ILLINOIS POLLUTION CONTROL BOARD
September 29, 1975

IN THE MATTER OF	)	
WATER QUALITY AND EFFLUENT	)	R 75-2
STANDARDS AMENDEMENTS,	)	
COOLING LAKES	)	

OPINION OF THE BOARD (by Mr. Zeitlin):

On January 22, 1975, this Board received a Proposal for Regulatory Amendment, with the signatures of more than 200 citizens attached, submitted by the Commonwealth Edison Company (Edison). Designated as R75-2, "Cooling Lakes", the Petition asked for revision of the Board's thermal standards as they would apply to a newly defined class of "Artificial Cooling Lakes", associated with steam-electric generating plants.

The Edison proposal was published in Environmental Register No. 98, on February 18, 1975 (Ex. 2). Following publication of a hearing schedule, (Ex. 3, 4(a),4(b)), public hearings were held in Chicago, on May 2, 1975, Springfield on May 23, 1975, and again in Chicago on June 23, 1975. After the final public hearing, the Record was held open for comment until July 10, 1975. The Board published a Proposed Final Draft of the Regulation on July 24, 1975, in Environmental Register No. 106. Comments were again received by the Board, through August 12, 1975. The Regulation was adopted by the Board on August 14, 1975.

BACKGROUND

The Board inherited the substance of the present water quality and effluent standards for thermal pollutants from its predecessor, the Sanitary Water Board (SWB). Illinois Sanitary Water Board Rules and Regulations SWB-14, Water Quality Standards, Intrastate Waters Exclusive of Interstate Waters (1967, 1968). (Although this citation applies generally, see also Sanitary Water Board Regulations SWB-8 through SWB-13, and SWB-15, applying water quality and effluent standards for thermal discharges as well as other pollutants.)

Pursuant to Section 49(c) of the Environmental Protection Act (Act), these thermal standards remained in effect until superceded or otherwise altered by the Board. Ill. Rev. Stat., Ch. 111-1/2, §1001 et. seq. (1973). Over the subsequent five years that the Board has been in operation, it has spent considerable time and effort on the question of thermal pollution.

The Board first faced the question in efforts to arrive at the proper thermal standards for certain individual bodies of water: Lake Michigan, the Mississippi River, the Wabash River, and the Ohio River. In the matter of: Thermal Standards Lake Michigan, R70-2, 1 PCB 697 (1971); In the matter of Mississippi Thermal Standards, R70-16, 3 PCB 177 (1971); In the matter of Ohio-Wabash Thermal Standards, R71-12, 2 PCB 563 (1971); In the matter of Water Quality Standards Revisions, R72-4, 10 PCB 69, 73-78 (1973) (Des Plaines River, "5-mile stretch").

The first consideration, of course, was the amount of heat that an individual discharge could contain before causing damage to the receiving stream and its existing aquatic biota.[1] (The term "heat" is used advisedly here. The Regulations and the Board's prior considerations have not strictly concerned themselves with the question of heat itself, but rather with the question of temperature and its effects.)

In each of the cases cited above, the Board attempted to arrive at a standard for effluents which would generally protect the waters and marine ecology of the state. In doing so, the Board also considered the benefits to be derived from an effluent source, and the cost and practicality of eliminating the thermal component from an effluent. The results are the Board's present effluent and water quality standards.[2]

1. The Board has not heretofore made a fine distinction between an existing biota and that which would naturally be present were pollutants other than heat not present; the problem arises where thermal discharges enter an already polluted water.

2. PCB Regs, Ch 3. In the Matter of Effluent Criteria, R70-8; Water Quality Standards Revisions, R71-14; Water Quality Standards Revisions for Intrastate Waters, R71-20, 3 PCB 755 (opinion), 4 PCB 5 (order); The Board's opinion states that, "In large part today's draft is simply a codification of existing water quality standards and associated provisions .... " 3 PCB at 755; see also 3 PCB at 763 (re: Rule 203(i)).

The Board has also considered the question of thermal effluents in a series of cases relating to individual dischargers; several of these cases directly concern the questions at hand: steam-electric generating stations and their attendant cooling impoundments.[3] In the most relevant of these cases, the Board determined that such impoundments, constructed to provide condenser cooling for power plants, fall into two categories: 1) treatment works, and 2) protected waters of the state. The distinction is of sufficient importance to have led to our considerations here.

The distinction, in summary, is based upon the way a cooling-water impoundment is constructed. Where artificial diking is erected, and water to fill the resulting enclosure is largely[4] obtained by withdrawal from a nearby natural body of water such as a lake or river, the enclosure constitutes a treatment works.[5] Commonly known as "perched" or "side-channel" lakes, these bodies of water are, as treatment works, exempt from the Board's water quality standards, and discharges into them are not subject to the thermal effluent standards.

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3 Commonwealth Edison v. EPA, PCB 73-359, 10 PCB 659 (1974); Commonwealth Edison v. EPA, PCB 74-182, 13 PCB 219 (1974) (extension of variance in PCB 73-359, itself an extension of variances granted in PCB 70-21 and PCB 72-350); considerations in two cases are central to this discussion, in that the Board there directly dealt with the question of thermal effluents into "cooling lakes": Central Illinois Public Service Co. v. EPA, PCB 73-384, 11 PCB 677 (1974); Citizens For A Better Environment v. Commonwealth Edison PCB 73-245, and Commonwealth Edison v. EPA, PCB 73-248 (Consolidated), 13 PCB 69 (1974). (PCB 73-384 has been appealed to the Illinois Appellate Court, Fifth District, No. 74-182 (R.571); PCB 73-248 is also before the Fifth District in case No. 74-281.)

4. Natural land contours may form part of the impoundment, such that some runoff from adjacent lands enters these lakes (R.11; see also R.97).

5. This definition has previously been given only by implication. Cf., cases cited, note 3, supra.

The other type of impoundment, an "artificial cooling lake",[6] encompasses the remaining field of cooling water enclosures at issue here. Generally formed by damming an existing watercourse which is itself a protected water of the state, such artificial cooling lakes remain subject to the Board's water quality and effluent standards.

This categorization by the Board was not a painless process. The utilities contended that since these cooling impoundments are initially formed to dispose of waste heat from a generating station's condensers, it would make no sense to deem them anything but treatment works, and that the imposition of the water quality and effluent standards would be improper.[7] The Board, however, held that the character of a protected water of the state is not changed by the simple construction of a dam; where a stream, whether continuously or intermittently flowing, is dammed to form an artificial lake for cooling purposes, it remains a protected water of the state. Its waters remain subject to the Board's standards.[8]

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6. For purposes of our discussion here, the term "cooling lake" should be understood to refer to cooling water impoundments formed by damming a natural stream, continuously or intermittently flowing. Where distinctions are required, the shortened terms "dammed lake" and "perched lake" will be used. As will be shown later, certain characteristics of the two types of impoundments are interchangeable, and the distinction between the two types will be the subject of a definition adopted in the accompanying regulation. The type of impoundment being discussed should be kept clear. (See discussion, R.55, regarding Edison's interpretation in this regard prior to the Board's decision in PCB 73-248, supra).

7. See, eg., discussion at R.81: "... the very concept of cooling the lake runs counter, really, to the Board's Regulations, in the sense that if you are going to design something to be a cooling facility, it shouldn't have to meet--except the effluent from that system-- ... temperature restrictions." See also 13 PCB at 78, 79.

8. See also, PCB 73-384, supra, 11 PCB at 680: "The Board in League of Women Voters v. North Shore Sanitary District, PCB 71-7, 12, 13, 14, has held that a protected water of the state (i.e., Lake Michigan) cannot be used as a treatment works .... "

Then, however, the Board stated that "The evidence further showed that not only is the lake an improvement over the previously existing waters, but it is possibly a better lake than natural lakes of its size and location." Still speaking of Lake Sangchris, the Board stated that, "From the facts elicited, there has been no environmental damage proven .... " 13 PCB at 80, 81.

Based on these facts, the Board stated that Edison had two forms of relief open to it with regard to the thermal effluent from Sangchris: 1) it could seek a Variance from the Board's limitations, if it felt that the regulations were arbitrary and unreasonable in their application to Sangchris; such a Variance would extend from year to year pending the development and implementation of a plan to bring Sangchris into compliance with existing regulation; or 2) Edison could seek a Regulatory change, if it felt that the rules were themselves unreasonable. Edison chose the latter route.

In this proceeding, Edison has attempted to show, simply, that the application of present water quality standards in Rule 203(i) to artificial cooling lakes is unnecessary for the protection of the environment. PCB Regs, Ch.3, Rule 203(i) (1972). Further, Edison has attempted to show that because the present limitations are unnecessary, it is not economically reasonable to apply them to artificial cooling lakes. To achieve this change, Edison offered the following Regulatory amendment (Ex. 1):

1. (Sec. 104): "Artificial cooling lake" means any manmade lake which is not a treatment works but is used to cool the water discharged from the condensers of a steam-electric generating plant for recirculation in substantial part to the condensers.

2. (Sec. 203(i)(10)): The preceding temperature provisions shall not apply to discharges into an artificial cooling lake.

3. (Sec. 957(a)(7): Where an artificial cooling lake is proposed to be constructed by damming the flow of a non-intermittent stream, a statement from the Illinois Department of Conservation that the lake will not diminish the recreational value of the area.

During the course of the hearings Edison stipulated to a change in its proposal, to the extent that under its proposed Rule 957(a)(7) the statement to be required from the Illinois Department of Conservation (Conservation) would show that an artificial cooling lake to be created would "enhance" the recreational value of the area, rather than merely "not diminish" such recreational value (R.52).

Later, in a letter to the Board, Dr. Briceland, Director of the Illinois Environmental Protection Agency (Agency), offered the Board an alternate wording for the proposed Regulation:

Rule 104: "Artificial cooling lake" means any manmade lake which is not a treatment works but is used to cool the water discharged from the condensers of a steam-electric generating plant for recirculation in substantial part to the condensers.

Rule 203(i)(10): All effluents to an artificial cooling lake must comply with the applicable provisions of the thermal water quality standards as set forth in Rule 203(i), except when all of the following requirements are met:

(aa) All discharges from the artificial cooling lake to other waters of the state comply with the applicable provisions of Rule 203(i)(1-4).

(bb) The heated effluent discharged to the artificial cooling lake complies with all other applicable provisions of this Chapter, except Rule 203(i)(1-4).

(cc) At a public hearing, the discharger demonstrates to the satisfaction of the Board that the artificial cooling lake receiving the heated effluent will be an environmentally manageable and acceptable fishery and recreational facility, and that control of the thermal component of the discharger's effluent, beyond that which is proposed in the demonstration, would be technologically infeasible or economically unreasonable.

(dd) Upon approval of such demonstration by the Board, the Board shall establish alternate thermal effluent standards to be applied to the discharge to the artificial cooling lake.

Dr. Briceland's proposed alternate wording was published by the Board in Environmental Register No. 104.

As the hearings progressed Dr. Briceland offered a final proposal in the matter, incorporated into the record as Exhibit 32:

Rule 104: "Artificial cooling lake" means any manmade lake which is not a treatment works but is used to cool the water discharged from the condensers of a steam-electric generating plant for recirculation in substantial part to the condensers.

Rule 203(i)(10): All effluents to an artificial cooling lake must comply with the applicable provisions of the thermal water quality standards as set forth in Rule 203(i), except when all of the following requirements are met:

(aa) All discharges from the artificial cooling lake to other waters of the state comply with the applicable provisions of Rule 203(i)(1-4).

(bb) The heated effluent discharged to the artificial cooling lake complies with all other applicable provisions of this Chapter, except Rule 203(i)(1-4).

(cc) At a public hearing, the discharger demonstrates to the satisfaction of the Board that the artificial cooling lake receiving the heated effluent will be operated in an environmentally acceptable manner so as to provide conditions capable of supporting an acceptable fishery, and that control of the thermal component of the discharger's effluent by means of an artificial cooling lake represents the most technologically feasible and economically reasonable means of thermal control. The demonstration documentation shall set forth the specific maximum thermal limits proposed by the discharger.

(dd) The demonstration required in Rule 203(i)(10)(cc) may take the form of those applicable portions of the final environmental assessments used in the preparation of the final environmental impact statement, that addresses the requirements of Rule 203(i)(10)(cc).

(ee) Upon approval of such demonstration by the Board, the Board shall designate the proposed thermal effluent limits set forth in the demonstration as the thermal standards to be applied to the discharge to that artificial cooling lake.

(ff) Any discharger to an artificial cooling lake who has been granted a variance from one or more of the provisions of the thermal standards [Rule 203(i)(1-4] prior to adoption of this Rule, shall be exempted from the requirements of Rule 203(i)(10)(cc). The alternate thermal limitations for that discharge shall be the conditions set forth in the Illinois Pollution Control Board Order on the variance.

NEED FOR CHANGE

The hearings and the record generated in this matter, including the extensive exhibits, conclusively demonstrated that some change is needed in the present thermal standards as they apply to artificial cooling lakes. This conclusion is mandated by our finding of the following facts:

1. No substantial environmental harm has resulted at several existing cooling impoundments[9] where the thermal effluents of the accompanying generating stations violate existing Board thermal standards.

2. The cost of providing alternate methods to cool the condenser coolant discharges from steam-electric generating plants associated with cooling lakes can be expensive.

It should be noted that these findings are essentially similar to our findings in the earlier Edison case, PCB 73-248. This is not, however, mere reiteration of facts already found by the Board. The findings in the earlier Edison case were limited and specific; they applied solely to an individual artificial cooling lake, Edison's Lake Sangchris. The proceeding at hand, however, has a much broader scope; our decision here will affect all presently existing artificial cooling lakes, and all those to be built in Illinois in the future.[10] The difference is significant.

9. Both dammed and perched lakes are considered here, although the regulations to be adopted will affect only the former.

10. Existing artificial cooling lakes in Illinois are: Lake Sangchris (Commonwealth Edison); Lake Springfield (City of Springfield); Lake of Egypt (SIPC); Lake Coffeen (CIPS). Presently planned artificial cooling lakes are: Lake Clinton (Illinois Power), Lake Newton (CIPS).

Nor, however, are these findings to be read as a commitment by the Board to the use of artificial cooling lakes in all situations where cooling is to be accomplished in conjunction with a steam-electric generating station. While existing lakes have generally proven environmentally acceptable, and the cost of alternate or supplemental cooling has been shown to be high, the present record is not conclusive as to the advisability of using or not using artificial cooling lakes in every situation. Whether an artificial cooling lake or some alternate cooling technology is to be used in a specific instance is dependent on many factors, and must be shown on a case-by-case basis.

For clarity, we will consider first the costs associated with the various technologies for cooling at electric generating stations, with a brief description of the way in which they work. We will then discuss the results of the thermal input from present steam-electric generating plants on the aquatic biota at existing cooling impoundments.

COOLING TECHNOLOGIES

The present state of the art allows several engineering choices in the design of cooling facilities for steam-electric generating plants. Such plants generate steam to drive electric generating units, after which the steam is condensed back into water for re-use. To achieve that condensation, the used steam is passed through "condensers", which are water-cooled heat exchangers. The water used to cool the condensers, (a considerably greater quantity than that used as steam to run the generators), must then in turn be either cooled or disposed of to make way for new, cooler water to absorb the heat conducted through the condensers (eg., R.9).

Once-Through Cooling

One common method of accomplishing condenser cooling is "once-through" cooling, whereby water is taken from a natural water body, (ie, a lake or river), passed through the condensers, and then returned, untreated and uncooled, to that or some other body of water. Since it requires a large volume of available cooling water, this method is used largely on major water bodies, such as Lake Michigan (ie., Zion Station) or the Mississippi River (ie., Quad Cities Station). This method of cooling is unimportant to our discussion here (R 10).

Mechanical Draft Cooling Towers

Water may also be cooled through the use of mechanical or natural draft cooling towers. Mechanical draft cooling towers, more common than the natural-draft variety in the United States, (R.353), dissipate waste heat to the atmosphere through the process of evaporation, with little or no loss though conduction or radiation, and a resultant loss of efficiency, whereas 40-50% of cooling on lakes is through radiation (R.115-122).

By way of example, the evidence in this matter indicated that the use of mechanical draft cooling towers at Lake Sangchris would involve approximately $17.6 million. Costs incurred from the need of such towers for auxiliary power and from the loss of generating capacity, as well as other factors, would amount to approximately $6.4 million, figured as the equivalent of present investment cost. After $1.2 million in operating and maintenance costs for these towers is added in, the evidence showed that the backfitting of mechanical draft cooling towers at Kincaid station, (Lake Sangchris), would amount to approximately $25 million (Ex. 6(N), testimony of Michael J. Groppi in PCB 73-248).

Exhibit 27, submitted by Central Illinois Public Service Company, shows similar breakdowns for the costs of mechanical draft cooling towers at that Company's Coffeen and Newton artificial cooling lakes. Although extensively questioned on cross-examination, the figures nonetheless show that the actual and equivalent (present value of lost generating capacity at the stations, maintenance operation, fuel, etc.,) costs would be approximately $20 million for Coffeen Station and Lake, and $18 million for Newton Station and Lake.

Figures were also presented for Illinois Power Company's proposed Clinton Nuclear Power Station. Figures presented indicated a cost for "once-through" cooling towers of $29.5 million, a figure termed "capital cost" over the 30-year life of the Station (Comment C, attachment 1, p.2; Letter, April 14, 1975, Illinois Power to U.S. EPA).

It should also be noted that these costs do not necessarily replace the cost of building and maintaining an artificial cooling lake or its equivalent, even for new stations where the cooling impoundment has not yet been built. The testimony of several witnesses, as well as several of the exhibits, showed that the use of mechanical draft cooling towers would still, (in the absence of a large natural body of water), require a large impoundment to supply make-up water, due to the increased consumptive water use of such towers. One witness stated emphatically that, to account for the 50-100 year drought conditions for which power station design must provide, a make-up water impoundment at least as large as an artificial cooling lake for the same facility must be built (R.126; see also R.32,378).

Natural Draft Cooling Towers

Natural draft wet cooling tower costs were also provided for Lake Sangchris. Not presently used in Illinois, these towers, (the large hyperbolic structures seen in the literature), are much less used in the United States than in Europe, although some examples are available (R.354). Exhibit 6(N) shows an estimate that Kincaid station would require a single hyperbolic tower 460 feet in diameter and 500 feet high, with a cost, (figured in the same manner as for mechanical draft towers), of approximately $31 million.

Trimming Towers

A further type of cooling tower, a "trimming tower" was also discussed for Coffeen and Newton Stations. Without providing a breakdown, the conclusion was made that such towers, designed such that after discharge to a cooling lake the effluent could meet a 5°F. temperature rise at the edge of the mixing zone, (ie., not a "closed cycle" system), would be less costly than a conventional closed cycle mechanical draft cooling tower system. Such towers would require the minimum of additional piping and additional power. However, this concept was dismissed by CIPS when it concluded that such towers would not work; "wet bulb" temperatures in the area would be too high to allow full and efficient performance for perhaps six months of the year (Ex. 27, p.3).

Dry Cooling Towers

A final type of cooling covered in the testimony and exhibits was the "dry" cooling tower. Such towers do not achieve condenser water cooling through evaporation, and instead channel the water through finned radiators cooled by air passage over the radiator surface. It was stated (Ex. 5, p.3) that such towers are much lower in efficiency than wet towers, since it is not possible to make use of evaporatve cooling. It was also alleged that the development of such towers is still in an "infancy" stage, and that they are not yet commercially viable (R. 114). (A hybrid tower, the "wet-dry" was mentioned only (Ex. 5, p.4) as being developed to control the problem of plume drift with wet towers).

Spray Canals

Similarly, spray canals form an expensive alternative when compared to artificial cooling lakes used alone. As was the case with towers, the Board was presented with considerable data on the costs of such spray canals.

A spray canal has been proposed by Illinois Power for its proposed Clinton Station and Lake, utilizing 232 total spray modules in a 3.1 mile long discharge canal. Cf. Illinois Power Co. v. EPA, R75-31 (July 31, 1975). Illinois Power states the cost of the proposed system as a "capital cost of $11,522,800 (cash flow through Unit #2 completion [Ed: 1983]) and ... a total revenue requirement of $34,524,800 to cover all capital, operating and maintenance costs over the assumed economic life of the generating units (30 years)" (Comment C, Exhibit 1, p.2).

A hypothetical closed cycle spray canal cooling system to replace Lake Sangchris for cooling at Edison's Kincaid Station would have 130 spray modules in a 7,600 ft. canal. Although the costs estimated for such a system at Kincaid may not be applicable generally, due to the fact that back-fit installation there would require extensive reconstruction, Edison estimated a total cost of approximately $38.4 million.

IMPOUNDMENTS TO COMPLY WITH GENERAL REGULATIONS

The costs associated with the design and construction of a cooling lake (or any artificial impoundment) which would be capable of meeting the general Board thermal standards must also be considered. Present Board Regulations[11] allow temperature rises of 5°F. above ambient, and set maximum water quality temperature standards for various waters and classes of waters. The testimony presented at the hearing indicated that present cooling lake technology[12] would not, as applied to an existing or planned standard cooling lake, allow for compliance with Board standards.

11. The principal Board Regulations controlling thermal pollution are contained in Rule 203(i) of Chapter 2: Water Pollution. The Rule applies to "General Use" waters. Ch. 3, Rule 205(f) sets a thermal water quality standard of 93°F, not to be exceeded more than 5% of the time, for Restricted Use (Secondary Contact and Indigenous Acquatic Life Waters, Rule 302) Waters. 100°F. is never to be exceeded.

Rule 402, in Part IV: Effluent Standards, prohibits any effluent which will result in a violation of any water quality standard.

Lake Michigan temperature standards are contained in Rule 206(e).

It should be noted, however, that under Rule 201, Mixing Zones, a discharger is given an area as would be contained in a circle with a radius of 600 feet within which the water quality standards may be violated. Were the case otherwise, all effluents would have to meet water quality standards. (Cf, Ohio-Wabash Thermal Standards, supra, 2 PCB at 565, (citing SWB 9 and SWB 10, limiting mixing to the area "immediately adjacent to outfalls." The basis of a 600'-radius mixing zone is questioned at 2 PCB 566).

An important decision of the Board, Commonwealth Edison v. EPA. PCB 73-359, 10 PCB 659, 662 (1974), found that mixing zones are limited only by the area contained within the 600' circle, and not by the shape of the circle; thus, the 26 acre mixing zone may be "cigar shaped" if necessary. (Note, however, the limitations on mixing zones in Ch. 3, Rules 201(a) and (b)).

See also, Water Pollution Amendment Regulations, R73-1, 11 PCB 135, 140-41 (1974).

12. Although not conclusive, testimony offered by Edison indicated that cooling lakes tend to be roughly proportional in size, as between generating plant size and lake surface area, resulting in roughly equivalent heat loading on cooling lake surfaces (R.124).

The "cooling"[13] properties of an artificial cooling lake, testimony showed, are largely dependent on two factors: the volume of a lake, and its depth (R.527). In other words, there must be a large volume of water with which mixing can take place before water quality standards can be met at the edge of a 26 acre[14] mixing zone. Such mixing allows heat to be dissipated from the effluent into adjacent waters through conduction; while this process does not actually remove the heat from the body of water in question, it does lower the temperature of the effluent fairly quickly. Since the adverse effects which Board regulations are designed to prevent are the result of temperatures in waters, rather than the total amount of heat contained in a water body, such mixing is effective.

Testimony at the hearing showed that it is simply not practical to perform such mixing on cooling lakes that either now exist or would be likely in Illinois.[15] In the opinion of one witness, a lake of the size of one of the Great Lakes would be required before the effluent from a current large electric generating station would meet the present Board standards at the edge of the allowed mixing zone (R.528,108).[16]

While the Board is not convinced that one of the Great Lakes would actually be required to meet its present standards, it is fairly plain that cooling lakes designed to meet present standards without supplemental cooling, (ie, towers or spray canals), would be far more expensive than has previously been the case. Present lake design simply does not provide a sufficient body of water for the required mixing; to provide sufficient water for such mixing would require a much larger lake, with the additional expense of the additional land to be inundated.

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13. "cooling" here being used in the sense of temperature reduction, as opposed to actual heat loss (cf. R.100, 104).
14. See, PCB 73-359, supra, 10 PCB 659 at 661. By way of contrast, discharge of 2,140 CFS at 13.5° F. Delta-T (change in temperature) requires a 500 acre mixing zone before the 5° F. Delta T requirement of Rule 203(i) is met (R.17).
15. Sangchris, for example, has no flowing water such as would be used for mixing with a large river (R.102). Sangchris cost in excess of $30 million for the construction of the enclosure alone (R.15). The lake has approximately 2700 acres of surface area (R.31). Only 46 lake sites such as Sangchris, with a potential of more than 2,000 acres surface area, exist in Illinois, and only 4 of those are located in Northern Illinois (R.675, 695, 698).
16. Ex. 5, pp I-1, I-2 show new units varying from 200 to 1175 megawatts, with only 2 examples (of 17) below 500 megawatts.

LACK OF ENVIRONMENTAL HARM

As was noted, in the quotations from PCB 73-248, relating to the lack of evidence of environmental harm at Lake Sangchris, the Board was impressed by the facts presented with relation to that Lake. However, more information has been developed since the time of the Board's findings there, which must necessarily be discussed here; it must be remembered that the Regulations proposed here would have much wider effect than could be justified on only the evidence presented in that case. The Regulations proposed, in both the Edison and Agency versions, would be effective as against all artificial cooling lakes. For that reason, we must examine the evidence presented regarding Lake Sangchris[17] in the light of its general applicability to cooling lakes, and we must examine the data available regarding other similar lakes to determine whether the results noted at Sangchris are borne out in other locales.

Environmental harm, as discussed here, refers to a range of potential damage which might be envisioned as resulting from the construction of an artificial cooling lake. A partial listing of the factors examined in determining the lack of environmental harm is the effect of the thermal effluent into an artificial cooling lake on:

a. water quality
b. Phytoplankton, Zooplankton
c. Benthos
d. Macrophytes, Periphyton
e. Fish
f. Wildfowl, Aquatic Mammals
g. Other uses

It should be noted that some of the data used in our consideration is obtained from "perched" lakes which, as previously discussed would not be affected by the regulations proposed here. Such lakes are, however, sufficiently similar to dammed "artificial cooling lakes" to allow the use of data gathered from them. In effect, since they are unregulated, the results of their unregulated thermal discharges on the environment may be profitably used to show the effects of thermal discharges on the biota of the unregulated lakes, and allow extrapolation of that data for application to the "artificial cooling lakes".

17. It should be noted that Edison bore the brunt of the evidentiary burden in this proceeding, and that much of the data now available to the Board resultantly relates to Edison's Lake Sangchris. The Board commends Edison for both the completeness and comprehensiveness of its presentation in this matter.

A. Water Quality

Edison's 316(a) demonstration[18] for Sangchris contains considerable data on water quality (Ex. 6). In addition, Edison commissioned the Illinois State Natural History Survey to prepare a long-term (4 year) study on conditions in Lake Sangchris. Ex. 6(I) is the first annual report on that study, and Ex. 7 is a further semi-annual report covering through February, 1975.

Earlier data on the lake was compiled in a study by Limnetics, Inc., which prepared a limnological survey of Sangchris submitted to Edison in 1972 (Ex. 6(D)). In essence, the information available from these sources does not show any degradation of water quality in Sangchris which is attributable to the thermal components of Edison's Kincaid Station effluent.

The 1972 Limnetics, Inc. study showed that Lake Sangchris, with a daily discharge averaging 700 million gallons having a Delta T of 13.5°F. (into a lake with a total volume of 10.7 billion gallons, 7.7 billion of which are actually in the cooling loop), has generally good water quality. The only difficulty found was turbidity. Fine clay sediments entering the lake in runoff are held in suspension by plant operations (Ex. 6(D), iv). Tests run to show levels for about 30 parameters (Ex. 6(D), p.84, Tables F-1 to F-36, Figures E-1 to E-15), revealed little of any interest. Although fairly high nitrogen levels were found, which might support algal blooms, low phosphorous levels in the lake would limit algal productivity; in addition, algal production is light limited in the lake (R. 308, 293) due to the high levels of turbidity and suspended solids.

Later data for Sangchris, (the Natural History Survey study results), show a continuing high water quality in Sangchris. The first annual report of that study, (Ex. 6(I)), covering through September 4, 1974, presents a considerable mass of data on water quality parameters. The report notes that nitrogen is readily leached from soil, and concentration increases during winter and spring are normal in lakes surrounded by agricultural lands (Ex. 6(I), p. 1.3). Mercury concentrations were rarely at the detectable limit, and never beyond the limits set by Board Regulations (id.). It

18. A "316(a) demonstration" relates to application by a discharger to the U.S. Environmental Protection Agency for an "alternate thermal standard" under §316(a) of the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, 70 stat. 498, 84 stat. 91, 33 U.S.C. 1251 et. seq. (1972).

was also noted that bacteriological concentrations (especially fecal coliform) are affected primarily by climate rather than any other factor; the source of the coliform is the surrounding land, and provides input to the lake only when the ground is not frozen. (Id., p. 1.5). The Sangchris study to date, (Ex. 6(I) and 7), has shown that deeper portions of the lake, little affected by the thermal component, may at times violate Board dissolved oxygen (DO) standards. It is shown, however, that this is the result of natural phenomena rather than the thermal input. No violations have occurred thus far in the second year of the study (R. 294).

The mass of data available for Lake Sangchris is made more useful by a Comparative Limnological Literature Survey for Sangchris Lake, conducted in 1973 by the Natural History Survey. Various data for five lakes, with and without thermal input, were collected. (Ex. 6J.) The lakes studied were: Lake Decatur, Evergreen Lake, Lake Lou Yaeger, Lake Springfield and Lake Taylorville. All these lakes are located in central Illinois, and several are very similar to Lake Sangchris. Although there were some problems with the comparative study due to lack of information, it did indicate that Lake Sangchris does not differ significantly from the other lakes in any of the water quality parameters important to our consideration.

Even the turbidity of Lake Sangchris, which was inferred by testimony to be a result of plant operations at Kincaid Station, was not particularly high (R. 293). In fact, Sangchris and Springfield, the only two lakes in the study with a thermal component from power stations, had the lowest turbidity readings of those lakes considered (Ex. 6(J), p. 91, Tables VIII-3, VIII-4). Sangchris did, of course, have significantly different temperature readings (Id., p. 101, Fig. VIII-6). DO levels for Sangchris, Evergreen and Springfield were essentially similar, while Decatur had higher readings at most depths. Essentially, the chemical and physical parameters would appear to be more dependent on the watershed providing a lake's water, and on the age of the lake, than on any other factor (Id., pp. 91,80,7.).

Thermal discharges from the Dallman and Lakeside generating plants of the City of Springfield affect approximately one-fifth of the waters in the North Basin of Lake Springfield daily. The only water quality anomaly present in the two studies submitted which might be seen to be a result of the thermal component is a high nitrate level (Ex. 24, pp. 6, 37; Ex. 25, pp XII-20,21). This does not, however, appear to be causing problems of plankton growth, as the thermal effluents from Lakeside and Dallman Stations are stressing the plankton communities (Ex. 25,p.XII-30). While this problem is not serious, it needs further study.

B. Phytoplankton, Zooplankton

As noted above, the Betz Study (Ex. 25, p.XII-30), reached the conclusion that the heated effluents from Lakeside and Dallman stressed the plankton communities in Lake Springfield. The earlier Burns/Swanson Study, however, (Ex. 24, p. 50), reached the conclusion that Lake Springfield supports a relatively good diversity of plankton species, both phytoplankton and zooplankton. It stated that a dominance of the diatoms suggests good overall ecological conditions at Lake Springfield. As with Lake Sangchris, small plankton speciman sizes were attributed to phytoplankton feeders, and possibly some temperature induced stress (id, p. 52).

The first annual report on Lake Sangchris, (Ex.(6)I, p. 2.17), showed as a conclusion a lack of overall thermal effect on zooplankton or phytoplankton. Sangchris was described as a moderately eutrophic lake with a typical phytoplankton community. It was also noted, that a reduction in size, (cell and colony sizes were consistently observed near the lower limits described for any given species), is a well-documented response to warm water conditions. The semi-annual report of the Natural History Survey Study, (Ex. 7), however, showed that during the second year of the study, when plant operations were at a lower level, population trends at each of the sampling stations were similar to those observed during the previous year (Ex. 7., p. 2.1).

From all the data available, it would appear that thermal inputs to cooling lakes result in some localized effect on plankton communities near station outfalls. These effects do not seem serious and have not been shown to upset the normal productivity cycles for these lakes.

C. Benthos

There was some indication, (Ex. 16, Report No. 3), that condenser passage at Baldwin Lake has proved harmful to certain benthic organisms. It was also felt that fish predation could account for the same population decline (id. p. 7). Later studies also indicated that low standing benthos crops may be the result of poor bottom compositions, primarily of clayey, heterogeneous sediments. It was doubted that high temperature caused the sparseness of bottom fauna, due to sampling station distributions (Ex. 16, Report No. 6, p.2).

Early studies at Lake Sangchris indicated some difficulties with the benthic population. This problem apparently was corrected in later years of operation. (See Infra, pp 30)

D. Macrophytes, Periphyton

An extensive study of aquatic vegetation at Lake Baldwin, (Ex. 17), was unable to determine what effect the thermal discharge had on the aquatic plant community. It was feared that too-extensive vegetation growth could interfere with the cooling properties of the lake, and possibly result in higher temperature discharges. A study by WAPORA, Inc., submitted March 25, 1975, (id.), studied the effects of herbicides on the lake as a macrophyte control measure. In essence, no thermal effect could be found.

The Limnetics study at Sangchris (Ex. 6(D), § 5.3.6), describes normal macrophyte growth. Similarly, the periphyton, (shoreline growth), was found to be normal, with considerable growth (id, p.96).

E. Fish

Discussion of the fish community in cooling impoundments, (both dammed and diked), occupied much of the record in this matter. Of the fish populations discussed, game fish received the greatest amount of attention (eg., R.232-288).

The record clearly indicates that several cooling impoundments support viable game fisheries. This was obviously true of Lake Sangchris, whose fishing virtues were praised by many of the witnesses. Fishermen representing various organizations, (ie., the Bass Anglers Sportsmen's Society, the National Wildlife Association, the Bass Casting Association, and the Illinois Wildlife Federation), stated unequivocally that Lake Sangchris provides some of the best fishing in Illinois. Perhaps more importantly, they stated that the thermal discharge from Kincaid Station makes possible a year-round fishery, providing winter recreation of a type not otherwise available in Illinois. Although this latter fact seemed of particular importance to the fishermen witnesses, it was also stated that Kincaid's thermal effluent makes possible year-around habitation and growth by many warm-water species of fish. Although cross-examination left open the possibility that the thermal component may eliminate some species which would otherwise habitate the lake, (R. 452), this issue was not heavily dwelled upon. Instead, testimony centered on the unique recreational opportunities afforded by Lake Sangchris.

It is apparent that Lake Sangchris is indeed widely used by Illinois residents. A creel census, prepared by the Illinois Department of Conservation, (Ex. 6(L), indicated that 1973-74 usage at Lake Sangchris constituted 42,235 total fishermen days, with each angler spending an average of 3.55 hours per year. It was projected, (id.), that over 31,000 blue gill would be caught, and over 20,000 large mouth bass; crappy and channel catfish would account for 12,964 and 15,006 catches, respectively. Approximately 24,000 fish were caught during the "unique winter fishery" (R. 679).

Although Lake Springfield has been less frequently sampled, 1972 population analyses showed good fish growth rate, condition and reproduction in all game fish species samples. It appears that this condition has not always been true of that Lake, however; Department of Conservation testimony indicated that fish condition at Lake Springfield has "changed dramatically" (R. 680). Conditions now are thought to be good, and fluctuations in fish condition cannot be attributed to the thermal component from the City of Springfield's generating stations (R. 684). Although no data was available, the Department of Conservation felt that angler usage of Lake Springfield is quite extensive. (See also R. 232-285; 148-154; 679; 271; (Baldwin and other lakes).)

In predicting conditions on Lake Clinton, Illinois Power cited extensively from experience on Lake Sangchris. Although temperatures at Lake Clinton would be lower than those experienced at Lake Sangchris, it was predicted that conditions on Clinton will not vary significantly from those observed at Sangchris (eg. Ex. 18, § 6 p.37). It is predicted that Clinton will provide the same type of year-round fishery.

Several specific problems, possibly attributable to the thermal component in Lake Sangchris, were discussed during the hearings in Chicago and Springfield. (For example, it was noted that in some thermal plumes from electric generating stations, super-saturation of air in the heated water causes gas bubble diseases in fish (R.481). This has not been observed at Lake Sangchris.) It was pointed out, (R. 466), that fish move away from the thermal plume during some seasons; while there is still some question as to whether this indicates a harmful but sub-lethal effect, such harm has not been shown. Although some species in Sangchris have, at times, shown signs of poor condition (i.e., weight-to-length ratio), this fact is offset by population densities within those species (Ex. 6(I); R. 482). (See infra p.29).

Many other questions were also raised at these hearings with regard to the possible sublethal effects of heat on various fish species. These include problems with reproduction, habitat crowding, species imbalance, species elimination, and fish diseases (eg. R.706). Many of these questions, however, remain academic, and the reader is referred to the record for a complete - and particularly in the Exhibits - thorough examination of these matters.

The fact remains that the cooling impoundments examined in this proceeding all support large fish populations. More importantly, the record shows that the existence of these fish populations may well indicate a generally healthy condition in the subject lakes. Game fish occur at the top of a complex, and finely balanced, food chain and ecosystem (eg. Ex. 6(D), p.124). A break in the ecology or food chain in a cooling lake might well prohibit the flourishing fisheries now found.

This fact seems borne out by the references cited in the Exhibits. One, (Bush, et al., Potential Effects of Thermal Discharges on Aquatic Systems, 8 Environmental Science and Technology 561 (June, 1974)), even suggests that the effects of thermal effluents on fresh water fish communities will suffice as a guideline for the protection of both fish and invertebrates. Due to the size and diversity of the biota to be protected, and the fact that thermal limitations are not known for all species, the effects on fish may well be our best guide. Certainly, the Board cannot hope in a proceeding of this nature, to completely resolve issues which apparently remain contested in the scientific community. But, based on the record here, we may accept the thermal effects on fish as one indication of general conditions in the biota.

This does not mean that we will blindly accept the existence of a fishery as our only criteria. Sufficient questions have arisen to show that many possible problems do exist, at many levels in the biota, which may be the result of thermal effluents. The record certainly indicates that, with fish as well as other aquatic animals and plants, very high temperatures may produce distinct harm to the environment. Thus, while we do not accept the contention that the existence of a fishery is the sole criteria of compatability between the ecosystem and additional heat loadings, the existence of a viable fishery must be given considerable weight.

F. Wildfowl, etc.

There was considerable testimony, (R. 305), to the effect that wildfowl usage of Lake Sangchris has been normal. It was asked at some length whether the migratory feeding, or other habits of wildfowl may be affected by the addition of heat to bodies of water used by those birds. The evidence shows that these effects, if they do exist, are minimal. Further, extensive predictive data on wildfowl usage for the proposed Clinton Lake has indicated that wildfowl usage of cooling lakes will not constitute a future problem, whether through the addition of nutrient or the introduction of parasites (eg. Ex. 18, § 6.3.2.3.2, p. 6-42).

G. Other Considerations

It has been argued that the function of the Board in protecting the environment does not allow for the consideration of other factors in reaching our decisions on environmental matters (eg. Submission of U.S. EPA, letter of July 9, 1975; see also, Ex. 20, p.4; R.365). We are not convinced that this is the case.

The General Assembly made it quite clear in the Environmental Protection Act that there are many factors to be considered by the Board in reaching our decisions. Section 27 of the Act sets out a listing of factors to be considered, several of which are important here insofar as they require our consideration of the benefit of artificial cooling lakes, to both the utility company owners of such lakes and to the public at large. These factors must then be balanced against either the harm, or the possibility of harm, which may result from our decision.

It would appear that, within limits (R. 481), the addition of heat from a steam-electric generating plant actually aids in the growth and development of gamefish in artificial cooling lakes (eg. R. 462). While the continued growth of fish and other aquatic organisms during winter is unquestionably not in the natural order of things for Illinois lakes; it would appear that this phenomena nonetheless contributes to the recreational value of an artificial cooling lake. Further, it would appear that the presence of such a fishery as is evidently produced by the thermal effluent may also be a good indication of the general environmental quality and acceptability of an artificial cooling lake (supra, p. 21). Apparently, then, the existence of this type of recreational use is compatible with the preservation of our environment.

Two other factors, besides those which might normally be covered in a purely environmental consideration of the acceptability of high-temperature thermal effluents to artificial cooling lakes, remain. The first is the need of the State of Illinois for the type of general recreational facility, (besides a game fishery), which has been provided at Lakes Sangchris and Springfield, and to a lesser extent at other artificial cooling impoundments in Illinois. Illinois has a serious deficit in recreational parkland for general use; this seems especially true of "water related" public land (eg. R. 113, 347, 703; Ex. 19). By providing multiple use areas, cooling lakes may thus provide a considerable public benefit to be weighed against any possible environmental harm.

The multiple recreational uses which have accompanied present cooling impoundments are perhaps best shown at Lake Springfield. Testimony showed that Lake Springfield supports a viable fishery as well as public swimming areas, eight public parks, children's zoo and botanical areas, a golf course, the Municipal Opera, a wildlife sanctuary, and boating and camping areas (R. 427, 429, 680). This listing is only partial; while this lake may not be typical of the uses to which an artificial cooling lake can or will be put, it may serve as an example of the types of uses possible.

There was also testimony, (eg., R. 272, 273), to the effect that there are multiple recreational uses, besides the excellent sport fishery, accompanying Lake Sangchris. The lake and park there provide a wildfowl refuge, as well as camping and general outdoor recreation areas

The need for such multiple-use facilities in Illinois was brought out in the testimony of Dr. Wayne Rogers of the Illinois Department of Conservation. Dr. Rogers testified on the beneficial qualities of these sites, and on the Department of Conservation's need for such sites (R. 674-713).

Our finding in that artificial cooling lakes may provide a suitable recreation resource was not the result of a consensus on the record. Mssrs. Adamczyk and Ginsler both stated that what is considered an acceptable recreational facility for some may in fact result from the destruction of the natural, unspoiled areas sought out by others (R. 156, 179). It was also pointed out that the use of an artificial cooling lake for recreational purposes is not always ideal, due to the presence of the steam-electric generating station for which the lake is constructed (R. 696).

Besides those public and recreational uses, there remains a final aspect to be considered in relation to the construction of artificial cooling lakes. Principally from the testimony of Dr. Ackerman, Chief of the Illinois State Water Survey, it would appear that the impoundment of artificial cooling lakes may be an important measure in the husbandry of our natural water resources. While Illinois may be considered a "water rich" state, to the extent that it receives an abundance of rainfall and has many large rivers and other bodies of water, there are nonetheless many areas of the state that are effectively impoverished as regards available water (eg., Ex. 11,12,13). Many of the state's streams are intermittent, and are dry much of the time. By impounding these streams, much of the water that would ordinarily be lost as runoff is retained and made available for public benefit.

An excellent example is Lake Springfield, which provides a public water supply for the City of Springfield. The Lake was, in part, constructed to provide for this use (R. 423). While not all artificial cooling lakes are - or could be - used for that purpose, this is again evidence that condenser cooling, with effluent temperatures in excess of present standards, is not incongruent with other beneficial uses. As was stated at the Springfield hearing of May 23, 1975, it is conceivable that artificial cooling lakes might be used for irrigation, industry, or any other use of general benefit (R. 340, 349). The retention for beneficial use of waters which would otherwise be lost provides the Board with a factor which must be weighed in setting Regulations for environmental benefit.

Discussion of this conservation of Illinois' water resources would not be complete without again mentioning that cooling impoundments may be the least consumptive of the engineering alternatives available for steam-electric generating station cooling. Testimony indicated that, in addition to any other problems with cooling towers or canals, their excessive use of evaporation as the principal cooling mechanism is extremely water-consumptive (eg., R. 335,370; Ex. 9; see also R. 357).

At a time when Illinois is lacking in both public recreational areas and in a full use of its water resources, artificial cooling lakes have historically provided at least partial solutions to both problems. This is not to say that these factors are sufficient to override all environmental

considerations. As was noted in the testimony of Dr. Rogers of the Department of Conservation, it would not necessarily be in the best interests of the state if all possible sites were developed for artificial cooling lakes. Further, the testimony of Mr. Adamczyk, Dr. Rogers, and Mr. Ginsler show that the types of recreational facilities provided by artificial cooling lakes may not always be the best use of available natural land. And there is the possibility that the construction of an artificial cooling lake may eliminate the habitats of important indigenous wildlife and aquatic species (eg., R. 446). The Board also remains concerned that the construction of such artificial cooling lakes may inundate excessive amounts of agricultural land. Again, these factors must be weighed on a case-by-case basis.

But in light of the paucity of evidence demonstrating any actual net damage to the environment from artificial cooling lakes, the multiple use of these lakes weighs heavily in favor of the adoption of these Regulations, and here led to the inclusion of the relevant portions of Rule 203(i)(10)(cc). This was also a consideration of the Board in adopting the specific thermal standard for Lake Clinton.

GENERAL CONCLUSION

In summary, the Board finds that the adoption of Regulations to allow for specific thermal standards for individual cooling lakes would be thoroughly justified. While the record has shown that there is not presently a full understanding of the environmental dynamics of lakes receiving large heat input, it nonetheless indicates that at present there is little or no indication of any significant damage.

The record indicates that there is no question that excessive thermal inputs can be damaging to the aquatic environment of an artificial cooling lake. Each artificial cooling lake must be judged on its own merits. No individual factor can justify the complete de-regulation of these lakes, and no individual factor, (such as recreational use), can by itself provide the test of acceptability for an artificial cooling lake.

We realize that the coverage of this regulation is narrow; it applies only to the thermal effluents from steam-electric generating plants. Since the testimony of Dr. Ackerman (R. 353) pointed out that there are many other sources of heated water, we have considered the question of applying the regulation more generally. We are however limited to the facts before us; the evidence herein concerns only the types of impoundments discussed above.

We have therefore adopted a careful case-by-case approach to the situation. The accompanying regulation provides for an individual Regulatory proceeding to set specific thermal standards applicable to an individual artificial cooling lake.

SPECIFIC STANDARDS: LAKE CLINTON AND LAKE SANGCHRIS

In adopting these Regulations, the Board has decided that it would serve no purpose to require a further showing, for Illinois Power's Lake Clinton, as would otherwise be required under the Regulations adopted here. Edison's Lake Sangchris may not be treated similarly in arriving at a specific thermal standard. While the Board feels that the evidence present supports the adoption of a final specific standard for Clinton Lake, the same conclusion cannot be reached for Lake Sangchris. Our discussion of specific thermal standards for individual artificial cooling lakes has been limited to Lakes Clinton and Sangchris; although other lakes were mentioned in the record, the information on them was insufficient to warrant such discussion.

For Lake Clinton, the Board has been presented with a specific thermal limitation proposal. The predictive modeling done for that lake is based on a maximum condenser cooling discharge of 96° F., and specific, narrow operating conditions for a supplemental system to be used in conjunction with the lake for cooling purposes.

For Lake Sangchris, however, the instant record nowhere reflects a proposed specific standard. Commonwealth Edison did not request such a standard until the public comment period following the final public hearing in Chicago on June 23, 1975. In the record on Edison's initial proposal, supra, its effect was shown as intended for general, as opposed to specific, (ie., Sangchris), applicability (R. 124). As a result, the mass of evidence introduced with regard to Lake Sangchris, while supporting the general conclusions reached here, was insufficient to allow adoption of a specific standard for that Lake.

Further hearing(s) on Lake Sanchris will, we feel, allow an opportunity for Edison to justify the higher specific standards which we are rejecting here. These higher standards are those requested in Edison's comment-period submission, and may in fact be justifiable; but that justification does not exist in the present record.

We have reached our decisions in both cases (Sangchris and Clinton) based on massive quantities of evidence submitted at the hearings held in Chicago and Springfield. It would serve no great purpose to require that Edison once again set out essentially the same data and testimony. We will therefore make provision for the incorporation of the record and findings here in a further hearing on Lake Sangchris. It is our hope that this will minimize duplication of effort, and still allow Edison a full opportunity to justify whatever numbers it feels would be appropriate as a specific thermal standard.

The specific provisions regarding Lake Clinton will take effect upon proper submission to the Secretary of State.

LAKE SANGCHRIS (DISCUSSION)

Lake Sangchris has previously been before the Board, at which time the Board was impressed by the lack of environmental harm seen there. As was noted above, this Regulatory proceeding is itself a result of our prior consideration in PCB 73-248. When instituting this proceeding, however, Commonwealth Edison did not ask for a Regulation which would be specifically applicable to Lake Sangchris, but instead sought a change which would have exempted all artificial cooling lakes from the present standards, subject to certain conditions.

The Board's prior Opinion has not changed. Based on many of the same evidentiary matters presented in PCB 73-248, and on the wealth of further data seen here, we can impose a specific thermal standard for that lake, once one has been proposed and justified. That specific standard, when adopted, will achieve the result originally sought by Edison in this Regulatory proceeding, but will do so, we feel, in an environmentally and legally sound fashion. We find that the data present as regards Lake Sangchris cannot justify the imposition of a specific standard.

a. Background. Lake Sangchris was created between 1964 and 1966 by the construction of an earthen dam across Clear Creek (Ex. 6, p.3). By damming Clear Creek just below the confluence of its three branches, (approximately one mile upstream of the confluence of Clear Creek and the South Fork of the Sangamon River), a three-armed lake was created at a cost of about $30 million. The lake, with a surface of about 2,700 acres at a designed surface elevation of 580 feet, has a volume of approximately 10.7 billion gallons (R.15; Ex. 6(D), p.iii).

The Lake provides condenser cooling water for Edison's Kincaid Station, a mine-mouth facility designed in the early 1960's to take advantage of the economies accompanying location near a fuel source (Ex. 6, p.2; R.14). Kincaid Station has two 661 MW units, and has a total condenser cooling discharge of 2140 cfs when the station is run at full capacity. Normally, three pumps are used to provide the cooling water from the intake arm of Lake Sangchris, (the eastern of the three arms), and the effluent is discharged into the discharge (central) arm. (The station has four pumps to provide cooling water, but maintenance difficulties have kept one pump down for much of the station's operating history, R.519.) The temperature of the effluent is dependent, among other things, on the temperature of the water withdrawn from the intake arm, (largely a function of the season), the level at which the plant is operating, and the number of pumps used (R.519: Ex. 10; Ex. 6(D), Table 4-1, pp 55-60).

The total site at Kincaid Station comprises approximately 13,000 acres, including the lake (Ex. 6, p. 2). In February, 1969, Edison conveyed about 2,300 of those acres to the Illinois Department of Conservation for the development of Lake Sangchris State Park (R.15). Since that time, considerable effort has been expended by the Department of Conservation to develop and operate a multi-purpose recreational site in conjunction with the park and lake (eg. R.272). Although the total of the actions taken to develop the site are too numerous to set out here,[19] there is no question of the fact that Lake Sangchris is an excellent recreational asset and sport fishery (eg., R.678,680), both widely and well used by Illinois residents (see also, R.232,252,268).

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19. See the discussion above regarding the multiple use and water conservation aspects of cooling lakes.

b. Biota. Much of the foregoing discussion of the effects of thermal discharges on the biota of artificial cooling lakes comes from data acquired at Lake Sangchris. The work done there by the Natural History Survey, the Department of Conservation and various private consultants for Commonwealth Edison, (in particular the Limnological Survey prepared by Limnetics, Inc.), provides the Board with a broad base on which to reach a determination with regard to that Lake. The data and evidence show little if any harm from past operations at Lake Sangchris.

Our discussion noted that game fish, at the top of the food chain, have fared well in Lake Sangchris. As also noted, this may be some indication of the overall "health" of a body of water. There have, however, been some anomalies noted in the fish population at Lake Sangchris, which require specific coverage. The Limnetics study, done in 1972, stated that gizzard shad, (the dominant fish in the lake at that time), showed poor condition with a low weight-to-length ratio (Ex. 6(D), pp. vi, 120-125). It was also thought at that time that the channel catfish population was not reproducing, although this may be normal for an impoundment without a strong current (Ex. 6(D), p.109).

Although this problem with the gizzard shad was not fully discussed in the later Natural History studies, (Ex. 6(I), p. 4-5), the results of similar studies relating to the "coefficient of condition" seem to indicate that the weight-to-length ratio of fishes in Lake Sangchris may be more related to the local availability of food organisms than to water temperature (Ex. 6(I), p. 4-8). Also, the problem of slow growth in certain fishes may be more than made up for by the numbers of individuals present in species, (R.686), where there is competition for limited food resources.

This is not to say, however, that all questions relating to the fishery at Lake Sangchris have been answered. The Natural History studies have indicated that the bluegill population is stunted, possibly from thermal stress (R.483), and that carp may not be successfully reproducing (Ex. 6(I), p. 4-5; see also Ex. 6, p.35, Ex. 7, pp. 4.3, 4.4). While these questions and others need further study and examination, it has not been shown that the thermal input from Kincaid Station has produced any of these anomalies (eg., R.707, testimony of Biologist Herndon, Department of Conservation). It may be that the problems which have been observed are all within the natural order of things (id.).

There have also been questions raised regarding the phytoplankton and zooplankton populations at Lake Sangchris. It was shown in the Limnetics 1972 study that there was a preponderance of the smaller species of both zoo- and phytoplankton (Ex. 6(D), p. 95). Although data for other Illinois lakes was not available for comparison, plankton from lakes in other parts of the country are larger (Id., p.86). This problem, however, may be more related to the selective feeding habits of gizzard shad than to condenser passage (Ex. 6(D), p. 120). The reduction in individual size is possibly a response, at least in part, to the warm water input from Kincaid Station (R. 297).

The earlier Limnetics study also showed a lack of benthos in certain areas of the Lake (Ex. 6(D), p.122). This was attributed to oxygen deficits occurring in the Lake, since the major benthic organism found is very tolerant of low oxygen tensions in the water. The problem was attributed primarily to the deeper portions of the Lake. There is very little background data on the benthic populations typical of Illinois reservoirs (R. 501). Some testimony indicates that the population density and diversity are more dependent on the available substrate or habitats than on the water temperature (R. 497-503). Later studies by the Natural History Survey indicate that the earlier pausity of benthos no longer exists, and that benthos are now "moderately abundant" in the Lake (R. 298). Heat tolerant species are even found in the discharge canal (R. 500).

Other testimony indicates that the macrophyte distribution in Lake Sangchris is fairly normal (Ex. 6(D), § 5.3.6), and that wildfowl patterns of usage are typical, both in terms of stay and distribution (R. 305-306).

c. Standards The evidence, then, has shown that an excellent fishery has been developed in Lake Sangchris, and that the fishery is extremely popular with area fishermen. This fact, and the record's rather minute examination of the effects which the thermal effluents of Kincaid Station have had on the aquatic biota of the Lake, lead us to the conclusion that past operations of Kincaid Station, with the attendant thermal effluent, have probably not been environmentally harmful. However, two questions remain: 1) Will future operations on Lake Sangchris be of the same nature as those in the past?; and 2) What effluent temperatures at Lake Sangchris have produced these results? When these are answered, we may set a specific thermal standard for Lake Sangchris based on the operational history of the Station and the Lake.

Commonwealth Edison, in a letter to the Board dated July 10, 1975, requested the following as the specific thermal standard for Lake Sangchris:

> The temperature of the condenser cooling discharge from Kincaid Station shall not exceed 107°F. except that for 5% of the hours in any 12 month period ending with any month during which time excursions shall be allowed up to a temperature not to exceed 122°F.

This request was evidently based on an attachment to that letter, consisting of a letter to the Board from Mr. McCluskey of Commonwealth Edison. Tables attached to that letter indicate that the highest Delta-T experienced at Kincaid during the period September 1, 1973 through October 31, 1974, was 25°F. This Delta-T was reached with a generated load at the station of 1,029 Megawatts, with two of four cooling water circulating pumps in operation. The letter goes on to extrapolate that with a full generation load of 1286 megawatts the Delta-T could have been 31.2°F. Based apparently on that same data, the letter goes on to state that although the maximum discharge temperature recorded during that same period was 107°F., the maximum that could have occurred, with two circulating pumps in operation, and the Station at maximum generating load, was 121.6°F.

This request by Edison was simply not reasonable. First, other evidence has shown that it is unusual for there to be only two circulating pumps in operation (the station has four such pumps), and historically there have been three of them in operation to provide condenser cooling water (R.519). Second, other exhibits, (eg. Ex. 6, § 316(a) demonstration, Table 4) indicate that over the course of approximately 10 years of operation at Kincaid, the discharge temperature rarely even approached the numbers requested by Edison.

Based on these facts, we have determined that Edison has requested a regulatory change based on a hypothetical, worst-case situation, which, based on the evidence in this proceeding, has never occurred. We therefore, after a further hearing, must arrive at a specific figure as the thermal standard for Lake Sangchris; or, alternatively, Edison must more fully justify the standard proposed.

The letter cited above states that during the period of September 1, 1973 through October 13, 1974, there were 7,741 observations made of the effluent temperature at Kincaid Station. During that time, the effluent temperatures cited exceeded 102°F. only 1.9% of the time, and never exceeded or equalled 108°F.; 104°F. and 106°F. were equalled or exceeded only 0.2 and 0.1% of the time, respectively. The temperature data in that letter are, however, incomplete.

Table 4 of Exhibit 6, (the § 316(a) demonstration for Lake Sangchris), containing sparse data for the years 1966 through 1974, (no figures are given for the period from November, 1968 through August, 1973), shows a maximum discharge temperature of 107°F., with five weekly high temperature readings exceeding 100°F. Further, of approximately 110 weekly high temperature figures given, only 28 exceeded 90°F., of which only 7 readings were between 96°F. and 100°F. Of the readings between 96° and 100°, three were 96°F., three were 97°F., and one was 99°F. During this period, however, it appears that the plant was not operating at high levels. Also, it seems that these readings, (those taken from both the letter cited above and those shown in Ex. 6), were the result of measurements made at the point of discharge into the plant's discharge canal, rather than at the point of discharge into the Lake itself. (It is not clear where the readings contained in Mr. McCluskey's letter were taken.)

Any standard which we may set for Lake Sangchris would be, in effect, the historic fact for that Lake. In the record before us, the history is incomplete. While we have determined that serious damage to the biota has probably not occurred at Lake Sangchris, we cannot determine fully the discharge temperatures, and their historic limits, which have produced this result.

SPECIFIC STANDARDS
LAKE CLINTON
(FINAL)

The evidence presented with regard to Lake Clinton, which will be constructed along with the proposed Clinton Station, is largely taken from the §316(a) demonstration presented to the U.S. EPA.[20] Looking at the same evidence and data, the Board shall adopt into the instant Regulation the same thermal standard as has been tentatively adopted for Lake Clinton by the federal government pursuant to §316(a) of the FWPCA.

Lake Clinton has also been rather thoroughly discussed by the Board in another previous matter, the Variance case of Illinois Power v. EPA, PCB 75-31, decided by the Board on July 31, 1975. While some of the following discussion may

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20. §316(a) of the Federal Water Pollution Control Act Amendment of 1972, PL 92-500, 33 U.S.C. §1326(a).

therefore be duplicative of that Opinion and Order, we feel that this is nonetheless necessary. The Board's grant of a specific thermal standard for Lake Clinton is, in effect, fulfillment of the compliance plan which was accepted in connection with the grant of that Variance. To avoid some repetition, however, we specifically adopt that Opinion and Order into the record here.

In addition to matters seen in the § 316(a) demonstration and the earlier Variance, our decision regarding a specific standard for Clinton Lake is based on additional matters entered at the May 23, 1975 hearing in Springfield and during the public comment period following the hearings. Introduced by both Illinois Power and the U.S. EPA, these matters are further evidence of acceptable conditions predicted for the Lake.

The same grounds that led to our grant of the Variance in PCB 75-31 are those which lead us to adopt a specific 96°F. standard for Lake Clinton, and to adopt the same technical conditions as those in the Variance.

The supplemental cooling system chosen by Illinois Power for the Clinton Station is a spray canal system, utilizing 232 individual spray modules along the discharge canal running from the Station to the Lake. By using this system, it will be possible to meet a maximum discharge temperature of 96° F. This maximum, we find, will be sufficient to preserve and protect the biota of the lake.

The proposed spray canal has been the subject of extensive modeling and planning. It has been conservatively engineered to meet "worse case" conditions, but nonetheless will not result in compliance with the general Board standards under those "worst case" conditions, although the present standards will be met under many meteriological conditions. It was noted in the earlier Variance Opinion that there was some question as to whether there will in fact be violations of the present standards. We found that the estimates of violation in drought years were credible. We again find that to be the case.

It should be noted that the predictive data for Lake Clinton is based on a rather thorough review of the literature with regard to thermal effects, and, importantly, on experience at Edison's Lake Sangchris, as well as a study by the Biology Department of Southern Illinois University. Since predicted temperatures for Clinton will be within the range of experience at Lake Sangchris, the predicted temperature effects at Lake Clinton are amenable to verification from the record on Lake Sangchris.

In a letter to Illinois Power dated May 9, 1975, the U.S. EPA Region V Administrator tentatively approved an alternate thermal standard for the proposed Lake Clinton. That tentative approval followed the submission, by Illinois Power, of voluminous data and predictions relevant to the proposed Lake. The original submission to U.S. EPA, October 10, 1974, was supplemented on February 24, 1975, and April 14, 1975. In a letter dated May 16, 1975, Illinois Power agreed to all the conditions specified by U.S. EPA.

Without reiterating all of the Board's findings in PCB 75-31, the predictive data for the proposed Lake indicate that minimal, if any, damage will result at Lake Clinton from the thermal effluent. As with Lake Sangchris, Lake Clinton will provide considerable "refuge" area for the fish populations, so that fish will be able to effectively avoid the "worst-case" effects of the thermal discharge, as predicted above.

Unquestionably, some minimal damage to the biota will occur. Entrainment will, partially as a result of the cooling water's passage through the spray canal system, kill essentially all of the organisms entrained at certain times of the year. This will be especially true of the zooplankton brought in through the plant intake. However, populations will be reestablished downstream of the discharge due to the reproduction of organisms not carried through the plant.

As was the case with Lake Sangchris, it is felt that any damage which may occur as a result of plant operation will be offset by the benefits to be gained. The thermal effluent may actually benefit the biota at times, although this would not occur in the normal course of events. This will take the form of an additional growing period during the normally dormant winter months, and should affect almost all of the biota.

In reaching these conclusions regarding the biota, we have taken into consideration the same balancing factors used in our discussion of Lake Sangchris. The probable costs of alternate cooling, the loss of water resources and increased consumptive water use, the energy crisis, and many other factors enter here. These have all been covered in PCB 75-31, in the § 316(a) demonstration, or in our general discussion above, and do not require reiteration.

There is one other important factor regarding the effect on the biota which we must mention here. Illinois Power has committed itself to take corrective action, if necessary, should biotic conditions in Lake Clinton differ

from those predicted. This condition, also continued in effect from the Variance, is in keeping with the Board's policy as stated in Rule 203(i)(5), that further study of thermal effects is needed, and that environmental protections may be added as shown necessary.[21] The corrective action envisioned here is not limited; if need be, we may require the backfitting of the station with additional cooling measures.

In addition to the effects on the biota, the Variance Opinion in PCB 75-31 set out some of the available data on the costs of achieving compliance with the general thermal regulations for the proposed Clinton Station and Lake. That information appears, in part, in the preceeding sections of this Opinion concerned with the costs associated with various cooling technologies. Data on Lake Clinton is included there, along with available data on other existing or planned artificial cooling lakes. The following data from the Variance Opinion is repeated for convenience:

Alternate Cooling System	Cost
(1) wet mechanical draft tower	$48,300,000
(2) wet natural draft tower	71,952,000
(3) spray canal	55,754,000
(4) dry mechanical draft tower	422,144,000

(PCB 75-31, Opinion at 12).

The costs shown above would be those associated with an "alternate" cooling system, that is, one which would not be used for cooling in conjunction with the proposed artificial cooling lake. The supplemental cooling system mandated in our grant of a specific thermal standard will, it is estimated, cost approximately $34.5 million, to include all capital, operating and maintenance costs over a 30-year life.

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21. This agreement, it is felt, will constitute a valid waiver of Illinois Power's right to rely, if in fact any such right is determined to exist, on §316(c) of the FWPCA, supra.

THE REGULATION

The Regulation adopted on August 14, 1975, provides two major additions to the existing Regulations:

1. A mechanism is adopted whereby the Board may, in a regulatory proceeding, promulgate a specific thermal standard, on a case-by-case basis, for artificial cooling lakes, using the standards set out in new Rule 203(i)(10); and,

2. A specific thermal standard is adopted for Lake Clinton. The final form of the Regulation differs significantly from the proposal submitted by Commonwealth Edison. Rather than totally[22] exempting all artificial cooling lakes from the general standards, we allow for the promulgation of new specific standards for individual lakes. Even the definition of an artificial cooling lake offered by Edison has been changed.

Similarly, changes have been made in each of the proposed drafts of this Regulation which the Board has seen. There have been five major drafts of this Regulation: 1) the original Edison proposal; 2) the first Agency draft, published in Environmental Register No. 104; 3) the second Agency draft, (Ex.32); 4) the Board's proposed final draft, published in Register No. 106; and, 5) the final Regulation. In addition, the record contains further alternate subsections submitted by the Agency, as well as other suggestions received during the two public comment periods.[23] The Board also published two alternate subsections to the Regulation with the proposed final draft.

To clarify our reasoning and intent in the final Regulation, we will examine both the final form of the Regulation, and our rationale in excising and amending portions of earlier drafts.

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22. The "total" exemption here was partially limited by certain conditions in Edison's proposed Rule 957(a)(7); see the discussion following.

23. The first public comment period followed the close of the hearings on June 23, 1975, and lasted through July 10, 1975. The second followed publication of the Board's proposed final draft in Environmental Register No. 106 and lasted until August 12, 1975.

Rule 104, Definitions. In its final form, the definition of an "artificial cooling lake" is designed to make clear the Regulations' limitation to those lakes created by the damming of existing streams. Previous cases have made it clear that these lakes are protected waters of the state, whether the dammed streams are intermittent or continuously flowing. cf., PCB 73-248, PCB 73-384, supra. This definition does not change our determinations in those cases.

The definition offered by Edison in the original proposal was dropped primarily because it attempted "definition in the negative." By calling artificial cooling lakes those which are, "not . . . treatment works", the Board would have avoided answering the important preliminary issue of the Regulations' coverage.

The final phrase of Edison's definition was retained, as a further limitation to the Regulations' applicability. It was suggested, (comment of Mr. Marder, Illinois Department of Business and Economic Development), that the definition of an artificial cooling lake be expanded beyond the scope of the prior proposals, to include impoundments used for any cooling purpose, whether or not associated with a steam-electric generating plant. This proposal was rejected because the record simply fails to indicate that conditions under any other situation would be the same. While it would indeed seem that, "heat is heat", regardless of the source, significant questions remain unanswered regarding the effects of sub-lethal thermal effluents on other pollutants, and the effects of such other pollutants on the biota under such conditions. The record shows that this has not been a problem with steam-electric generating plants, but is silent on the issues for any other situation.

Rule 203(i)(10). The first portion of subsection (10) is intended to make it clear that any exemption which might be granted from the general thermal water quality rules, in a specific thermal standard, will be limited to the specific circumstances and requirements set out in the following subsections. It is intended in this language that any such exemption be narrowly limited to thermal discharges into artificial cooling lakes.

The original subsection 203(i)(10), submitted by Edison, would have provided a general exemption for all artificial cooling lakes, and was deleted in its entirety. The record simply failed to support such a generalized proposal, even where the conditions set up in Edison's proposed Rule 957(a)(7) might have been met. The record did show just the opposite: too-great a thermal load on an artificial cooling lake can cause extensive environmental damage. The parties, including Edison, seemed to realize that this proposal was not viable by the time of the second hearing on May 23, 1975. By the third hearing on June 23, 1975, almost no mention was made of the original Edison proposal. Particularly from the testimony of Dr. Tranquilli and his associates at the Natural History Survey, it had become clear that the Board would have to examine each artificial cooling lake individually. The language eventually used in the Regulation for the first portion of Rule 203(i)(10) was taken from the first Agency draft, which first presented the concept of a case-by-case approach.

Subsection (aa). In contrast to prior Board determinations, (see pp. 2-4 supra, and cases cited), the new Regulations adopted in R75-2 allow limited thermal effluent dissipation in protected waters of the state, once it has been shown that no harm to the environment will result. Subsection (aa) limits this exception to the boundaries of the artificial cooling lake in question, and prohibits any interference with natural temperatures in any other waters.

The language and concept for this section are taken from the first Agency draft. The same language remained through the second Agency draft, but was changed in the Board's proposed final draft. That change, which would have required compliance with "all applicable" provisions of Chapter Three, was deleted, and the language of the first and second Agency drafts was reinserted; this was done to avoid the confusion which the changed language might have caused, and because the language suggested by the Agency was more limiting.

Subsection (bb). This subsection was adopted from the first Agency proposal, and is intended by the Board to narrowly limit the scope of the Regulation. As was the case

with subsection (aa), subsection (bb) was changed in the Board's proposed final draft but later returned in the final Regulation to its initial form. It was decided that because the Regulation as a whole is limited to thermal standards and effects, it might be unnecessarily confusing to make reference to all the standards contained in Chapter 3 of the Regulations. This Regulation is limited by its own terms to thermal constituents, and need not refer to any other section of the Regulations.

Subsection (cc). This subsection makes it clear that any attempt by a discharger to obtain a specific thermal standard must take the form of a Regulatory proceeding. It also acts in part as a procedural rule by showing that the burden is upon the applicant for a specific thermal standard to make the showing(s) required under the Regulation. By requiring a showing that the lake will be environmentally acceptable, and by setting out in subsections (cc)(1) and (cc)(2) certain minimal elements of such a showing, this subsection is intended to give an applicant guidance to allow adequate preparation for the required hearing(s), and to give guidance as to the burden which must be met.

The general heading of environmental acceptability as the thrust for the required showing under this subsection is necessarily broad. The many factors which the Board must consider, under its mandate in the Act, prohibit more concise or narrow a general definition. It is hoped that subsections (cc)(1) and (cc)(2) will provide sufficient guidance, but the showing is specifically "not limited to" the considerations set out in those subsections.

Subsection (cc)(1) lists those tests which the Board found most helpful in evaluating artificial cooling lakes generally, and in choosing a specific thermal standard for Lake Clinton. Under subsection (cc)(1), it is not absolutely required that there be a fishery, or that an artificial cooling lake provide recreational or any other uses except that for which it was designed. One public comment pointed out that factors besides generating plant operations might prohibit a recreation facility.[24] But it is nonetheless felt that by requiring such conditions in a lake we will have taken a significant step in protecting water quality.

24. An example would be the prairie chicken sanctuary shown in CIPS' letter received August 11, 1975.

Qualitatively, while the end use of a body of water is indeed important, and may be weighed by the Board in the regulatory process, the Board is most concerned with assuring water quality sufficient to allow these (fishery and recreational) and any other beneficial and ecologically-sound uses. We may not require that water be properly and beneficially used; we must require that it can be so used.

In subsection (cc)(2), the Board recognizes two points: first, where it would in the judgement of the Board be economically reasonable and technically feasible to meet the general thermal water quality standards in Rules 203(i)(1)-(4), there is no need for a specific thermal standard under this regulation; second, the Board is required under the Act to evaluate these economic and technical factors in arriving at its regulatory decisions. (It has been argued that we may not consider economics or technical factors in arriving at suitable thermal standards to protect the environment; this is not how we interpret the Act.)

A further point follows from our consideration of the environmental, economic and technical aspects of setting thermal regulations for individual artificial cooling lakes: in balancing all of these factors to determine a specific thermal standard, the Board may well find that such a standard cannot be justified. A necessary corollary is that the Board might find that an artificial cooling lake incapable of meeting the general thermal standards of Rules 203(i)(1)-(4) would not be environmentally acceptable, and that if the generating plant in question is to be built, some supplemental or other cooling mechanism must be provided, (e.g., Lake Clinton). We decline to give blanket approval to artificial cooling lakes at any thermal standard other than those designed for the general protection of the waters of the state, and contained in the general thermal water quality standards.

As with other parts of the Regulation, the concept here came from the first and second Agency drafts. The first Agency draft of subsection (cc), set out on page 6, supra, overemphasized the necessity of having an acceptable fishery and recreational facility. While the underlying thoughts of this section were retained, it was re-phrased to emphasize environmental effects generally, and require only "conditions capable of supporting" fishery and recreational uses.

The "conditions capable" concept was introduced in the second Agency draft, along with some of the language used in the final Regulation to include the economic and technical reasonableness tests. The "public hearing" phrase in the second Agency draft was changed to read, "regulatory hearing", for clarity. The words, "so as to provide" in the second Agency draft were also dropped, as being unnecessarily self-limiting.

One significant change from the Board's proposed final draft to the final Regulation should also be discussed. Subsection (cc) in the Board's proposed final draft would have required that "management" of an artificial cooling lake be performed in an environmentally acceptable manner. In the final Regulation, this was changed to reflect a requirement that the artificial cooling lake itself be environmentally acceptable.

Many of the defects in the language of subsection (cc) in the two Agency drafts were also seen in the Board's proposed final draft. Insofar as the Act sets a broad range of factors to be considered in regulatory proceedings, most of the language deleted or amended in subsection (cc) between the proposed final draft and the final Regulation itself was found to be improperly limiting future Board considerations of artificial cooling lakes; it was removed or changed to correct that deficiency.

Subsection (dd). This section is provided in the Regulation to minimize the duplication of paperwork which might otherwise result. It is hoped that if presentation of similar facts and data before other agencies or regulatory bodies is required, the same materials used there may be used to satisfy the showing requirements of subsection (cc). The specific instances listed in that section are for general guidance, and it is expected that any appropriate reports or materials which address the requirements of subsection (cc) may be used.

The language and idea in subsection (dd) of the final Regulation first appeared in the second Agency draft and were necessary additions. The changes subsequently made were for purposes of clarity.

Subsection (ee). This subsection is essentially procedural, and points out that an adequate showing under subsection (cc) must be made before any specific thermal standard will be promulgated by the Board. Similar language to that of subsection (ee) of the final Regulation first appeared in subsection (dd) of the first Agency proposal. In subsequent drafts, the word "alternate" was changed to reflect the difference between the specific thermal standards to be set under this Regulation, and an alternate thermal standard to be set pursuant to §316(a) of the FWPCA.

As proposed in the second Agency draft, this subsection was simply too limiting. The language used there for (ee) would have required an "all or nothing" determination by the Board, in that it did now allow for the adoption of any specific thermal standard other than that requested by a discharger. The Board requires a greater flexibility in determining the proper thermal standard for an individual artificial cooling lake, and the language of subsection (ee) was changed accordingly.

Other Subsections. Both the second Agency draft and the Board's proposed final draft contained additional subsections to Rule 203(i)(10), which were subsequently dropped in the final Regulation. A subsection (ff) was contained in both the second Agency draft and the Board's proposed final draft, and the latter contained an additional subsection (gg).

Subsection (ff) as contained in the second Agency draft would have led the Board to consideration of a "grandfather" clause, based on the existence of a Variance, before there was in fact any artificial cooling lake with an applicable Variance. The Agency apparently felt that this would be appropriate to deal with the case of Illinois Power's Lake Clinton, which was then the subject of a pending Variance proceeding in PCB 75-31. (On July 31, 1975, the Board did grant a two year Variance of "specific standards" for Lake Clinton.) While this was intended by the Agency to eliminate unnecessary duplication of effort by Illinois Power, the Board felt that the statutory requirements for Variances and those for regulatory amendments were not sufficiently similar to allow this as a "grandfather" vehicle. It was questionable whether, 1) the public

hearing requirements for a Regulation could properly be fulfilled by the Variance hearings, and 2) because a Variance is designed to grant temporary relief from the general rules, and is conditioned on efforts to achieve compliance with those general rules, it was not clear that temporary approval of a thermal effluent under those conditions would be legally sufficient to justify the permanent imposition of the same standard.

In the Board's proposed final draft, published on July 24, 1975, we significantly changed the thrust of subsection (ff). Instead of granting an actual "grandfather", the Board's language provided that certain factors could amount to prima facie proof of compliance with the showing requirements of subsection (cc). The Board proposed this subsection to resolve the problems which the Board had seen with duplication of effort, and in part to recognize that the points considered by the U.S. EPA in a 316(a) determination approximate those which the Board might consider in reaching a specific thermal standard for an artificial cooling lake. Among other problems raised regarding this language, it was pointed out that this version of subsection (ff) might shift the burden in the regulatory proceedings envisioned in subsection (cc) away from the discharger and to any citizen objectors. The problem of re-delegation vis-a-vis the Board's fact finding function under the Act was also a problem with this language.

With its proposed final draft the Board also offered an alternate section (ff) in an attempt to deal with the problem of pre-emption as between federal law, (in §316(a)), and applicable state law. By dropping subsections (ff) and (gg) in the final Regulation, we effectively eliminate any present case or controversy on the issue, so we need not discuss it here.

In a public comment dated July 28, 1975, the Agency submitted two further proposals for alternate language in subsection (ff). Again, the central issue in these proposals by the Agency was a "grandfather" for Lake Clinton, or any other artificial cooling lake which might achieve the same regulatory status. The Agency alternatives focused on the following facts:

1. Lake Clinton had already been the subject of numerous public hearings and regulatory proceedings before public bodies, i.e., the AEC and NRC.

2. Lake Clinton had already received tentative approval of an alternate thermal standard under §316(a) of the FWPCA, from the U.S. Environmental Protection Agency.

3. Lake Clinton was then before the Board in a Variance proceeding, PCB 75-31, wherein the Agency had already submitted a Recommendation that the Variance be granted, adopting essentially the same standards as those contained in the tentative §316(a) approval of U.S. EPA.

It was the Agency's contention that any discharger having met the burden already carried by Illinois Power for Lake Clinton should be entitled to a specific regulatory thermal standard without again being required to propose and defend the same standard. While the Board agrees that duplication of effort is to be avoided whenever possible, we cannot delegate our fact finding or regulatory functions to another agency, even where that agency's requirements and goals are the same as those of the Board. While we may rely on the expertise of other agencies, we cannot redelegate our statutory powers to them. We may take steps to avoid unnecessary duplication only to the extent allowed by law.

Although the Board did not adopt any of the language in subsection (ff), from any of the drafts, the same result for Lake Clinton was reached in new Rule 203(i)(11)(aa). However, the determination to apply a specific thermal standard to Lake Clinton was based in part on the foregoing factors, but more importantly, also on the following additional fact:

4. Illinois Power was a participant in the instant proceeding, and its Lake Clinton was therefore the subject of consideration in it. The Board was able to examine essentially all the materials in this proceeding which had previously been submitted to the AEC, NRC, U.S. EPA, and to this Board in the Variance case. The record in this proceeding was then replete with the substantive environmental showing which is the justification for a specific thermal standard for Lake Clinton.

Subsection (gg) was subsequently dropped as unnecessary. Those factors which the Board must consider in any regulatory proceeding are presently set out in the Act. Unlike subsection (cc), it was not felt that additional guidance will be required in this regard. Specifically addressing

alternate subsection (gg) as published with the Board's proposed final draft, we note that whether the requirements for a showing under subsection (cc) will affect our future determinations under Rule 410(c), after assumption of NPDES authority, must be decided on a case-by-case basis.

Nor did the final Regulation contain the proposed Rule 957(a)(7) seen in Edison's original draft. By requiring only a statement from the Illinois Department of Conservation concerning a lake's recreational value, the Edison proposal completely ignored the need for any consideration of the overall environmental effect of an existing or proposed artificial cooling lake. As it has been noted, there may indeed be some relationship between the recreational value of a lake and its environmental soundness. The record notes that it is the existence of, or the conditions capable of supporting, fish at the top of the aquatic biota that is a significant binding fact in the relationship between recreation and environmental soundness. The section as proposed by Edison was therefore notably deficient. The recreational value of a lake is, however, one of many aspects to be considered by the Board in a Regulatory proceeding pertaining to an artificial cooling lake.

Rule 203(i)(11). This section was added to the final Regulation because, 1) The Board had before it sufficient legal and factual grounds to set a specific thermal standard for Lake Clinton, and, 2) it would serve no purpose, at yet another hearing, to once again examine the evidence on Lake Clinton, at further expense to both the discharger and the Board.

Subsection 203(i)(11)(aa)(1). This subsection sets an absolute maximum thermal standard for Lake Clinton. This is the same maximum set by the Board in the Variance case, PCB 75-31, and by U.S. EPA in its tentative §316(a) determination, and by NRC in its recommendation to U.S. EPA. The basis for this standard is fully set out in the Variance Opinion, and the evidence is again examined, in part, in the foregoing sections of this Opinion, (cf., Ex.1 to comment c, Copy of letter from Illinois Power Co. to U.S. EPA, dtd. April 14, 1975).

In summary, we have examined the possibility of ecological damage, and weighed this against the costs which would be required to comply with general Board thermal standards vis-a-vis alternate cooling methods at Clinton Station, and, the public benefits which will accrue from Clinton Station and Lake. Our findings are:

1. There remains a possibility of ecological harm in Lake Clinton; but the possibility is no more than that: a possibility. In the Board's grant of a specific thermal standard it was a most important consideration that Illinois Power had committed itself to whatever corrective action may be necessary should such a possibility be realized. Further, the present record indicates an improbability of even minimal environmental damage, other than as noted in the Variance Opinion and the foregoing parts of this Opinion, under the conditions accompanying the imposition of the specific thermal standard for Lake Clinton. (These conditions are those taken from the Variance.)

2. Clinton Station and Lake will provide considerable public and economic benefit to the immediate area and to the state as a whole.

3. The costs to provide such cooling as would be required to meet the general thermal standards would be excessive, and in light of the foregoing a requirement that those standards be met cannot be justified by the record before us.

Indeed, as we noted in the Variance Opinion, effluent temperatures at Lake Clinton will possibly not exceed the general thermal standards during most years under average meteriological conditions. But predictable and probable conditions in dry years will result in summer effluent temperatures approaching or equalling 96°F.

Subsection 203(i)(11)(aa)(2). This subsection specifically adopts into the Regulation conditions (i) through (viii), which accompanied the Variance granted in PCB 75-31. While the principal grounds for our imposition of the specific thermal standard for Lake Clinton were our findings on the likelihood of environmental damage and the costs of requiring compliance with the general standards, the matters which are the subject of those conditions to the Variance provided additional factors which, under the Act, had to be weighed. These factors provided further weight in favor of imposing a specific thermal standard.

The most important of these conditions, was Illinois Power's commitment to take whatever measures are necessary to prevent further environmental damage should conditions as predicted in the §316(a) demonstration for Lake Clinton not be achieved in the Lake. The condition is of sufficient importance to warrant its inclusion here:

> That if it is determined after operation of the first unit or by ongoing research, that conditions in Clinton Lake will be significantly different than has been described in the 316(a) demonstration, or if it is determined that the cooling water use, recreational aspects of the lake, or that protection and propagation of indigenous aquatic life cannot be assured, Illinois Power Company shall take whatever measures are needed to correct the problem, including backfitting of the proposed or existing plant with additional cooling facilities.

That condition is a total commitment in plain language to provide adequate protection of the aquatic environment and biota in the proposed Lake. It is in keeping with the Board's previously stated intent in Rule 203(i)(5). Further, it is our opinion that this commitment by Illinois Power will act as an effective waiver of any right which the company might have under §1316(d) or §1326(d) of Title 33, United States Code, or any other statutory language designed to prevent the imposition of more stringent standards at a future date. (FWPCA, §§306(d), 316(c).) That being the case, we are assured that protection of the environment will not be jeopardized by our action here.

To a lesser degree, the remaining conditions also entered into our consideration of the specific thermal standard for Lake Clinton. These included a commitment by Illinois Power to provide start-up and shut-down procedures for the Station which will prevent "thermal shock", which the instant record showed may prove damaging to aquatic life even when the upper and lower temperatures would not, by themselves, prove harmful. In addition, Illinois Power has agreed to submit operating plans for the Lake which will assure protection of its fishery and recreational value. This, in conjunction with a commitment to allow public access to the Lake, will provide a further and considerable public beneficial use of the Lake.

Finally, it should be noted that condition (i) of the Variance is in effect a part of the specific thermal standard which we have imposed. That condition is a requirement that Illinois Power operate a supplemental cooling system in conjunction with the lake itself, employing a minimum of 232 spray modules along the 3.1 mile discharge canal from the Station's two units to the Lake. The condition can be summarized as a requirement that the "spray canal", more fully described in a earlier section of this Opinion, will be phased into operation each summer as ambient and discharge temperatures rise, to assure safe temperature levels in the Lake. If, even with this supplemental cooling system in operation, temperatures were to exceed the 96° absolute maximum specific thermal standard, Illinois Power must take whatever actions are necessary--including a cutback in generating operations--to remain within that maximum.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion was adopted on the 29th day of September, 1975, by a vote of 4 to 0.

Christan L. Moffett

Christan L. Moffett, Clerk
Illinois Pollution Control Board