASNY expects its Arthur Kill Unit to come on line, Con Edison will supply any public authority load which exceeds PASNY's capability."

The acronym in Table 6-4 has been corrected.

53. It should be indicated that there is a potential for the closed cycle cooling system to be ruled tax exempt as a pollution control device.

It is the staff's understanding that if the State of New York rules that the IP-2 cooling towers are pollution control devices, then they could possibly be partially or fully tax exempt under the Real Property Tax Law for the State of New York, Section 481. It is the staff's understanding that eligibility and certification of IP-2 cooling towers as pollution control devices would be determined by the New York Department of Environmental Conservation (NYDEC). However, the staff is not aware of any definitive position released by NYDEC in regard to this matter. Also, according to the staff's information, an application for certification of cooling towers as pollution control devices has not yet been filed with NYDEC by Con Edison or any other utility operating in New York State.

In view of NYDEC's comment, the staff does recognize that there is a possibility that Con Edison will apply for certification, that it will be granted, and that the IP-2 cooling towers will be ruled partially or fully tax exempt under Section 481 mentioned above. In the event that this

TABLE 8-2

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

PLANNED CAPACITY, LOAD, AND RESERVE

	SUMMER MEGAWATTS									
MAXIMUM INSTALLED NET CAPABILITY	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
THERMAL (OIL FIRED)	7001	7001	6936	6747	6747	6693	6693	6573	6573	6210
THERMAL (COAL FIRED)	0	0	0	0	0	0	0	0	0	0
THERMAL (OTHER)	0	0	0	0	0	0	0	0	0	0
THERMAL (GAS TURBINES)	2165	2224	2234	2255	2255	2255	2255	2255	2255	2255
THERMAL (DIESEL)	0	0	0	0	0	0	0	0	0	0
THERMAL (NUCLEAR)	873	873	873	1033	1033	1033	1033	1033	1033	1033
HYDRO (CONVENTIONAL)	0	0	0	0	0	0	0	0	0	0
HYDRO (PUMPED STORAGE)	0	0	0	0	0	0	0	0	0	0
TOTAL CONTROLLED SOURCES	10039	10098	10043	10035	10035	9981	9981	9861	9861	9498
*NET CAPACITY TRANSACTIONS	607	407	1025	993	981	965	1554	1796	1619	2508
TOTAL CAP. FOR LOAD OF AREA	10646	10505	11068	11028	11016	10946	11535	11657	11480	12006
COINCIDENT PEAK LOAD***	7845	7440	7560	7785	8050	8355	8665	8675	8900	9125
GROSS MARGIN	2801	3065	3508	3243	2966	2591	2870	2982	2580	2881
GROSS MARGIN-% OF LOAD	35.7	41.2	46.4	41.7	36.8	31.0	33.1	34.4	29.0	31.6

*In accordance with New York Power Pool Agreement Section 104.

SOURCE: 1976 Report of Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article VIII, Section 149-6 of the Public Service Lay, Volume 2, Appendix D.

TABLE 8-2

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

PLANNED CAPACITY, LOAD, AND RESERVE

MAXIMUM INSTALLED NET CAPABILITY	WINTER MEGAWATTS									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
THERMAL (OIL FIRED)	7125	7125	7058	6865	6865	6805	6805	6685	6685	6322
THERMAL (COAL FIRED)	0	0	0	0	0	0	0	0	0	0
THERMAL (OTHER)	0	0	0	0	0	0	0	0	0	0
THERMAL (GAS TURBINES)	2735	2794	2804	2825	2825	2825	2825	2825	2825	2825
THERMAL (DIESEL)	0	0	0	0	0	0	0	0	0	0
THERMAL (NUCLEAR)	873	873	873	1033	1033	1033	1033	1033	1033	1033
HYDRO (CONVENTIONAL)	0	0	0	0	0	0	0	0	0	0
HYDRO (PUMPED STORAGE)	0	0	0	0	0	0	0	0	0	0
TOTAL CONTROLLED SOURCES	10733	10792	10735	10723	10723	10663	10663	10543	10543	10180
*NET CAPACITY TRANSACTIONS	67	-29	116	13	-72	-79	1197	1047	1938	1745
TOTAL CAP. FOR LOAD OF AREA	10800	10763	10851	10736	10651	10584	11860	11590	12481	11925
COINCIDENT PEAK LOAD***	4905	4985	5045	5195	5345	5570	5550	5700	5850	6000
GROSS MARGIN	5895	5778	5806	5541	5306	5014	6310	5890	6631	5925
GROSS MARGIN-% OF LOAD	120.2	115.9	115.1	106.7	99.3	90.0	113.7	103.3	113.4	98.8

*In accordance with New York Power Pool Agreement Section 104.

SOURCE: 1976 Report of Member Electric Systems of the New York Power Pool and the Empire State Electric Energy Research Corporation pursuant to Article VIII, Section 149-6 of the Public Service Lay, Volume 2, Appendix D.

does occur, the potential property tax benefits which would accrue to communities in the locale of IP-2 and reported in Section 6.3.3.3(d) and Table 6-25 would be reduced by the appropriate amounts.

8.2.11 Responses to Comments by the State of New York Department of Law

See response to comments by HRFA (Section 8.2.16 below).

8.2.12 Responses to Comments by the Palisades Interstate Park Commission

The NDCT, FANDCT and CMDCT are all unacceptable because of visual and/or drift impacts.

The basis for the staff's conclusions and recommendations has been described as carefully and fully as possible in this statement. Further study is not warranted because all of the alternatives which are technically and economically feasible at the present time have been evaluated. The information available supports the recommendations and conclusions expressed and there appears to be no justification for delay in construction of a closed cycle cooling system to await the development of an unknown technology in cooling systems.

The staff has described the area of risk to vegetation from the drift emitted from mechanical draft cooling towers in Section 5 of the FES. This area is smaller than that implied by Figure 5-21 and it does not include the parks stated in the comment.

8.2.13 Responses to Comments by the Village of Buchanan

1. Standard Coated Products of Buchanan no longer operational, and Standard Brands of Peekskill greatly reduced.

Appropriate corrections have been made in Table 6-19.

2. Comments about future development and planning, correcting the information in the DES.

The staff relied on information published in Profile Legislative District No. 1, prepared by Westchester County Department of Planning. Appropriate modifications to the text have been made.

3. Visual characteristics of plumes.

Based on various sources of data and information presently available and as reported in Section 6.3.3.3, the staff concludes that the largest and longest plumes would be expected to occur only 3 percent of the time at the Indian Point site. Approximately 85 percent of the time the plumes will be small and extend only a short distance before dissipating. The vast majority of the time the plume will be running SSW toward the Georgia Pacific property and the west side of Verplanck; the second most frequent direction would be directly north over the river. Incremental changes in overcast due to various plume configurations is expected to be minimal and have no measurable impact on family living styles, including energy use patterns. The visual intrusion of the plume will be quite moderate a large percentage of the time for any of the five alternative cooling tower designs.

4. Effects of drift.

The staff analysis of salt drift effects on vegetation does not deny the existence of risk to vegetation but rather establishes a perspective on risk. Part of the perspective concludes that concerns for widespread catastrophic damage in the offsite environment are unfounded.

The environment will not be denuded of vegetation regardless of which cooling tower option is chosen. Foliar symptoms similar to salt burn but unrelated to power plant operation already exist on a few trees in the vicinity of Buchanan and Peekskill. The possible effect of added salts in this environment could be to add somewhat to the frequency of occurrence of similar symptoms and to add incrementally to the naturally occurring loss rate. A change in frequency of loss or symptoms, if it occurs at all, may or may not be apparent to a casual observer depending on its magnitude. Monitoring would therefore, be required to establish with reasonable certainty whether a change actually takes place and, if it does, to quantify its magnitude. Monitoring programs would serve the important practical purpose of establishing a data base to aid in the equitable resolution of possible conflicts if any occur.

The possibility of replacing lost vegetation was introduced by the staff as a contingency to aid decision making. The actual need for such action has not been demonstrated and it almost certainly would not be needed if natural draft towers were selected.

Adding further to the perspective on possible vegetation damage, the staff has indicated that cumulative or progressive damage over the life of the plant is unlikely. Salt drift in the amounts expected will not cause a progressive long-term deterioration of vegetation due to salt accumulation in soil. Any damage which does occur will be primarly expisodic in nature due to the fact that the principal pathway for possible salt entry in toxic amounts is by foliar interception of salts occur in late summer and early autumn.

Some accumulation of Na^+ and Cl^- in soils will occur. The staff conclusion that this will not cause progressive deterioration is based on two factors: (1) accumulation of toxic free soluble salt in soils in the vicinity of the plant is impossible because there is more than adequate rainfall to dissolve the salt. Accumulation will be in the form of Na^+ and to a much lesser extent Cl^-, (2) The amount of Na^+ which could be deposited in the region of highest concentration around a mechanical draft cooling tower (the worst case) would result in about 14% saturation of the soil ion exchange complex of the surface 12 inches in 30 years assuming that there was no run off whatever. With two towers, a maximum exchange saturation of about 28% could occur. Offsite saturations would be smaller by a factor of 10 or more from these values.

Maximum identified soil exchange saturation would not produce toxic effects in vegetation but would result in equivalent loss of nutrient cations principally K^+ and Ca^{++}, but also including others. Loss of nutrients would result in some loss of soil fertility which would be less than proportional to the increase in exchange saturation with sodium (a 14% reduction in equivalent calcium saturation would not result in a 14% reduction in plant growth, for example). Fertilizer routines commonly recommended to householders by the commercial trade are more than adequate to furnish the required nutrients in adequate amounts. The amount of fertilizer theoretically required annually would amount to 1/30 of the exchange saturation accounted for by added Na^+ during 30 years. The loss of fertility would therefore be unnoticeable in practice on an annual basis since the nutrient replacement could be accomplished with a few ounces of commercial fertilizer on an average yard.

Accumulation of Cl^- in soil would occur only slightly because soils have little or no anion exchange capacity. Chloride ion will, therefore, move freely along the principal pathways of soil water. Some will be taken up by plants, some will percolate through the soil profile and some will be carried away in runoff water. Uptake of Cl^- by plants in the amounts anticipated is not deleterious to most plants. Many commercial fertilizers which house holders use routinely on ornamental plantings without adverse effects contain KCl as a source of potassium. Agriculture uses KCl on a variety of crops at rates of 50 to 150 lbs/acre annually without adverse effects attributable to Cl^-. Agriculturists consider the chloride ion to be innocuous for most applications as testified by the widespread use of KCl as a commercial fertilizer for ornamental and crop plants. Tobacco is the most well know crop for which KCl is not recommended for use because the Cl^- affects the burning quality of the leaf, although it does not cause visible damage to growth.

5. Concerning comments about toxic materials.

See Section 8.2.10.42.

6. Effects of Construction Activities on Terrestrial Biota.

Conservative estimates of land requirements for the closed-cycle cooling systems considered by the staff range from 11 to 30 acres. More recent staff estimates indicate that the maximum land requirements for all considered alternatives would not exceed 20 acres. The staff has assessed this loss of habitat and has concluded that although existing on-site terrestrial populations will be impacted there will be no unacceptable impact on off-site biota due to this loss of habitat.

7. Cooling tower moisture effects on human populations.

The staff has considered this effect and has concluded that contributions of moisture from any type of cooling tower operation are too small to cause an increase in human respiratory irritations (Section 5.2.2.6)

8. Noise.

The staff was made aware of sporadic resident complaints over the operation of the main steam blow-off vents for Unit 2 and the operation of the loud speaker system for the construction activities for Units 2 and 3. The information was transmitted to the staff by Consolidated Edison personnel and by local officials during the staff site visit in June 1975. Corrective action is being taken to eliminate problems with these systems. The staff was not made aware of any other related complaints in the site vicinity.

The staff's assumption that there have been no complaints and threats of legal action has been made with respect to the general existing acoustic environment around the site. The staff is not aware of general dissatisfaction with the normally experienced sound levels in the Buchanan-Peeksville area. The various impulse and non constant intermittent noises, such as those mentioned above, have likely not been considered in the baseline acoustic survey, because of their infrequent occurrence. The staff's analysis of the operational acoustic environment is consistent with this approach. This analysis does not consider those unusual complaint causing occurrences mentioned above, because they are not related to the normal operation of the cooling towers themselves.

To eliminate, or reduce to the extent practicable, the noises during construction likely to generate complaints experienced previously as noted in this comment, the staff has recommended noise mitigating actions to be taken by the licensee during construction of the towers.

9. Property values will be depressed.

Caution must be exercised in determining the weight placed on information that the value of a property was depressed in West Berlin due to placement of the Bochum Station. Specifically, the information given to a member of the staff by a plant official was based on knowledge that one apartment house located adjacent to the station perimeter was sold at what was considered to be a depressed price. The area in which the station was placed is densely developed multi-family residential and there was little distance between the station facilities and the impacted apartment house.

10. Transfer primary Impact of cooling system to atmosphere.

The ultimate sink for waste heat from power plants with either open or closed cycle cooling is the atmosphere. The tradeoff is between concentrated water discharge with the subsequent evaporative and convective loss to the atmosphere over a dispersed area which occurs with open cycle and the concentrated atmospheric discharge which occurs with closed cycle system. It has not, to the present time, been demonstrated that one or two concentrated atmospheric discharges impact any atmospheric natural resource to the same extent that a once through cooling system can affect the aquatic environment.

11. Tower plume can reach the ground in mountainous terrain.

While the staff does not agree that "mountainous" is an accurate description of the terrain around Indian Point, it has acknowledged that a conservative assessment predicts the possibility of an incremental increase in the incidence of fog which falls well within the natural variation of such occurrences (see Section 5.1.3.3).

12. Con Edison's estimates of drift high.

The staff conclusion regarding the applicant's natural draft predictions being too high relate primarily to the fact that no allowance was made for the monthly variation in make-up water salinity. During the spring the make-up water is almost completely fresh thus causing erroneous predictions of magnitude and direction for the annual and drift. The applicant's calculations for the selected system in the Closed Cycle Cooling System Environmental Report for Indian Point 3 have corrected this error. The uniform terrain assumption in ORFAD is addressed in response to the applicant's comment 5-2.

13. Lent's Cove Beach should not be used for disposal materials.

The staff agrees. See response to comment 8 by the NY Department of Environmental Conservation.

14. Discharge of sulphuric acid, chlorine and other pollutants to meet state standards.

Should the effluent, when diluted as described, not meet state standards, appropriate changes in procedures or treatment will be required to conform to the standards.

15. Estimates have been predicted on the use of models which are inaccurate at best.

The analyses performed by the staff were based on conservative estimates and assumptions. The staff agrees with the view that the element of error should favor the maximum effects. Further, the staff believes that given results of a conservative analysis which indicate little or no effect and that a proposed action is acceptable, it is prudent to monitor for verification of the analysis even though no measureable effects are expected.

16. Reference is made to the wooded area of 80 acres...visualization of this area as a greenless, barren stretch is terrible to contemplate.

None of the projections made by either the applicant or staff indicate any possibility that this might happen. See section 5 and also response to comment 15 above.

17. Noise.

One of the factors leading to the recommendation of a natural draft cooling tower at the Indian Point site was that it is less noisy than other feasible closed cycle cooling systems.

18. Impacts on terrestrial biota.

See response to comment 15 above.

19. Once-through cooling versus closed cycle cooling.

It is incorrect to state that the DES is based on the assumption that once-through cooling will be disallowed and that some type of closed cycle cooling will be preferable (see section 1.3). A closed cycle cooling system is required; the purpose of this statement is to recommend the preferred type of system. Thus, arguments pro and con relative to once-through vs. closed cycle cooling are irrelevant.

20. Use of cooling towers at Indian Point does not represent an improved solution to the thermal problem.

See responses to comment 19 above and comments by the Palisades Interstate Park Commission (Section 8.2.12).

21. Blowdown will be diluted with water from Unit No. 1.

See response to comment 14 above.

22. Assumption of uniform terrain elevation in the ORFAD model.

See response to comment 5-2 by Con Edison.

23. No mention is made of cumulative effects of drift on exposed surfaces.

See response to comment 33 by NY Department of Environmental Conservation.

24. Replacement of killed trees is possible. This unfeeling statement does not take into account the inconvenience to the homeowner.

First, the staff believes that very few trees will require replacement (see response to comment 15 above). Second, the staff assumes that monetary compensation for replacement would include considerations of inconvenience and the like.

25. Interaction of tower plumes and SO_2 stack effluent.

See response to comment 43 by NY Department of Environmental Conservation.

26. Effects on terrestrial biota overlooked in favor of aquatic biota.

The purpose of the closed cycle cooling system is to mitigate effects of once-through cooling on the aquatic biota. The effects on terrestrial biota are a result of the requirement for the protection of the aquatic biota. However, mobility of terrestrial animals, aside from some invertebrates, is such that temporary displacement may occur without permanent adverse effects.

27. Why the concern about drift and salt deposition if no problems are anticipated.

See response to comment 15 above.

28. Cumulative effects from salt deposition.

See response to comment 5-6 by Con Edison.

29. Panel of "experts". None of the experts were from the Indian Point area. No comparisons were made between "no towers" and "towers".

The issue is not towers vs. no towers (see response to comment 19 above). The study referred to was specifically pointed to a stated set of cooling towers. The "experts" were chosen on the basis of their technical qualifications, not geographical, in order to obtain an unbiased view of the visual impact of the towers. While the "experts" did not live in the area, their opinions deserve consideration, as do those of other interested individuals. The staff's analysis attempts to incorporate all of the various views in reaching its final recommendation.

30. It should be noted that the NEPA states as an objective:

> "Assure for all Americans safe, healthful, productive and aesthetically and culturally pleasing surroundings."

This is an accurate quotation. However, the staff believes that the remainder of NEPA is also pertinent, specifically "Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities." (For the remainder of NEPA objectives see Foreword.) Because no action is without environmental impact, emphasis falls finally on the balance between costs and benefits, neither of which can be totally quantified, especially in terms of dollars. To reach a conclusion, the staff evaluates the potential benefits of having power against the impacts of producing the power. Part of the evaluation is to determine how to protect the environment so as to meet the objectives of NEPA. Upon completion of review, if the benefits appear to outweigh the costs, a proposed action is recommended.

In the present case, it has already been determined that the power produced by Indian Point Unit No. 2 is desirable, provided only that closed cycle cooling is installed. The purpose of this statement is to recommend the preferred type of closed cycle cooling system.

8.2.14 Responses to Comments by the City of Peekskill

See responses to comments by Village of Buchanan (Section 8.2.13), Bernard G. Gordon, (Section 8.2.17) and Hamilton Fish (Section 8.2.18) and Sections 8.2.10.42.

8.2.15 Responses to Comments by the Town of Cortland

See responses to comments by the Village of Buchanan (Section 8.2.13), Bernard G. Gordon (8.2.17) and Hamilton Fish (8.2.18).

8.2.16 Responses to Comments by the Hudson River Fisherman's Association

HRFA's major comment dealt with the date for cessation of the present once-through cooling system.

The construction schedule, as originally proposed, is given in Figure 4-1 and was based on completion of NRC and agency evaluation and issuance of permits by December 1, 1975. However, as stated in sections 1.3 and 4.1 a stipulation, signed by the parties to the Indian Point proceedings, provides that the "May 1, 1979" date is subject to acceleration or delay depending on various conditions. Paragraph 2E(1)(b) of the stipulation which is applicable is reproduced below in its entirety.

Paragraph 2E(1)(b)

> "The finality of the May 1, 1979 date also is grounded on a schedule under which the applicant, acting with due diligence, obtains all governmental approvals required to proceed with the construction of the closed cycle cooling system by December 1, 1975. In the event all such government approvals are obtained a month or more prior to December 1, 1975, then the May 1, 1979 date shall be advanced accordingly. In the event the applicant has acted with due diligence in seeking all such government approvals, but has not obtained such approvals by December 1, 1975, then the May 1, 1979 date shall be postponed accordingly."

To date (June 1976) there has been six months' delay in obtaining the necessary approval from the NRC and there may be an additional estimated three months' slippage because of the time required for public hearing and licensing board decision. This delay, in effect, makes the termination date for once-through cooling February 1, 1980, in accordance with the stipulation. This date will also permit tie-in of the closed system to be done during the preferred winter season.

With the stipulation in effect, the statements made by HRFA concerning "1) a showing by the company...; 2) an environmental statement...; and 3) a hearing..." are incorrect.

In preparing the DES, the staff recognized the widespread public interest in the potential impacts of a closed-cycle cooling system at Indian Point. As a result, the staff made a determined effort to evaluate as many viable alternative cooling systems as possible in order to assure an optimum selection of the preferred closed system. To this end, the staff obtained much information from sources other than the applicant and performed extensive analyses and evaluation of what appeared to be the better systems. Although the effort took longer than anticipated, it appears justified by the staff's objective to provide sufficient information to permit the parties to any subsequent public hearing and commentors to judge and weigh the subjective aesthetic impacts against the varying environmental impacts. Every effort was made to produce an optimum selection of the preferred system recognizing the impacts on the local population and biota.

The foregoing discussion deals only with NRC approvals and their estimated effect on the construction schedule. In addition, however, the Village of Buchanan has denied Con Edison's application for a building permit for the cooling tower. The validity of that denial is now being determined by the NY State courts. The amount of delay in construction due to this process is unknown.

8.2.17 Responses to Comments by Bernard G. Gordon

Specific response is provided in a letter to the Honorable Bernard G. Gordon which is reproduced below.

8.2.18 Response to Comments by Hamilton Fish

Specific response is provided in a letter to the Honorable Hamilton Fish which is reproduced below.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 24 1976

Docket Nos. 50-247
and 50-286

Honorable Bernard G. Gordon
New York Senate
Albany, New York 12224

Dear Mr. Gordon:

This letter is in reply to your statement issued April 19, 1976 commenting on the Draft Environmental Statement (DES) for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2.

The staff's initial position of need for a closed cycle cooling system for Indian Point Unit No. 2, to which you refer, became public knowledge when the Final Environmental Statement was issued in September 1972. That document went into considerable detail on the basis of the staff's position and it was found, on balance, that the closed cycle cooling system would be required. Subsequently, a similar evaluation for Indian Point Unit No. 3, after a more detailed and up-to-date review, arrived at the same conclusion. Both conclusions have since been litigated before the Atomic Safety and Licensing Board, in public hearings (the record included your statement of April 1, 1975), reviewed by the Atomic Safety and Licensing Appeal Board, and confirmed in the Nuclear Regulatory Commission Memorandum and Order of December 2, 1975.

All of the points you raised in your statement of April 1, 1975 in the Indian Point Unit No. 3 Public Hearing had been discussed in considerable detail at the Indian Point Unit No. 2 Public Hearings and reassessed in detail in the Indian Point Unit No. 3 Final Environmental Statement. As a result of the public hearings, subsequent appeals and Commission Order the remaining question in both Indian Point Unit No. 2 and Unit No. 3, is the selection of the Preferred Closed Cycle Cooling System.

The applicant, as required by the Indian Point Unit No. 2 license, submitted to the staff its assessment and basis for selection of a natural draft cooling tower as the preferred closed cycle cooling system. The staff is preparing an assessment of the alternative closed cycle cooling systems in the form of a Draft Environmental Statement (allowing Federal agency, State agency, local agencies, and public comment) and Final Environmental Statement. The staff made a very determined effort to evaluate as many viable alternative cooling systems as possible in order

to assure an optimum selection of the preferred closed system. In addition, it was the staff's objective to provide sufficient technical information in their assessment to permit the parties to any subsequent public hearing on the subject and commentors to judge and weigh the subjective aesthetic impact against the varying environmental impacts such as salt deposition, fog, and noise. Every effort was made to produce an optimum selection of the preferred system recognizing the impacts on the local population and biota.

The specific comments you have provided as attachments will be carefully reviewed and considered in the preparation of the staff's Final Environmental Statement for the Selection of the Preferred Closed Cycle Cooling System.

Sincerely

Original Signed By
Ben C. Rusche

Ben C. Rusche, Director
Office of Nuclear Reactor Regulation

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 14 1976

Docket No. 50-247

Honorable Hamilton Fish, Jr.
U. S. House of Representatives

Dear Mr. Fish:

Your letter of April 12, 1976, to the Chairman, Nuclear Regulatory Commission, relative to the Draft Environmental Statement (DES) for the closed-cycle cooling system at Indian Point Unit No. 2 has been referred to me for reply. Since the applications of Consolidated Edison Company of New York, Inc., for amendments to facility operating licenses for Indian Point Unit Nos. 2 and 3 may be subject to review by the Commission in the exercise of its quasi-judicial duties, it would be inappropriate for the Chairman to respond directly to you. It is, therefore, a pleasure for me to respond to your letter.

In your letter of April 12, you recommend that consideration be given to staying licensing action requiring construction of the cooling towers until after completion of the Hudson River fish study. In addition, you state your belief that an alternative closed-cycle system other than a natural draft cooling tower would be preferable for Indian Point Unit Nos. 2 and 3.

Both of these issues are being considered by the Staff in evaluating three applications made by Consolidated Edison of license amendments related to closed-cycle cooling systems at the Indian Point site. These are listed below.

1. Application for Amendment to Facility Operating License DPR-26. This deals with selection of the preferred closed cycle cooling system for Indian Point Unit No. 2 and is the application for amendment for which the DES was issued in February 1976 and to which you referred in your letter.

2. Application for Facility License Amendment for Extension of Operation with Once-Through Cooling for Indian Point Unit No. 2 This application will result in a DES which is scheduled for issuance in May 1976.

3. Application for Amendment to Facility Operating License DPR-64 January 1976. This deals with selection of the preferred closed-cycle cooling system for Indian Point Unit No. 3. The DES addressing this application for amendment is scheduled for issuance later this year (tentatively, August 1976).

With respect to the use of a natural draft cooling tower for the Indian Point Unit No. 2, the DES issued in February 1976 (item 1 above) presented a quite detailed evaluation of five alternative closed-cycle cooling schemes. The Staff's analysis considered design, construction and operating characteristics of each type; all major environmental impacts including socio-economic considerations; and an overall cost-benefit balance. On the basis of that evaluation and assessment, the Staff summarized in the draft statement that the acceptable alternative cooling systems are natural draft, fan-assisted natural draft, and circular mechanical draft cooling towers. The other alternatives were considered environmentally or economically unacceptable. Finally, the Staff identified the major environmental parameters which enter into choice of tower type to be noise, drift and aesthetics. Although there were very minor differences among the types of towers considered, the differences, on balance, did not present a case to the Staff which would warrant a change in the applicant's selection of the natural draft tower as the preferred system.

As indicated above, the matter of initiating construction of the Unit 2 cooling system relative to completion of the Hudson River fish study is an integral part of the staff's evaluation being addressed in the DES cited in item 2 above. Since this issue is still under review, we are not yet able to state a conclusion. However, as soon as that statement is published, you will be promptly provided a copy.

The Staff has made, and will continue, in the different environmental statements, to make, every effort to set forth the rationale and pathways (procedures) used in arriving at its conclusions and recommendations. It is believed that by doing this the public and parties involved can better understand the basis for the actions recommended.

Your comments concerned with the Indian Point Units are appreciated, and we will continue to consider them in our evaluation.

Sincerely,

William J. Dircks
Assistant Executive Director
for Operations

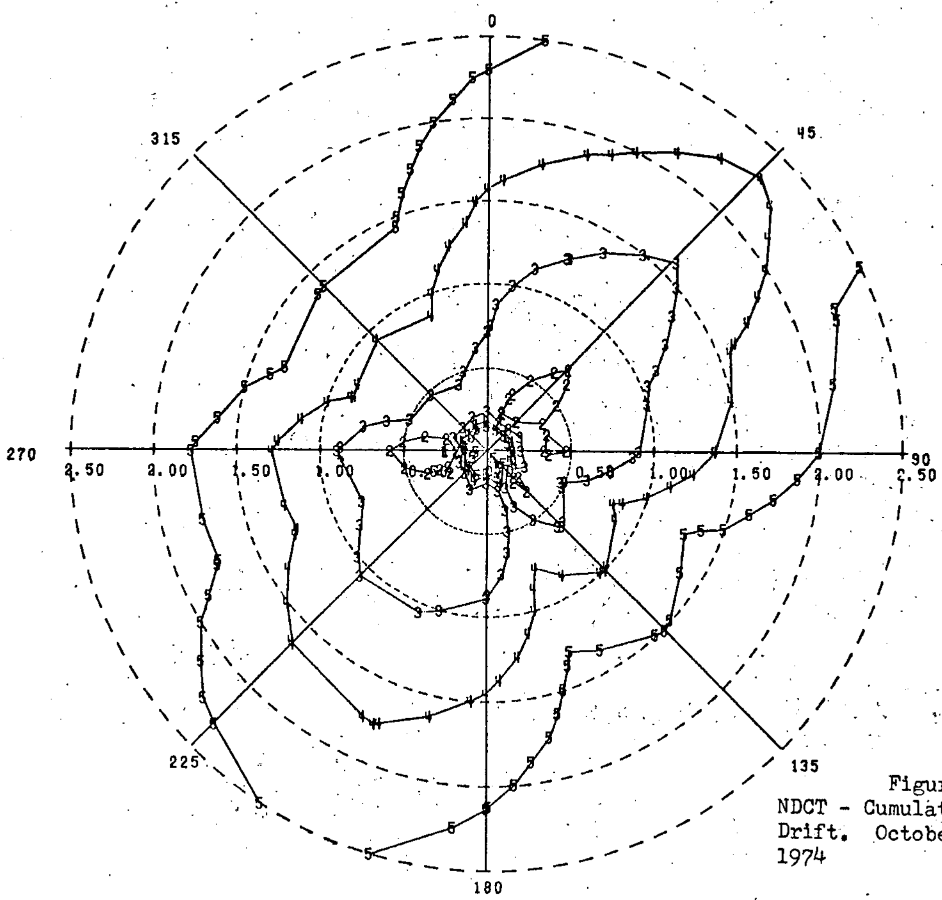
APPENDIX A

RESULTS OF STAFF CALCULATIONS OF SALT DRIFT DEPOSITION, INDUCED FOGGING AND ICING AND SALT AEROSOL CONCENTRATION FROM OPERATION OF A NATURAL DRAFT COOLING TOWER AND A CIRCULAR MECHANICAL DRAFT TOWER AT INDIAN POINT UNIT NO. 2

APPENDIX A

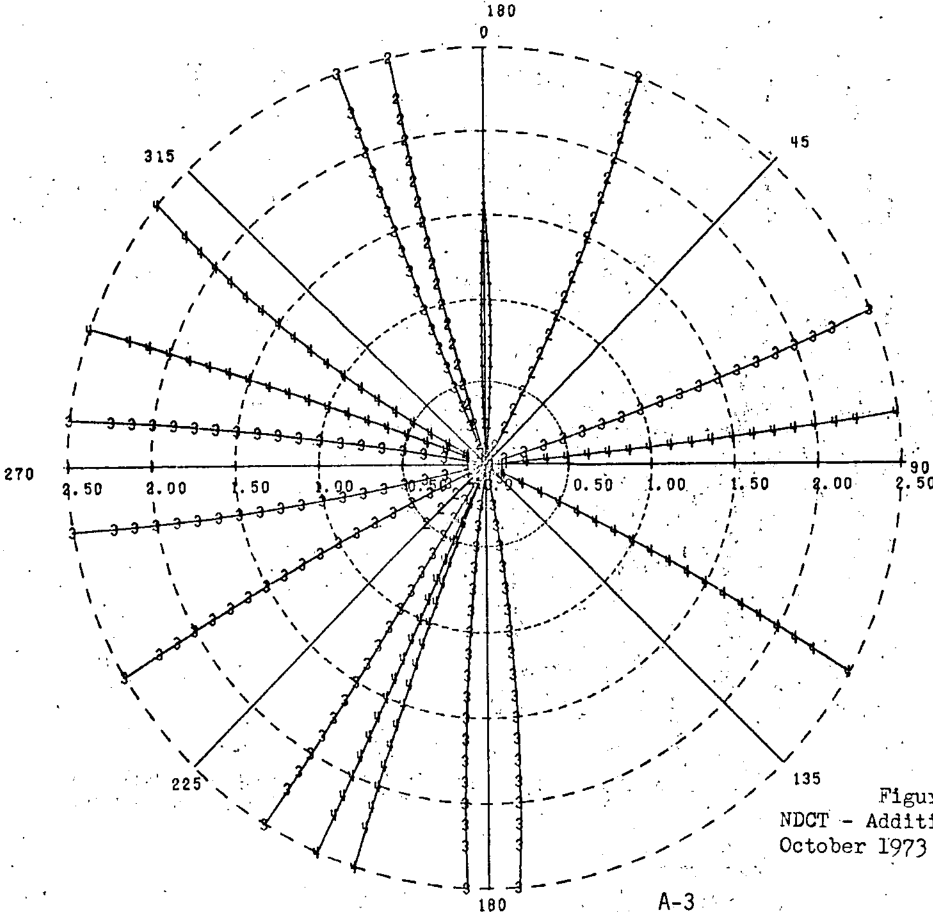
The results of the staff's calculations for natural draft cooling towers (NDCT) are presented graphically as Figures A-1 through A-41. The results of the staff's calculations for circular draft cooling towers (CMDT) are presented graphically as Figures A-42 through A-83. The model (ORFAD) and tower parameters used for these calculations are described in Section 5.

The drift levels are presented in kilograms per hectare. To convert these numbers to pounds per acre, simply multiply by 0.892. All distances are given in miles. Fog and ice plots are not presented for months in which no additional hours of fog or ice conditions were reported. The concentrations of salt in air represent averages taken over the period indicated for each graph and are given in micrograms per cubic meter.



1	22.00
2	11.00
3	5.50
4	2.75
5	1.37

Figure A-1
NDCT - Cumulative Amount of Drift. October 1973 - September 1974



1	20.000
2	10.000
3	5.000
4	2.500
5	1.250

Figure A-2
NDCT - Additional hours of fog October 1973 - September 1974

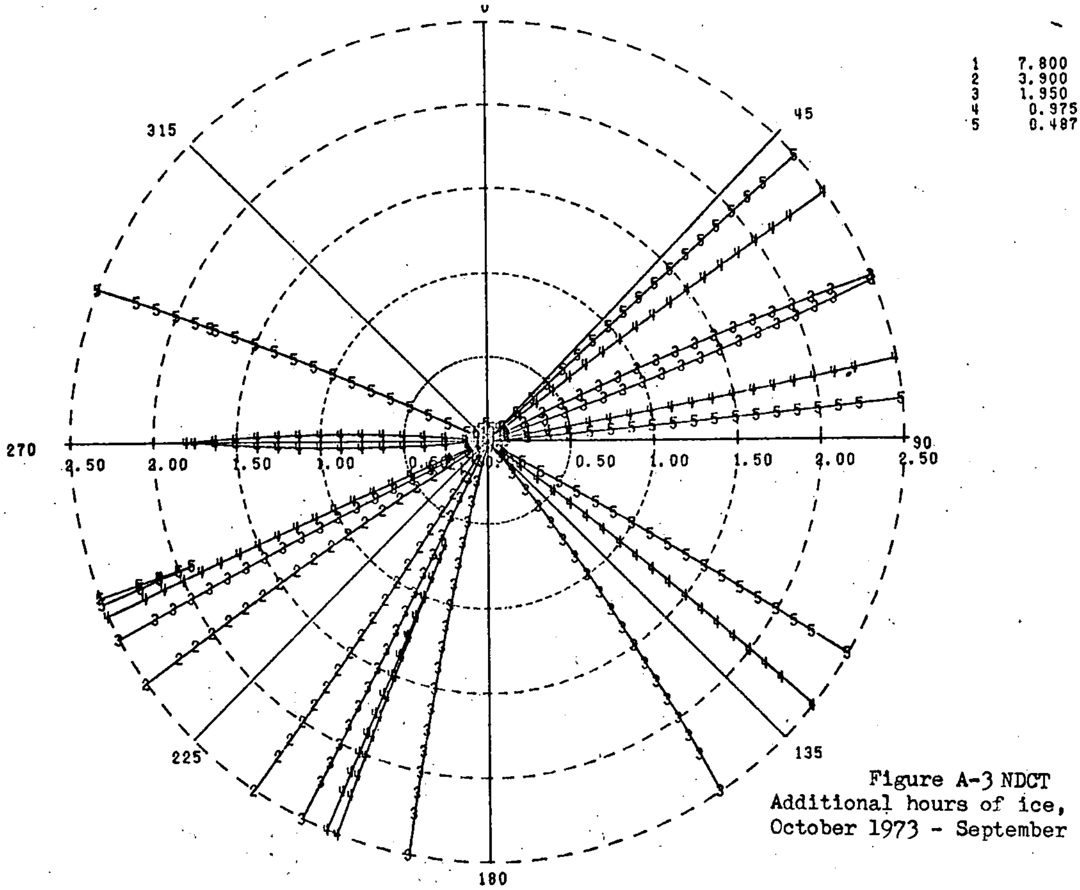


Figure A-3 NDCT
Additional hours of ice,
October 1973 - September 1974

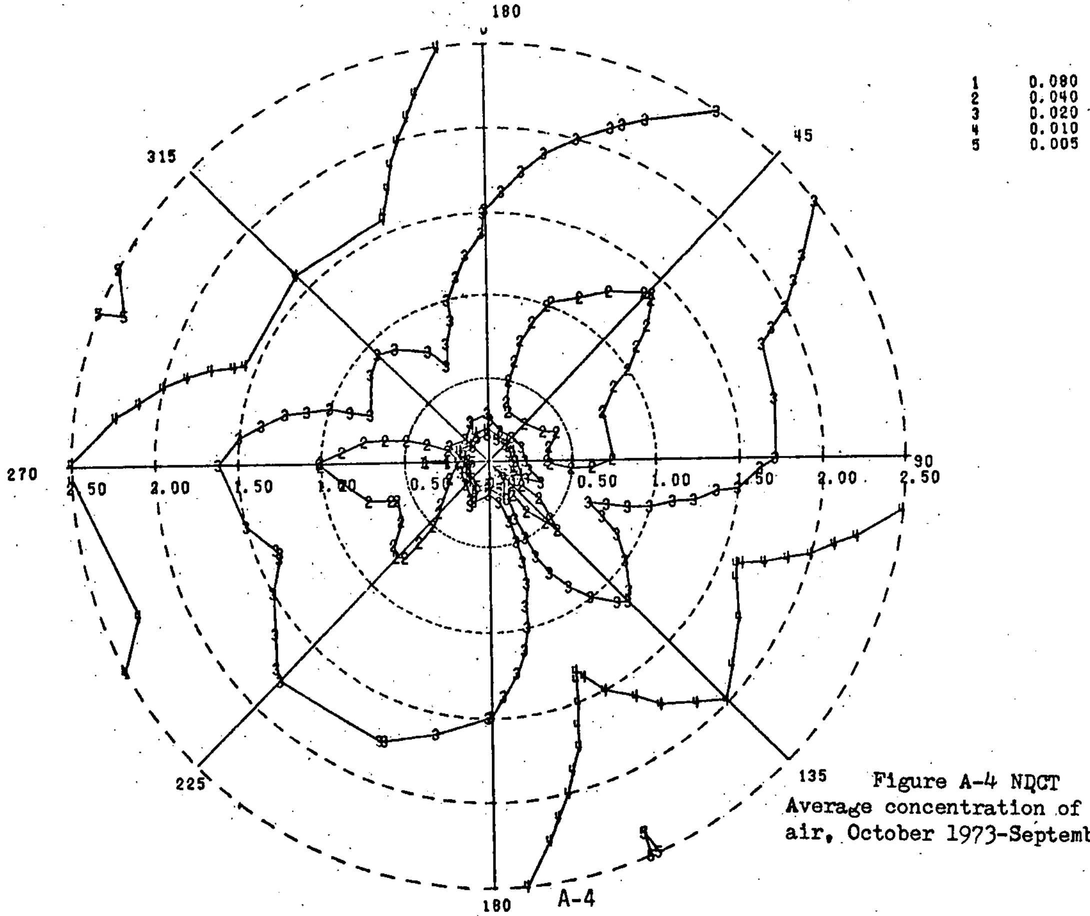


Figure A-4 NDCT
Average concentration of salt in
air, October 1973-September 1974

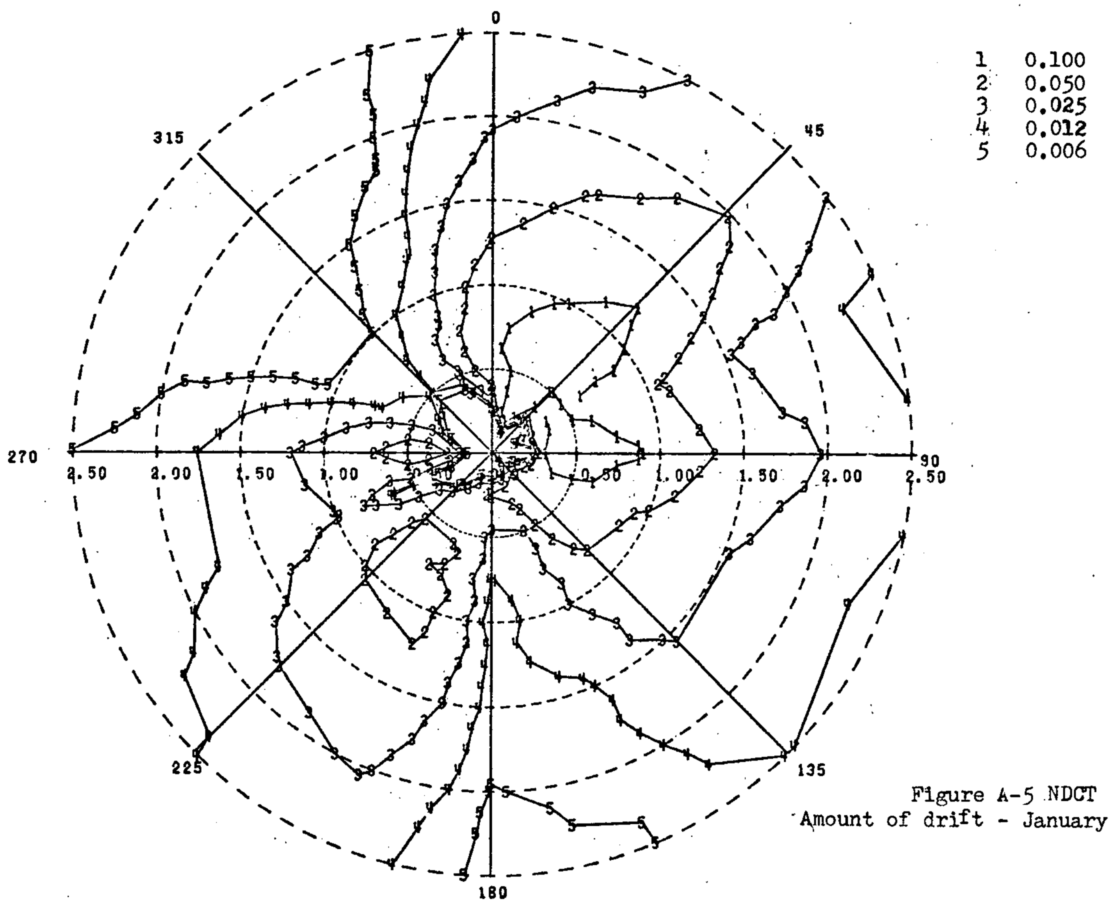


Figure A-5 NDCT
Amount of drift - January

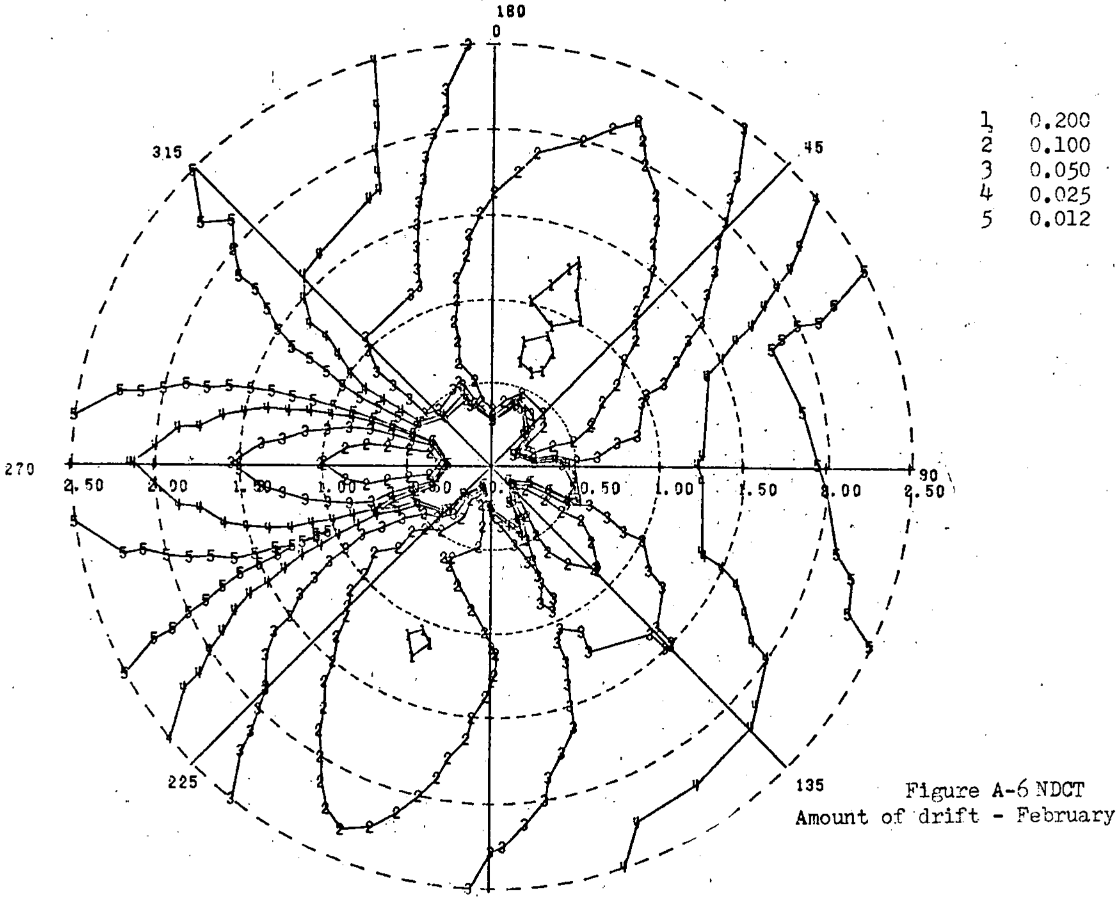
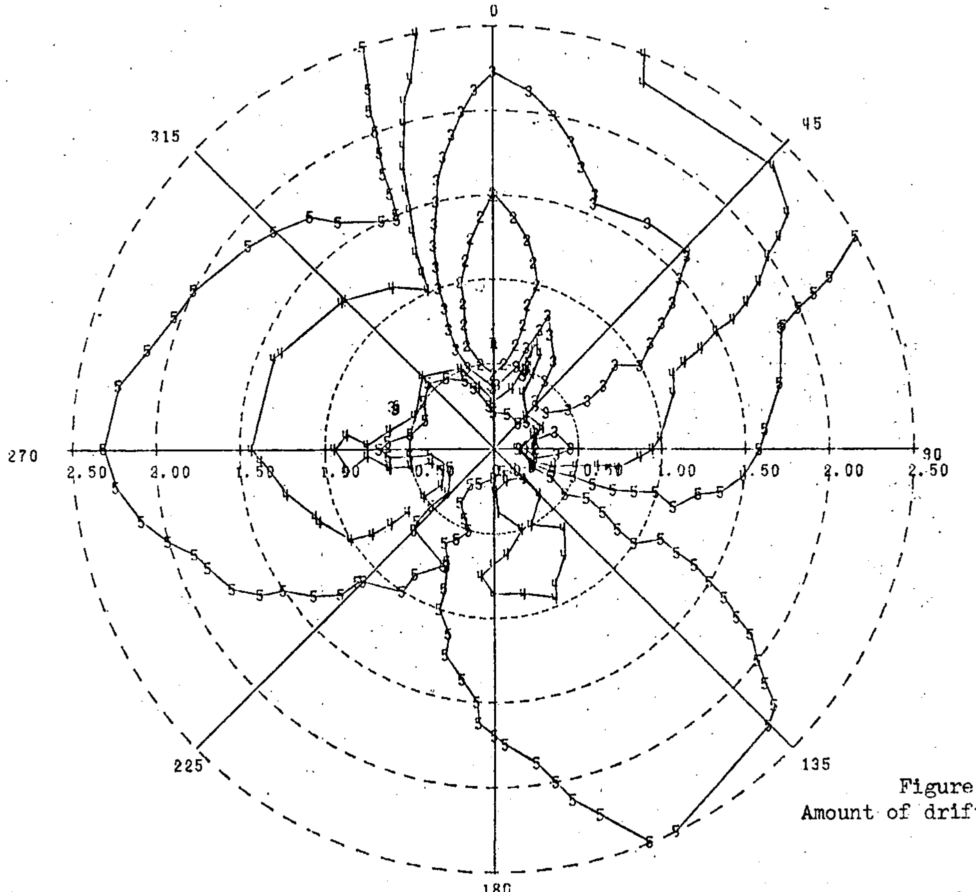
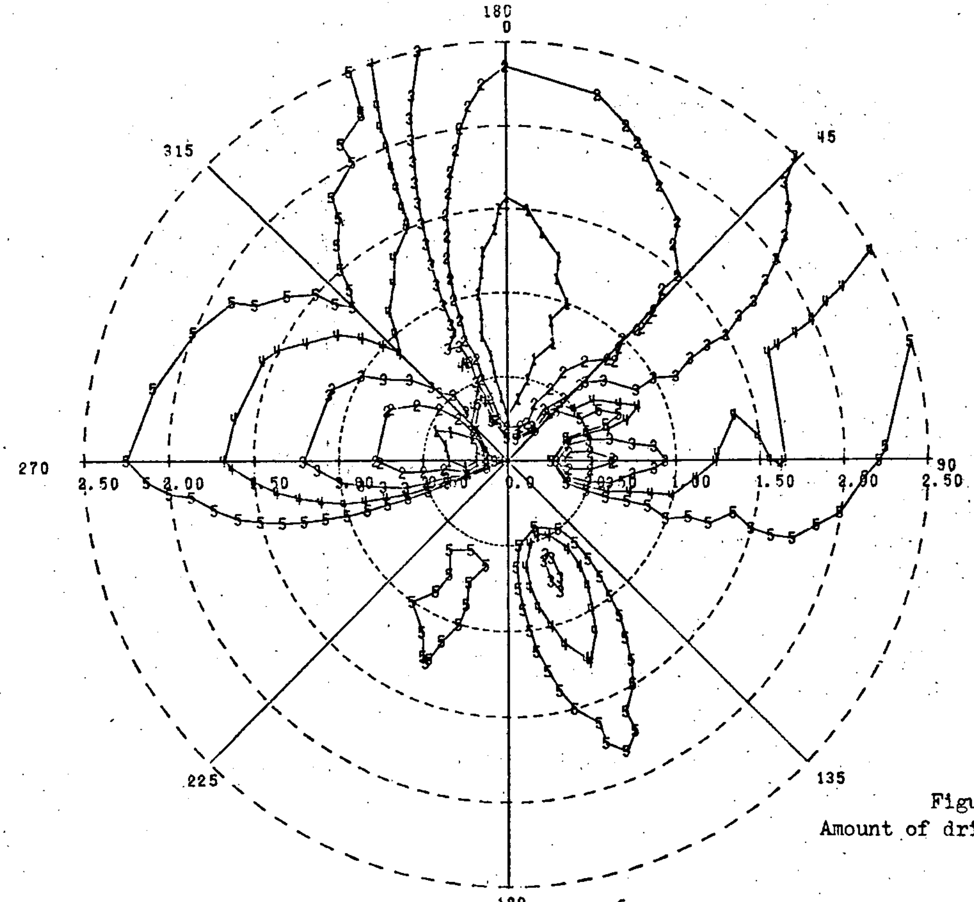


Figure A-6 NDCT
Amount of drift - February



1	0.000700
2	0.000350
3	0.000175
4	0.000088
5	0.000044

Figure A-7 NDCT
Amount of drift - March



1	0.0000100
2	0.0000050
3	0.0000025
4	0.0000012
5	0.0000006

Figure A-8 NDCT
Amount of drift - April

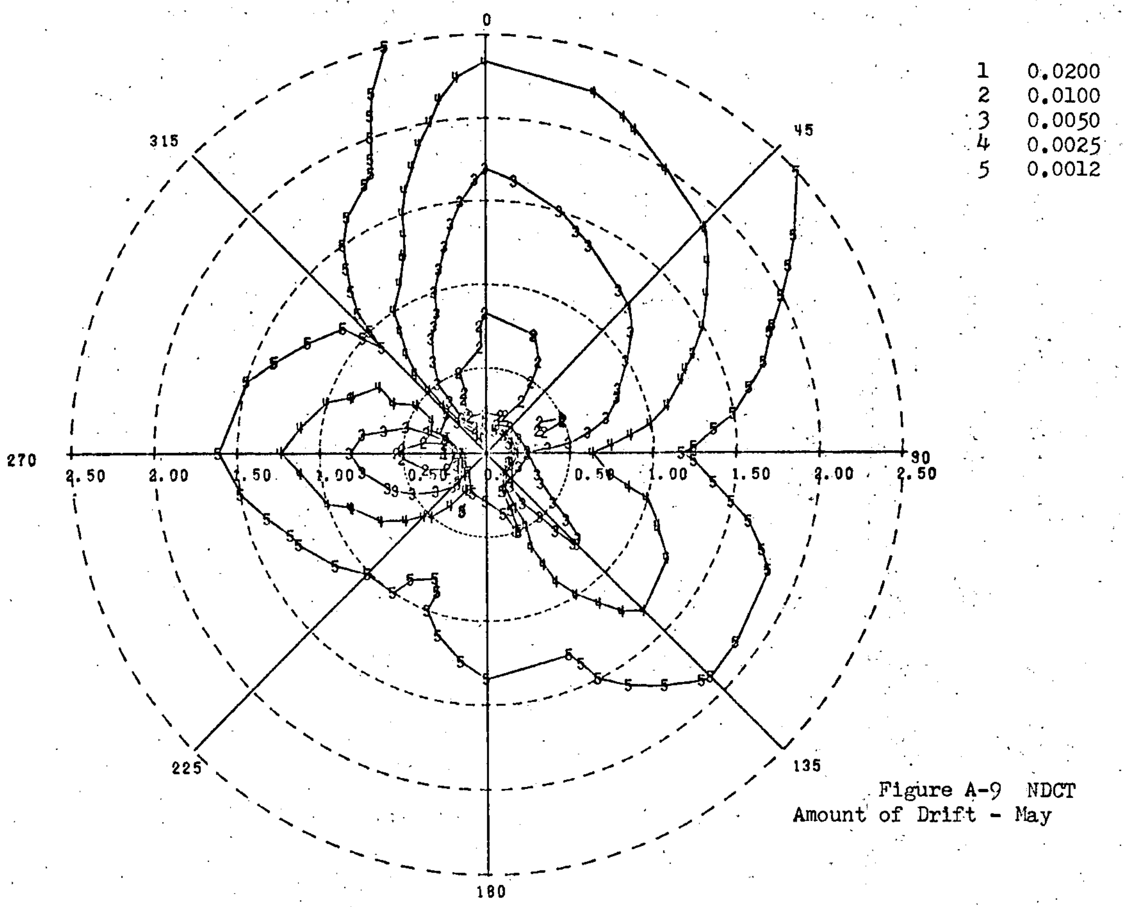


Figure A-9 NDCT
Amount of Drift - May

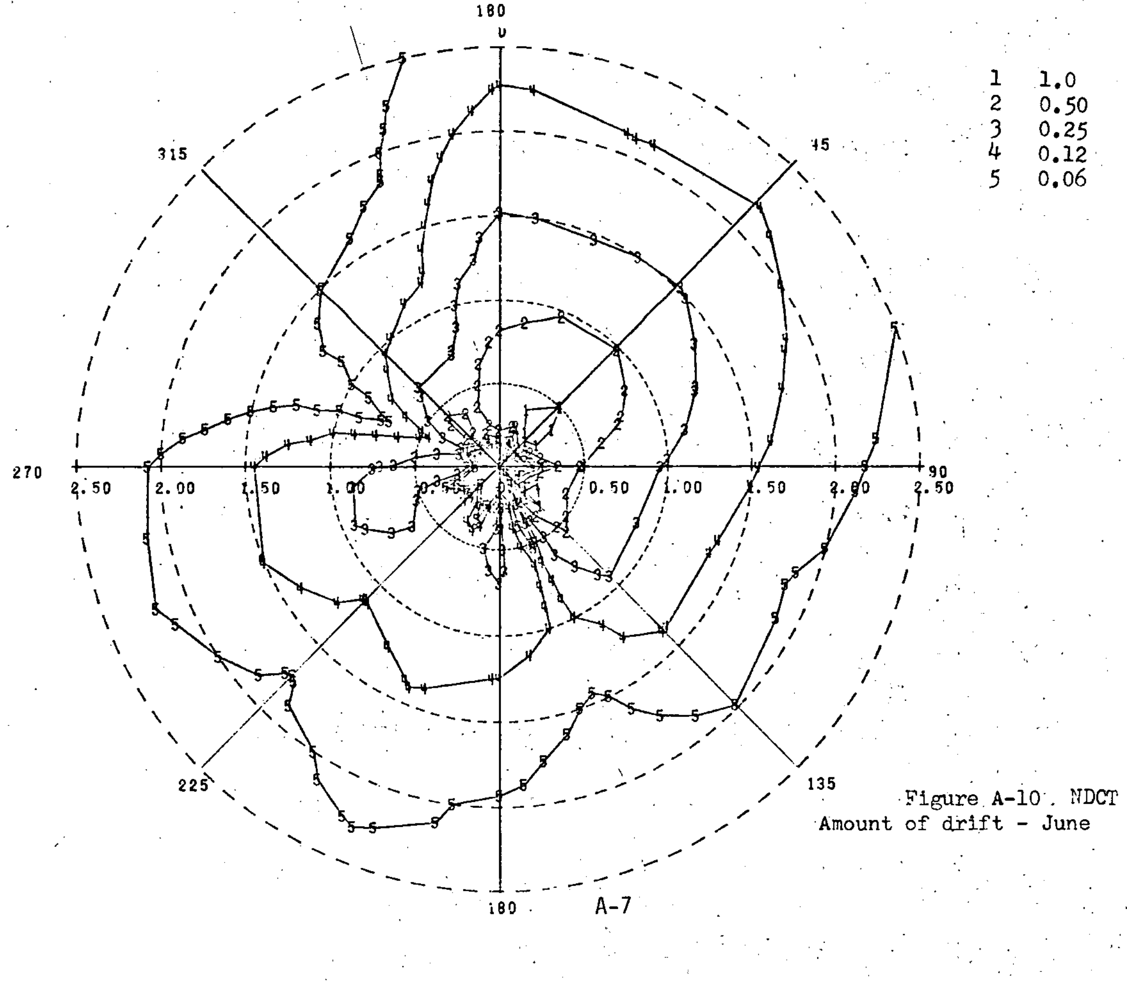


Figure A-10 . NDCT
Amount of drift - June

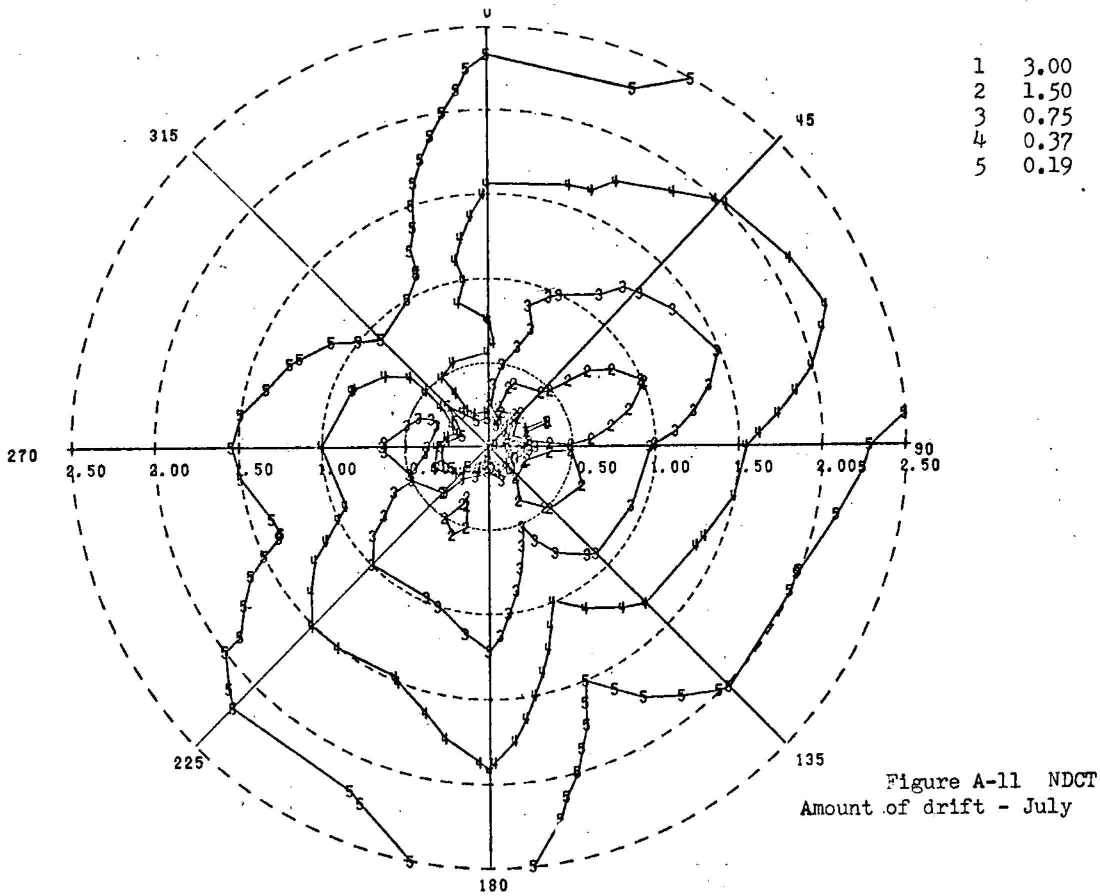


Figure A-11 NDCT
Amount of drift - July

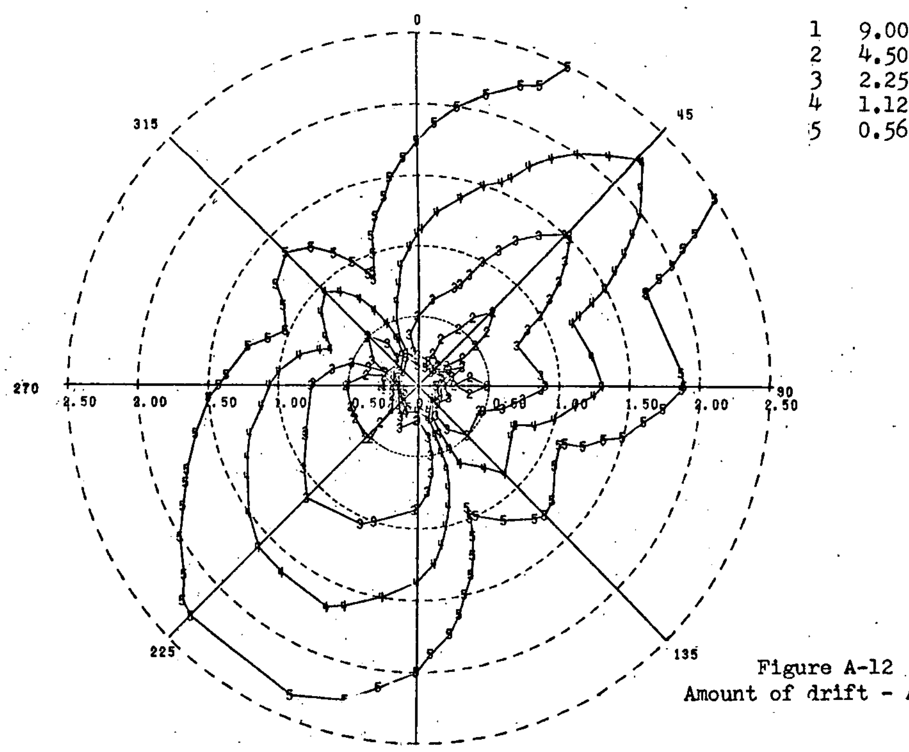


Figure A-12 NDCT
Amount of drift - August

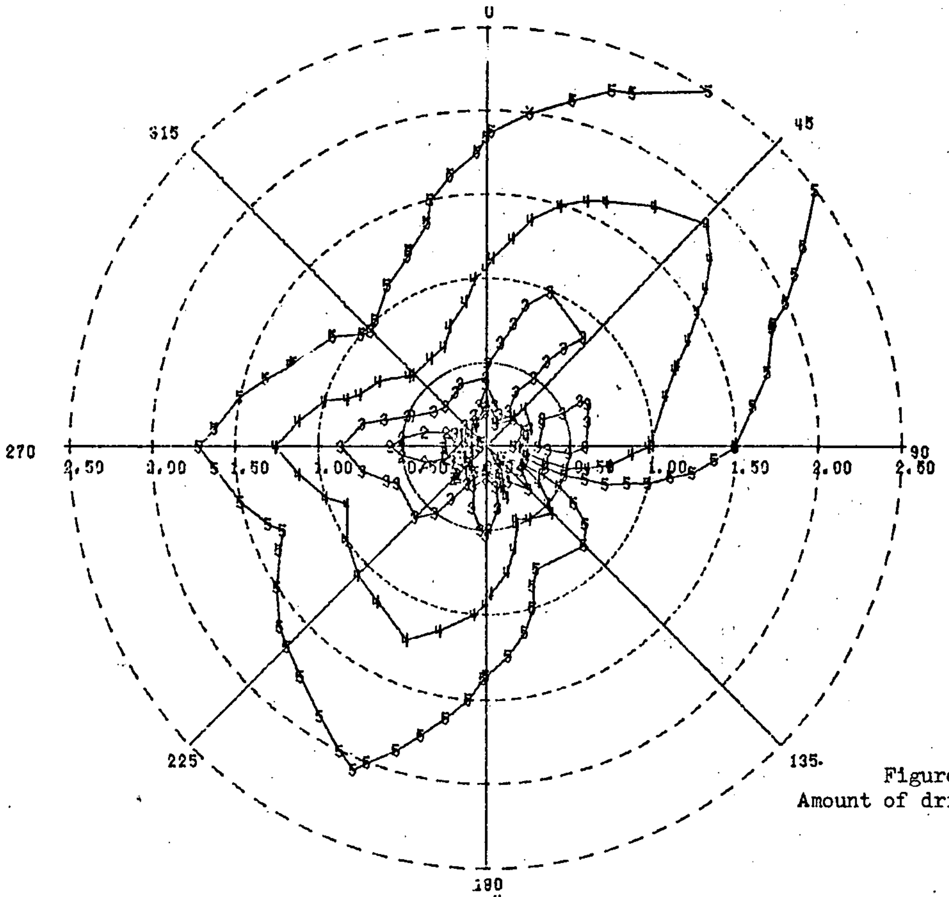


Figure A-13 NDCT
Amount of drift - September

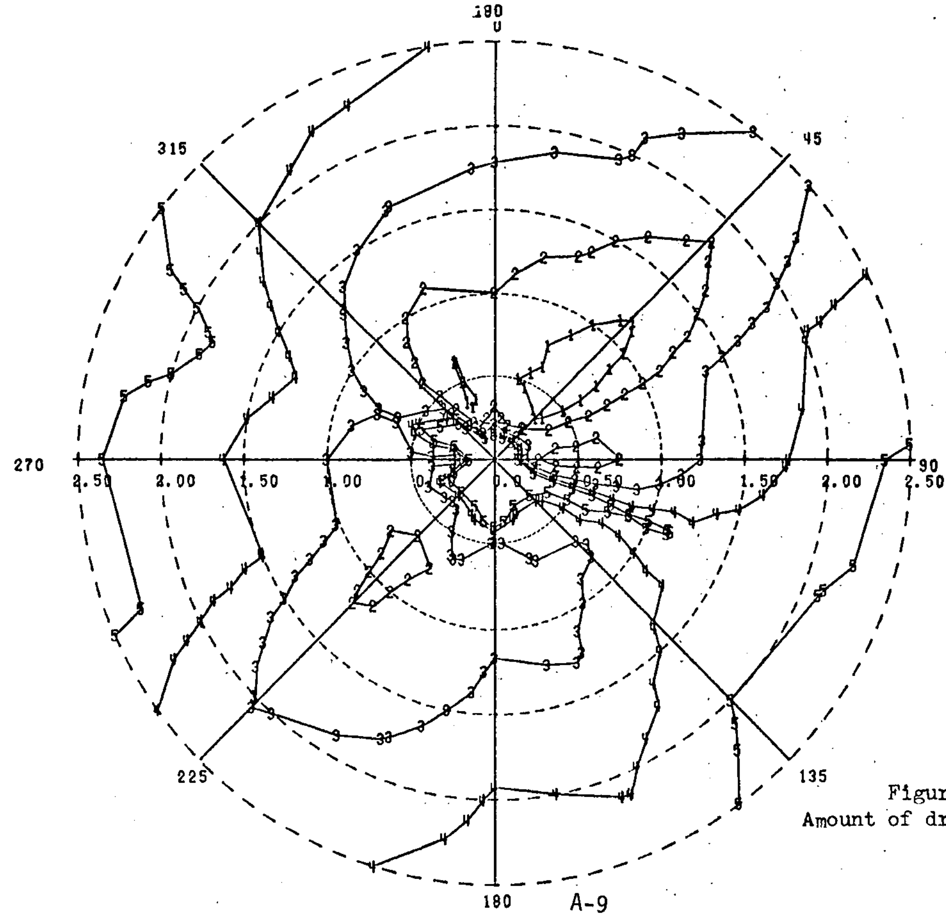


Figure A-14 NDCT
Amount of drift - October

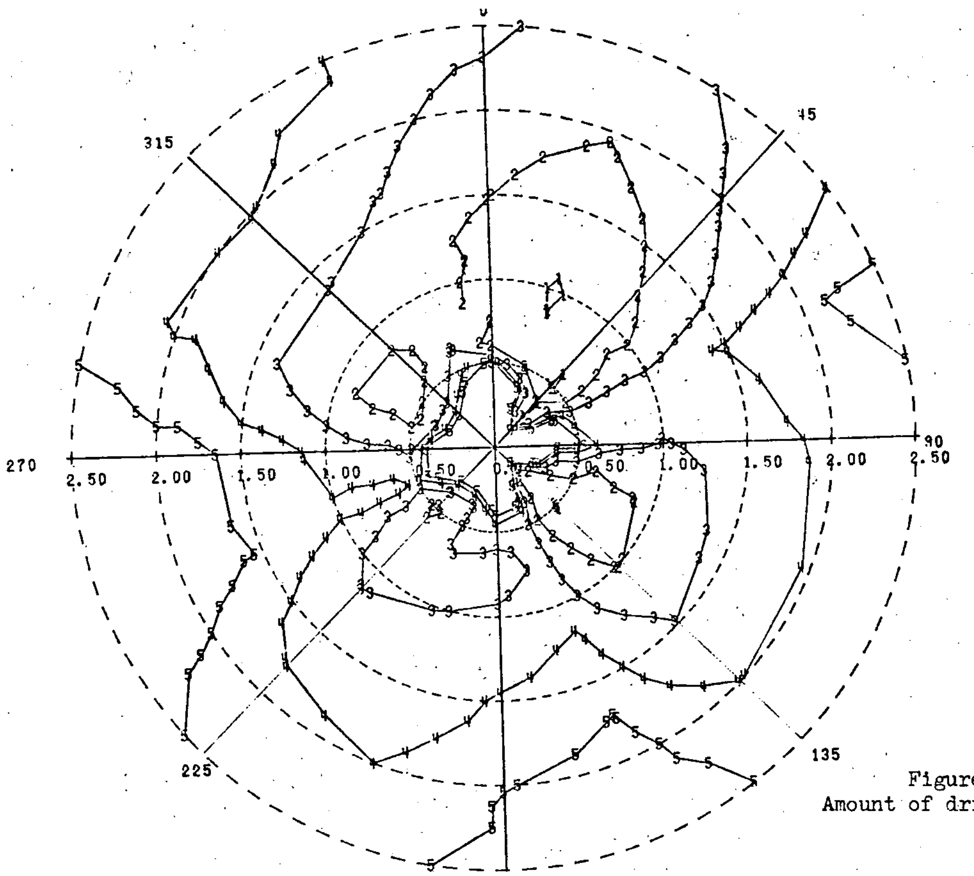


Figure A-15 NDCT
Amount of drift - November

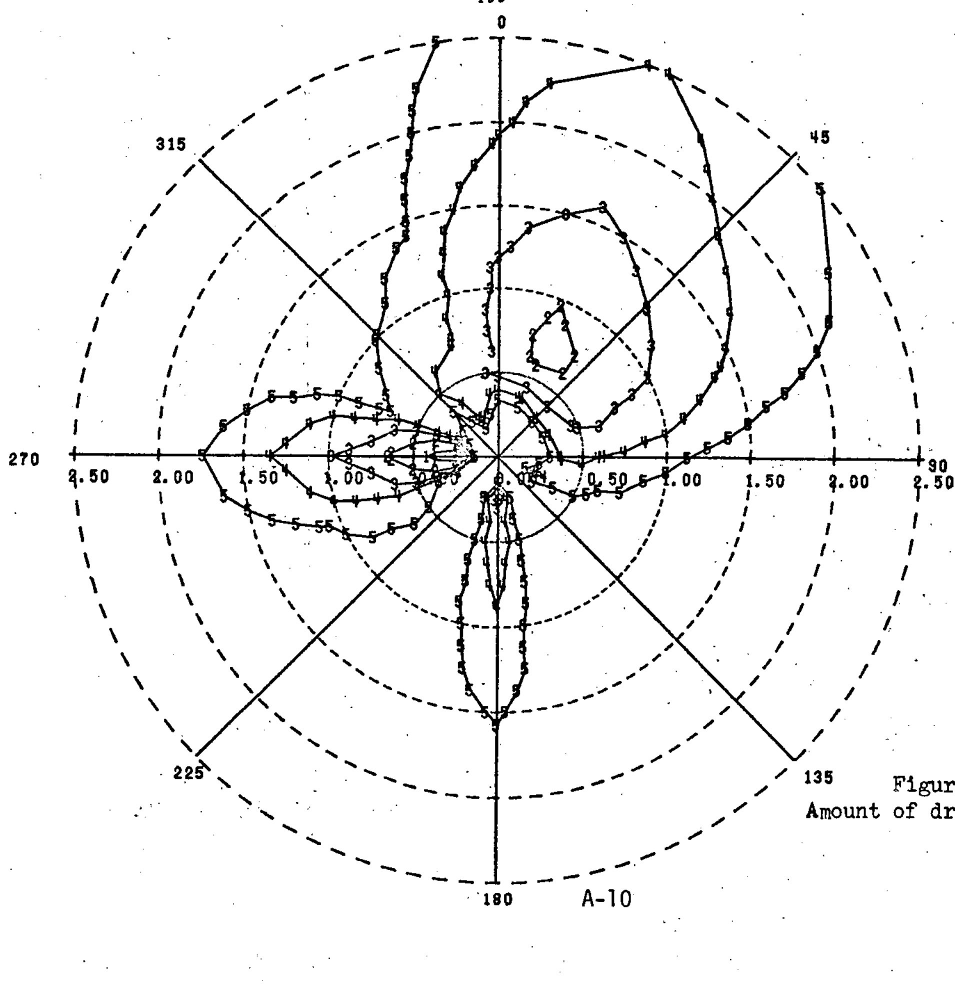


Figure A-16 NDCT
Amount of drift - December

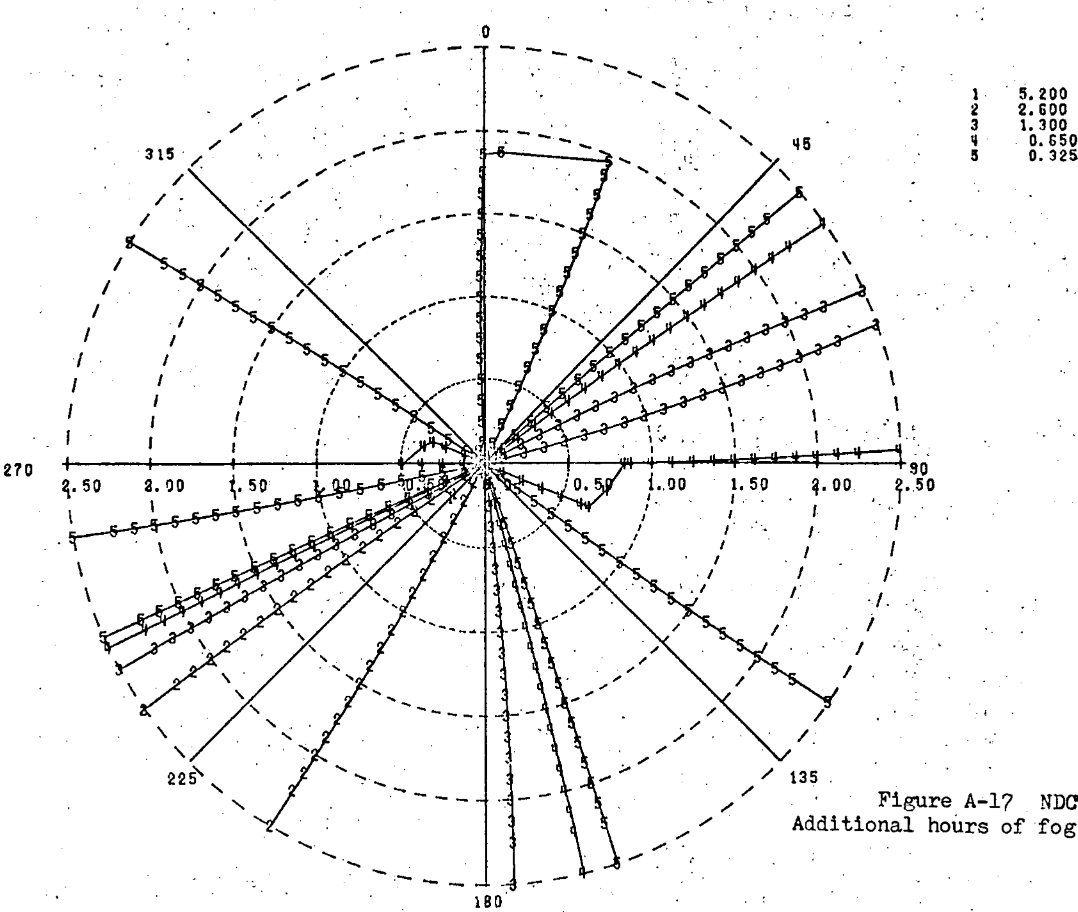


Figure A-17 NDCT
Additional hours of fog - Jan.

No additional hours of fog predicted for February

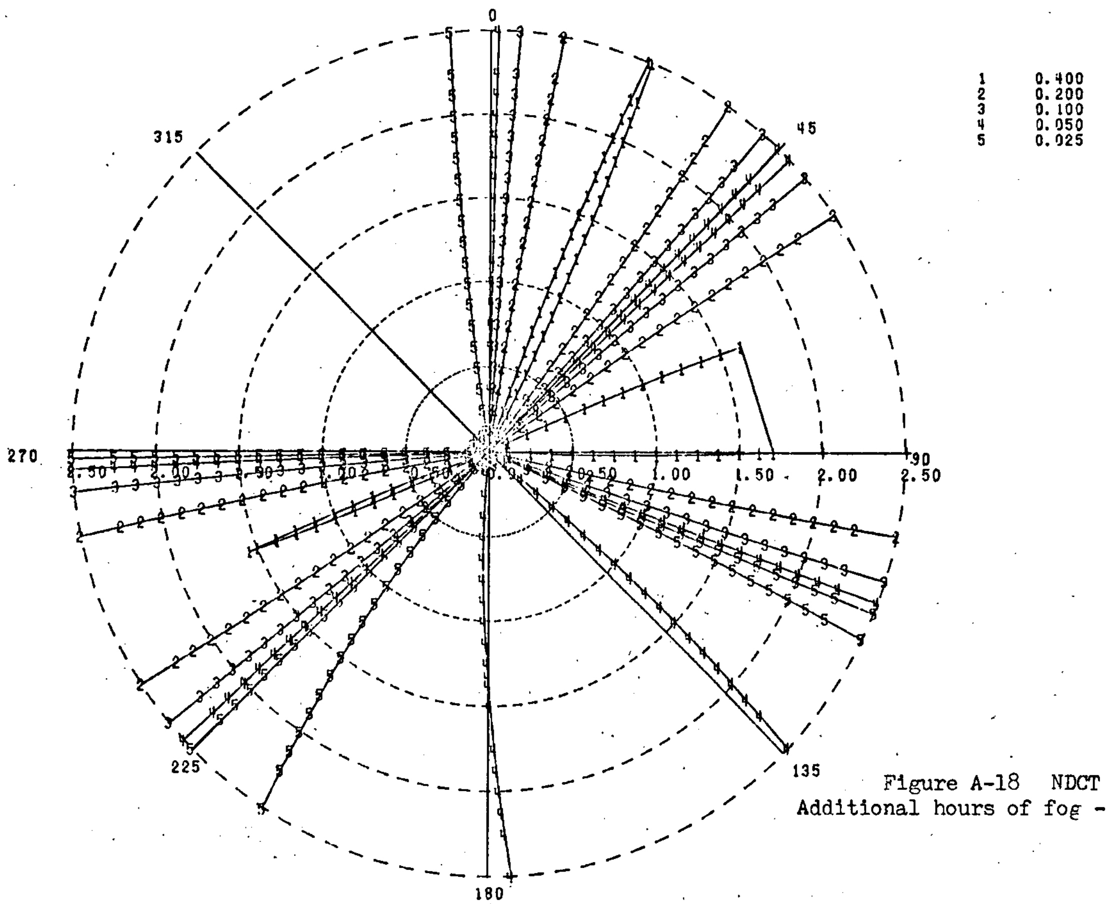


Figure A-18 NDCT
Additional hours of fog - March

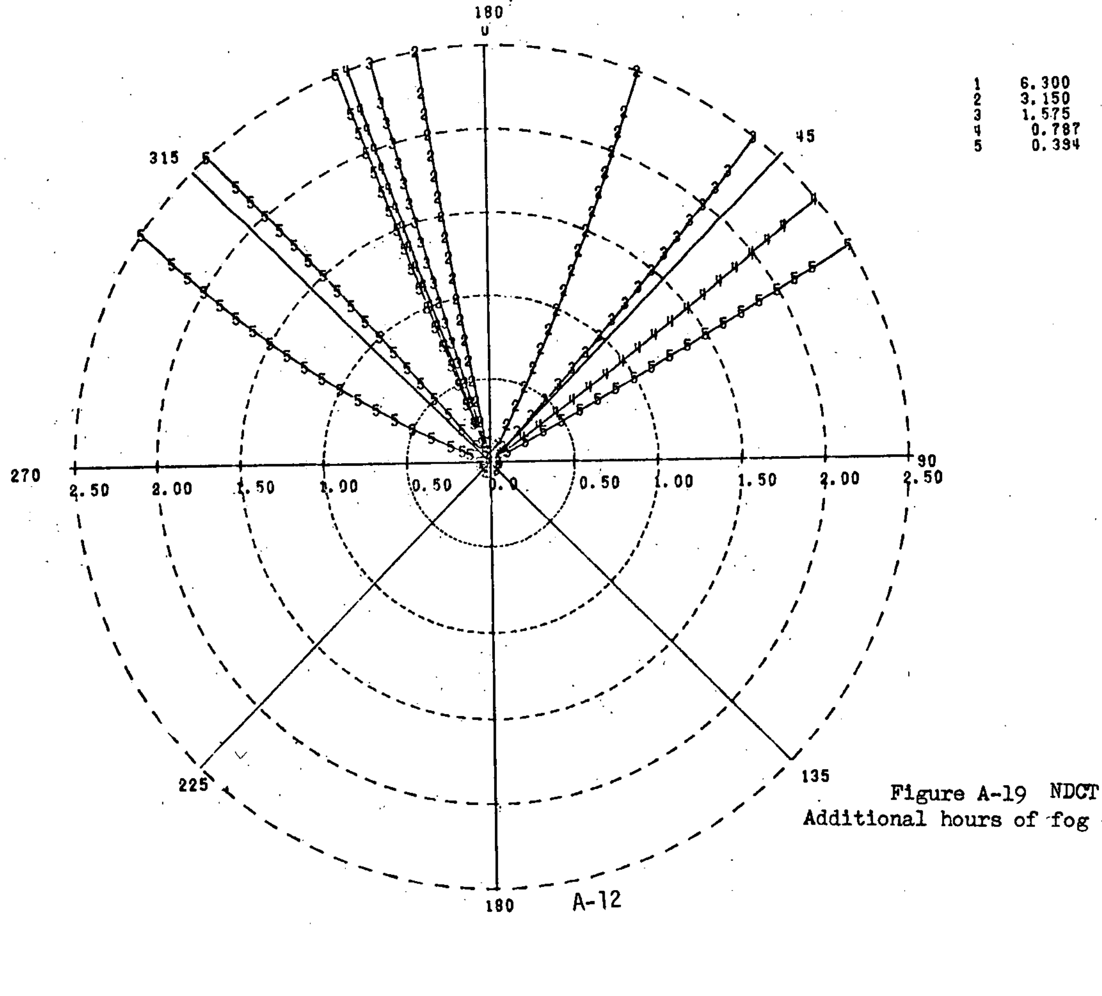


Figure A-19 NDCT
Additional hours of fog - April

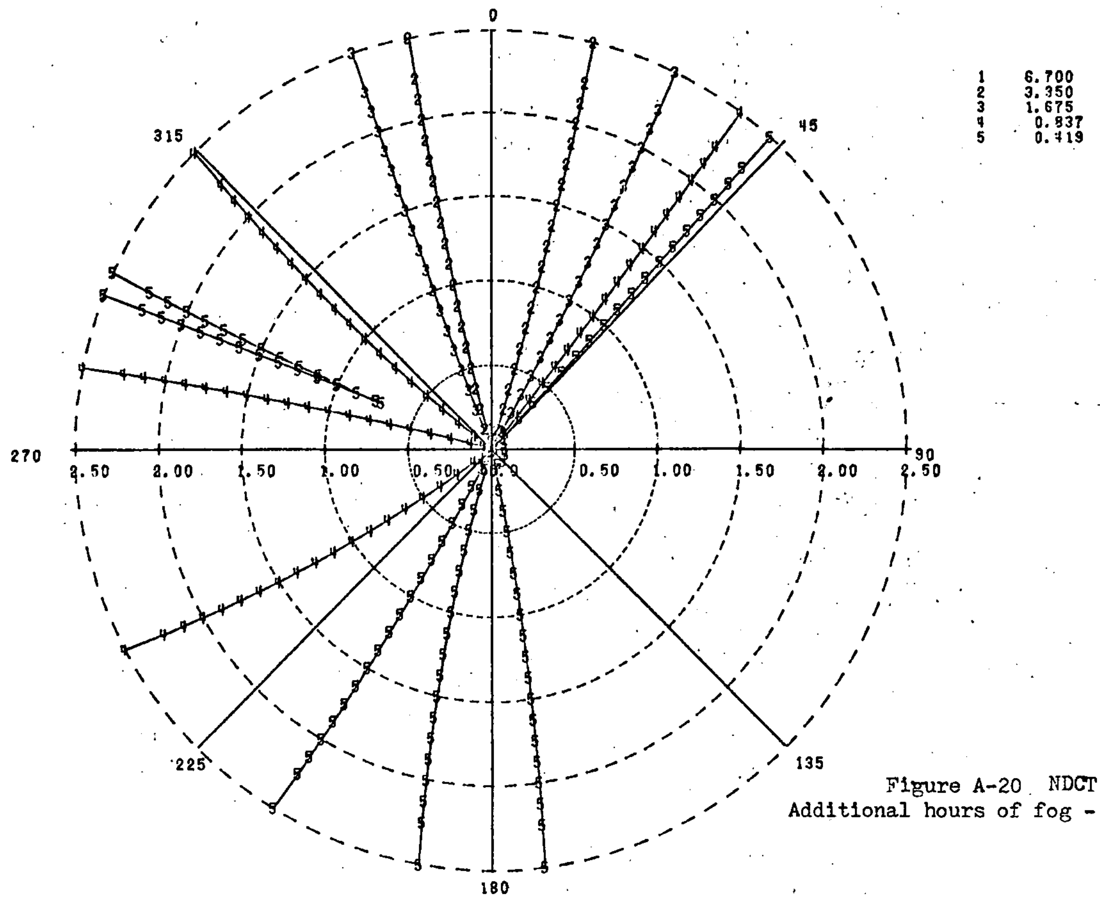


Figure A-20 NDCT
Additional hours of fog - May

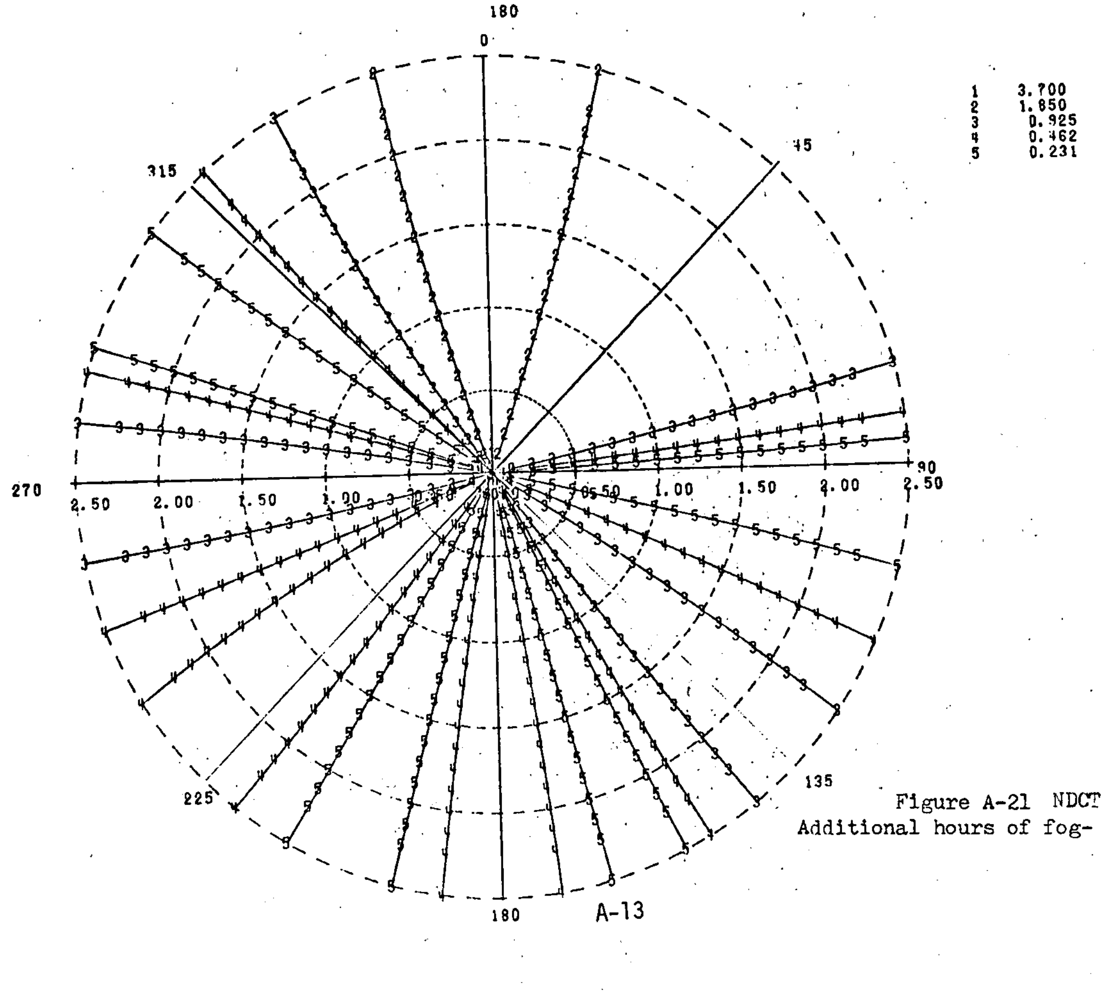


Figure A-21 NDCT
Additional hours of fog- June

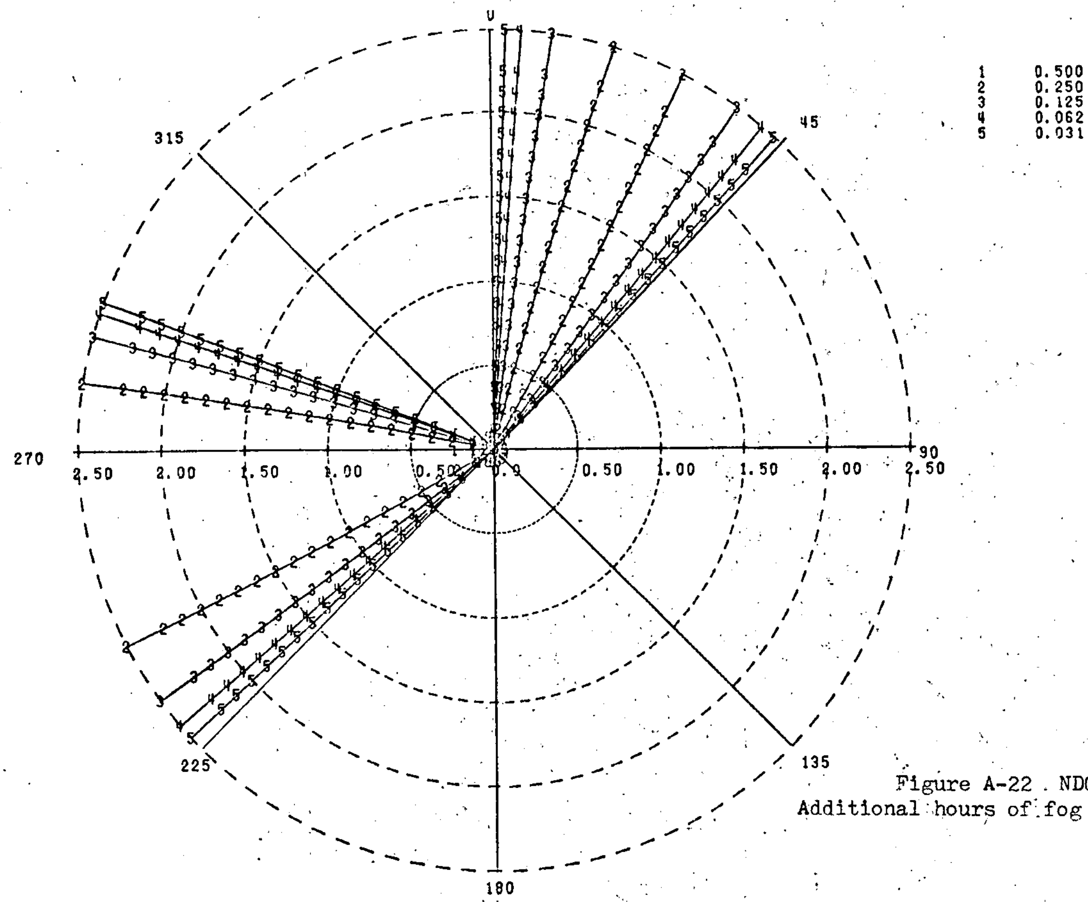


Figure A-22 . NDCT
Additional hours of fog - July

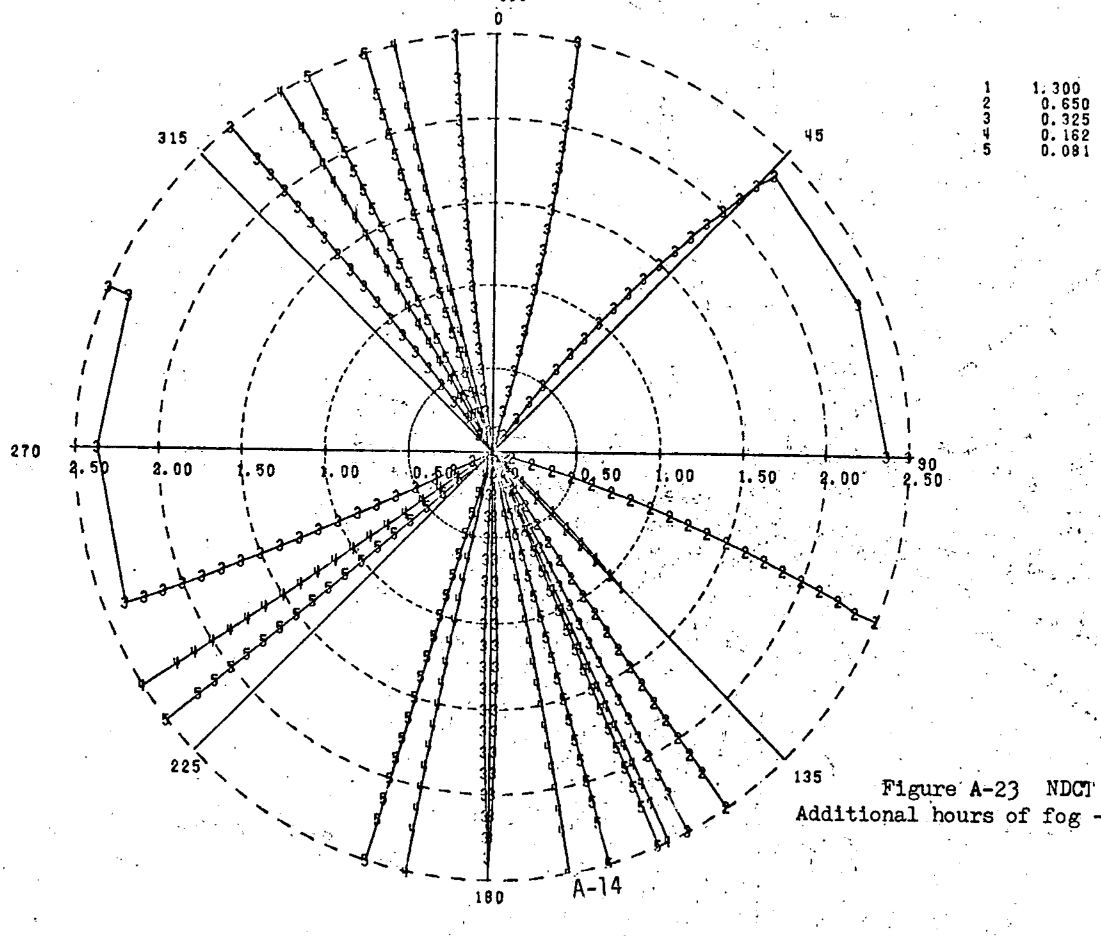


Figure A-23 NDCT
Additional hours of fog - August

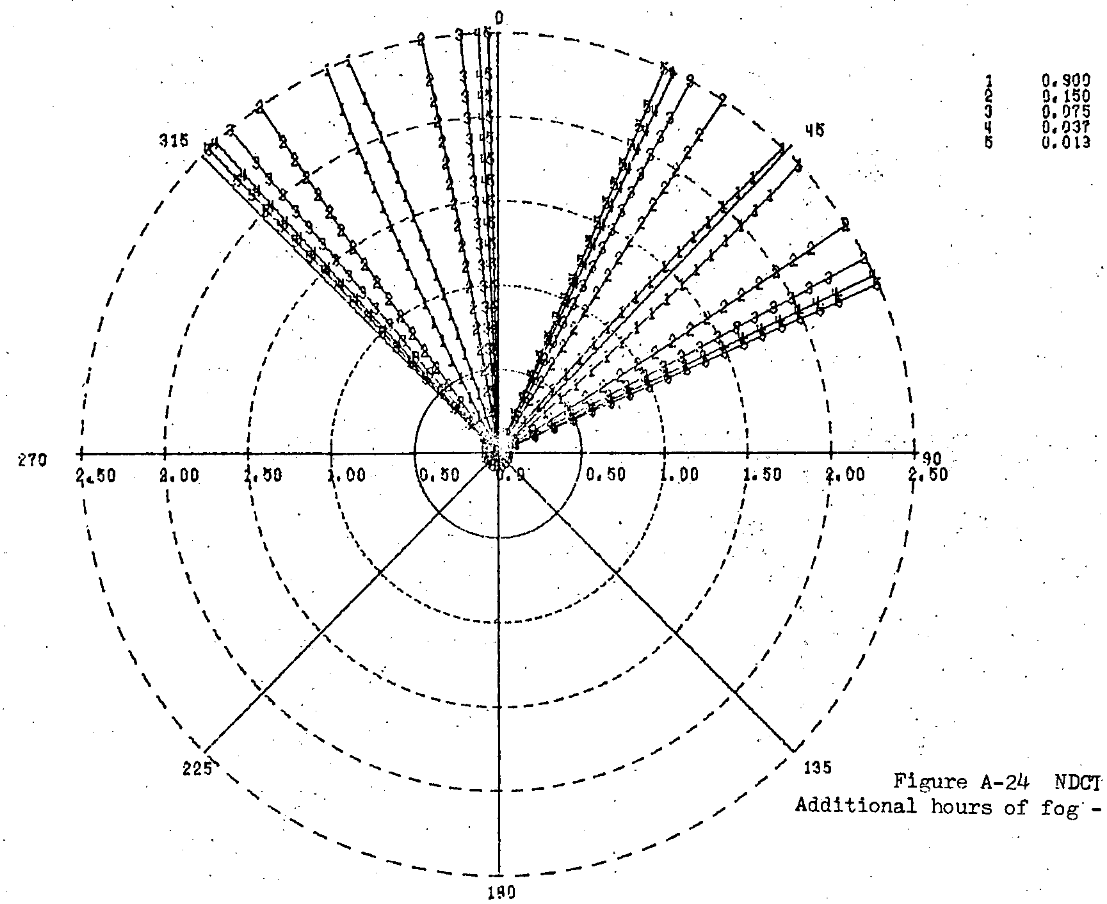


Figure A-24 NDCT
Additional hours of fog - Sept.

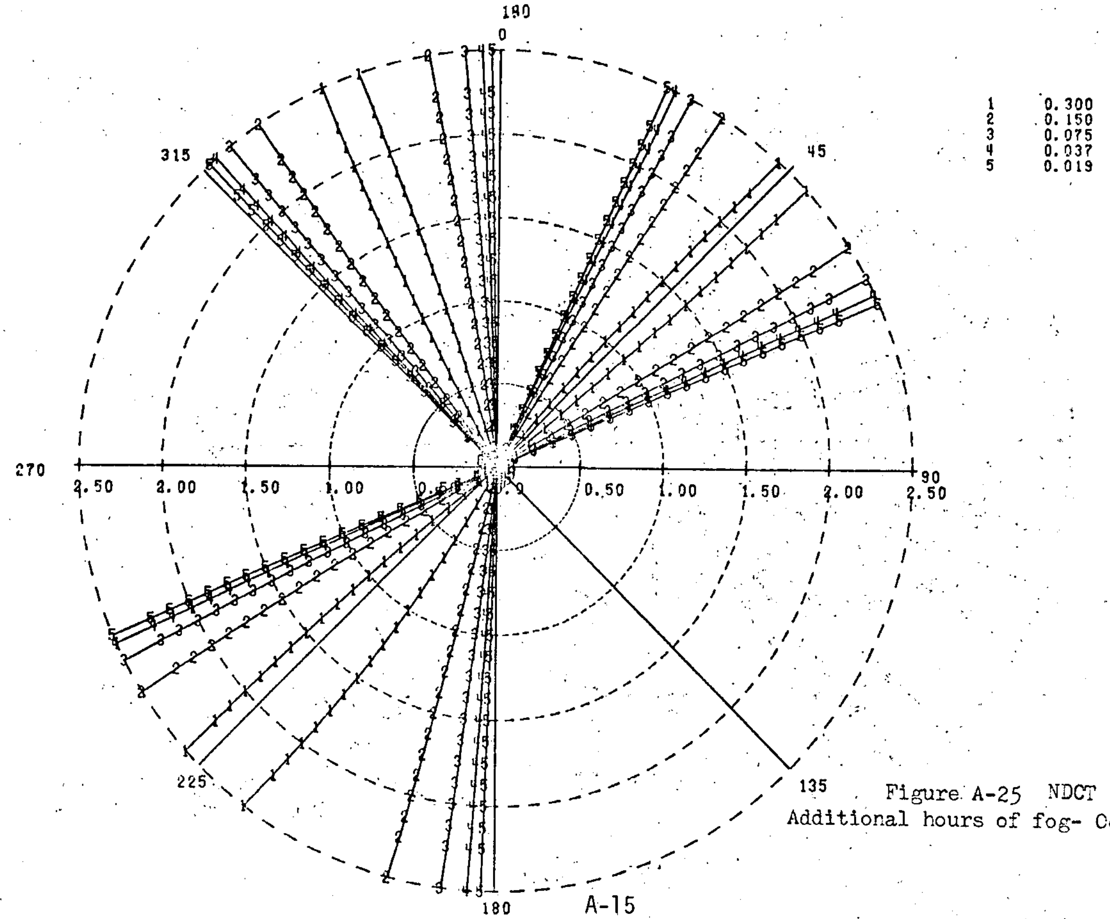


Figure A-25 NDCT
Additional hours of fog- October

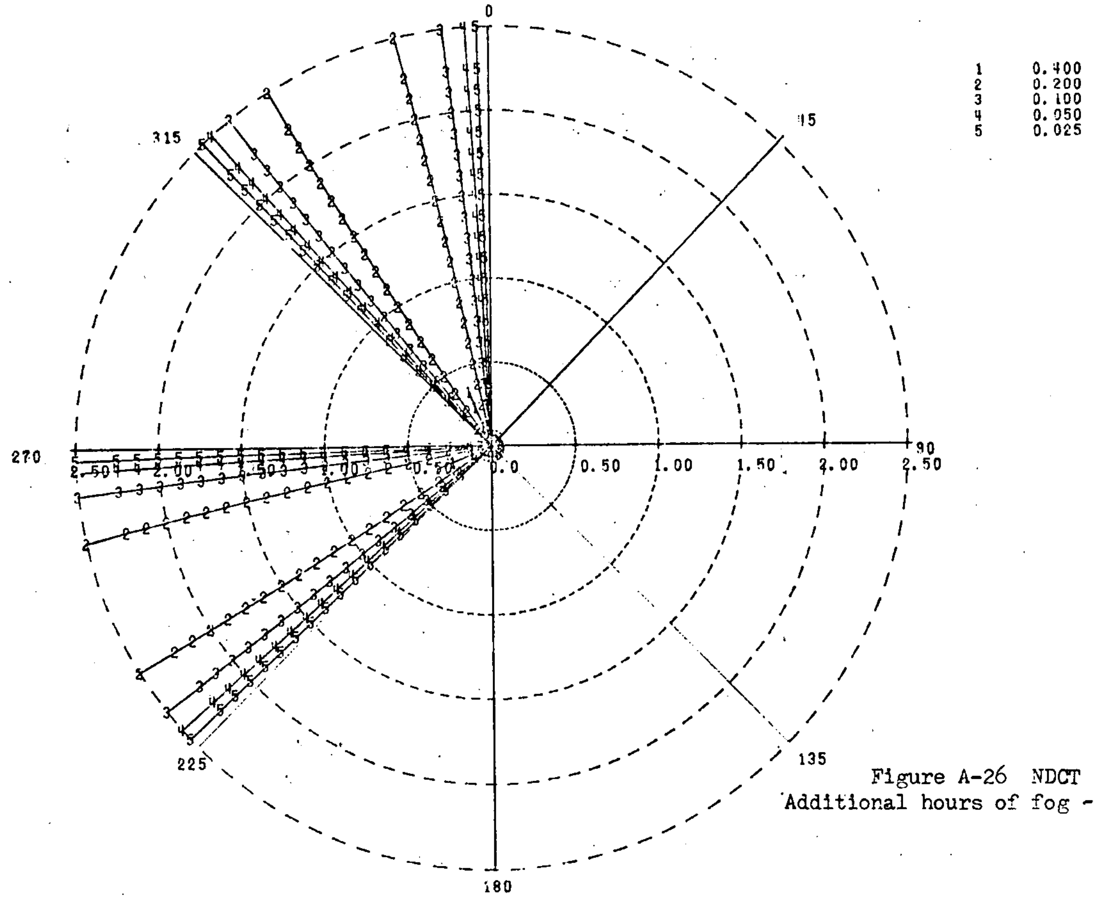


Figure A-26 NDCT
Additional hours of fog - Nov.

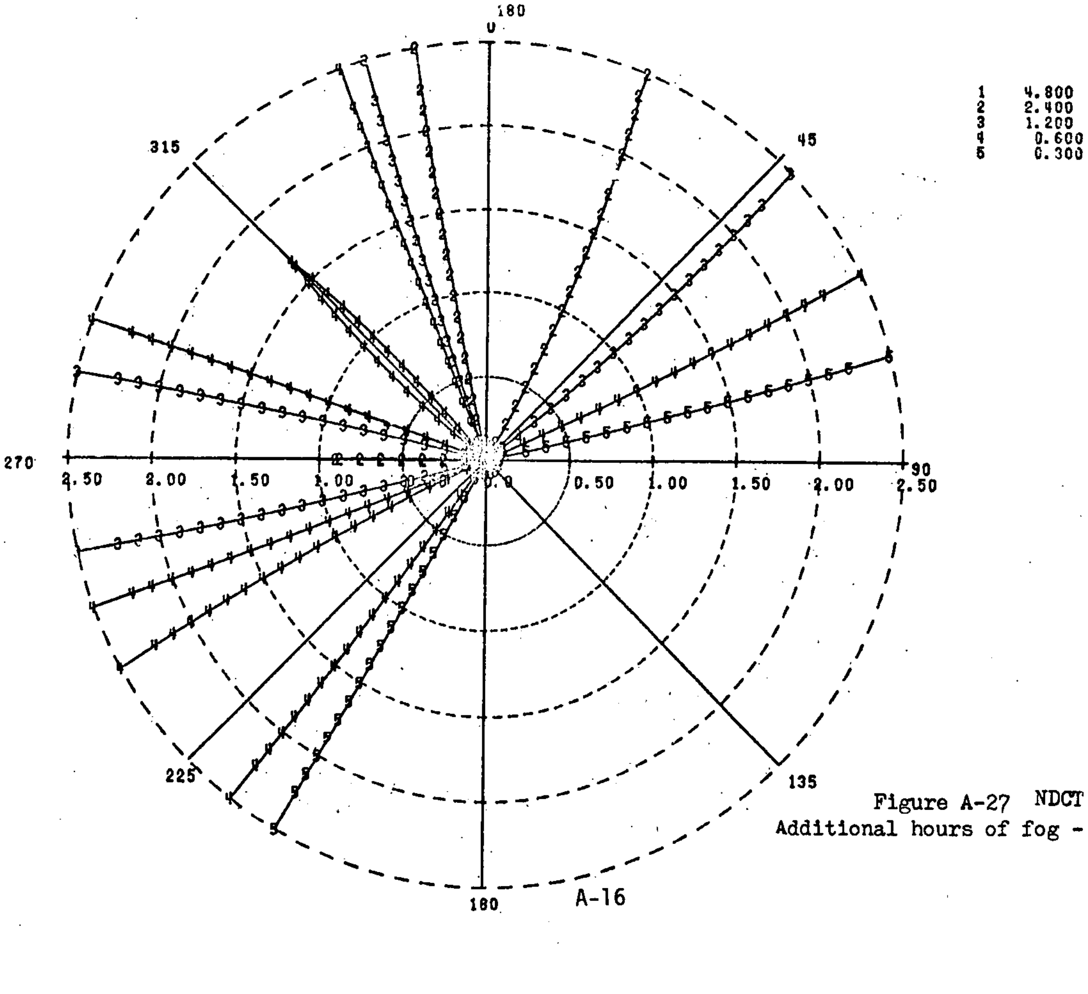


Figure A-27 NDCT
Additional hours of fog - Dec.

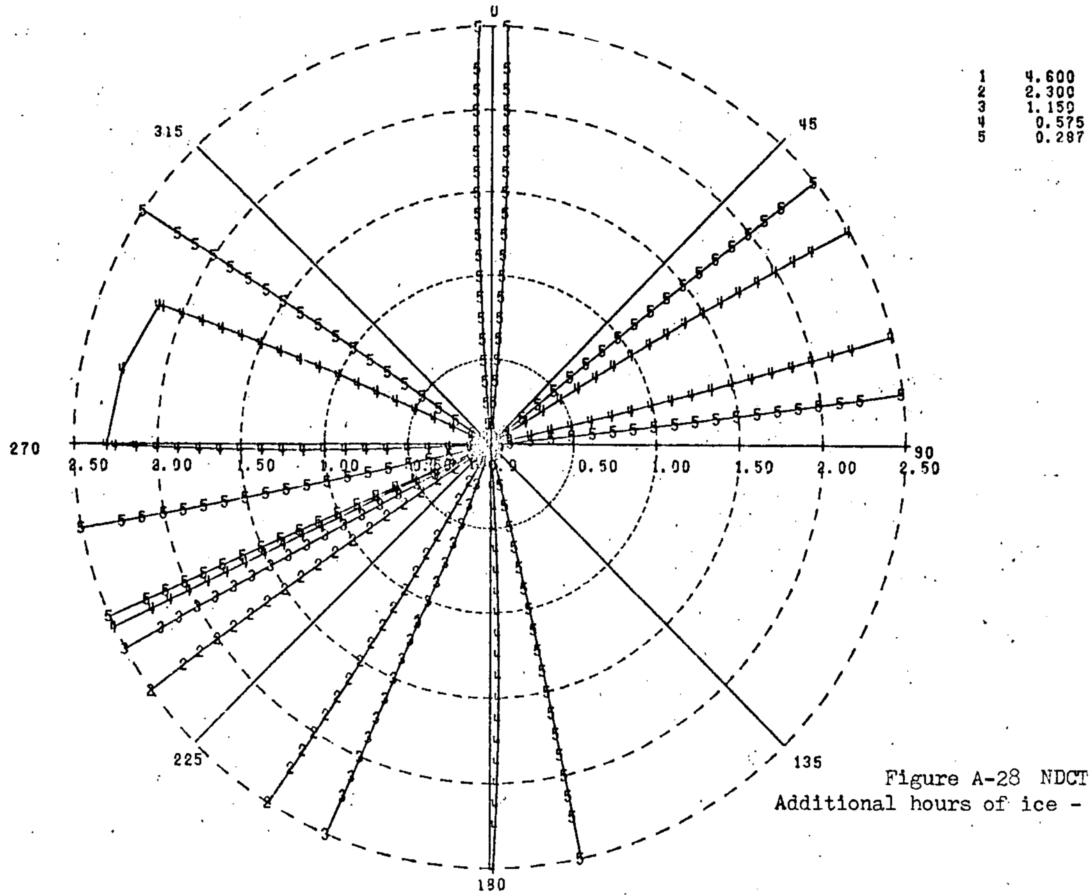


Figure A-28 NDCT
Additional hours of ice - Jan.

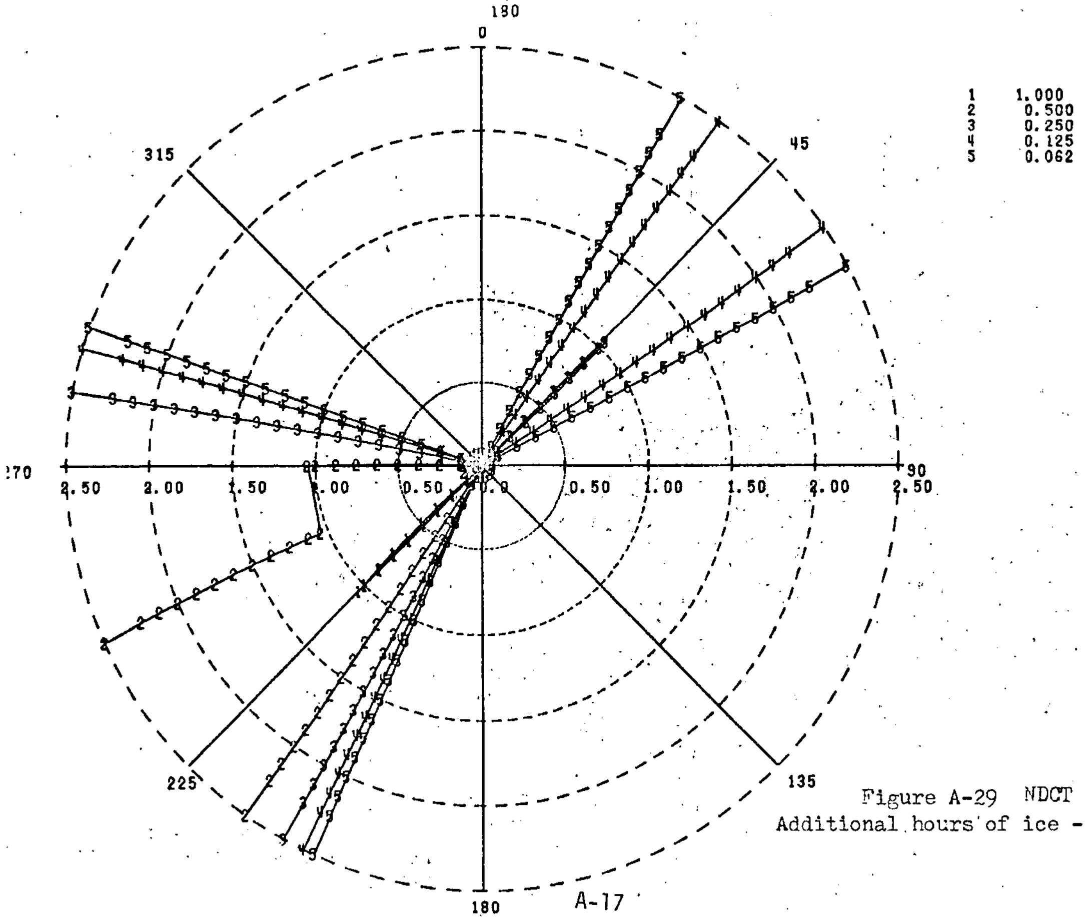


Figure A-29 NDCT
Additional hours of ice - Dec.

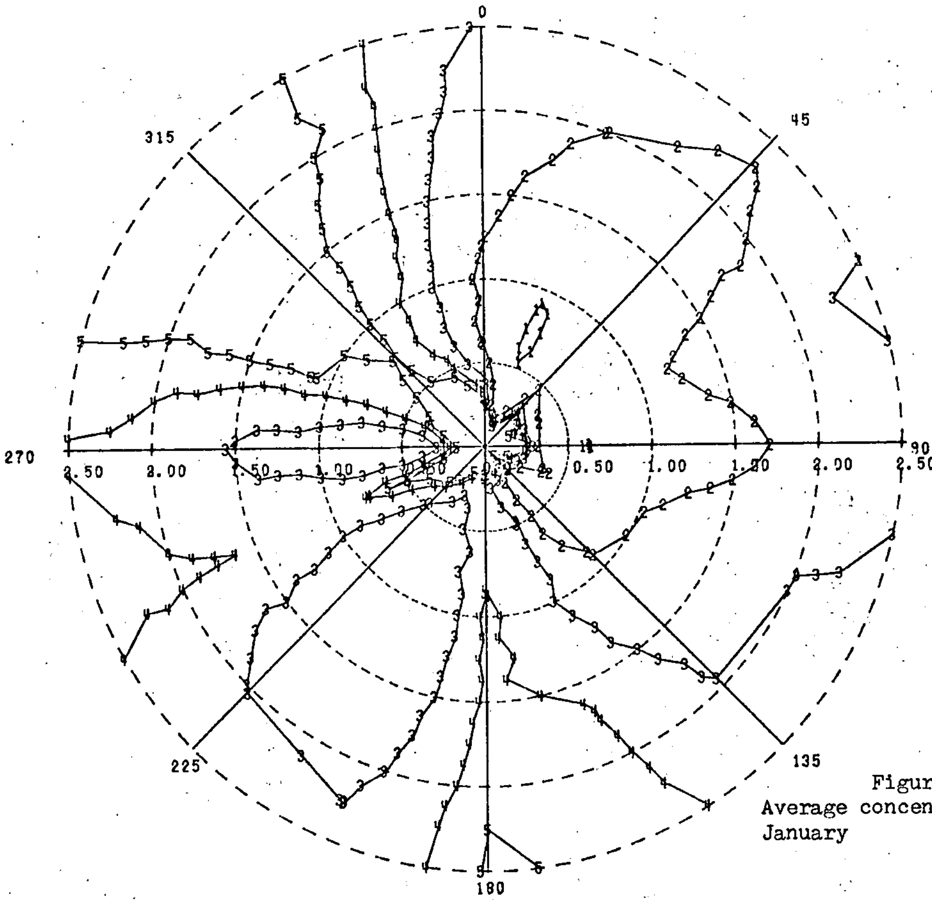


Figure A-30 NDCT
Average concentration of salt in air
January

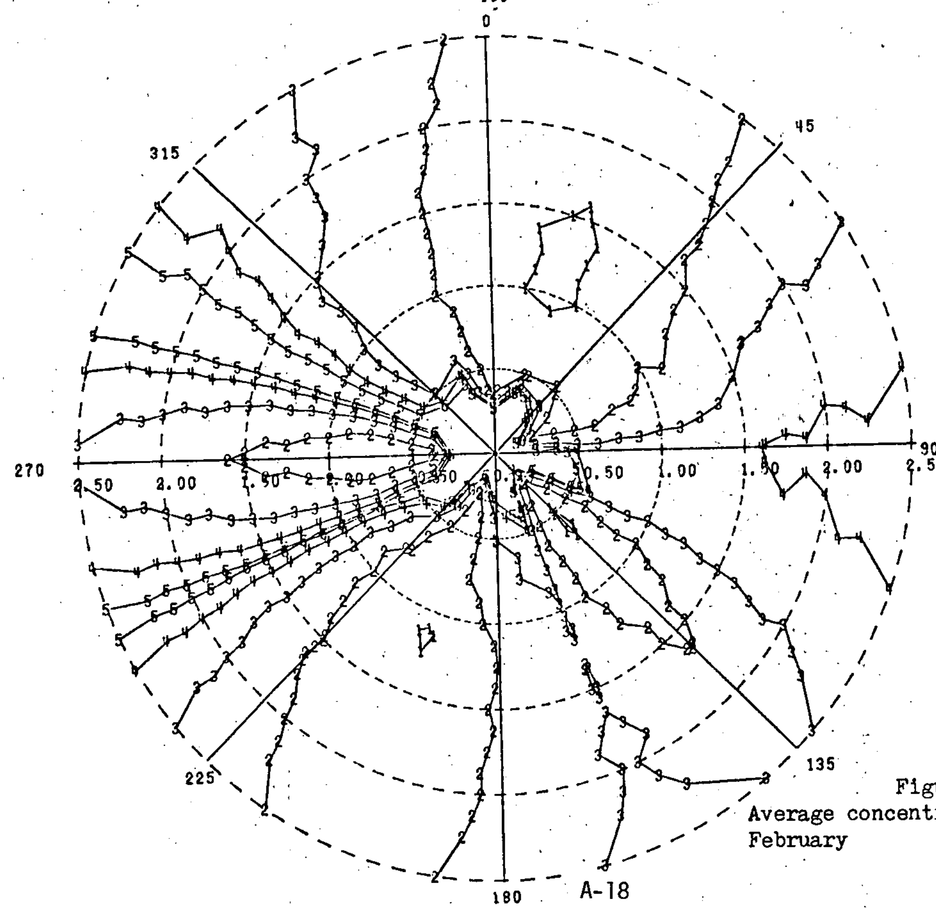
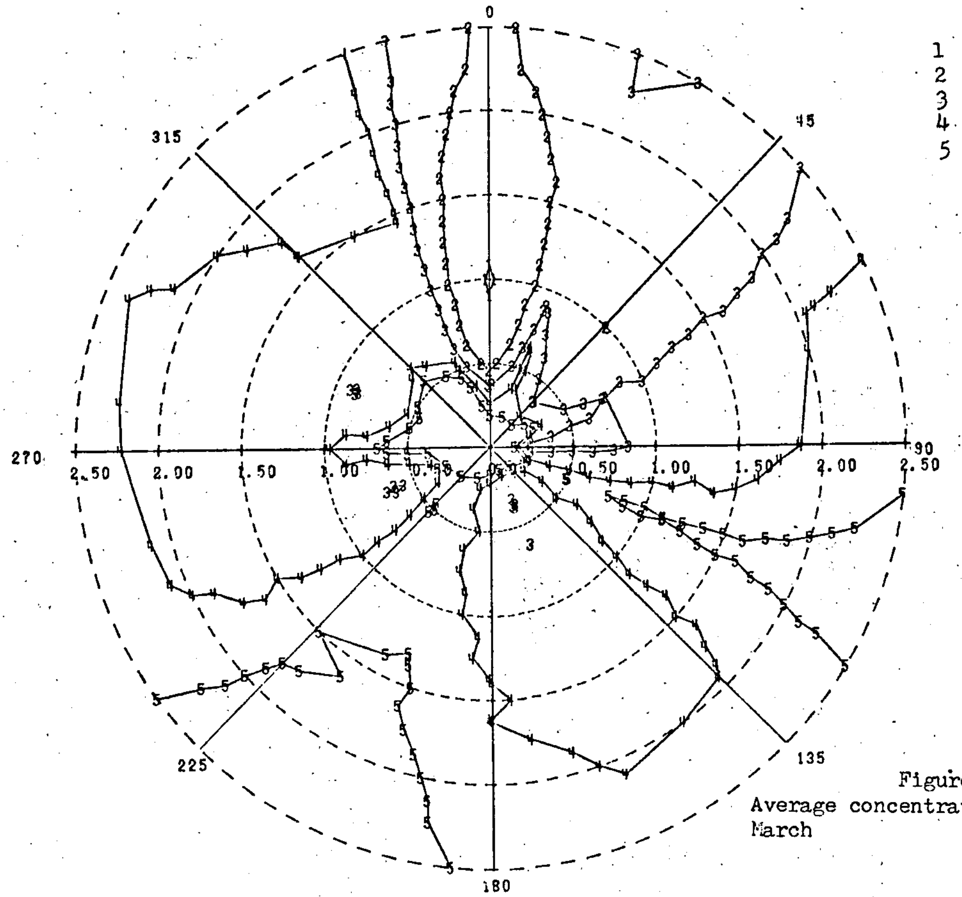
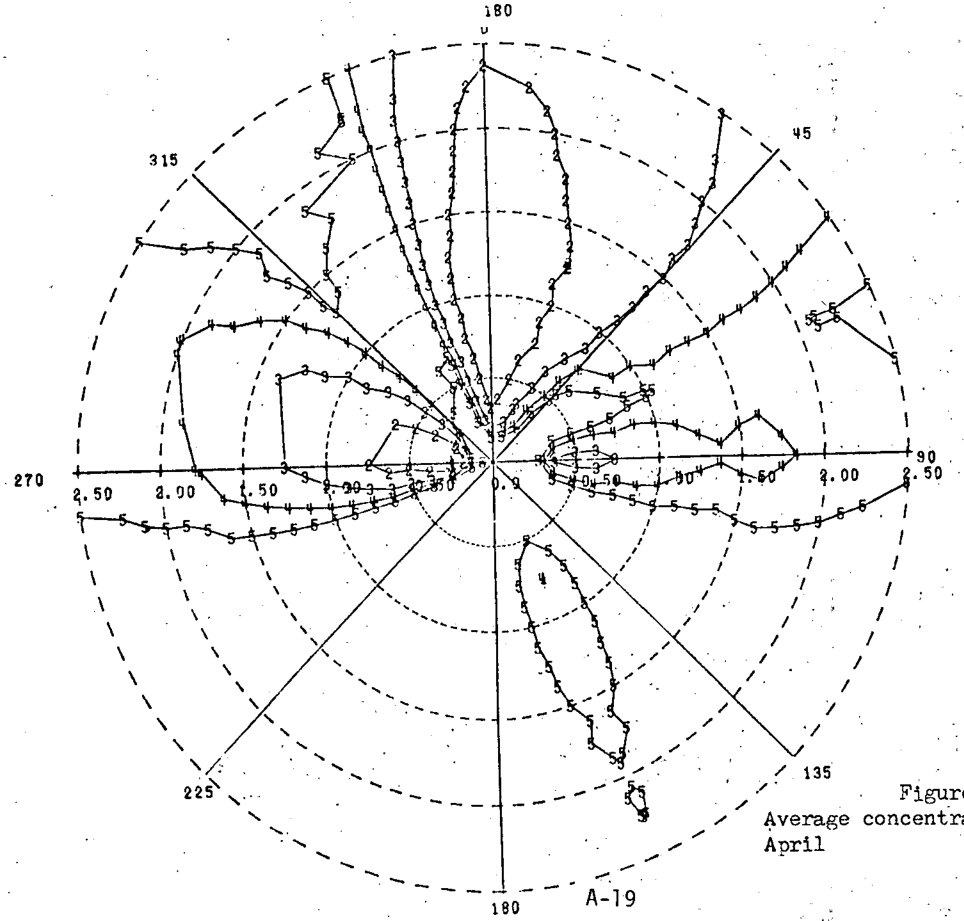


Figure A-31 NDCT
Average concentration of salt in air
February



1 0.000030
2 0.000015
3 0.000007
4 0.000004
5 0.000002

Figure A-32 NDCT
Average concentration of salt in air
March



1 0.00000090
2 0.00000045
3 0.00000022
4 0.00000011
5 0.00000006

Figure A-33 NDCT
Average concentration of salt in air
April

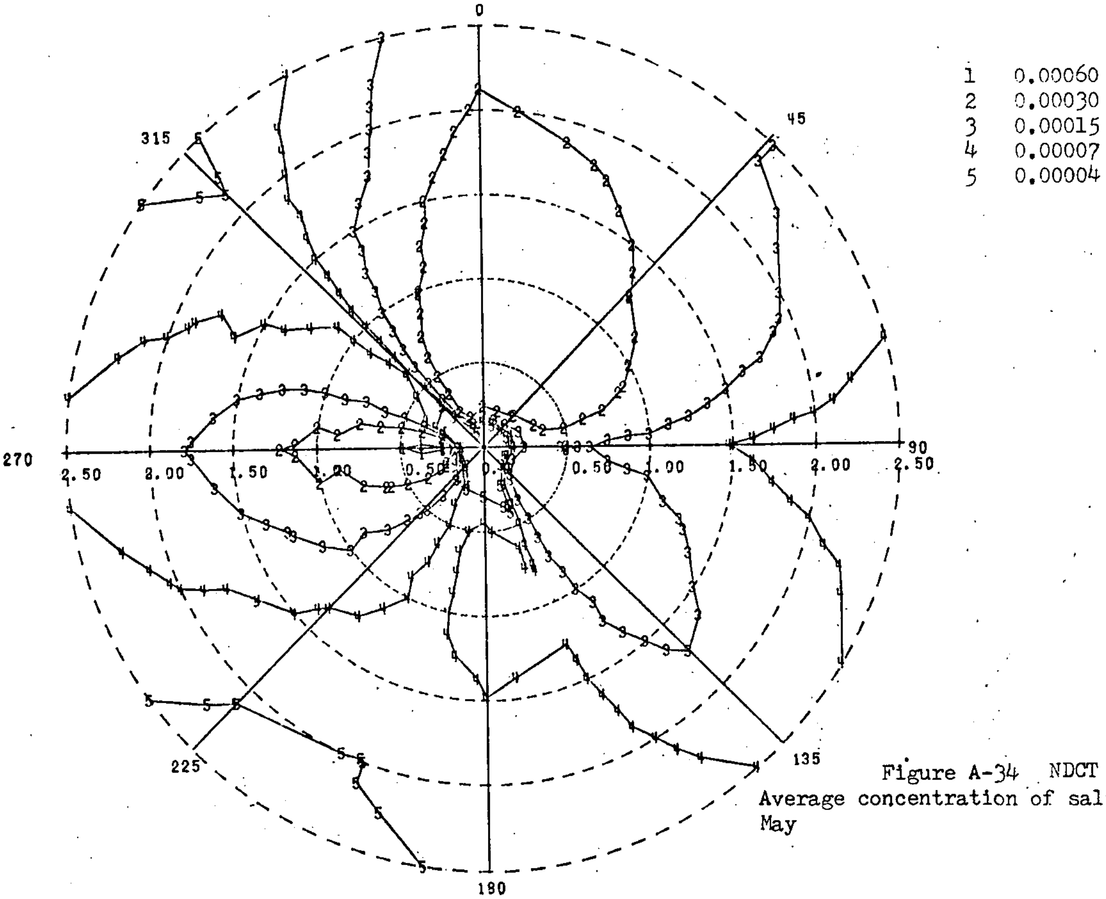


Figure A-34 NDCT
Average concentration of salt in air
May

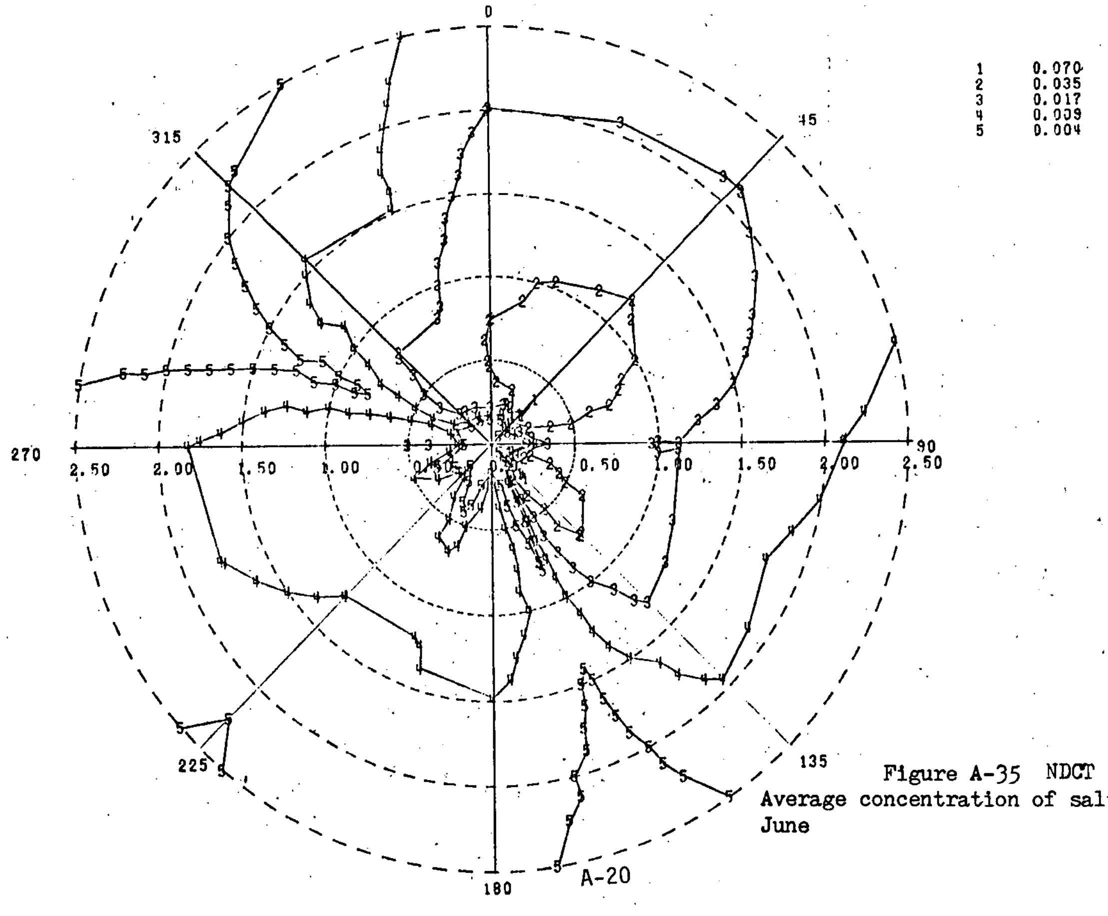


Figure A-35 NDCT
Average concentration of salt in air
June

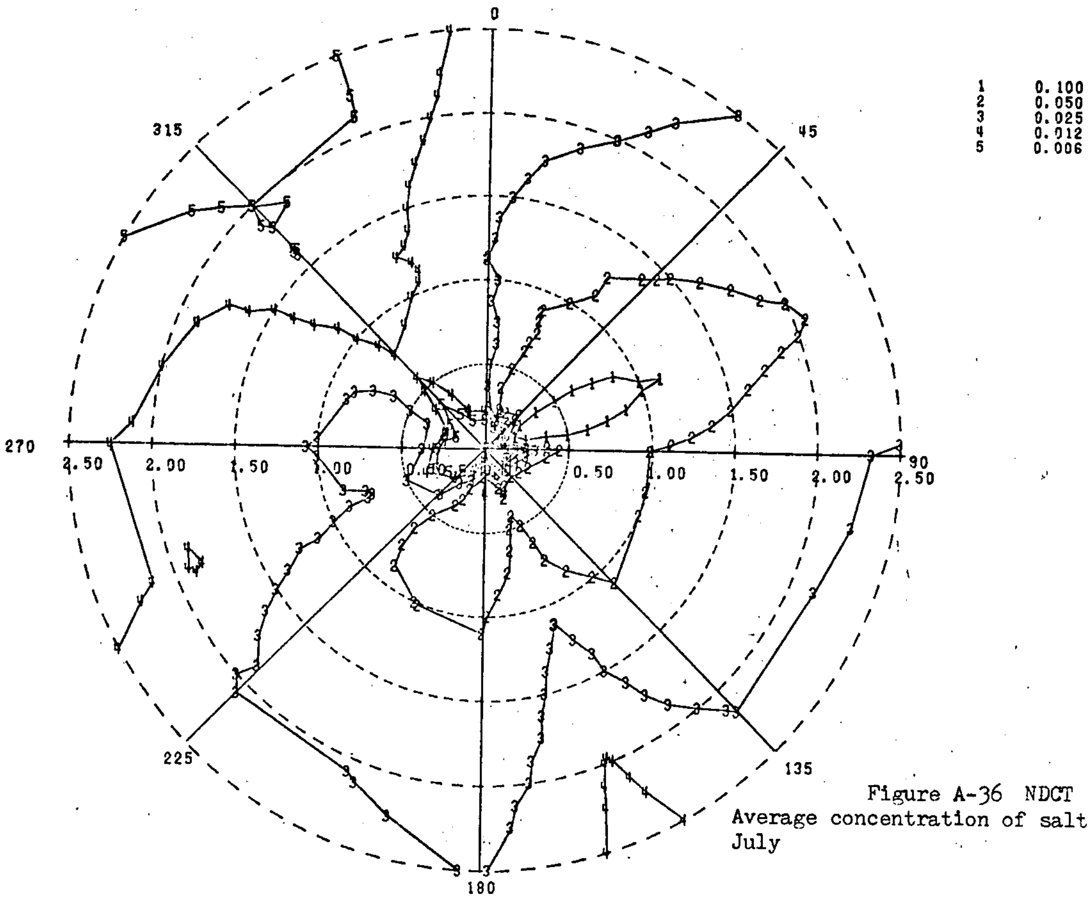


Figure A-36 NDCT
Average concentration of salt in air
July

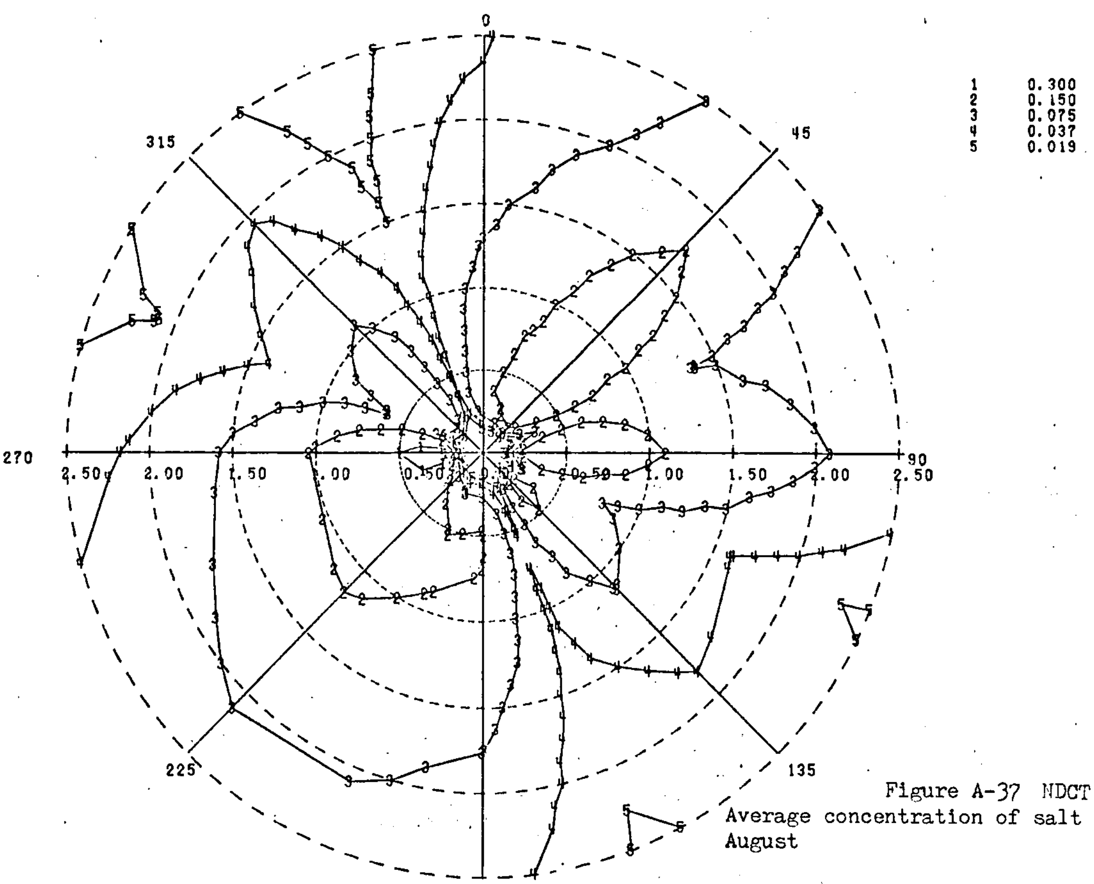


Figure A-37 NDCT
Average concentration of salt in air
August

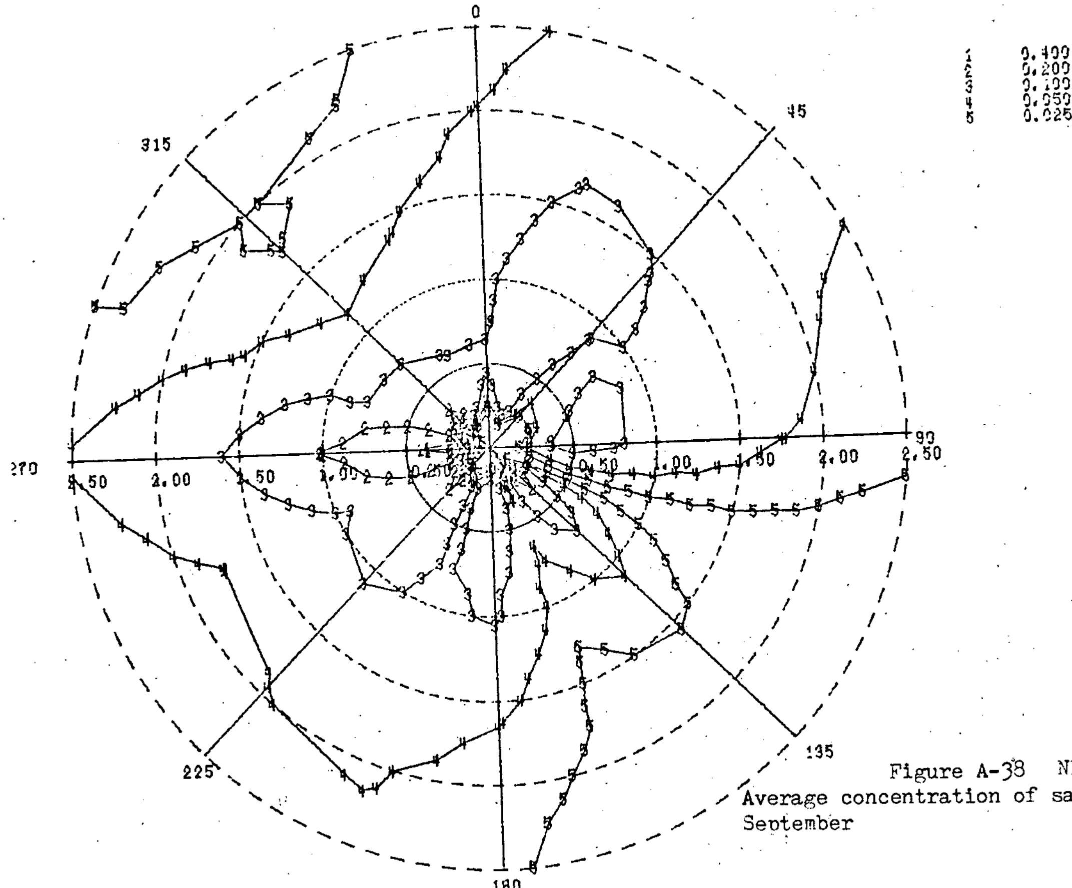


Figure A-38 NDCT
Average concentration of salt in air
September

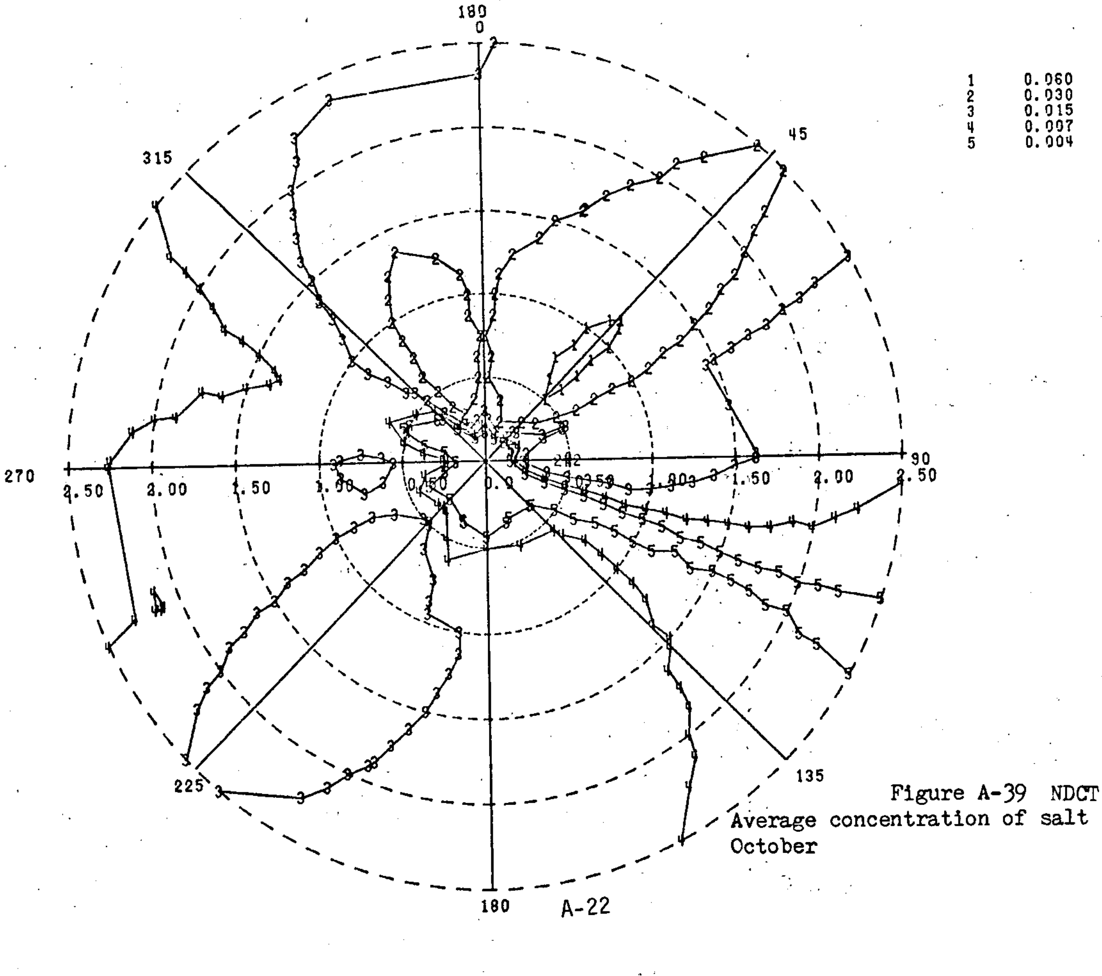
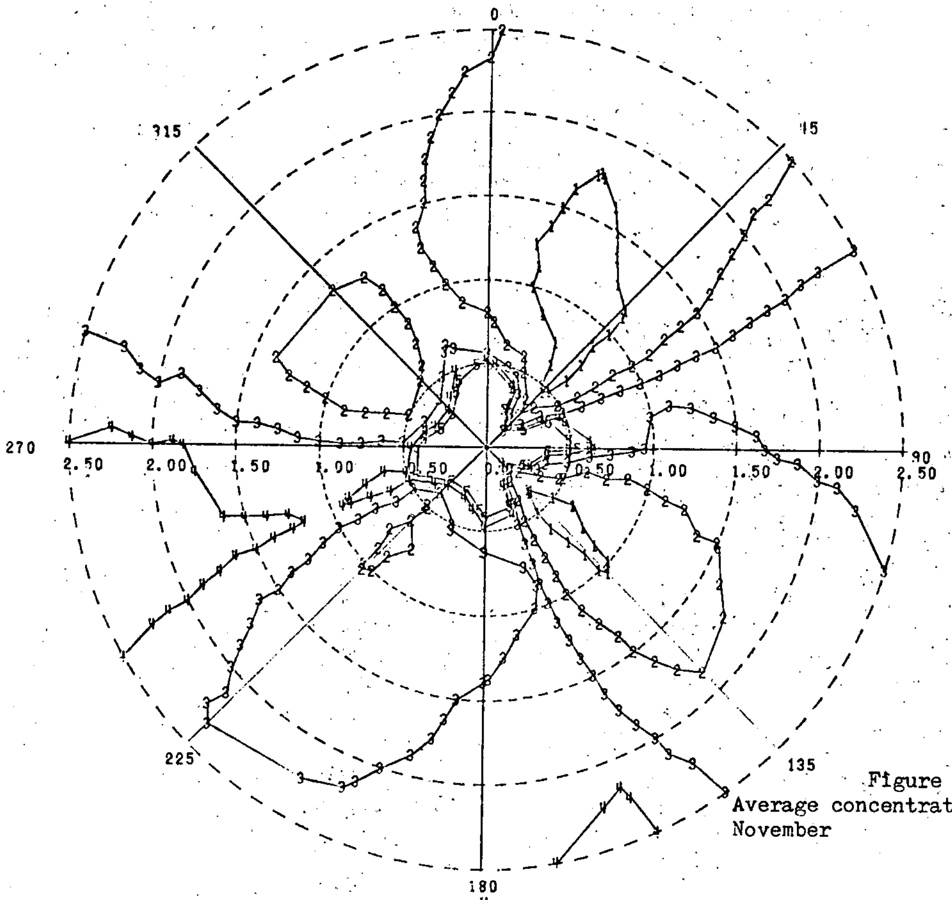
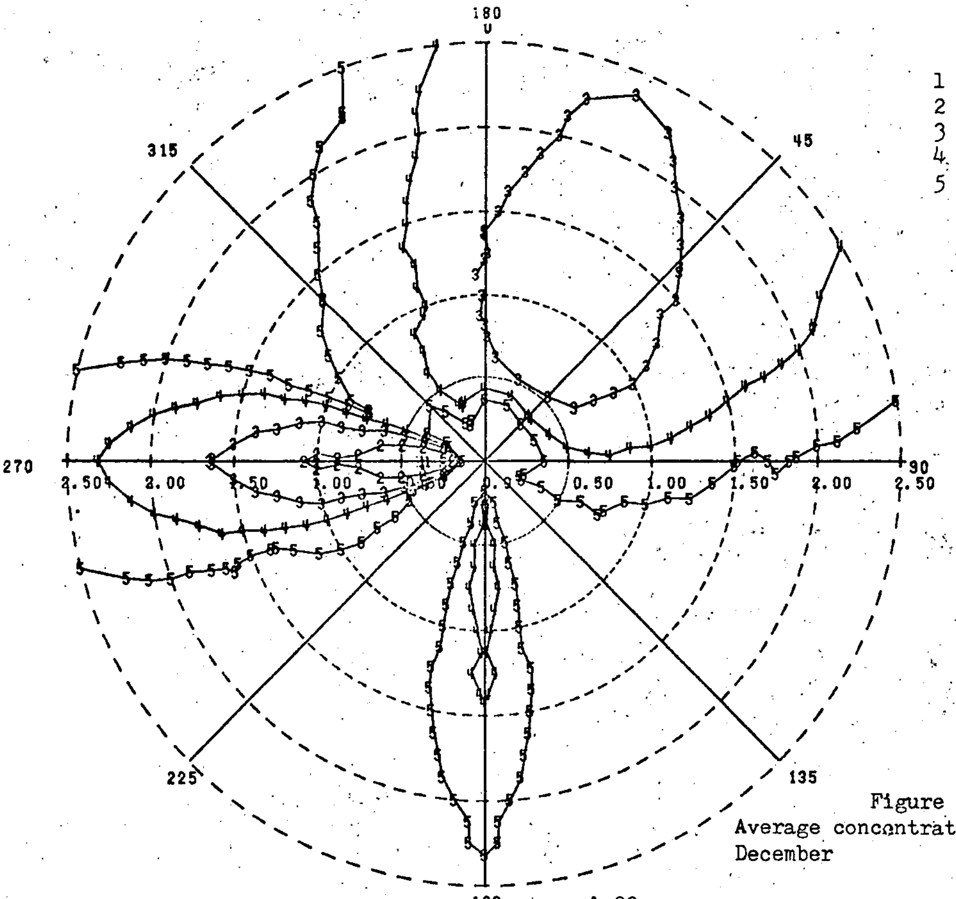


Figure A-39 NDCT
Average concentration of salt in air
October



1 0.0030
2 0.0015
3 0.0008
4 0.0004
5 0.0002

Figure A-40 NDCT
Average concentration of salt in air
November



1 0.0100
2 0.0050
3 0.0025
4 0.0012
5 0.0006

Figure A-41 NDCT
Average concentration of salt in air
December

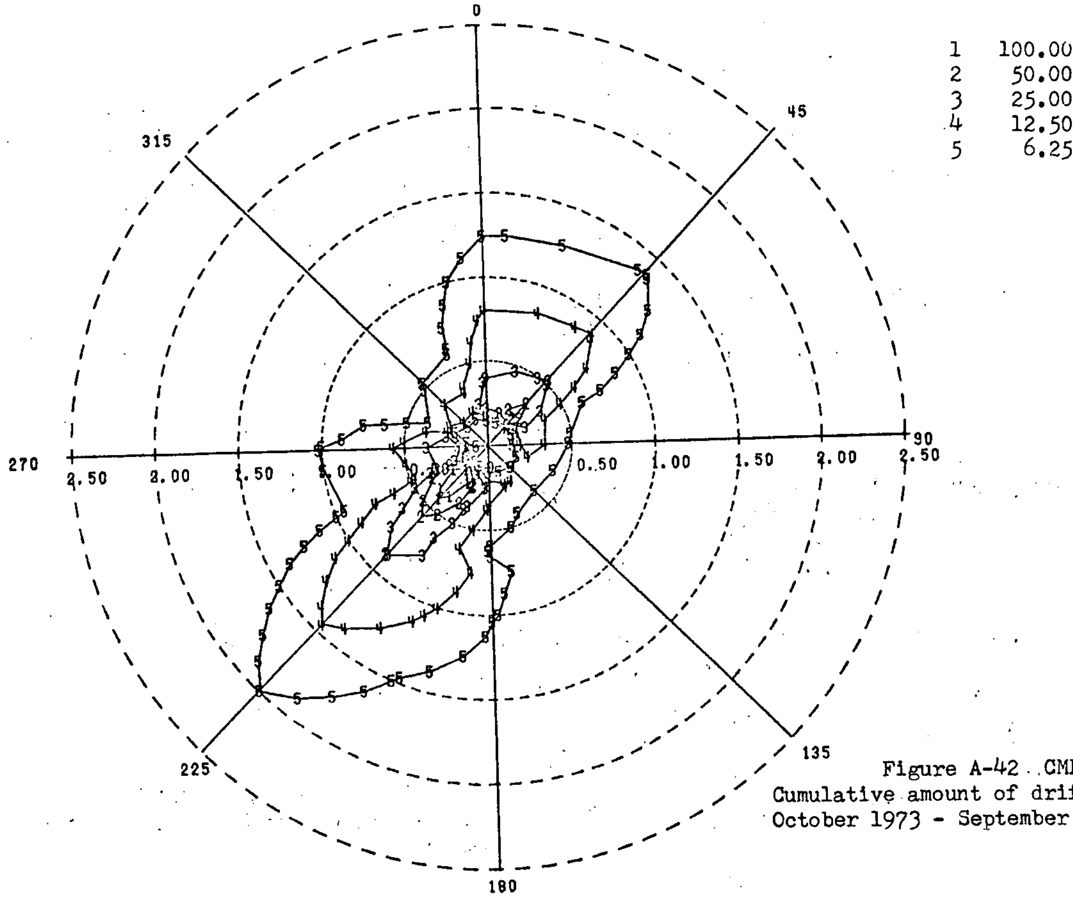


Figure A-42 CMDT
Cumulative amount of drift
October 1973 - September 1974

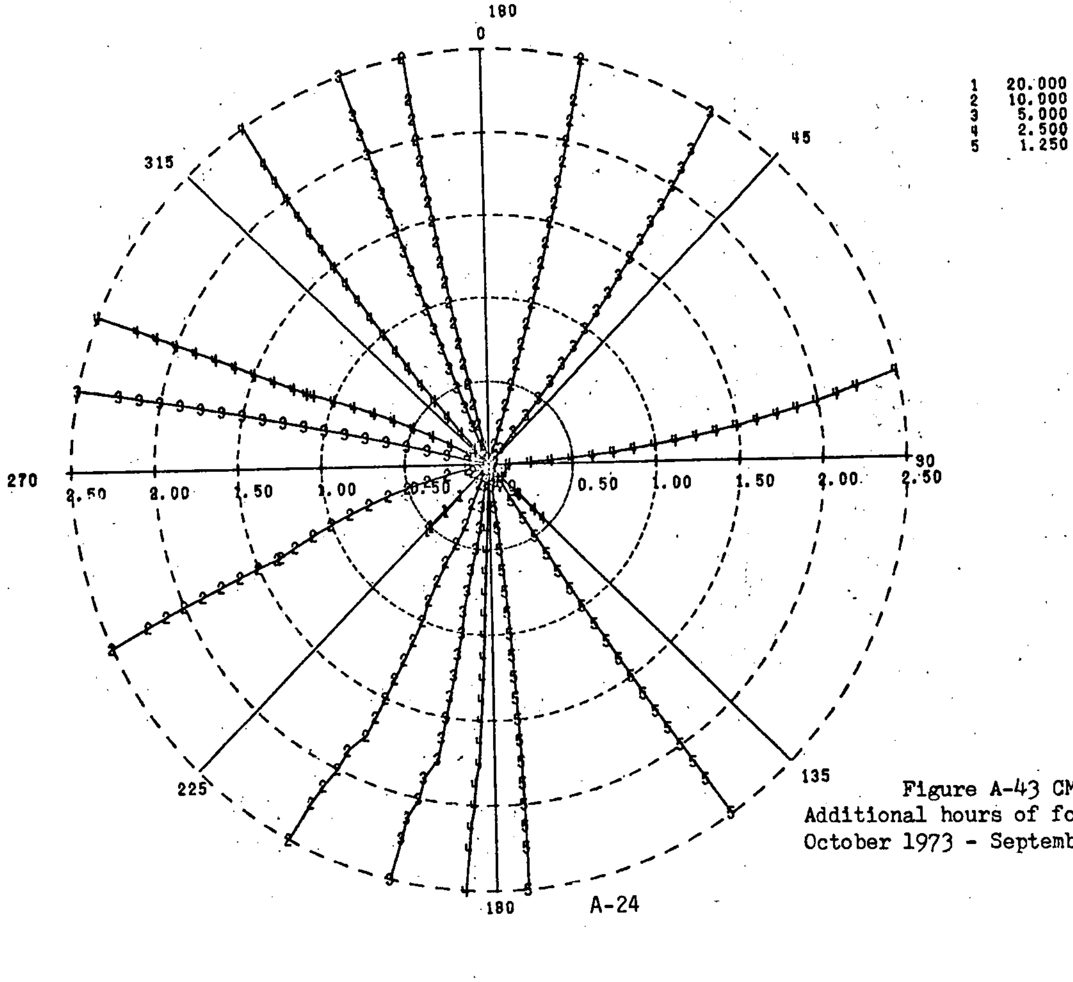


Figure A-43 CMDT
Additional hours of fog
October 1973 - September 1974

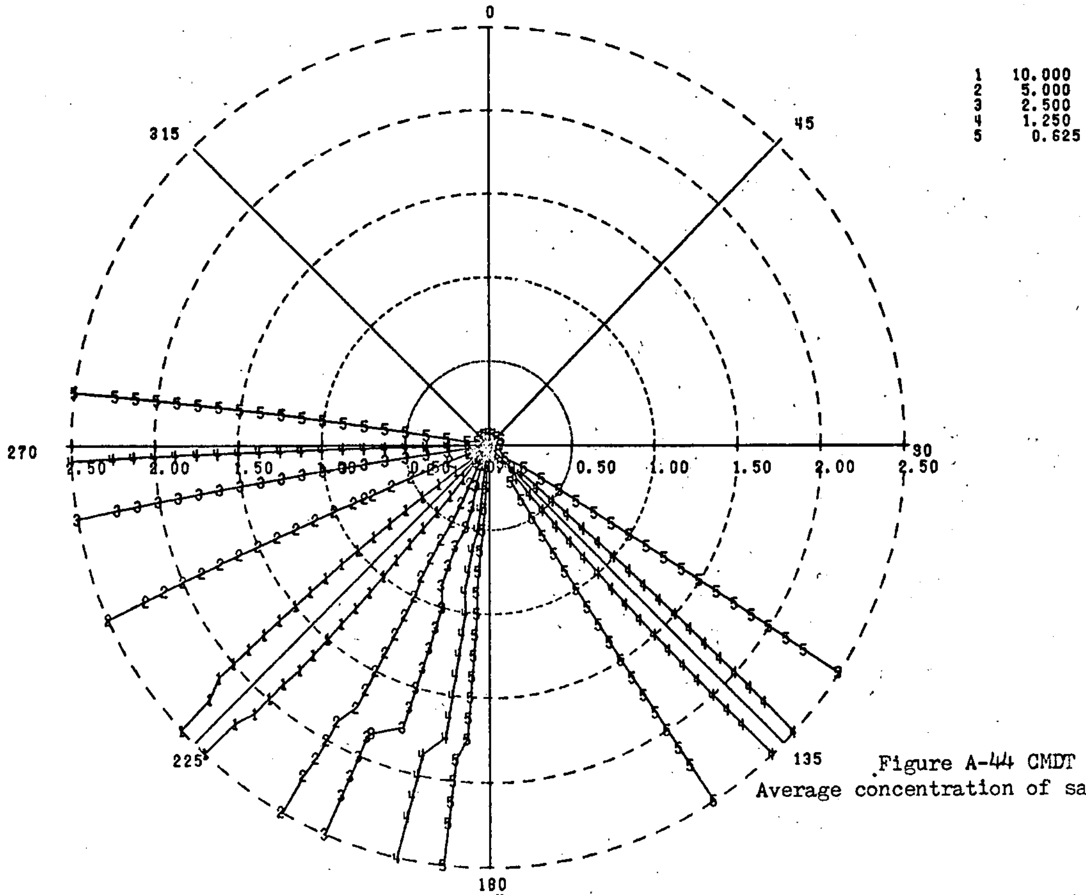


Figure A-44 CMDT
Average concentration of salt in air

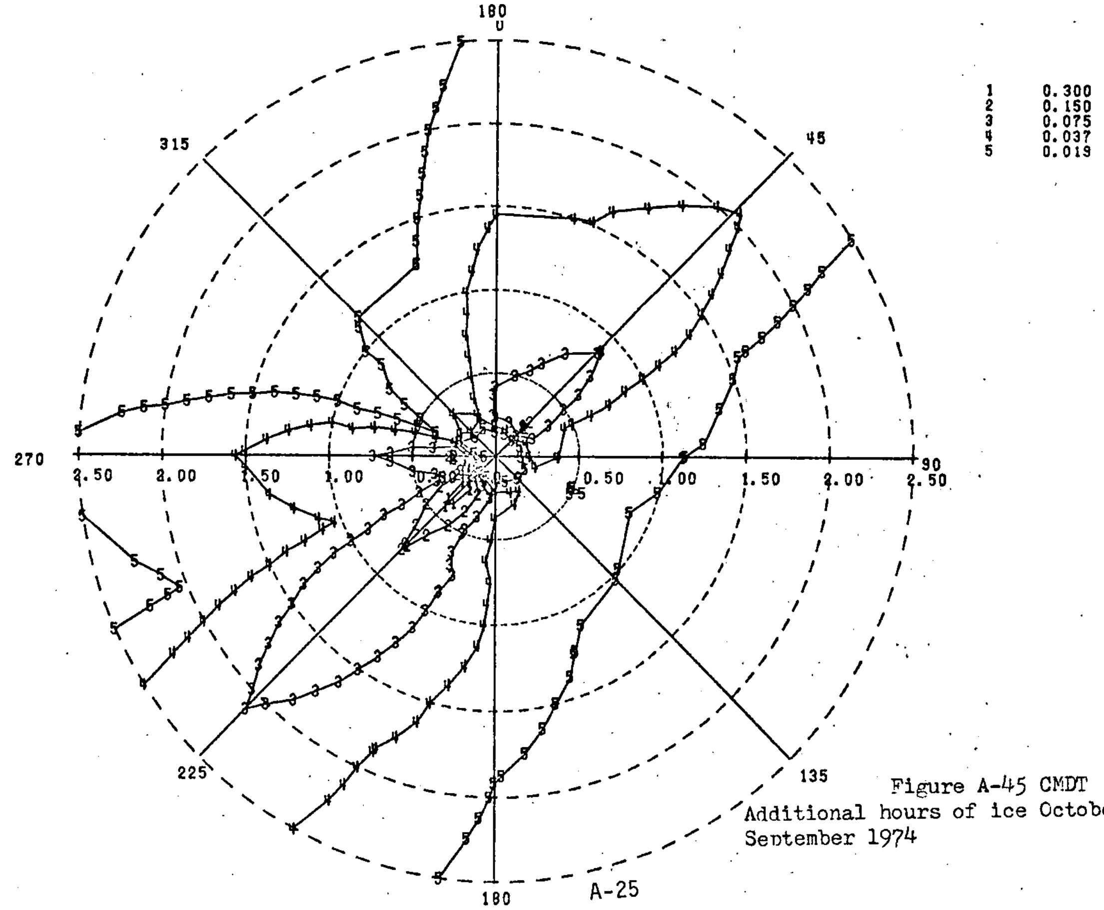
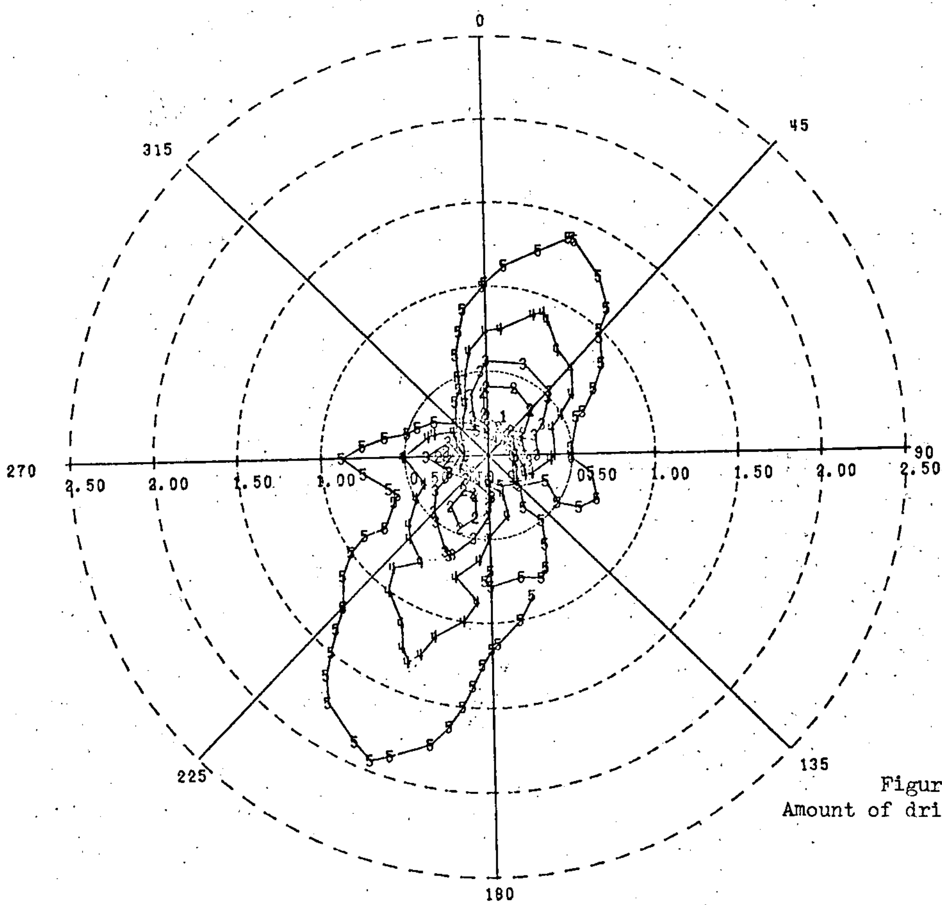
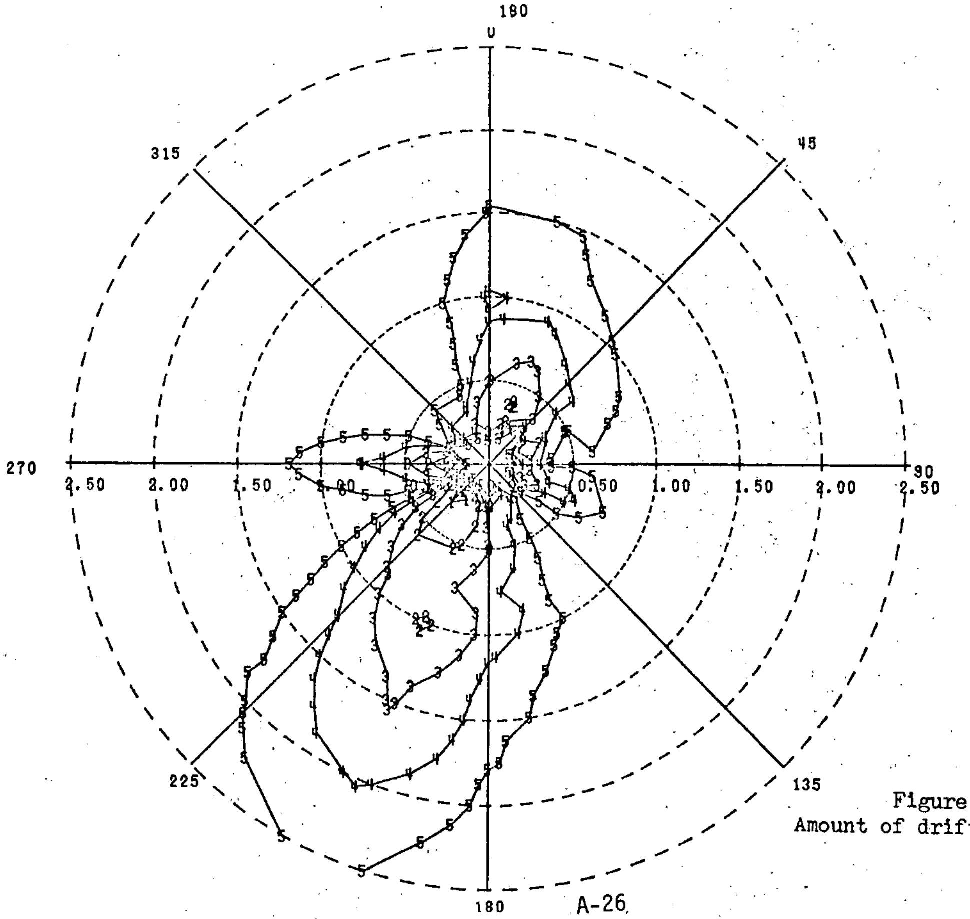


Figure A-45 CMDT
Additional hours of ice October 1973-September 1974



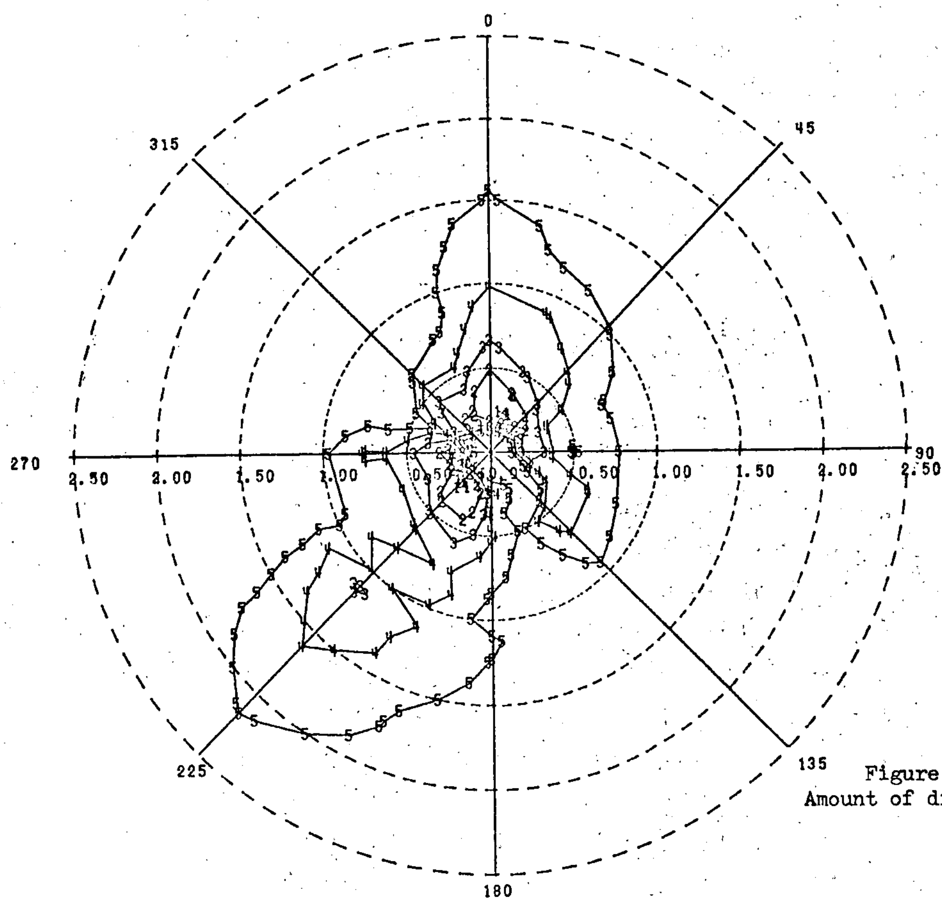
1 1.00
2 0.50
3 0.25
4 0.12
5 0.06

Figure A-46 CMDT
Amount of drift - January



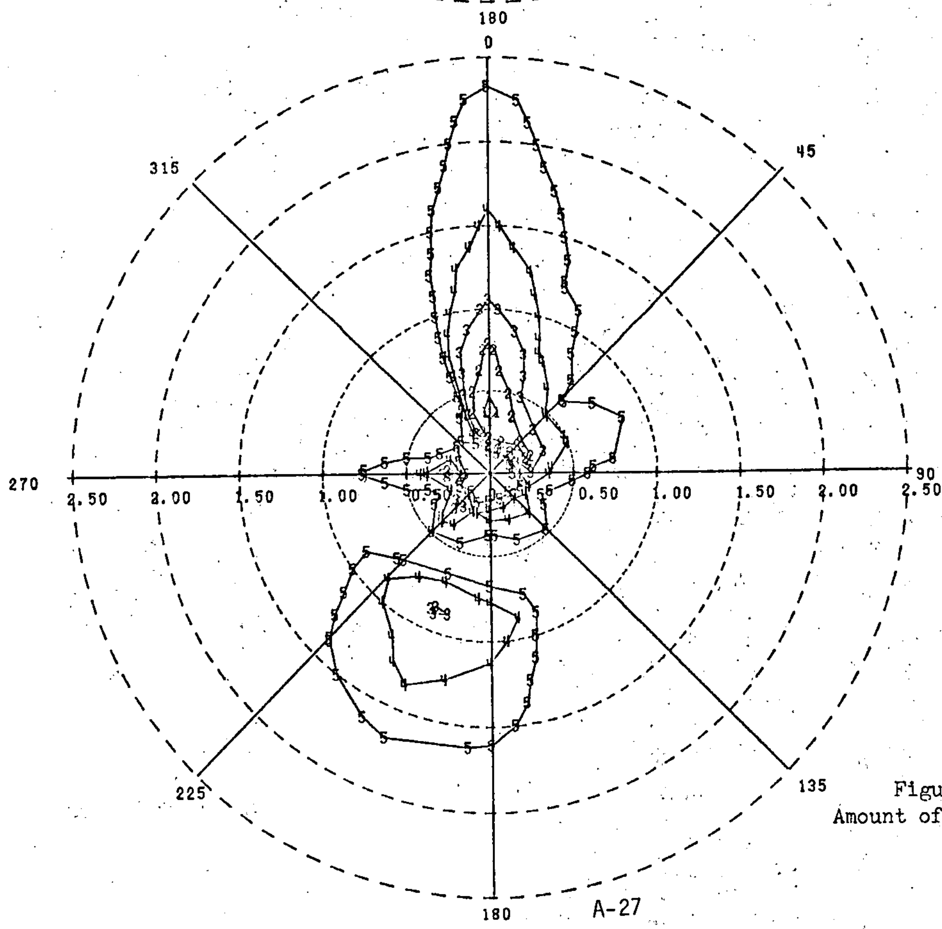
1 2.00
2 1.00
3 0.50
4 0.25
5 0.12

Figure A-47 CMDT
Amount of drift - February



1 0.0030
2 0.0015
3 0.00075
4 0.00038
5 0.00019

Figure A-48 CMDT
Amount of drift - March



1 0.000100
2 0.000050
3 0.000025
4 0.000012
5 0.000006

Figure A49 CMDT
Amount of drift - April

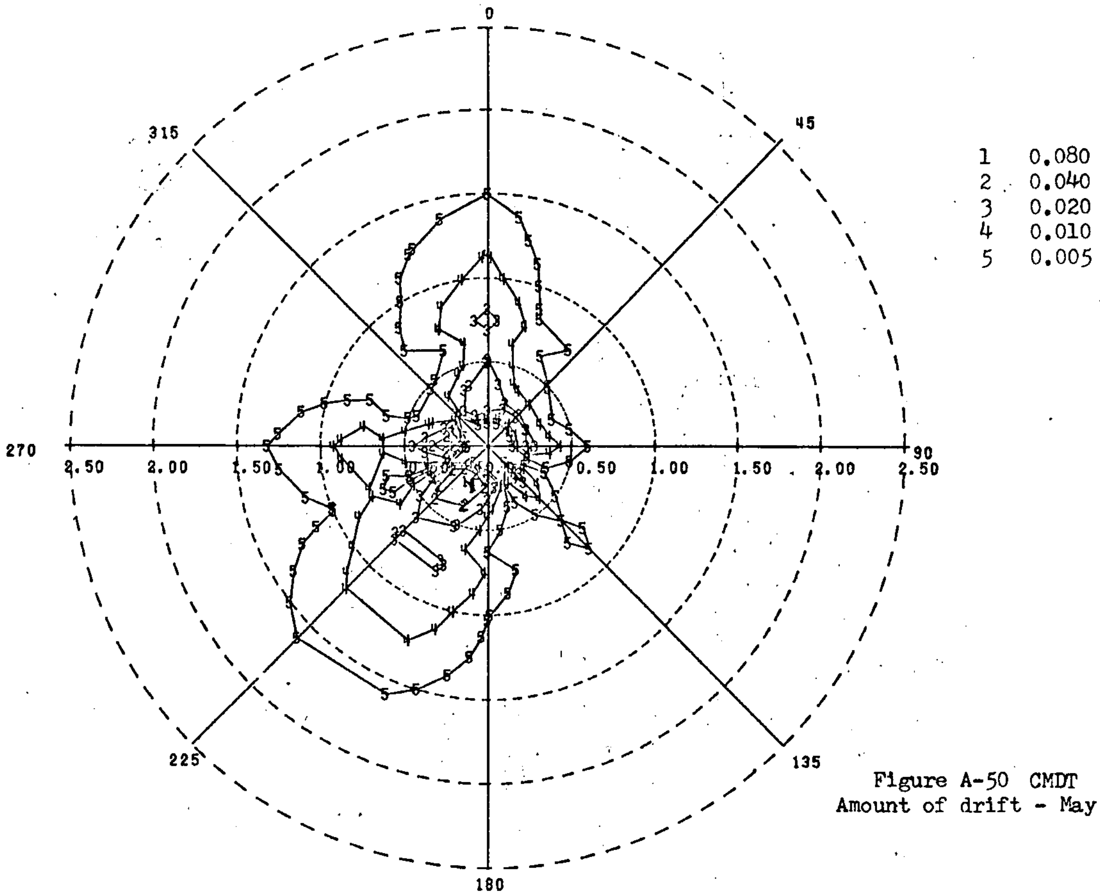


Figure A-50 CMDT
Amount of drift - May

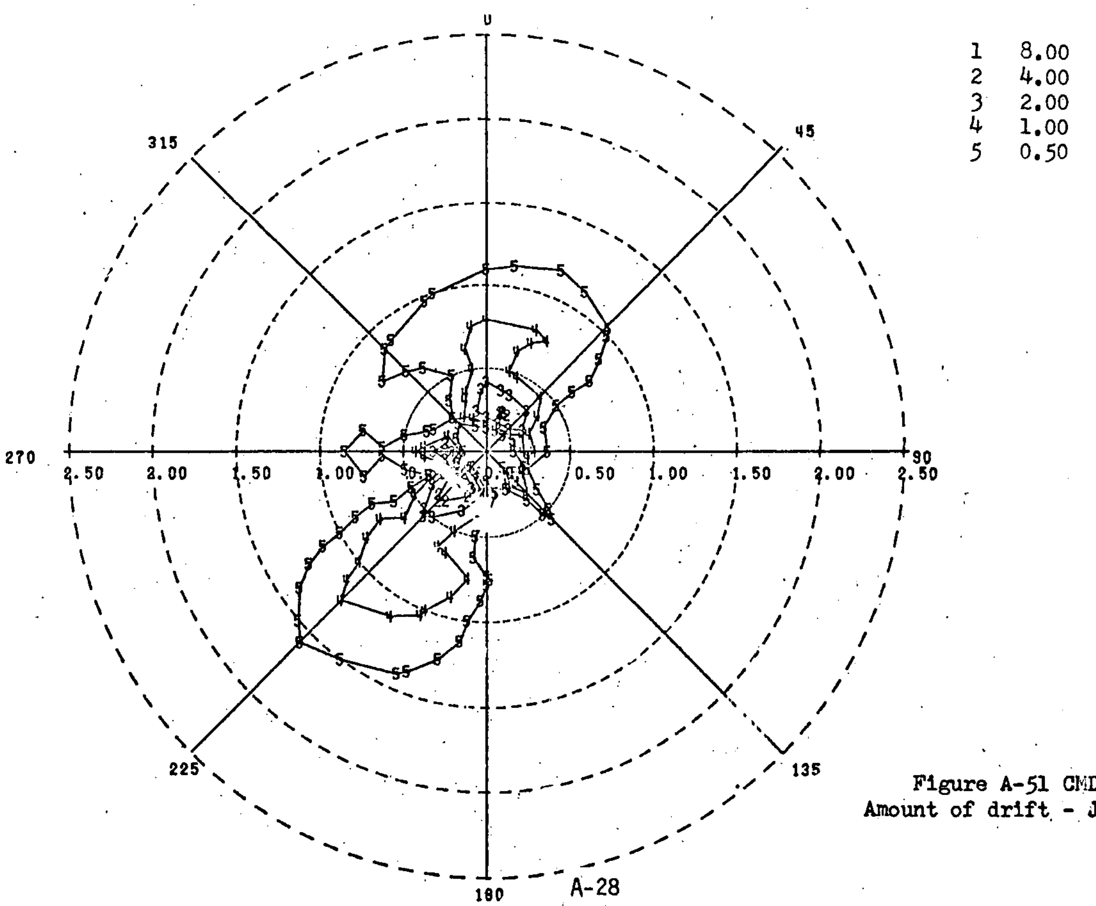


Figure A-51 CMDT
Amount of drift - June

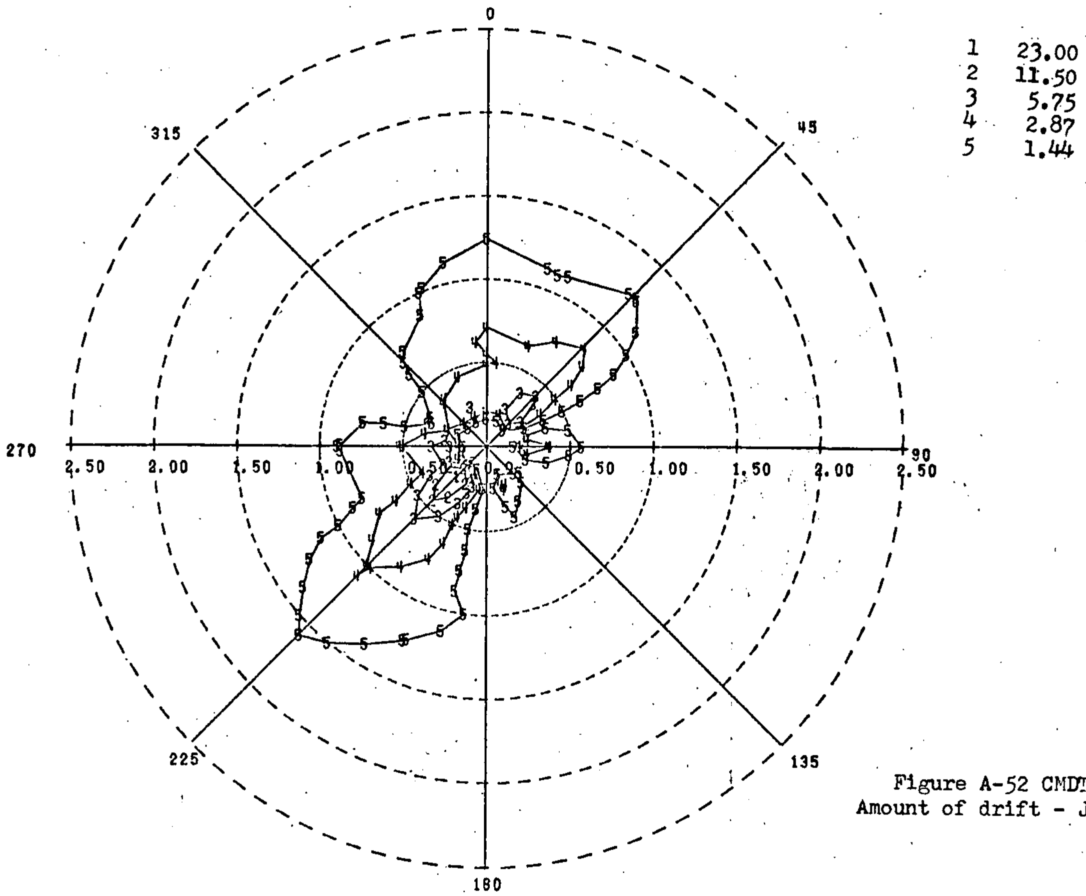


Figure A-52 CMDT
Amount of drift - July

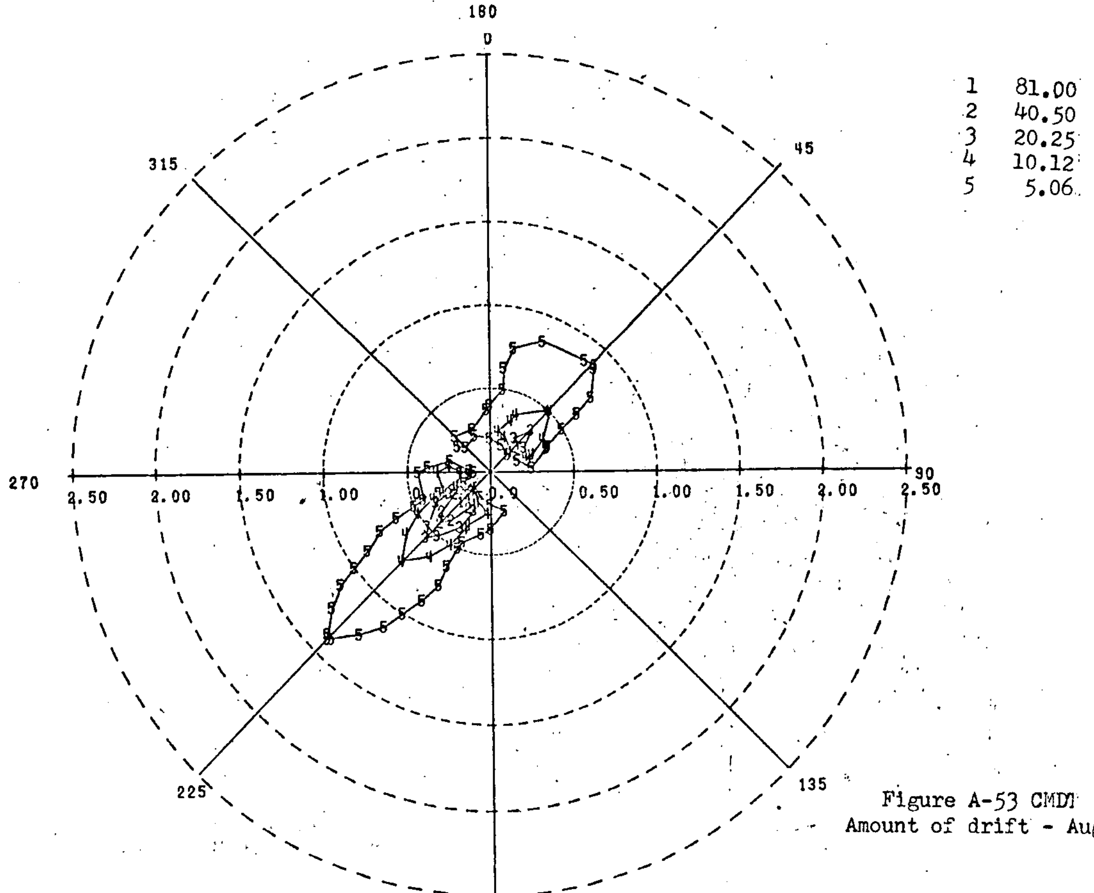


Figure A-53 CMDT
Amount of drift - August

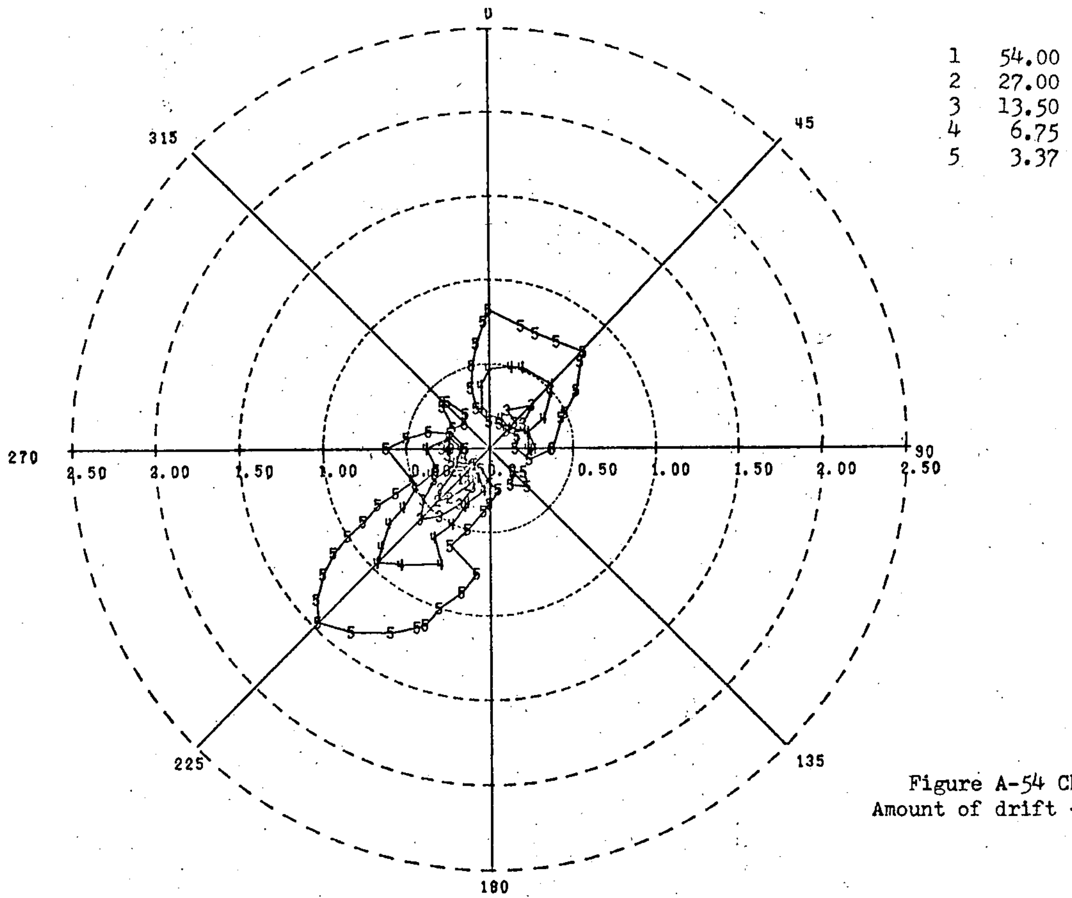


Figure A-54 CMDT
Amount of drift - Sept

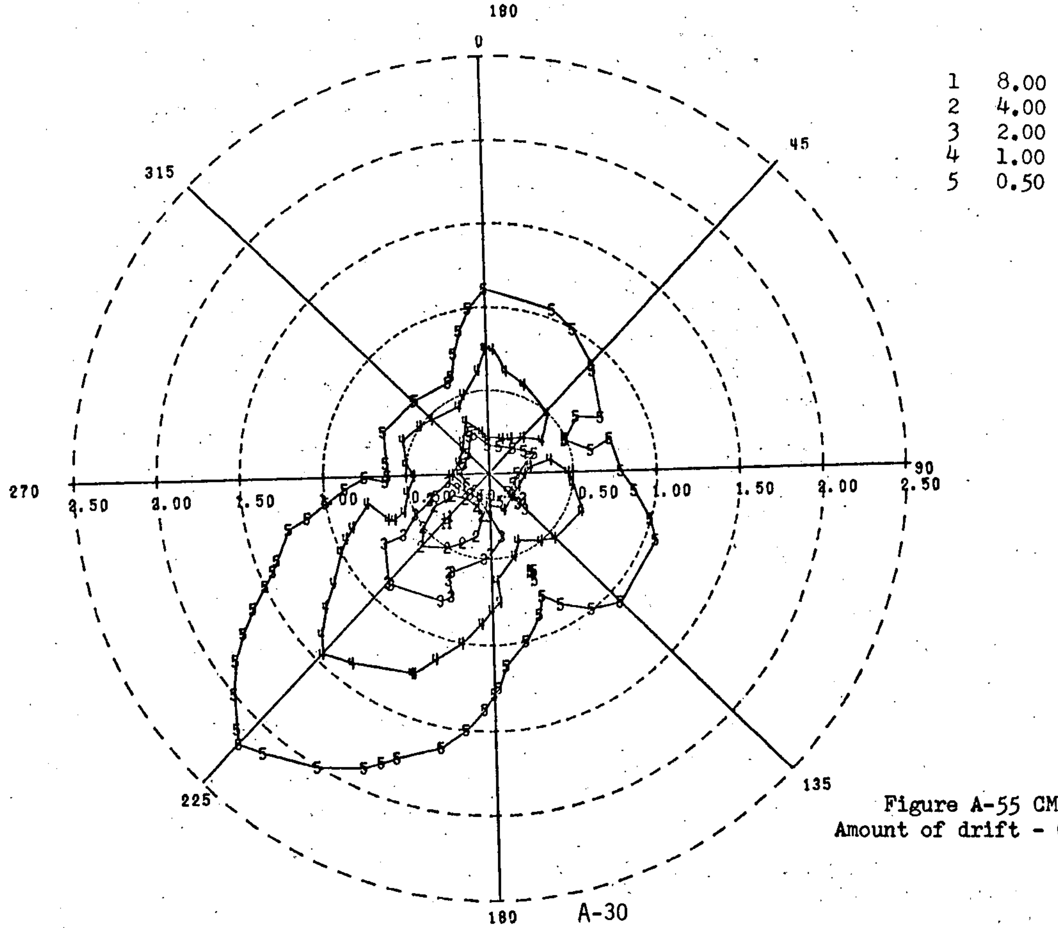


Figure A-55 CMDT
Amount of drift - October

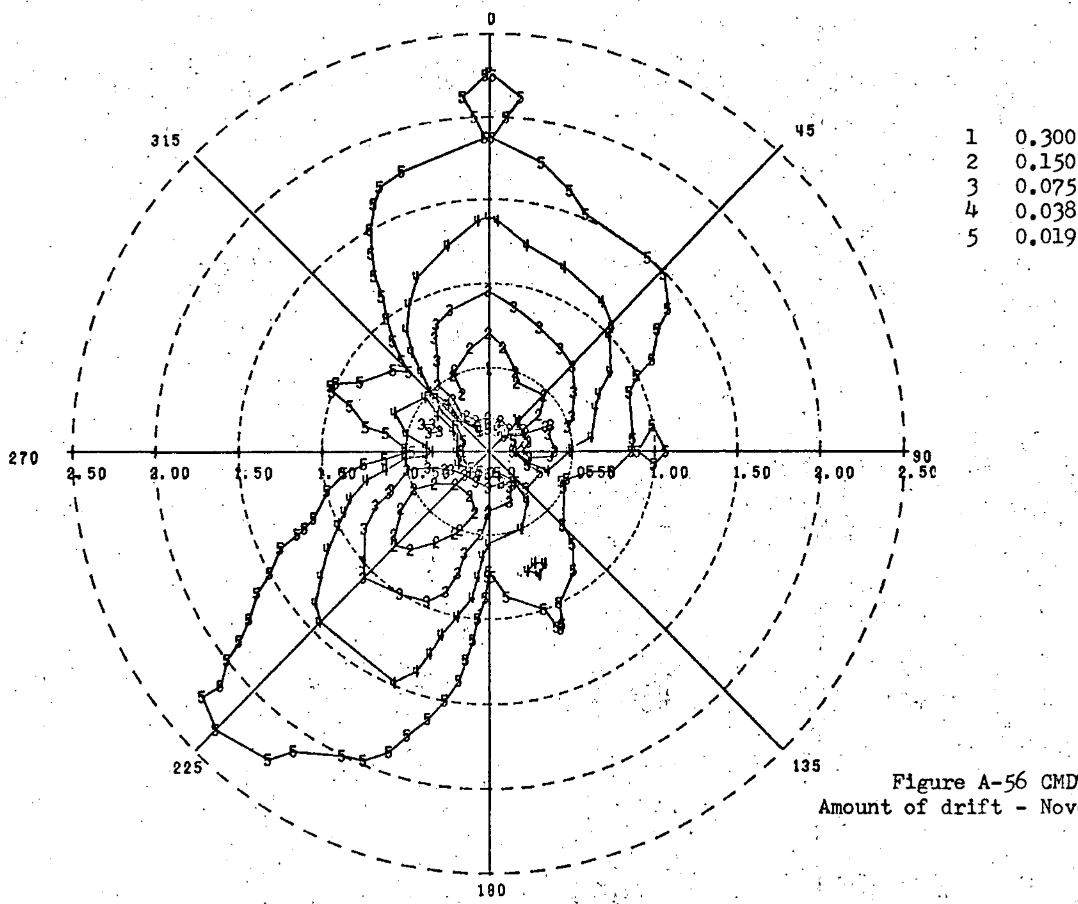


Figure A-56 CMDT
Amount of drift - November

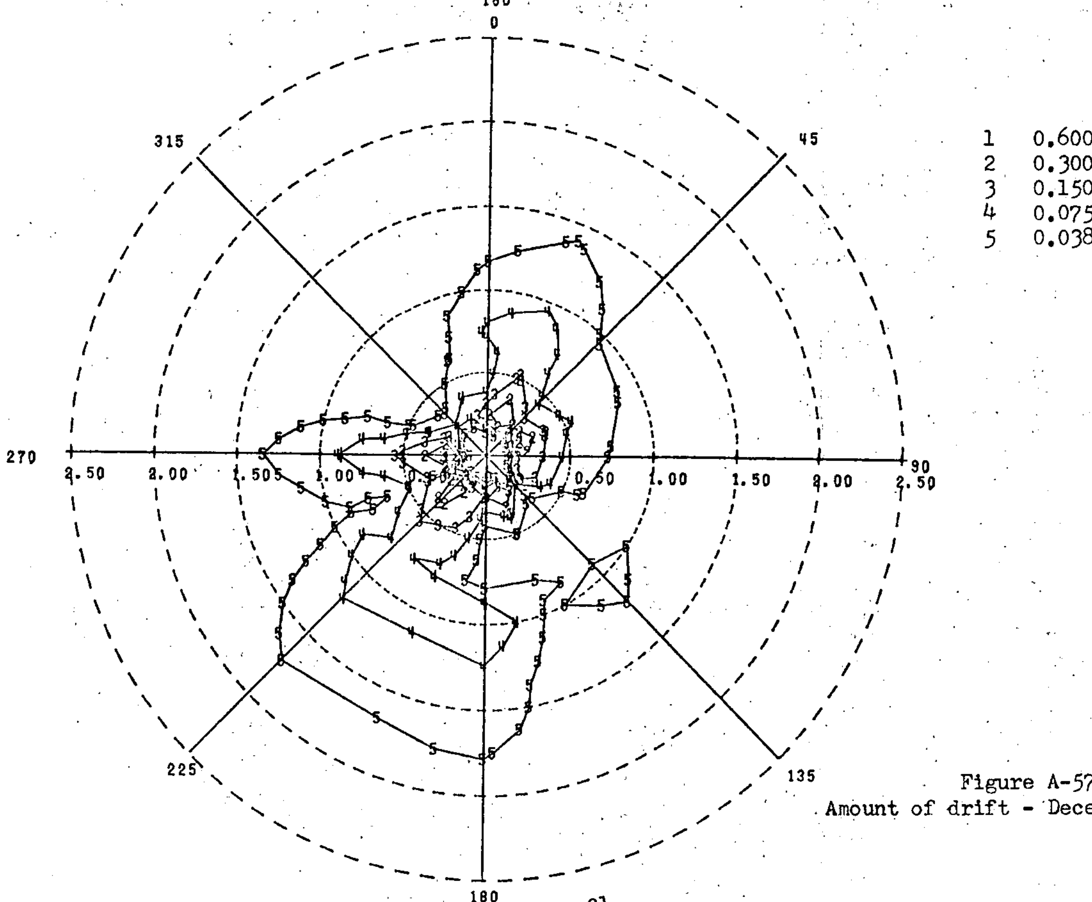


Figure A-57
Amount of drift - December

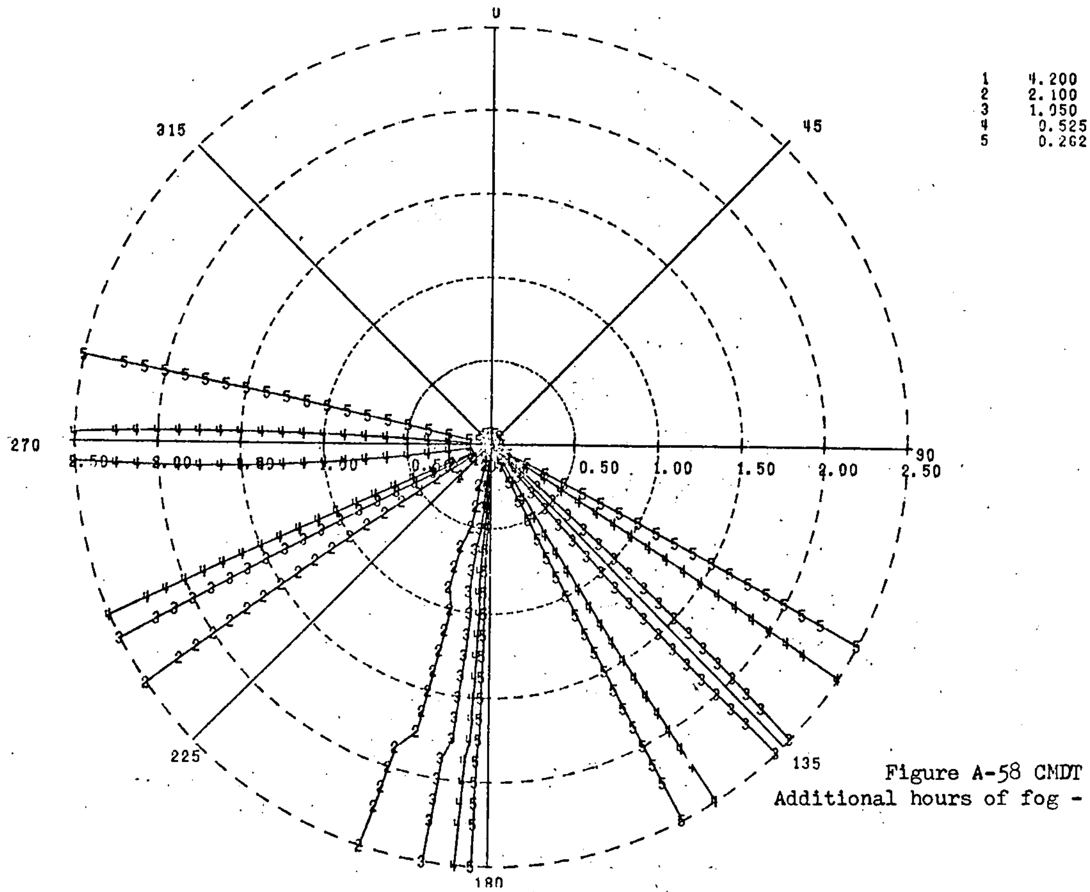


Figure A-58 CMDT
Additional hours of fog - January

No additional fog predicted for February

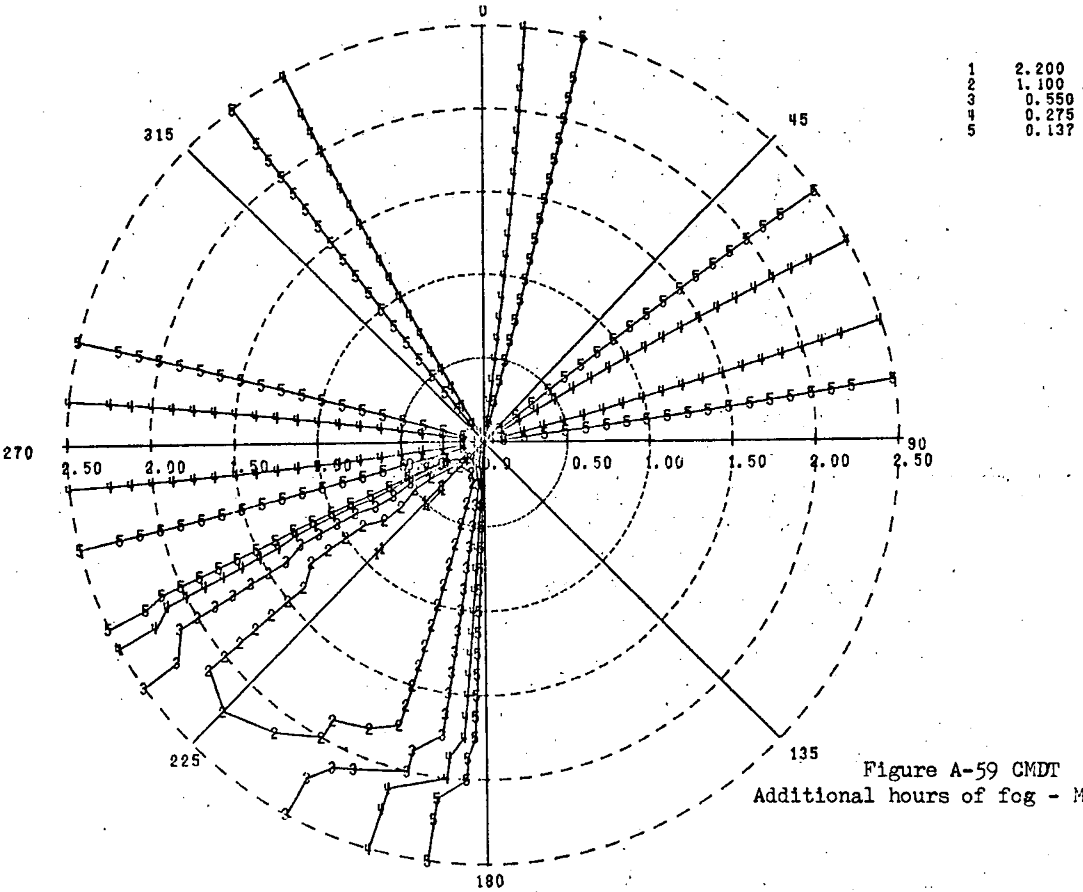


Figure A-59 CMDT
Additional hours of fog - March

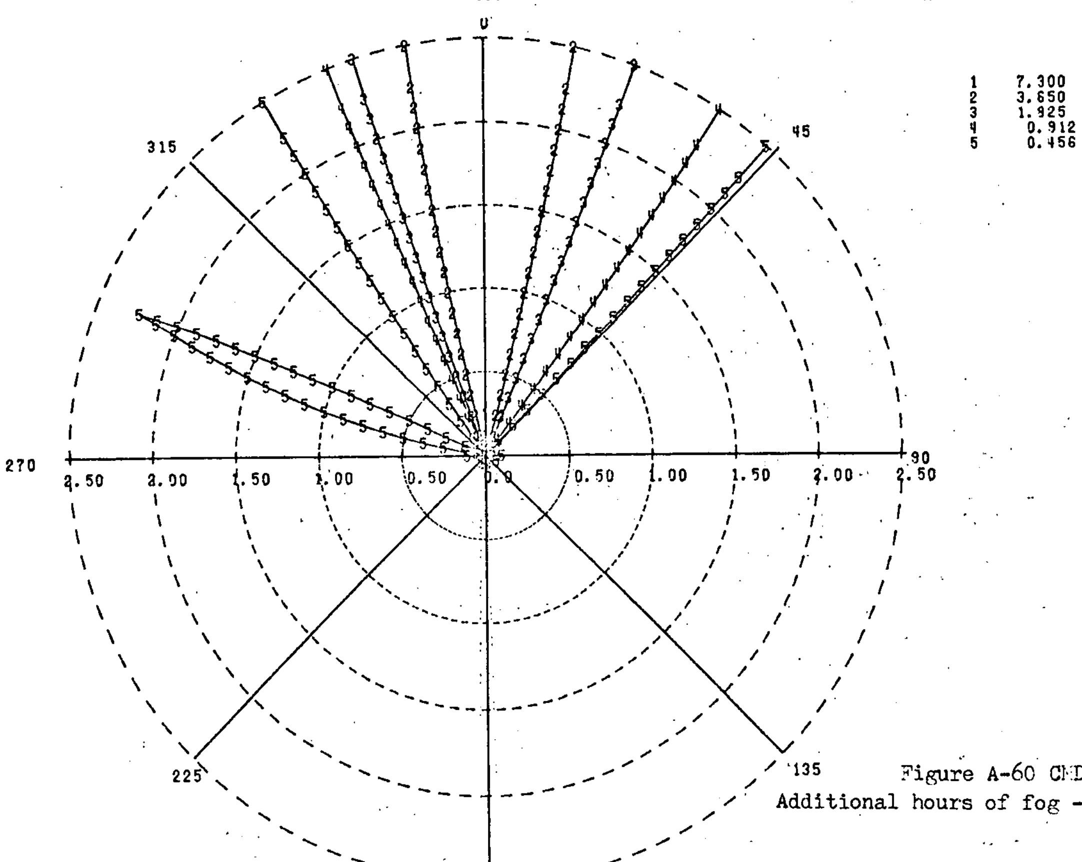


Figure A-60 CMDT
Additional hours of fog - April

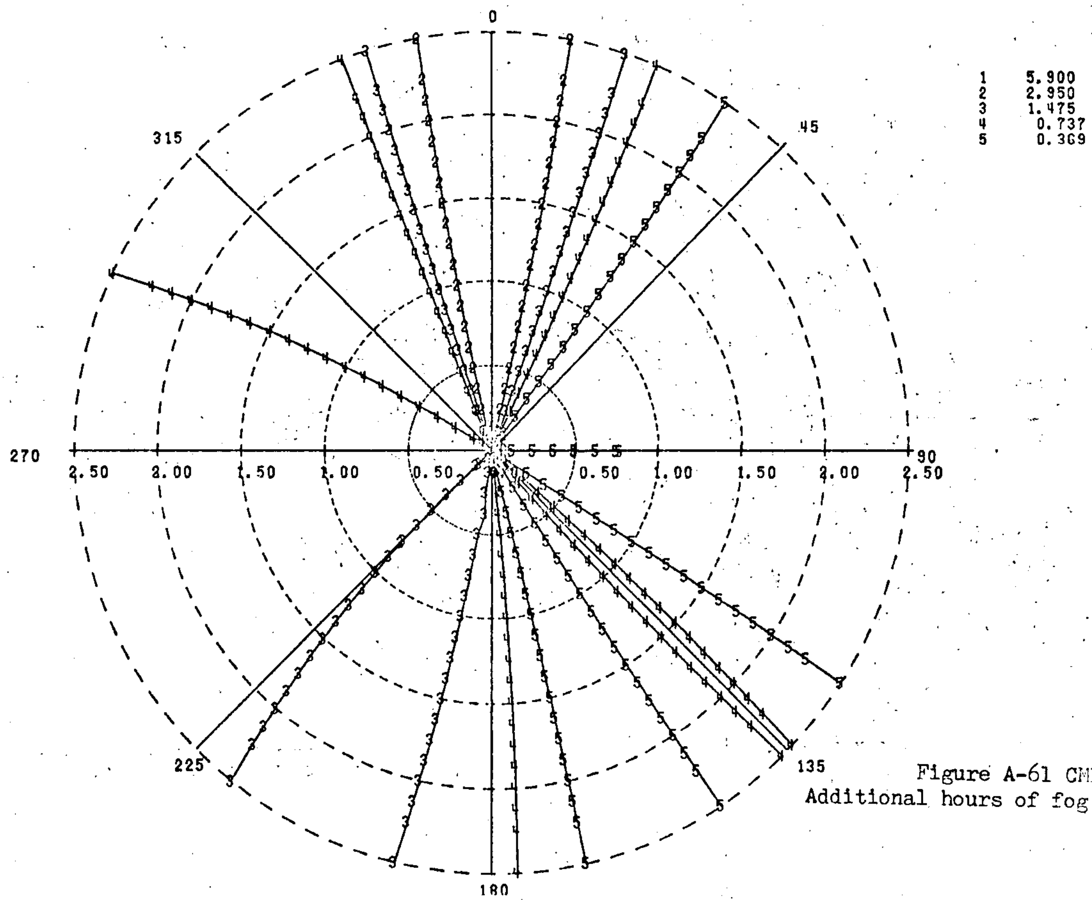


Figure A-61 CMDT
Additional hours of fog - May

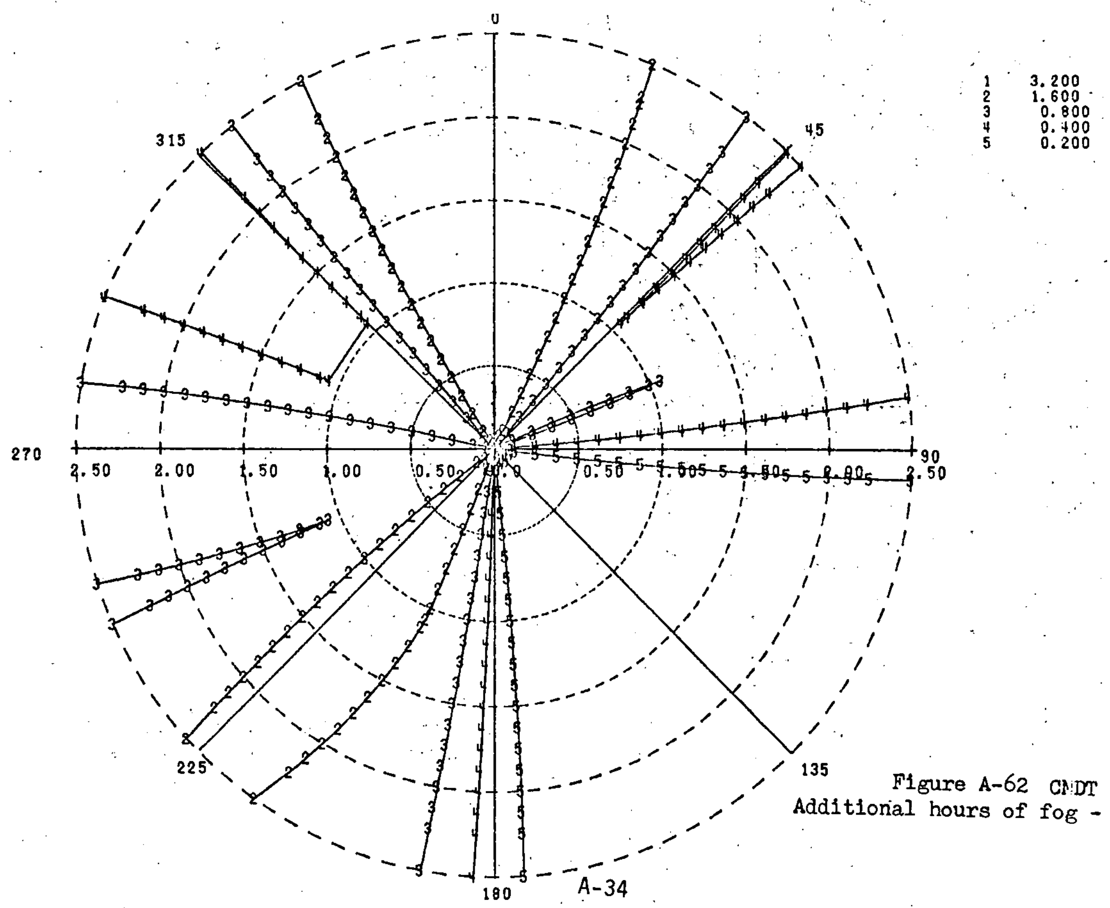


Figure A-62 CMDT
Additional hours of fog - June

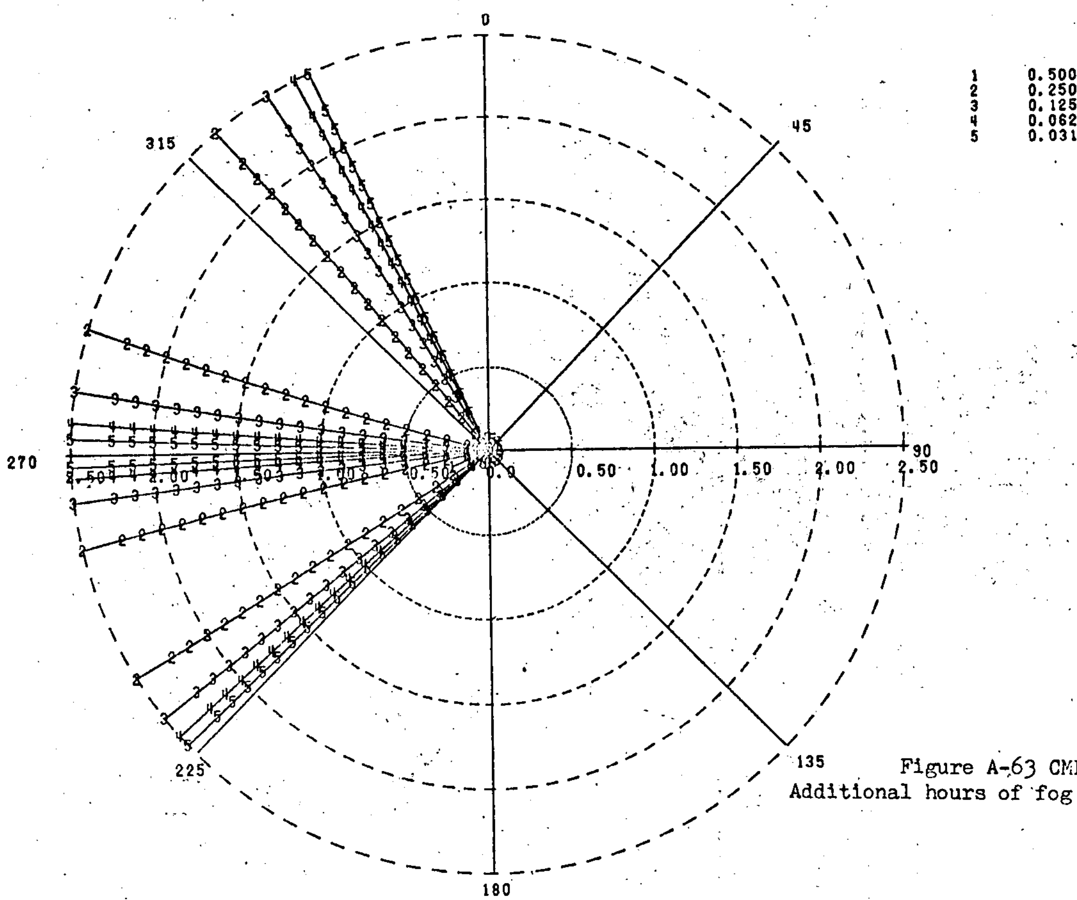


Figure A-63 CMDT
Additional hours of fog - July

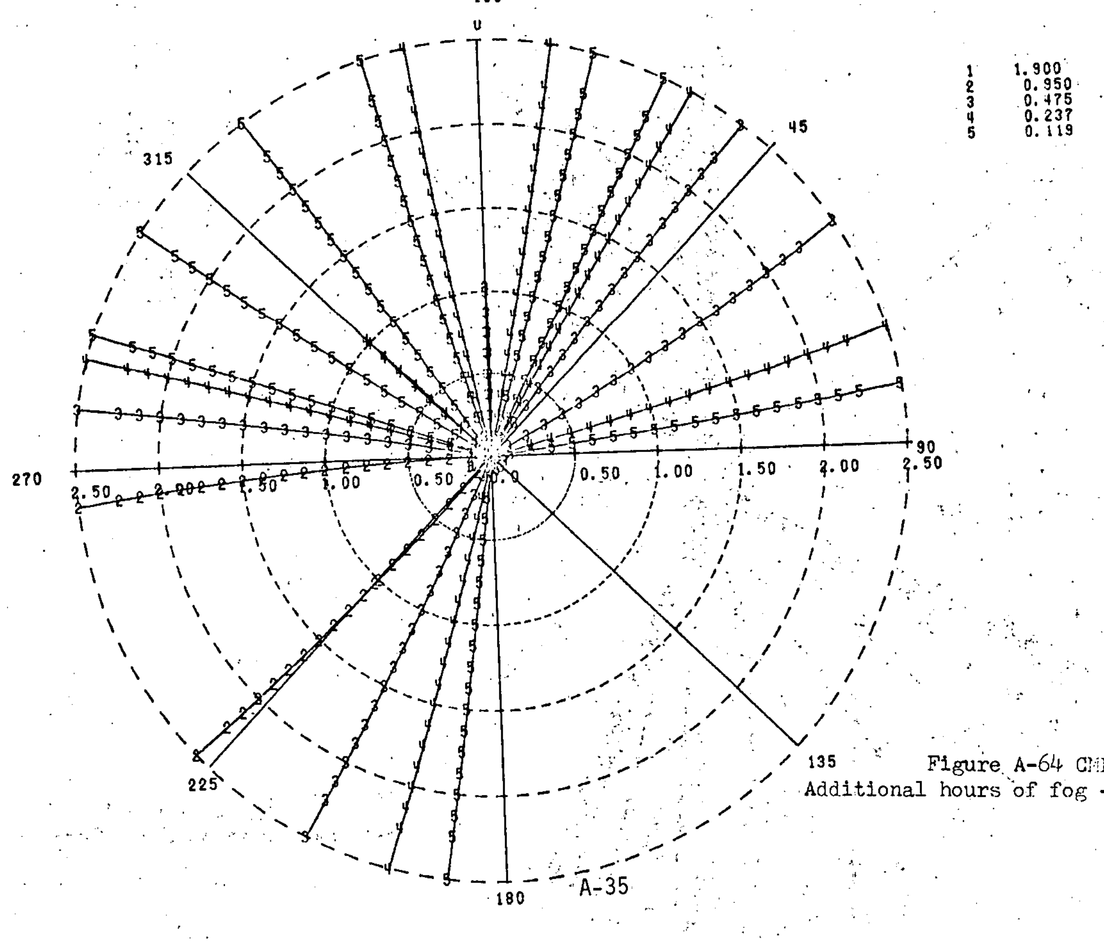


Figure A-64 CMDT
Additional hours of fog - August

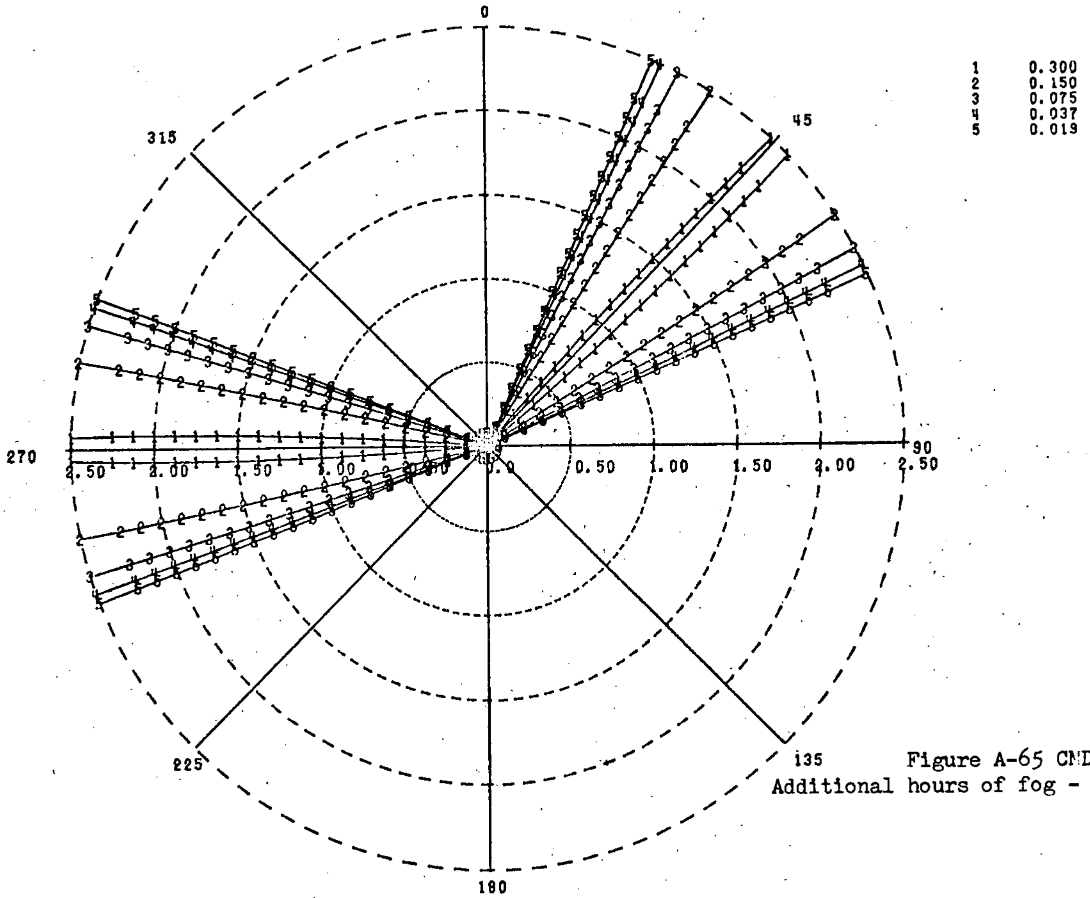


Figure A-65 CMDT
Additional hours of fog - Sept.

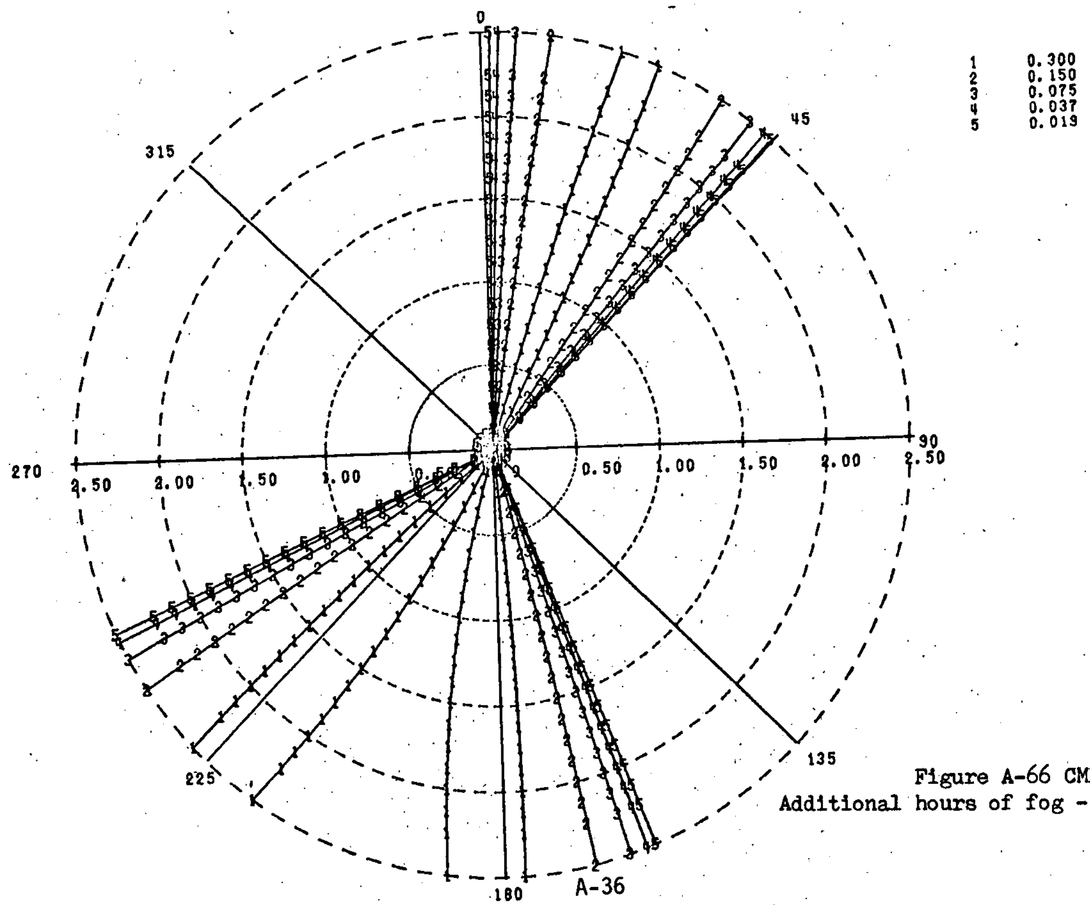


Figure A-66 CMDT
Additional hours of fog - October

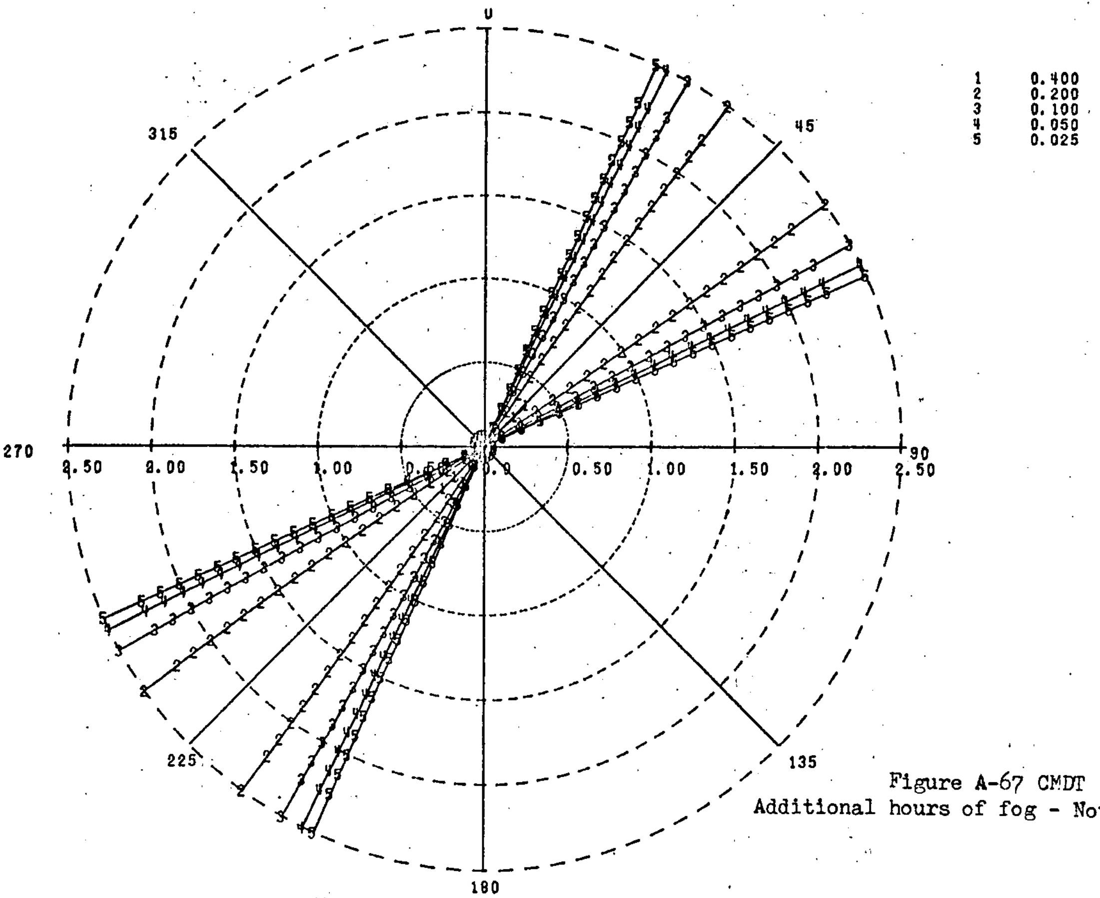


Figure A-67 CMDT
Additional hours of fog - November

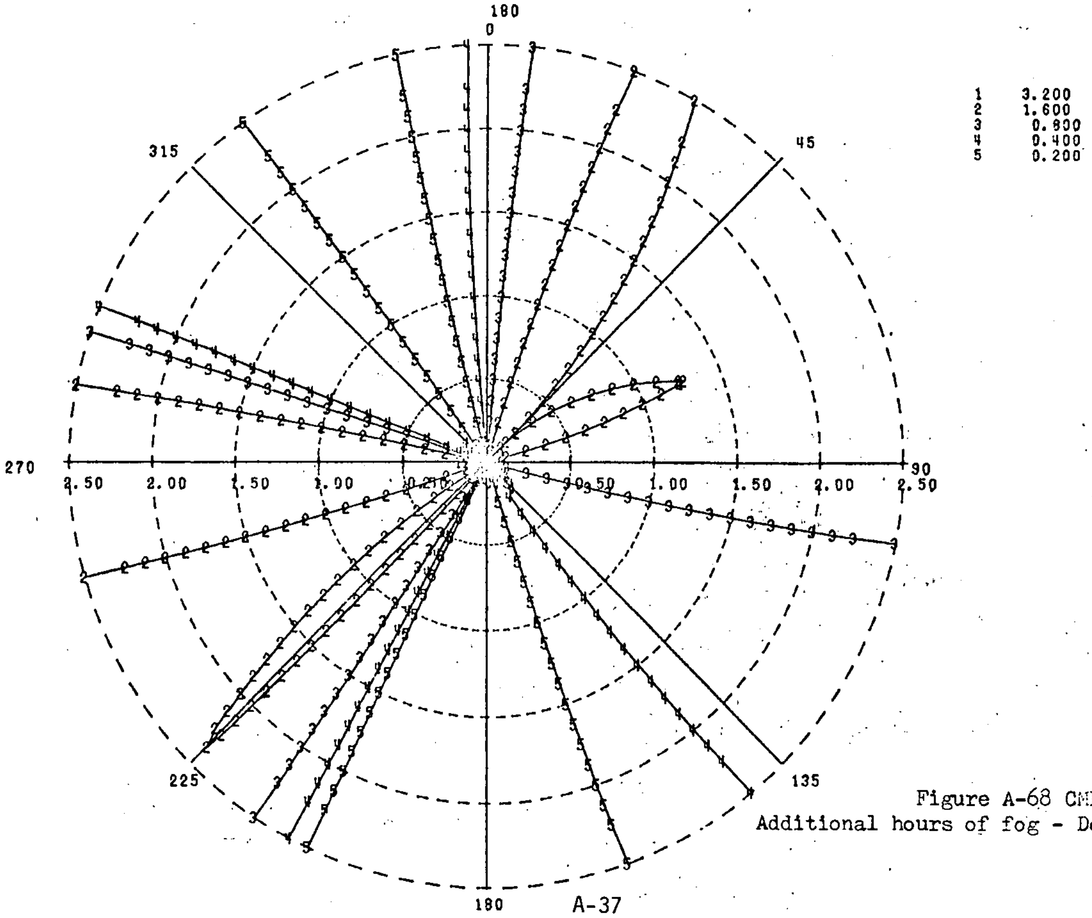


Figure A-68 CMDT
Additional hours of fog - December

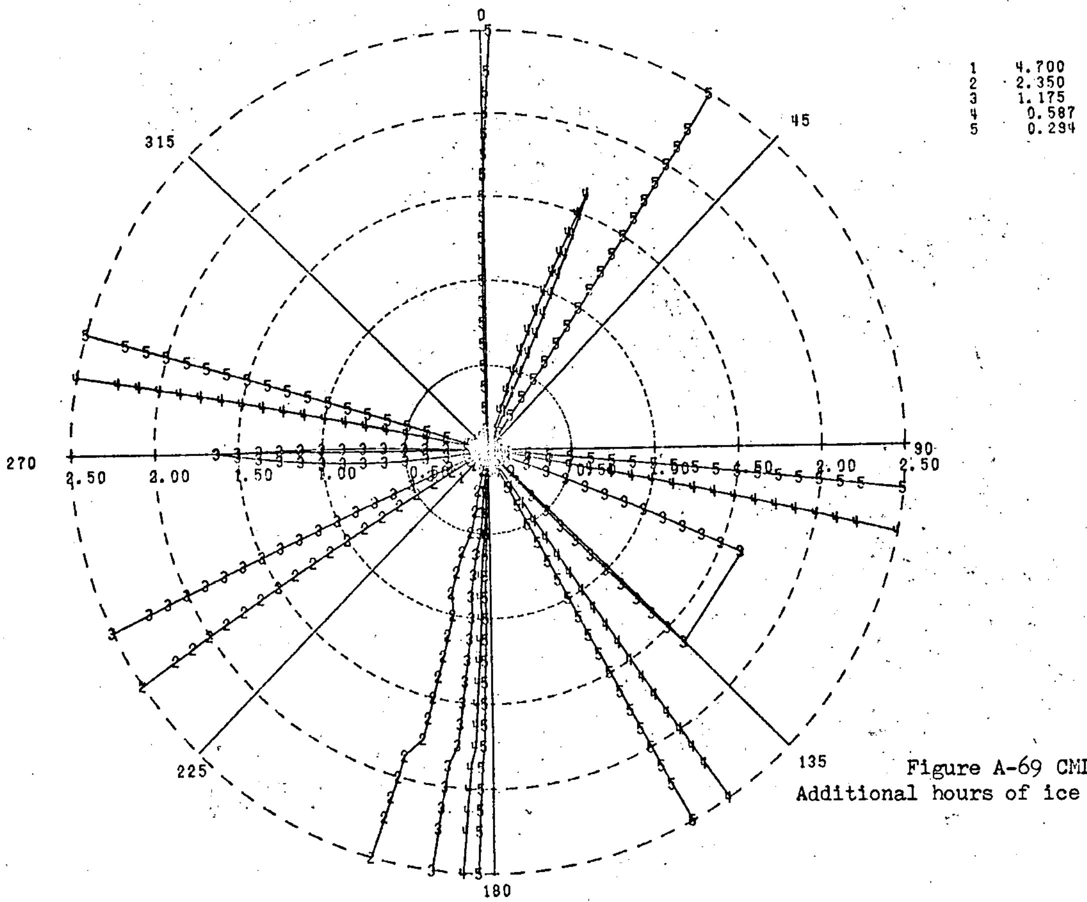


Figure A-69 CMDT
Additional hours of ice - Jan.

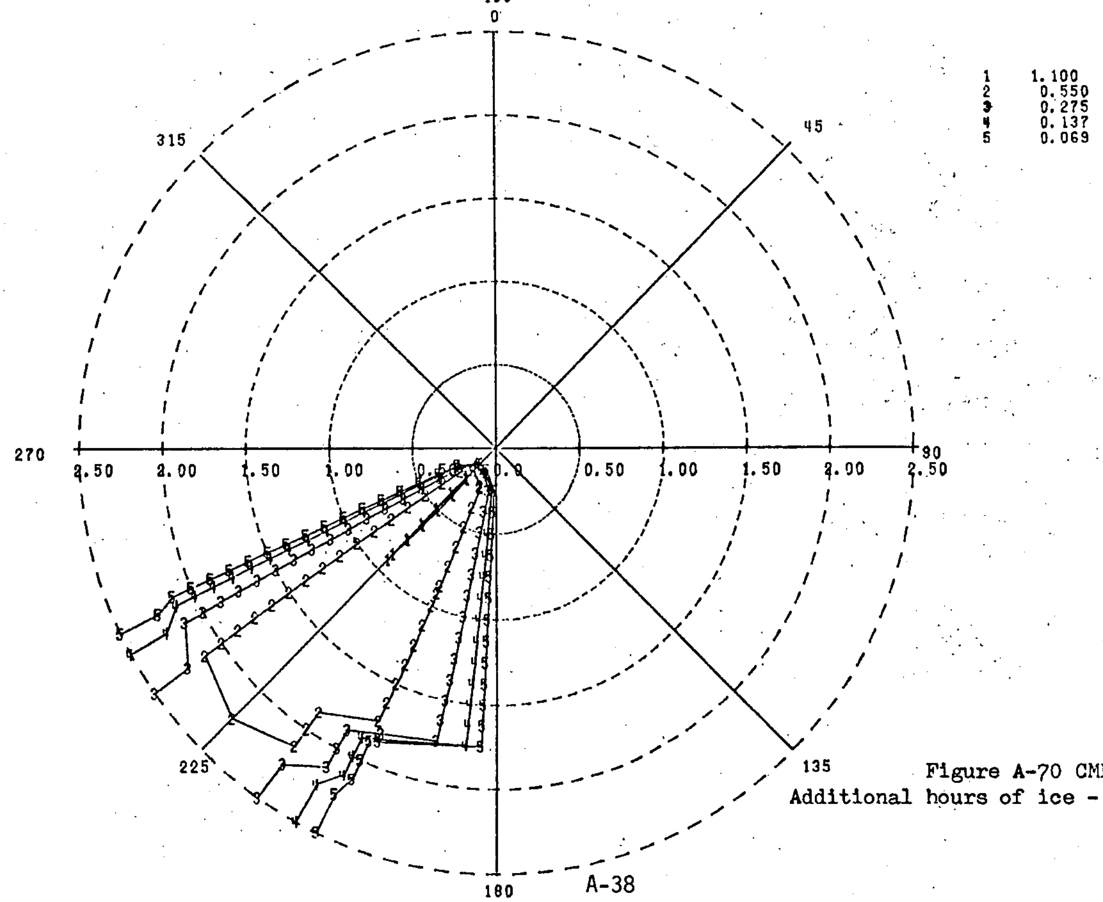


Figure A-70 CMDT
Additional hours of ice - March

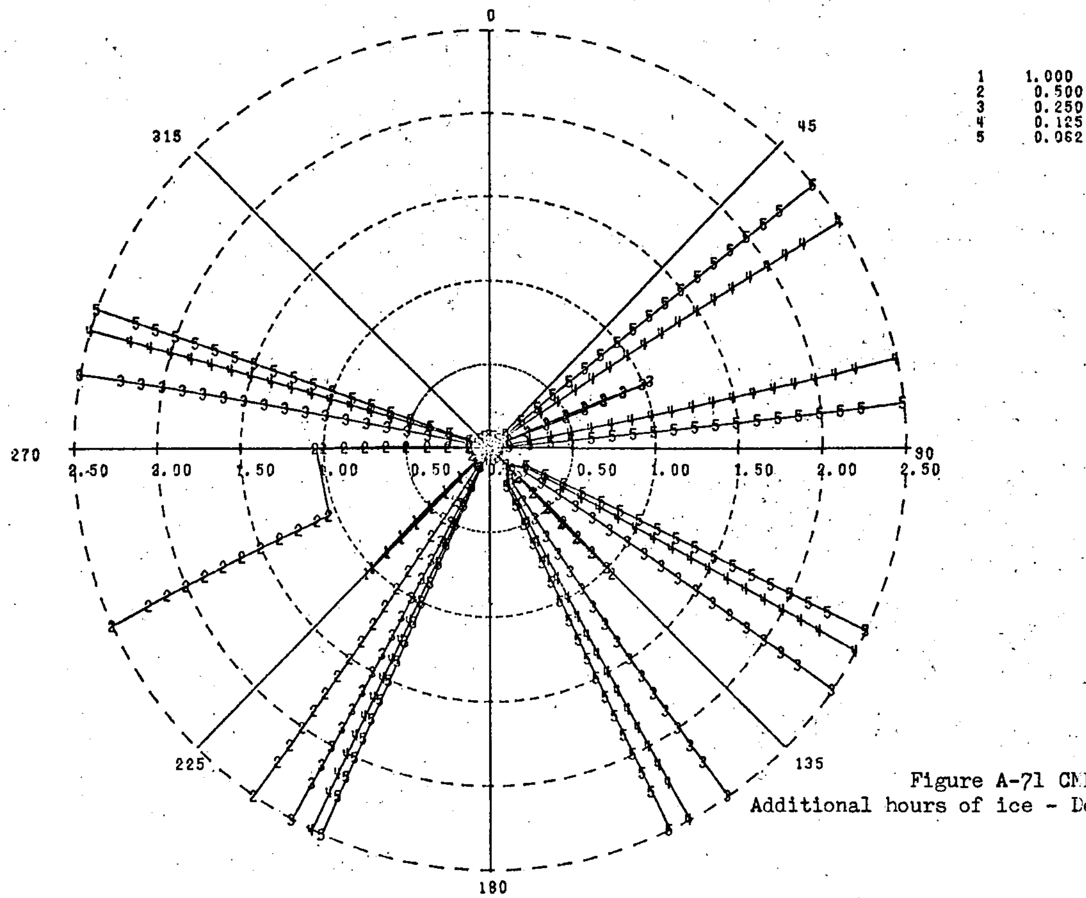


Figure A-71 CMDT
Additional hours of ice - December

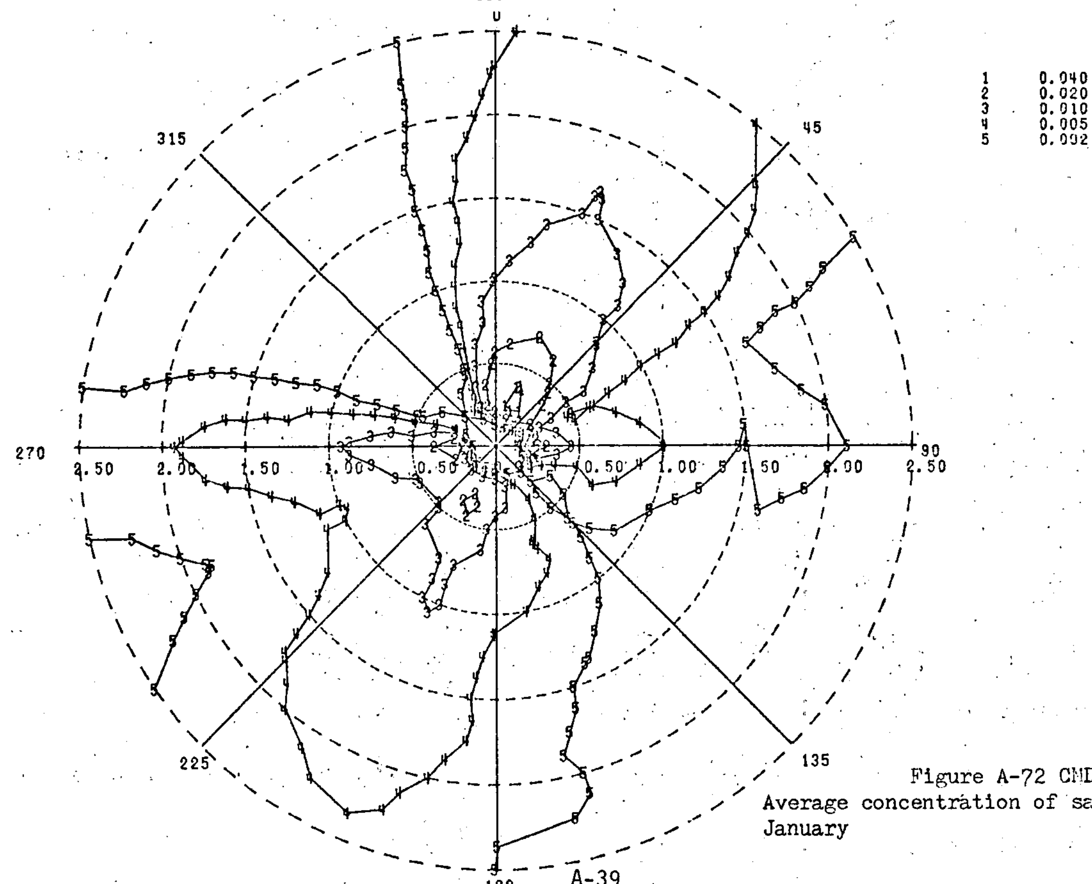


Figure A-72 CMDT
Average concentration of salt in air
January

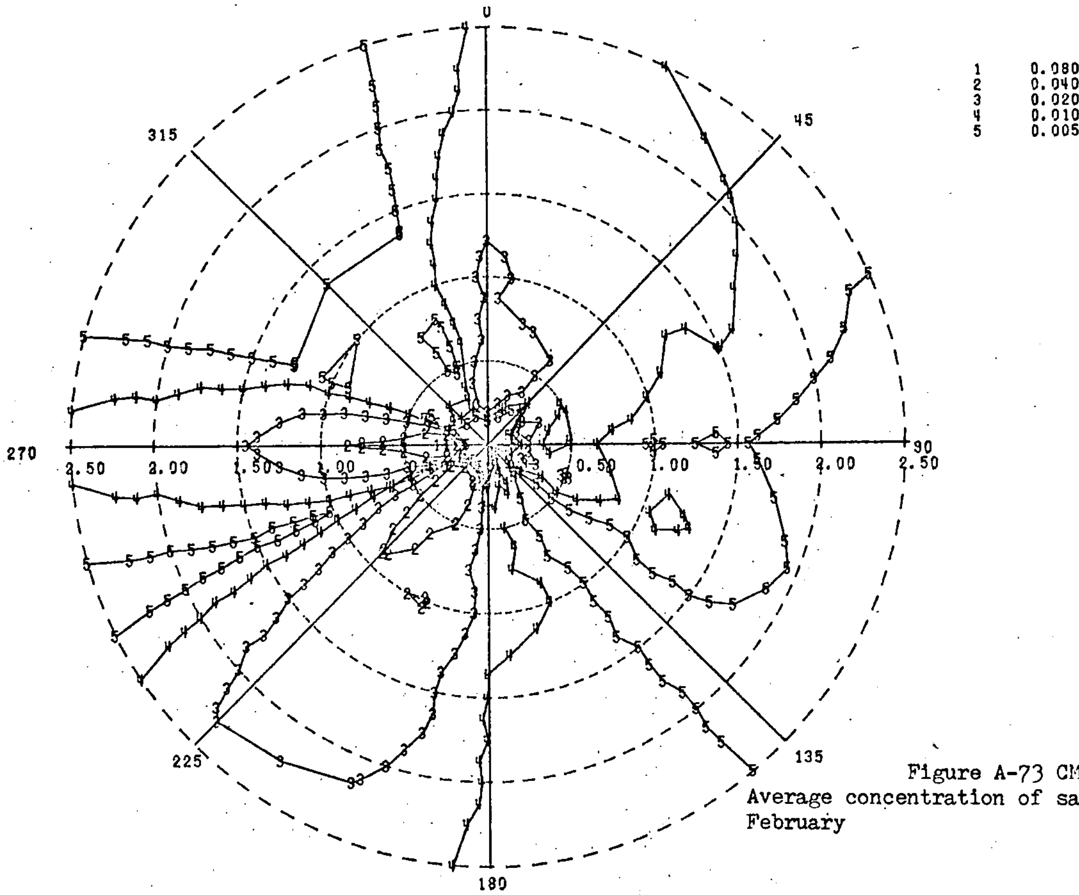


Figure A-73 CMDT
Average concentration of salt in air
February

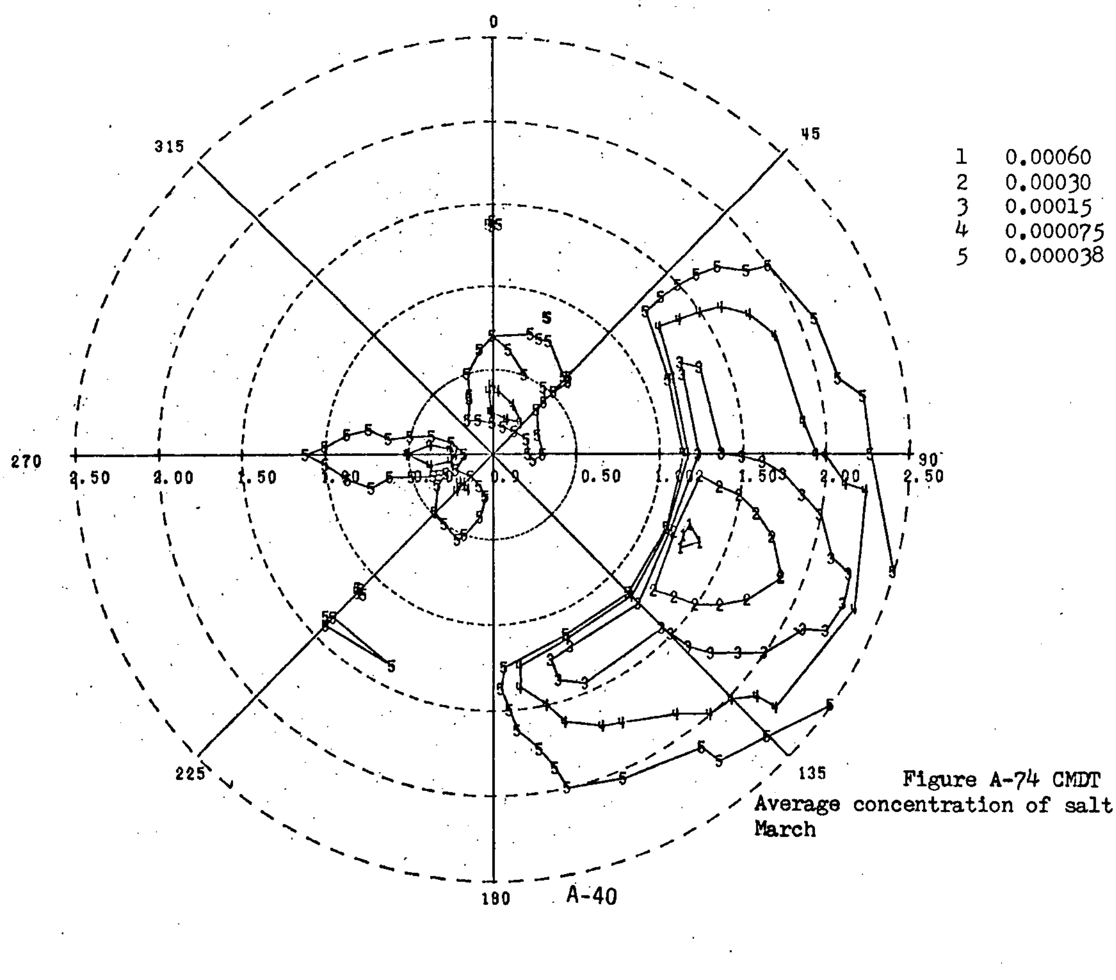
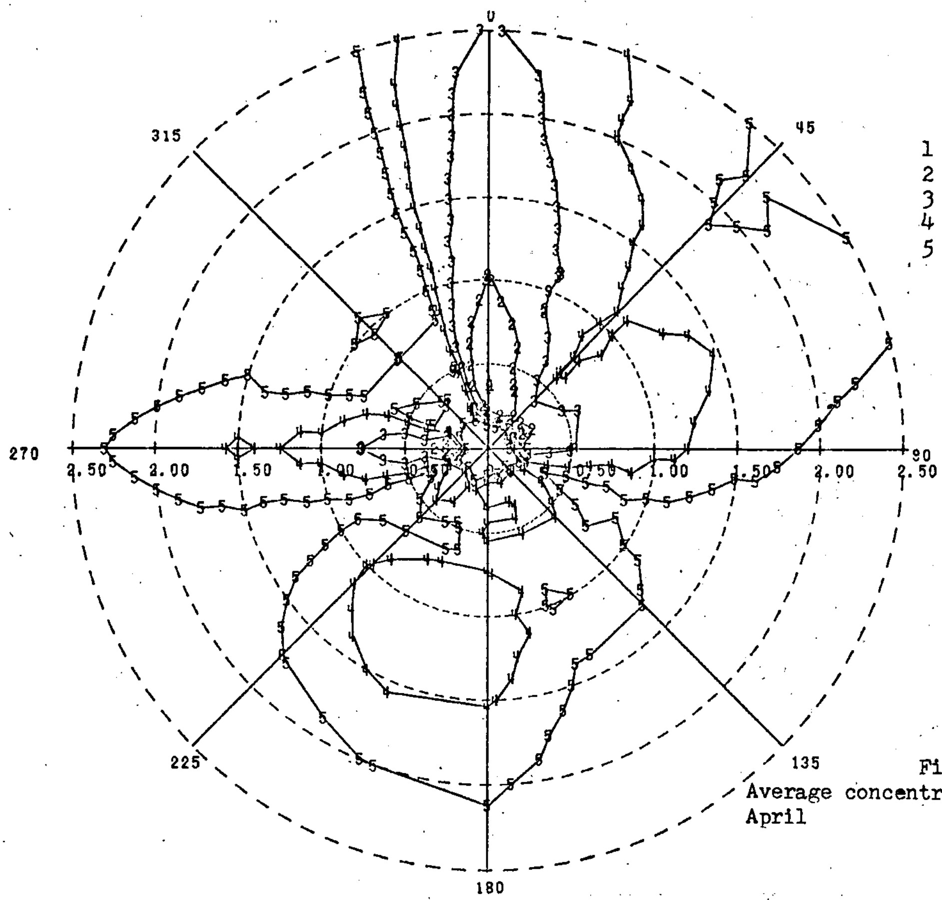
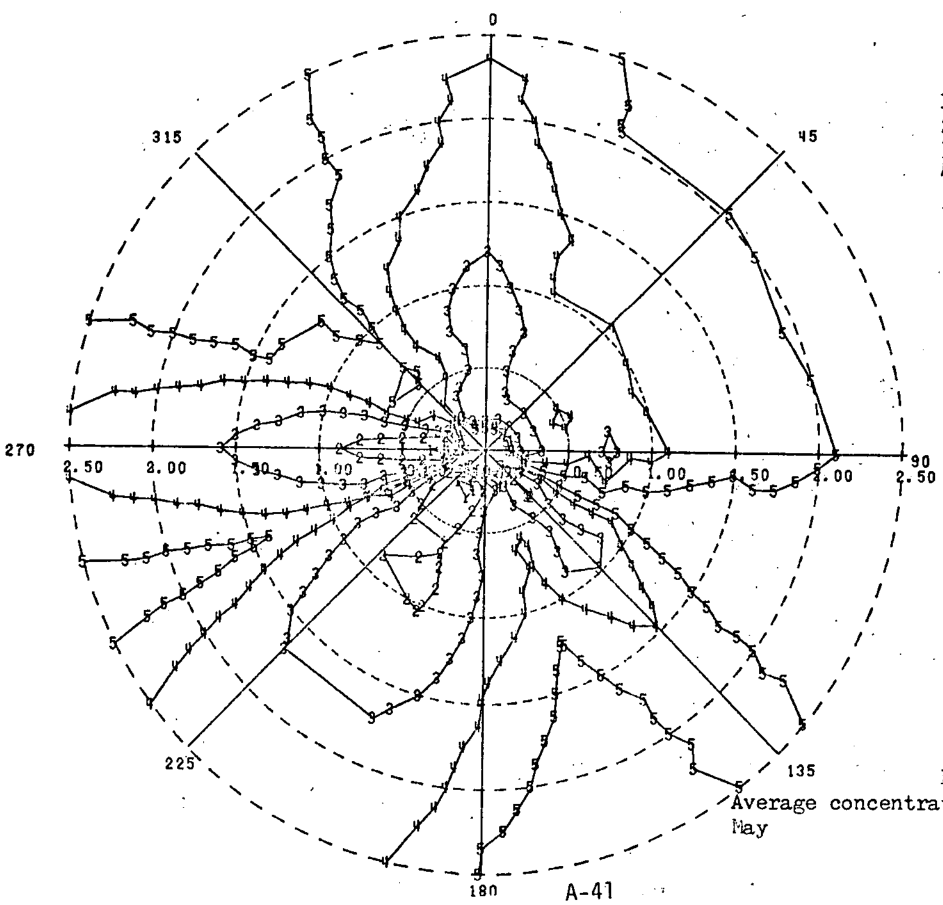


Figure A-74 CMDT
Average concentration of salt in air
March



1	0.00000300
2	0.00000150
3	0.00000075
4	0.00000038
5	0.00000019

Figure A-75 CMDT
Average concentration of salt in air.
April



1	0.00200
2	0.00100
3	0.00050
4	0.00025
5	0.00012

Figure A-76 CMDT
Average concentration of salt in air
May

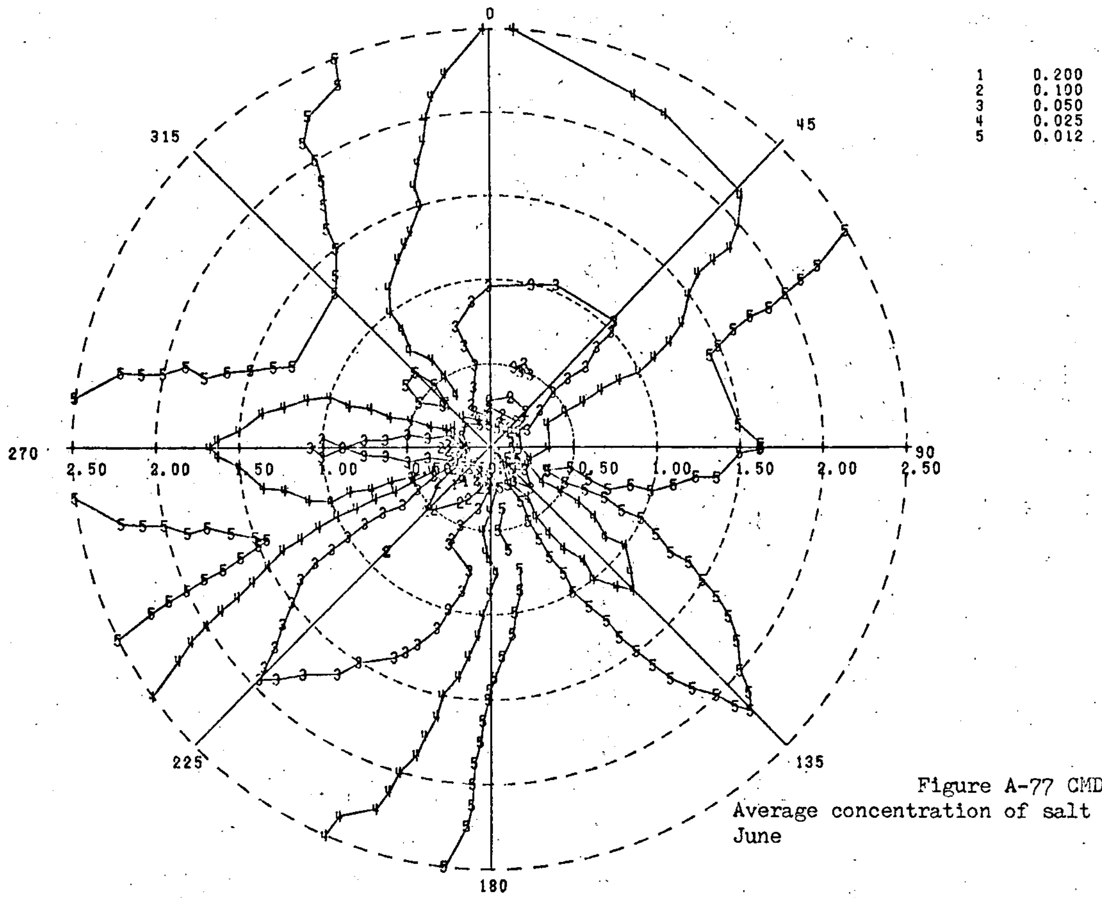


Figure A-77 CMDT
Average concentration of salt in air
June

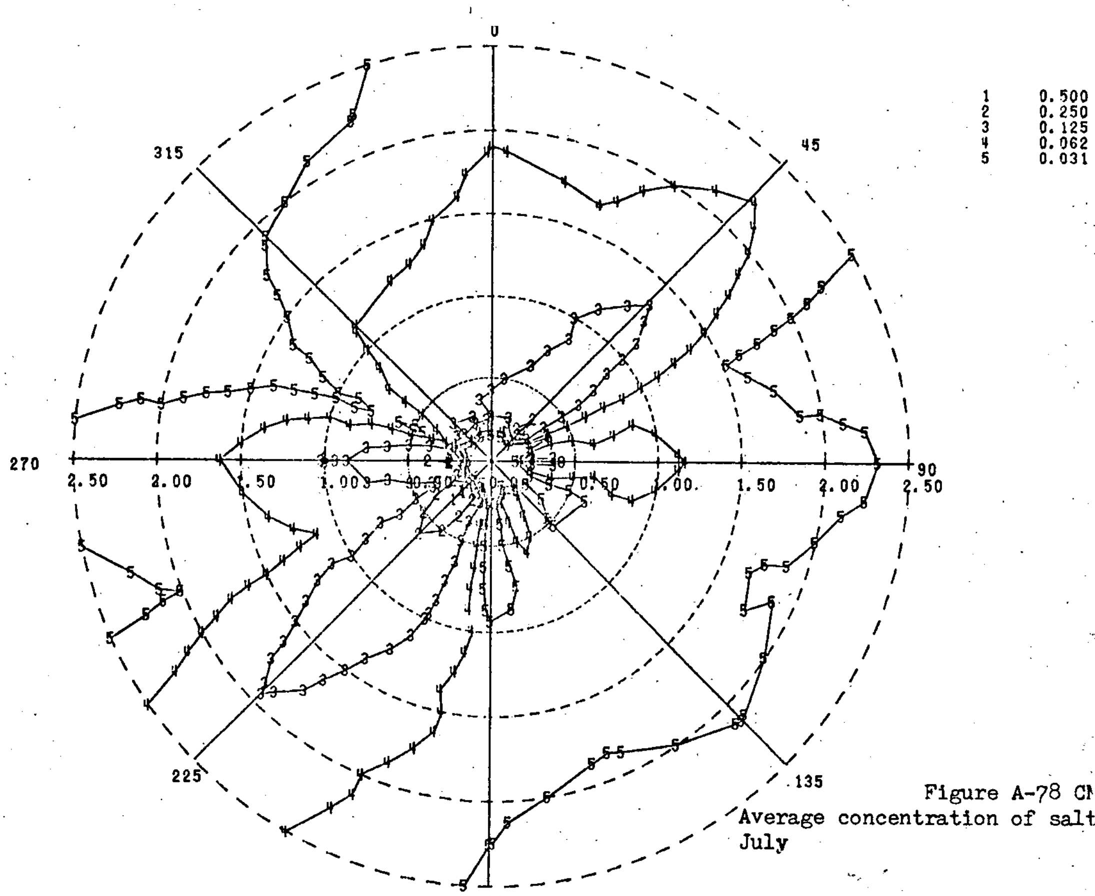


Figure A-78 CMDT
Average concentration of salt in air
July

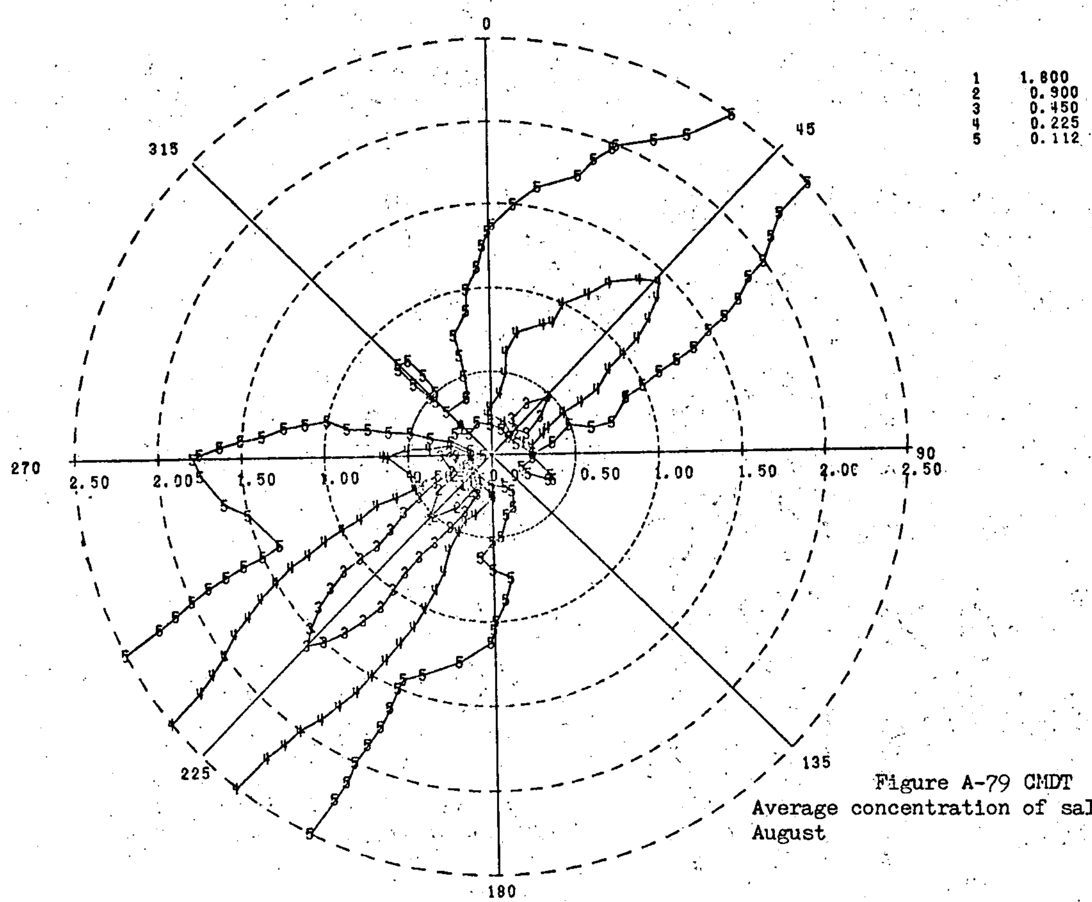


Figure A-79 CMDT
Average concentration of salt in air
August

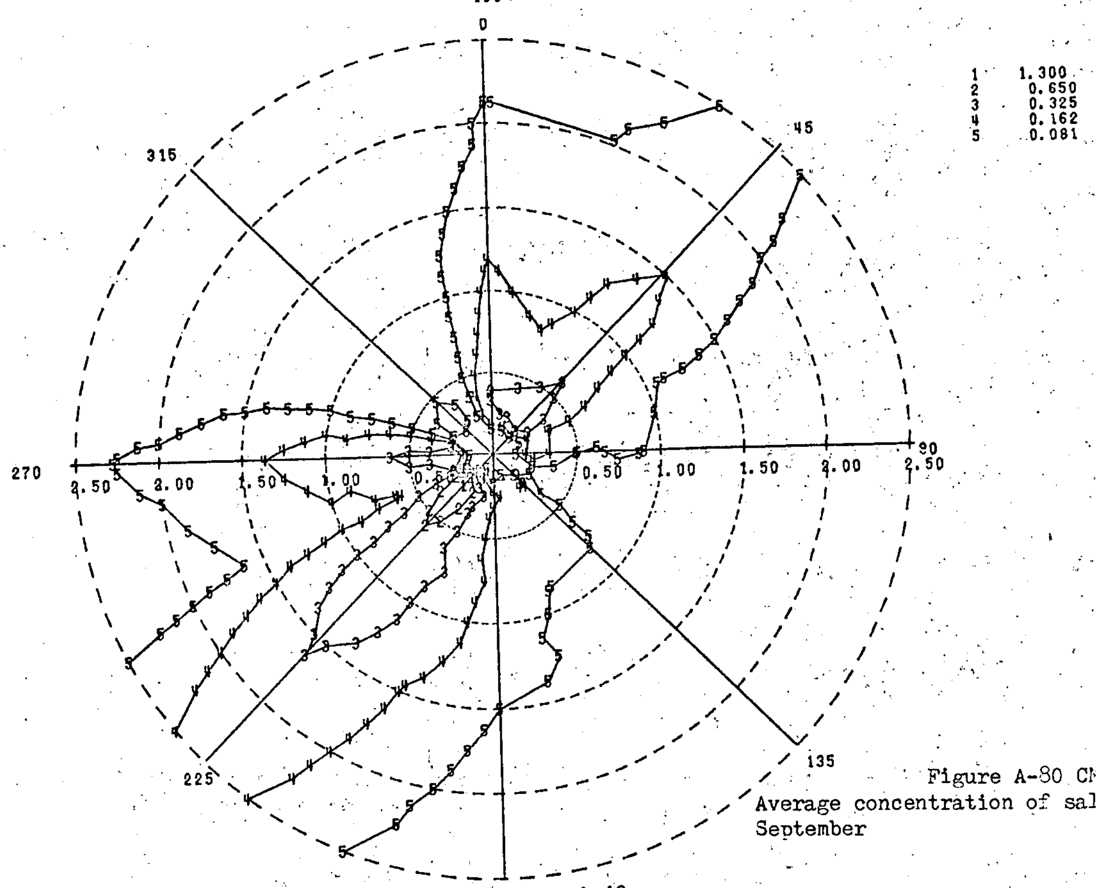


Figure A-80 CMDT
Average concentration of salt in air
September

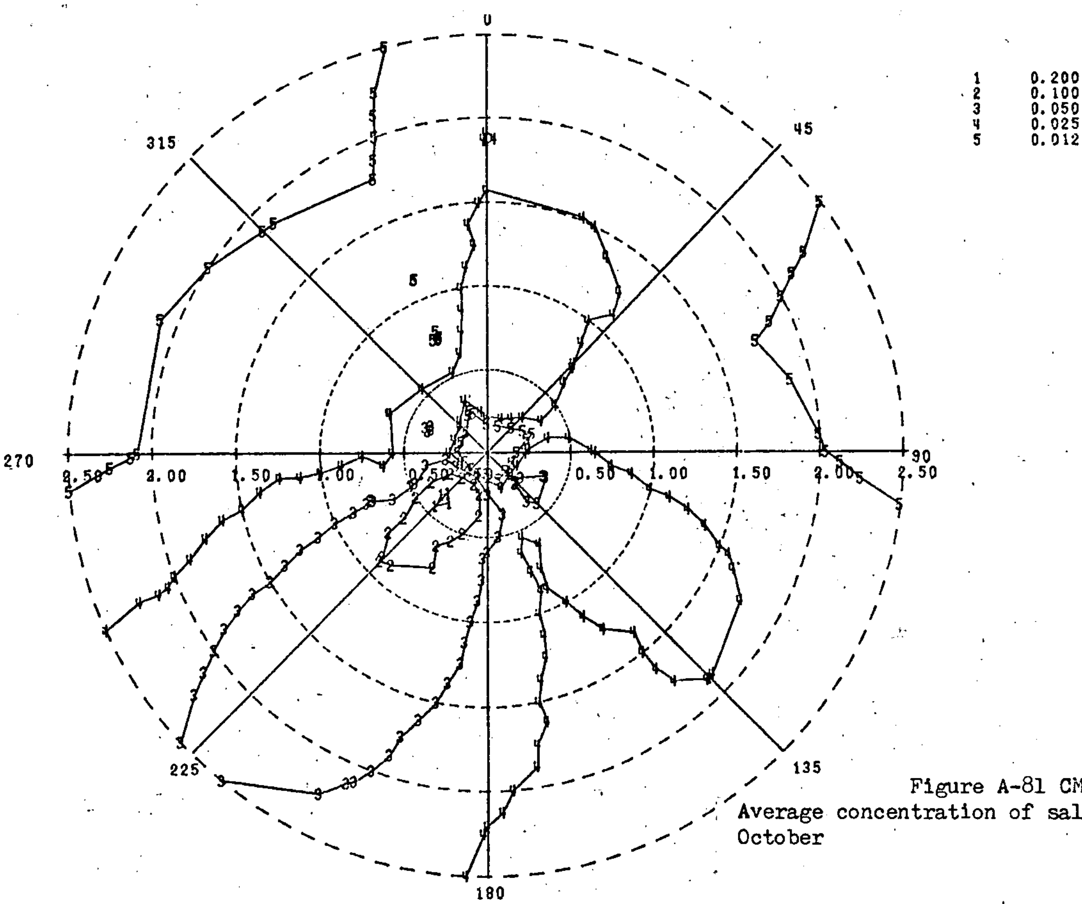


Figure A-81 CMDT
Average concentration of salt in air
October

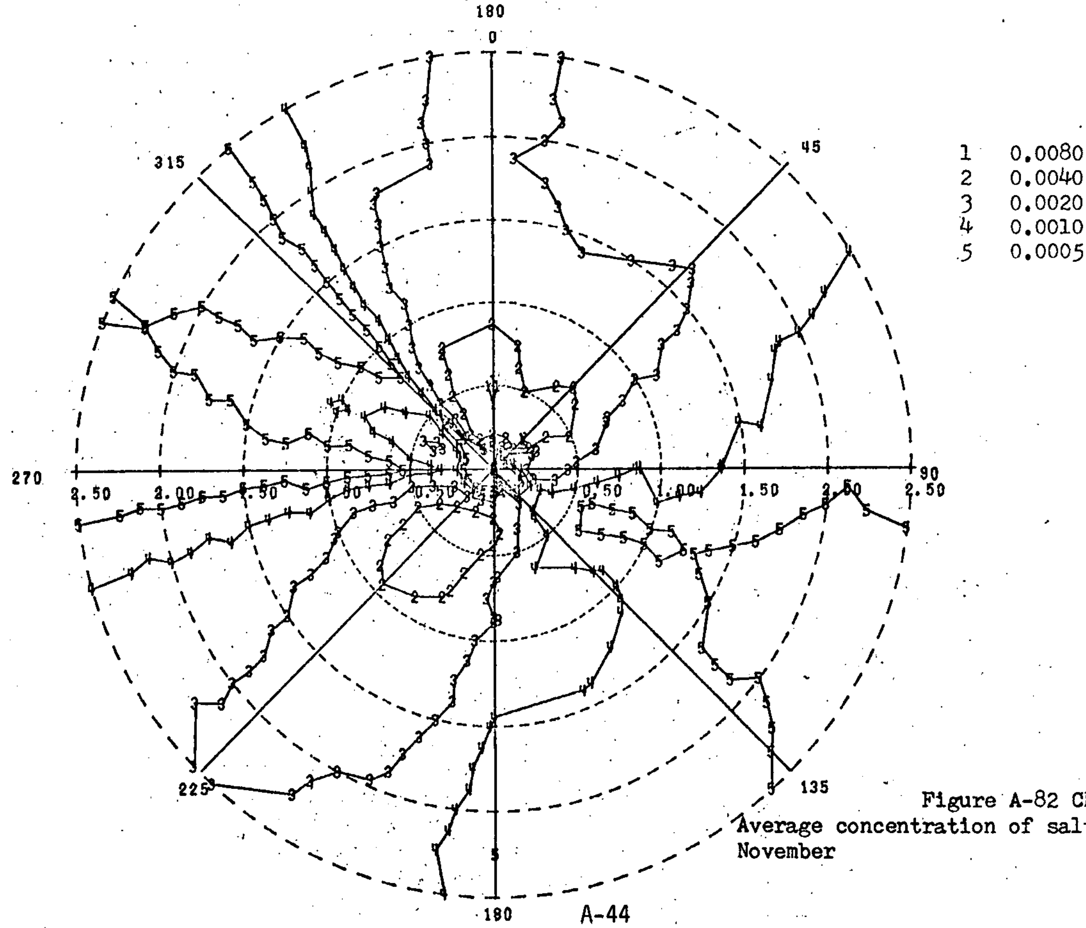


Figure A-82 CMDT
Average concentration of salt in air
November

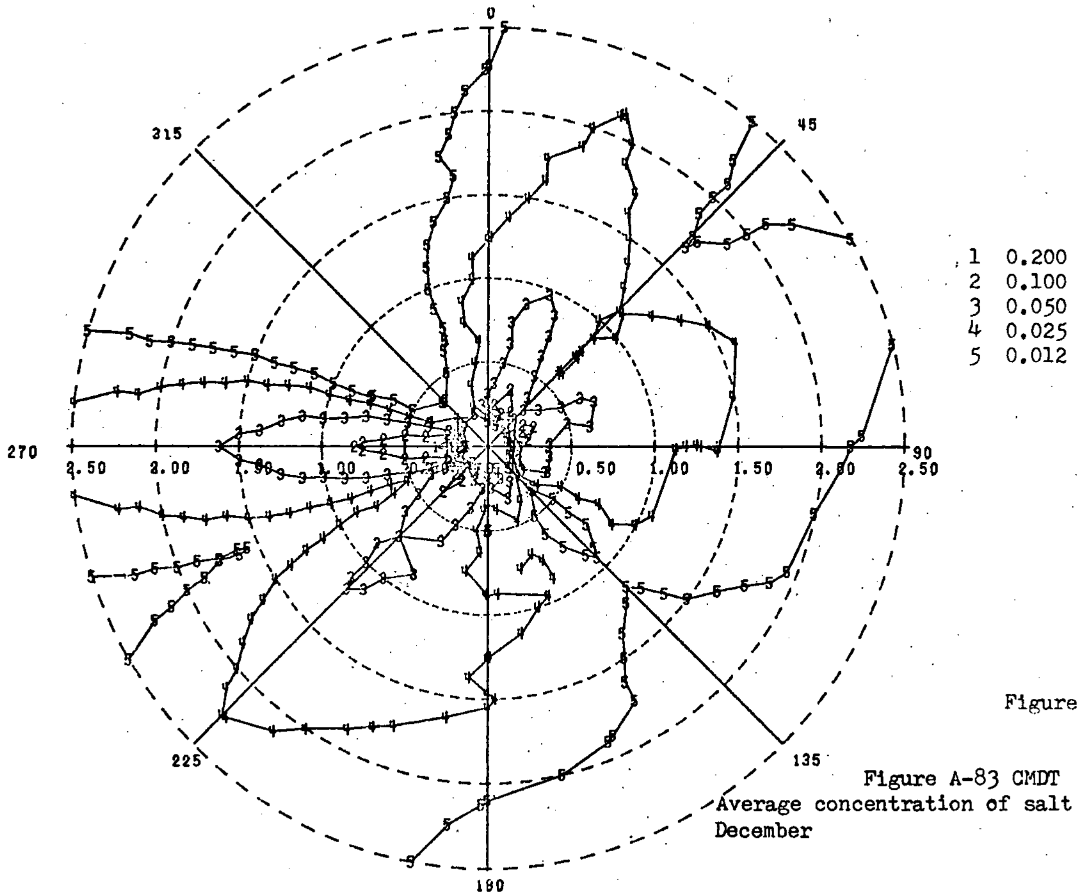


Figure A-83 CMDT

Figure A-83 CMDT
Average concentration of salt in air
December

Point Unit 2. We note that the staff's judgment is based on limited or no actual engineering data. As Con Edison stated in the report, "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2, Supplement, Vol. No. 1," dated August 6, 1975, both of these cooling systems are considered technically unproven cooling alternatives at the present time. We do not believe it prudent to consider them as alternatives for a backfit on a large operating plant. Although Con Edison will continue to follow technological developments in this area, it should be noted that any such alternative cannot be designed and constructed within the time constraints of the present license.

3. Village of Buchanan

Con Edison believes that a major deficiency in the Statement is its failure to discuss the very strong local opposition to cooling towers. The staff has been notified by officials of the Village of Buchanan and other elected officials of neighboring communities that there is widespread concern among people living in the vicinity of Indian Point concerning the environmental impacts of cooling towers. The staff is also aware that the Village of Buchanan has denied Con Edison's application for a building permit for the cooling tower and the

validity of that denial is now being determined by the N.Y. State courts. One sentence on page 6-39 refers to this "strong local concern". More attention to this extremely serious and potentially controlling problem would appear warranted.

4. Cost Analysis

There are several serious deficiencies in the staff's analysis of cooling tower costs. The most significant one is the staff's apparent misunderstanding of the two concepts of replacement energy and of replacement power (capacity). Additional operation of existing capability can provide replacement energy, not replacement power. In order to perform a benefit/cost analysis, values must be placed on both the loss of energy and the loss of capacity. The loss of energy is valued by computing the incremental fuel cost to the Con Edison system of replacing the energy. It is assumed for purposes of calculation that the energy can be generated at existing power plants. This assumption is made merely for purposes of calculation and is not a guaranty that such generation would be available. The staff appears to have agreed with Con Edison's computation of the value of replacement energy.

The lost capacity must be valued by the cost of construction of a generating facility to replace the capacity. It cannot be determined at this time precisely what type of generating capacity would be constructed at some time in the future. Presumably this would be a portion of a new base load facility. For purposes of the benefit/cost analysis, Con Edison valued the lost capacity on the basis of the cost of a gas turbine replacement, not because it in fact intends to buy such gas turbines, but because this capacity has the lowest capital cost and represented the least expensive generating source to produce a "conservative" number. The fact that Con Edison may not have to purchase a gas turbine in the summer of 1979 is irrelevant. This is a cost of the cooling tower system which will be incurred at some time and must be taken into account in any proper benefit/cost analysis.

Other shortcomings in the staff analysis include using inaccurate discount factor and inaccurate capital cost estimates.

5. Environmental Analysis

The staff presented an inaccurate analysis on several environmental issues dealing with cooling towers. For example, the staff has seriously underestimated the potential for

botanical injury resulting from the operation of cooling towers at Indian Point Unit No. 2. This underestimation appears to result from the staff's use of erroneous assumptions which led to a misinterpretation of the botanical study conducted by Boyce Thompson Institute. The staff has made similar questionable assumptions on the analysis of plume, drift, and noise.

6. Schedule for Implementing Cooling Tower Construction Program

The staff correctly stated that the May 1, 1979 date of License No. DPR-26 for termination of operation with the once-through cooling system has been postponed. (p. 4-3.) By letter dated January 8, 1976 (copy annexed), Con Edison submitted to the staff a revised schedule based on the then anticipated NRC schedule for processing the instant application. In that letter Con Edison said that its interpretation of the license condition resulted in a date for termination of once-through cooling at Indian Point 2 of February 1, 1980. Con Edison believes that the staff should express either its concurrence with the approach taken by Con Edison in deriving that date or indicate its basis for disagreement. The staff should address this matter in greater detail in the Final Environmental Statement although the exact length of the postponement cannot be definitively determined until all regulatory approvals have been received.

APPENDIX B

COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT

William J. Cahill, Jr.
Vice President

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

50-247

April 16, 1976

Director of Nuclear Reactor Regulation
ATTN: Director, Division of Site
Safety and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Consolidated Edison Company of New York, Inc. (Con Edison) respectfully submits its comments on the Draft Environmental Statement (the Statement) for selection of the preferred closed-cycle cooling system at Indian Point Unit No. 2, dated February 1976, prepared by the Office of Nuclear Reactor Regulation of the United States Nuclear Regulatory Commission. These comments are submitted pursuant to the notice of the Council on Environmental Quality in the Federal Register on March 5, 1976.

The comments are organized into two parts. The first contains Con Edison's principal comments on the Statement. The second part contains detailed comments and suggested corrections to the Statement.

Con Edison hopes that these comments will be of use to the Office of Nuclear Reactor Regulation in preparing the Final Environmental Statement.

Very truly yours,

William J. Cahill, Jr.
William J. Cahill, Jr.
Vice President

Enc.

3892

Part I - Principal Comments

1. General

The Office of Nuclear Reactor Regulation (the staff) has in general done a thorough job of analyzing environmental impacts and is to be commended for the extent of its independent investigations.

2. Selection of a Preferred Cooling Alternative

The staff concluded that, on the basis of the evaluation and analysis set forth in this statement, the Facility Operating License for Indian Point Unit No. 2 should be amended to authorize construction of a natural draft cooling tower as proposed by Con Edison (p. iv, Item 8). However, the staff has found that the relative merits of the fan-assisted natural draft and circular mechanical draft cooling towers "warrant further investigation" (p. 5-1, para. 1). This request for further investigation is inconsistent with the conditions of the license which require Con Edison to proceed with construction of the cooling tower. It is not clear what purpose would be served by such an investigation in view of the necessity to proceed with construction.

Con Edison disagrees with the staff on the assessment of the fan-assisted natural draft and circular mechanical draft cooling towers as feasible cooling alternatives for Indian

7. Impact of Natural-Draft Tower on Property Values

In connection with Con Edison's application for a zoning variance to the Village of Buchanan Zoning Board of Appeals, Con Edison requested three real estate appraisers familiar with property values in the communities surrounding Indian Point to prepare independent estimates of the impact of a natural-draft cooling tower on property values. The results of these three reports are inconsistent and inconclusive as to the magnitude of the impact but may be of interest to the staff in attempting to quantify esthetic impacts, although Con Edison does not believe that impacts on appraised values necessarily constitute full recognition of such esthetic impact.

The first appraiser concluded that the construction of a natural-draft cooling tower will not measurably reduce real estate values in the area. The second appraiser concluded that the market prices of residential property in the area would decline significantly, by approximately $22,755,000; there would be no reduction in the value of commercial and industrial properties. The third appraiser concluded that the adverse effects of the esthetics and plume would have no measurable impact on property values while the saline fallout would result in an estimated loss of $300,000.

Part II - Specific Comments

0-1. P. iii, Item 2: The description of the licensing condition is misleading because of omission of modifying conditions. If it is necessary to paraphrase the license conditions, we suggest the following would be more accurate (new material underlined):

> "Under conditions of the operating license (¶ 2.E) of the Facility Operating License No. DPR-26), the licensee is required to terminate once-through cooling at Unit No. 2 after an interim period, the reasonable termination date for which appeared at the time the license was issued to be May 1, 1979, and to operate thereafter with a closed-cycle cooling system, unless licensee can show that empirical data collected during this interim operation justifies an extension of the interim operation period or such other relief as may be appropriate."

0-2. P. iv, Item 5: It is suggested that the Advisory Council on Historic Preservation and the Village of Buchanan be asked to comment on the report.

0-3. P. iv, Item 8: The staff's conclusion is that a licensing condition should be imposed, requiring a determination of the significance of drift and salt deposition and botanical injury. This requirement is inconsistent with the staff's assessment that the salt drift impact was minor on-site and not important off-site (Table 7-1, p. 7-3).

1-1. P. 1-4, Footnote: The footnote is in error in implying that issues were resolved contrary to the wishes of Con Edison. The Commission's decision states that all parties were in agreement as to the disposition of the case.

1-2. P. 1-7, Line 7: Reference "5a" is not documented.

2-1. P. 2-13, Para. 2: "The staff considers the circular mechanical draft cooling tower to be a viable cooling option for Indian Point No. 2 despite the lack of data at operating units to validate computer modeling and wind tunnel tests." Con Edison disagrees with the staff on the above subjective assessment. Field data available on the only operational circular mechanical draft cooling tower (a 13-fan unit at Jack Watson Unit 5, Mississippi Power Company, Gulfport, Mississippi) indicated that the tower has failed to meet its thermal design criteria. (Oral conversation with tower manufacturer.) The tower will have to be backfitted with 3 additional fans in order to satisfy its performance guarantees. Until sufficient field data concerning thermal performance and environmental impacts are on hand for a realistic evaluation, the circular mechanical draft cooling tower should not be considered viable for Indian Point No. 2.

2-2. P. 2-14, Para. 5: "The staff considers the two types of FANDCTs

discussed above to be feasible for Indian Point Unit No. 2." This conclusion is not based on sound engineering justification. The staff failed to recognize the fact that those FANDCTs operated in Europe are either associated with plants smaller than Indian Point No. 2 or designed for part-time use. Since no actual performance data and no quantifiable basis for evaluating system reliability of FANDCTs capability of meeting the Indian Point Unit 2 design criteria, FANDCT should not be considered as feasible for Indian Point Unit 2 at this time.

3-1. P. 3-4, Para. 1: The staff has misinterpreted information furnished by Con Edison with respect to deratings for the fan-assisted natural draft cooling tower (FANDCT) and the circular mechanical draft cooling tower (CMDCT). The figures of 30 MWe and 38 MWe respectively, reported in the Statement represent the annual average total derating, not summer peak derating. See Supplement to IP-2 Cooling Tower Report dated April 6, 1975. Con Edison did not furnish data on summer peak deratings for these two alternatives. We have calculated those deratings as 65 and 69 MWe respectively, based on a 75°F peak ambient wet bulb temperature.

3-2. P. 3-13, Section 3.5.2: The total yearly average waste heat rejected to the Hudson River with the addition of a closed-cycle cooling system is not 120×10^6 Btu/hr; it should be 210×10^6 Btu/hr, which is the sum of 110×10^6 Btu/hr from the cooling tower blow-down and 100×10^6 Btu/hr from the service water system.

3-3. P. 3-14, Section 3.6, Para. 2: The statement "smaller sizes for the natural draft towers could be possible for the site" should be clarified by adding the following:

> "The specific natural draft cooling tower size will depend upon the final proposals submitted by the cooling tower vendors. The proposals will be evaluated on the basis of costs, environmental impacts, and other important factors. The 565-foot-high tower shown on Figure 3-1 was selected on the basis of preliminary evaluations. In general, a shorter tower, with a larger base area, requires added rock excavation during construction; a taller tower has certain benefits regarding dispersion characteristics."

4-1. P. 4-4, Para. 2: It is recommended that the following sentence be added to the end of this paragraph:

> "This requirement which was based on the license schedule described in Section 4.1 has, in accordance with EPA's regulations, been suspended pending an adjudicatory hearing."

4-2. P. 4-3, Section 4.2: This list of permits and regulatory approvals fails to include the Village of Buchanan building permit and the NY State air pollution permit. This failure is apparently based upon a recent decision of the Westchester County Supreme Court, a lower New York State court, which held that the U.S. Constitution prohibited the Village of Buchanan from interfering with the construction of a cooling tower. This New York State proceeding has not yet terminated because an appeal is pending.

5-1. Page 5-5, Section 5.1.3.1. The staff correctly notes that Con Edison's analysis of drift deposition was based on an assumed river salinity of 7,200 ppm. This was described as "a very conservative assessment of saline aerosol values." ER-CCC, IP-2, p. 6-15. This was intended as a "worst case" assessment. Con Edison used half this value, 3,600 ppm, to determine botanical injury for the month of August for the reasons stated by the staff. (See Figure 6.5, ER-CCC, IP-2, p. 6-18, which uses a drift salinity of 7,200 ppm corresponding to a river salinity of 3,600 ppm.) Since the staff used an August value of 5,000 ppm (Table 5-3), the staff has used a higher salinity value than Con Edison in assessing botanical injury.

The reference to Table 3-1 should be to Appendix B of ER-CCC, IP-2.

5-2. P. 5-11, Section 5.1.3.3.a: The ORFAD Program assumed a surrounding terrain of uniform elevation. This inapplicable assumption would underestimate the rate of ground drift deposition.

5-3. P. 5-12, Table 5-2: The 1.44 water/air ratio used by the staff seems too low for a natural draft cooling tower. In our opinion, this underestimates the impact of the cooling tower plume and drift deposition.

5-4. Page 5-13, Table 5-3: In evaluating monthly salinity, it is recommended that the more current river flow/salinity data as presented in ER, IP-3, Appendix EE, Figure 7, be used.

5-5. P. 5-20, Table 5-5: Fan diameter for circular mechanical draft cooling tower should be about 30 feet, not 10 feet as referred to by this table. (The staff reported a 33-foot fan diameter on p. 6-18.)

5-6. Pp. 5-28 to 5-37: The staff analysis has seriously underestimated the potential for botanical injury resulting from cooling towers at Indian Point Unit No. 2. This underestimation appears to result from the staff's use of the following erroneous assumptions and serious misinterpretations of the Boyce Thompson

Research Institute Botanical Study:

1) Staff mistakenly assumes that experimental exposures were made at relative humidities of 50% - 90%.

2) Staff mistakenly assumes that injury levels were equal within the range of 50% - 90%, but doubled at relative humidities above 90%.

3) Staff mistakenly assumes that chamber experiments were carried out with a background saline aerosol concentration of 1500 µg/m.

4) Staff mistakenly assumes that botanical injury would not result in chronically deteriorating biota, but would, instead, be infrequent and transient.

5) Staff mistakenly assumes that because two pathways of leaf contamination may exist, real saline injury thresholds may be greater than those reported by Con Edison.

5-7. P. 5-28, Para. 2: Con Edison has been advised by its botanical consultant that the staff assertion that saline drift injury to vegetation in the Indian Point environs will not lead to progressive deterioration of the biota is inaccurate. There is no reason why plants cannot exhibit chronic deterioration from the cumulative effects of both injurious and non-injurious atmospheric exposures. Each exposure need not be injurious. The aggregation of serial acute and chronic exposures causes plant deterioration. This effect may or may not be accompanied by observable foliar injury.

5-8. P. 5-28, Para. 5: Con Edison agrees that rainfall may wash salt from needles and leaves and reduce foliage injury from the non-absorbed aerosol. However, very light precipitation could increase injury by making soluble the deposited salt and providing a vehicle for penetration of salt into the needle or leaf.

5-9. P. 5-28, Para. 6: The staff asserts that results of screening indicate that only three species are sufficiently intolerant to be considered at risk. Other species may also be susceptible to some extent.

5-10. P. 5-28, Para. 7: Con Edison agrees with the staff that saline-induced symptoms do not imply that affected plants will die. However, partial or premature defoliation does adversely affect the subsequent growth and vigor of the tree, as well as its susceptibility to pathogens and destructive insects. Premature abscission of foliage from both coniferous and deciduous trees could produce abnormal effects such as reduced flowering and growth, and altered growth habitat, over a period of years. These

effects, although not necessarily lethal, are nevertheless significant.

5-11. P. 5-29, Table 5-8: The usefulness of the statistics presented in this table is questionable because:

1. The site of the staff survey cannot be readily determined from the Statement.

2. It cannot be determined whether only flowering dogwood and white ash, or all species of dogwood and ash were included in the survey. The statistics presented, therefore, may not represent a significant sample of the real totals for each species. (See also p. 22.)

5-12. P. 5-30, Para. 2: The appearance of foliar necrosis resembling "salt burn" and other air pollution injury is not unusual in any field survey. A pre-operational survey, therefore, might be of limited usefulness in determining apparently "healthy" vegetation upon which to measure the impact of saline injury.

5-13. P. 5-30, Para. 3: It would be more accurate to describe the position of the parafilm-covered deposition plates in the chambers as at a height close to the tops of the trees.

5-14. P. 5-30, Para. 4: The staff asserts that about twice the damage for the same amount of salt is caused when humidity above 90% exists as compared with the situation when humidity in the range of 50-90% prevails. The basis for this statement is not known, because a relative humidity of 90% was not used in the BTI studies; 50%, 70% and 85% values were used.

5-15. P. 5-30, Para. 5: The experimental difficulties described by the staff are, in fact, constraints which might be applied to all air pollution studies with controlled environment fumigation chambers. Because appropriate methods for tests under field conditions have never been devised, the great weight of data on which air quality standards have been based has come from this type of study.

The second sentence of this paragraph states that in the experimental chambers, the background aerosol content approached or exceeded 1500 $\mu g.m^{-3}$ of salt. The comment appears to be based on section 4.2.1 (page 35) of the BTI report, where it states that "the concentration of saline aerosol found in the chamber would be 2000 $\mu g\ Cl^{-} \times m^{-3}$ when the chamber was devoid of plants . . ." and ". . . measurements taken during the exposure period with plants showed a reduction of about 20% in aerosol concentration (i.e., a value of 1500-1700 $\mu g\ Cl^{-} \times m^{-3}$). These statements appear to have been taken to imply that there was a high background saline aerosol concentration. In reality, there was no background saline aerosol concentration. All saline aerosols in the chamber were produced by the spray nozzles.

5-16. P. 5-30, Para. 7 & 8: Because high background concentrations of non-deposited aerosols did not prevail in the chamber, the tests were run at the doses used, not at the dose plus some background amount. Under field conditions both deposition rate and amount of injury may be expected to increase due to effect of wind impaction of salt particles on foliar surfaces. Therefore, we believe the staff conclusion that Con Edison's "estimates of damage thresholds are highly conservative" is unjustified.

5-17. P. 5-30, Para. 9 and P. 5-31, Para. 1: Con Edison has been advised by its consultant that, for the following reasons, it is unlikely that two pathways of contamination exist:

1. The stomatal dimension would, in all likelihood, be too small to allow the direct penetration of saline aerosols. The size of ambient aerosols in the staff reference (Cassidy) was between 0.1 and 10 µm. For aerosols of cooling tower origin, much larger particles are expected. In the Boyce Thompson experiments, nearly 95% of the particles ranged in size from between 50-150 µm (Table 7, ER-CCC, Appendix E, IP-2).

2. The stomatal distribution on deciduous tree species of the type used in the Boyce Thompson experiments essentially precludes the possibility that saline aerosols could enter by direct deposition on the upper leaf surface. While tropical

plant species used by Cassidy have significant numbers of stomates on the upper leaf surface, stomates on the leaves of deciduous trees, however, are generally confined to the lower surface or leaf underside. It is the susceptibility of these species that is reported in the Boyce Thompson experiments.

Also, while stomatal dimensions are usually measured when the stomates are fully open, there are several factors which influence the degree and daily periodicity of openness under both field and chamber conditions. These factors include light, internal water relations of the leaf, and temperatures. Furthermore, not all of the stomates on a plant are necessarily open at the same time, and different stomates may differ markedly in their degree of openness at a given time. It thus becomes apparent that stomatal size could limit entry of even the small particles that Cassidy describes, much less those expected from a cooling tower.

3. Further evidence that salt does not necessarily enter stomata is shown in the response of individual leaves of trees exposed to saline aerosol. In cases where two adjacent leaves or leaflets overlap, injury often occurred only on the leaf being overlapped. It is postulated that an area of localized high humidity was created which hydrated any salt crystals on the upper surface so that more rapid foliar absorption could

take place. Therefore, one may expect that saline aerosols enter the leaf through the cuticle (perhaps through fissures) in the liquid state.

5-18. P. 5-31, Para. 2: Because the dose rate in the experimental chambers was approximately equivalent to the dose rate expected in the field, less injury should not be expected. Also, although it is true that some ions absorbed through leaves are translocated to the roots, there is evidence that sodium accumulates in roots, and chloride accumulates in the foliage. Foliar chloride tends to accumulate along the margins of leaves of monocotyledonous plants. It is also generally reported that chloride is the more toxic ion in the salt molecule, but there are also many reports of the toxicity of sodium to plants. If injury is less under conditions of chronic exposure, it is not because the salt has not translocated but, more likely, because it has been removed from the tissue by weathering or has reacted with cellular components to make it physiologically inactive.

5-19. P. 5-31, Para. 3: The statement that threshold values were selected from 90% relative humidity experiments is incorrect. In fact, relative humidity of 90% was not tested by BTI. The highest relative humidity tested was 85%, where injury was twice that at 50% relative humidity.

Because chamber experiments were never conducted at 90% relative humidity, there is no factual basis for the staff assertions that these experiments established conservative injury thresholds, (indeed, the actual thresholds are not yet known) and that injury has been overstated by a factor of two. Also, we note that the probability of a 14-day drought during the critical summer months is 0.4 per year. In contrast to the staff's assertion that a low probability of 14 rainless days exists, we maintain that 0.4 is a rather high drought probability. The staff's assertion that susceptible vegetation will survive ignores several important considerations:

1. Most plant species indigenous to the Indian Point environs have not been tested for saline drift susceptibility.
2. Injury to the susceptible species will have effects on subsequent growth, and tree vigor. Saline injury to hemlock produces dead branches and needles that are not replaced the following spring. Premature abscission of foliage from both coniferous and deciduous trees could produce abnormal effects such as reduced flowering and growth, and altered growth habits over a period of years.

Most importantly, the staff analysis does not incorporate a significant safety factor. Also, partial defoliation and occurrence of foliar salt burn appear to be acceptable to the staff even though these symptoms may not be acceptable to the 44.8% of property owners determined by the staff survey to be affected.

5-20. P. 5-31, Para. 6: Plant dormancy is unlikely to mitigate the injurious effects of saline drift since other pollutants can cause injury to conifers during dormant periods.

5-21. P. 5-34, Para. 3 and Para. 4: Statements contained in these paragraphs appear to be inconsistent and misleading. For example, although the staff states that land uses in the potential affected areas consist of "single family residences, manufacturing plants, and scattered woodlots," only residential ornamental vegetation is inventoried. The effect of saline drift on the three susceptible species known to be growing in woodlots a mile above and below the plant site are ignored in this analysis. Also, for the following reasons, the survey conducted by the staff is of limited usefulness in determining the ornamental impact and cost of saline drift in this impact area:

1. Because ornamental trees are inventoried en masse, the resulting percentages are not meaningful impact measurements: There appears to be no distinction between ornamental tree species. The result is that percentages of dogwoods are compared with percentage of hemlock. It would appear that the potential ornamental impact of saline drift could best be determined by percentage comparison between species that serve comparable purposes in the ornamental landscape. For example, the percentage of (flowering) dogwood should be compared to the percentage of flowering crab, or magnolia; the percentage of hemlock should be compared to the percentage of yew, juniper or spruce.

2. Replacement costs are known to vary with tree size, yet the staff survey presents no information on ornamental tree size classes. All are assumed to be 20' tall for analysis of replacement costs. This size distribution may be the most important variable in calculating the total replacement costs figure.

3. As previously discussed, an adequate safety factor does not seem to be incorporated into the staff analysis.

5-22. Replacement of sensitive ornamentals should be related not only to mortality, but also to diminished plant esthetic value, and abnormal growth effects resulting from partial defoliation.

5-23. P. 5-34, Para. 7: For reasons previously stated, Con Edison disagrees with the staff assertion that injury to susceptible species will occur only within the area bounded by the 200 Kg/Km^2 isopleth and that hemlock will "recover" the following spring following scattered "brownouts."

5-24. Although "scattered brownouts and "infrequent deaths" of susceptible ornamental vegetation may not be as visible to the public as "wholesale destruction", every such occurrence is likely to adversely affect individual property owners.

5-25. P. 5-34, Para. 9: Con Edison disagrees with the staff assertion that the risk of serious saline drift-induced injury to vegetation is confined to the immediate MDCT area. MDCT's pose a serious threat to the continued biological productivity of hemlock over residential and open space areas in the Indian Point environs. Complete restoration of injury to hemlock in these areas is not technically feasible.

5-26. P. 5-35, Para. 3: For the reasons previously stated, Con Edison disagrees with the staff assertion that our biological assessment of the potential for saline drift-induced botanical injury is "conservative."

5-27. P. 5-35, Par. 7: For reasons previously stated, Con Edison disagrees with the staff assertion that the statistic of 52 hemlocks per 100 households is necessarily useful in determining the ornamental impact in the Verplanck-Buchanan area.

5-28. P. 5-35, Para. 9: For reasons previously stated, Con Edison disagrees with the staff assertion concerning numbers of trees at risk, estimates of injury thresholds, and restoration potential.

5-29. P. 5-36, Section 5.2.2.7, Conclusion (3): Con Edison disagrees with the staff on this conclusion. It has been shown that the probability is relatively high - 40% - that drought conditions sufficient to cause a maximal saline injury will occur at Indian Point. On the average then, such conditions may occur every 2.5 years over the approximately 40-year plant life span. Cumulative injurious effects of the type described for hemlock would likely be visible as crown defoliation within groves or complete or partial defoliation of free standing trees within areas where high saline deposition rates are predicted. Visible

injury such as leaf spotting and premature abscission of foliage may normally be less pronounced for ash and dogwood; however, the cumulative impact of such effect may well be reduced flowering and reproduction, reduced growth, altered growth habit, and other abnormal effects over a period of years.

5-30. P. 5-36, Section 5.2.2.7, Conclusion (5): Con Edison disagrees with the staff on this conclusion. Botanical injury, especially to hemlock, is not predicted to be slight and/or non-existent; injured hemlock foliage will not recover in the spring. Effects of injury are predicted to be cumulative.

5-31. P. 5-36, Section 5.2.2.7, Conclusion (6): Con Edison disagrees with the staff on this conclusion. In fact, neither the total number of trees at risk, which are known to be both susceptible and indigenous to the area, nor the total number of trees at risk which may be both susceptible and indigenous, is known. Also, although the staff asserts that it may be both technically and monetarily possible to replace ornamental trees known to be at risk with less susceptible species, a similar operation would not appear possible for naturally occurring species found in parklands and open spaces in the Indian Point area.

5-32. P. 5-44 Para. 3: The staff compares the measured ambient A-weighted equivalent sound level, L_{eq}, with the A-weighted equivalent of the Buchanan property line noise limit, and concludes that the ambient noise exceeds local requirements (which are equivalent to L_{eq} = 48 dB(A) or L_{dn} = 54 dB). The source of the ambient noise has been identified as transportation vehicles (see page 5-45). Since the Buchanan noise ordinance objective is to limit continual noise from fixed facilities located in M-D districts, the ordinance is not applicable to regulating other community noise sources, such as vehicular traffic. (See Buchanan Zoning Code, §54-22 F(3)).

5-33. P. 5-45, Last Para.: The staff imposes three restrictions which it believes will make construction noise "not be unacceptable". However, the staff does not provide a noise analysis to justify these restrictions. The Con Edison analysis indicates that on-site construction noise emissions will not significantly change the surrounding community ambient equivalent noise level. Therefore, it appears to be unnecessary to impose the restrictions cited by the staff. Furthermore, off-site construction noise from motor vehicles is limited by the New York State motor vehicle noise emission regulations (see 6-53, ER-CCC, IP-2).

5-34. P. 5-47, Section 5.2.5.4: To evaluate the proposed closed-cycle cooling system impact, the staff compared estimated noise emissions with the measured ambient noise level only at the eleven discrete sites where Con Edison measured ambient noise levels. We do not believe this procedure is sufficiently objective. In our analysis, we evaluated the noise impact on all areas within 2,000 meters of a proposed tower, and could thus account for local ambient noise variations that depend upon relative distances from transportation arteries. The procedure we used evaluates the amount of land area for which there will be an expected change in noise due to the proposed cooling tower's continuous operation.

The Con Edison analysis determines the area for which each alternate cooling system would increase the existing community ambient noise level (Table 6-8, p. 6-59, ER, CCC Indian Point 2). However, the staff's discrete point analysis does not evaluate the overall extent of the community noise increase.

The staff states that the only violation of the Village of Buchanan noise code would be caused by linear mechanical draft-cooling towers. The Con Edison analysis shows the extent to which alternate cooling towers could be expected to exceed the Village of Buchanan noise limits (Supplement 1, ER-CCC, IP-2, p. 16-18).

5-35. P. 5-56, First 3 Paragraphs: The staff asserts that Ldn is a conservatively high offsite noise descriptor, because it is strongly influenced by nighttime ambient noise levels and is sensitive to nighttime noise level increases. We believe that it is necessary to evaluate changes (although minor) in nighttime noise caused by continuous operation of an alternate cooling system since use of the Ldn descriptor is recommended for environmental noise assessment by the USEPA (U.S. Environmental Protection Agency Report No. 550/9-74-004) and similarly permitted by the NRC (U.S. Nuclear Regulatory Commission Regulatory Guide 4.2 Revision 1). Furthermore, Table 5-10 of the staff's report shows only a 1-3 dB difference between daytime equivalent noise levels (L_{eq}) and L_{dn} levels, which illustrates the minor influence nighttime noise affects L_{dn} levels in the community surrounding the site.

5-36. P. 5-68, Para. 7: The staff states the issuance of a new NPDES permit will require review of chlorine discharges to see if lower than guideline limits are required. This is not necessarily the case. If the discharges comply with existing license conditions, a new NPDES permit may not be required.

The staff correctly states that the proposed maximum chlorine concentration of the blowdown (less than 0.5 ppm free available Cl_2) could be higher than that permitted by the existing ETS (0.5 ppm maximum total residual). However, the IP-2 cooling tower blowdown should not exceed these limits for available chlorine, whether total or free. Since the condenser will be chlorinated 1/3 at a time, there will be an insignificant residual because the chlorinated portion will be diluted with the unchlorinated portion. Furthermore, the water is aerated in the tower which should minimize, if not eliminate, the residual chlorine.

6-1. P. 6-1, Section 6.2.1, Item 3: The cost described in this item should include two components: (1) cost of replacing deficient energy and (2) cost of replacing capacity. Additional operation of existing capability can only provide replacement energy, not replacement power (capacity). (See Part I, comment 4, above.)

6-2. P. 6-1, Section 6.2.1, Item 4: The downtime cost is not only the cost of providing replacement energy, but also the cost associated with the loss of reliability incurred by the system during the outage period.

6-3. P. 6-2, Line 15: The use of a discount factor derived from the average rate of return for investor-owned utilities for an economic analysis of a specific utility is invalid, when data applicable to the specific utility are available.

6-4. P. 6-3, Section 6.2.2.2: In cost estimates, the staff has discounted the costs to a present value in 1976 while Con Edison discounted to a present value in 1974. Also, the staff annualized the costs over the twenty-eight-year period from 1976 to 2003, while Con Edison annualized the costs over the twenty-four-year period from 1980 to 2003, which is the period during which the cooling tower would be in operation. It is recommended that the staff should either perform the estimates on the identical time basis used by Con Edison or specify these differences in the text to avoid confusion when comparing the two independent cost analyses.

6-5. P. 6-6, Last 3 Paragraphs: The staff suggests that the loss of 63 MW of capacity at peak should not be considered, as it would not result in "lowering the reserve to an unacceptable level". This is a misunderstanding of Con Edison's argument

(see Part I, comment 4, above). The reduction in capability is a cost of a closed-cycle cooling system which must be taken into account in a proper benefit/cost analysis.

6-6. P. 6-10, 2nd Paragraph from bottom: The discussion should not ignore the fact that it is extremely doubtful that the firm purchase alternative would be available to Con Edison.

6-7. P. 6-11, "Case 3: Winter Outage": The staff should be more specific on the referred "winter outage scenario" which must be established on a realistic construction schedule. A "Winter Scenario" would require "replacement energy". It would not "maintain system reliability", as it would reduce the corresponding reserve over the winter period, although with a smaller impact than in the case of a summer outage. A winter tie-in could lead to a need to delay maintenance outages and cause the performance of some units to deteriorate. Postponing the cut-in to a later winter period would be beneficial as compared to the May 1, 1979 date, but it would not be without some effect on reliability, and would certainly not "cancel the need for replacement energy" during the tie-in. The same comment applies to the description of Case 3, in the Summary of Page 6-24 (Section 6.2.7).

6-8. P. 6-4, Table 6-1: The capital cost estimate for a natural-draft cooling tower has been revised by Con Edison and was submitted to the staff on June 6, 1975 (refer to Con Edison's "Environmental Report To Accompany Application for Facility License Amendment for Extension of Operation With Once-Through Cooling for Indian Point Unit No. 2" p.4-11). It is recommended that the revised cost estimates be used.

6-9. P. 6-25, Table 6-17: The derivation of the cost of installing 900 MW of gas turbines ($21,271,000, annualized) in Case 2 is unclear, since the reference calculation on p. 6-11 for Case 2 produces $33,438,000.

6-10. P. 6-34, Line 3: The planned 80-acre recreation area on the site will be reduced considerably if a closed-cycle cooling system is implemented.

6-11. P. 6-39, Para. 2: It is highly speculative to generalize that "during the winter the slight warming of the air as the sun rises in the sky will decrease the relative humidity sufficiently to greatly reduce the visibility of the plume."

6-12. P. 6-40, Fig. 6-1: The viewshed map is unclear and has no key.

6-13. P. 6-53, Line 11 from bottom: The staff's reference to cooling tower noise abatement devices is unwarranted, since the staff has not identified practical and feasible noise abatement devices which could be incorporated into all cooling alternatives, in particular the natural-draft cooling tower. In response to the staff's question concerning sound mitigative measures, Con Edison stated that there is no readily available, proven technology of noise abatement for natural-draft cooling towers (Supplement, ER, CCC IP-2, p. 16).

7-1. P. 7-1, Section 7.2: It is our understanding that the purpose of the Statement is to analyze the economic and environmental assessments of various cooling alternatives so that an appropriate conclusion could be reached on selecting the preferred system that should be built if one is ultimately determined to be necessary. Thus the Statement fails to reflect the limited "proposed action" involved in Con Edison's December 2, 1974 application.

7-2. P. 7-1, Section 7.3: "The staff concludes that the irreversible and irretrievable commitments are appropriate for the benefits to be gained." Con Edison considers this conclusion inappropriate in this Statement for the reasons given in comment 7-1 above.

The Statement contains no benefit/cost analysis to support this conclusion, and indeed contains only the most cursory reference to the alleged benefits of closed-cycle cooling systems. We agree with the staff that a discussion of such benefits is not required in this Statement, but believe it follows that these conclusions must be deleted.

7-3. P. 7-1, Section 7-4: For the several reasons stated above, Con Edison believes that the range of cost for natural draft, fan-assisted natural draft and circular mechanical draft cooling tower systems is substantially greater than the 3% estimated by the staff.

William J. Cahill, Jr.
Vice President

ATTACHMENT

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

January 8, 1976

Mr. Ben C. Rusche, Director
Office of Nuclear Reactor
Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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

Dear Mr. Rusche:

This letter is in reference to the letter to you dated December 9, 1975 from Sarah Chasis and Ross Sandler as attorneys for the Hudson River Fishermen's Association, concerning my letter to you dated November 17, 1975.

In its December 9 letter, HRFA's principal point appears to be that Con Edison will not suffer any "irreparable harm" if the Company is required to terminate operation of Indian Point 2 with once-through cooling on May 1, 1979. This is not only an irrelevant consideration under the terms of License No. DPR-26 but it is also a highly inaccurate statement.

Paragraph 2.E(1)(b) of License No. DPR-26 specifically provides that the May 1, 1979 date shall be postponed in the event that all regulatory approvals are not obtained by December 1, 1975 if Con Edison has acted with due diligence. Con Edison is not required to show "irreparable harm" as a basis for the postponement. In ALAB-188 the Appeal Board stated the basis for this license condition:

> "Although the applicant must act with due diligence in carrying out its responsibilities . . . it is beyond dispute that the applicant cannot control the time required for regulatory actions. And, moreover, we are not endowed with the powers of clairvoyance which would enable us to know how those matters will

be resolved or when. Thus, a fundamental point which should be understood is that the reasonableness of the construction schedule has to be judged on its own merits and the necessary time provided . . . . In view of the uncertainties which surround the events over which the applicant has no control, tying the completion of construction now to some date certain in the future would not appear to be correct." RAI-74-4 at 389.

Con Edison has been proceeding in good faith and with due diligence with the cooling tower program as required by the terms of License No. DPR-26 and ALAB-188 even while pursuing its continuing ecological research efforts to determine whether or not a closed-cycle cooling system is necessary. Con Edison has completed its studies of the environmental effects of cooling towers, has analyzed the available data and submitted a report on December 2, 1974 containing its recommendation for a natural-draft cooling tower system. It has also studied the engineering concepts of closed-cycle cooling systems and has completed substantial engineering and design work.

"Irreparable harm" would be incurred by Con Edison if it were to proceed any further with this program prior to completion of regulatory reviews. As noted in HRFA's letter, the next steps in the construction program are finalizing designs, obtaining bids for site preparation, incorporation of comments of agency reviews and awarding contracts for cooling towers. It is simply not possible to finalize designs, obtain bids for construction, etc., unless the basic closed-cycle cooling system has been identified and approved so that Con Edison knows what it is to design and construct. As the Appeal Board recognized, this work should not proceed in the absence of regulatory approvals of the closed-cycle cooling system proposed by Con Edison.

To proceed otherwise would create a substantial risk to the Company and its ratepayers in making expenditures for construction of a system which may not be authorized by

the cognizant agencies in accordance with the requirements of License No. DPR-26 and applicable laws and regulations. Moreover, Con Edison cannot properly negotiate with suppliers when the suppliers are aware that there is a substantial probability that the project may be altered. Vendors incur substantial expenditures in reviewing detailed specifications and submitting bids, and it is not consistent with prudent procedure for a construction project of this magnitude to request them to perform such work when there is a strong possibility that the basic design of the cooling tower may change.

HRFA's reference to Figure 4.2 of the Cooling Tower Report demonstrates a fundamental misunderstanding of that figure. Figure 4.2 shows Con Edison's alternative schedule for potential cooling tower system construction following completion of ecological studies. The regulatory review which is completed after commencement of the activities to which HRFA referred (Item 1438 on Figure 4.2) is regulatory review of the ecological studies, not regulatory review of the approval of the closed-cycle cooling system alternative. In Figure 4.2 the evaluation by regulatory agencies of the Cooling Tower Report is scheduled, as it is in Figure 4.1, for completion by December 1, 1975 (Item 1936 on Figure 4.2).

In its December 9 letter HRFA also states that permits from the Village of Buchanan and the State of New York are not required because of a decision of the New York State Supreme Court, Westchester County. It is elementary that a judicial decision is not final until all rights to appeal have been exhausted or have expired by lapse of time. As the authors of the December 9 letter well knew, the Buchanan Zoning Board's time to appeal this decision had not yet expired when the December 9 letter was written. On January 2, 1976, the attorneys for the Buchanan Zoning Board filed a Notice of Appeal to the Appellate Division of the Supreme Court. Further appeals are thereafter possible to higher courts. Con Edison should not be required to make expenditures and commence negotiations with suppliers on the basis of a judicial decision which is not final.

The last argument in the December 9 letter appears to be that the NRC, if it agrees with Con Edison's position, is somehow bestowing a benefit on itself which it cannot do on the basis of its own failure to act. This is a strange argument because the rights involved are those of Con Edison, not those of the NRC Staff. Con Edison has no knowledge of the reasons for the NRC Staff's delay in this matter apart from the obvious need to comply with the requirements of NEPA. In any event, the terms of the license make it clear that Con Edison is entitled to an extension of the May 1, 1979 date if all regulatory approvals -- including that of the NRC -- are not received by December 1, 1975.

For the reasons stated above, HRFA's letter of December 9, 1975 should be disregarded. Moreover, on the basis of the new target schedule established by Mr. Knighton in his telephone call of December 12, 1975, the Final Environmental Statement concerning Con Edison's December 2, 1974 application for approval of a preferred closed-cycle cooling system is now scheduled to be published on April 15, 1976. The Commission's regulations contemplate that no licensing action will be taken less than 30 days after availability of the Final Environmental Statement. Since the NRC may not issue a final order on Con Edison's application prior to May 15, 1976, the reasonable date for terminating once-through cooling for Indian Point 2 must now be deemed to be further extended by an additional 12 weeks to February 1, 1980. (An additional two weeks' winter lag is created because site preparation is shown as completed on November 15 and it is not feasible to start major foundation work in the two-week interval before December 1.) A revised schedule taking into account this additional delay is attached.

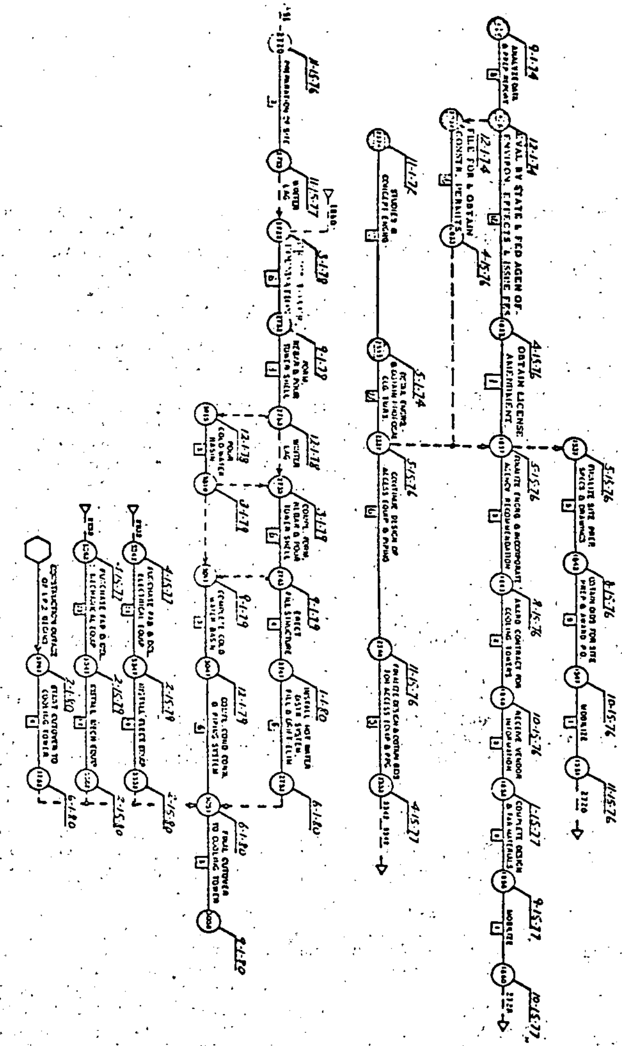
Finally, Con Edison continues to urge the Staff to accelerate its review of Con Edison's June 4, 1975 application for an extension of the period of once-through cooling to May 1, 1981. For the reasons stated in my November 17, 1975 letter, Con Edison considers unduly distant the new April 30, 1976 target date established by the Staff for issuance of the FES concerning this application.

Sincerely yours,

William J. Cahill, Jr.

William J. Cahill, Jr.
Vice President

Attachment



"NRC LICENSING SCHEDULE" WITH
F.E.S. ON 4-15-76 AND AMENDMENT ON 5-15-76

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

APR 14 1976

RECEIVED
APR 16 1976
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

50-247

Mr. Voss Moore
Assistant Director for
Environmental Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Moore:

The Environmental Protection Agency has reviewed the draft environmental impact statement issued by the Nuclear Regulatory Commission on the Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2 located in Westchester County, New York. Specific comments are attached.

The EPA believes that the proposed replacement of the once-through cooling system with a closed-cycle cooling system will have benefits which far outweigh potential adverse impacts. The large volume flows required by once-through cooling would be substantially reduced by a closed-cycle cooling system, and in turn, biotic effects due to entrainment, impingement, thermal shock, gas bubble disease, etc. would be proportionally reduced.

The major environmental effects of cooling towers considered in the draft statement are deposition of salt, fogging and icing conditions, and increased noise levels. We agree that none of these factors is likely to be of sufficient magnitude to cause rejection of any of the cooling tower alternatives.

In light of our review and in accordance with EPA procedure, we have designated this draft statement as category LO-2, indicating that EPA lacks objection to the project as proposed (LO) and has requested additional information in order to complete its evaluation (2).

Thank you for the opportunity to review this impact statement. If you have any questions concerning our comments, please feel free to contact this office at (212) 264-8556.

Sincerely yours,

Barbara M. Metzger

Barbara M. Metzger
Chief
Environmental Impacts Branch

3869

SPECIFIC COMMENTS

RADIOLOGICAL DOSE ESTIMATES

The draft statement presents both the applicant's and the NRC's estimates of radioactive liquids released by Indian Point's Units 2 and 3 with Unit 1 not in operation. Based on these estimates, the NRC has stated that such releases will be below the limits set in 10 CFR Part 20, "Standards for Protection Against Radiation." Radiological dose estimates for fish consumption and swimming have also been made by the NRC. The NRC has concluded that these doses are "negligible in comparison with the background levels of radioactivity." Since the design base objectives of 10 CFR 50 (Appendix I) have been promulgated for light water reactor operations, EPA suggests that all estimated doses resulting from such operations be compared to these limits.

NOISE IMPACTS

EPA believes that noise impacts should not be of significant magnitude to cause rejection of any of the cooling tower alternatives. However, before a final determination can be made of the noise impact that closed-cycle cooling towers can have on the surrounding community the following information should be provided in the final statement:

1. The discussion of ambient noise levels should include descriptions of the equipment and methodology used to perform the survey. Sampling sites should also be described and the distances to dominant noise sources indicated. Any sampling location influenced by construction related noise should be clearly identified.

2. The environmental statement compares the ambient acoustic environment to the limits established by the Buchanan zoning ordinance which is directed at limiting noise from point sources in industrial and commercial zones to residential zones. Since many of the sites surrounding Indian Point are identified in the draft statement to be in violation of this ordinance, the conditions under which the Buchanan zoning ordinance is applicable should be identified. Also since such ordinances are directed at controlling noise from point sources, relevant noise measurements should be made in the absence of non-point sources such as traffic.

3. The methods used to estimate construction noise impacts should be included in the final statement. If it has been determined that noise from the construction site will have no significant impact, it would be appropriate to give a worst-case projection for the nearest noise sensitive location. Noise levels expected from blasting, and the duration of exposure to these noise levels should be discussed.

4. The draft statement gives a good description of the projected operational noise levels. However, a map which shows clearly the surrounding land uses would be helpful if included in the final statement.

IMPACT ON BIRDS

Tall structures, such as natural draft cooling towers, are potential obstructions to night-flying and migratory birds. The literature contains a number of references to bird mortalities from television towers and ceilometers,[1,2] and preliminary evaluations of hazards of cooling towers are underway.[3] These evaluations indicate that cooling towers do not present as great a hazard to birds as do guy wires of television towers. However, more studies are needed to establish precise bird mortality rates at cooling towers. We believe that the final statement should discuss the potential for bird mortalities at Indian Point, and correlate migratory bird patterns and weather conditions to potential bird mortality rates.

ECONOMIC IMPACTS

EPA believes that the following factors should be considered in the final statement in order to better define the economic impact of alternative closed-cycle cooling systems:

1. Projected incremental plant and system costs should be determined in mills per kilowatt-hour and compared to total plant and system generating costs. This comparison would allow the economic impact to Con Edison rate payers to be determined.

2. The capital cost of gas turbines appears to be greatly overestimated. For example, NRC's final impact statement on Indian Point Unit No. 3, dated February 1975, estimates a cost of $215/Kw in 1981 dollars while this draft statement uses a 1979 cost of $315/Kw. The reason for this difference should be explained.

3. The draft impact statement states that Con Edison anticipates that Unit 2 would not operate during the seven-month downtime period (5/1/79 - 12/1/79) required for the tie-in of closed-cycle cooling system. According to EPA sources, plant downtime for the cooling system tie-in should not exceed 2-3 months, including the 2 month refueling outage. The need for a seven-month downtime should be explained.

4. The draft statement includes property and gross revenue taxes in its estimates of annual carrying charges. However, the Atomic Safety and Licensing Board, in its Initial Decision for Indian Point Unit 2, dated September 9, 1973, determined that taxes should not be used in determining carrying charges on capital, since such taxes represent transfers within the economy. This situation should be corrected and explained.

5. Annual average and peak unit deratings are based upon the unit's present capacity of 873 MWe net, whereas cooling tower design parameters are based on a future capacity uprating to 1033 MWe net (using a once-through cooling system). We recommend that all pertinent cooling system parameters be based on the same capacity.

References

1. Kemper, C. A. A Tower for TV-30,000 Dead Birds. Audubon. March-April 1964.

2. Howell, J. C., et al. Bird Mortality at Airport Ceilometers. Wilson Bulletin. Vol. 66:207. 1954-55.

3. Bird Mortality, Fall 1973, Davis-Besse Site. Environmental Studies Center, Bowling Green University. Internal Report. 1973.

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

MAR 22 1976

RECEIVED
MAR 25 1976
U.S. NUCLEAR REGULATORY COMMISSION

Mr. George W. Knighton
Chief
Environmental Projects Branch No. 1
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Knighton:

This is in response to your letter dated February 23, 1976, requesting comments on the NRC Draft Environmental Statement (DES) related to the proposed issuance of a construction permit to the Consolidated Edison Company of New York (Con Ed) for the construction of a natural draft cooling tower for its Indian Point Unit No. 2 (Docket No. 50-247), located at Indian Point, Village of Buchanan, Westchester County, New York State.

The operating license for Indian Point No. 2 required termination of once-through cooling by May 1, 1979; thereafter the unit was to be operated only in conjunction with a closed-cycle cooling system. Amendment No. 6 to the license permits the May 1, 1979, date to be delayed. It is currently expected that conversion to closed-cycle cooling will occur at a later date than originally specified.

These comments by the Federal Power Commission's Bureau of Power staff are made in compliance with the Guidelines of the Council on Environmental Quality, under the National Environmental Policy Act and are directed to the effect of shutting down Indian Point No. 2 for completion of the closed-cycle cooling facilities. In preparing these comments the staff has considered the Draft Environmental Statement, related reports made in accordance with the Commission's Statement of Policy on Reliability and Adequacy of Electric Service (Docket No. R-362), and other information available to the staff.

According to the DES, the closed-cycle cooling systems proposed by Con Ed is a natural draft cooling tower, which is expected to have the following effects:

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

2980

a) the generating capability of Indian Point No. 2 would be reduced by 25 megawatts from the unit's 873 megawatt design electrical rating, under normal ambient temperature conditions.

b) Indian Point No. 2 capability would be reduced by 63 megawatts, from the 873 megawatts rating, under summer conditions of high ambient temperature.

c) Indian Point No. 2 will be taken out of service for seven months to connect the cooling tower facilities to the unit's cooling system.

Staff believes that the seven-month outage, if it encompassed the summer peak load period of Con Ed, could have an undesirable effect on the bulk power supply system of Con Ed and the New York Power Pool (of which Con Ed is a member). The reliability of the Pool is affected by the reliability of each member. The Con Ed system is the largest in the Pool and has a significant effect on Pool reliability.

The NYPP criterion for reliability specifies that each member is to maintain an installed capacity reserve margin of 18 percent above peak load. Diversity between summer-peaking and winter-peaking member systems in the Pool will then result in an overall Pool reserve margin of about 20 percent. As shown by Table 1, Con Ed's reserve margin with Indian Point No. 2 unavailable would be less than the 18 percent level in 1980 and 1981 if its annual load growth is as projected in the DES. If the annual rate of load growth is only one percent greater than projected by the DES, the reserve margin would be significantly less than 18 percent in each of the years 1979 through 1984. Table 2 shows that with Indian Point No. 2 unavailable, the Pool reserve will be above the 20 percent minimum if Pool load growth is as projected in the DES. However, if Pool annual load growth is one percent greater than projected, the Pool reserve margin without Indian Point No. 2 would be less than the 20 percent level in 1980 and 1981.

The reserves of Tables 1 and 2, with Indian Point No. 2 unavailable, include the capacity of Indian Point No. 1. The DES projects IP-1 as returning to service in 1978 at a capability of 257 megawatts. However, the Nuclear Regulatory Commissions (NRC) publication "Operating Units Status Report" for February 1976 (NUREG 0020-2) states that no decision has been made on the future operation of IP-1. Therefore it is appropriate to consider the New York Power Pool reserves shown in Table 2 under the heading "Indian Point No. 1 and No. 2 Unavailable." These reserves indicate that the Pool margin would be sufficient if the load growth postulated by the DES actually obtains, but would be insufficient in 1980 and 1981 if the load growth were one percent greater annually.

In view of the foregoing considerations, we think it would be prudent to consider taking Indian Point No. 2 out of service in the summers of 1980, 1981, or 1982 only if Con Ed makes arrangements with the Pool for delivery of firm capacity sufficient to meet its load and reserve obligations. Alternatively we believe Con Ed should seek to purchase capacity elsewhere or install peaking capacity units.

Another alternative would be to perform the necessary work during the period October through April. Tables 3 and 4 show that the winter peak demand for Con Ed and for the New York Power Pool is projected to be significantly less than the summer demand. The reserve margin would then be higher in winter than in summer and the stated reliability criteria would not be compromised.

Very truly yours,

W. Ridgway

W. Ridgway
Chief, Bureau of Power

Attachments

Table 1

CONSOLIDATED EDISON COMPANY
PROJECTED SUMMER PEAK LOAD GROWTH
1979 - 1984

	1979	1980	1981	1982	1983	1984
Capacity Available1/ (MW)	12696	12651	13126	13752	14821	14704
Estimated Peak Load2/ (MW)	9700	10075	10450	10825	11175	11650
Reserve (%)	30.9	25.6	25.6	27.0	32.6	27.3
Peak Load 1% Higher3/ than estimated (MW)	10156	10631	11110	11593	12055	12646
Reserve (%)	25.0	19.0	18.1	18.6	22.9	16.3
Indian Point No. 2 Unavailable:						
Reserve with estimated peak load2/ (%)	21.9	16.9	17.3	19.0	24.8	18.7
Reserve with 1%3/ higher peak load (%)	16.4	10.7	10.2	11.1	15.7	9.4

1/ Installed capacity including Indian Point Units No. 1, No. 2 and No. 3 plus net of external purchases and sales, as reported in Draft Environmental Statement p. 6-7.

2/ Draft Environmental Statement p. 6-7.

3/ Load growth 1% higher than expected, beginning in 1975, with 1974 as the base.

NEW YORK POWER POOL
PROJECTED SUMMER PEAK LOAD GROWTH
1979 - 1984

	1979	1980	1981	1982	1983	1984
Capacity available1/	33171	33396	35932	38182	40506	42841
Estimated Peak Load2/ (MW)	25300	26360	27540	28720	29980	31160
Reserve (%)	31.1	26.7	30.5	32.9	35.1	37.5
Peak Load 1% higher3/ than estimated (MW)	26460	27782	29237	30704	32264	33755
Reserve (%)	25.4	20.2	22.8	24.3	25.5	26.9
Indian Point No. 2 Unavailable:						
Reserve with estimated peak load2/ (%)	27.7	23.3	27.3	29.9	32.2	34.7
Reserve with 1% higher3/ peak load (%)	22.1	17.1	19.9	21.5	22.8	24.3
Indian Point No. 1 and No. 2 Unavailable:						
Reserve with estimated peak load2/ (%)	26.6	22.4	26.4	29.0	31.3	33.9
Reserve with 1% hgiher2/ peak load (%)	21.1	16.1	19.0	20.7	22.0	23.6

1/ Installed Capacity including Indian Point Units No. 1, No. 2 and No. 3 plus net of external purchases and sales, as reported in Draft Environmental Statement p. 6-9.

2/ Draft Environmental Statement p. 6-9.

3/ Load growth 1% higher than expected beginning in 1975, with 1974 as the base.

CONSOLIDATED EDISON COMPANY
PEAK DEMAND
(reported for 1965-1974; projected for 1975-1984)*

Year	Summer (MW)	Following Winter (MW)	Summer Less Winter (MW)	Ratio Winter Summer (%)
1965	5710	4859	851	85.1
1966	6154	5120	1034	83.2
1967	6147	5313	834	86.4
1968	6960	5441	1519	78.2
1969	7266	5789	1477	79.7
1970	7041	5869	1172	83.4
1971	7719	5988	1731	77.6
1972	78.72	6104	1768	77.5
1973	8220	5898	2322	71.8
1974	7973	5898	2075	73.9
1975	8600	6050	2550	70.3
1976	8800	6200	2600	70.4
1977	9100	6375	2725	70.1
1978	9400	6575	2825	69.9
1979	9700	6800	2900	70.1
1980	9625	6625	3000	68.7
1981	9950	6850	3100	68.8
1982	10250	6900	3350	67.3
1983	10425	7125	3300	68.3
1984	10750	7350	3400	68.4

*Data from 1975 Report of the member corporations of the New York Power Pool and the Empire State Electric Energy Research Corp. pursuant to Article VIII, Section 149-b of the N.Y. Public Service Law, Vol. 2 App. D.

NEW YORK POWER POOL
COINCIDENT PEAK DEMAND
(reported for 1965-1974; projected for 1975-1984)*

Year	Summer (MW)	Following Winter (MW)	Summer Less Winter (MW)	Ratio Winter/Summer (%)
1965	12679	12962	-263	102.2
1966	13609	13937	-328	102.4
1967	14119	14462	-343	102.4
1968	15499	15211	288	98.1
1969	16716	16028	688	95.9
1970	17037	16675	362	97.9
1971	18146	16774	1372	92.4
1972	18943	17709	1234	93.5
1973	20408	17313	3095	84.8
1974	19589	17429	2160	88.9
1975	21100	19130	1970	90.7
1976	22180	20090	2090	90.6
1977	23250	21020	2230	90.4
1978	24230	21910	2320	90.4
1979	25300	22930	2370	90.6
1980	26360	24130	2230	91.5
1981	27540	25240	2300	91.6
1982	28720	26360	2360	91.8
1983	29980	27800	2180	92.7
1984	31160	29000	2160	93.1

*Data from 1975 Report of the member corporations of the New York Power Pool and the Empire State Electric Energy Research Corp. pursuant to Article VIII, Section 149-b of the N.Y. Public Service Law, Vol. 2 App. D.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
NEW YORK AREA OFFICE
666 FIFTH AVENUE
NEW YORK, NEW YORK 10019

REGION II
26 Federal Plaza
New York, New York 10007

APR 22 1976

IN REPLY REFER TO:
2.1SS

50-247

RECEIVED
APR 28 1976
U.S. NUCLEAR REGULATORY COMMISSION

George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and
Environmental Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Knighton:

Subject: Draft EIS
Proposed Action: US NRC Closed Cycle Cooling System
Indian Point Nuclear Generating Unit No. 2, Village of
Buchanan, Westchester Co., N. Y.

We have reviewed subject statement and we have the following comments on the environmental impact of the proposed action.

A critical issue is the increasing massiveness of the power complex at Indian Point. The number of reactors has increased over the years to three and waste heat will now be disposed of entirely on the land and atmosphere. The impact of Indian Point will therefore be felt directly as a daily experience and will cut across the major constituents and qualities of this part of the Hudson River valley.

For example, the City of Peekskill, which has spent much time, money and effort on its planning and development, must now contend with an unexpected and detrimental influence. The classical river community of Verplanck is in the direct path of much of the worst air-borne effects of the proposed tower. The height of the tower will almost reach the height of Dunderberg Mountain across the river, overwhelming all other man-made features in the area.

The final statement should address the following issues:

Since at least two on-site cooling systems and possibly three will be required, has the cumulative impact of the systems been assessed?

Are there any particular requirements critical to the siting of three cooling systems that should be considered at this time in the siting of the first tower?

Has the shadow effect cast by the sun been determined, particularly for the cumulative impact of a possible set of three towers including their plumes?

4218

Is it possible to reclaim the waste heat for some useful local purpose?

Can a cooling system be devised that shares the impact of disposing of waste heat on both the river and the land-atmosphere?

Thank you for the opportunity to review the statement.

Sincerely,

Joseph Monticciolo

Joseph Monticciolo
Director
New York Area Office

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

RECEIVED APR 27 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

PEP ER-76/177

APR 26 1976

50-247

Dear Mr. Knighton:

Thank you for your letter of February 23, 1976, requesting our comments on the draft environmental statement on the Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2, Westchester County, New York.

Our comments are submitted according to the format of the statement or by subject.

Selection of Cooling Tower Design
An excellent review has been made of the relative merits of different cooling tower designs by the NRC staff which leads to the general conclusion that any of the systems could achieve the cooling function satisfactorily but with different costs, design requirements, and aesthetic impacts. Although the NRC staff has concurred in the applicant's selection of the NDCT as the preferred cooling tower design, the draft statement appears to lack a clear cut summary of reasons why the NDCT is the design of preference for the NRC staff as well as the applicant. The section on Evaluation of Program Activities, page 7-1, could appropriately be expanded in the final statement to summarize the reasons why the NDCT is preferred.

On page 3-14, the NRC staff notes that smaller sizes of natural draft towers could be possible for the site. This possibility is not evaluated further in the statement but would seem to merit further consideration if the visual impacts could be lessened through this means.

The NRC has made a commendable effort to project the future viewscape with the cooling towers in operation, through photographic exhibits. Although the draft statement indicates that local viewpoints have been solicited, we believe the review process will be enhanced if all local parties having a prime concern in the aesthetic

CONSERVE AMERICA'S ENERGY

4207

Save Energy and You Serve America!

impact of the cooling towers have had the benefit of these projected viewscapes. It would seem appropriate for the final statement to indicate to what extent these viewscapes have been made available for local comment.

Cooling Tower Impacts on Parks, Recreation Areas, and Historic Sites
Since various recreation facilities, parks, and historic sites are located within fifteen miles of the cooling towers, the impacts could best be discussed by proceeding radially outward from the cooling towers and identifying each park, recreation area, or historic site with an evaluation of visual impacts in each case. This would provide a better appraisal of the aesthetic impact of the cooling towers on recreational areas and historic sites than is now evident from the draft statement.

Parks at Plant Site
Page 5-39 mentions plans for a natural park area at the plant site and notes that the cooling towers will impact on the 80 acres designated for this purpose. If these plans had been discussed in another environmental statement, this should be referenced. Otherwise, the proposed park should be discussed in more depth, describing the facilities to be offered (parking, restrooms, picnicking), who could use it, and when it would be opened.

Cultural Resources
No mention is made in the draft statement to indicate that cultural resources at the construction site have been considered. The final statement on Indian Point Unit No. 3 indicated that contact had been established with the State Historic Preservation Officer and the National Advisory Council on Historic Preservation. The final statement for the closed cycle cooling system on Unit No. 2 should indicate what measures were taken as a result of these contacts and whether the previous arrangements adequately cover cultural resources in the cooling tower area for Unit No. 2.

To assure that the archeological potential in the area to be excavated is properly appraised, we recommend contact with the State Archeologist, Dr. Robert Funk, New York State Museum and Science Service, Albany, New York 12224.

Disposal of Excavated Materials
Construction of the proposed cooling system would require excavation of approximately 700,00 cubic yards of rock and unconsolidated material (page 3-4, paragraph 3.3). The only information on disposal of the excavated material is the statement that "the beach of Lent's Cove could also be used for delivery and disposal of material" (page 3-9, paragraph 1). However, no information is provided on the ultimate disposal site proposed for the excavated material, or on related environmental impacts. The present use of the beach at Lent's Cove is not discussed. The final statement should adequately address these matters.

Ground Water
Locations of the wells (page 5-68) should be shown on one of the maps, and typical magnitudes of rates of infiltration in areas of ground-water use should be provided. An indication of relations between the rate of water-table change and precipitation or other evidence of infiltration potential is needed for full impact evaluation.

Fish and Wildlife
Although we generally support the conclusions and recommendations contained in the environmental documentation, we are concerned that the differences in evaluation made by the NRC staff and the applicant could cause delays in the licensing process and interfere with the established schedule which requires termination of once-through cooling by 1979. The welfare of the fishery resources of the Hudson River should not be jeopardized by any delays which could be avoided. The final statement should give assurance that this schedule will be maintained.

Specific comments according to section and page are as follows:

Section 3.4.3, page 3-10: Asbestos fibers have been found to be carcinogenic to fish and humans. In view of recent adjudicatory hearings which have highlighted the potential hazards of Hudson River polychlorinated biphenyls (PCB's) to human health, we recommend that NRC require the use of wooden or plastic components (rather than asbestos-cement) in cooling towers at Indian Point.

Section 3.5.1, page 3-13: We support the staff's recommendation that the applicant use amertap balls, rather than chlorine, to clean the tubes in the condenser. This would greatly reduce the adverse effects of residual chlorine discharges on Hudson River biota, especially egg, larval, and juvenile fishes.

Section 5.1.3.3, pages 5-8 to 5-27: We commend the staff on its application of the ORFAD drift model to the Indian Point Unit No. 2 situation. The staff's modified ORFAD model represents a substantial improvement over the applicant's model. However, the credibility of staff conclusions is limited by the availability of only one year of on-site meteorological data. The staff should make additional model runs using more recent data, as they become available. These should include observations of on-site fog and cloud cover. Additional runs will enable the staff to better define the variability of local meteorological conditions and refine its predictions concerning salt deposition and botanical damage.

Figures 5-4 and 5-19 should be improved in the final statement for the following reasons:

1. It is unclear what scale (units) was used to denote radial distances from the cooling towers.

2. It is very difficult to read and properly interpret the estimated rates (salt deposition, fog, ice) in the immediate vicinity of the cooling towers.

3. The use of the index from one to five to indicate decreasing rates (salt deposition, fog, ice) is potentially confusing. Index values should increase as the estimated rates increase.

Section 5.5.2, pages 5-28 to 5-38: The staff has pointed out that the applicant's experimentally determined threshold for salt deposition (on hemlock, dogwood, and ash) may be in serious error (i.e., too low) for at least two reasons:

1. The possibility that trees in experimental chambers may have been affected by two pathways--gravitational deposition on leaf surfaces and entry of salt particles into stomata.

2. The importance of dose rates as opposed to total dose has not been conclusively demonstrated to be the critical factor causing damage.

In view of these potential errors and the importance of establishing accurate values for damage thresholds, and the dependency of overall environmental impact assessment on these thresholds, we recommend that NRC require the applicant to conduct more extensive and technically sound experiments designed to resolve the potential errors mentioned above. Unless these problems are resolved, there will continue to be a difference of opinion as to whether the botanical impacts are of primary concern or whether the aesthetic impacts are more important.

We hope these comments are helpful to you.

Sincerely yours,

Stanley D. Doremus

Deputy Assistant Secretary of the Interior

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

April 8, 1976

RECEIVED 4-12-76 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

50-247

Mr. George W. Knighton
Chief
Environmental Projects Branch No. 1
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Knighton:

This is in reference to your draft environmental impact statement entitled, "Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2/Docket No. 50-247." The enclosed comments from the National Oceanic and Atmospheric Administration, National Marine Fisheries Service and Environmental Data Service are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving ten (10) copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures - Memo from: NOAA, Environmental Data Service (3-3-76)
NOAA, National Marine Fisheries Service (3-16-76)

3686

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA SERVICE
Washington, D.C. 20235

MAR 3 1976

March 3, 1976

Dx61/DLEC

TO: William Aron
Director, Office of Ecology and Environmental Conservation, EE

FROM: Douglas LeComte
Special Projects

SUBJECT: EDS Review of DEIS 7602.60 (Indian Point Unit No. 2, Preferred Closed Cycle Cooling System)

The EDS has reviewed the subject DEIS and offers the following comments:

Evaluation of the meteorological impact of cooling tower plumes would be aided by the inclusion of data on inversion frequencies at the site. The present onsite meteorological program includes measurements of the temperature difference between the 400-ft. and 33-ft. levels. The frequency and intensity of temperature inversions can be computed from these measurements and, since such inversions would have an important influence on plume spread, it would be helpful if such data were included.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
Federal Building, 14 Elm Street
Gloucester, Massachusetts 01930 MAR 30 1976

DATE : March 16, 1976

TO : Director, Office of Ecology and Environmental Conservation, EE

Robert L. Schmidt MAR 29 1976

THRU for: Associate Director for Resource Management, F3

FROM : William G. Gordon
for Regional Director, FNE Marvin F. Bowers

SUBJECT: Draft Environmental Impact Statement--Indian Point Unit No. 2, Preferred Closed Cycle Cooling System--NRC--DEIS #7602.60

The National Marine Fisheries Service was consulted during the planning stages of the proposed project or during development of the DEIS. Resources for which NMFS bears a responsibility and alternatives to reduce adverse impacts on these resources have been addressed to our satisfaction in the DEIS. Therefore, we have no comments.

Background Information

The National Marine Fisheries Service has been involved for years with the issues regarding impacts on fisheries of the Hudson River due to the operation of power generating facilities. We support the concept of closed-cycle cooling systems in general for the major new installations along the Hudson and for Indian Point Units 2 and 3, specifically. While cooling towers may affect climatic conditions locally and, to some degree, vegetation as a result of salt drift, we are certain the concept, which has been proven to be economically and technically feasible, represents the most effective means available to protect the living aquatic resources.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Washington, D. C. 20250

4-14-76

8420

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and Environmental
Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

50-247

Dear Mr. Knighton:

We have reviewed the Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2.

The analysis of cooling tower drift and salt deposition was comprehensive and dealt with vegetation effects thoroughly. However, it was not clear what steps Consolidated Edision would take if botanical injury occurred from salt accumulation. Gradual replacement of intolerant plants injured by salt by tolerant plants would reduce total damage in the long term.

From the standpoint of minimizing damage to trees, the natural draft cooling tower appears to be preferable to mechanical draft cooking towers, because effluent is chiefly in the form of low-salt water vapor; the models of salt deposition show lower ground concentration in the vicinity of the plant.

The statement described extensive excavation, road building, and other construction. Mitigation of erosion by revegetation of the soil surfaces exposed by these activities should also be described in the final statement.

We appreciate the opportunity to review and comment on this environmental statement.

Sincerely,

R. MAX PETERSON
Deputy Chief

3701

6200-11 (1/69)

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
700 East Water Street, Syracuse, New York 13210

April 12, 1976 50-247

RECEIVED APR 19 1976

Mr. George W. Knighton
Chief, Environmental Projects Branch No.
Division of Site Safety and
Environmental Analysis
U. S. Nuclear Regulator Commission
Washington, D. C. 20555

Dear Mr. Knighton:

The Draft Environmental Impact Statement for 'Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2," in Westchester County, N.Y., prepared by NRC, dated February 1976, addressed to Dr. Maxwell, was referred to SCS for review and comments.

We submit the following comments:

(1) Page 3-9, first sentence

This statement discusses disposal of excavated materials. We suggest that topsoil material not be disposed of. The statement would be improved by stating topsoil would be salvaged, protected and re-used.

(2) Page 5-28 - Paragraph 5.2.2.1 Botanical Effects of Drift and others

This paragraph and others that follow discusses botanical effects of various drifts.

The paragraph, as written, does not directly address effects of drift on grasses and legumes (which can and do serve erosion control purposes). A statement on the impact of various kinds of drift on grasses and legumes would improve the statement.

We appreciate the opportunity to review and comment on this proposal.

Sincerely yours,

Robert L. Hilliard

3876

Robert L. Hilliard
State Conservationist

cc: R. M. Davis, Administrator, SCS, Washington, D.C.
Dr. Fowden G. Maxwell, Coordinator, USDA, Washington, D.C.
Council on Environmental Quality, Washington, D.C. (5 copies)

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE (202) 426-2262

50-247

RECEIVED 4-12-76 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Knighton:

This is in response to your letter of 23 February 1976 addressed to Mrs. Judith T. Conner concerning a draft environmental statement for the selection of a Closed Cycle Cooling System for the Indian Point Nuclear Generating Unit No. 2, Westchester County, New York.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket No. 50-247

MAY 19 1976

Note to Docket File:

COMMENT ON INDIAN POINT UNIT NO. 2 DES ON PREFERRED CLOSED CYCLE COOLING SYSTEM SELECTION

Mr. Frank Leone of ERDA telephoned several comments on April 4, 1976. The comments were mainly editorial and are incorporated into Section 1.5 of the FES.

Robert P. Geckler

Robert R. Geckler, Project Manager
Environmental Projects Branch No. 1
Division of Site Safety
and Environmental Analysis

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

50-247

Ogden Reid,
Commissioner

April 19, 1976

RECEIVED
APR 23 1976
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

U.S. Nuclear Regulatory Commission
Washington, D. C.
20553

Attention: Director, Division of Site Safety
and Environmental Analysis

Dear Sir:

The State of New York has completed its review of the U. S. Nuclear Regulatory Commission "Draft Environmental Statement For Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2", issued in February 1976. In preparing the enclosed comments, we have taken into consideration the views of interested State Agencies including those represented on the N.Y.S. Atomic Energy Council.

The closed cycle cooling systems considered in the draft environmental statement were analyzed for an 873 MWe nuclear plant with its corresponding thermal discharge. This is the present licensed level of operation for Unit 2. However, by May 1980 Con Edison plans to utilize the entire capacity of Unit 2, namely 1033 MWe. The draft statement should, therefore, have been based on comparison of closed cycle cooling systems capable of dissipating the heat from a 1033 MWe plant, not a 873 MWe plant; otherwise additional cooling capability must be installed as Unit 2 is uprated. Considering the fact that Unit 2 will achieve its total electrical output of 1033 MWe within one year after a closed cycle cooling system commences operation in 1979, it is felt that the environmental statement should assess the preferred closed cycle cooling system for operation at the 1033 MWe level. We strongly urge this be done in the final EIS.

Thank you for providing the State the opportunity to comment on this environmental statement.

Sincerely yours,

Theodore L. Hullar, Ph.D.
Deputy Commissioner for
Programs and Research

cc: Members, N.Y.S. Atomic
Energy Council
C. Simian

4080

STATE OF NEW YORK

Comments on the

U.S. NUCLEAR REGULATORY COMMISSION

"DRAFT ENVIRONMENTAL STATEMENT

FOR SELECTION OF THE PREFERRED CLOSED CYCLE COOLING SYSTEM

AT INDIAN POINT UNIT NO. 2" (NUREG-0038)

DOCKET NO. 50-247

PUBLISHED: FEBRUARY 1976

APRIL 15, 1976

1. General Comment

The draft statement should discuss the ultimate disposition of the various CCC systems considered. Decommissioning costs and environmental problems of decommissioning should be presented for each CCC system considered.

2. General Comment

The draft statement should contain a discussion of the seismology and geology of the site. It should also present the maximum seismic event the preferred CCC systems are capable of sustaining and reference the amendments to the Staff Safety Evaluation Reports which have addressed this issue. If the Safety Evaluation has not been amended to assess safety considerations relative to the preferred CCC systems, then an assessment should be provided in the draft statement, since these considerations should be factored into the cost-benefit analysis for selecting the preferred CCC system.

3. General Comment

The draft environmental statement should present an assessment of the potential for interference by a NDCT with the migratory patterns of any birds such as water fowls, raptors, etc.

4. General Comment

The construction period for the addition of a cooling tower is somewhat over two years; the "cut in" period is stated to be seven consecutive months. In view of the usual two month refueling period each year, the installation of towers would result in at least a five month loss of plant output in a single year. If a portion of the "cut in" construction could be performed during an earlier refueling period, the plant outage associated with tower construction would be reduced. It is recommended that this option be explored.

5. General Comment

It is agreed that the conclusion on page 2-1 is correct that operation of cooling towers in the open cycle or "helper" mode would not assist in meeting the problems of concern in the Hudson River. To the degree that the operation of Indian Point #2 constitutes a hazard to the maintenance of the indigenous fish populations of the Hudson River and of areas dependent on the Hudson River as a nursery area, the major problem appears to be the quantity of water withdrawn and the resulting ichthyoplankton entrainment losses. Since the "helper" mode does not reduce water withdrawal it would not help in this regard and there would be no value in providing a system for such application.

6. General Comment

NRC staff's evaluation of visual impact resulting from the various CCC's alternatives is limited to a comparative analysis of the relative mass of the proposed structure(s) and related plume(s). However, the third paragraph on page 6-39 makes reference to an overall visual impact study prepared for the NRC by Jones and Jones, November 1975. The inclusion of this report in the final EIS would be desirable and may provide the answers to the following:

a. With consideration for scale, color, texture, and form, the draft statement should discuss the visual compatibility of the various types of CCCS, considered in the draft EIS with:
   - The existing power block
   - Other nearby man-made structural forms or complexes
   - Recreational uses within the visual and physical impact zones of the towers
   - Regional landforms, considering the inherent visual quality of the lower Hudson Valley and its environs in the vicinity of the Indian Point facility.

6. General Comment (cont.)

b. The environmental statement should provide a comparative analysis for each type of structure with consideration for site restoration and alternate uses when the generating facility is ultimately decommissioned.

7. General Comment

The statement should have further addressed the construction activity and associated acoustical impact, especially in the vicinity of the designated transportation routes for the delivery and removal of material.

8. General Comment

Section 3.3, page 9 states that Unit No. 1 wharf, as well as the beach at Lent's Cove, could be used for the delivery of construction materials and removal of excavated material. The statement should have addressed this alternative, because it could significantly affect the acoustical impact from construction related transportation activity.

9. General Comment

The thermal plume from once-through cooling of Units 1 and 2 is not expected to exceed New York State Thermal Criteria for estuaries. With once-through cooling added to Units 1 and 2, Unit 3 probably would exceed the criteria under certain conditions. The environmental problem at Indian Point has historically been stated as impingement and entrainment and the heat rejection rate or the cooling efficiency in terms of BTU designed into the towers is not the prime environmental consideration. The important operating characteristic is the amount of water the towers will use, coupled with other possible savings in service water usage, and a consideration as to whether Unit 1 should be allowed to operate with a once-through system.

9. General Comment (cont.)

If Unit 1 continues to operate with once through cooling at roughly 300,000 gallons per minute, it is of little consequence to consider an additional 10% or 30,000 gpm which could be saved if the house service water were also required to utilize on-site recirculating cooling technology. However, if Unit 1 never operates again or is required to go to closed-cycle cooling, then the service water system would represent 50% of the water use associated with the closed-cycle cooling for the main condenser system (30,000 gpm, 15,000 gpm for blowdown and 15,000 gpm for evaporation). It appears that for safety and reliability factors, the house service cooling system would have to be separate from the main system to provide independent operation during shutdown procedures.

10. General Comment

The discussion of emissions from the alternative facilities does not address the contributions which cooling tower drift will make to settleable and suspended particulate levels in the air around the plant and whether these contributions will result in violations of applicable New York State ambient air quality standards. This issue must be addressed explicitly.

11. General Comment

From an air quality viewpoint, it is felt that NRC and Con Edison correctly concluded that a natural draft cooling tower is the most environmentally preferable form of wet-cooling tower. Further, the calculated impact of natural draft cooling towers on settleable particulate concentrations at Indian Point meets an increment deemed acceptable. Mechanical draft towers would not.

a. The maximum drift deposition predicted for natural draft cooling towers, given in Table 5-1, meets the allowable increment of 0.1 mg/sq. cm./month, which is considered acceptable towards meeting settleable particulate standards, and does not give contravention of the standard of 0.3 mg./sq. cm./month.

11. General Comment (cont.)

b. The maximum drift deposition for circular mechanical draft cooling towers, given in Table 5-7, does not meet the increment referenced above.

12. General Comment

The expected impact of the cooling tower plume on increased cloudiness, precipitation, fog and icing is small.

13. General Comment

The models used by NRC and Con Edison in predicting plume impact are representative of current state-of-the-art and are valid.

14. Genral Comment

NRC did not justify its conclusion regarding conservatism in the Con Ed estimates of visible plume length and duration.

15. General Comment

Suspended particulate concentrations were not addressed in the draft statement and should be included. The statistical summary for calendar year 1975, however, suggests that State and Federal primary suspended particulate concentrations were met throughout the impact area of the cooling tower.

16. General Comment

Because of the extensive use of acronyms throughout the statement, a glossary would materially assist the reader who is unfamiliar with them.

17. Page iv, Item 8

It is recommended that additional information is needed and should be included to "determine the significance of drift and salt deposition and to detect botanical injury to sensitive plant species if it occurs." The draft report recognizes, however, that installation of any closed cycle cooling system,other than a dry system, will probably have some adverse effect on terrestrial biota which must be balanced against the expected beneficial effect of reducing the withdrawal of cooling water from the Hudson River. Natural draft towers will minimize the potential effects associated with drift and salt deposition.

18. Page 2-1, Section 2

Description of Alternate Closed Cycle Cooling Systems - The beneficial use of part or all the waste heat should have been considered among the alternatives.

19. Page 2-1, Section 2.2

Although the pond/lake/channel cooling technique has been discarded, sentiment by fisheries biologists continue to be directed toward an aquaculture concept. A development of this type might be used in conjunction with a cooling structure as a development program for alternative cooling and thermal discharge for future installations.

Since land surface area is not available, a controlled impoundment section of the main river should be considered.

20. Page 2-1, Section 2.3

Local industry or the commercial community should be afforded the opportunity to consider the use of the thermal discharges for processing or other continuous activities. Although the temperature level of the waste water is relatively low, it does contain a substantial thermal potential (BTU's).

20. Page 2-1, Section 2.3 (cont.)

For certain processes, this thermal potential might be an inducement for the location of other commercial enterprises in this area.

21. Page 2-3, Section 2.3

A negative conclusion is reached on the suitability, of the powered spray - module system based on the lack of suitable land on or near the site. However, the previous paragraph indicated that this sytem would require about 55 acres of the 239 acre site. NRC staff should indicate how many acres on the site are suitable and whether consideration was given to the feasibility of utilizing the Hudson River for part of the necessary acreage.

22. Page 2-5, Section 2.4.3

This section should discuss whether the back-pressure on the turbines varies for the various wet cooling systems.

23. Page 2-5, Section 2.4.3

This section should present the typical noise levels emitted for each of the wet cooling tower options. This information should also be presented in Section 2.4.1 and 2.4.2 for the dry and wet-dry towers.

24. Page 3-4, Section 3.2

This section should explain how the 500 ft. distance from the natural draft cooling tower to the wall of the Unit No. 2 containment building was arrived at. It is stated that the 500 ft. was determined by economic and safety considerations.

25. Page 3-4, Section 3.3

The Commission staff should thoroughly investigate the possibility of disposing of the excavated material at the quarry on Con Edison's Ver Plank site. In this manner, an old quarry site could be restored to a more natural

25. Page 3-4, Section 3.3

condition at the same time resolving a large disposal problem.

26. Page 3-4, Section 3.3

With the exception of paragraph (2), Section 4.2, no discussion is provided with respect to the ultimate disposal of up to 350,000 cubic yards of excavated material. This activity in and of itself may be of environmental significance. In the consideration of disposal alternatives,beneficial uses as well as adverse environmental impacts should be addressed.

27. Page 3-6, Figure 3-1

The report should discuss the potential safety implications of siting a 565' cooling tower 500 feet from the reactor containment building.

28. Page 3-9, Section 3.4.1

The maintenance of once-through operating capability, as noted on page 3-9, is a useful adjunct to the proposed system. Although capital costs of this "redundancy" are greater, the dollar and fuel savings which result (when such operation is possible in terms of aquatic impacts) appear to far exceed the incremental cost of making provision for such alternative operation where the once-through capability is already in place. Moreover, "once-through whenever possible" has environmental advantages in terms of air quality, terrestrial ecology, acoustics, and aesthetics.

29. Page 3-10, Section 3.4.3

This section should present the amount of various materials necessary to construct each of the alternate CCC systems. The staff should pay particular attention to those materials which are scarce or result in proportionately greater environmental impacts in their processing.

30. Page 3-12, Section 3.4.5

It is stated that "the proposed cooling towers would be located at least a tower height away from all safety-related structures...", yet, on page 2-8, the natural draft tower was recommended to be 565 feet tall while on page 3-4 (Section 3.2) it is stated that the "...natural draft cooling towers at the base is located 500 feet north from the outside wall of the Unit No. 2. containment building. Since the containment building is a safety related structure, this apparent discrepancy should be resolved.

31. Page 3-13, Section 3.5

It is not clear why the total heat rejection to the Hudson River will be 120 x 10^6 Btu/hr as indicated on page 3-13 rather than 220 x 10^6 Btu/hr. In general, the State favors use of the service water as the source of make-up water for closed cycle cooling systems. It is not clear why this will not be done in this case. While the volume of water used and the anticipated impact of such low volume withdrawals on fish life are small, the extra withdrawal would seem to require installation of additional service water pumps and an unnecessary increase in withdrawal of eggs and larvae. On the assumption that reduction of such withdrawal is the purpose of the imposition of the closed cycle requirement, the use of service water as a make-up source should be seriously considered and probably required.

32. Page 4-3, Section 4.2

This section fails to discuss permits or approvals of State and local agencies. Readily identifiable New York State Department of Environmental Conservation permits are:

1. Air - Air Contamination Source Permit

(continued)

32. Page 4-3, Section 4.2 (cont.)

2. Water - SPDES permit or modification of existing NPDES permit and attendant 401 Certification (PL92-500).

3. Disposal of excavated material - Protection of Water Permit and 401 Certification to obtain Section 404 permit (Corps of Engineers) if subaqueous disposal is selected.

4. Modification or construction of docks (suggested in section 3.3) would also require Protection of Water Permits and permits of the Corps of Engineers.

33. Page 5-21, Section 5.1.3.4

This Section should discuss the incremental adverse effects of salt deposition on automobiles and trucks of residents and workers in the vicinity of the site. Other exposed surfaces in the vicinity of the site such as on bridges, garden houses, etc., should also be assessed for potential corrosion attack and estimates of expected damage given.

34. Page 5-28, Section 5.2.2

Increased consideration should be given to the change that the associated forested area will undergo with an increase in the amount of air-borne salt.

The impact of the frequent extended dry spells in the area in the months of July through October should be considered. Compilation of precipitation data (see attached Table1)from the West Point weather station, published by the U.S. Department of Commerce, shows that in the 8 selected years, there were 11 months which had dry spells with a duration of 10 days or longer. If the statement "brownout and partial defoliation of the susceptible species" is valid during a 10 day period, then at least 9 of these episodes could potentially cause complete defoliation, which would kill conifers. Eastern Hemlock, Eastern White Pine, Junipers, Scotch Pine, Elm, Magnolia, Dogwood, Sugar and Norway Maples are susceptible to salt damage. The salty environment of the Long Island

34. Page 5-28, Section 5.2.2 (cont.)

coast does not usually support these species. The Hemlock elimination in the zone of salt drift is likely, since it is sensitive to many environmental alterations such as soil compaction, drought and forest stand changes. It is also very susceptible to attack by numerous pests and diseases when in a weakened condition.

Suggestions for replacement planting are Spruce, Holly and Yew. These tree species are resistant to salt injury and are compatible to the local growing condition. Austrian and Japanese Black Pine are also tolerant of salt but their existence in this region is hampered by a fungus and a lethal insect problem.

Specific data demonstrating the effects of doses of salt on foliage for specific tree species is not available for this area. A more thorough study of the initial species screening should be done by the applicant so that dose tolerances for the affected plant groups could be established.

35. Page 5-28, Section 5.2

This section should indicate if there are any unique individual vegetation (e.g., oldest or largest Hemlock in N.Y.S.) which may be affected by the various CCC systems considered.

36. Page 5-30, Section 5.2.2.1

Since some vegetation in the vicinity of the site already exhibit signs of foliar necrosis resembling "salt burn", the additional salt deposition from the various CCC systems considered should be analyzed to ascertain if this stressed vegetation will tolerate the additional stresses from a CCC system. Also, the causes of the damage to these species should be determined in any preoperational surveys.

37. Page 5-39, Section 5.2.5

This section should discuss alternative plant designs and equipment modifications which would reduce the noise impacts for the various CCC systems considered.

38. Page 5-39, Section 5.2.5

This section should discuss the noise impacts which will result from various CCC systems for combined operation of Units 2 and 3, not just Unit 2.

39. Page 5-45, Section 5.2.5.2

The NRC staff considers the offsite acoustical impact associated with construction of the closed cycle cooling system to be "temporary". The State does not concur with this opinion. In considering the protection of the public health and welfare, it is unreasonable to designate construction activity as temporary when it could occur for a duration of approximately two years, and where the daily removal of excavated material by steady truck traffic past residences will occur for a 6 or 12 month period.

40. Page 5-46, Section 5.2.5.2

The statement implies that the acoustical impact during construction could be reduced to a level of acceptability if the applicant takes three precautions, one of which is "Equips all equipment used at the site during the construction phase with the required noise suppression equipment according to federal and state regulation procedures." The statement should have identified these "...federal and state regulation procedures.", and discussed how these regulations will influence this particular construction project.

41. Page 5-59 and 5-60, Section 5.2.5.5

The statement should have included in the section entitled "Staff's Conclusions on the Assessment of the Offsite Sound Levels", the staff's specific conclusions regarding acoustical impact from construction site activity and construction related transportation.

42. Page 5-60, Section 5.3

This section should discuss the potential of dispersing into the atmosphere heavy metals and potentially toxic chemicals, such as PCB's (poly-chlorinated-byphenols), which presently exist in the Hudson River due to industrial and municipal effluents. Data of the initial State analysis of this is presented in the attached Table 2.

43. Page 5-67, Section 5.3.2

This section must be expanded to discuss fully the potential interaction of the wet cooling tower plume with the SO_2 effluents from nearby fossil fired plants such as Lovett, Bowline, Roseton, and Danskammer creating acid mist or rain. Also, this section should discuss potential shifts in when "acid mist" will rain out from those areas it presently does.

44. Page 5-71, Section 5.4.4

Quantification of "current entrainment and impingement problems" should be provided. Additional foundation for use of term "acceptable levels" is also necessary. If nothing else,at least a concise summary of the conclusions reached in the EIS for Indian Point No. 2 should be included.

45. Page 5-71, Section 5.5

This section should indicate whether the radiological effluents will meet the Appendix I guidelines, and also the EPA proposed standards 40CFR 190.

46. Page 5-72, Section 5.5.2

It should be indicated in this section whether the various CCC systems would have an impact on the present circulation patterns of gaseous effluents and the locations where effluents such as I-131 settle out. In particular, the statement should discuss the impact the alternative CCC systems have on dispersion and settling out of gaseous radioactive effluents including 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.

47. Page 6-1, Section 6

The cost ($/year) to the average Con Edison customer of the various CCC systems considered should be clearly presented.

48. Page 6-1, Section 6

In the Socio-economic Analysis of Closed-Cycle Cooling Systems, the energy implications have not been directly considered. While changes in energy use will probably be reflected in the annual operating costs, it is felt that a direct consideration of the energy implications of cooling tower operations is necessary.

49. Page 6-6, Section 6.2.2.2.c

It is important to note that the NRC staff believes that the applicant's proposed installation of gas turbines to replace reduced peak generating capability (due to CCC) is an uneconomically large commitment of resources. The basis for the NRC staff's conclusion is that the absence of 63 MW to 70 MW of peak generating capability would not lower the reserve to an unacceptable level. With the lowest reserve margin Con Ed forcasts between 1976 and 1985 at 29% staff is correct(cf. 1976 Long Range Plan of NY Power Pool).

50. Pages 6-6 and 6-26, Section 6.3.1.3

Electric power stations are indicated as representing an important component of the industrial use of the Hudson River shoreline in the Verplank-Haverstraw area. If the projected eight power stations within 10 miles of this cooling tower site were to utilize the river valley ecology in this suggested way, the entire area environment could be jeopardized. This potential impact would possibly involve future consumptive water supply plans for the metropolitan area and would certainly exaggerate the existing biotic habitat situation. This impact should be addressed.

51. Page 6-7, Table 6-4

This Table indicates that Indian Point No. 3 will be a new capacity addition for Con Edison. Since the Power Authority now owns Unit 3, an explanation of the PASNY sales to Con Edison should be presented. Also, the acronym for the Power Authority of the State of New York is PASNY, not PASHY.

52. Page 6-36, Section 6.3.2.1

This section should discuss the impacts on aquatic biota that disposal of the excavated material will have if disposed of via the Hudson River.

53. Page 6-53, Section 6.3.3.3d and Page 6-54, Table 6-25

It should be indicated that there is a potential for the closed cycle cooling system to be ruled tax exempt as a pollution control device.

TABLE 1

PRECIPITATION DATA
WEST POINT, N.Y. STATION

Year	Month	Ppt. In. Total For Month	# of Rain Days over .01"	Longest # of Consecutive Dry Days
1960	July	9.64"	10	7
	August	5.66	14	5
	September	8.26	9	8
	October	2.46	9	9
	November	2.87	8	7
1965	July	3.53	9	8
	August	4.19	13	5
	September	3.24	13	5
	October	3.95	7	8
	November	2.31	14	5
1970	July	2.48	11	5
	August	2.57	7	9
	September	4.46	9	8
	October	3.78	6	11
	November	4.85	13	5
1971	July	3.84	10	12
	August	8.01	9	14
	September	6.48	11	8
	October	3.21	7	11
	November	--	--	--
1972	July	2.87	6	9
	August	--	--	--
	September	1.75	9	6
	October	5.60	8	8
	November	9.01	14	5
1973	July	4.54	7	6
	August	1.35	3	15
	September	2.96	9	9
	October	2.39	6	10
	November	2.46	10	11
1974	July	2.32	10	12
	August	3.62	9	12
	September	7.27	9	6
	October	2.19	4	17
	November	2.48	11	5
1975	July	7.91	12	7
	August	4.72	13	6
	September	9.74	13	4
	October	4.63	8	10
	November	4.41	11	8

TABLE 2

Calculations of Airborne Contaminant Concentrations and Comparison with Standards

	A	B = 2 x A	C = B x 3406.5	D = C x 11.2 / 39.21	E = TLV / 50	F = D / E
	ug / l	ug / l	kg / hr. x 10-6	ug / m3 x 10-6	ug / m3	
Cadmium	0.083	0.166	565	161	1.0	161 x 10-6
Chromium	Maximum 50.0	100.	340.65	97.3	20	4.9 x 10-6
Copper	Maximum 30.0	60.	204.39	58.4	20	2.9 x 10-6
Mercury	Maximum 1.4	2.8	9.54	2.7	1	2.7 x 10-6
Nickel	Average 2.1	4.2	14.31	4.1	20	0.2 x 10-6
Zinc	Average 50.0	100.	340.65	97.3	20	4.9 x 10-6
Arsenic	Maximum 12.0	24.	81.76	23.4	10	2.34 x 10-6
Lead	Maximum 250.0	500.	1,703.25	486.5	3	162.2 x 10-6
Iron	Average 760.0	1,520. 1,520	5,177.88	1,479.0	20	74.0 x 10-6
Manganese	Average 60.0	120.	408.78	116.8	100	1.2 x 10-6
PCBs	.00025	.0005	1.70	0.49	0.5	1.0 x 10-6

Description of Columns

A = Concentration of contaminants in river water.
B = Concentration of contaminants in cooling tower water.
C = Emission rate of contaminants from cooling tower based on a drift rate of 15 gallons per minute.
D = Maximum near ground concentration of metals based on Table 3-1 of Con Ed's application attached.
E = Threshold limit values divided by 50 for each metal. Since there are no State or Federal standards for the metals in question, the TLV limit values, normally applied to industrial hygiene, were used. Dividing the threshold limit values by 50 makes them quite conservative.

TABLE 2

(cont.)

F = The ratio of airborne metal concentrations to the standards. These values should be less than 1.

Notes: (1) The accuracy of calculations presented herein is limited by the available data on river water concentrations of metals and by the indirect method used to obtain estimated airborne concentrations.

(2) Water analyses from Division of Pure Waters.

(3) Value of drift (15 gpm) given in NRC Draft Environmental Statement, Section 3.3.3 on page 3-13.

Table 3-1 Predicted Monthly Average Salt Deposition Rate and Near Ground Airborne Concentration of Salt for Each Month at Peak Value and at Five Miles Downwind from the Tower

		Estimated Peak (at 1.24 mile downwind)		Estimates at 5 miles downwind	
Month	Sector	Deposition Rate, Kg/Km^2-month	Near Ground Airborne Concentration, $\mu g/m^3$	Deposition Rate, Kg/Km^2-month	Near Ground Airborne Concentration, $\mu g/m^3$
October	SSE	693	3.8	8.0	0.04
November	SE	1970	11.2	17.4	0.08
December	SE	1530	8.0	15.0	0.06
January	SE	1140	7.1	16.5	0.09
February	SE	1880	10.7	19.5	0.1
March	SSE	1716	10.8	14.9	0.07
April	SE	1390	7.6	13.5	0.06
May	SSE	571	3.7	5.6	0.03
June	ENE	284	0.9	20.3	0.1
	SE	268	1.5	12.4	0.07
July	ENE	691	2.8	18.7	0.09
	S	639	3.1	15.1	0.07
August	ENE	488	1.5	19.0	0.1
Annual Average (1)	SE	896	5.6	12.5	0.07

(1) Based on 11-month average.

Basis: Drift: 0.002% (39.21 Kg salt/hour)
Number of towers: One

LOUIS J. LEFKOWITZ
ATTORNEY GENERAL

STATE OF NEW YORK
DEPARTMENT OF LAW
TWO WORLD TRADE CENTER
NEW YORK, N.Y. 10047
TELEPHONE: 488-3098

PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

50-247

April 8, 1976

4-12-76
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

Re: DEIS for Selection of Preferred
Closed Cycle Cooling Systems at
Indian Point Unit No. 2
NUREG-0038

Director
Division of Site Safety &
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

The Attorney General of the State of New York submits the following comments with respect to the above-referenced draft environmental impact statement.

With respect to the substantive technical matters discussed in the DEIS, the Attorney General concurs in your office's analysis and conclusions, and endorses the selection of a natural draft cooling tower as the preferred closed cycle cooling system at Indian Point Unit No. 2.

However, the Attorney General must take issue with your analysis of the schedule for construction, contained in Chapter 4, Section 4.1 of the DEIS (pp. 4-1 to 4-3). The schedule established by the Appeal Board for the construction of a closed cycle cooling system required the applicant to submit its economic and environmental evaluation report to the NRC by December 1, 1974, with regulatory approval expected by December 1, 1975, fully one year later.

The DEIS, however, was not issued until two months after this deadline, with final action anticipated at some unspecified future date.

Indeed, your division has abandoned all pretense of maintaining any semblance of a schedule, asserting in essence that approval will be forthcoming when issued, no sooner, no later (p. 4-3). While the Attorney General understands that your staff has other duties, nevertheless, the establishment of a schedule by the Appeal Board would appear to require you to give priority to the Indian Point 2 licensing requirements, so that the NRC can fulfill its obligations under the license issued to the applicant, which was after all conditioned by the Appeal Board on the installation of a closed cycle cooling system according to a stated schedule.

Your office's failure to set out a timetable for future government approvals would seem to reflect a determination by your office not to assign this project the priority inherent in the Appeal Board's determination. The Attorney General is of the opinion that your office should establish priority treatment for this project, set a rigorous schedule for the completion of all governmental action, and make every attempt to adhere to that schedule.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

PAUL S. SHEMIN
Assistant Attorney General

PSS:wr

Palisades Interstate Park Commission
Administration Building
Bear Mountain, NY 10911
914 786-2701

Nash Castro
General Manager

RECEIVED
APR 21 1976
U.S. NUCLEAR REGULATORY COMMISSION

April 15, 1976

50-247

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Att: Director, Division of Site Safety and Environmental Analysis

Gentlemen:

The staff of the Palisades Interstate Park Commission has completed its review of the Draft Environmental Statement for the Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2 and offers the following comments:

1. Parklands administered by the Palisades Interstate Park Commission are visited by over 7,000,000 visitors each year, a substantial number of whom visit portions within direct visual contact of the proposed cooling tower site. These lands include areas within Bear Mountain State Park, Harriman State Park and Stony Point Historic Site. It is felt that construction of a closed cycle cooling system as proposed (Natural Draft Cooling Tower) represents a most serious visual intrusion. The Commission feels that this cooling system is unacceptable because of the magnitude of the cooling tower and the resultant plume.

2. A Fan-Assisted Natural Draft Cooling Tower is unacceptable for the same reasons as above.

3. Circular Mechanical Draft Cooling Towers, while esthetically more acceptable, present potential saline drift hazards. The report states that White Ash, Flowering Dogwood and Eastern Hemlock, three common Park trees, are highly sensitive to this type of drift. Figure 5-21, showing areas of potential botanical injury, includes portions of all three parks mentioned under comment No. 1. Subsequently, some damage to Park trees could result. For this reason, Circular Mechanical Draft Cooling Towers are unacceptable.

4. The Commission recommends that further study be given toward finding an alternate solution that will satisfy not only the functional requirements but the esthetic and botanical as well.

Sincerely,

Nash Castro

General Manager

Mayor
GEORGE V. BEGANY

Trustees:
WILLIAM DURR
JAMES EDGAR
JACK LOEBER
WILLIAM MCNALLY

RECEIVED APR 20 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

VILLAGE OF BUCHANAN 1928

Village of Buchanan

MUNICIPAL BUILDING, BUCHANAN, N. Y. 10511
PHONE: (914) 737-1033-4

Clerk & Treasurer
FRANK R. COLACINI
Village Attorney
CARL D'ALVIA
Village Consulting Engineer
HUGH GREGORY
Building & Plumbing Inspector
CHARLES WHITE

April 14, 1976

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

50-247

Attention: Director, Division of Site Safety
and Environmental Analysis

Gentlemen:

On the 29th of March 1976 we received two copies of the Draft Environmental Statement prepared by your Agency, regarding the selection of the closed cycle cooling system for Con Edison Indian Point Unit No. 2 bearing Docket No. 50-247.

This matter is of deep concern to me as the Chief Executive Officer of the Village.

After reviewing the contents of this report I am convinced that the proposed installation will be even more detrimental to the Village and its inhabitants than I originally conceived. It is unbelievable that a superior governmental unit would consider enforcement of the recommendations made therein, which could and may result in the death of our Village, or at best, will result in vastly depressed living standards for our citizens.

At my request, our Village Consulting Engineer, Hugh S. Gregory, has reviewed the Statement, and has prepared a report setting forth in detail his comments and conclusions.

I have also requested our Environmental Consultant, Dr. William H. Shuster, Professor of Environmental Engineering at the Rensselaer Polytechnic Institute, to examine your Statement and prepare his own report of the effects of the recommended tower installation on the Village.

Both reports are attached hereto for your examination and consideration. I emphatically support the substance and conclusions

stated therein.

In addition, I add the following comments of my own for your consideration.

First of all the Village neither wants nor needs a grotesque land mark, towering almost 500 feet above our highest ridge and some 450 feet in width, to identify it as an industrial site, making our citizens ashamed of their origin and heritage. There is no doubt that the long term effects on our "native" population will be catastrophic.

Regardless of the statement that the installation is short term, this short term comprises a period of some forty years. Unquestionably, forty years of the abhorrent conditions anticipated in the report, plus the overpowering visual assault of the tower, will result in an abandoned community.

It must be realized, too, that the native wildlife in the area will be annihilated, first by construction, ultimately and completely by the environmental effects of the tower. The fauna will never seek nor find refuge in Blue Mountain Park or other areas.

It is completely unrealistic to assume that outsiders can judge fairly the feelings of and the effects of this proposal on our Village residents. After their decisions these outsiders can return to their own clean atmosphere, flowering dogwoods, green hemlocks and green lawns. We will remain with our bare dogwoods, browned hemlocks and browned lawns, our eternal cloud, gasping for breath, all in the shadow of the overwhelming monster.

It is my opinion that so far the decisions have been based on hastily made conclusions; that the impact on the whole environment of our Village has not been properly weighed; and that the conclusions have been unduly influenced by certain pressure groups.

It must be added that if all data contained in your report is as carefully documented as the mis-information set forth regarding the Buchanan planning "effort", there is ample reason to doubt the reliability of the entire presentation.

It is obvious that the proposed installation is improper. Likewise, it is obvious that the "once through" system is the least objectionable until the proper solution is found.

It is my judgement that, if this proposed tower is constructed, it will be a monument to unsound reasoning, insufficient research, political pressures, and lack of just plain common sense.

Yours very truly,

George V. Begany (59)

GVB/sg Mayor

Atts: Report - Village Consulting Engineer (1)
Report - Village Environmental Consultant (1)

Village of Buchanan

BUCHANAN, NEW YORK 10511
Tel. PEekskill 7-1033

GEORGE V. BEGANY, Mayor
FRANK R. COLACINI, Clerk & Treasurer
CARL D'ALVIA, Village Attorney
HUGH GREGORY, Village Consulting Engineer
CHARLES WHITE, Building & Plumbing Inspector

13 April 1976

Re: Draft Environmental Statement
Closed Cycle Cooling System Selection
Indian Point Unit No. 2
Docket No. 50-247 (Published February 1976)

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Director, Division of Site Safety
<u>and Environmental Analysis</u>

Gentlemen:

Under date of 24 March 1976, one copy of the subject Draft Environmental Statement was directed to Mayor Begany of the Village of Buchanan, New York. It was received on 29 March 1976.

The Mayor has requested that I review this material and set forth my own findings and opinions in a direct report to you. This letter constitutes such report. It is additional to the Mayor's own statement which is being sent herewith.

My review constituted the general perusal of the NRC report, with extraction of the items deemed of major consequence to our community, as well as those items in which inaccuracies, untrue and unsupported statements of fact occur.

The information extracted is set forth and referenced hereinafter, with appropriate comments, factual data and opinions immediately following each item. The items appear in numerical page order, not necessarily in order of significance to us.

<u>Page 3-9</u>.

Lent's Cove Beach use for disposal of materials.

Lent's Cove Beach and adjacent land is at present the property of the Village, having been deeded thereto by Con Edison. The origi-

nal State grant to Con Edison allowed filling of the entire cove within the grant limits. The dedication deed from Con Edison to the Village provides that the area be used for Village Recreational purposes. The Village is presently proceeding with installation of Boat Launching and Landing Facilities and other improvements. The use of the beach for disposal is <u>not</u> permissible. It is also unreasonable that the recreational use be restricted during construction.

<u>Page 3-13</u>.

Discharge of Sulphuric Acid, Chlorine and other pollutants.

The total design discharge to the river comprises 15M gpm of polluted effluent, diluted by 30M gpm of service water, and 318M gpm from Unit 1, or about 1/3 of the combined discharge from "once through" cooling systems for Units 1 and 2. It is to be noted that Unit 1 has been "off line" since October 1974, and will remain so at least until 1978, with the probability of complete abandonment. Therefore the discharge of properly diluted effluent meeting State Standards seems difficult of achievement.

<u>Page 5-1</u>.

Relative merits of two additional closed cycle systems warrant further investigation.

I concur with this opinion.

<u>Page 5-4, 5-5</u>.

Drift: Wetting of vertical surfaces of structures and Biota downwind can cause damage or corrosion to structures as well as disease to plants.

The Village is within the area of maximum deposition of salt. It has approximately 550 dwellings, 60-80% of which have tilled gardens, with the larger garden areas on Bleakley Avenue and Broadway, in the area of major contamination. Most of the remaining gardens are between Westchester Avenue and Henry Street, the area directly in the path of the major drift. The drift would not only destroy the gardens and landscaping, but have a devastating effect on the dwelling units as well. Although it is pointed out that the salt deposit will have no accumulative effect, which may be true on impervious surfaces, it is obvious that on cultivated garden land it will be 100% accumulative, and will result in severe damage to or destruction of food vegetable crops.

Page 5-8, 5-14, 5-28, 5-31.

Estimates have been predicated on the use of models.

Such estimates are inaccurate at best, and could well be in error on the lower side, rather than be considered conservative. The analyses and assumptions of the Con Edison report are equally as valid as those in this report. Without question a safety factor of two or more should be a requirement, using the higher estimates rather than the lower. Use of the latter minimizes all effects. In my judgment, the element of error should rather favor the maximum estimated effects.

Page 5-34.

Defoliation and destruction of Plantings.

Disagreement is taken to the statement that "the threshold chosen appears unnecessarily conservative". Possibly, the dogwood, hemlock, and white ash will be the most affected. However, it is obvious that there are many other species of common landscaping plants which are incompatible with even minor salt dosage. In my own experience, English boxwood, several varieties of ilex, and lilacs have been seriously affected on my own property from the drift from the salt applications to the public roadway. Defoliated dogwoods and browned hemlocks, with recovery a year away, then a repeat performance, is hardly a condition to be tolerated by any householder. To replace such plantings under the same conditions of imminent destruction is asinine, totally unsatisfactory to both owner and utility.

It is to be noted that our Village has a history of complaints of damage to resident's trees and shrubs, especially where any liability whatever can be attached to the Village or other public authorities. It is emphasized that our citizen's pride in their homes and grounds is exceptional. The impact of such a condition, both actual and psychological, would be tremendous.

Some suitable, simple means of indemnification for damages must be established, including incontestible joint responsibility by both Con Edison and the New York State Power Authority.

Page 5-37.

The effect of towers for both Units 2 and 3 can be approximated at twice the drift levels for Unit 2 alone.

This means simply a doubling of the destructive effects above-

mentioned.

Reference must be made at this point to the wooded area of 80 acres to the north of the plant center site. Among the conditions under which the Site Plan received Planning Board approval was the requirement that this area be forever maintained in its natural in its natural, wooded state. Since this is directly in the path of maximum salt drift, its maintenance as natural woods seems impossible. The visualization of this area as a greenless, barren stretch is terrible to contemplate.

Page 5-44 to 5-60.

Noise.

Basically, the conclusion relating to noise effects has been based on the erronious assumption that there have been "no complaints and threats of legal action."

Actually, since the start of construction there has been a history of complaints of noise and smoke and particle emissions. These complaints have been made mainly at Village Board meeting appearances, or informally to Village Board members. The traffic noise has been tolerated on the assurance that there will be a major reduction on completion of construction.

Other complaints registered were as follows:

1. Steam blow-off from Unit 2. This is being alleviated by the design and installation of mufflers for the blow-off. (Unit 3 installed. Unit 2 in process).

2. Operation of Gas Turbines. Enclosures and other measures being taken to reduce this most disturbing noise.

A background noise increase resulting from the cooling towers is projected to affect most seriously the Lent's Cove area. Unquestionably this will be objectionable for the present and planned uses by Village residents.

Again, there will be double the noise nuisance from the addition of the cooling tower for Unit 3.

Page 5-74.

Conclusion - "none of these factors (environmental effects) are likely to be of sufficient magnitude to cause rejection of any of the cooling tower types".

I must disagree. A summary of the five various types investigated, attached hereto as Exhibit A, indicates that the natural draft type selected is the most objectionable from the standpoint of visible intrusion, towering to elevation 610 or 470 feet above the Broadway Ridge of elevation 140, a non-esthetic monstrosity visible from as far south as Yonkers. The alternate selection of the fan-assisted natural draft type is some 183 feet lower, still at objectionable, monstrous height. The remaining types have top elevations below the Broadway Ridge. It is to be noted that the ND type selected ranks number three in plume effect, and number one in only drift, noise and cost. It is my understanding that the relative differences of the latter effects between all types are inconsequential, with reductions in the alternate types possible. It is difficult to understand the statement that the low profile MD towers do not present appreciable esthetic advantages over the ND types.

Page 6-6.

Installation of gas turbines.

In my opinion the installation of additional gas turbines is objectionable on the basis of noise and atmospheric pollution, as well as being completely impracticable economically.

Page 6-31.

Major Employers.

Standard Coated Products of Buchanan no longer operational, and Standard Brands of Peekskill greatly reduced.

Page 6-35.

Future Development and Planning.

Contrary to the mis-information contained in the report, the Village of Buchanan has both a Planning Board and has retained Planning Consultants since 1951. There is not, and never has been an Industrial Development Authority. The Zoning Ordinance was adopted in 1951 and the preparation of a Village Master Plan authorized in 1964, but never completed. The Zoning Map, prepared in 1969 has served as the Master Plan to the present. Due to the fact that Village development was virtually complete except for the Industrial Area, the Planning Board, established by the Zoning

Ordinance in 1951, has jurisdiction over all site development plans. It made the determination that a Master Plan with pre-planned road network was unfeasible, undesirable and unnecessary, since Con Edison and Georgia-Pacific owned the major portion of undeveloped land. Ultimate use of the remaining land will determine criteria for such subdivision and planning. Also most of the remaining undeveloped land can be improved without construction of additional roads and utilities. In the few instances in which such construction may be required, the particular situation dictates the planning, which is controlled by the Zoning Ordinance and subject to approval by the Planning Board.

Site development and building construction of the Con Edison and Georgia-Pacific parcels was controlled by the Planning Board. It was required that all buildings constructed therein maintain a low profile, well below the crest of the Broadway Ridge, to insure their exclusion from the view of the remainder of the Village. The proposed cooling towers violate this fundamental planning principle established and maintained by the Planning Board.

The Village of Buchanan has been and is the leading community in the area in providing sewers serving 100% of its residential population. The Village operates its own Sewage Treatment Plant which maintains the highest standards of treatment and operation in the region.

The Village Consulting Engineer has prepared comprehensive studies for improvements to the Water Distribution System, the Sewerage System, the Sewage Treatment Plant, the Drainage Facilities, and the Highway System, for which implementation programs have been continuing each year.

Page 6-38.

Impacts on Terrestrial Biota.

It is my opinion that there is sufficient doubt, as pointed out hereinbefore, to question the conclusion that the level of damage to Terrestrial Biota (Human, Animal and Plant) is non-existent, both on-site and off-site. These doubts are sustained by the recommendation that the drift and salt deposition, as well as sensitive plant species be monitored to determine their significance. This, of course, after the fact.

Page 6-44.

Visual characteristics of plumes.

The conclusions relating to plume formations from plume-tower combinations are unacceptable. Much discussion has been devoted to rating the various types of towers in more or less degree of detraction. The simple truth is they are all obnoxious. The shadow over the Village from a plume continually changing shape will create intolerable living conditions, with constant changes from light to darkness. Doubtless it will cause a complete change in family living modes, with residents avoiding the use of natural light. This, of course, will increase the use of energy, and the cost to the residents.

Page 6-51, 6-52.

Real Estate Values.

Again I disagree with the conclusions set forth. The Buchanan situation is unique in that the entire Village is within the radius designated as "on-site" in most of the cases used for comparison. In other words, in those cases the nearest dwelling was remote from the station. The example most nearly comparable to the Buchanan case is that of the Bochum Station in West Berlin. In this case the value of the abutting properties was depressed.

Page 7-1,2.

Evaluation of Proposed Action.

It seems to me that the conclusions reached have been based upon insufficient and inaccurate data. There is little of fact, much of speculation, with many variables of wind, weather and other indeterminate conditions.

The Village is not satisfied that the proposed closed cycle cooling system is the best solution, compared either to the "once-through" system or to other closed cycle systems. Much further research and study must be devoted to improving the effectiveness and reducing the hazards and objectionable features of any system considered.

The overall environmental effect of the closed cycle system seems much greater than that of the "once-through" system, with the latter limited to affecting the river and aquatic biota only. However, the chemical discharge from blowdown of the closed cycle system may more seriously affect the aquatic life and result in other serious problems.

In the original study it was pointed out that the "once-through" system resulted in a heat level in the Hudson exceeding the limit by only a slight margin. With Unit 1 non-operative and with heat discharge limited to Unit 2, such heat discharge to the River would be reduced to about 77% of that from Units 1 and 2, and with Units 2 and 3 on line reduced to about 88% of that from the three units. Thus, the plant could operate within the specified heat limit, pro-

vided Unit 1 remains inoperable.

It is to be noted that the thermal effect on the aquatic life is still under study. Results of the present moratorium on fishing in the Hudson may well reverse the original conclusions attributed to present cooling methods, considering also the improvements made to reduce impingement. More fish are killed during winter than in summer due to the lower water temperature making the fish slower and less active. This is controlled to the extent that the plant river water intake is reduced to 60% of normal, with a corresponding reduction in power output. When the water temperature drops to 40°, consideration might be given to discharging a portin of the heated effluent into the river at a pointsome distance from the intake, thus raising the river temperature and attracting fish activity in areas remote from the intake. Also consideration is warranted to study the possibility of discharging the higher temperature effluent into the river at several remote points to provide distribution of the heat into a larger volume of river water.

An additional hazard to terrestrial biota with the closed cycle system is the possibility of accidental contamination, including radioactive pollution, of the condenser cooling water by failure in the circulating water system. This could result in released aerosol contamination with greater potential danger to terrestrial biota, particularly humans.

It is also to be noted that due to the thin shell concrete in the superstructure, the Village Building Department will require special concrete design precautions to insure against structural failure from salt and acid attack.

The final conclusion must be drawn that, in the interests of preventing the destruction of the Village and seriously affecting adjoining neighborhoods, construction must be deferred until all doubts of the potential damages are resolved.

Yours very truly,

Hugh S. Gregory

HSG/sg

Village Consulting Engineer

Atta: Exhibit A - Summary of CT Types (1)

13 April 1976

Summary of Cooling Tower Types
(from NRC Report - Docket #50-247)

				Preference Rank*				
Type Tower	Hght (ft)	Elevation Base	Elevation Top	Visual Intrus.	Plume	Drift	Noise	Cost
CMDCT	74	32	106	2	1	3	3	3
FANDCT	382	45	427	4	2	2	2	2
NDCT**	565	45	610	5	3	1	1	1
LMDCT	68	32	100	3		Not	Rated	
W/DCT	74	32	106	1		"	"	

The Elevation of the Broadway Ridge is 140 ±

*** Ranking by NRC.**
**** NRC Recomended Type.**

Extracted from NRC Report by Hugh S. Gregory, Village Consulting Engineer, to accompany Report to NRC.

Appendix A

WILLIAM W. SHUSTER, D. CH. E.
ENVIRONMENTAL ENGINEERING CONSULTANT

RENSSELAER POLYTECHNIC INSTITUTE
TROY, NEW YORK 12181
518-270-6363

April 12, 1976

To: Mayor and Board of Trustees
Village of Buchanan
218 Westchester Ave.
Municipal Building
Buchanan, New York 10511

Gentlemen:

In response to your recent request, I have reviewed the Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2, Docket No. 50-247, published February 1976 by the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. I would like to offer a number of reactions to this statement.

The Draft Environmental Statement is based on the assumption that the present method of once-through cooling will be disallowed and that some type of closed cycle cooling system will be preferable. I have stated previously, and I would like to reiterate that I strongly disagree with this position because of the particular features of the situation at Indian Point, perhaps not found typically at any other location. My reasons for this opinion are summarized in the following paragraphs.

The principal arguments which have been presented against the use of once-through cooling include the following:

1. The withdrawal of cooling water from the river will result in the killing of substantial numbers of fish by impingement on the intake screens.
2. The discharge of heated effluent will, under certain conditions, be in violation of the New York State thermal discharge criteria.
3. Discharged cooling water will contain objectional levels of residual chlorine resulting from treatment used to prevent development of biological growths on heat exchange equipment.
4. That thermal discharges will interfere with the life cycle of fish and other aquatic life, especially the striped bass.

5. That dissolved oxygen levels in the river will be seriously depleted.

While these arguments are well considered and important, it would be well to examine them closely.

1. It is indeed important that steps be taken to minimize the effects of inflow on the impingement of fish on inlet screens. It is felt that a number of possibilities exist for redesigning the intakes to alleviate this condition. It is felt that innovative approaches can solve or at least markedly reduce the magnitude of the problem.

2. Whether the discharge of heated effluent will violate New York State thermal discharge criteria is highly in doubt. Predictions of behavior are based on mathematical models which depends upon field data which is largely inadequate, and upon numerous unproven assumptions. This has been clearly stated in the Impact Statement of the U.S. Nuclear Regulatory Commissiin. Even with the results of such models, any predicted violations are marginal.

3. It is anticipated that any residual chlorine in discharged water will rapidly be dissipated by dilution and by consumption by oxidizable materials naturally present in the river water.

4. It seems highly unlikely that the heated discharges will have any marked effect on life cycles of aquatic species, since the temperature levels at worst will barely exceed acceptable limits. Even under these relatively rare occurrences, which by-the-way are most likely to occur at times other than normal spawning times, most life forms may find that they can adjust to such minor excesses, or avoid them entirely. It may be noted that some reports have indicated that some life forms instead of being injured by thermal discharges, actually thrive in them.

5. Again occasional marginal temperature excesses, if they occur at all, will hardly have a significant effect on dissolved oxygen content in excess of that anticipated for temperatures within acceptable limits.

In the present Draft Environmental Statement, the NRC has considered various alternatives to once-through cooling in the form of a number of closed cycle cooling systems. It is felt that a number of points in their analysis are at fault and that the conclusions are subject to criticism in several respects.

1. It is felt that the use of cooling towers at Indian Point does not represent an improved solution to the thermal problem. As the draft statement itself says, "CCC does not eliminate thermal pollution, but transfers the primary impact from the hydrosphere to the atmosphere."

2. It is stated that the blowdown of twice concentrated recirculated cooling water, containing treatment chemicals including sulfuric acid, will be diluted with water from Unit No. 1 and discharged back to the river. Unit No. 1 has been shut down for some time and all indications are that it will not be returned to service. Hence, the dilution water is not available.

3. The position is taken that ground level fogging will not be serious. It is stated, however, that while fogging is usually not anticipated to be a problem, Hosler reported an instance where the tower plume did reach the ground in a <u>mountainous terrain</u>. The area of Indian Point might well be so described.

4. It is stated that the estimates of salt deposition and drift as presented by Conn Ed are unduly high. This appears to be highly questionable in view of other experimental evidence. The NRC staff estimates are based on mathematical models which of necessity must contain simplifying assumption. One such assumption, as stated in the report, is that surrounding terrain is uniform in elevation and that wind speed is independent of elevation. This is obviously far from the facts.

5. It is admitted that salt drift has deleterious effects on exposed surfaces such as various metals. It is stated that such effects fall off with distance. However, such distances are not clearly stated. The estimates are based on seashore experience at low altitudes, much different from the situation at Indian Point. No mention is made of possible cumulative effects.

6. The statement is made that only white ash, flowering dogwood and Eastern Hemlock appears to be sensitive to salt deposition. However, it is noted that more than 44% of properties in the area have at least one of these sensitive species. The NRC staff suggests that replacement of killed trees is possible. This unfeeling statement does not take into account the inconvenience to the homeowner nor the loss in property values resulting from killed or partially effected vegetation.

7. A real possibility exists of the interactions of tower plumes with stack effluents containing SO_2 to produce sulfuric acid rain. The Indian Point Plant uses 0.3% S fuel and in light of the peculiarities of wind currents in the area, such intermixing is entirely possible.

8. It is felt that NRC overlooked entirely the impact of cooling towers on the terrestrial biota in the area proposed for tower construction. Great concern was expressed about the impact of once-through cooling on aquatic biota, but the same concern was not expressed with regard to the bird and animal life of the area. It is casually stated that they can probably find a home in other areas, without however, considering any resulting ecological impacts. This is viewed as a serious oversight on the part of the NRC staff.

9. The claim is made that there is an extremely small potential for sever damaging episodes resulting from the operation of cooling towers at the Indian Point site. However, the report goes on to say that the licensee should monitor drift and salt deposits and determine their significance. Why the concern about drift and salt deposition if no problems are anticipated? It is interesting to speculate what NRC would suggest if later studies, after towers were constructed, indicated serious salt deposition was taking place.

10. NRC claims that no cumulative effects from salt deposition should be expected. Yet experience with spray irrigation has shown that salt does accumulate in soils, often through an ion exchange mechanism, and that the resulting accumulations have serious effects on plant life.

11. The report describes the opinions of a panel of "experts" on the projected aesthetics of cooling towers. It is quite apparent, however, that none of the experts were property owners from the Indian Point area. It is easy enough to express opinions on matters of no impact to the people involved. It was also of note that the aesthetic comparisons were between tower alternatives, but no comparisons were between "towers" and "no towers."

12. It should be noted that the NEPA states as an objective:

> "Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings."

It is strongly felt that the construction and operation of closed cycle cooling towers will violate the spirit and intent of the NEPA for a segment of population long established in the area. While one can be coldly objective and say that the destructive effects of cooling towers involve a relatively small area and only a moderate number of people, the people of Buchanan are human beings and their rights are just as important as those who are making decisions from afar.

I trust these remarks will be of help to you and if I can be of further service, please let me know.

Yours truly,

[signature]

Dr. William W. Shuster, P.E.
Director of Environmental Programs
Rensselaer Polytechnic Institute

PLANNING COMMISSION
CITY OF PEEKSKILL
CITY HALL
PEEKSKILL, N. Y. 10566
April 14, 1976

RECEIVED APR 15 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Director, Division of Site Safety and Environmental Analysis

Re: Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2
Docket No. 50-247

Gentlemen:

At its meeting on April 1, 1976 the Planning Commission of the City of Peekskill adopted a resolution opposing the construction at Indian Point of any of the closed cycle cooling systems necessitating the construction and use of cooling towers because of the aesthetic and economic impact of these towers on the City of Peekskill and its neighboring communities.

Although the Commission members do not possess the expertise necessary to independently evaluate all the technical information presented in the Draft Environmental Statement, as involved and concerned citizens all are able to understand the visual impact of the towers illustrated in the rendered photographs on pages 6-41, 42 and 43 of the report. The thought of the preferred natural draft type monstrous structures, each wider than the length of a football field, towering more than fifty-five stories above the ground and spewing forth a saline cloud that will both eclipse the sun and shower salt droplets on the surrounding communities, is inconceivable and unacceptable to the Commission.

The Draft Environmental Statement notes that the City of Peekskill is presently formulating proposals to revitalize its waterfront property along Peekskill Bay. Modest recreational improvements in this area are already underway. Consideration is being given to the provision of additional recreational facilities as well as possible residential and commercial development in the future plans for the proposed waterfront area. However, the above-noted photographs show that these cloud belching monsters will impose an industrial atmosphere on the

waterfront area and the City itself. This will make the City of Peekskill, in general, and its waterfront area, in particular, less attractive to potential developers and impose an economic hardship and an unsightly visual impact on the City.

In the Draft Environmental Statement the Office of Nuclear Reactor Regulation's staff has concluded that the effects of saline drift on local vegetation are unlikely to have major consequences for any of the cooling towers considered and that the risk to vegetation from natural draft type towers on or offsite is sufficiently low to be considered negligible. The Commission has really no way to verify these conclusions but anyone who has ever lived near the seashore is aware that a marine atmosphere accelerates corrosion of automobiles and other metal products, hastens weathering of wood and painted surfaces and even causes concrete buildings and pavements to deteriorate. The Commission hopes that the data used by your staff in arriving at its conclusions regarding saline drift were extensive and accurate enough to insure that the City of Peekskill will not be subjected to any adverse effects.

The power brown-outs that have occurred over the past few years have provided ample illustrations of the metropolitan area's need for the electricity generated at Indian Point and the Commission is not suggesting that the safe generation of power be in any way disrupted or discontinued. The Commission suggests that the power plants be permitted to continue to operate with the existing once-through cooling system. Surely there must be a screening perimeter long enough and a screen with a mesh suitable to reduce the impingement and entrapment of fish and fish eggs to acceptable levels.

The Planning Commission requests of the Office of Nuclear Reactor Regulation that the City of Peekskill and its inhabitants be given consideration commensurate with that being afforded to the inhabitants of the Hudson River.

Very truly yours,

Edwin I. Ziegler

Edwin I. Ziegler, Chairman

CITY OF PEEKSKILL
CITY HALL
PEEKSKILL, N. Y. 10566

April 20, 1976

RECEIVED
APR 23 1976
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Director, Division of Site Safety and Environmental Analysis

Re: Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2, Docket No. 50-247

Gentlemen:

As Mayor of the City of Peekskill, I am in strong disagreement with the recommendation of the Nuclear Regulatory Commission that natural draft cooling towers, as proposed by Con Edison, be constructed at Indian Point. I feel that insufficient consideration has been given to the quality of life of those people living in close proximity to the site as well as to the social and economic needs, both present and future, of the Peekskill community. I, therefore, oppose the construction of natural draft cooling towers and recommend that you reconsider your findings and dedicate time to searching for new and positive means of dealing with the problem of waste heat at Indian Point.

The City of Peekskill, located directly north of the Consolidated Edison Nuclear Power Plant at Indian Point, is a small urban center with a population of 20,000. In recent years the City has made a concerted effort to reverse a trend towards deterioration and blight common to many older cities, especially along the Hudson River Valley. We are very proud of the progress we have made in this direction. Today, with the assistance of 30 million dollars in Federal and State funding and the resulting private investments this public money has encouraged in our community, there are few, if any, lingering signs of blight in Peekskill and new development, showing confidence in the future, is evident throughout our 4½ square miles. This job is far from done however, and there remain many new developments which the City is attempting to attract to expand its economic base and housing inventory.

4030

Of course, much of this progress is a result of the support given to Peekskill by the Federal and State governments as well as our own goals and efforts to rebuild our community. However, of equal importance has been the physical setting with which Peekskill is gifted. We are located approximately 45 miles north of New York City with excellent road and rail connections to Manhattan. We are also located on the eastern shore of the Hudson River with a picturesque panorama of the Palisades Interstate Park system located opposite the Peekskill Bay and with a varied topography offering many advantageous views. Many parcels for which development interest has been shown are strategically located in our upland and waterfront areas offering exciting views of the Hudson River Valley. We have found such locations have attracted many prime developers interested in constructing new residential and related development designed to take full advantage of the scenic setting possible from these sites.

Without these scenic attributes, Peekskill would probably be just another small urban center and in a much less competitive situation to attract developers. We, therefore, are in great fear of the construction of a closed-cycle cooling system using natural draft cooling towers for Indian Point Unit No. 2. The scale and drift of this proposed tower will have a disastrous impact upon the beauty of this valley, a quality which Peekskill has been able to and hopes to continue to be able to take full advantage of, to improve the quality of life for our community and to build a stronger economic base for the future. Many new developments have been constructed and, as stated before, many more are planned. This trend has been most exciting for Peekskill; however, if the attribute of our scenic location in the Hudson Valley is negated, we foresee that this positive growth will be reversed.

Of special import to the future of the City of Peekskill is its waterfront which is largely City-owned and for which we have planned ambitious and exciting projects. This development is mentioned briefly in the Draft Environmental Statement, Docket #50-247 (6-29, 32, 35, 36, 52). We are a landlocked community with no possible options for expansion and therefore must make full and complete use of our limited land area. The cooling tower being proposed for Indian Point Unit No. 2 would seriously detract from this area and therefore curtail our options for future growth.

Much of our interest in the waterfront area is directed to those parcels in private ownership which we anticipated would be upgraded as a result of public improvement in the Bay area. There is sufficient land in proximity to the waterfront to attract private dollars for new residential/commercial development. Of special note in this area has been the future of the land now owned and used by Standard Brands/Fleischmann Products, Inc. should, in the long term, their operation be reduced or removed from its present site (the Fleischmann Brewery has already moved its Peekskill facility to a New Jersey plant and many structures on the site have been demolished and cleared). Serious consideration is being given in our long range planning proposals for the waterfront area to the redevelopment of this land for luxury residential/marina development use due to its strategic location and setting. With the construction of the proposed cooling tower at Indian Point, directly adjacent to the Standard Brands property, this option for development would be seriously limited or even cancelled.

Therefore, as a result of the proposed construction of a cooling tower, we are being forced to redirect much of our upcoming planning efforts, funded with a Federal H.U.D. 701 Comprehensive Planning Assistance grant, to step backwards and reconsider alternate and less desirable uses for the Peekskill waterfront and upland areas, because of the anticipated impact of the scale and drift of these cooling towers.

I would also like to make note of the impact that such a tower would probably have upon the residents of my community. The scale proposed for the tower is unknown in northern Westchester County and being a part of a nuclear power generating plant, the safety of which has been seriously questioned as of late (geological as well as nuclear safety concerns), would stigmatize our community as being near a possible "doomsday machine" and thereby have serious psychological effect on our residents both present and future. This, of course, is in addition to the drift from this tower which would be a saline mist unlike that from other existing cooling towers. The drift, aside from having an effect on the physical environment and its biota as mentioned in your report, would, in addition, add to the humidity which is already intense during the summer months, perhaps endangering the health of those people with asthmatic or respiratory ailments. I would like to here add that Peekskill has just finished completion of approximately 300 housing units for Senior Citizens (funded by various New York State and Federal agencies) which have been designed to take advantage of the views of the River so that the effect on these people would be compounded.

I realize that the findings of this report state that the effect of the installation of gigantic cooling towers would be minimal or even negligible, however I also realize that your request for a monitoring program (p. iv) to determine the significance of drift and salt disposition, after construction of said tower, indicates that you question the possible validity of the findings of this report. Our concerns about the proposed cooling towers are both many and, in our estimation, quite serious, with imminent impact upon the City's future and should not be subject to speculation. The needs of residents and the future of our community should also be evaluated with the same intensive scrutiny and sensitivity given to the natural environment. Our plight becomes even more serious if we project to the future and realize that, if the proposed cooling tower for Indian Point Unit No. 2 is constructed, a similar system will probably be installed for the other large reactors located at this site, therefore, further compounding its impact on our community.

With a national prohibition of open cooling systems by the Nuclear Regulatory Commission, what happens at Indian Point will also decide the future fate of many other nuclear power plants and their neighboring communities. I strongly feel that the serious questions being raised at Indian Point, as well as the importance of nuclear power to the future of our country, warrants considerable attention. We should move quickly and use our nation's sophisticated inventory of technological talent to explore "new" means of dealing with the problem of surplus waste heat from nuclear power production, rather than just itemizing the cost benefits of older and perhaps now outdated methods of treating this problem, as was done in the Draft Environmental Statement, Docket No. 50-247.

We, in the City of Peekskill, with a grant from the National Endowment for the Arts, have undertaken an exploratory study in this area and have found that many imaginative options are available and many more could be realized if a concerted effort were directed toward this topic. I therefore urge the Nuclear Regulatory Commission to support efforts toward the formulation of new and productive methods of dealing with the problem of waste heat.

In our energy conscious times this by-product of nuclear power production should not be interpreted as a problem or a waste production, but instead as a recyclable source of energy allowing us to make better and more efficient use of our natural resources.

Concerning the short term problem at hand, I question the cursory discussion given to spray ponds, especially powered spray modules, as a means of dissipating this waste heat in a closed system. The report states that there is not sufficient land area in proximity to Indian Point for this system to be implemented. My staff, in exploring this statement, has informed me that there exists a large tract of land (122 acres) to the south of the nuclear reactors to which Con Edison has access and which could accommodate spray ponds. In my layman opinion, spray ponds would more than fulfill the requirements for a closed cooling system yet would engender far fewer negative impacts upon the environment and our community.

I also question the dismissal of wet/dry mechanical draft towers or the circular mechanical draft towers as a possible solution. These, with the possible exception of noise, would impinge less upon our City than the recommended natural draft tower and we feel modifications could be made in the tower design to reduce this noise factor allowing for a system which might be able to stand as a possible secondary compromise solution to this serious problem. Of course, the expense involved in this particular solution would be perhaps higher than that of the draft cooling towers preferred by Con Edison, however, considering the negative external economy created by this tower and borne by our community, as well as the national interest in power production, this seems over the long run to be a justifiable investment as would the aforementioned research concerning alternate new means of dealing with this "waste heat".

I therefore strongly oppose the construction of natural draft cooling tower(s) and urge you to reconsider the findings of your report and your recommendation to support Con Edison's suggested solution. I feel proper consideration has not been given to the many people who live in adjacent communities and to the possible disastrous esthetic <u>and</u> economic effect on our City's present and future development.

I thank you for your attention in this matter and look forward to your response to the aforementioned points. I also invite you to visit us in Peekskill to discuss this problem in greater detail.

Sincerely,

Fred J. Bianco Jr.

Fred J. Bianco, Jr.
Mayor

NRC BHDA

NRC BHDA

WU INFOMASTER 1-032942C110 04/19/76
TLX WU PRESS WSH B
043
TWX 7108280476 USERDA GTWN

SPL043 WAE129(1548)(2-035154E110)PD 04/19/76 1548
ICS IPMMTZZ CSP
9147373713 TDMT MONTROSE NY 165 04-19 0348P EST
PMS U S NUCLEAR REGULATORY COMMISSION ATTN DIRECTOR DIVISION
OF SIGHT SAFETY AND ENVIRONMENTAL ANALYSIS, FONE, REPORT DELIVERY
BY MAILGRAM, RUSH RUSH FONE BY 5PM URGENT IN TODAY BY PHONE, DLR
WASHINGTON DC 20555

GENTLEMEN, THIS DRAFT E.I.S. DOES NOT ALLAY OUR FEARS ABOUT DAMAGE TO PLANTS AND ANIMAL LIFE IN OUR TOWN. NEITHER DOES IT PROJECT THE POSSIBLE DAMAGE TO PRIVATE AND PUBLIC PROPERTY. THE DAMAGE TO AUTOMOBILES ALONE MAY BE IN THE MILLIONS OF DOLLARS PER YEAR. IT APPEARS THAT OUR WEATHER PATTERNS WILL BE ALTERED INDEFINITELY AND IRREVERSIBLY.

AS SUPERVISOR, I DO NOT FEEL THAT THIS DRAFT E.I.S. HAS THOROUGHLY COMPARED THE ALTERNATIVE.

E.G.: NEGATIVE EFFECTS OF ONCE-THROUGH SYSTEM SUCH AS INDIAN POINT UNIT #1 HAVE NOT ALL BEEN ENUMERATED IN DETAIL IN THIS DRAFT E.I.S.

A POINT OF MAJOR CONCERN IS THAT IF THIS CLOSED CYCLE SYSTEM IS APPROVED FOR UNIT #2, IT SEEMS TO FOLLOW THAT A SIMILAR APPROVAL MAY BE GRANTED FOR UNITS #1 AND #3.

THE TOTAL EFFECT OF SUCH AN ARRANGEMENT IS NOT COMPLETELY EVALUATED OR REVEALED IN THIS DRAFT E.I.S. AS I FEEL IT SHOULD BE

SUPERVISOR MURIEL H MORABITO TOWN OF CORTLANDT WEST CHESTER COUNTY NEW YORK MAILING ADDRESS: MUNICIPAL BUILDING CROTON-ON-HUDSON NEW YORK 10520

2028 EST

C

NRC BHDA
a

Natural Resources Defense Council, Inc.

15 WEST 44TH STREET
NEW YORK, N.Y. 10036
212 869-0150

Washington Office
917 15TH STREET, N.W.
WASHINGTON, D.C. 20005
202 737-5000

Western Office
664 HAMILTON AVENUE
PALO ALTO, CALIF. 94301
415 327-1080

April 8, 1976

50-247

RECEIVED
APR 12 1976
U.S. NUCLEAR REGULATORY COMMISSION

George W. Knighton, Chief
Environmental Projects Branch 1
Division of Site Safety &
Environmental Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Knighton:

Enclosed are comments submitted on behalf of the Hudson River Fishermen's Association on the Draft Environmental Statement related to the Preferred Closed Cycle Cooling System for Installation at Indian Point Unit No. 2.

Yours sincerely,

Sarah Chasis

Sarah Chasis
Attorney for Hudson River
Fishermen's Association

SC:ps

Enc.

3648

50-247

COMMENTS ON BEHALF OF

HUDSON RIVER FISHERMEN'S ASSOCIATION

ON

DRAFT ENVIRONMENTAL STATEMENT

Related To The

PREFERRED CLOSED CYCLE COOLING SYSTEM

For Installation At

INDIAN POINT UNIT NO. 2

Submitted by

SARAH CHASIS
(Natural Resources Defense Council)
15 West 44th Street
New York, New York 10036

April 8, 1976

These comments are being submitted on behalf of the Hudson River Fishermen's Association (HRFA). HRFA is a citizens' organization with a membership of more than 750 made up of citizens, fishermen, and scientists who seek to protect the natural resources of the Hudson River and the environment of the Hudson Valley. HRFA was a party to the licensing proceeding for Indian Point Unit No. 2 and on December 3, 1975, HRFA filed a petition to intervene in the Nuclear Regulatory Commission (NRC) proceeding to designate a preferred alternative closed cycle cooling system for Indian Point 2. An order granting intervention was issued on December 23, 1975.

The interests of all HRFA members are affected by the present once-through cooling system at Indian Point Unit No. 2 which is extremely destructive of fish life. Therefore, HRFA supports the installation of a closed-cycle cooling system at Indian Point 2 and supports the installation of the proposed natural draft cooling tower, or any other closed-cycle cooling system agreed on by Consolidated Edison and the NRC, which will assure once-through cooling at Indian Point 2 ceases on schedule.

The Draft Environmental Statement (DES) on alternative systems makes clear that there are several alternative systems which are feasible and may be constructed and operated

in an environmentally acceptable manner. The statement lays a firm foundation for this conclusion through a detailed review and analysis of the data relating to the different systems and their impacts.

HRFA's major concern with respect to the proceeding on alternative closed cycle cooling systems is to assure compliance with the license term establishing May 1, 1979 as the date for cessation of operation with the present once-through system. That date, set after years of hearings and litigation, the NRC staff now states, is obviated by virtue of the NRC staff's own failure to act expeditiously. (DES, Section 4-3). Such a conclusion may not be reached unless there is 1) a showing by the company that the NRC staff's failure to designate a preferred alternative closed cycle cooling system by December, 1975 necessitates a deferral of the May, 1979 date; 2) an environmental impact statement is prepared on any proposed action respecting deferral of the May 1, 1979 date; and 3) a hearing is held to determine whether the deadline should be adjusted and, if so, to when. None of these conditions have been met to date.

The statement, however, deals with this critical issue in the following offhand manner:

"Since the December 1, 1975 date for completion of all regulatory approvals is impossible due to the time required for detailed staff evaluation*, the May 1, 1979 date is postponed accordingly ... no hearing date has been established, depending as it does on the publication of this DES and FES at a later date. Therefore, no definitive schedule can be set until later and any attempt to devise one would be unrealistic at the present time." DES, Sec. 4-3.

This conclusion is totally unacceptable. As previously stated by HRFA in a letter to Mr. Ben Rusche (December 9, 1975):

"License deadline dates are not to be shifted about as if the License requirement related solely to an immaterial plan and structure modification. The License provision allowing postponement of the May 1, 1979 date can not be read as automatic, but must be interpreted under the strong admonitions of the License to mitigate harm to the Hudson River biota. Delay where it appears that Con Edison will suffer no real or potential harm in continuing along the present schedule is irrational, unnecessary and at odds with the basic requirements of the License."

It is HRFA's position that the conclusion by the DES with respect to scheduling is unacceptable and violative of the public interest.

*The NRC staff took 15 months to analyze the company's license application and supporting report; in the end, it reached basically the same conclusions as the company had. The staff's failure to act in an expeditious fashion indicates the low priority afforded this matter within the NRC despite the clear public interest involved and the explicit license requirement. The staff now seeks to use its own slowness to act to justify a delay which poses a serious threat to the very interests the NRC's license condition is designed to protect.

The Environmental Impacts of the Alternative Closed Cycle Systems. The DES analysis confirms the fact that there will not be significant damage caused by salt drift, fogging, icing or noise. Research conducted by both Con Edison and the NRC staff confirm the fact that there will be only insignificant effects on the local environment.

With respect to the alternative preferred by Con Edison, i.e., wet natural draft cooling towers, the NRC staff estimates that the effects of saline drift on local vegetation either on or offsite is sufficiently low to be considered negligible (Sec. 5-72); that an average annual addition of 20 hours of ground fog in an area over the Hudson River would be the maximum impact from fogging (Sec. 5-38); that an average of 11 additional hours of icing might be expected to occur on an annual basis (Sec. 5-38); and that the predicted operational acoustic effects will not significantly exceed the ambient acoustical environment (Sec. 5-59 & 60). Thus the major potential environmental effects of the natural draft cooling towers which are saline drift, weather modification and noise are shown to be minimal.

Con Edison's own Report on "Economic & Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2" reached substantially the same conclusions.

1. No significant ground level visibility hazard is expected to occur by operation of a natural draft cooling tower.
Report at 6-12, et seq.

2. Damage to vegetation from saline drift would be a potential problem for three species in a small area (1 Km^2) and for hemlock in a slightly larger area (3.5Km^2) after 14 rainless days coinciding with low fresh water flow in the Hudson River.
Report at 6-14, et seq.

3. Noise will not be a significant problem.
Report at 6-48, et seq.

CONCLUSION

HRFA believes that the DES supports the position HRFA has taken all along, that the environmental impacts of closed cycle cooling systems are vastly outweighed by the environmental impacts of once-through cooling, and that the research conducted by the NRC staff and Con Edison confirms this position which was taken by HRFA in the licensing proceedings for Indian Point Unit No. 2. Among the closed cycle systems, natural draft towers appear to minimize the effects of fogging, saline drift and noise, but are more visible than mechanical draft towers. However, if mechanical draft towers are more desirable because of their reduced visibility, such a system would meet with no objection from HRFA.

SENATOR
BERNARD G. GORDON
37TH DISTRICT
CHAIRMAN
COMMITTEE ON JUDICIARY

THE SENATE
STATE OF NEW YORK
ALBANY 12224

LEGISLATIVE OFFICE BUILDING
N.Y.S. CAPITOL
ALBANY, N.Y. 12224
518-472-2027

1019 PARK STREET
PEEKSKILL, N.Y. 10566
TELEPHONE
914-PE 7-1100-1

STATEMENT
BY SENATOR BERNARD G. GORDON
APRIL 19, 1976

At a hearing held by the Nuclear Regulatory Commission last year concerning Indian Point Plant #3 I raised objections to the Commission's plan to require cooling towers at Indian Point. At that time I detailed, and documented, the adverse economic, environmental and aesthetic impact that would result if such towers were built. The draft Environmental Impact Statement prepared by the N. R. C. staff and the Con Edison study showing natural draft towers to be the preferred type of cooling system contained information clearly establishing that the dangers posed by these towers are in fact very real.

Since that time further research has only served to heighten my dismay at the apparent lack of concern for human needs evidenced by the N. R. C. The N. R. C. Environmental Impact Statement in no way answers any of the questions raised in my statement of April, 1975. Rather, important questions are again left unanswered, assumptions are made on the basis of non-existent data, and the health and quality of life of the area's residents given little weight when viewed against the sole focus of protecting the fishlife of the Hudson.

SENATOR
BERNARD G. GORDON
37TH DISTRICT
CHAIRMAN
COMMITTEE ON JUDICIARY

THE SENATE
STATE OF NEW YORK
ALBANY 12224

LEGISLATIVE OFFICE BUILDING
N.Y.S. CAPITOL
ALBANY, N.Y. 12224
518-472-2027

1019 PARK STREET
PEEKSKILL, N.Y. 10566
TELEPHONE
914-PE 7-1100-1

For your benefit, I enclose a copy of my earlier statement footnoting to the page the information, or lack thereof, which concerns me so greatly. But in order to lend greater substance to the feelings of the area's residents, I have sought, and enclose expert testimony, to support my apprehension as to these towers, These experts, I might add, are not from the threatened area and were unbiased as to what conclusions they would reach after dispassionate review. Their conclusions are frightening.

The "Comment", prepared for me by the Northeastern Legislative Energy Staff, finds the N. R. C. Environmental Statement "sadly deficient". They confirm my fears that the cooling needs of other plants (such as Bowline, less than 5 miles away) are ignored, althought the cumulative environmental impact from these plants could be devastating. In addition, these scientists outline six potential beneficial uses for waste heat and sadly conclude that the N. R. C.'s brief dismissal of this important issue "is reflective of the process by which the United States has been locked into the most energy wasteful industrial infrastructure in the world". The Comment points out that "many other factors are not covered by the N. R. C. report and that the prospect of a better pure cooling solution being developed is also ignored." Further information on these issues should unquestionably be obtained before a decision to mandate these

SENATOR
BERNARD G. GORDON
37TH DISTRICT
CHAIRMAN
COMMITTEE ON JUDICIARY

THE SENATE
STATE OF NEW YORK
ALBANY 12224

LEGISLATIVE OFFICE BUILDING
N.Y.S. CAPITOL
ALBANY, N.Y. 12224
518-472-2027

1019 PARK STREET
PEEKSKILL, N.Y. 10566
TELEPHONE
914-PE 7-1100-1

towers is made.

In addition, a study prepared for me by the Atmospheric Sciences Research Center of the State University of New York concludes "that once-through cooling will have less detrimental physical impact and less displeasing aesthetic impact than the cooling towers". It also points out, and details, the fact that at the time of theN. R. C. study "not enought data were available to analyze all the environmental impacts of the salt drift from the cooling towers." Dr. Ulrich Czapski, Associate Professor of Atmospheric Science at the State University concludes that, "Not only is the use of cooling towers a great economic penalty, but its atmospheric consequences are not sufficiently well known to guarantee a diminished total environmental impact." In outlining the very real dangers to the plant life of the area raised by this salt drift the Atmospheric Sciences report notes "The synergistic effects of salt drifts and drought have not been considered in the Environmental Impact Statement". It concludes that the Statement "contains too little data" to evaluate the potential adverse impact of salt deposits on the area's vegetation.

The N. R. C. studies thus far have contained too little data, have made too many assumptions, and have shown too little concern for the threatened plight

SENATOR
BERNARD G. GORDON
37TH DISTRICT
CHAIRMAN
COMMITTEE ON JUDICIARY

THE SENATE
STATE OF NEW YORK
ALBANY 12224

LEGISLATIVE OFFICE BUILDING
N.Y.S. CAPITOL
ALBANY, N.Y. 12224
518-472-2027

1019 PARK STREET
PEEKSKILL, N.Y. 10566
TELEPHONE
914-PE 7-1100-1

of thousands of people in a four county area. We bring our fears to your attention and urge that these concerns are justified by the facts. There is a clear obligation ou your part to defer the requirement of cooling towers at Indian Point until all environmental questions have been completely and satisfactorily answered. To do less than this would be to condemn the residents of the Hudson Valley to live with the frightening consequences of these monstrous towers before their full impact has been adequately studied.

Bernard G. Gordon
SEP

BERNARD G. GORDON

NEWS

FROM: SENATOR BERNARD G. GORDON

37th STATE SENATORIAL DISTRICT

CONTACT: Joe Shannon
Area Code (518) 472-2027
Area Code (914) 237-6611

TESTIMONY

by

SENATOR BERNARD G. GORDON

before the

ATOMIC SAFETY and LICENSING BOARD of the

NUCLEAR REGULATORY COMMISSION

April 1, 1975

I appreciate the opportunity to submit this statement to the Nuclear Regulatory Commission concerning the very real fears and concerns that the people of the Hudson River Valley have relating to the planned construction of hideous and offensive water cooling towers at the site of Con Edison's atomic plants at Indian Point.

I also emphasize that I am absolutely convinced that I am expressing the opinion and viewpoint of the large majority of people who will be grievously and adversely affected by a Washington directive that will have such a catastrophic impact upon them.

It is my hope that the Commission will be able - - even at their considerabl and comfortable distance from the effect of their ruling - - to revise its ill-conceived viewpoint toward more humane considerations.

Since the final environmental statement prepared by the N.R.C. considers the environmental impact from operation of all three reactors, I would like to direct my remarks to the N.R.C.'s decision to order a cooling tower for Plant #2, as well as to the operation of Plant #3.

It is most disheartening to recognize that the Commission is prepared to mandate not only a tower at Plant #2, but also at Plant #3. Indian Point can very well become known as the world's largest towering inferno, - - a most dubious distinction.

Exactly seven years ago, I publicly warned that the continued proliferation of atomic plants at Indian Point "must be weighed against the common welfare." That premise still holds true today. The Commission's license provisions requiring cooling towers are an outrage to the people of the Hudson Valley and poses a clear danger to the health, welfare and livelihood of a quarter million - - and more - - people of Westchester, Orange, Putnam and Rockland counties.

Construction of two natural draft wet cooling towers, as approved by the Commission,[1] would, unquestionably, ruin the natural beauty of the Hudson Valley. These concrete towers would be over 560 feet high, over 300 feet across the top, and emit a plume of saline mist that would rise thousands of feet into the air and cover an area miles wide. They would be the tallest structures between New York City and Albany. While every subtle attempt has been made to minimize the other horrible consequences to the Hudson Valley which would result from construction of these towers, the N.R.C. report concluded:

> "The staff recognizes that there is one impact of cooling towers that is not negligible; this is the visual insult of the towers themselves and, under certain meteorological conditions, the plumes from the towers."[2]

"Insult" is certainly the proper word for the order requiring a tower for Plant #2. But it is an insult that too greatly threatens the very existence of the people affected to be allowed to go uncorrected.

Economically, the cost of these towers will be added to the tremendous burden already borne by the Con Ed consumer. 489 million dollars, almost one-half billion dollars, is the estmated total revenue requirement over the life of the Plant for just one of these towers.[3] And this amount will be added to the rate structure of Con Ed, whose customers already pay the highest electric rates in the country!

Apart from the obvious aesthetic and economic reasons, human health and environmental considerations alone fully demonstrate the iniquity of constructing such towers. Never before in the world, to my knowledge, have such towers been constructed on an inland salt-water estuary. The millions of gallons of salt water mist which will be spewed daily from the top of these towers will kill plant life, block sunlight, create dangerous ice and fog at certain times, rust our automobiles and erode the very structure of our homes!

And - - I emphasize - - these are not just idle fears. Your own report says that this smog plume will create an artificial cloud cover blanketing an area having a radius of more than four miles, a possible diameter of more than eight miles and a fall-out affecting an area more than twenty miles wide.[4] The Con Ed environmental study concluded this saline mist could increase corrosion activity, stating:

> "Metal, concrete, wood, painted and asphalt surfaces in the vicinity of the cooling tower may all present a potential for saline damage."[5]

Your study has concluded that these towers would drop almost 20 pounds of salt per acre each year in some areas, and deposit over 8 pounds each year in an area ten miles from the towers![6] The impact of this salt drift on plant life alone will be devastating.

The N.R.C. environmental study also concluded that these towers will cause fog.[7] And your report states that:

> "When temperatures are sufficiently low, cooling tower plumes can cause icing."

To these horrors must be added the cumulative effect we can expect from construction of two similar towers across the river at the Orange and Rockland Bowline plant, as required by a Federal Environmental Protection Administration ruling just a month ago.

Visual insult, salt deposits, fog, corrosion, icing, blockage of sunlight - - these environmental catastrophes are all conceded as inevitable in the N.R.C. report. And yet the report concludes:

> "In the judgement of the staff, this impact is acceptable, whereas the likely damage to striped bass is not."[9]

I won't accept - - nor will the people accept - - such a callous, indifferent and absurd conclusion!

The fact that such conclusion is not based on sound information regarding the impact of the products of the towers, namely, ice and plumes, rests uneasy upon us, particularly since your own study determines that:

> "No quantitative method of predicting these situations are generally accepted."[10]

Relative to the killing of plant life, the report points out that:

> "Unfortunately, the effects of aerial salt impaction upon plant species in areas removed from the influence of coastal salt spray have received little study."[11]

Unfortunate indeed! Not for the Commission members, but for those of us who live here and who will be so gravely affected. And, incidentally, no consideration at all was given in your report of the effect of additional salt, mist, ice, fog and corrosion from the towers now mandated for across the river.

In the name of environmental conservation this Commission, after inadequate study and with limited foresight, seeks to condemn the people of this area to live in a smog-shrouded wasteland. I intend to do everything in my power to prevent this from happening.

If the total isolation of this Commission from the concerns of the people who live and work in this area is not yet clear, one final quote from your staff report ends all doubt:

> "From the analysis of alternative cooling systems, the staff believes that additional information of

impacts of such systems should be obtained. As predictions of minimal vegetation damage were based upon calculated drift deposition rates, which have not been verified, the staff requires that upon completion of the construction of the cooling towers the applicant should establish a series of permanent plots at strategic locations..... In the event that major vegetation damage is observed (e.g., extensive defoliation, dieback of trees and ornamentals on adjacent properties, decline of screening vegetation, etc.), it is recommended that appropriate steps be taken.....".[12]

The Commission has the temerity to order the building and operation of these monstrous towers - - and they tell us that if the countryside rots in the process, we'll worry about it then! They're putting the cart before the horse - - and they are also placing the value of aquatic life before that of human life. I urge your to rescind your order requiring cooling towers for Plant #2 and I urge you to not require a tower for Plant #3.

I intend to vigorously pursue passage of legislation that I have already introduced in Albany to require our State agencies - the Public Service Commission, Environmental Conservation Department and others to study and mandate approval of all plans for these towers before construction can be started.

I emphasize, too, that I appreciate and understand the problems relating to the environment of the Hudson River and the desire to properly regulate such factors. I have addressed myself only to some objections. It is certainly proper to consider alternatives. I have not been able to conclude as to the best methods of approach although I believe that several addressing you today will be offering solutions. I am aware, too, that the Commission has considered other approaches and they should be fully explored.

However, frightening towers and their calamitous impact are not the answer.

There must be a better way - - and it must be found.

Footnotes

1. Final Environmental Statement, February, 1975, United States Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Summary and Conclusions, p. xii.
2. Ibid, Ch. XII - 90.
3. Ibid, Appendix G-23.
4. Ibid, Appendix G-6.
5. Economic and Environmental Impacts of Alternate Closed-Cycle Cooling Systems, December 1, 1974, Consolidated Edison Company, p. 6-34.
6. N.R.C. Report, supra, Appendix G-3.
7. Ibid, Appendix G-7.
8. Same as 7.
9. Ibid, Ch. XII - 90.
10. Ibid, Appendix G-7.
11. Ibid, Ch. XI - 22.
12. Ibid, Ch. XI - 52.

STATE UNIVERSITY OF NEW YORK AT ALBANY
ATMOSPHERIC SCIENCES RESEARCH CENTER
1400 Washington Avenue
Albany, New York 12222

TO: The Honorable Bernard G. Gordon
LOB - Room 708
Empire State Plaza
Albany, New York

FROM: Ulrich Czapski and Ronald Stewart

DATE: 29 March 1976

RE: Indian Point Cooling Towers

Enclosed please find a short analysis by an ecologist, Mr. Alvin Breisch, concerning the salt discharge from the cooling towers at Indian Point. It simply points out that not enough data were available to analyze all the environmental impacts of the salt drift from the cooling towers.

Once again we are trying to compare the environmental impact of two cooling systems. We believe that once-through cooling will have less detrimental physical impact and less displeasing aesthetic impact than the cooling towers.

The enclosed American Electric Power brochure will provide examples of cooling tower plumes 6-9 miles downwind of the towers. We thought that this analysis might be of interest.

RS:UC:mh
Enclosures

STATEMENT ON COOLING TOWERS

Ulrich Czapski

Cooling towers are being used increasingly in the United States because of environmental concerns and consequent regulations about the direct dissipation of heat in the cooling water by returning it to large water bodies. Not only is the use of cooling towers a great economic penalty, but its atmospheric consequences are not sufficiently well known to guarantee a diminished total environmental impact. Ultimately the heat from thermal effluents into rivers and lakes is transferred to the atmosphere by the same process as in cooling towers - namely by evaporation (about 80%) and by convection (about 20%). The difference for the atmospheric environment lies in the radius (area) and hence concentration, as well as in the elevation where this transfer occurs, causing the different atmospheric consequences. The waste heat in cooling towers and the concomitant amount of water vapor is put into the atmosphere over the exit surface of the cooling towers (ca. 1 acre). Because of the bouyancy of the water vapor and heated air, the plumes of cooling towers can rise to considerable heights, but they almost invariably cause large visible plumes and under the right circumstances can trigger convection activity or reinforce existent instabilities of the surrounding airmass (see Czapski, 1968; AEP Brochure, 1974). Direct heat disposal into river waters will disperse the heat through mean and turbulent transport in the water over a vastly larger area (i.e., a distance of tens of miles downriver under moderate flow velocity) and therefore the concentration of water vapor and heat when entering the atmosphere will be much lower.

On the other hand, because of the low elevation and the lack of appreciable bouyancy of the air above the water in many situations, fog can occur and be augmented over the river. This effect, however, is almost certainly confined to the immediate neighborhood of the river and will occur predominantly only when fog could naturally occur. A meteorological advantage of cooling towers over direct cooling water disposal cannot be easily demonstrated, and it might well be that cooling towers also have a disadvantage from the physical point of view, in addition to their unsightliness and the severe economic penalty. These considerations do not take additional environmental damage into account that may occur from salt spray of the cooling tower plumes.

INDIAN POINT: IMPACT OF SALT WATER COOLING TOWER ON VEGETATION

(Discussion based on Alternative B of Appendix G - Cooling Towers for Units Nos. 2 and 3)

Alvin Breisch

1. Indian Point Environmental Statement on the impact of salt drift from cooling towers is based on a very limited field survey of vegetation communities which does not include the entire area of influence of the towers.

2. The sensitivity of species used in the experiments at Forked River (the basis of comparison to Indian Point) was measured as to the extent of leaf injury. No evaluation was made of the possible effects on such phenologically important events as needle elongation, flowering, and fruit set which are generally considered more sensitive times for injury due to pollutants.

3. The evaluation assumes normal precipitation rates to determine dilution of salt drift from cooling towers for purpose of vegetation impact analysis. Such an analysis fails to consider occurrence of meteorological drought which would combine naturally occurring water stress with additional stress due to salt drift. Drought conditions tend to heighten the effect of salt on sensitive species.

Indian Point Environmental Statement on the impact of salt drift from cooling towers on the terrestrial biota is based on data from low lying plant communities within two miles of the cooling towers. The three terrestrial sample areas described (Indian Point EIS p. II-35) may be sufficient analysis if direct discharge of cooling waters to the Hudson was used, but the analysis is unacceptable if consideration of cooling towers is to be made where an airborne pollutant can be broadcast in potentially large quantities over a much larger area. The upland communities in Blue Mountain Reservation (2½ miles to the east) and Palisade Interstate Park (2½ miles to the west) have not been analyzed although these areas represent the closest plant communities to Indian Point that are protected as parks and contain more natural and undisturbed vegetation than would generally be found in the industrially or residentially zoned low lying area along the Hudson. These areas have not been shown in the EIS to be comprised of salt resistant species or to be similar in species composition to salt spray communities along the coast.

Vegetation impacts are considered no greater than those of Forked River area partly on the assumption that Indian Point cooling towers utilize less salty water (~12,000 ppm vs. 45,000 ppm) than does Forked River. However, Indian Point deposits more total salt on the surrounding landscape. The maximum at Forked River is approximately 30 $Kg/Km^2/mo$ (Fig. 7 and 8) versus 180 $Kg/Km^2/mo$ at Indian Point (Indian Point EIS Fig. G-3). According to Fig. G-3, salt deposition as great as the maximum from Forked River (~2 miles) could occur in an area around Indian Point five miles to the west, three miles to the east and over 10 miles north and south. The Forked River report determined their cooling tower emissions to be low by a factor of six for short term effects and a factor of 40 to 100 below average annual near ground air concentrations necessary to effect vigor and plant distribution. The Forked River report also determined the concentration of natural salt spray up to 15 miles inland will exceed that from the cooling towers so that the natural vegetation of the area is already adapted to a salt spray environment and the addition of another small increment of salt from the cooling towers will

have no effect. The area and intensity of the influence of the salt deposited from the Indian Point cooling towers (up to six times as high as levels from Forked River) is significantly greater than for the Forked River cooling towers.

Although the vegetation of Indian Point and Forked River contain a number of common species (red and white oak, beech and cherry) there are some differences which are significant in terms of salt tolerance. White pine, maple and hemlock are all less salt tolerant than the oaks and are reported to occur in the Indian Point area but not in the Forked River area. Westing (1969) found that the effects of salt accumulation greatest on those trees he observed with shallow roots (sugar maple, hemlock and white pine) than on trees with deep roots (most oaks). Kotheimer et al. (1967) found salt to be a factor in maple decline. Hall and Hofstra (1970) found red and white pine to be most sensitive to salt of the trees they tested. The Forked River report reported no damage to white pine grown in a greenhouse and sprayed with salt water mist. Observations on salt damage experiments conducted as part of the Forked River environmental assessment were based on extent or presence of foliage damage, whereas air pollution of other types have been found to have greatest effect at phenologically significant times, such as needle expansion in white pine. The experiments of Westing and of Hall and Hofstra are with winter salting of roadways and in general deal with higher concentrations of ions than would be associated with cooling towers but which have a much more local distribution (<400 ft. from highway).

The Indian Point EIS diminishes possible impact on vegetation by concluding (p. XI-23) "The deciduous habit of a major proportion of area vegetation coupled with the large volumes of precipitation (average 43 in.

annually) available for dissolution and transport of saline deposits via percolation and runoff, will serve to further reduce any potential for damage due to impaction or deposition of drift solids." Westing (1969) found that generally woody plants are more sensitive to salt accumulation than non-woody plants which is in agreement with conclusions reached by Woodwell (1970) concerning exposure to increasingly severe environmental stress. No advantage should be attributed to the deciduous habit. The assumption of "large volumes of precipitation" fails to consider impact of drought which tends to heighten effect of salt (Westing, 1969). Drought periods would also be times of generally low fresh water flow in the Hudson and, therefore, higher salt concentrations in cooling water. Occurrence of drought conditions during growing season would, therefore, increase chance of short term effect of salt on vegetation. Drought conditions occurred in the Hudson Valley 20.7% of the time in the 35-year period from 1929 to 1963 (Fieldhouse and Palmer, 1965). During this period, 14 growing seasons were affected by drought of five months' duration or longer. The synergistic effects of salt drift and drought have not been considered in the EIS.

The statement (p. XI-22) that salt concentrations are much less (20 ppm vs. 640-1280 ppm) than water used for supplemental irrigation in eastern United States of plants having low salt tolerance, ignores the potential for timing irrigation to coincide with water need and with periods of plant development not as likely to cause damage. Such a program of timing salt release would be impossible with a cooling tower.

The problem of salt spray affecting an area of natural vegetation not previously subject to a salt spray environment has in the past only been applied to the problem of salting of highways and only after such

salting has been underway. The problem of year round application of less concentrated dosages of salt over larger areas, such as from cooling towers, cannot be compared to irrigation of farm land using salt water. Westing (1969) feels that the needs of humans will prove sensitive to the build up of high salt concentrations than will most plant communities, but the fact that many roadside trees have low salt tolerances should be an area of concern since the Indian Point EIS presents little vegetation data.

The Indian Point EIS contains too little data to evaluate the environmental impact of salt drift on the vegetation or to base a study analyzing the effects once cooling towers are in operation.

References

Fieldhouse, D. J. and Palmer, W. C., 1965. Meteorological and Agricultural Drought. Univ. of Delaware Ag. Exp. Sta. Bull. 353. 71 pp.

Forked River Nuclear Station: Assessment of Environmental Effects, 1972.

Hall, R. and Hofstra, G., 1970. Salt Spray Damage to Roadside Pine and White Cedar (Abstract). Phytopath. 61:128.

Kotheimer, J. B., et al., 1967. The Role of Ions in the Etiology of Maple Decline. Phytopath. 57:342.

Westing, A. H., 1969. Plants and Salt in the Roadside Environment. Phytopath. 59:1174-1181.

Woodell, G. M., 1970. Effects of Pollution on the Structure and Physiology of Ecosystems. Sci. 168:429-433.

Commentary On

"DRAFT ENVIRONMENTAL STATEMENT

for Selection of the Preferred

Closed Cycle Cooling System at

INDIAN POINT UNIT NO. 2"

The Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 2 is sadly deficient in two regards. First, analysis of the effects of a cooling system is completed largely without reference to the cooling needs of other large thermal electrical generating plants and other facilities in the area. Second, the economics section is totally deficient in ignoring any aspects of the problem of generator waste heat beyond cooling.

This statement will largely elaborate on the second point, without meaning to detract from the problem of multiple installations.

Cooling towers, or any primarily cooling device for a thermal electrical generator, are a way of disposing of "waste" heat, heat not needed for the generation of

electricity, in hopefully the least environmentally damaging fashion. In the case of Indian Point Two, this means dumping heat more than equivalent to the entire power output of the plant, at a cost of over 90 million dollars for the preferred dumping facility, and total costs of 153 million dollars, using the most conservative cost estimate.

Conservatively, the fuel value of recoverable heat dumped to the environment will be between 20 million and 25 million dollars yearly.

This situation of wasting heat which would require over 5.8 million barrels of oil a year to produce at one site alone, is the product of an institutional heritage separating the electricity generating industry from others, brought on in large part by cheap energy, as compared to the cost of capital. However, it has been clear at least since the Arab oil embargo, that such patterns are unwise and counter productive. "Waste" heat from industrial processes is now one of our largest and cheapest energy resources; its use, including the building of the necessary institutional framework, should be one of the nation's highest priorities.

This point was raised over two years age, in the December, 1973 State of New York Department of Environmental Conservation review of the Draft Environmental Statement related to the operation of Indian Point Nuclear Generating Plant Unit No. 3 (Docket No. 50-286). The department stated, as its second General Comment,"The Commission staff should consider alternate use of the rejected heat from plant operation. In this time of energy crises, the wasteful disposal of heat which could be used for heating homes and businesses, used in the production of food, etc., does not appear to meet those goals of NEPA presented in the Foreward."

In reply, the commission stated that it had examined the problem of the use of waste heat during its (pre-embargo) assessment of Indian Point Unit No. 2, and found such uses incompatible with the existing turbine systems, and that "there are no potential users of waste heat in the quantity available within reasonable proximity to the Indian Point Plant." The commission concluded its two paragraph discussion with "The staff believes it reasonable to assume that recovery of any significant portion of the waste heat from the Indian Point Plants would not be economical at the present time."

This analysis (ignoring its brevity) is reflective of the process by which the United States has been locked into the most energy wasteful industrial infrastructure in the world. The analysis ignores (1) the possibility and desirability of creating adequate uses for some of the

heat, and (2) the possibility that recovery will be economic in the near future, or at least shortly after the cooling tower(s) comes on line. Of course, the prospect of a better pure cooling solution being developed is also ignored.

At this point, it whould be made clear that we are talking about immense expenditure to further erode the thermal efficiency of a process, electrical generation from nuclear fission, already quite inefficient, or perhaps deficient (Brookhaven National Laboratory uses a figure of 28% total thermal efficency for the light water nuclear reactor electrical generating process, including fuel cycle).

Onto this cycle, a cooling tower system contributes an added 0.91% drop in thermal efficiency, from the original 31.65% efficiency of the plant itself, ignoring the fuel cycle, or a 2.8% loss of the energy production of the plant. This calculation ignores the energy expended in building the cooling device.

In addition, we are assured that the cooling system for one plant will add only about 1% to the cost of Con-Edison power. Again, the micro picture being focused avoids the generic consideration. Given requirements for cooling towers at Indian Point Unit No. 3, and Bowline and

Roseton facilities, we are talking about a 3 1/2% increase.

Given, on the other hand, the potential benefit in thermal energy, it becomes clear that great expenditures can be justified to utilize the power plants fully. Such utilization would, of course, provide economic benefits, certainly to the area and Consolidated Edison's stockholders, and most probably utility ratepayers. The failure of the "evaluation of proposed action" is that it does not address the loss of the potential use of the waste heat. This may be less than surprising, given that the "evaluation" runs just over one page of print, supplemented by a table.

Value of the waste heat varies, depending on calculations. Based on the 7,350 x 10^6 btu/hr design cooling capacity of the proposed Indian Point No. 2 (and remembering that the Indian Point No. 3 system will be bigger, which will make-up for any overstatement here), a .65 capacity factor, and recovery of .43 of the total thermal capacity of the plant, an 80¢/10^6 btu fuel cost (ignoring totally fuel coversion losses), now unobtainable, yields a foregone annual benefit of over $21 million dollars; a one dollar per 10^6 btu fuel cost raises the value to almost 26.5 million dollars yearly. Multiplying these values by two, for Indian Point Unit No. 3, puts discussion in the 40 to 50 million dollar yearly range at one site without discussing

other electrical plants in the area. Fuel conversion losses would further escalate the value discussed, to the 48 to 60 million dollar range.

The above discussion is based on natural gas or coal costs, the former unavailable at the regulated prices, and the later, subject to transportation difficulties in New York and much of the Northeast, possibly available in quantity by water ways. Oil, the dominant Northeastern industrial full, would double the cost, based on controlled prices, which will rise further in the future to the foreign price under recent federal legislation.

Using the same methcd of calculation as used for cooling tower calculations in the draft environmental statement, we arrive at a present value in the realm of 500 to 600 million dollars. The oil price equivalency would be about three times this figure.

Given over a half billion dollars, what kind of systems can be conjectured to use the heat available for the taking at Indian Point in 1978 or later? Put another way, how close are we to being able to use relatively low grade waste heat?

Most potential uses demand temperature differentials above the 15°F above ambient currently generated as waste by the plants at Indian Point. However, two things may be said that offer some hope to change this. First, as noted above, there is the potential of up to half a billion dollars in benefit that may be used to pay costs. Second, research and development continues on these and other energy problems. To commit almost one hundred million dollars to wasting large quantities of heat only two to three years after energy utilization became a subject of intensive investigation is to improperly continue practices from a by-gone era.

Among possibilities for heat utilization are:

1. Researchers at Gruman Aerospace Corporation have suggested the concept of the wind tower or tornado generator. With a three to one ratio of height to diameter reminescent of cooling towers, and similar size magnitude, the two devices appear to be compatible. What is most interesting is that the researchers have already stated that waste heat from electrical facilities could be used beneficially, calculating that a temperature differential in excess of 19°F will maintain electrical generation in the wind tower in windless conditions.

2. Conventional Rankine cycle heat engines. Bottoming cycles are the subject of extreme interest, and new designs, usually utilizing fluorocarbon working fluids, promise lower and lower operating temperatures. As with

other waste energy development, the lure is the utilization of energy obtained for free. The extreme case of such thinking is the development of the ocean thermal gradients generator, which would work on thermal differences of 50 to 40°F, or less. Utilization of power plants as a heat source would clearly minimize complexity compared with ocean devices planned to operate using the heat differences of water layers 1,000 feet apart.

3. District heating. European systems use heated water down to 80°C, attaining thermal efficiencies for combined generation of electric power and useful heat of better than 85% and over 75% including distribution. This possibility eliminates much of the existing pollution due to decentralized burning of fossil fuels for space heating, and has such incidental benefits as heated streets in wintertime, eliminating snow and ice removal. While electrical generating efficiency would decrease, and plant modification would be necessary, the savings possible make it unreasonable to dispense with the idea out of hand.

4. Process heat uses would entail a similar need for higher temperature ranges as district heating, but probably would provide a more concentrated use, lessening distribution costs, and provide a year-round use for energy. Areas immediately adjacent to the Indian Point complex are industrial.

5. Given the size of the expenditures involved, moving water some distance to cooling ponds, agricultural or aquacultural uses should not be ruled out as rapidly as in the draft impact statement, where cooling ponds are disposed of in one sentence, after a one paragraph description.

6. Although quite wasteful compared to initially designing a plant to provide steam or water at more useful temperatures, waste heat water can be raised to heating quality or steam by heat pumps; in winter the heating advantage over ambient conditions might well be significant.

In closing, it is clear that the "Draft Environmental Statement for Selection of the Preferred Closed Cycle Cooling Systems at Indian Point Unit No. 2," does not consider waste heat problems in a generic fashion, in impacts on the area, and most especially does not consider the economic benefits being wasted. The cooling problem is not a last item of the electric business to be disposed of expeditiously, but one part, and a symptom of, a large complex of problems indicative of America's energy problems.

HAMILTON FISH, JR.
25TH DISTRICT, NEW YORK

DISTRICT OFFICES:
POUGHKEEPSIE OFFICE
62 MARKET STREET 12601
PHONE: (914) 452-4220

PEEKSKILL OFFICE
738 SOUTH STREET 10566
PHONE: (914) 739-8282

KINGSTON OFFICE
292 FAIR STREET 12401
PHONE: (914) 331-4466

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

JUDICIARY COMMITTEE
SMALL BUSINESS COMMITTEE
SELECT COMMITTEE ON THE OUTER CONTINENTAL SHELF

WASHINGTON STAFF:
JOHN D. BARRY
ADMINISTRATIVE ASSISTANT
MRS. AYA H. ELY
EXECUTIVE AND APPOINTMENT SECRETARY
JARED O. BLUM
LEGISLATIVE ASSISTANT
SHIRLEY CAVANAUGH
CASE WORKER

April 12, 1976

DOCKETED
USNRC
APR 23 1976
Office of the Secretary
Docketing & Service
Section

Mr. William A. Anders
Chairman
Nuclear Regulatory Commission
Division of Site Safety
Washington, D.C. 20555

Re: Draft Environmental Statement
Closed Cycle Cooling System
Indian Point Unit No. 2.

Dear Mr. Anders:

In your consideration of the Draft Environmental Statement for a Closed Cycle Cooling System at Indian Point Unit No. 2, which is located within the 25th Congressional District, it is my understanding that an extensive study of fish in the Hudson River is being conducted at this time and nearing completion.

It is further my understanding that fishing in the Hudson has been banned due to the high levels of PCB's in the water.

Therefore, although I am in full support of preservation of our environment, would it not be wise to pause for completion of the fish study at this time. I also believe that alternative closed cycle cooling systems would be preferable to the natural draft system proposed for Indian Point #2 and #3 which, due to the conjestion of the area, could have devastating adverse economic effects on the entire area.

Sincerely,

Hamilton Fish, Jr.

Hamilton Fish, Jr.
Member of Congress

F:JDBjt

blt 11

MR. SACK: Con Edison would like to reserve the right to cross-examine these witnesses at the appropriate time.

CHAIRMAN JENSCH: Oh, yes.

MR. GRAINEY: Mr. Chairman, let me elaborate on that.

I would not object if this would help Mr. Sack's problem of during this session having the witnesses available to be recalled by any of the parties here or by the Board for that matter, after the questioning is completed. However, with respect to Mr. Sack's point of possibly disagreeing with portions of the Final Environmental Statement, I think if he does, and if he elects to put those portions in controversy, he is free to do that with appropriate witnesses or through cross-examination. But that by itself I would not think would be grounds for striking any of the Final Environmental Statement unless he showed that certain portions didn't meet the usual prerequisites under the law for granting a motion to strike.

CHAIRMAN JENSCH: We will take that matter up if and when he makes any motion.

Very well, does that complete the direct presentation by the Staff?

MR. GRAINEY: I do have a few additional questions.

blt 12

CHAIRMAN JENSCH: Proceed.

MR. GRAINEY: Let me also add that the Staff did intend to call an additional witness, Mr. Carson, as part of the panel who was involved in certain meteorological aspects of the Final Environmental Statement.

I believe, though, that the current panel can answer most of those questions, since we did not expect the panel to be on this quickly and Dr. Carson is flying in from Chicago.

If the hearing goes into another day, Dr. Carson will be here tomorrow, if there are areas that this panel has not satisfactor y answered to the Board's satisfaction.

CHAIRMAN JENSCH: Very well. Proceed.

MR. GRAINEY: Yes, sir.

BY MR. GRAINEY:

Q First, Dr. Geckler, can you indicate to me whether the Staff analysis in its Final Environmental Statement of environmental impacts and economic impacts was assessed on the basis of plant operation at 1033 megawatts electrical, or 873 megawatts electrical?

A (Witness Geckler) The economics were evaluated on the basis of 873. All of the environmental impacts were evaluated on the basis of the 1033. That includes Appendix A, which has the drift, results of the drift calculations, and the remainder of the text.

blt 13

Q. Now, if the economics were re-evaluated at 1033 megawatt electrical, would that change any parts of the Final Environmental Statement?

A. I would have Mr. Sav respond to that.

A. (Witness Sav) It would change the absolute values in terms of cost of alternatives, but it would not change the relative ranking of the alternatives.

Q. So then it would not change your conclusions?

A. No, it wouldn't.

Q. Now, with respect to operation at 873 megawatts, would that, if you assumed that level of operation for your environmental impacts, would that result in any changes?

A. (Witness Geckler) It would make a minor difference but none that would be significant. It would not change conclusions.

Q. Secondly, there has been some discussion this morning both of circular mechanical draft cooling towers, fan-assisted mechanical draft and natural draft. In the Final Environmental Statement I believe you mentioned that both circular mechanical and fan-assisted mechanical are viable forms of closed-cycle cooling but are not the preferred alternative. Is that correct?

A. That is correct.

Q. Could you elaborate on the reasons for that?

blt 14

A. We consider the circular mechanical draft and fan-assist-d draft to be viable concerns, or viable systems, although they are relatively new and they have limited operational experience. In the Staff's opinion the circular mechanical draft does not invoke any new technology, whereas the fan-assisted may.

VOICE: Would you speak up, please?

CHAIRMAN JENSCH: Yes, it is difficult, 'nd I think you will have to make an extra effort. We do not have microphones, unfortunately. If you will just raise your voice it will be very helpful.

WITNESS GECKLER: We considered that both the circular mechanical draft and the fan--assisted tower to be viable, although they are relatively new. The technology involved in the circular mechanical draft does not represent new technology, since they are a collection of mechanical draft cells simply arranged in a new pattern. The fan-assisted is relatively new technology, but it is the Staff's opinion that they are well enough developed to be viable selections.

BY MR. GRAINEY:

Q. What is the basis for not selecting them over the natural draft tower?

A. (Witness Geckler) The major effects that one can -- impacts that one anticipates from cooling towers are

blt 15

drift, noise and visual impacts, both of the plumes and of the structures. In addition there is the matter of costs among various systems.

In the present case the costs wash each other out pretty much. They are all within 3 percent of the same.

Q That is of the three towers under discussion?

CHAIRMAN JENSCH: May I interrupt?

You ladies, if you cannot hear, or the others, move right over in the front row here and be closer to the witnesses. I think it will assist you.

MS. DONALDSON: Before, when the air conditioner was turned off, it made it easier.

VOICE: We asked the custodian. He did seem to take care of it.

CHAIRMAN JENSCH: Do feel free to move over.

WITNESS GECKLER: I will try to speak louder.

CHAIRMAN JENSCH: If you will, each of you.

WITNESS GECKLER: One should remember also that the original intent of the closed-cooling system to be installed at Indian Point is to protect the fishery. And with all of the delays that have occurred, the time is getting rather short to attempt to protect it.

Therefore, the impact of changing from, say, a natural draft tower to some other type, which would take approximately a year more design time, even though it might

blt 16

take less to construct it, works in favor of the natural draft tower.

The drift effects of the natural draft tower, as we have heard earlier, are considerably less than from a mechanical draft. The major thing working against the natural draft tower is the visual impact of the plumes and of the tower structures themselves. However, in view of the overall picture of all the cooling systems, we felt that the visual impact did not turn over the natural draft towers, and therefore we considered that, overall, the natural draft tower was more desirable than the other systems.

MR. TROSTEN: Mr. Chairman, I move to strike all that portion of Dr. Geckler's statement that referred to the need to act quickly to protect the fishery. It is utterly irrelevant to this particular proceeding. It is immaterial and unreliable, and I move to strike it.

If the Reporter would read it back, I could identify those portions more specifically.

CHAIRMAN JENSCH: I think I have the portions in mind to which you refer.

MR. GRAINEY: Mr. Chairman, I oppose that motion. I think this goes back to the discussion we had this morning of why we are here.

Is this an academic exercise, or are we fulfilling a license condition which has been put in as a result of

blt 17

approximately 5,000 transcript pages of hearings on the impact to the fishery?

I think this Board, not only did it make a determination, but it could certainly take judicial notice of its own decision as to why we are discussing closed-cycle cooling at all. It is not a question of the abstract at all.

MR. TROSTEN: Mr. Chairman, on the basis of that I move we adjourn this proceeding and simply combine the entire proceeding for the extension with the proceeding for the determination of the appropriate tower, the appropriate closed-cycle cooling system.

CHAIRMAN JENSCH: Is it your thought that we would avoid duplication?

MR. TROSTEN: Mr. Chairman, excuse me, sir, I interrupted you.

CHAIRMAN JENSCH: Go right ahead.

MR. TROSTEN: Mr. Chairman, we entered this proceeding on the basis of a stipulation with what we thought, after months of discussion with the other parties, was a very clear understanding of what the issues were to be in this proceeding and what this proceeding was about. Frankly, sir, we walked into the hearing room this morning, and we are really surprised to see what it is that is being proposed, surprised at the concept that is being advanced to this Board as to what this proceeding is about, surprised

blt 18

as to what the issues are.

This is utterly inconsistent, as Mr. Sack has already stated, with what our understanding of what we were attempting to accomplish here. It is perfectly obvious to me, sir, that we ought to go back to Square 1.

We have been diligently operating on the basis of attemtping to define what these issues were for this proceeding, and the whole thing has come to naught, and not at our fault, sir, I would submit. We seem to somehow be getting into the question of what should be the -- whether we should proceed, what we should be proceeding to doing, whether we should be getting started.

And I submit that on the basis of that we ought to adjourn this proceeding and decide what this hearing is all about.

CHAIRMAN JENSCH: Maybe we can work this out ourselves.

Did you sit through the Indian Point 3, or did you follow that procedure on the stipulation?

MR. TROSTEN: Yes, sir, I followed it. I was not attorney of record.

CHAIRMAN JENSCH: The reason I ask is this. My recollection of that proceeding was that we went into several aspects of what the parties considered before they arrived at their determination to sign the stipulations.

blt 19

MR. TROSTEN: Yes, sir.

CHAIRMAN JENSCH: And to see whether the stipulation adequately represented the public interest considerations.

MR. TROSTEN: Yes, sir.

CHAIRMAN JENSCH: In the course of that, we went into several phases of the matter. Each party had different views of what should be really achieved. But to use a term I t ink that Mr. Grainey did this morning, that the stipulation represents a sort of adjustment or compromise to their ol,ectives.

The Indian Point 3 proceeding, as I recall it, each party had several tangents that they would like to follow. But they agreed to settle on one thing. On the basis of their presentations, the Board concluded that the stipulation reflected a consideration by the parties of many various factors, and the net result of what they achieved was in the public interest. And so this, I take it, presentation is a part of the background of what the Staff has considered before they finally agreed to sign the stipulation for the natural draft or what cooling tower, closed-cycle system.

So, while you are correct that your stipulation is narrowed to one particular achievement, nevertheless these other factors are important to the Board to determine how did you ever come to that one, after all.

blt 20

MR. TROSTEN: Yes, sir, Mr. Chairman. We are not in the slightest way disputing the right of the Board to inquire into the adequacy of the Final Environmental Statement or to decide whether the stipulation should be approved. The stipulation was expressly made subject to the Board's approval, and we are not in the slightest way disputing that, sir.

We are simply saying that we are frankly surprised at the issues that appear to be surfacing now in this proceeding. We think it is absolutely necessary that we -- that all of the parties have a clear understanding of what issues we are supposed to address.

It is incumbent upon all of us to bring positions that we assert to the Board's attention in a timely fashion. It is absolutely essential that we bring to your attention so that you may have an opportunity to consider our views with respect to any contested issue.

What is bothering me more and more about the direction that this proceeding is taking is that there are a whole series of issues that are surfacing here based upon different people's interpretation of what is really happening in this proceeding and different views are being presented to the Board. The whole effort of the stipulation was to avoid all of these controversies because we didn't frankly think that they were proper for this particular proceeding.

blt 21

What is happening, frankly, now, sir, in my view, is that other parties are attempting to have this Board put a gloss upon the Indian Point 2 license. Now, they may have their view as to what that gloss should be, and we have our view; but I submit, sir, that if that is what is going to happen, then we are going to need a lot more time to get ready for this. And we won't just be briefing things; we are going to need to cross-examine the Staff at great length on a number of matters, and we are going to need to put on a lot of evidence.

We don't know what those issues are yet, and we just want the opportunity to know what they are.

CHAIRMAN JENSCH: Let me give you the format of Indian Point 3.

Each party came in, as I recall that proceeding, and each one went off in a realm where they said, "Look at all the things we think should have been in here." And then another party came in, and they thought it should be over in this area. All kinds of problems they thought were present, but they settled it.

What the Staff is doing is saying, "We considered all these different things, and we are staying with this."

Now, there was no cross-examination in the Indian Point 3 proceeding of the various positions asserted by the parties in these realms that they had considered before they

blt 22

settled on this thing. The stipulation guided the ultimate consideration that was brought to the Board, but these various realms that were examined were just to give the Board back-ground of the several factors that these parties had in mind before they finally settled on this one stipulation in Indian Point 3.

This is precisely the same position. Maybe you folks considered all kinds of factors before you signed the stipulation. I don't know what the Hudson River Fishermens Association considered, but they will tell us. We are not concerned in the sense of whether they were right in going into the different realms, but these are the factors that reflected the totality of consideration that reflected the public interest concerns.

Now, I don't know what the fan-assisted mechanical draft thing is or what its worth is. But these parties have considered it, and they have settled on this wet draft cooling. You may have many other factors you have examined. Just tell us what they are. These people are allowed to contest these various realms because the stipulation limits their concern in this proceeding. Likewise, you folks have agreed, all agreed, on this one form of a closed-cycle cooling system. That restricts your interest, or legitimate interest in all these other things that these other parties have considered.

blt 23

So it forecloses your testing whether the Staff should have taken this fan-assisted thing and dealt with it to the "nth" degree. They have looked at it; it satisfied their views; they rejected it and settled on this one.

MR. TROSTEN: We have absolutely no objection to the Staff stating its conclusions and the reasons that led to its conclusions. We, of course, will introduce our evidence, set forth our views.

CHAIRMAN JENSCH: Right.

MR. TROSTEN: But the problem raised here is by virtue of the fact that certain findings are --

CHAIRMAN JENSCH: Let's argue that phase of it later, as to what should be in the findings. Let's get the evidence first.

MR. TROSTEN: Well, my objection, sir, the thing that led me to this, of course, was my objection not to a discussion of these various types of considerations that led them to reach their conclusions, but to the utterly ancillary statement that it was necessary to move very quickly to proceed to protect the fishery. That is not the issue in this proceeding.

MR. GRAINEY: Mr. Chairman, whether or not that is the issue in this proceeding, that is obviously one of the considerations, as Dr. Geckler explained, in our

blt 24

decision.

Now, Mr. Trosten may not agree with that, and he may have witnesses who say there are other considerations that are more important to Consolidated Edison. That is fine. But that is not what was the Staff's view. I simply asked the witness what his reasons were.

End 8

#9

CHAIRMAN JENSCH: I think that to which you refer is necessary to the interest here. We are trying to determine what were the factors they considered before they finally settled on the stipulated form of the closed cycle cooling.

Motion is denied. Proceed.

BY MR. GRAINEY:

Q Am I correct, then, in summarizing the Staff's reasons for rejecting, compared to natural draft, the choice of either circular or fan-assisted mechanical on the basis of both additional time that would have been involved in design, plus the fact that the operating experience had been relatively limited for both systems; is that correct?

A (Witness Geckler) That is partially correct, because we did consider other things as well.

Q I see.

You did consider what?

A We considered other things as well. But those are two major things that led us to this decision.

Q These other things being what?

A The drift, the noise, costs.

Q Fine.

Secondly, in response to a question that Dr. Briggs brought up at the prehearing conference, has the Staff taken another look at the question of spray canals, cooling pump sprays as a possible alternative for cooling towers?

A Yes, we have. And Dr. Carson is the most appropriate one to respond to that. Though I do have some information if it is desired.

Q Would you tell us what that information is?

A Basically, the information that I have gathered together has to do with perhaps three or four spray systems. Power spray modules. The experience with them in the cases that I have looked at, one being in a marine environment, and the remainder in fresh water environments, is that the maintenance costs are higher than anticipated according to the original designs.

They have not cooled in some portions of the year to design capacity, which requires that the power plant be reduced in power.

In fact, one case, they are abandoning the spray modules to go to cooling towers because they are so unhappy with the behavior of the cooling system as it exists.

MR. GRAINEY: I have no other questions, Mr. Chairman.

CHAIRMAN JENSCH: The witnesses are available for cross-examination.

Well, they are not. Excuse me. The stipulation precludes that.

MR. KUHN: Your Honor, I believe I addressed this matter at the prehearing conference. I has not been our position all along, and I think I made this very clear at the prehearing conference, that the stipulation would preclude investigation of the proper basis and bringing to the Board's attention the adequate information concerning the appropriate closed cycle cooling system.

New York State feels, based upon its evaluation, that the natural draft cooling towers are indeed the best choice.

We are concerned, however, that there are some aspects of the Final Environmental Statement which should be explored to a limited extent in order to provide your Honors with the record basis required under the law upon which to make your own determinations.

It was based upon that that we had intended to conduct a limited amount of cross-examination.

CHAIRMAN JENSCH: That was not the procedure we followed for Indian Point 3, and the Indian Point 3 proceeding bears the approval of the Commission. Because each party was allowed to put on all the evidence that they wanted. But the stipulation was construed to preclude testing whether they were accurate in their analysis of their selection. So that all parties by this stipulation have agreed on a certain form of cooling system. And everybody is agreed that

that should be it.

So if you were to say, well, you tell us a bit more about your fan-assisted mechanical circular whatever it is cooling system, you get into a problem that really goes beyond your agreement to limit yourself to the stipulation.

MR. SACK: Mr. Chairman, there is a difference here between that stipulation, because here, the Staff is inserting a new issue that was not covered by the stipulation.

CHAIRMAN JENSCH: What?

MR. SACK: That these two alternative closed cycle cooling systems are vialbe alternatives.

Now, the stipulation did not say anything about that.

CHAIRMAN JENSCH: We will disregard that because they have agreed to a stipulation that selects this type.

Some of these gross indiscretions are the prices we pay from latitude in expression.

But we will guide our concerns as to the validity of the stipulation by having some understanding that they have had a broad view of possibilities.

MR. SACK: If the Board rules that it will not make a finding on whether or not these two options are viable alternatives, then we see no need to cross-examine.

That is exactly the position we took in the stipulation.

jon5

But, at the moment, we are not sure where we stand on this because the Staff has submitted an initial decision which has the Board making a finding that these two options are viable alternatives.

If the Board is going to consider that, then we want to cross-examine these witnesses, and we will have some direct testimony in that regard this afternoon.

(Board conferring.)

CHAIRMAN JENSCH: VEry well. We will adhere to the ruling of no cross-examination, but there is a full opportunity for all parties.

Now, if the State of New York feels there are lots of other things we ought to know about, call your witnesses.

We will not make a finding as to whether it is a viable alternative. We may assert that the Applicant and Staff believe there are others and you disagree with that.

But it seems to us that if there is another viable alternative, that destroys the stipulation. And we would not reach that point until we have found some adequate evidence that it has been fully presented.

Now, I know that the parties always endeavor to develop their case, if they can, through cross-examination.

This issue is whether this stipulation, as was the stipulation in Indian Point 3, is in the public interest and was reflective of many considerations.

We will proceed upon that basis.

Do you have any --

MR. BRIGGS: Could I just say a word?

CHAIRMAN JENSCH: Sure.

MR. BRIGGS: I think, Mr. Sack, certainly, if the Board listens to the testimony of the witnesses and concludes that these are viable alternatives, and then are preferabe to the natural draft cooling towers, then we just reject the stipulation and the whole situation is open.

CHAIRMAN JENSCH: We go ahead and hold hearings.

MR. TROSTEN: If I just may offer this. The problem troubling me conceptually about this, Mr. Chairman, is the following: that we are dealing here with the Final Enviornmental Statement which under the rules can be modified by the Board; that would then become the Final --

CHAIRMAN JENSCH: On the basis of evidence.

MR. TROSTEN: Yes, sir.

CHAIRMAN JENSCH: That would have to be evidence subject to cross-examination.

MR. TROSTEN: Yes, sir, that's correct.

CHAIRMAN JENSCH: We are not at that stage. I think we are solely at the stage, as Mr. Briggs has just pointed out, we are just to determine here whether the stipulation presented by the parties is fully reflective of many considerations in the public interest.

If it is not, we start from year one, as you say.

MR. TROSTEN: Right.

Obviously the Board has the complete power to do that.

The thing that is troubling me about this is that unless we know what are the concerns that the Board has and have an opportunity to address them, we might end up with a Final -- with an initial decision by the Board that had findings of fact that we never really had an opportunity to contest.

CHAIRMAN JENSCH: No; the only findings of fact we will make is whether this stipulation is reflective of the many concerns and is in the public interest.

We are not at the moment going to test circular fan-assisted whatever.

MR. KUHN: Your Honor, may I just address this for a moment?

I believe by not permitting cross-examination of witnesses presenting, for example, here the Final Environmetnal Statement, I think your Honors are taking a step based upon the stipulation that at least to my knowledge, and you might ask the other parties to the stipulation, was by no means intended and, indeed, was a matter that was discussed among the parties.

CHAIRMAN JENSCH: This subject of the Final Environmental Statement may well be opened up for cross-examination when we get to the point of the extension of time for the once-through cooling system.

That is not here.

MR. KUHN: Yes.

What I am concerned about, your Honor, is the following: according to my understanding of the National Environmental Policy Act and the way it is applied in NRC proceedings, your Honors are going to have to go forward based upon the stipulation, but also based upon an independent analysis of the facts and of the alternatives involved.

It is our concern that your Honors are going to be basing your decision in part upon the Final Environmental Statement as well as other reports that have been submitted to your Honors.

If that is indeed not correct, then we could indeed put off our cross-examination of the Final Environmental Statement until a later point.

But we are concerned that as a basis for your initial decision that you are going to require a reliance on this document. And that is why we wanted to bring to your attention through cross-examination of the environmental statement to provide you with a better factual basis for your determination.

CHAIRMAN JENSCH: You read the proceedings from the Indian Point 3 proceedings and then let us hear from you again.

MR. KUHN: Well, I have been somewhat familiar with that, your Honor.

CHAIRMAN JENSCH: You have a full opportunity as every party there did ot put on all the witnesses you desire.

You need not undertake cross-examination. We would be glad to have your presentation through your own efforts.

MR. KUHN: I see. Then perhaps I don't see -- we are going to have to object to admission of the Final Environmental Statement at this time until such point as we are provided the opportunity to conduct cross-examination with regard to that.

CHAIRMAN JENSCH: You will have that opportunity when the issue requires cross-examination. That appears to be, at the moment, when the consideration is given to the motion by the Applicant to extend the time for operation under -- operation of the once-through cooling system.

It may well be that we will have to open up the FES at that time.

MR. KUHN: That, your Honor, is not the subject of this environmental statement. It is the subject of a separate environmental statement that the Staff is preparing.

CHAIRMAN JENSCH: Well, we may still have to open this up for cross-examination if the stipulation is rejected.

MR. TROSTEN: Mr. Chairman, may I offer a few comments?

First, there is nothing, sir, in the stipulation that bars cross-examination.

Apart from the Indian Point 3 proceeding with which I am not totally familiar, there is nothing in the stipulation that bars cross-examination.

All the stipulation was intended to do, we submit, sir, was simply to define the issues in a classic way for the hearing.

Further, with regard to the extension request, there is no issue posed, sir, in the extension request that deals with this particular Final Environmental Statement.

I agree with Mr. Kuhn that we have not raised any issues or proposed any evidence or cross-examination with regard to which alternative closed cycle cooling system should be chosen, so there would be no opportunity to consider that point.

CHAIRMAN JENSCH: You will have the opportunity if the stipulation is rejected.

The stipulation may well be rejected and this will be open to cross-examination.

MR. GRAINEY: Mr. Chairman, let me state that in putting my witnesses forward in sponsoring the Final Environmental Statement, I do not object to the other parties cross-examining.

Perhaps because of the stipulation, the scope of the cross-examination should be limited simply to consider policy considerations you have enumerated that the Board is going to examine.

But I think -- while I was not that intimately involved with Indian Point 3 proceeding, as I recall, none of the parties at that time wished to cross-examine the others.

The issue really was never raised.

CHAIRMAN JENSCH: The effect of the stipulation was to preclude cross-examination.

It is true the stipulation does not mention that, but the stipulation represents an agreement by the parties for a certain kind of cooling system.

Everybody is standing on that.

MR. TROSTEN: That's correct, sir.

CHAIRMAN JENSCH: So it doesn't make any difference how many things people thought before they signed it.

We will expect, until the stipulation is rejected, that everybody is going to hold to the stipulation.

MR. TROSTEN: I think I understand what you are saying, sir.

It is certainly true that the effect of the stipulation is to preclude cross-examination with regard to the agreed -- the agreement here, which is that a natural draft cooling tower is the preferred alternative.

If you are saying, sir, that only if the Board reaches a decision to reject the stipulation will these other matters be opened, that would be fine.

The only problem that is posed by that, sir, is when would we know that?

CHAIRMAN JENSCH: You will know when a decision is made at the conclusion of the presentation of these direct evidence, and whatever decision is reached.

If the stipulation is accepted, no problem to anybody because that is what you have all agreed to.

If the stipulation is rejected, we start from square one.

MR. KUHN: Your Honor, let me just explain one step further. And that was the reason we had wanted to conduct some amount of cross-examination.

We agreed that for purposes of our interests, since we have participated in the stipulation, that an order by your Honors that the preferable form of closed cycle cooling would be a natural draft cooling tower is indeed what was the purpose of the stipulation.

That binds us as a party. It does not bind your Honors in your determination.

CHAIRMAN JENSCH: No, and we may well ask some questions of the Board. But that does not open it up to the parties.

MR. KUHN: In entering into the stipulation, we in no way reached a judgment according to the adequacy or the nature of the Final Environmental Statement or any of the other documents that have been submitted here.

CHAIRMAN JENSCH: We so understand.

MR. KUHN: It was in order to provide your Honors with a proper record basis under the National Environmetnal Policy Act to make a determination of the appropriate form of closed cycle cooling which we believed, based upon all the information available to us, is the natural draft cooling system that we wish to provide you with some additional cross-examination.

CHAIRMAN JENSCH: Your activity would be redundant because supposing you cross-examined these witnesses and you pointed out that the fan-assisted mechanical circular whatever it is cooling system isn't worth a hoot. We are standing with your stipulation in the end.

So it is cumulative. It doesn't contribute to change your position in any way, does it?

MR. KUHN: No, your Honor, but we do not participate

jon14

in this proceeding in order merely to take one position or another.

It is in order to advise you and to help you in order to reach the best decision that you can.

CHAIRMAN JENSCH: We appreciate that and we are taking you from the stipulation.

We will proceed from that basis.

Now, the Board may have some questions about these things. I don't know. We haven't gotten into the salt drift. It might well be an area for inquiry. But when we get all done with that, it is something we want to be sure that they have explored those possibilities.

MR. BRIGGS: The State of New York will not provide the information through witnesses rather than by cross-examination?

MR. KUHN: Your Honor, most -- we are not prepared to present any witnesses today. We had previously made clear to the NRC Staff some of our concerns about the Final Environmental Statement in the comments -- excuse me, of the draft statement in our comments on the draft.

Some of those were indeed adequately addressed. Others we felt could be somewhat expanded.

We have had some further discussions with the parties explaining what our concerns were, and we -- if we had known that we would not be permitted to do so, and as I indicated, all the parties did not anticipate that this would occur, then we would have considered that possibility, of course.

But, as of today, we are not prepared to do so.

MR. BRIGGS: Your concerns are all listed in the comments on the draft environmental statement and supplemental, and were not treated adequately?

MR. KUHN: I believe the answer to your question is yes, that's correct. Some of our concerns were dealt with adequately and others were not. It was in order to explore those that we felt were not dealt with adequately that we wished to question the NRC Staff witnesses.

CHARIMAN JENSCH: Having faced that understanding from the beginning, you still signed the stipulation. And we expect you to stay with the stipulation. Unless you are now stating you are going to withdraw from it.

If you are withdrawing from it, we will open the door.

You should have considered the color of the paint on the doors and all these other horrible things, and you still are sticking with the stipulation?

We are just going to find out whether the stipulation is valid. That is as far as we are going here today.

MR. KUHN: It is not of concern to us what the

NRC Staff has considered or has not considered in reaching their determination to enter into the stipulation.

What is of concern to us is what your Honors consider in reaching an ultimate decision, and it is our understanding that yourselves and your decision making capacity then to be considered by the Commission as a whole, you are the ones that have to have an adequate record in front of you and full exploration of the issues.

The NRC Staff can make its recommendations based upon whatever information it deems advisable. But it is your Honors' responsibility to have the full record basis there.

It is for that reason that we didn't say to the Staff that they have to go back and do another Final Environmental Statement or anything of that sort in order to enter into the stipulation.

CHAIRMAN JENSCH: We understand what you have said but it didn't answer my inquiry of you.

With all your understanding that there were some parts that you felt had not been adequately dealt with, you signed the stipulation.

If you will bring your witnesses in and tell us what the factors were they considered and you still signed it, we will be glad to have the information of what you had done, not what you think the Staff should have done.

So we provide the opportunity for you to bring your witnesses here and tell us, with all these ramifications that you envision, you still signed the stipulation as in the best interests of the people of the State of New York.

We will be glad to have a presentation, but we don't believe that it will help in the consideration of the validity of the stipulation to cross-examine these people about whether fan-assisted circular system is valid when you have all agreed and signed.

MR. KUHN: Let me make very clear, your Honor, that it would not be the purpose of any cross-examination that we would conduct today to point out that any alternative form of closed cycle cooling other than the one stipulated to is the appropriate form.

Indeed, we believe that through cross-examination we would bring additional information to the record that would help your Honors reach the conclusion that the stipulation is in the public interest.

CHAIRMAN JENSCH: We will adhere to the same ruling and will proceed upon that basis.

The Board has some questions of these witnesses.

It is near our usual recess time. Would an hour be adequate?

We hope to continue through rather late, if we can.

MAYOR BEGANY: When Ann Donaldson was up there in her presentation one thing she said which is true, the --

CHAIRMAN JENSCH: Will you come forward, please?

We are glad to have your statement. Ordinarily we would try to accommodate all members of the public with one presentation and one statement. Every time you hear a witness say something, hey, I have got something a little different.

Thank you very much.

MAYOR BEGANY: This isn't different. This is some neglect on the part of the Village.

There has been some question as to we refuse to participate in previous hearings and cross-examine and such. This was done, I think, on advise of previous counsel, feeling Con Edison will well represent the feelings of the Village.

I think they have done so. But there have been different things come up in these hearings where questions haven't been asked and I would like to know at this time if Buchanan couldn't be considered an intervenor, be able to cross-examine and ask questions ourselves.

CHAIRMAN JENSCH: Have you been present at discussions with the State of New York and Licensee about cross-examination?

MAYOR BEGANY: Yes, sir.

CHAIRMAN JENSCH: We will adhere to the same ruling of no cross-examination.

Not being a party, we are not in a position to determine whether you are a party.

At this time let's recess and reconvene in this room at 1:30.

(Whereupon, at 12:25 p.m., hearing in the above-entitled matter was recessed, to reconvene at 1:30 p.m., this same day.)

AFTERNOON SESSION

(1:35 p.m.)

CHAIRMAN JENSCH: Please come to order.

Are the Staff witnesses available?

MR. GRAINEY: They should be back in a minute. We had a problem getting served for lunch. I thought they would be back by now. Hopefully they will be in just a minute or so.

(Pause.)

CHARIMAN JENSCH: While -- if Staff doesn't mind, while the Staff is gone, perhaps the State of New York will tell us wherein you feel the Staff did not fully address your concerns as you set them forth in your comments.

Maybe the Board will give consideration to the matter.

MR. KUHN: Yes, your Honor.

A number of areas that we felt required a certain amount of further clarification and exploration, in particular the area of decommissioning of the cooling tower unit, we feel that it is important to find out what assumptions are incorporated in the Final Environmental Statement concerning decommissioning and how that impacts on the overall assessment of impacts depending on the life of that facility and the extent to which it is planned that that facility would be decommissioned and be perhaps taken down.

CHAIRMAN JENSCH: Decommissioned. Do you mean considering how they are going to knock the cement out and push it over, or whether they are going to put a stick of dynamite to it?

MR. KUHN: Not the method, no. We are not interested in the method that would be utilized particularly, but, rather, whether it is assumed for purposes of the analysis that the cooling tower will be standing for how long a period, having impacts either operating or not operating.

Obviously cooling towers we know have a substantial visual impact and we were concerned about how long a period that visual impact would continue, and whether that was taken into account, that is, the extent of the period of that impact in terms of the overall assessment.

CHAIRMAN JENSCH: If they should decide to use it as a grain elevator, would that be a useful purpose?

MR. KUHN: That is one possibility as well, of course.

I don't have any technical knowledge as --

CHAIRMAN JENSCH: What else did you have in mind?

MR. KUHN: That was one area.

CHAIRMAN JENSCH: As I understand it, the expression you had at the prehearing conference, that whether the operation was at full power or partial power, I take it that was answered either at that hearing or here this morning; is that correct?

MR. KUHN: Not completely, your Honor.

It was stated, and we would be interested in exploring a little bit further -- it was stated that the environmental analysis was all predicated on the full operating level of 1033, while the economic analysis was predicated upon the lower licensed operating level of 873.

We are not certain that that is necessarily accurate, although it is difficult to tell from the environmental statement.

In particular, there is one area -- excuse me a moment, please.

In particular, we were concerned about the question of salt drift and icing and fogging, whether the extent of those impacts was predicated upon the 1033 or the 873 levels.

CHAIRMAN JENSCH: If they say it was environmental, does that answer your question?

MR. KUHN: I guess we wanted to explore that a little further to test that judgment.

CHAIRMAN JENSCH: I appreciate that. If you don't know, I am puzzled that you --

MR. KUHN: I think those are environmental impacts.

jon

CHAIRMAN JENSCH: Yes.

MR. KUHN: And yet from the report there seems to be some inconsistency in that judgment.

CHAIRMAN JENSCH: Where? Where in the report?

MR. KUHN: Yes, Table 3.1. There is a natural thermal design criteria, the natural draft wet cooling tower, the cooling water flow is listed as 600,000, and it is our understanding from Indian Point, from the Indian Point 3 Final Environmental Statement, that the coooing water flow there which was assessed, which is for 1033, was higher than 600,000.

So there seemed to be some inconsistency here in terms of saying that the design here was for 1033 that was evaluated.

CHAIRMAN JENSCH: Maybe the mechanics, the whole thing is different. I don't know. But if you are going to compare some -- Mr. Sack, I think, had some problem with some-over at Indian Point 3, and maybe he -- the Commission has done it and we won't go beyond what the Commission has done.

MR. KUHN: I don't think there is any problem in referring to documents of record before the NRC.

CHAIRMAN JENSCH: If they are relevant and so forth, pertain to the same type facility.

MR. KUHN: Exactly. It is the same type cooling twer, It may very well be that that could be determined on the record through cross-examination that indeed the cooling water --

CHARIMAN JENSCH: There wouldn't be any cross-examination, but the Board is considering the extent to which your expressions would become their concerns.

MR. KUHN: Certainly. So that was our concern. So that there seemed to be an inconsistency between the Final Environmental Statement for Indian Point 3 and the analysis in this Final Environmental Statement as to whether all of the environmental impacts had been looked at at the full operating level rather than at the licensed operating level.

I believe, as you will recall, at the prehearing conference, I had indicated our concern that the Board and the Nuclear Regulatory Commission in reaching their determination have before them the full operating level information.

The other area that we were concerned about that is related to this, to the 1033 as opposed to 873 question, is the question of the economic analysis, and in particular the down time costs.

The down time costs are the costs, of course, that arise out of having to actually turn the plant off while the closed cycle system is hooked up, which is estimated to be seven months. And we are aware that we had to question in our comments the downtime cost calculations, in particular whether a portion of that time could include a period when refueling is going on in any event.

That was responded to positively.

The Environmental Protection Agency in its comments also suggested -- that is the federal Environmental Protection Agency, had suggested that perhaps only two to three months down time might be necessary and, therefore, the entire hookup procedure could take place in at least close to the amount of time that the plant would have to be down in any event for refueling.

And we wish to explore that somewhat more.

We had also wished to explore with regard to seismology and geology the whole question of why the Staff had reached the conclusion that the cooling towers were not a safety-related facility and, in particular, was this based upoin the assumpiton that the facility, that is the Indian Point 2 facility, would retain the capacity for once-through cooling.

Is it the ability to switch to once-through cooling that makes then the closed cycle system not a safety related facility?

Furthermore, we had in our comments suggested the possibility that in terms of the delivery of construction materials, that wharf that presently exists for Unit 1 could be used for the delivery of those construction materials and also possibly for the removal of any excavated materials.

Of course, the possible advantages of doing this are apparent in terms of minimization of acoustic and other impacts on the surrounding area, in particularly, obviously, if you don't have to use trucks going through the Village of Buchanan and other surrounding areas and can use an existing whatever for loading and unloading things from river-going vessels, this might be a real benefit.

Again, this is not a question that we feel impact, for example, on the choice, the specific choice of the specific type of closed cycle cooling.

On the other hand, we see all of these questions before your Honors in terms of possibly ordering that these steps be taken or that they be investigated and that appropriate steps be taken to minimize the overall environmental impacts of these cooling towers.

To move on to another point, there — we did also raise in our comments on the draft environmental statement the fact that the New York State settleable and suspended particulate standards had not really been assessed.

However, that has now been done.

However, we wish to point out that Staff has indicated some uncertainty, and we would be interested in knowing the source of that uncertainty with greater particularity.

?

Staff cites a letter that the Power Authority wrote, but some uncertainty as to the interpretation of the states ambient air quality standards for settleable particulates.

We wish to indicate that this standard as it is written and is quite clear from the text of the standard, does apply to the effluent from cooling towers.

On the other hand, we have determined that the stipulated design would comply with that standard.

We were just interested in finding out whether the Staff had any further basis for questioning that other than a letter from the Power Authority in view of the fact that the standard quite clearly applies to any sort of effluent of this sort.

CHAIRMAN JENSCH: Did you ask the Staff?

MR. KUHN: No, we have not.

CHAIRMAN JENSCH: Feel free to converse with them during the hearing or the recesses.

MR. KUHN: Thank you. We try to do that.

MR. BRIGGS: Actually, I think that is the kind of information that you can provide to us better through your people than asking the Staff what they thought about it because here you have said that these standards do apply.

MR. KUHN: Yes. And staff has not questioned it.

And in response to our comment on the DES, they say yes, indeed, and it will comply.

So it is not a question, but there is a statement that says that it is not clear whether the standard was intended to include the disposition of highly soluble particles.

To the extent that it is not clear, I guess one could also say that if Staff desired clarification of this matter they could have contacted us and we would have been glad to provide such clarification.

Indeed, we have provided testimony to any number of state proceedings under Article 8 of the Public Service Law to the nature that these particular standards to apply.

Frankly, we had not even realized that this was at all a question until it was included in the response to our comments.

If we had been permitted cross-examination of NRC Staff witnesses, we would have examined in a little bit greater detail the consideration that Staff had of the use of the waste heat with regard to aquaculture, what assumptions the Staff had taken into account in rejecting that possibility.

MR. BRIGGS: Do you have people who believe that that is a viable way of getting rid of the heat from the plant, and who could talk to us about that?

MR. KUHN: I don't believe that we have any Staff experts who could make a positive proposal at this particular time as to -- from this particular cooling tower.

If you are interested in having such a witness, I would have to determine whether we could obtain one.

But we do not have any Staff specialist in this area.

MR. BRIGGS: Thank you.

MR. KUHN: We had also raised in our draft environmental statement comments the possibility of disposing of excavated materials at the Verplanck site, a quarry at the Verplanck site, and suggested that that might be beneficial.

Again that was dealt with in a positive fashion by the NRC Staff but we would have explored the amounts of materials that they had taken into consideration in stating that they thought the materials were going to be used for a road that Con Edison is going to be preparing and whether they had any estimate of whether any materials would be left over.

Excuse me a moment.

One of our comments had related to the problem of salt deposition and had noted the fact that certain existing process resembling salt burn was in evidence and what impact the additional salt deposition from the cooling towers would have on the sensitive vegetation, and had also suggested that some additional study was desirable in terms of both pre-operational surveys of the existing plant pathological symptoms, and also of control areas.

We would have explored on the record how the Staff had reflected in the FES its agreement with our recommendation, how this was going to be reflected in the actual operations, building of this facility.

Again Staff has agreed with DEC, New York State comments on the desirability of maintaining once-through operating capability at the same time that the closed cycle system is put into operation, and indeed had discussed the desirability of operating it once-through at those periods when he river was not particularly sensitive, and the aquatic biota would not be impacted to an undesirable degree.

However, we saw no reflection in the Final Environmental Statement of conditions or suggestions as to how such once-through operating capability was to be utilize in terms of standards which would be utilized to decide when once-through operating would occur and when closed cycle operating would occur.

And in light of the potential benefits of utilizing once-through operating at certain periods, and when it can be done in an environmentally compatible fashion, that certainly could have been, we would have explored that some

jon

in cross-examination.

It may be possible that the license could be conditioned in such a way as to permit this during certain time periods.

Finally, a major area of concern was the question of the Type A analysis, the methodology of the analysis that was utilized in doing the visual impact analysis, and we had intended to do some cross-examination in that area. Obviously, visual impact analysis is a difficult area. There are some very fine methodologies, a variety of methodologies that have developed.

I believe, again with regard to the stipulation, that the Department has come out with a similar conclusion as the NRC Staff, but has utilized a somewhat different methodology.

Now, in this regard I did discuss over lunch with our environmental impact expert whether he would be willing to go on the stand this afternoon to share with you his analysis. Unfortunately, we are not able to offer that at this time for the following reason, that we have not analyzed the site and the alternatives in the great amount of detail that the NRC Staff has.

For example, the individual who is down there today, here today, with me has not visited the site for the specific purpose of analyzing the impact of these particular cooling towers. His involvement has been primarily utilization of photographs, utilization of the reports of others, analysis of the Final Environmental Statement. And therefore it would be unfair to the Board to put him up

blt 2

without his having had the opportunity to then go and visit the site with the specific purpose of preparing comments to your Honor, to the panel.

In this regard, and I can only give this as an explanation, the State of New York is unable to do the type of in-depth analysis that is required, for example, for a preparation of a Final Environmental Statement. We limit our responsibilities to the review of the work of others in order to see that this work is done comprehensively and adequately. And that is the focus of our involvement in this proceeding.

So I just wanted to explain to you why we are unable to come forward with the visual impact expert at this particular time.

MR. BRIGGS: Concerning the visual impact analysis of the Staff, was it your intention in cross-examination to indicate that this was not an adequate analysis? That one could not really come to the conclusion that they arrived at as a result of their analysis?

MR. KUHN: May I have a moment, please?

MR. BRIGGS: Yes.

(Pause.)

MR. KUHN: Your Honor, we are unable to say at this particular point whether or not it is an adequate analysis, simply because, although we have some familiarity, or

blt 3

considerable familiarity with methods similar to the methodology that was utilized, we are not entirely certain about how this methodology was utilized to get from A to B -- in effect, to get from the assumptions to the conclusion -- and, obviously, on the other hand we saw the validity of the conclusions based upon our own analysis and therefore wanted to test, if that is the proper word, the method of arriving at those conclusions.

So it is not our assertion at this particular point, and we cannot affirmatively prove that that analysis is not adequate.

MR. BRIGGS: But you used a somewhat different analysis when you arrived at the same conclusion, is that right?

MR. KUHN: That is correct. I believe that sums up the areas in which we were going to conduct some cross-examination.

CHAIRMAN JENSCH: I think this has been very helpful to the Board, to give consideration to these things. As I mentioned this morning, with all the reservations you apparently had you nevertheless signed the stipulation, and we will proceed from there.

If the Board does not accept the stipulation, we will open it up.

MR. BRIGGS: In the comments of the State of

blt 4

New York, Comment No. 21, I don't have the page in here --

MR. KUHN: That is B-42.

MR. BRIGGS: Thank you.

The question says the NRC Staff should indicate how many acres on the site are suitable and whether consideration was given to the feasibility of utilizing the Hudson River for part of the necessary acreage.

Did you finally decide that this wasn't an important question and that one could not utilize the Hudson River for spray power modules, or power spray modules?

MR. KUHN: I guess two factors come into play here. I don't doubt that it is not -- it certainly is not unimportant, the question of adequate land and adequate space for alternatives is obviously a very important question. I noted that at the prehearing conference you had requested that some further information be provided, and a very small amount was provided today. And perhaps there will be some more provided.

I think we, in terms of the answer that was provided there, although the specific area, the specific amount of space that would be required, is not indicated, I think we were in general agreement with the reasons why the Staff had not chosen that method.

MR. BRIGGS: You might like to answer this later sometime, but what I was interested in mostly was has

blt 5

anyone on the staff of the State looked at the feasibility of utilizing the Hudson River for a cooling pond, if you wish?

MR. KUHN: That is a good question. Are you talking about legal feasibility, or spacewise feasibility at this specific site?

MR. BRIGGS: The practicality of the specific site. There is plenty of space; it is just a question of whether it is practical to utilize it.

MR. KUHN: The answer to your question is no, we have not done a detailed feasibility study with respect to Indian Point 2.

If you would like, I think we could do something of that sort, if it became --- if for other reasons it appeared that this particular, the power spray module system, should be given greater consideration, we would be glad to do that.

MR. BRIGGS: Thank you.

CHAIRMAN JENSCH: Dr. Daiber has some questions of the Staff.

DR. DAIBER: I have two, one dealing with the problem of salt drift and this has to deal with the question, is there any information available from natural areas that would receive this comparable load of salt as is being projected from the cooling towers that are being contemplated?

blt 6

WITNESS KLINE: Yes, there is. We have referred in Chapter 5 to a paper by Devine, which appeared in the volume entitled "Cooling Tower Environment," 1974, and he, this author, has a graph indicating salt distribution from the seacoast as a function, a concentration as a function of distance. And very close to the seacoast he has values ranging up to about 19 micrograms per cubic meter of air, ranging downward to about 1 microgram at 18 miles. This covers the range of possible concentrations at Indian Point.

In fact, it is higher than what we project from our models. Now, the studies from this paper indicate that the lower threshold for injury in their observations was associated with an airborne concentration of about 125 micrograms per cubic meter of salt. They have indicated that no obvious leaf scorch or injury occurs when long-term average values of airborne salt concentrations are about 40 micrograms per cubic meter. They go further to state that airborne salt levels, at about 10 micrograms per cubic meter, appear to play a role in the distribution and growth of plants. So that 10 micrograms per cubic meter appears to be the lowest threshold that we have found where we could identify any effects on plants.

Our projections for the Indian Point case indicate about, for the natural draft cooling case, indicate something less than 1 microgram per cubic meter of salt in

blt 7

the environment.

DR. DAIBER: From a natural draft?

WITNESS KLINE: From the natural draft tower.

DR. DAIBER: Now, the study that you are citing there, is this based on a condition where you have comparable loads of salt in the aquatic environment, that is, you have a comparable situation such as you find in the Hudson River?

WITNESS KLINE: Yes, sir, actually more so. This is a study of natural conditions where the source of salt was sea salt.

DR. DAIBER: Yes. But of the same concentrations, parts per thousand in water as one finds at Indian Point?

WITNESS KLINE: My understanding from this paper is that the source is from undiluted sea water, which I believe is around --

DR. DAIBER: It is higher than what you expect from the river.

End 10-A

CRAIG
blt 1

WITNESS KLINE: Thirty-five parts per thousand, which is higher than that at Indian Point.

DR. DAIBER: Does this paper give any indication of the impact of the vegetation? Is there any stunting or creation of lopsided growth as a result of continuous salt impact?

WITNESS KLINE: This paper describes similar symptoms on vegetation, leaf scorch, that was described in the Con Edison report. In addition to that, I made a trip to Long Island two weeks ago to observe directly the effects of salt that resulted from the hurricane that passed over Long Island on August 9, and the salt damage there was very extensive. The symptoms were similar, and -- in that the leaves were scorched on the margins, and we did find evidence of severe effects, defoliation in some cases. In some cases defoliation on one-half the tree on the windward side, and emergence of new leaves and, for some spring-blooming species, emergence of flowering immediately after the storm.

DR. DAIBER: That particular case happened just once; there was a storm that went through?

WITNESS KLINE: Yes, sir.

DR. DAIBER: What would be the impact of a continuous day-in-and-day-out, 24-hour-a-day, 365-days-a-year for so long as the plant is in operation? What would be the impact on vegetation then?

blt 2

WITNESS KLINE: Yes. In the storm case we obtained data from Brookhaven National Laboratory which indicated that the salt concentration in the air was about three orders of magnitude higher than normal. So this was a single episode, and we can't project from that what daily -- what a much lower daily dose would do.

The paper by Devine did comment that 10 micrograms per cubic meter of air seem to be the lowest threshold that they have found that would affect vegetation. They claimed that it would affect distribution of vegetation more than the emergence of these typical acute salt burn symptoms.

DR. DAIBER: I am not quite sure, but are you saying there are not very many studies that have been done to analyze the impact of salt on vegetation over a long term basis?

WITNESS KLINE: The most useful studies that I am aware of occur in this single volume, which was a symposium gathered to examine this question. There are fragmentary reports in the older literature which largely document the effect -- the fact that salt damage from storms actually do occur.

DR. DAIBER: But not in terms of where you have a continuous exposure, relatively low levels, relative here to that that might be projected from a storm over a long period of time, such as one finds along the seacoast of

blt 3

Long Island or North Carolina or wherever there is a salt aerosol?

WITNESS KLINE: I am not aware of any studies that attempt to make that point explicitly. Ecologists have in the past studied the vegetation gradient from the seacoast, in-land, without attempting to make a quantitative connection to the amount of salt.

DR. DAIBER: Is this something that perhaps should be examined more closely?

WITNESS KLINE: For the purposes of this case, do you mean?

DR. DAIBER: Yes.

WITNESS KLINE: Or in general?

DR. DAIBER: Well, for this case and also in general.

WITNESS KLINE: Well, in the general case it is always useful to have more information. We think that for the purpose of this case our projected ambient salt concentrations are well below the literature values of thresholds that are likely to cause damage or even to cause a shift in the vegetation type, and that further studies I don't think would alter our conclusions.

DR. DAIBER: All right.

The second question has to deal with the presence of a natural draft cooling tower or some other means for

blt 4

providing a cooling mechanism for the Indian Point plant.

At the moment we are talking about Indian Point 2; however, there has been during the day inferences directed towards Indian Point 3. The Final Environmental Statement somewhere shows some photographs of the visual impact at least of various kinds of cooling towers, systems, be they natural draft or otherwise, from the various viewpoints around the area of Buchanan. One of the pictures very clearly shows two such towers being dubbed in. I don't recall in detail that there was any discussion of the collective impact of two such towers. Up to this point we are talking about, one, would this be a simple additive effect in terms of concentration and/or of distance from the Point source.

WITNESS KLINE: Is this a question relating to the aesthetics of towers or to salt?

DR. DAIBER: No. I am referring to salt.

WITNESS KLINE: To salt.

We are at present running computer models for the case of two towers. The effects will in a technical sense not quite be additive, the reason being that the towers represent two Point sources that are displaced in space. For practical purposes we believe that simply doubling the salt levels will give an adequate description of the salt deposition.

blt 5

DR. DAIBER: This would be in terms of concentration in a particular location, or would it be in terms of distance from the point?

WITNESS KLINE: Well, the -- again, for practical purposes, we can take the drift contours that appear on our computer models for 2, for Indian Point 2, and simply double the values attributed to them in the FES for Unit 2, so that the distribution will be similar but nearly double.

DR. DAIBER: One of the reasons I brought this particular question up was that there are many places where there are multiple towers certainly in existence. And certainly this summary, for other reasons, was in England, and I went by several clusters of cooling towers. They were tall structures. I presume that they were something resembling natural draft towers, although I am not sure of this. But certainly, 30-odd years ago, when I was looking at some aerial photographs, again for other reasons, I was conscious of single towers or two towers or three towers, the point being, is there any information available from the world literature that would give us some insights in terms of the impact of added towers beyond a single structure?

WITNESS KLINE: The only summary of world literature I am aware of is in a document published I believe by Westinghouse. And the title escapes me right now. It is in our list of referances.

blt 6

Oh, yes, our reference No. 54 for Chapter 5. Author is Roffman, R-o-f-f-m-a-n. The title is "The State of the Art of Saltwater Cooling Towers for Steam Electric Generating Plants." This is the only summary I know of, and I can't recall what they said about multiple units. They would have to be European units. I don't think we have any American experience on it.

DR. DAIBER: So that at the moment all we have is your projected computer model?

DR. KLINE: Yes.

DR. DAIBER: Of course, I must ask the question, how can you design it when you don't have any basis on which to make a design? If there is no experience whatsoever in the American scene--I am not a computer designer by any stretch of the imagination, but one has to have some basis on which to initiate the design.

WITNESS KLINE: I am not sure I understand the question.

DR. DAIBER: At the moment you are saying that the American experience is that there are single towers at various locations.

WITNESS KLINE: Yes.

DR. DAIBER: And how can you then create a computer design where you would analyze two or more towers configuration in terms of assessing the impact?

blt 7

WITNESS KLINE: Yes.

The approach that our computer model is taking is to plot the isopleths for each tower individually and then making overlays.

DR. DAIBER: I see.

WITNESS KLINE: In order to get the cumulative effect. The overlays do not overlay exactly, but they are sufficiently close that for practical purposes doubling for two towers of equivalent effluent is reasonable.

DR. DAIBER: Is it possible that your designer could make contact with some appropriate European experience to perhaps see how well his design might approach reality?

WITNESS KLINE: On cooling tower modeling?

DR. DAIBER: Yes.

WITNESS KLINE: Yes, sir, we have done that. And we have a contract underway which we had hoped to have ready for this proceeding, but because of administrative delays it is not now ready. This is in fact being done with a European firm which has performed modeling which has been validated in Europe. And we are doing this now, and our intent is to use -- is to run the same data base that is used with the European model along with the model we now use to improve our validation.

DR. DAIBER: At the moment that is all I have.

MR. BRIGGS: I have here page G-14 from that

blt 8

Westinghouse report that you mentioned in which it says that airborne salt concentrations above 10 micrograms per cubic meter appear to affect the distribution and growth of plants. And it says further that signs of acute injury, however, are not usually found in coastal vegetation when airborne salt concentrations are approximately 40 micrograms per cubic meter. Those were the numbers that you gave, also.

Does coastal vegetation include hemlock trees and dogwood trees?

WITNESS KLINE: No, sir, not immediately on the coast. In that report you will note that the distribution of salt appears to take an exponential die away from the coast so we would not expect hemlock or dogwood to occur in the beach areas.

Now, on my trip to Long Island I observed commercial nurseries growing hemlock for sale within two or three miles of the coast.

MR. BRIGGS: Were these hemlocks badly damaged by the salt?

WITNESS KLINE: They were badly damaged by the storm, yes.

MR. BRIGGS: Were there other hemlocks, larger ones in the area?

WITNESS KLINE: Yes, sir, there were some hemlocks

blt 9

outside of the nursery just planted for ornamental purposes, some of which were also damaged.

MR. BRIGGS: When you say "planted for ornamental purposes," were those planted at the nursery, or were those distributed around through the homes in the area?

WITNESS KLINE: This was a rural area, and we saw an occasional hemlock growing in a farmyard or along a farm driveway.

MR. BRIGGS: How frequently have they had hurricanes that caused similar damage in that area, do you know?

WITNESS KLINE: I don't know the frequency, no.

MR. BRIGGS: So you don't know whether there had been another one in the past 10 years or 20 years?

WITNESS KLINE: I do not.

MR. BRIGGS: And so on the basis of the information now, one can't say how well these might have recovered from previous exposures, is that right?

WITNESS KLINE: No, sir, we cannot.

MR. BRIGGS: How about dogwood trees? Were there lots of dogwood trees in the area?

WITNESS KLINE: Yes, sir, there is a large number of dogwood trees on Long Island.

MR. BRIGGS: Within three miles of the seacoast?

WITNESS KLINE: I didn't look at that explicitly. The dogwoods that I looked at were in the village of

blt 10

Riverhead, which is probably more than three miles from the south coast of Long Island, which is the direction the storm came from.

It is less than that from the bay, but I don't think the storm came from that direction.

MR. BRIGGS: I believe the Applicant indicated that the natural salt deposition rate in the Indian Point area is about 160 kilograms per square kilometer per month.

WITNESS KLINE: I believe that is correct.

MR. BRIGGS: Are you satisfied that that is a reasonably good value?

WITNESS KLINE: I saw no reason to challenge it, no.

MR. BRIGGS: And did you take that into account in evaluating the effect of the deposition of salt from the cooling tower out in the surroundings?

WITNESS KLINE: Yes, sir.

MR. BRIGGS: And you believe that the additional deposition will have little or no effect on the plant life, is that right?

WITNESS KLINE: That is correct.

MR. BRIGGS: When one says "little or no effect," what deposition rate do you consider will have little effect? Is it the 800 kilograms per square kilometer that the blt 11 10-B

Applicant proposes as the average annual value, or is it some other value?

jon1

10C

WITNESS KLINE: My analysis was influenced by not only the deposition rate, but also by the airborne concentration.

There are two different ways of attempting to predict vegetation. One is by airborne concentration and the other by deposition.

In some ways airborne concentration is better, the reason being that the salt damage appears to be related to wind deposition of salt, or the wind driving of salt into the foliage which really wouldn't be reflected in a situation where we measured only sedimentation.

So I was influenced by the value of ten micrograms per cubic meter which was something on the order of a factor of 100 higher than we are predicting for air concentration in the vicinity of Indian Point.

Now, in terms of deposition, we have -- deposition is a little harder to measure in the natural state because one has to make a separation between wet and dry deposition

Presumably the wet deposition has very little effect because even though it deposits, the rain simply washes it off the leaf surfaces.

So the fraction of concern is the dry deposition.

And we don't have this separation, and it gives us numbers that are a little harder to work with.

However, the Chuck Point Study has done wet deposition studies on crops, and they indicate a value something ranging from about 15 to 30 kilograms per hectare per month had an effect on reducing the yield of corn and soybeans.

This is not directly applicable to the question of trees, but I suspect that it is in the ballpark within a factor of two or so.

So that in terms of deposition, I would take a number on the order of 10 or 15 grams per hectare which would translate to 1000 or 1500 kilograms per square kilometer as being a probable level, a probable threshold level for affecting vegetation.

MR. BRIGGS: That is analyses that you made and the information that is put into the report here, you indicated earlier that the environmental impacts were based upon extended power operation; that is, higher than present full power.

Is that still a valid statement? The State of New York seems to have some question.

WITNESS KLINE: Yes. My analysis was done on the basis of the cooling tower that was presented to us which I presume was designed for its ultimate power level.

In looking further at it I concluded that the effects of salt were not really related to the power level.

MR. BRIGGS: You mean evaporation rates are not related --

WITNESS KLINE: We are not dealing here with evaporation rates. Evaporation rates would be. But we are dealing with drift levels.

My understanding is that the amount of circulating water doesn't change, and then though other parameters of the tower do change, the amount of salt carried over the throat of the tower as drift, which is unevaporated water droplets, would not be strongly affected.

MR. BRIGGS: You say then that the drift rate is related only to the throughput of water through the tower and not the throughput of air or the evaporation rate; is that correct?

WITNESS KLINE: The drift is carried out of the tower by the air flow and the amount of water falling over the fill in the tower.

MR. BRIGGS: That was your basis for indicating that there would be relatively little difference between the 873 megawatts and the 1033; is that correct?

WITNESS KLINE: That's right.

MR. BRIGGS: Indication was given earlier concerning the reasons for not using power spray modules. How much attention did you give in your studies to the use of the river and spray modules, power spray modules, or otherwise in the river for removing the heat?

WITNESS KLINE: I gave none.

jon4

MR. BRIGGS: Did any of the other Staff members consider this?

WITNESS GECKLER: I can respond to that.

The river channel, that is the ship channel in front of Indian Point, is roughly 500 yards off the Indian Point property. There is a lot of leeway.

But a ship's captain would tend to stick to the center of the river in that area.

The only place that one could stick spray modules from a practical standpoint appears to be the Peekskill Bay which has a marina in it and is relatively shallow.

In the FES we indicated that approximately 55 acres would be required for placement of the modules.

But, in addition to that, another 1000 acres -- I am sorry, another 100 acres or so would be needed.

May I correct that? It is 55 acres for the module and roughly the same area for a buffer zone around the area.

Now the degree of fogging and icing around a spray module is considerably more than around the mechanical draft towers.

If one examines a map of the Peekskill Bay, a good portion of the Bay would be taken up by one set of modules and the buffer zone would extend almost out to the ship channel.

MR. BRIGGS: Is there a particular page where there is a map that shows that well?

WITNESS GECKLER: No. I have got my information off of a NOAA chart.

MR. BRIGGS: Well, on page 532 there is a rather small map, 532 of the Final Environmental Statement.

WITNESS GECKLER: We can use that.

If you turn to that figure you will see that the county line between the two counties on either side of the river follows generally what would be the ship channel, with Indian Point being indicated in the center of the figure.

Not shown on this map are three channels between Indian Point and the center of the Peekskill Bay. There are three channels. One of which is 26 feet deep. The other two are of the order of 10.

To run piping to carry to -- to the power modules would probably destroy the deepest channel.

In addition to that, the whole area of Peekskill Bay as well as other areas on the other side of the river and southward form part of the nursery and spawning area for stripped bass.

MR. BRIGGS: Well, I guess you would have to make it so that the stripped bass couldn't get into that area. In other words, you would have to erect barriers such that they wouldn't be able to get in.

I believe there was once a proposal that there be an intake put out in the river and that there be rock fill at least up to the surface and that the water be filtered through that rock, and so I suppose you would have to make an area here that was bounded by rock fill and completely enclose it.

WITNESS GECKLER: I haven't examined that particular alternative. But with the marina in that general area, you run the risk of blocking the boats passing in and out of the bay.

MR. BRIGGS: Yes, I understand. But you did make some examination, and I guess it would be a question of whether the marina is preferable to the -- whether one would prefer to have a marina and natural draft cooling towers or no marina and no natural draft cooling towers in a case like this.

WITNESS GECKLER: The sprays would present -- they would extend into the air perhaps 15 feet in front of the marina and waterfront of Peekskill.

MR. BRIGGS: You say it would take up most of Peekskill Bay; is that right?

WITNESS GECKLER: If you went to two cooling towers with two sets of modules, you would use up practically the whole bay.

You would use up half that much --

jon

MR. BRIGGS: You would use 100 acres?

WITNESS GECKLER: Essentially. For each one.

CHAIRMAN JENSCH: Did you have any further questions that you wanted to supplement?

MR. GRAINEY: No, sir, I don't.

CHAIRMAN JENSCH: Very well, the Staff witnesses are excused.

(Panel of witnesses excused.)

CHAIRMAN JENSCH: Does the Applicant desire to put on some evidence?

MR. SACK: Yes, sir.

Could we have approximately a 20-minute recess so that I could discuss with the witness these matters which have come up this morning just now?

CHAIRMAN JENSCH: All right. Let's recess to reconvene in this room at 3:00 o'clock by that clock on the wall.

end 10-c

(Recess.)

CRAIG
blt 1
begin 11

CHAIRMAN JENSCH: Please come to order.

Is the Applicant ready to proceed?

MR. SACK: Yes, Mr. Chairman.

CHAIRMAN JENSCH: Proceed.

MR. SACK: I call Mr. Carl L. Newman.

CHAIRMAN JENSCH: This is a little different proceeding. Perhaps you will have to be sworn in again.

Whereupon,

CARL L. NEWMAN

was called as a witness on behalf of the Applicant and, having been first duly sworn, was examined and testified as follows:

xxx

DIRECT EXAMINATION

BY MR. SACK:

Q Mr. Newman, I show you this document entitled "Professional Qualifications of Carl L. Newman." I ask you, has that document been prepared under your supervision and direction?

A It has.

Q And do you testify that it is true and correct?

A I do.

MR. SACK: Mr. Chairman, I move that this be annexed to the record, transcript, as if read.

CHAIRMAN JENSCH: Is there any objection from the State of New York, Hudson River Fishermens Association,

blt 2

Regulatory Staff?

MR. KUHN: Might I ask what the purpose of annexing such professional qualifications to the record is for purposes of the Board?

CHAIRMAN JENSCH: Well, there is just no reason for these things, State of New York. This is just our policy. I mean, we have always done this, put background information about the witness in. It saves a little time and permits him to speak to the subject to which his attention will be directed and gives a quick and broad review of his background.

MR. SACK: He could read it into the record if you prefer.

MR. KUHN: I guess the question, then, was, this is simply in lieu of a question and answer or series of questions and answers with regard to this individual's background.

MR. SACK: And qualifications as an expert to testify.

MR. KUHN: We have no objection.

MS. CHASIS: No objection.

MR. GRAINEY: No objection.

CHAIRMAN JENSCH: The request is granted, and the professional qualifications of Mr. Newman will be physically incorporated into the transcript and constitute evidence

blt 3

on behalf of the licensee.

(Professional Qualifications of Carl L. Newman follows.)

only 1 copy available

PROFESSIONAL QUALIFICATIONS
CARL L. NEWMAN
VICE PRESIDENT

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

My name is Carl L. Newman. My business address is 4 Irving Place, New York, New York 10003.

I majored in Liberal Arts at the University of Pennsylvania from 1939 to 1942 when I entered the United States Army Air Corps. In 1945 I returned to the University of Pennsylvania. I graduated with a Bachelor of Science degree in Mechanical Engineering in 1948 and earned a Master of Science degree in Mechanical Engineering in 1952. While working towards the Master of Science degree, I was employed by United Engineers & Constructors, Inc., as a designer of steel mill power facilities and heavy industrial facilities.

In 1952 I was promoted to Power Engineer at United Engineers. Assignments included economic studies of optimum methods for meeting steam and power requirements and heat balance studies of steam electric generating units in the 30,000 to 75,000 kilowatt range.

In 1953 I was promoted to Consulting Engineer. In this position, among other assignments, I consulted on the design and construction of the primary system for the SSN 575 "Sea Wolf" atomic-powered submarine and its land base prototype.

In 1954 my title was changed to Mechanical Engineer. Between 1954 and 1958 I had various assignments, all associated with fossil and nuclear power plants. I was responsible for all mechanical engineering design work performed by United Engineers on the boiling water reactor facility (ARBOR) for the Argonne National Laboratory; for the design and erection of a 10,000 kilowatt power station and black liquor recovery unit for Bowaters Carolina Corporation, Catawba, South Carolina, and a 25,000 kilowatt power plant for Bowaters Southern Paper Company at Calhoon, Tennessee. In 1959 I served on the fluid fuel task force which reviewed aqueous homogeneous, liquid metal fueled, and molten salt reactor concepts for the Reactor Development Branch of the Atomic Energy Commission.

During 1959 through 1963 as an Assistant Supervising Engineer, later Supervising Engineer, and then Project Manager, I was responsible for all work by United Engineers for the first major thermal power development in the Province of Quebec. I prepared the initial economic justifications, site studies and coordinated mechanical, structural, and electrical design and construction of two 150 megawatt generating units for Shawinigan Water and Power Company, Montreal, Canada; and recruited and instructed the principal members of the thermal operating department. During this period I was also responsible as Project Manager for the design of a polyvinyl chloride extrusion facility at Borden Chemical Company, North Andover, Massachusetts; for preparing specifications and coordinating the construction of two polyvinyl chloride plants and a butadiene styrene plant for Borden Chemical Company, Illiopolis Illinois; and for supervising the design of a melamine plant for Brook Park, Inc., San Juan, Puerto Rico.

Between 1963 and 1968 in various capacities as Project Manager, Consulting Engineer, and Power Consultant, I studied the feasibility of a 2000 megawatt mine mouth power plant for Middle Atlantic Power Company, Philadelphia, Pennsylvania; conventional and sodium heated steam generating equipment for a fast breeder reactor for Argonne National Laboratory; and two light water reactor plants, each containing two 900 megawatt units for Joint Generation Task Force, Philadelphia, Pennsylvania. I participated in the design and construction of three 600 megawatt units for a new generating station for Allegheny Power Service Company, Masontown, Pennsylvania, and preliminary design of the proposed 800 megawatt boiling water nuclear unit at Bell Station, New York State Electric and Gas Corporation. I participated in an architect-engineering assignment by Westinghouse Electric Corporation for the engineering and design of Indian Point Generating Station Units Nos. 2 and 3. I participated in the architect-engineering services for a 1000 megawatt fast-breeder reactor follow-on study for the Atomic Energy Commission.

I was Power Consultant for the design and construction of two nominally rated 800 megawatt nuclear units at Brunswick Steam Electric Plant for Carolina Power and Light Company. I was Project Manager for the design of Units 3 and 4 of Tracy Generating Station for the Shawinigan Engineering Company. I provided consulting services in connection with the design and construction of Unit No. 3, a 150 MW addition to the Indian River Power Station for Delmarva Power and Light Company of Delaware. I provided engineering services for a study of a fossil fuel plant for Quebec Hydro-Electric Commission consisting of two 550 megawatt units and with an ultimate site capacity of 2,000 megawatts. I was Consulting Engineer for Delmarva Power and Light Company in connection with the design and construction of Unit No. 4 at Edge Moor Station. I also provided consulting services for the design of Units No. 1 and 2 of the Sioux Power Plant for Union Electric Company, St. Louis, Missouri. These units were rated 500 megawatts. I served as project manager of a team of Westinghouse licensees preparing a proposal for the fourth nuclear power plant for ENEL. This work was carried out in Italy and Switzerland.

From 1968 to 1970, I was Chief Engineer of United Engineers Power Division. In this capacity, I directed preliminary engineering for proposals and for consulting assignments, and developed standards of engineering practice. I left United Engineers in 1970 to join Consolidated Edison Company of New York as an Assistant Vice President. In this capacity I was responsible to the Vice President for mechanical, civil, and nuclear engineering functions. I was responsible for the design of the Narrows Generating Station, and I developed a nitrogen oxide control program for use in the Con Edison System. In 1971, I was promoted to my present position of Vice President, Engineering. I am responsible for the engineering functions of general, civil, mechanical, nuclear and emissions control, and electrical engineering. I am a licensed professional engineer in the States of Massachusetts, Nebraska, North Dakota, Pennsylvania, Utah and New York. I am a member of the American Nuclear Society, the National Society of Professional Engineers, a fellow of the American Society of Mechanical Engineers, a senior member of the Institute of Electrical and Electronics Engineers, Inc., and a fellow of the American Society of Civil Engineers.

blt 4

BY MR. SACK:

Q Mr. Newman, I show you a series of documents. Document 1 is entitled "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point Unit No. 2," dated December 1, 1974, together with a letter -- no, together with a document entitled "Economic and Environmental Impacts of Alternative Closed-Cycle Cooling Systems for Indian Point No. 2, Supplement No. 1," and a letter dated -- for Mr. William J. Cahill, Jr., to the Director of Nuclear Reactor Regulation, dated October 6, 1975, constituting Supplement No. 2 to the report previously identified.

These three documents constitute the report as supplemented. I ask you, was this report and the supplements prepared under your supervision and direction?

A Yes, they were.

Q And do you swear that the information contained therein is true and corre-t to the best of your knowledge, information and belief?

A Yes, I do.

MR. SACK: I move that these documents be submitted into evidence as Licensee's Exhibit No. 1 in this proceeding.

CHAIRMAN JENSCH: The documents to which licensee's counsel has just referred may be collectively referred to as

blt 5

xxx

Licensee's Exhibit No. 1.

(The document referred to was marked for identification as Applicant's Exhibit No. 1)

CHAIRMAN JENSCH: Having thus been identified, are you offering the documents into evidence?

MR. SACK: Yes, I am offering these documents in evidence.

CHAIRMAN JENSCH: Any objection?

MS. CHASIS: No.

MR. KUHN: Your Honor, we have difficulty with this, under the ground rules that you have established, quite frankly.

As I indicated when we were requested to comment on entering the Final Environmental Statement evidence, it is our understanding that to the extent that these documents will be utilized to represent the voracity of what is contained therein, that the State of New York should have an opportunity to cross-examine these documents. That was our position with regard to the Final Environmental Statement, and that was also our position with regard to these documents.

CHAIRMAN JENSCH: The same ruling.

Any objection?

MR. GRAINEY: No, sir.

CHAIRMAN JENSCH: Licensee's Exhibit No. 1 is

blt 6

xxx

received in evidence.

(The document previously marked for identification as Applicant's Exhibit No. 1 was received in evidence.)

CHAIRMAN JENSCH: Proceed.

BY MR. SACK:

Q. Mr. Newman, I hand you another document entitled "Consolidated Edison Company of New York, Indian Point Unit No. 2, Report on Regulatory Approvals." Has this document been prepared under your supervision and direction?

A. Yes, it has.

CHAIRMAN JENSCH: You seem to pause. Is that the first time you have seen it?

(Laughter.)

THE WITNESS: No, sir, I was looking to see if all the pages were here. I believe it was transmitted over my signature, also.

CHAIRMAN JENSCH: I was just wondering about the letter prepared by Mr. Cahill under your supervision and direction. You directed Mr. Cahill to write the letter that was part of Licensee's Exhibit No. 1?

THE WITNESS: Perhaps I can explain that. In order to consolidate all incoming and outgoing mail on regulatory matters, Mr. Cahill has been designated as a

blt 7

signatory of these letters, and in his absence I have his delegation to sign letters.

However, the nuclear licensing is performed by my staff and under my direction and requires my approval prior to Mr. Cahill transmitting the letter.

CHAIRMAN JENSCH: Are we going to get copies of Licensee's Exhibit No. 1?

MR. SACK: Yes, sir. You have them by mail. We have additional copies here if you want them.

CHAIRMAN JENSCH: You have mailed them to us? Under what date? Can you identify the date you transmitted them, how recently?

MR. SACK: We transmitted the cooling tower report, the original Volume 1, some time ago.

CHAIRMAN JENSCH: That came in at the time of the licensee's request, didn't it?

MR. SACK: Excuse me, to make an amendment of Exhibit 1, the first document was in three volumes. I don't think that was clear on the record, but there are three volumes to the first document and then two supplements.

The first exhibit, Exhibit No. 1, is three volumes plus two supplements.

CHAIRMAN JENSCH: Yes.

MR. SACK: The three volumes were transmitted some time ago, is that correct?

blt 8

CHAIRMAN JENSCH: That is all right.

MR. SACK: Supplements 1 and 2 were transmitted last Friday by letter to the Board, so you probably would not have received it in the ordinary course. But they have been transmitted.

CHAIRMAN JENSCH: Do you have any extra copies of these two supplements?

MR. SACK: Yes, we have extra copies for the Board.

CHAIRMAN JENSCH: If you will, give one to me at least.

(Pause.)

CHAIRMAN JENSCH: Will you proceed.

BY MR. SACK:

Q. This document which I last described, the report on regulatory approvals, is this true and correct to the best of your knowledge, information and belief?

A. Yes, it is.

MR. SACK: I ask that this be submitted into evidence as Con Edison's Exhibit No. 2, Licensee's Exhibit No. 2.

CHAIRMAN JENSCH: The document which Licensee's couns 1 has just referred may be marked for identification as Licensee's Exhibit No. 2 and, having thus been identified, is it then offered into evidence?

blt 9

MR. SACK: I move it be offered in evidence.

CHAIRMAN JENSCH: Any objection, State of New York?

MR. KUHN: State of New York has a question on whether it is relevant at this particular point to enter into evidence something that we have deferred for further consideration. I don't know whether the particular document referred to, the report on regulatory approvals, is relevant to the question of the specific type of closed-cycle cooling and to your proposed initial order in this proceeding.

I would respectfully request, suggest, that perhaps, since we are anticipating further hearings on the other questions, that -- and, furthermore, that we have not prepared ourselves for consideration of this particular report, that this be deferred.

We have no objection to having it adopted as an exhibit under the condition that it would be considered at a future time rather than today.

CHAIRMAN JENSCH: Will you address yourself to the relevancy?

MR. SACK: It is relevant to the -- to what has been called subsequent proceedings. I am still not clear whether there is going to be an evidentiary session on the subsequent matters. No one has yet advised us of any

blt 10

factual issues in contention.

So on the possibility that there may not be another evidentiary session, I thought it would be helpful, since we have an evidentiary session now, to put into evidence at this time.

It is relevant to the whole proceeding. If under what we call the bifurcation it is not directly relevant to the first part of the bifurcation, I agree with that. I am not sure whether we are going to have a hearing, an evidentiary session on the second part.

CHAIRMAN JENSCH: I thought it was somewhat implicit in some of the statements from some of the parties that they certainly were stating that they were going to request that a hearing be had and that they were ready to assist in the formulation of issues for that second session, bifurcated session of hearings.

Is that a correct statement of your position, State of New York?

MR. KUHN: Well, yes, your Honor, in particular we are just claiming surprise at this particular point because we figured it was going to be taken up at a later point.

CHAIRMAN JENSCH: How about Hudson River Fishermens Association?

MS. CHASIS: We join in the question of relevance

blt 11

of this document being entered into evidence at this point. It relates, it would seem, to questions of Con Edison's pursuit of the necessary approvals with due diligence and the extent to which it has received the requisite approvals, issues which are not before the Board at this time.

CHAIRMAN JENSCH: Is it your thought that the Hudson River Fishermens Association would request a hearing and would assist in the formulation of issues respecting such a hearing?

MS. CHASIS: We would anticipate requesting such a hearing and participating in the formulation of issues concerning the scheduling issue. That is the factual issue which we deem remains outstanding.

CHAIRMAN JENSCH: The question extending the time for once-through cooling is a matter to which you feel there is some contention, is that correct?

MS. CHASIS: That is correct.

(The Board conferring.)

CHAIRMAN JENSCH: At the risk of some duplication of presentation --

MR. GRAINEY: Mr. Chairman, before you rule, could I state the Staff position, or are you about ready to rule?

CHAIRMAN JENSCH: No, we are raising the question

blt 12

that the statement so far--the Board understands that there will be a request for hearing on this question of extending the time for once-through cooling. What is the view of the Staff with reference to the identified Licensee's Exhibit 2?

MR. GRAINEY: I think it is also irrelevant to the issue before the Board, as well as I don't think it is material to the issue the Board has before it today. I also think that with respect to whether there be a hearing on the question of what regulatory approval is required may or may not be necessary. That might be the type of issue that the parties could stipulate to the facts, and then simply be a legal issue for the Board to decide.

But I think whether it is in the form of a legal issue for the Board to decide or an actual evidentiary hearing, I think that is something this Board will have to decide at a not too distant time in the future.

Because of that, I think it would be prejudicial to the other parties' rights as well as being irrelevant to the issue before the Board right now to let this in as evidence.

CHAIRMAN JENSCH: I think it would under the procedures of not having cross-examination in reference to the selection of the preferred type of closed-cycle cooling system to consider a matter that might be unrelated to it,

blt 13

and yet not available to cross-examine.

Objection to Licensee's Exhibit 2 is sustained.

xxxxx

(The document referred to was marked for identification as Applicant's Exhibit No. 2.)

MR. SACK: It remains marked as Exhibit 2 for identification?

CHAIRMAN JENSCH: Yes.

MR. SACK: Then I would assume that before we adjourn this session we will have a statement of the issues in contention in the -- for the second portion of the hearing and set a schedule for that portion. I think it would be most irresponsible to adjourn this session without doing that much.

CHAIRMAN JENSCH: If that can be accomplished, that is fine. I suggested in talking with Mr. Trosten that perhaps the parties could communicate some way. If time permits us to do it here, that is fine.

I do think an early determination in that regard can be undertaken. Perhaps this evening the parties could get together.

MR. SACK: I understood that conversation to relate to the two-year extension request. What we are now discussing is what we call the automatic extension to which we are entitled to by reason of failure to seek regulatory

blt 14

approvals. That is something where Con Edison has stated its position several times. The other parties have not indicated in any way in what respect they disagree with it. So we are quite amazed that it should get this far along in the proceeding without having any specificity in the contentions of the parties that we are not entitled to that extension.

CHAIRMAN JENSCH: Let's move along and perhaps this evening that can be resolved and we can take it up in the morning.

Do you have further direct?

MR. SACK: Yes.

BY MR. SACK:

Q. Mr. Newman, we had some discussion this morning about the feasibility of other alternative closed-cycle cooling systems than the natural draft. Let's take them one at a time. We should start with the circular mechanical system.

Do you believe that it would be practical to install a circular mechanical draft cooling system at Indian Point 2?

A. I do not believe it would be practical to install a circular mechanical draft cooling tower at Indian Point 2.

Q. Would you explain your reasons for that conclusion?

blt 15

A. We have no basis on which to evaluate performance of circular mechanical draft cooling towers at Indian Point 2. To the best of my knowledge there are no towers of this size operating anywhere in the world.

My staff has indicated to me that there are some towers not of this size that have been ordered. They are not on salt water applications, and it would be less than prudent for us to apply these to closed-cycle cooling should that be necessary at Indian Point in the absence of anyway predicting the environmental effects or the thermal performance of these towers.

Q. Another alternative that was considered this morning was the fan-assisted natural draft cooling tower system. Would you consider it practical to install that type of system at Indian Point 2?

A. I would not consider it practical to install a fan-assisted natural draft cooling tower for reasons similar to those that I stated before.

Q. Now, there was a question raised at the pre-hearing conference concerning the possibility of utilizing a portion of the river as a spray pond. Have you and your staff investigaged that possibility?

A. Yes, we did.

Q. Have you concluded that it would be practical to install that kind of system?

blt 16

A. We concluded that it would be totally impractical to install that type of system.

Q. Would you explain the reasons for that?

A. I heard the Staff's comments on the same system. Our investigations were totally independent, and we investigated a different part of the river in that we investigated the portion of the river immediately adjacent to Indian Point.

The problem is that the river slopes off, and the outboard portion of the canal system that would be required to provide a spray module type of canal is about 80 feet deep. We carried this work through some preliminary designs and estimates. The Staff carried it through to the point where they had prepared an estimate. Their estimate was higher than a natural draft cooling tower.

When I reviewed the design, I found they had omitted many of the practical considerations associated with the difficulties of this type of construction. The construction envisioned sheet pile walls and reenforcing steel to make it a stable structure. They had, even within this very costly design, failed to properly evaluate the ice difficulties in the river during the winter.

There were great difficulties associated with overturning of the 80-foot high sheet pile wall due to head differentials between the river and the canal that are

blt 17

required to get a flow gradient through the canal.

We concluded after a design review of this preliminary design that it was totally impractical.

Also, our findings concerning environmental effects were essentially those that were addressed by the Staff, namely, much more incident of icing and fogging, and also this icing and fogging would be down at river level. The channel comes quite close into the shore at the Indian Point reach. We concluded this was a totally impractical approach.

Our calculations indicated, based on the performance that was given to us by the manufacturers, that it would require about 45 acres. In further investigations we found the modules have not performed as predicted by the manufacturer where they have been installed.

End 11

jon1

12

MR. SACK: I would now like to ask another witness to join Mr. Newman as a panel.

I call Mr. Lester A. Cohen.

CHAIRMAN JENSCH: Will you stand and raise your right arm, please?

Whereupon,

LESTER A. COHEN

was called as a witness and, having been first duly sworn, was examined and testified as follows:

CHAIRMAN JENSCH: Will you give your full name to the reporter, please?

WITNESS COHEN: Lester A. Cohen.

DIRECT EXAMINATION

BY MR. SACK:

Q Mr. Cohen, I hand you this document entitled Statement of Qualifications of Lester A. Cohen. Has this document been prepared under your supervision and direction?

A (Witness Cohen) It has.

Q Do you state this doucment is true and correct?

A Yes.

MR. SACK: I ask that this document be annexed to the record of the proceeding as if read.

CHAIRMAN JENSCH: Is there any objection? State of New York? Hudson River Fishermens Association? Regulatory Staff?

(No response.)

There being no objection, the request of the Licensee's counsel is gratned. Statement of Professional Qualifications of the Witness Lester A. Cohen may be physically incorporated into the transcript as if orally presented and shall constitute evidence on behalf of the Licensees.

(Document follows.)

Statement of Qualification
of
Lester A. Cohen

My name is Lester A. Cohen. Since December, 1972, I have been employed as a Senior Engineer in the Emissions Control Bureau of the Nuclear and Emissions Control Engineering Department of Consolidated Edison Company of New York, Inc. My responsibilities consist of planning of meteorological and air quality programs for fossil and nuclear facilities, coordination and technical assistance to contractors and consultants, preparation of environmental reports, testimony and responses to regulatory agencies.

I received both my Bachelor of Arts in Meteorology (1960) and Master of Science in Meteorology (1963) from New York University, Bronx, New York.

From June, 1960 to April, 1963 I was employed as a research assistant in the Meteorology Department, College of Engineering, at New York University. My duties included teaching courses in weather observations and forecasting, and scientific investigations of the sea breeze and hurricane low level wind structures.

During the period April, 1963 to July, 1971 I was employed as a meteorology associate at Brookhaven National Laboratory, Upton, New York. I conducted atmospheric diffusion field experiments using inert, radioactive, combustion and aeroallergen tracers. Research programs were sponsored by the Atomic Energy Commission to develop and document diffusion processes in the ten meter to tens of kilometer range using gaseous and particulate tracers. I directed airborne and ground level diffusion programs for plume tracking of fossil plumes from generating stations at Shelocta, Pa., Northport, N.Y. and New Haven, Conn. Other tracer studies included use of sulfurhexafluoride, uranine dye, and pollens in the open field and forested areas. Additional activities involved plume rise measurements, design of meteorological acquisition systems, development of gaseous and particulate samplers, and use of laser technology for atmospheric soundings. Several papers have been published in technical journals on the results of the research programs. Additionally, I served as a private meteorological consultant to various utilities and industrial companies.

For the July, 1971 to June, 1972 period I was Eastern Field Manager for Enviro Metrics Inc., serving as technical liaison for air quality and stack sampling systems.

From July, 1972 to November, 1972 I was Senior Meteorologist for Dames and Moore coordinating meteorological field programs for siting of power plants and industrial facilities.

Professionally, I am a member of the American Meteorological Society, Air Pollution Control Association and serve on the ANS Standards Working Group 2.5, "Guidelines for Determining Meteorological Information Appropriate for Power Reactor Sites".

jon3

MS. CHASIS: We would like to request copies of that.

BY MR. SACK:

Q Have you investigated the literature to determine if there could be an area between sites such as Indian Point and the ocean that has comparable salt deposition rates to that which Con Edison has predicted would occur in the Indian Point area if a natural draft cooling tower were constructed?

A (Witness Cohen) Yes, I have.

Q What did you find as a result of that investigation?

A I found in the draft that was published in -- can I present this?

Q Just describe it.

A The cooling tower environment. The Forked River, New Jersey's Oyster Creek generating facility, measurements were taken --

Q Excuse me. Is that the same graph the Staff witnesses referred to this morning?

A I believe so. One of the graphs. There have been several in the report. It is Figure 13, page 478.

Q Who was the author of that study?

A Schrecker, Wilber & Shofner.

Q What does that draft show?

A It shows measurements taken, natural background measurements taken of ambient air concentration and salt deposition approximately a tenth of a kilometer from the sea-coast which is the Atlantic Ocean and proceeding inward to approximately 28 kilometers.

It illustrates the fall-off of ambient salt and deposition values as one proceeds inland.

Q Can you identify on that curve at about what idstance you would find salt deposition rates similar to that which Con Edison has predicted would occur at Indian -- in the area of Indian Point if a natural draft cooling tower were constructed?

A Yes. In reference to our Figure 6.9, the net salt emitted from the cooling tower would be approximately 250 kilograms per kilometer squared, added to the natural background which we assume of 160, would result in approximately 410 kilograms per kilometer squared which is approximately four kilometers inland from the shore.

Q Did you make an attempt to ascertain what vegetation is found in that area approximately four kilometers from the ocean?

A Yes, I did. I investigated the Forked River Nuclear Station Unit 1 natural draft salt water cooling tower assessment of environmental effects dated January 1972 where a vegetation survey was taken for a ten-mile diameter area, about 50,000 square acres. And the results showed that no hemlock or flowering dogwood were identified within that area.

CHAIRMAN JENSCH: May I have the last sentence again?

WITNESS COHEN: Yes, sir. No hemlock or flowering dogwood were identified inthe 50,000 square acre area of the Forked River site.

CHAIRMAN JENSCH: You mean there was none there?

WITNESS COHEN: That's correct. None.

CHAIRMAN JENSCH: None. Thank you.

MR. SACK: That concludes my questioning.

CHAIRMAN JENSCH: That concludes your direct testimony?

MR. SACK: That's correct, it concludes the direct testimony.

MR. BRIGGS: I have a question for Mr. Newman.

On page 2-13 of the Staff's Final Environmental Statement there is a list of round towers installations, one of which is operational and several of the others of which are not presently operational or were ot operational at the time that this table was made.

The first one is for the Washington Public Power Supply System for an 1100 megawatt nuclear system with 560,000 gpm.

One of the lower ones is Gulf States Utilities for 934 megawatts.

Presumably these are for fresh water installations.

Could one conclude from this that the engineering community, if you wish, has confidence that you can design these towers for fresh water installations for large plants?

WITNESS NEWMAN: One could assume that from the table, yes.

MR. BRIGGS: Do you have reason to doubt that one can -- could expect these to perform according to the specifications; in other words, could give the capacity that is required?

WITNESS NEWMAN: I would have reason to doubt it, yes.

MR. BRIGGS: You think then it is likely then that these will not perform according to specification?

Let me put it a little bit differently. If salt water were not involved, do you think towers of this type could be constructed at Indian Point and be expected to operate according to specification?

WITNESS NEWMAN: In the absence of reported test data, I wouldn't want to conjecture on that.

The point that I was making is that it would be less than prudent in view of the very difficult situation at Indian Point, and in view of the fact that there is salt water there, to proceed in the absence of performance data, either thermal or environmentally sensitive performance, when there towers that have been more thoroughly investigated and of which there is some question as to the acceptability of the environmental effects.

MR. BRIGGS: Do you think that the round tower has significant advantages over the straight mechanical draft tower?

WITNESS NEWMAN: I don't have data on which to base a conclusion.

The straight mechanical draft towers have been in operation in this country for many years. And their design has been much refined.

It is my understanding from some conversations with my colleagues that the Gulf States Utilities tower -- I believe that is the one that is in operation; is that correct?

MR. BRIGGS: Well, it indicates here that the Mississippi Power Company tower is operational.

WITNESS NEWMAN: Yes, that is the one, I guess, had some difficulty with their distribution and did not perform thermally.

In all events, when one looks at an investment of what appears to be close to $100 million, one is not inclined, if they are in my position, to authorize embarking on such a developmental activity.

I would also like to point out tnat at the time

jon8

we started our design efforts, which was 1973, there were no such towers. And, if you recall, the preference document was submitted in December of 1974. I am sure that there will be technical advances by the year 2000, but I don't think that they are practical to consider.

MR. BRIGGS: Thank you.

Concerning the deposition rates of salt near the seacoast , did I understand that a number of 250 kilograms per square kilometer per month was taken as the deposition rate, and then one adds to that 160 kilomgrams per square kilometer per month; or is that per year?

WITNESS COHEN: That is per month, sir.

MR. BRIGGS: Per month?

WITNESS COHEN: Yes. That is the maximum. That is illustrated in our Figure 6.5.

MR. BRIGGS: That is 6.5 in the Staff's --

WITNESS COHEN: No. This is our submittal, Volume 1.

nd12

#13

MR. BRIGGS: I am afraid we don't have that one.

CHAIRMAN JENSCH: I wonder if we could take a look at that.

MR. BRIGGS: Is that okay?

WITNESS COHEN: Yes, sir.

MR. BRIGGS: Then that is the same as the Staff's Figure 5.1 on page 5.6, I believe.

jon9

WITNESS COHEN: That's correct.

MR. BRIGGS: All right. So your statement, then, is concerned with the maximum deposition rate during that month of October, and that is a deposition rate for just one month.

The deposition rate that you were -- the deposition you compared it with was at the seacoast where the deposition occurred over the full year; is that correct?

WITNESS COHEN: Yes, sir, averaged.

MR. BRIGGS: So one says that if you get 250 kilograms per square kilometer per month in this amll area and if that were to persist over the entire year and you added on to that 160 kilograms per background, you could expect conditions to be like those that you observed or obtained from the seacoast data?

WITNESS COHEN: We analyzed the data month by month and the effects are based on that.

The data in the Forked River Study is also predicated on a month.

MR. BRIGGS: Does it vary from month to month on the Forked River data?

WITNESS COHEN: I don't have all the data to assess that, but just general meteorological, let's say, assessment of the situation, I would say that it would vary from month to month depending on the prevailing wind flow.

MR. BRIGGS: By a large amount or a small amount, do you suppose?

WITNESS COHEN: I would have no way of judging unless I looked at the data.

MR. BRIGGS: How far inland did you have to go before you found hemlock and dogwood?

WITNESS COHEN: In the report they just studied a five-mile radius of the site, and they did not have any other data further inland.

MR. BRIGGS: So that you took this information directly from the report, you didn't go there and observe the information?

WITNESS COHEN: No, sir, I am not a botonist. No, sir.

DR. DAIBER: I would like to follow up on that, Mr. Cohen.

The inference that I am getting from your statements is that the absence of dogwood and hemlock from this five-mile radius, Forked River --

WITNESS COHEN: Yes, sir.

DR. DAIBER: -- is due to the presence of salt?

WITNESS COHEN: I couldn't speculate what it was due to. I am not a botanist.

DR. DAIBER: However, this was the inference I got from your statement.

WITNESS COHEN: Well, as a layman I can make a conjecture on it, but I am not an expert on the natural background of dogwood or hemlock.

DR. DAIBER: You did not visit the site itself?

WITNESS COHEN: No, sir, I did not.

DR. DAIBER: Is it possible that there could be some other factors that would preclude the presence of hemlock or dogwood in such an area?

WITNESS COHEN: I assume there could be, yes, sir.

DR. DAIBER: And not related solely to the presence of salt air salt?

WITNESS COHEN: Correct.

CHAIRMAN JENSCH: What vegetation was reported witin that five-mile radius, do you know?

WITNESS COHEN: There is quite a list, sir. Mainly, if I can just -- we could either present this or if you want me just to read off --

CHAIRMAN JENSCH: If you read it off, read all that was there.

WITNESS COHEN: Hardwoods, black ash, white oak are the most common species present, while scarlet oak is enough in evidence to be considered a major part of the over-story. Their Table 10 represents white cedar as the over-story.

Table 11 --

CHAIRMAN JENSCH: What is that, over-what?

WITNESS COHEN: Over-story. That is, I believe, a botanical term.

CHAIRMAN JENSCH: Can you spell it?

WITNESS COHEN: O-v-e-r-s-t-o-r-y.

It is all the vegetation in the area. Mixed hardwood and pine.

Over-story of the mixed sites consists of both hardwood and softwoods. Oaks predominate, but there are also considerable amounts of pitch pine present.

They also document pine, salt water marsh, and a whole list of other species, salt water marsh species.

These are Tables 9 through 14 of the Forked River Report.

CHAIRMAN JENSCH: How did you happen to use the term or standard of hemlock and dogwood as the standard to tell whether salt was there or not?

WITNESS COHEN: Well, we didn't work backwards, sir. That was from the literature. At our site hemlock and dogwood are predominant species. We just wanted to see if they were also existing in that area.

CHAIRMAN JENSCH: Did you check with any botanists to know, for instance, whether hemlock needs a pretty moist soil?

MR. SACK: Excuse me, Mr. Chairman. Unfortunately, Mr. Coehn is not our botanical expert. I think he will be available tomorrow if you have any questions.

The salt -- the dogwood and hemlock were selected because our botanical studies had shown that those were the most salt-sensitive species of the ones in -- that were found in the area and was the subject of the botanical report.

CHAIRMAN JENSCH: How was that determined, that they were most salt-sensitive?

Do you have some salt deposition going on in the Hudson River area now?

MR. SACK: No. Those were special studies that our consultant at Boyce Thompson Institute prepared to try to anlayze what the environmental impact of this cooling tower would be.

Let me explain for a minute our procedure.

Mr. Coehn is the expert on how much salt will be deposited where in that area, and then Boyce Thompson Institute, our consultant, picks up and determines what the botanical effect of that level of salt would be.

Now, if you want to ask detailed questions on botanical effects, I am sorry, but our Boyce Thompson man was not able to be here today. He had a commitment. I believe with the NRC Staff that he could not avoid, but because --

CHAIRMAN JENSCH: I am not pressing for his attendance at all. I just thought he might know, because I think I had the same inference from Mr. Cohen's testimony that all is lost, from the pointof view of lumber, I think people would take quite fair in excess of hemlock, and so it looks like this is the thing to do, is to put some cooling towers for Indian Point, you would get a better crop of lumber and everybody will be ahead, this is the way to make it grow.

MR. SACK: We did not mean to imply that the cooling tower will produce vegetation similar to what is found in Forked River.

CHAIRMAN JENSCH: And vice versa.

MR. SACK: That's right. We only -- we were only responding to the question that was asked at the prehearing conference.

In order to determine the botanical effects, Boyce Thompson prepared this special study and indicated they thought it was one of first impression at the time, and this is Appendix E to Licensee's Exhibit 1, and it is found in Volume 3 of Exhibit 1.

CHAIRMAN JENSCH: Thank you.

DR. DAIBER: May I ask a question. I think either to you, Mr. Sack, or to Mr. Cohen, whoever feels capable of responding.

Is the climate and topography of the Peekskill area, Indian Point area, similar to that of the Forked River area of New Jersey?

MR. SACK: Mr. Cohen can respond to that.

WITNESS COHEN: Not at all. The topography of the Jersey coast where these studies were taken is relatively flat whereas at Indian Point we have terrain in excess of 1000 feet.

DR. DAIBER: I am trying to draw a mental picture exactly geographically where Forked River is.

WITNESS COHEN: It is roughly in the Atlantic City area. Atlantic City, New Jersey, area, as a general point.

DR. DAIBER: That is quite a different kind of terrain than you have around here.

WITNESS COHEN: Yes.

DR. DAIBER: Quite different. Therefore, I would suggest that perhaps that was not a very good comparison for presentation.

MR. SACK: That's correct. We were not making it for comparison purposes. We were responding to the question as the only document we could find which had this kind of salt study.

CHAIRMAN JENSCH: Well, then, you would indicate, then, the basis of the evidence you have, there is no likelihood of damage on the basis of the information you have to the area around Indian Point; is that correct?

MR. SACK: No, sir, that is not correct. The evidence that we have is set forth in Exhibit 1, and particularly that appendix which I bleieve indicated there would be some damage to salt-sensitive species under conditions of extended drought.

e[illegible]3

#14

CHAIRMAN JENSCH: Very well. Thank you, gentlemen. You are excused.

(Panel of witnesses excused.)

CHAIRMAN JENSCH: That completes the direct presentation for the Licensee?

MR. SACK: Yes, sir.

CHAIRMAN JENSCH: Ms. Chasis, do you have any evidence to produce?

MS. CHASIS: We have no evidence, but we wish to state the rationale for our position taken in the stipulation for purposes of your consideration and the record.

There have been five independent analyses of the effects of closed cycle cooling, the natural draft wet cooling towers in particular at the Indian Point site by three parties to the proceeding.

First, the Con Edison Report which was just introduced into evidence; second, the Staff analysis which was undertaken originally in the Final Environmental Statement related to operation of Indian Point Unit Number 2; then in the Final Environmental Statement related to operation of Indian Point Number 3; finally, the Final Environmental Statement which was issued in connection with this partiular license amendment.

In addition, in the Indian Point 2 licensing proceeding the Hudson River Fishermens Association presented testimony of Eric Ainsley related to the different types of closed cycle cooling systems.

Con Edison, the Licensee, has been an adamant opponent of the closed cycle cooling requirement and, therefore I think it is fair to assume that its analysis of the impacts of closed cycle cooling systems will reflect possibly the worst impacts that such systems could produce.

Upon analysis of all the studies which have been undertaken, it is revealed that apart from the fact that the natural draft wet tower has significant visual aesthetic effects, there is no evidence that there will be significant damage to the environment caused by salt drift, fogging, icing or noise.

And I just would like to summarize very briefly on these different points.

The Staff has estimated that the natural draft closed cycle cooling towers for both Indian Point Units 2 and 3 will produce less than four hours per year of additional fogging in the center of Peekskill.

Con Ed came essentially to the same conclusion.

"No significant ground level visibility hazard is expected to occur by operation of a natural draft cooling tower."

With respect to damage resulting from salt drift, the Staff has concluded that such damage would be negligible.

Con Edison's research has reached basically the same conclusions, showing only potential injury to three species in a small area and potential injury to hemlocks in a slightly larger area, after 14 rainless days coinciding with low fresh water flows in the Hudson River.

Con Edison also has examined the case of 30 consecutive rainless days, but this seems a truly unrealistic event since the longest rainless days the company could find reported in the area was 27 rainless days.

The Staff has also concluded that noise will not be a significant problem with the natural draft cooling towers pointing out that traffic noise along the property line exceeds the level of noise expected from the towers, more than 50 percent of the time.

Con Ed reaches basically the same conclusion.

Among the different types of closed cycle cooling systems, the natural draft wet cooling towers appear to minimize the effects of fogging, saline drift and noise.

They, therefore, in our view represent the preferable system.

No probative evidence has been produced in this proceeding or any other proceeding related to the Indian Point site which would contradict these predictions of impact.

It is the Fishermen's position that the time has come to choose the type of system and that on the basis of the existing data the natural draft wet cooling tower represents the preferred alternative closed cycle system.

CHARIMAN JENSCH: Very well. We do have some time today. I wonder if we can take up Mr. Trosten's suggestion that what are the issues for consideration in reference to the procurement of all the needed regulatory approvasl to see what issues would be raised by the parties for consideration.

I wonder if that would or would not be an easy part of the other aspect as was correctly pointed out as to extending the time for once-through cooling, to take those two up at that same separate proceeding.

MR. TROSTEN: Let me be sure I understand you.

The point that I was seeking to raise was not the issues related to seeking regulatory approvals. That was the -- that was an aspect of this proceeding.

My suggestion that we have a prehearing conference, which was reflected in our motion, had to do with the extension of time with once-through cooling.

jon20

The extension of time with once-through cooling we submit, sir, is not related to the question of seeking all regulatory approvals.

CHAIRMAN JENSCH: It is not.

I wondered if there were to be any questions raised.

Now, Mr. Grainey believes the parties can really all stipulate on the facts and we would resolve a legal issue and not require any particular hearing about it.

If, however, there were to be some contentions raised, perhaps we could join it into this other phase of the hearing having to do with extension of time of once-through cooling.

If it can be resolved prior to that time, good. If it can't, why, maybe we could combine it with the extension of once-through cooling.

MR. TROSTEN: There are different aspects, I agree, Mr. Chairman.

Let me say this. As Mr. Sack has indicated, we would certainly be delighted to hear from the other parties as to what particular problems they have concerning seeking regulatory approvals, what the issues are, and we will attempt to resolve them by stipulation so that there is no need for an evidentiary hearing on that particular point.

CHAIRMAN JENSCH: I think Ms. Chasis has raised the question that due diligence might be raised, and that sounds to me like a factual matter. I don't know.

MS. CHASIS: What I indicated I believe was that we have anticipated factual controversies on the question of the termination date and whether or not there is an automatic slippage in that in view of the fact that the requisite approvals have not been received.

We do not anticipate raising factual issues with the due diligence question.

CHAIRMAN JENSCH: Let's see. Do you want to adjourn now and meet here at 9:00 o'clock in the morning and see what can be done?

MR. BRIGGS: Is it possible that the parties can get together on Issue B on page 3 of the stipulation, and decide what a reasonable termination date will be on the basis of governmental approvals being obtained at some time in the very near future?

MR. SACK: Well, we are certainly prepared. We have stated our position. We have annexed schedules. There is a schedule annexed to the brief that we are filing tomorrow.

But we still don't know in what respect the other parties disagree.

MR. BRIGGS: All right. So if the other parties agree with that schedule, then that removes that particular issue; is that right?

MR. SACK: That's correct.

CHAIRMAN JENSCH: Do you have a draft of your brief here?

MR. SACK: I have a draft, but with all due respect, it was typed yesterday and I have not had a chance to read it since I was not in the office yesterday.

CHAIRMAN JENSCH: Just take a look at your schedule.

MR. SACK: The schedule shows that if you assume all regulatory approvals are received by November 1, 1976, the data for termination of operation of the once-through cooling system would be May 1, 1980.

MS. CHASIS: It is our concern that Con Edison come forward not simply with a schedule setting forth a date, but with some showing that the amount of time that they are requesting in effect is necessary and represents the earliest feasible date for termination of once-through cooling, which is the language that the Appeal Board utilized in setting the original 1979 date.

We would ask that some kind of showing at least be made so that the other parties can fairly respond to this.

MR. SACK: That's an issue that is addressed in brief, and perhaps on that I guess we have to wait until the parties have exchanged briefs.

We take the position that the schedule has been fixed and the interval between receipt of regulatory approvals and termination of operation is fixed by ALAB 188 which has extensive discussion on the subject.

MR. BRIGGS: So there may well be a requirement for hearing on that issue?

MR. SACK: In my view it is a strictly legal issue, that that has been settled. It would only become an evidentiary matter if you overruled my legal position that that is res judicata between the parties because of ALAB 188.

We had extensive testimony on that matter, as you will recall, in the Indian Point 2 proceeding.

And the Appeal Board devoted several pages to it in their decision.

There is no new fact or evidence presented by any party that would reopen the issue.

CHAIRMAN JENSCH: I don't recall just what the Appeal Board said in the Indian Point 2 decision, but my recollection is that it was sort of a conjectural situation. That if these things moved along and so forth.

I think what Hudson River is saying, has Con Edison really put its shoulder to the wheel to do as well as they could, and to that extent it seems to raise a factual

jon24

matter.

I didn't have the impression that the Appeal Board was casting something in cement for a schedule because it was -- I was going to say speculative at the time, but I don't think the Appeal Board uses that language anymore, and so I don't know that we should talk about it either.

MR. SACK: What they said they could not speculate on was the date w e could receive all regulatory approvals.

That has turned out to be a very correct statement on their part.

After the receipt of regulatory approvals, they then went into quite some detail. They discussed the alternative findings, alternative evidence on excavation, on the various construction intervals for the various steps, and there are several pages in here where they have discussed -- they discuss the testimony of all the witnesses that were presented. And they wind up with quite a detailed schedule.

CHAIRMAN JENSCH: Would you give us that reference?

MR. SACK: What is it, 7 AEC. It starts on -- well, the decision itself starts on 323. The discussion that I have reference to starts on 392.

We now discuss the schedule for the steps which will ecome necessary in the event the decision is made that the tower must be constructed and after all governmental approvals necessary for initiaition of construction have been

jon

granted.

That starts on 392 and goes on for several pages thereafter.

end14

CRAIG
blt 1
Begin 15

CHAIRMAN JENSCH: The Appeal Board didn't say we are going to allow 62 days for them to dig rock and 49 1/2 days to haul some cement in. There wasn't any fixed, rigid schedule as I recall it.

They kind of surprised, or rather they discussed what the evidence had been at the time of Indian Point 2 hearing. But since that time the calendar has been rolling, and, as Mr. Newman said, technology has improved in some phases. He was talking about cooling towers or something. But I suppose it applies to cement hauling.

MR. SACK: You are correct, Mr. Chairman, that the Appeal Board reviewed the evidence in detail and stated its findings and made findings.

CHAIRMAN JENSCH: On that record?

MR. SACK: On that record.

Now, if some party has new evidence, now we are not aware of any new major breakthroughs in excavation techniques; we are not aware of any major breakthroughs in pouring concrete. If someone presents that kind of evidence, then these issues should be reopened.

But I didn't understand Ms. Chasis' statements as indicating that she had any evidence in this regard to offer. She was just stating we ought to relitigate what was litigated before.

CHAIRMAN JENSCH: Well, I have the impression

blt 2

Hudson River is saying, granted, the Appeal Board reviewed the evidence of the Indian Point 2 proceeding, at which time there were projections of time needed and so on. Now we are in a different time schedule; as I understand it you are projecting in your brief that it would be a year later than the Appeal Board thought it would be. And for that reason, since there is a change even from what the Appeal Board considered, Hudson River is saying you have the burden to justify any change from your 1979 to 1980 date. And therefore you are expected to come forward with what you have done to show you have been diligent in your effort.

MS. CHASIS: That is a fair statement of our position.

In addition, we are concerned about the effect that a delay in the cessation date for Indian Point 2 could have on the cessation date for Indian Point 3 and would ask that Con Edison be directed to address that question as well as the desired schedule that they propose for cessation of once-through at Indian Point 2.

MR. SACK: I am baffled by your last statement, Mr. Chairman. We say we are entitled to the new schedule on the basis of the license decision which said that if all regulatory approvals were not received. We submitted Exhibit 2 for identification. If anyone wants to contest the matters in there, well, they have not yet done so.

blt 3

But on the basis of that, we believe we are entitled to the extension. That is all we have to show.

As far as construction intervals, that is a separate subject. And, unless somebody offers new evidence as to why we can build it faster than we could have built it then, there is nothing new for this Board to consider.

MR. BRIGGS: Mr. Sack, as I remember that decision, and the Licensing Board's decision, the Licensing Board pointed out that Con Edison had made and presented to the Board several schedules for constructing the cooling tower 3, I believe. And the Appeal Board then sort of examined the information and apparently decided that the last schedule that Con Edison had proposed was a more reasonable schedule; more time had elapsed and the Applicant had had more time to look at things.

It seems to me that the question now may be, since the time that the Appeal Board examined the schedule, has Con Edison done nothing that would change that schedule? Maybe the schedule is longer; maybe the schedule is shorter.

MR. SACK: Well, first of all, as I am sure you are aware, these are projected schedules. They are not commitments; they are projected schedules.

Con Edison has proceeded on the schedule diligently to date. That is up to the time of receiving all regulatory approvals. And that is with the completion of

blt 4

the design and other documents, and we know of no reason to change these projected intervals from what was developed in the Indian Point 2 hearing.

There is no major change in technology that we are aware of.

MR. BRIGGS: That is what you put in your brief, and that is what --

MR. SACK: That is correct.

MR. BRIGGS: That is what the others are responding to?

MR. SACK: That is correct.

MR. TROSTEN: May I also comment on an aspect of this that relates to the other proceeding pending before the Board?

I submit the Hudson River Fishermens Association simply cannot have this both ways. If they want to have this proceeding open to consider whether May 1, 1979, is an appropriate time, whether perhaps it should be some other further date on account of the summer peak period, if they want to consider whether or not there should be a delay in this schedule, if they want to get into this whole question, I would like to renew my motion that we adjourn this proceeding to allow opportunity for consideration of this whole matter at this time.

But what the Fishermens Association simply

blt 5

cannot have is a reopening of all matters that are of interest to them in connection with what is and should be a very limited proceeding before the Board at this time, which is to determine whether or not -- which of the alternative closed-cycle cooling systems is a proper one and whether or not we have received all regulatory approvals; or they ought to go in the other direction, and then we will have the whole hearing.

MR. GRAINEY: Mr. Chairman, I would agree with that except the stipulation which all the parties signed says what is the effect of the licensee's failure to have received all these governmental approvals by December 1, 1975. I think that is clearly one of the issues we have to face.

The only question is do we do it now, or do we do it in the next session of this hearing. Or, as we suggested possibly this morning, doing it in the session of the hearing where we discuss the once-through two-year extension.

I think it is clearly a proper issue for Hudson River Fishermens Association to raise. It is clearly within the terms of the stipulation that everybody signed.

MR. BRIGGS: I don't want to change the subject, but there is one more issue that I would like to have information on, and that is the Applicant has in issue the

blt 6

necessity for and, if necessary, the scope of the monitoring program. Is that still in issue?

MR. SACK: I hope it should be -- I hope it is not. It is a minor matter. We have sent to the Staff a proposal for a monitoring program on bird impacts. If the Staff indicates that that is acceptable, that would eliminate that issue.

They have not indicated that they are looking for major -- a major undertaking. But I want to document in some way their agreement to the scope of the program. If they agree to this minor program that we have suggested, then that is not in issue. If they do not agree with it, if we do not agree with it, then we would want to address that in this hearing.

End 15

jon1

16

CHAIRMAN JENSCH: I think perhaps the thing to do is to suggest that we do have a preharing conference as the Licensee has suggested, but after a review of the briefs that are to be available tomorrow, but that the prehearing conference be held in Washington, with the evidentiary hearing, if any, to be held up here as requested.

We had a hearing up here the other day, two or three hours, and I don't think the government enthuses on expenditures, bringing us all up here for such a short period of time.

The State of New York and possibly Hudson River, if that isn't too much of an inconvenience.

Let's think about a date in that regard for a prehearing conference.

We will have to have some leeway in the sense that it will depend upon what space we can get for our prehearing conference.

MR. KUHN: Your Honor, just to seek clarification, is this then a prehearing conference to discuss the further open questions that are discussed in the stipulation that we have discussed with regard to the selection of closed cycle cooling system and questions realted to that, or would that also deal with the issue of a requested two-year extension?

CHAIRMAN JENSCH: Well, my thought was that we consider at the prehearing conference this rather at the moment somewhat nebulous -- because we don't have the briefs of the parties -- what the conclusions should be as to the effort by Licensee to get regulatory approval for one thing.

MR. KUHN: The State of New York does not at this particular point feel that it is useful to have a prehearing conference with regard to the two-year license extension unti the Final Environmental Statement has been issued by the Staff.

CHAIRMAN JENSCH: That is the second phase, the extension of the once-through cooling, that we perhaps combine the prehearing conference.

Maybe the better thing to do is to -- Mr. Grainey has assured us it will be out in November.

MR. GRAINEY: That is my optimistic hope.

CHAIRMAN JENSCH: Perhaps maybe the thing to do is to try to set a prehearing conference in the middle of November.

MR. GRAINEY: I think the estimate I have is that the statement wouldn't be out until towards the end of November.

CHAIRMAN JENSCH: The end of November.

MR. GRAINEY: Yes.

CHAIRMAN JENSCH: How about sometime in the week anywhere from the 16th to the 18th?

MR. TROSTEN: That is fine, sir.

jon3

CHAIRMAN JENSCH: It will just depend upon our getting the space. Allright.

MR. KUHN: Your Honor, I just wanted to point one matter out that had been discussed at the prehearing conference, and in this proceeding, and which the state felt was a very salutary feeling on your part in coming up with a mechanism of initial order in this proceeding with regard to the specific choice of the closed cycle cooling system.

I believe you also indicated a desire to address the issue of whether all regulatory approvals had been obtained.

Of course, with Con Edison having -- or the Licensee having a determination of that as soon as possible, I would feel that it would be inappropriate to put that determination off until after the middle of November, for example.

CHAIRMAN JENSCH: Well, let me say this. The Board has not made a decision about this adequacy of the stipulation. If the Board --

MR. KUHN: Yes.

CHAIRMAN JENSCH: If the Board accepts the stipulation and accepts the thought of the parties as to the preferred closed cycle cooling system, I believe the Board would issue an initial decision promptly in that regard and that would dispose of the matters we have here.

However, these other matters are pending. We would

jon4

hope that we could do something with the final FES. If it is not out, perhaps we could set a prehearing conference earlier this October in Washington to see what we can do even without an FES.

Although it seems to indicate a second prehearing when the FES came out.

MR. KUHN: I think that would be a salutary approach for the reason that the question of the two-year extension has a number of questions that will be before you at that particular time while the narrow issues we will be discussing at the prehearing and here today, the question of due diligence, the question of whether all regulatory approvals have been obtained and finally, the question of what is the effect on the data of cessation of once-through cooling, those questions are far narrower in scope and very specific in terms of relating to Applicant's responsibilities under its license to cease once-through cooling by a certain date.

I would suggest we should try to dispose of these questions as rapidly as possible as congruent with our schedules without holding up until a Final Environmental Statement has been issued, and what is really a series of different questions that will be before the Board at that time.

end16

CHAIRMAN JENSCH: Do you want to move the prehearing conference up toward the last week in October?

MR. TROSTEN: We would be agreeable, Mr. Chairman, to holding a prehearing conference on all of these questions in the last week of October.

CHAIRMAN JENSCH: Let's leave it as kind of a wide open prehearing conference.

We will consider everything the parties want to bring up.

By that time I would hope the parties will have had a chance to confer among themselves, unless you feel it advisable to do that tonight and report in the morning, or, if you think that time is too short, we will put the whole thing over until the last week in October.

MR. TROSTEN: All right, sir.

CHAIRMAN JENSCH: Let us keep the range from October 26 to the 28th.

MR. TROSTEN: Could we possibly avoid the 26th, Mr. Chairman, if possible?

CHAIRMAN JENSCH: We will try for the 27th or 28th.

MR. SACK: One other matter before we adjourn.

CHAIRMAN JENSCH: Excuse me. Yes. Proceed.

MR. SACK: Mr. Chairman, it now appears that we will have to file briefs in response to the proposed initial decisions involving the scope of those decisions as we discussed this monring of somewhat more complexity than the rules normally provide for.

jon

Could we have until October 15? We have some holiday weekend coming up. Could we have until October 15 to file a brief in response to the proposed initial decisions?

CHAIRMAN JENSCH: Yes. All parties, if they desire, will comment on the proposals by any of the other parties.

I think it is safe to say that the Board is not going to make findings of an evidentiary character because we are here concerned with the adequacy of the stipulation.

We are not going to make determinations on what are viable alternatives because the statements presented have not been subject to cross-examination.

We will follow the format which we believe the Commission has implicitly approved in Inidan Piont 3, the scope of the considerations and adequacy of the stipulation.

If the stipulation is rejected, that puts an entirely different character on it and will require further hearing.

MR. GRAINEY: Mr. Chairman, one other suggestion. This morning I suggested that the Board consider deferring to the two-year extension hearing the question of regulatory approvals.

I think in light of the fact that the Final

Environmental Statement wouldn't be out until probably the end of November, the second hearing, that at least on that question as to what regulatory approvals were required, if they have all been received or not, that will probably I think be in the interest of everybody to resolve before then assuming this Board accepts the stipulation.

I think perhaps the question of how much slippage in terms of construction scheduling, that that might be more appropriately deferred.

Certainly the question of which regulatory approvals are required I think would be better resolved as quickly as possible.

CHAIRMAN JENSCH: It may be that you folks can stipulate or agree as you have indicated previously and leave us with a legal question.

So it may be that at the prehearing conference we will get some report on our endeavors or have a stipulation we can give some consideration to.

If there is nothing further, we can adjourn now.

MR. KUHN: Your Honor, I presume -- I gather at least that it is your intention to continue the hearing tomorrow morning and, if so, what is the purpose of that?

CHAIRMAN JENSCH: No. We are going to adjourn at the moment.

MR. KUHN: Fine.

CHAIRMAN JENSCH: If there is nothing further, then this evidentiary session is concluded with the expectation that there will be further evidentiary sessions in this Indian Point 2 proceeding.

This hearing will now be concluded.

(Whereupon, at 4:20 p.m., hearing in the above-entitled matter was adjourned.)

105 11 100

6

293