

ILLINOIS POLLUTION CONTROL BOARD
November 15, 1989

IN THE MATTER OF:)
)
PROPOSED DETERMINATION OF) PCB 87-93
NO SIGNIFICANT ECOLOGICAL) (Thermal Demonstration)
DAMAGE FOR THE JOLIET)
GENERATING STATION)

MR. A. DANIEL FELDMAN APPEARED ON BEHALF OF COMMONWEALTH EDISON COMPANY;

MR. JOHN J. BRESLIN APPEARED ON BEHALF OF THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY;

MR. ALBERT ETTINGER APPEARED ON BEHALF OF INTERVENOR SIERRA CLUB, GREAT LAKES CHAPTER.

OPINION AND ORDER OF THE BOARD (by R. C. Flemal):

This matter comes before the Board upon a June 19, 1987, Petition for Thermal Determination under 35 Ill. Adm. Code 302.211(f) filed by the Commonwealth Edison Company ("Edison"). An Amended Petition was submitted to the Board by Edison on August 1, 1988, with the intent that this Amended Petition replace the previously submitted petition.

The issue before the Board in a thermal demonstration is whether the petitioner has shown that thermal discharges from the petitioner's facility have not caused or cannot be reasonably expected to cause significant ecological damage to General Use waters. In the absence of such showing, Board is required, pursuant to Section 302.211(f), to order the petitioner to take appropriate corrective measures.

In the instant matter, Edison requests the Board to determine that the discharges from its Joliet Station have not caused, and cannot be reasonably expected to cause, significant ecological damage to the "Five-Mile Stretch" of the lower Des Plaines River. The Five-Mile Stretch is that segment of the lower Des Plaines River between the Interstate 55 Bridge and the head of the Illinois River (confluence of the Des Plaines River with the Kankakee River). It is the General Use water most immediately downstream of Edison's thermal outfall.

Based upon consideration of the record as explained below, the Board finds that Edison has successfully made its demonstration. Accordingly, the Board need not order that corrective measures be undertaken.

PROCEDURAL HISTORY

As part of its June 19, 1988 petition Edison requested that the Board determine that the submission of a Section 302.211(f) petition for the Joliet Station is not necessary. Edison argued that because the Joliet Station discharges into the Des Plaines River at a point where Secondary Contact Standards govern, the thermal demonstration of 302.211(f) for discharges into General Use waters is not required. However, the Board by Order of September 17, 1987 found that 302.211(f) does apply to Edison. Specifically, the Board found that even though Edison's immediate discharge is to Secondary Contact waters, the discharge nonetheless impacts the downstream General Use waters.

Hearings were held on November 29 and 30, and December 7, 1988 in Chicago. Members of the public attended the hearings. The Great Lakes Chapter of the Sierra Club ("Sierra Club") participated as intervenor. A series of briefs and reply briefs were submitted in this proceeding. Edison filed its brief on February 16, 1989; Sierra Club filed its reply brief on April 7, 1989; the Illinois Environmental Protection Agency ("Agency") filed its brief on May 1, 1989; Edison filed its reply brief on May 11, 1989; and Sierra Club filed its brief in response to the Agency's brief on May 12, 1989.

The Agency supports Edison's petition, contending that Edison has satisfied the requirements of Section 302.211(f) and that Edison's thermal discharges have not caused and cannot be reasonably expected to cause significant ecological damage. Sierra Club contends that Edison has not met its burden of proof and urges that Edison's petition be denied.

PLANT DESCRIPTION AND OPERATIONS

Edison owns and operates the Joliet Station, a steam-electric generating facility capable of producing 1,414 net megawatts of electricity. The station is located in Will County, approximately one mile southwest of the City of Joliet, Illinois, adjacent to the Des Plaines River. The station consists of three coal-fired units, Units 6, 7, and 8 (Report at 1)¹.

¹ The "Report of Petitioner Commonwealth Edison Company in support of Petition for Determination under Rule 302.211(f) (1988 Submittal)" was submitted as part of Edison's Amended Petition and admitted into the record at transcript page 226, but not given an exhibit number. The document will be cited as "Report at ____."

The Joliet Station utilizes Des Plaines River water for once-through condenser cooling. The station has two thermal discharges to the Des Plaines River; one from Unit 6 on the east bank of the river and the other from Units 7 and 8 on the west bank. The design maximum temperature rise in the circulating cooling water is approximately 9.4°F, with a total circulating flow rate of 2,620 cubic feet per second. Both thermal discharges flow into the Des Plaines River approximately one mile downstream of the Brandon Road Lock and Dam, at River Mile 285, which is approximately seven miles above the I-55 Bridge, the beginning of the Five-Mile Stretch (Report at 2).

The annual average capacity factors of the Joliet Station from 1982-1987 have ranged from 29.9% to 45.7% with a six year average of about 38.3%. Edison states that since the Joliet units are less economical on a marginal cost basis than Edison's nuclear units and certain other coal units, annual average capacity factors are expected to be much lower than 38% over the next five years and are not expected to exceed 33% during the remaining life of the station. Maximum operation of this station generally occurs during Edison's peak summer-month demand periods. Higher daily load factors approaching 80% may be expected during this time. However, monthly summer capacity factors normally are approximately 50% (Report at 1).

Projected annual capacity factors (1988-1991) for the Joliet units range from 18.1% - 23.6%, with a four-year annual average of 21%². Thus, it is expected that the future operating regime of the station will remain similar to or less than that of the past three years. With the greater reliance on the new nuclear units, dependence on the older fossil units, such as those at Joliet Station, may decrease further. Although there have been no specific plans made regarding retirement of the units, Edison has estimated retirement dates between 2002-2005 for the three Joliet units (Report at 3).

The Joliet units have been shutdown on several occasions for various reasons. Shutdown durations range from minutes to months. Most of the instances of extended duration (twelve or more days) were due to the scheduled maintenance of each unit (Report at 1).

² It is apparent from testimony that the annual capacity factor for 1988 was probably higher than projected due to the excessive heat during that summer, although it was not stated how much higher (R. at 13-15).

NATURE OF A THERMAL DEMONSTRATION

Certain dischargers of heated effluent are required to perform a thermal demonstration pursuant to 35 Ill. Adm. Code 302.211(f). This subsection states in pertinent part:

The owner or operator of a source of heated effluent which discharges 150 megawatts (0.5 billion British thermal units per hour) or more shall demonstrate in a hearing before this ... Board ... not less than 5 nor more than 6 years after the effective date of these regulations ... that discharges from that source have not caused and cannot be reasonably expected to cause significant ecological damage to the receiving waters. If such proof is not made to the satisfaction of the Board appropriate corrective measures shall be ordered to be taken within a reasonable time as determined by the Board.

In order to make a thermal demonstration as required by Section 302.211(f), a petitioner must submit information in accordance with the Board's procedural rules at 35 Ill. Adm. Code 106.Subpart A. Such rules require information on the general plant description, method of heat dissipation, plume studies, and biological studies.

PRIOR VARIANCES

Since the substance of Section 302.211(f) was adopted in June 1972³, it is uncontested that Edison was originally required to make its 302.211(f) demonstration prior to July 1978.

However, Edison has been granted three variances from the requirement to perform its thermal demonstration (PCB 78-79, May 25, 1978, 30 PCB 315; PCB 81-24, June 10, 1981, 42 PCB 55; and PCB 84-33, December 20, 1984, 60 PCB 1). In each case the Board found that it would be unreasonable for Edison to engage in a thermal demonstration at that time because temperature was not then a relevant and limiting factor in the quality of the Five-Mile Stretch. The Board reasoned that the installation of control equipment (or, in the alternative, derating) would not be reasonable as long as such control measures could not be reasonably expected to lead to an improvement in the aquatic habitat. It would therefore be meaningless to undertake an

³ In the Matter of Water Quality Standards Revisions, R72-4, adopted June 28, 1973; supporting Opinion adopted November 8, 1973 at 10 PCB 69. As adopted, this rule was Rule 203(i)(5). Upon codification it was changed to Section 302.211(f).

exercise the purpose of which is to determine what control equipment, if any, was needed to improve the aquatic habitat.

Edison and the Agency contend that, even today, heat is not a factor which limits the quality of the aquatic habitat of the Five-Mile Stretch. However, rather than continue to pursue the variance route under the uncertain prospect that heat will eventually become limiting, Edison proposes to discharge its 302.211(f) obligation now. Edison's desire to proceed at this time appears to be based in part on Edison's belief that it is in compliance with all pertinent thermal water quality standards, and hence that it cannot plead that compliance with the standards would constitute an arbitrary or unreasonable hardship. Similarly, Edison appears to believe that the information necessary to make its demonstration is available and ready to be presented. Hence, there is no basis for a finding that gathering and presenting this information would constitute an arbitrary or unreasonable hardship. Moreover, Edison's last variance expired on July 1, 1987, triggering the requirement that the thermal demonstration now be made.

APPLICABLE WATER QUALITY STANDARDS

The Des Plaines River from its confluence with the Chicago Sanitary and Ship Canal (five miles upstream of Joliet Station) to the I-55 Bridge is designated as Secondary Contact and Indigenous Aquatic Life water. Hence discharge from the Joliet Station is to points where Secondary Contact Standards govern. Section 302.408 contains the temperature standard for Secondary Contact water:

Temperature ... shall not exceed 34°C (93°F) for more than 5% of the time, or 37.8°C (100°F) at any time.

In previous orders, the Board has found that although the Joliet Station discharges into water designated Secondary Contact, the General Use water downstream at the Five-Mile Stretch is also affected. Therefore, Edison must make the showing required under Section 302.211(f). The General Use Standards for temperature do not become applicable to water affected by Edison's discharge until such water reaches the I-55 Bridge. These General Use Standards, which are found 35 Ill. Adm. Code 302.211(b) though (e), state in pertinent part:

- b) There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.
- c) The normal daily and seasonal temperature fluctuations which existed before the addition of heat due to other than natural causes shall be maintained.

- d) The maximum temperature rise above natural temperatures shall not exceed 2.8°C (5°F).
- e) In addition, the water temperature at representative locations in the main river shall not exceed the maximum limits in the following table during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 1.7°C (3°F).

	°C	°F		°C	°F
JAN.	16	60	JUL.	32	90
FEB.	16	60	AUG.	32	90
MAR.	16	60	SEPT.	32	90
APR.	32	90	OCT.	32	90
MAY	32	90	NOV.	32	90
JUNE	32	90	DEC.	16	60

EDISON'S CASE

The focus of the information presented by Edison is related to three general contentions which Edison makes before the Board. These are:

- 1) That the heated discharge from the Joliet Station is in compliance with all applicable Illinois laws and regulations;
- 2) That [Edison] has made a commitment to continue this record of compliance; and
- 3) That existing physical and chemical conditions associated with domestic/chemical waste disposal and transport and unrelated to the discharge of heat from Joliet Station are paramount in controlling ecological balances in the Des Plaines River system. Heat discharged from Joliet Station plays no significant role in determining the well-being of aquatic life within the drainage.

Edison Brief at 15

Edison presented the testimony⁴ of five witnesses in support of its contentions. These were Mr. Thomas E. Hemminger, Director of Water Quality in Edison's Environmental Affairs Department; Dr. John F. Kennedy, Hunter Rouse Professor of Hydraulics and Director of the Iowa Institute of Hydraulic Research at the University of Iowa; Dr. Ben B. Ewing, Professor of Environmental Engineering Emeritus, Department of Civil Engineering and Institute for Environmental Studies, University of Illinois at Urbana-Champaign; Dr. William M. Lewis, Visiting Professor in Fisheries, Southern Illinois University; and Dr. Robert G. Otto, ecologist and fisheries biologist, and president of the consulting firm of R. G. Otto and Associates.

Thomas E. Hemminger

Mr. Hemminger presented a general overview of Edison's current proposal. He noted Edison's belief that both the Secondary Contact and General Use portions of the Des Plaines River are currently in compliance with the Board's temperature standards (Edison App. 1 at 2). Mr. Hemminger noted that Edison has operated a temperature monitor at the I-55 bridge since mid-1984, and that the data collected there indicate that the General Use temperature limits were not exceeded during 1984-87 (Edison App. 1 at 2; Petition Table 8). He further contended that exceedances of the General Use Standards are not to be expected in the future. He attributed this circumstance in part to decreased operations at the Joliet Station and emphasized that additional projected decreases in operations will further limit the impact of the Joliet Station on the Des Plaines River (Id. at 3).

Mr. Hemminger next explained Edison's efforts at analyzing the effect that Edison's thermal discharges have on downriver temperatures, and the steps that Edison is undertaking to further minimize the effect. He noted that results of modeling studies (see following) have been incorporated with river flow data and cooling water intake temperatures to allow Edison to develop a

⁴ Written copies of the testimony of each of Edison's five witnesses were appended to the Amended Petition. At hearing, each witness attested to his written comments and noted any corrections, and the testimony was admitted and given an exhibit number. However, the testimony was not entered into the transcript "as if read". Citations to the testimony will therefore be to the appendix number as printed in the Amended Petition and page number, such as "Edison App. 1 at 2". Any attachments to the testimony will be cited to the numbers given therein, such as "Edison App. 2, Figure 3". It should be noted that Edison's Exhibits 1 through 5 are the same as Edison's Appendices 1-5 of the Amended Petition.

relationship between plant load and instream water temperatures (Edison App. 1 at 6 and G and H). Edison believes that it can use this relationship, as an operating protocol, to adjust operations at the Joliet Station, including temporary derating if necessary, to continue to assure that the Joliet Station does not contribute to violation of any of the ambient water quality temperature standards (Edison App. 1 at 6). In particular, the protocol is "designed to achieve the 90° general water quality standard" at the I-55 Bridge and never to exceed 93° (R. at 69-70).

Lastly, Mr. Hemminger reviewed Edison's options should it be found by this Board that corrective action is necessary. He noted that Edison considers cooling ponds and natural draft towers not to be feasible options because of land and height limitations at the Joliet Station (Edison App. 1 at 6). The one viable cooling option appears to be the use of mechanical draft cooling towers. However, Edison believes mechanical draft cooling towers raise several serious environmental concerns due to the need to site them within a congested area. Among these are icing and moisture causing flashover on electrical transmission lines, and fogging (Id. at 7). Moreover, Edison believes that mechanical draft cooling towers may be so costly, particularly for a facility now seeing only limited duty, as to require retirement of some or all of the Joliet units (Id.)⁵.

Dr. John. F. Kennedy

Dr. Kennedy discussed studies he has undertaken on Edison's behalf regarding how excess heat from the Joliet Station is distributed in the Des Plaines River and the extent to which this heat may affect downstream locations. Dr. Kennedy based his testimony on results of computer-based modeling of the magnitudes, spatial distributions, and rates of change of temperature rise produced in the Des Plaines River by discharges from the Joliet Station (Edison App. 2 at 1-2).

As a basic principle, Dr. Kennedy noted that temperature of the Edison effluent decreases downstream due to a combination of mixing and heat transfer to the atmosphere (Edison App. 2 at 2). Based upon his modeling studies, Dr. Kennedy concluded that at high discharge the Edison effluent is completely mixed after

⁵ It should be noted that the parties stipulated that further information on the issue of corrective measures would not be presented unless corrective measures becomes an issue in the proceeding (Hearing Officer Exh. 1). Corrective measures become an issue only should the Board find that Edison has not successfully made its demonstration.

two miles of transport, and that at low discharge complete mixing is achieved after five to six miles of transport; this condition occurs even at maximum plant loads (Id. at 4). Therefore, Dr. Kennedy concluded that there is no plume effect recognizable at the I-55 bridge (Id. at 5).

Dr. Kennedy also calculated water-temperature rises at the I-55 bridge under various plant loads and river discharge conditions. For the 7-day 10-year low-flow and average plant load Dr. Kennedy calculated that the station-induced temperature rise at the I-55 bridge would be 2.9°F (Edison App. 2 at 8).

Lastly, Dr. Kennedy modeled the temporal variation in water temperature at the I-55 bridge which would occur due to load changes at the Joliet Station. Dr. Kennedy found that the maximum rate of temperature change for a plant load reduction from 1,100 megawatts to zero load in about 55 minutes is less than about 0.3°F/hr (Id.).

Dr. Ben B. Ewing

Dr. Ewing discussed the past and present water quality conditions within the Des Plaines River, with emphasis on how water temperatures interplay with the various other water quality parameters. He also compared the water quality of the lower Des Plaines River with that of some other Illinois Rivers. The results of his studies yielded several conclusions, including statements on the water quality of the Lower Des Plaines:

The waters of the Lower Des Plaines river are of marginal water quality. There has been some general improvement in some of the important water quality indices in the years between 1979 and 1983, but little change since then.

Comparison with general quality data for other Illinois streams indicates that the Lower Des Plaines River is still inferior. The presence of toxic metals, PCB's and pesticides in sediments and macrophytes places the stream in the two poorest categories of the Illinois stream sediment classification system.

Edison App. 3 at 11

Through analysis of hypothetical scenarios using conditions considered typical of those on the lower Des Plaines, Dr. Ewing estimated the effect of temperature increases on DO, BOD, ammonia nitrogen, and fecal coliform bacteria. His conclusions for these parameters are:

Except under extreme worst-case conditions, the DO is expected to decrease less than 10% due to temperature

risers resulting from thermal load of the Joliet Station. The greatest value projected for the DO decrease caused by temperature increase was 15% at the lower end of the Five-Mile Stretch under summer conditions with low flow and assuming the high bacterial decomposition rate constant, k , equal to 0.3 per day. This scenario predicts DO values less than 4.0 mg/l, which has not been observed to occur. It is concluded that this far range of conditions is more adverse to the DO regime than actually occurs. It is not likely that the DO will decrease more than 10% under any usual conditions.

At average stream flow, the decrease in DO and BOD will be less than 10% and at maximum flow the decrease will be less than 5% under all summer conditions and at all decomposition rate constants. Under the winter conditions, the DO and BOD will decrease less than 8% at the lower end of the reach and less than 5% at the upper end, even under the worst conditions.

The increase in temperature resulting from the Joliet Station thermal load will decrease the BOD in the Five-Mile Stretch by percentages slightly less than for DO. This is due to the effect of temperature increase in speeding up the bacterial decomposition of organic matter. The more rapid decomposition would be considered desirable for the self-purification of the stream if the DO depletion is not too great.

The ammonia nitrogen would be decreased at higher temperatures because of the more rapid nitrification. The percent un-ionized ammonia would be increased 14% but the remaining total ammonia would be decreased about 12% so the net effect would be very small. The effect of the increased nitrification on DO is reflected in the DO analysis because the oxygen depletion is based on a rate constant for combined carbonaceous and nitrogenous BOD exertion.

There would be significantly fewer fecal coliform organisms surviving in the stream due to the faster die-away at higher temperature. This would be the change of the greatest magnitude. Since the waters of the Lower Des Plaines River are not used for public water supply, for body contact recreation, or for shellfish production, the decreased coliform organism count would not be very important.

The overall result is that some water quality parameters would be slightly worse and some would be somewhat better as a result of a temperature

increase. The net effect would be small. It is concluded that these hypothetical analyses provide a reasonable estimate of the magnitude of the temperature effect on water quality and that it would be virtually impossible to measure the actual effect because of the many confounding variables and the small change involved.

Edison App. 3 at 11-12

Dr. William M. Lewis

Dr. Lewis discussed the current status of the fish community of the lower Des Plaines River. He also provided his estimation of what improvements in the fish community may be reasonably expected in the future. He noted that studies indicate that improvement in the Des Plaines had occurred from 1977-1987, as indicated by a trend of increase in species diversity (Edison App. 4 at 3). He cautioned, however, that "there are still water quality problems which apparently continue to limit species diversity", as indicated by the high incidence of disease and physical abnormalities found in fish collected (Id.). He also stated that the nature of the diversity appears questionable in that "[m]any of the new species appear so seldom and in such limited numbers as to suggest that they are not newly established members of the community, but more likely are recent invaders that are not destined to persist" (Id.).

Lewis testified that current observations continue to indicate poor water quality, as shown by chemical analysis of the sediments which indicate levels of heavy metals in the "Highly Elevated" and "Extreme" categories, and high levels of heavy metals found in microphytes collected from the Des Plaines (Edison App. 4 at 1-2). He further noted that barge traffic through the Five-Mile Stretch is pronounced, adding that while "repeated resuspension of sediment by barge traffic probably hastens decomposition of toxic sediment, there is little question but that the preponderance of environmental effects of barge traffic is negative" (Id. at 2).

He finally concluded that "the thermal discharge from Edison upstream plants has not adversely affected the fish community of the Five-Mile Stretch and that there is little or no basis to anticipate that the extent of elevation of the temperature as now exists will have any adverse effects" (Edison App. 4 at 5).

Dr. Robert G. Otto

Dr. Otto presented a synopsis of the other consultants reports and a summary of the ecosystem implications of each of the components of the various testimonies.

Dr. Otto underscored Dr. Ewing's testimony that the heat discharges from the Joliet Station interact with the ambient water in several ways. On balance, Dr. Otto concluded:

[t]hese changes would be considered to be advantageous in the overall recovery of the water courses, both ecologically and with regard to human health. Heat discharges at Joliet Station are, at worst, a benign factor in the overall chemical dynamics of the system and, at best, play a positive role in the restoration of a desirable physical-chemical environment.

Edison App. 5 at 6

Dr. Otto pointed out the complex factors which have, and which in his opinion will continue to, determine the ecological quality of the lower Des Plaines River:

The drainage receives an extraordinary variety of domestic, industrial and urban runoff-type wastes that have historically resulted in a highly degraded character for both the water quality and sediment conditions. Sections of the channel have been straightened and dredged with the associated loss of habitat diversity to facilitate a high volume of barge traffic. These barges continually resuspend the bottom sediments causing high turbidity and enhancing the release of contaminants to the water. The natural character of the river has been totally disrupted for a considerable distance downstream of the Station.

There has been a significant public effort in recent years to improve environmental conditions in the drainage. This has included major expenditures for upgrading public water treatment and wastewater storage facilities. There have also been substantial improvements in control of non-point source inputs. The actual improvements in water quality and associated enhancements of opportunities for public use of the waterways are difficult to define and may lag expectations to some degree. Nonetheless, there is substantial momentum for demonstrating improved water quality or enhanced recreational use/esthetic appreciation of the drainage. ... [t]he Company [Edison] is anxious to assure this Board that operations at Joliet Station do not, in any way, impede the recovery and restoration process.

Edison App. 5 at 5-6

Dr. Otto noted that, given the many complex impacts of man on the lower Des Plaines River, it is difficult even to define what constitutes "significant ecological damage" related to a single source (Edison App. 5 at 3). Dr. Otto testified that, nevertheless, an analysis of whether significant ecological damage has occurred or is likely to occur should take into consideration expectations for ecological structure and function. This includes analysis of the types and amounts of habitat, and of the flora and fauna occupying comparable habitats downstream or comparable nearby waters. In addition, in the case of the lower Des Plaines River, it should take into account the ecological changes associated with diversions from Lake Michigan, upstream effluent discharges, and habitat losses resulting from channelization and constant disruption by barge traffic (Id. at 6-7).

Dr. Otto emphasized that the testimony of Dr. Lewis shows that the lower Des Plaines River exists in a depauperate ecological state, and that it is dominated by species characteristic of degraded conditions (Edison App. 5 at 7). He concluded, as does Dr. Lewis, that there are pragmatic limitations on expectations for the lower Des Plaines. Most significantly, he and Dr. Lewis concluded that the present and projected future thermal regime of the river is an insignificant factor in controlling the existing ecological balance (Id.); it is also an insignificant factor which does not inhibit the recovery process (Id.).

Finally, among other points underscored by Dr. Otto was Dr. Kennedy's observation that, given a total shutdown of the Joliet Station over a minimum period of one hour, the rate of temperature decline at the I-55 bridge would be at the most on the order of even less than that which often occurs on a daily basis due to natural factors alone (Edison App. 5 at 5). Dr. Otto therefore suggests that variable operation of the Joliet Station should not lead to cold shock, a winter affliction associated with the abrupt loss of heat, of fishes within the Five-Mile Stretch (Id.).

AGENCY POSITION

The Agency supports Edison's demonstration. Among the Agency's conclusions is that the Joliet Station's discharge complies with the temperature limits set forth in both the Secondary Contact and General Use Standards. The Agency therefore agrees with Edison that compliance with all present thermal standards currently exists. The Agency further accepts Edison's commitment to load manipulation at the Joliet Station as assurance of continued compliance with the General Use Standards at the I-55 bridge (Agency Brief at 2).

The Agency's principal position is that the subject waters are an impaired segment of the Des Plaines River, and that the present water temperature regime is not likely to be the limiting factor of a more diverse aquatic assemblage. The Agency notes that it has used several sources of information upon which it bases this conclusion. Among these are findings of Agency surveys on the river system and a review of discharges to the river (Agency Brief at 4).

The Agency reviews the water quality of the Des Plaines Basin in its Brief, noting such matters as the occurrence of limited use support, the existence of a sport fish health advisory on the lower Des Plaines River, and the large volumes of wastewater which characterize the flow of the river (Agency Brief at 4-5). The Agency further emphasizes that many water quality problems exist in the lower Des Plaines, including phosphorus, pH, dissolved oxygen, ammonia toxicity, municipal and industrial discharges, combined sewer overflows, urban runoff, and agricultural runoff (Id. at 5). Sediment composition is also a problem, including its arsenic, chromium, lead, mercury, zinc, cadmium, chlordane, DDT, and dieldrin components (Id.).

The Agency also points out that bioassays of the Joliet Station effluent show no significant toxicity. This contrasts to the toxicity of some other effluents (that of the Joliet municipal treatment plant is cited) for which bioassays show 100% mortality (Agency Brief at 6).

The Agency concludes that, as long as the Joliet Station meets all the applicable standards at the point of discharge and in the downstream General Use waters, the Agency does not view the Station's thermal discharges as limiting the aquatic diversity of the receiving waters. The Agency therefore is of the opinion that it has been successfully demonstrated that the Edison's thermal discharges have not caused and cannot be reasonably expected to cause significant ecological damage (Agency Brief at 7-8).

SIERRA CLUB POSITION AND PETER H. HOWE

Sierra Club raises several challenges to Edison's general contentions noted above, including alleged violations of Section 302.211, which will be discussed more fully below. As a preliminary matter, the Board further notes that Sierra Club in its brief cites a number of studies which Edison alleges are not part of the record in this proceeding. In its reply brief, Edison moves that these references be stricken from Sierra Club's brief. The Board finds that all but two of the references alleged were not made part of the record. The Board denies the motion to strike. However, the Board has not considered the studies which were not made part of the record, nor the arguments based thereon, in its determination in this proceeding.

Sierra Club argues that heat discharges from the Joliet Station have probably caused significant harm to the environment and may well cause such harm in the future. Sierra Club raises several specific challenges to Edison's presentation here, including whether the heat discharge causes significant increases in unionized-ammonia, contributes to low dissolved oxygen levels, causes harm to fish spawning and development through temperature variations, causes reduction in fish populations through cold shock or heat aversion, increases toxicity of pollutants already present in the waterway, and destroys macrophyte populations. Sierra Club also challenges whether Edison's operations plan will assure that there will be no adverse effects on aquatic life. Sierra Club relied to a large extent upon the testimony of Peter H. Howe, former supervising biologist for Edison, who testified as a member of the public in this proceeding. His testimony, which includes many of the same concerns of Sierra Club, is also discussed here.

Ammonia Nitrogen and Dissolved Oxygen

Sierra Club does not challenge Dr. Ewing's conclusions regarding heat from the Joliet Station reducing total ammonia due to increased nitrification while increasing the percentage of unionized ammonia. However, Sierra Club does question whether or not significant nitrification is in fact occurring in the seven miles between Joliet Station and the I-55 Bridge. Sierra Club quotes a Metropolitan Sanitary District of Greater Chicago ("MSDGC") June 1987 Water Quality Proposal cited by Mr. Howe in his testimony, which apparently states that "there is little nitrification of ammonia within the MSDGC waterway"⁶ (Sierra Club Brief at 21-24). Mr. Howe further questioned whether or not chlorination of the cooling water or entrainment (movement of organisms through the condenser cooling system) may also affect nitrifying bacteria such that significant nitrification does not occur (Howe Exh. 2 at 25).

Sierra Club questions Dr. Ewing's conclusion that, although the heat discharge decreases dissolved oxygen levels, the effect on dissolved oxygen levels in the Five-Mile Stretch is very small. Sierra Club questions Dr. Ewing's hypothetical model, stating that Ewing, in his earlier report, cautioned that the one-day SOD values may be subject to error due to lag time in oxygen consumption (Sierra Club Exh. 9 at 6-7). Sierra Club argues from this that the DO values predicted by Dr. Ewing's

⁶ The Board notes, as does Sierra Club, that "the MSDGC waterway" extends only to Lockport, which is located upstream from the Joliet Station. It does not therefore coincide with the reach of the Des Plaines River under consideration herein.

model may be too high and addition of heat may cause violations of the DO standard that would not otherwise occur.

Effect on Fish Spawning and Development and Fish Populations
(Cold Shock, Heat Shock and Heat Aversion)

Sierra Club and Mr. Howe allege that the heat from Joliet Station may be affecting fish in at least three ways. These are: 1) decreased viability of gametes, 2) thermal related mortality of eggs and larvae, and 3) premature spawning. Sierra Club cites Mr. Howe's testimony wherein he discussed viability of fish eggs of certain species:

The USEPA Laboratory in Duluth (Jones et. al. 1977) has concluded based on studies that yellow perch and probably other species require winter temperatures for a certain length of time below 50°F if gametes are to be viable. If temperatures remained above 50°F, eggs would not be viable. At temperatures between 46 and 50° only a portion of the eggs would be viable and in order for "all" of the eggs to be viable average temperatures would have to remain below 43°F.

(Howe Ex. 1 at 21-2)

Mr. Howe further stated that yellow perch in the absence of elevated temperatures was hypothesized to become a common member of fish assemblage of the lower Des Plaines as water quality improves (Id.). He further noted that:

This species is a common inhabitant of the Upper Sanitary and Ship Canal and portions of the Chicago River as demonstrated in studies of this system by MSD [Metropolitan Sanitary District] biologists and reported in [Board proceeding] R87-27. . . It is reasonable to conclude that large numbers of this species will migrate down the Chicago waterways and populate the Lower Des Plaines as water quality continues to improve. Some migration is already occurring since this species is periodically sampled in the Lower Des Plaines and Upper Illinois River . . . Segments of the Lower Des Plaines, such as the DuPage River Delta where large macrophyte growth is now developing, would be ideal habitat for this species if maximum temperatures specified in the petition are no longer present.

(Id. at 14-5)

Sierra Club further states that Edison's Report shows that winter temperatures in 1986-7 may not have been cold enough to provide fish eggs the necessary "chill factor". The average temperatures reported were above 46°F, with maximum temperatures

of 55°F in December, 51°F in January and 54°F in February (Report at Table 7). Sierra Club indicates that Edison's Report at Table 7 shows a maximum spring temperature at the I-55 Bridge of 79°F in May 1985, 1986, and 1987, which is above the maximum temperature for embryo survival or spawning success for black and white crappie and smallmouth bass, as reported in Exh. 2 to Howe Exh. 1 (See also Howe testimony, R. at 539-40). Mr. Howe stated:

Existing and maximum temperatures specified in the Petition at the I-55 Bridge and even higher temperatures near the station in winter and early spring months are high enough to result in spawning by fish weeks earlier than normal.

Howe Exh. 2 at 6

Sierra Club further states that temperatures approaching the 63°/93°F limitation of subsection 302.211(e), as Mr. Hemminger testified are possible (R. at 71-3), could also be detrimental to fish spawning and larvae. Sierra Club cites Dr. Lewis' testimony that raising temperatures to 90°F in May could be detrimental to the larvae of some fish (R. at 177-8).

Sierra Club states that its Exhibit 10 indicates that a 12°F drop in temperature occurred over a thirty six hour period between June 8 and 10, 1988. Mr. Howe testified that had a such a temperature drop occurred in early May, there could have been widespread mortality of the larvae of yellow perch, northern pike, and white bass (R. at 536-7).

Sierra Club argues that in winter, fish near the Joliet Station discharge (Secondary Contact Water) may be subject to extreme temperature changes and suffer cold shock (Sierra Club Brief at 27-8). Mr. Howe discussed that fish in the Secondary Contact Water may also suffer heat shock at temperatures allowable for Secondary Contact Water. Neither Sierra Club nor Mr. Howe argued that Edison's discharge was causing exceedance of the Secondary Contact standards for temperature. Sierra Club also argues that some fish, particularly walleye, might avoid high temperatures (heat aversion) by going over the Dresden Lock and Dam and hence be lost to the Des Plaines System, since the dam effectively blocks all upstream migration (Howe Exh. 1 at 19, Howe Exh. 2 at 16-17, and R. at 174-5). Mr. Howe added:

Many species in the mesothermal group such as walleye and many species of catostomids such as redhorse species and white suckers will avoid maximum temperature increases specified in the Petition for the General Use Segment when these temperatures are several degrees above those that would normally exist in this area and there is a significant temperature gradient in the waterway.

Howe Exh. 1 at 19

In conclusion, Sierra Club argues that Edison has not shown the extent of its contribution to the temperature variations or, the extent to which heat from the Joliet Station may cause abnormal levels of mortality of fish in early life stages.

Toxicity of Other Pollutants and Effect on Macrophyte Populations

Sierra Club raises the question of the cumulative effect of heat discharge on other pollutants, stating that the toxicity of most substances increases as temperatures rise (See also, Dr. Ewing, Hearing Examiner Exh. 3 at 2).

Sierra Club cites Mr. Howe's testimony that on the basis of his observations of cooling ponds, maximum temperatures between 90° and 93°F may eliminate or significantly reduce macrophyte populations (Howe Exh. 2 at 20). Mr. Howe further supported his conclusions by studies showing that marsh grasses were eliminated at temperatures similar to those which occurred in the Des Plaines in 1988 (maximum temperature of 30°C) (Howe Exh. 2 at 20-1). Sierra Club challenges the Edison petition as incomplete because studies were not conducted on possible losses of macrophytes caused by 1988 temperatures (R. at 85), and because the petition did not address limiting temperatures for macrophytes or wetlands (Sierra Club brief at 29-31). This type of investigation of the effect of temperature on the macrophyte community was also suggested by Mr. Howe (Howe Exh. 2 at 21-22).

Challenges to Operations Plan

Sierra Club also challenges Edison's operations plan as untested, citing Mr. Hemminger's testimony that Edison is in the process of installing and field testing the revised temperature flow and monitoring system, and that the testing had not been completed as of the date of his testimony (R. at 68-9).

DISCUSSION AND CONCLUSIONS

Violations of Water Quality Standards

Much has been made in this record of alleged compliance or non-compliance with the Section 302.211(d) and (e) standards in the Five-Mile Stretch. Edison first contends that 302.211(d) and (e) do not apply to discharges from the Joliet Station⁷, and, second, that the discharges do not cause violations of 302.211(d) or (e). Sierra Club contends that violations have been recorded,

⁷ The Board notes that the Agency joins Edison in this contention.

and implies that Edison is at least partially responsible for them.

The Board finds that 302.211(d) and (e) do apply to the effect of Edison's discharges. Although Secondary Contact Standards may govern at the point of a particular discharge, it is possible for an entity located upstream of the beginning of General Use waters to cause or contribute to exceedances of the General Use Water Quality Standards. In fact, the reason the Board required Edison to perform a thermal demonstration under subsection (f) is because the Board recognized that a source which discharges to Secondary Contact waters could affect downstream General Use waters.

The Board finds, however, that in this proceeding the issues of whether violations of the 302.211 standards have occurred in the Five-Mile Stretch and, if they have, whether Edison is responsible for them, is at best ancillary to the matter at hand. The only proper forum for the Board to hear allegations of violation of the Board's rules is an enforcement action brought pursuant to Title VIII of the Illinois Environmental Protection Act. The Board cannot and will not here reach the issue of whether Edison is in violation of any Board water quality standard.

Consideration of whether there is non-compliance of the waters of the Five-Mile Stretch with the Board's water temperature standards can enter the immediate case only where non-compliance stands as proof of significant ecological damage associated with Edison's discharge. The Board finds that there is no substantive indication that any of the observed temperatures in the Five-Mile Stretch have caused significant ecological damage.

Sierra Club also argues that Joliet Station has contributed to exceedances of the limits contained in 302.211(e) at the Dresden Island Lock and Dam, located on the Illinois River approximately 1.5 miles below the Five-Mile Stretch. Sierra Club observes that in August 1987 a temperature of 94°F was recorded there (Sierra Club Exh. 3), which is 4 F° above the temperature prescribed in 302.211(e). The Dresden Island Lock and Dam is located downstream from another Edison power plant, the Dresden Station. Edison does not dispute the occurrence of the temperature cited by Sierra Club. However, it does dispute that the Joliet Station significantly contributed to that temperature, noting that the Dresden Station is a more immediate source of heated effluent, and that the Dresden Station discharge is largely governed by the performance of the cooling pond at Dresden (R. at 68).

It is not shown that the one incident of a 94°F temperature at Dresden Island Lock and Dam was in fact caused by the Joliet

Station or Dresden discharge, or that higher intake temperatures at the Dresden facility had caused the 94°F temperature, or even that higher intake temperatures at Dresden are caused by the Joliet Station and not by other causes. The Board cannot on this basis find that Edison's Joliet Station causes significant ecological damage in the Illinois River.

Determination

Pervading both the original promulgation of 302.211(f) and the three variances previously granted to Edison has been the belief both by the Board and by the participants that at some future time the Five-Mile Stretch would improve to the point where its water quality was limited solely by thermal discharges. Upon promulgation of 302.211(f) the Board noted that several major projects were then underway which would result in a reduction of the pollution load to the Des Plaines River (10 PCB 77). On this basis the Board found "that by July 1978, temperature will be a limiting factor to the attainment of a desirable aquatic biota in the Des Plaines River below the I-55 bridge" (Id.). However, by the time 1978 arrived, it had to be conceded concomitant with the granting of variance in PCB 78-79 that the Board's earlier hopes had not materialized. Similarly, again in 1981 and 1984 the Board found in PCB 81-24 and PCB 84-33 that other factors continued to override the effect of temperature on the Five-Mile Stretch.

Today, inspite of the passage of another five years, and more than 17 years after the prospect was first raised before the Board, the Board must still find that temperature is not a factor limiting the water quality of the Five-Mile Stretch, and that other factors continue to override the effect of temperature on this waterway. Some of these factors, as noted in the record, include loss of habitat due to channelization, disruption of habitat due to barge traffic, and the presence of heavy metals and other pollutants in the system (see above Otto testimony and Agency position). The Board does not find this a happy result. Moreover, it is also a result which the Board earnestly hopes can be reversed in a not-distant future. However, it is the condition today.

It is within this framework that the Board must now turn to the heart of the matter at hand: i.e., whether Edison has successfully demonstrated that the heat discharges from the Joliet Station have not caused and cannot be reasonably expected to cause significant ecological damage to the waters of the Five-Mile Stretch. Upon review of Edison's presentation, Sierra Club's and Peter Howe's submittals, and the Agency's position, as noted above, the Board finds that Edison has successfully made the demonstration at this time.

The Board believes that Edison has a viable monitoring program, as described by Thomas Hemminger, which, although not field tested at the time of hearing, is capable of assuring adjustments to operations should they prove necessary to ensure compliance. The Board also finds convincing, based on Dr. Kennedy's studies, that complete mixing is achieved and no plume effect is recognizable at points prior to completion of transport of effluent to the I-55 bridge. Also, the temperature difference upon shut down is minor.

The Board is further convinced that Dr. Ewing's testimony indicates that the net effect of temperature increase upon the parameters he studied is small. Although Sierra Club and Peter Howe raise certain questions regarding some of these parameters, particularly regarding ammonia nitrogen and dissolved oxygen, nothing was provided which would indicate that substantial damage is occurring due to ammonia or lack of dissolved oxygen caused by Joliet Station heated effluent. Furthermore, the Board finds Dr. Ewing's conclusions regarding the net effect of the increase in unionized-ammonia and the DO values predicted (even under summer/low flow conditions) were not rebutted.

The Board finds the many concerns regarding fish spawning and development, and effects upon macrophyte population raised by Sierra Club and Peter Howe to be the same as could be raised regarding any Illinois waterway which receives heated effluent. Most of the concerns note problems that could occur while temperatures are within the limits for the General Use or Secondary Contact waters. The concerns are more in the nature of challenges to the Board's water quality standards for temperature, and are therefore beyond the scope of this proceeding⁸. Furthermore, there is no substantive evidence that the suggested problems are in fact occurring, and if so, that they are caused by the Joliet Station heated effluent. It is also not shown that the species mentioned are indigenous to this waterway, and if not, whether these species are affected by heat such that other constituents are not limiting factors. Again, although regrettable, it cannot be ignored that other factors continue to exist which have a limiting effect on this particular waterway. Sierra Club and Peter Howe seem to maintain that heat is the sole limiting factor for certain species. From the evidence presented in this proceeding, this just cannot be said with certainty at this time.

⁸ It is to be noted that this type of examination of the temperature limits was suggested by Peter Howe (Howe Exh. 1 at 36).

Revisitation

The Board has given consideration as to whether Edison should be required to revisit the instant matter at some future date. The spur for this consideration is that long-standing hope that the Des Plaines River will experience a significant improvement in water quality related to non-thermal conditions. Should the improvement be enough, there then might exist justification for further limitations on Edison's thermal discharges.

The question is thereby raised as to whether a thermal demonstration made successfully today could also be made successfully in the future. A collateral question is whether, as a consequence, Edison should be required to revisit its demonstration at that future time. The Board finds that the first of these questions has marginal relevancy. As regards the second, the Board finds that it has limited authority to require revisitation in the instant proceeding, but nevertheless that in-place processes are sufficient to cause revisitation should that action ever be warranted.

Section 302.211(f) requires the Board to look at future conditions to the extent that the phrase "cannot be reasonably expected to cause" implies a judgment on anticipated conditions. However, it is a substantial and unwarranted jump from this judgment on the future to the much longer-range question of whether conditions in the Five-Mile Stretch will change to the point where today's thermal demonstration could no longer hold up. Not the Board, nor anyone, has a crystal ball of clarity sufficient to answer this question. If nothing else, the protracted history of this matter in its various incarnations should teach us that speculative determinations in the instant arena are only likely to produce ghosts to haunt those who follow us.

The Board therefore finds that it cannot speculate as to whether Edison's demonstration made today could also be made at some future date. The only appropriate question is whether the demonstration is made today.

Assuming *arguendo* that there is grounds to find that today's demonstration would not be successful in the future, the Board can find no basis in this limited proceeding to allow for a revisitation. As the thermal demonstration rules are crafted, they do not require a petitioner to address speculative future circumstances, and it would be neither appropriate nor necessary for the Board to so condition the instant determination. In short, Edison either has made its demonstration or has not made its demonstration.

The question is also raised (Howe Exh. 2 at 28-9; Sierra Club Brief at 35) as to whether the Board might require revisitation through a condition imposed in a variance. However, the Board finds also that this action would not be appropriate. The instant proceeding is not a variance proceeding, and none of the tests necessary thereto have been addressed. Moreover, Edison contends that a variance is unnecessary. It contends that it is in compliance with all the Board's thermal discharge regulations (R. at 80; Edison App. 1 at 2,3), and hence that a variance from thermal standards is not requested and cannot be justified. The Board's practice, in fact, is not to grant variances where the petitioner has not demonstrated it would be in violation absent the grant of variance (e.g., The Village of Grove Village v. IEPA, PCB 84-158, 62 PCB 296; City of West Chicago v. IEPA, PCB 85-2, 64 PCB 251; Village of Minooka v. IEPA, PCB 85-100, 65 PCB 529; Village of Spring Valley v. IEPA, PCB 88-181, Slip Op. at 7, January 5, 1989). Moreover, Edison has attempted no showing that compliance with the existing thermal standards constitutes an arbitrary or unreasonable hardship, a showing which is a prerequisite for the granting of variance from any standards.

Similarly, Edison does not request another variance from making its required thermal demonstration. To the contrary, it herein presents its case that a successful thermal demonstration has been made, in agreement with the conditions imposed upon it by the Board in the prior variances. Likewise, Edison has attempted no showing that compliance with the requirement to make the thermal demonstration now would constitute an arbitrary or unreasonable hardship.

In balance, therefore, the record currently before the Board contains no grounds upon which the Board could grant Edison a variance, yet alone impose a variance condition requiring some revisitation.

This is not to conclude, however, that Edison is absolved by today's action from any future burden of compliance with either existing or prospective future regulations, including water quality standards. Today's action, for example, does not absolve Edison from compliance with the thermal standards for either the Secondary Contact or General Use portions of the Des Plaines River. Neither does it insulate Edison from compliance with any amended thermal standards which might in the future be promulgated for the Des Plaines River. All today's action does is determine that Edison at this date, and based solely on Edison's showing that no significant ecological damage can be expected as a consequence of its thermal discharge, is not required to make additional efforts to correct the ecological damage. No similar determination is implied or intended should Edison's thermal discharges become, at some future time, the cause of ecological damage. Edison will have to revisit the effects of its thermal discharges in that event.

It must additionally be pointed out that Edison appears to be fully aware that (1) future regulatory changes could negate the consequences of today's determination, and (2) the impact of Edison's thermal discharges will remain under regular scrutiny under both federal and State programs. Edison notes, for example:

[Edison] anticipate[s] the need to have to address thermal discharges into that water body [Des Plaines River] in the future, because [Edison knows] that the state is considering revisions to water quality standards.

R. at 77

[Edison] speculates that the Board may deem it necessary to re-examine thermal discharges if water quality improves to a level that in their opinion makes a thermal discharge a controlling factor in the quality of the stream.

R. at 78

Should, in fact, Edison's speculation about revisions of the water quality standards applicable to the Des Plaines River come true, Edison would be required to take whatever steps necessary to comply with those revised regulations.

Scrutiny of Edison's thermal discharges comes under Agency and USEPA review at a minimum of every three years, pursuant to renewal of Edison's NPDES permit. At these times Edison must, among other matters, demonstrate that it is not in violation of any thermal standards (R. at 94). Similarly, any person at any time may bring an enforcement action on the grounds that the Edison is in violation of any thermal standards or its permit requirements. Edison's inability to show that it is complying with all pertinent regulations under any such circumstances could negate the consequences of today's determination.

In balance, therefore, the Board finds that there are sufficient safeguards in place, and that no formal requirement to revisit this matter is necessary or appropriate.

Summary

In summary, the Board finds that Edison has demonstrated that the heated effluent discharged from the Joliet Station has not caused and cannot be reasonably expected to cause significant ecological damage to the General Use waters of the Five-Mile Stretch.

This Opinion constitutes the Board's findings of fact and conclusions of law in this matter.

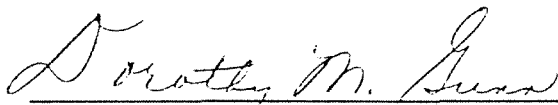
ORDER

The Board finds that the Commonwealth Edison Company has complied with 35 Ill. Adm. Code 302.211(f), in that it has demonstrated that the thermal discharges from its Joliet Generating Station have not caused and cannot reasonably be expected to cause significant ecological damage to the receiving waters.

IT IS SO ORDERED.

Chairman John C. Marlin concurred.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 15th day of November, 1989, by a vote of 7-0.



Dorothy M. Gunn, Clerk
Illinois Pollution Control Board