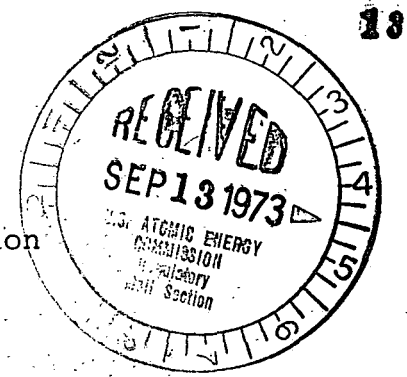
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

13 SEP 1973



OFFICE OF THE ADMINISTRATOR

50 - 237
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Mr. L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Muntzing:

The Environmental Protection Agency has reviewed the draft environmental statement for the Dresden Nuclear Power Station, and our detailed comments are enclosed. Inasmuch as the environmental impacts of nuclear power generation at this site are the result of the combined operation of all three units, we believe that the evaluation and modification of this plant's operation must include Unit 1 as well as Units 2 and 3.

The present gaseous waste treatment system for Unit 1 is not capable of limiting gaseous radioactive discharges to levels that are "as low as practicable." The final statement should discuss in detail the proposed modifications necessary to limit these emissions.

Although we concur with the proposal for closed-cycle operation of the cooling system for Units 2 and 3, a significant thermal discharge to the Illinois River from Unit 1 will continue. We recommend that the applicant consider conversion of Unit 1 from once through to closed-cycle cooling.

In light of our review of this draft statement, and in accordance with EPA procedure, we have classified the project as "ER" (Environmental Reservations), and rated the draft statement as "Category 2" (Insufficient Information). We would be pleased to discuss our comments or classification with you or members of your staff.

Sincerely yours,

Sheldon Meyers

Sheldon Meyers
Director
Office of Federal Activities

Enclosures

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EPA#D-AEC-06111-IL

ENVIRONMENTAL PROTECTION AGENCY

Washington, D. C. 20460

September 1973

ENVIRONMENTAL IMPACT STATEMENT COMMENTS

Dresden Nuclear Power Station

TABLE OF CONTENTS

INTRODUCTION AND CONCLUSIONS

The Environmental Protection Agency has reviewed the draft environmental impact statement (EIS) for the Dresden Nuclear Power Station, Units 2 & 3 prepared by the U.S. Atomic Energy Commission and issued on June 26, 1973. The following are our major conclusions:

—1. In general, the proposed modified gaseous and liquid waste treatment systems for Units 2 & 3 are expected to be capable of limiting radionuclide releases, and subsequently offsite doses, to levels that are "as low as practicable" in accordance with the proposed 10 CFR Part 50 Appendix 1. However, our analysis indicates that the present gaseous waste treatment system for Dresden Unit 1 is not capable of limiting gaseous radioactive discharges to such levels. The draft statement indicated that modification would be made to the Dresden Unit 1 system in 1975. Since the discharge limits for gases apply to the site as a whole, the final statement should discuss in greater detail the proposed modified system for Unit 1, and the potential environmental impact from the operation of Unit 1 after the modifications are completed.

2. Since the cooling system for Units 2 & 3 is proposed to be closed-cycle by the Spring of 1974, we expect that these units will meet the thermal requirements on the Illinois River if Unit 1 does not violate water quality standards. However, once-through

cooling for Unit 1 will probably result in violation of water quality standards. Therefore, it is our recommendation that consideration also be given to converting Unit 1 to the closed-cycle system.

3. We are also concerned with the impact on aquatic life as a result of condenser cooling water intake. It is our opinion that the amount of water withdrawn from the Kankakee River and the velocity at which cooling water is withdrawn are excessive. Section 316(b) of the Federal Water Pollution Control Act Amendments of 1972 (FWPCA) requires that intake structures reflect the best technology available for minimizing adverse environmental impact. Therefore, we believe that the applicant should apply the best technology available to limit the aquatic impact.

RADIOLOGICAL ASPECTS

Radioactive Waste Treatment

The existing liquid and gaseous waste treatment systems for Dresden Units 2 & 3 are not capable of limiting radioactive discharges to levels that are "as low as practicable." However, in an effort to comply with the 10 CFR Part 50 regulations, the applicant is modifying both waste treatment systems. In general, the proposed modified systems should limit radionuclide releases, and subsequently offsite doses, to levels within those proposed in Appendix 1 to 10 CFR Part 50.

Although this is a draft statement for a licensing action associated with Dresden Units 2 & 3, we believe it is appropriate for us to address comments, as needed, to systems in Dresden Unit 1. This is particularly true for the gaseous effluents since the present and proposed regulations which govern gaseous effluent releases apply to the site as a whole. Furthermore, it is our understanding that there will be no seperate statement issued for Dresden Unit 1. The present gaseous waste treatment system for Dresden Unit 1 is not capable of limiting radiogas discharges and subsequently offsite doses (to individuals and to the population), to levels that are "as low as practicable." The draft statement indicated that the applicant is committed to install a modified off-gas system for Dresden Unit 1 in 1975. We commend this action

and encourage the applicant to expedite the plant's effluent control system modifications (especially since the population doses from Dresden Unit 1 are comparatively large; the Dresden Unit 1 population dose estimate is over an order of magnitude greater than any population dose estimate for a nuclear power plant for which statements have been prepared). Although the design details for the augmented systems may not be available, we believe that the final statement for Dresden Units 2 & 3 should include the design objectives for the proposed Unit 1 radioactive waste system modifications and any other descriptive information available.

Since Dresden Units 2 & 3 are operating, actual operating data would provide a basis for making estimates of plant performance. Actual operating data for Dresden Unit 1 were utilized to estimate the radiological environmental impact for that facility; however, the standard source term model was used to estimate discharges from Dresden Units 2 & 3. We request that the available operating data for Dresden Units 2 & 3 be utilized to evaluate the radiological environmental impact of the units and to compare the results with the assumptions used in the standard models. In particular, available operating data from the Dresden Units should be presented and utilized in the

final statement for:

1. Gaseous and liquid releases (on an isotopic basis, if available);

2. Leak rates from the coolant and power conversion systems;

3. Radionuclide concentrations in the reactor coolant as a function of time;

4. Radionuclide partition factors and waste treatment equipment decontamination factors (on an isotopic basis, if available);

and

5. Power generation history (either a histogram or a tabular presentation of effective full power days).

Dose Assessment

We have independently evaluated the potential doses to individuals which might result from the operation of all three Dresden units and our results were in substantial agreement with those of the draft statement. Once the modified waste management systems are operational at all three units, the offsite doses will be "as low as practicable" and are expected to be within the whole body dose guidelines of the proposed Appendix 1 and the interim Regulatory Guide 1.42. Furthermore, our series of cooperative field studies in the environs of

operating nuclear power facilities have greatly increased knowledge of the process and mechanisms involved in the exposure of man to radiation produced through the use of nuclear power. We expect that the results of current studies (including ones at this site in cooperation with the applicant) will provide additional data on the behavior of specific radionuclides in the environment, such as radioiodine. As more information is developed, the models used to estimate human exposures will be modified to reflect the best data and most realistic situations possible. Depending on the results of these cooperative studies, it is possible that the scope and extent of present environmental monitoring programs can be based on more realisitc data. In the interim, we believe that current dose models will provide conservative estimates of the potential whole body and thyroid doses.

Transportation

In our earlier reviews of the environmental impact of transportation of radioactive material, we agreed that many aspects of this problem could best be treated on a generic basis. On February 5, 1973, AEC published for comment in the Federal Register a rulemaking proposal concerning the Environmental Effects of Transportation of Fuel and Waste from Nuclear Power Reactors. We commented on the proposed rulemaking by letter dated March 22, 1973, and by an appearance at the

public hearing on April 2, 1973.

Until such time as a generic rule is established, we will continue to assess the adequacy of the quantitative estimates of environmental radiation impact resulting from transportation of radioactive materials provided in statements. The estimates provided for this station are deemed adequate based on currently available information.

Reactor Accidents

We have examined the analysis of accidents and their potential risks which have been developed in the course of engineering evaluation of reactor safety in the design of nuclear plants. Since these accidents are common to all nuclear power plants of a given type, we concur with the approach to evaluate the environmental risk for each accident class on a generic basis. Extensive efforts have continued to assure safety through plant design and accident analyses in the licensing process on a case-by-case basis. However, we favor the additional step now being undertaken of a thorough analysis on a more quantitative basis of the risk of potential accidents in all ranges. We believe this will result in a better understanding of the possible risks to the environment.

In order to provide a fuller understanding of the direction of these efforts, we request that the final statement provide information on the nature, expected schedule, and level of effort of those generic

studies which are expected to lead to a basis for a subsequent assessment concerning the risk from all potential accident classes in the Dresden Nuclear Power Station. We recognize that this subsequent assessment may be either generic or specific in nature depending on the outcome of the generic studies. In addition, the final statement should include a commitment that this assessment will be made publicly available within a reasonable time period following completion of the generic studies. If the above efforts indicate that unwarranted risks are being taken at the Dresden Nuclear Power Station, we are cnfident that appropriate corrective action will be taken.

NON-RADIOLOGICAL EFFECTS

Thermal Effects

The Dresden Nuclear Power Plant is located at the confluence of the Kankakee and Des Plaines Rivers, which form the Illinois River. Condenser cooling water is obtained from the Kankakee via two intake canals, one for Unit 1 and the second for Units 2 and 3. Presently the condenser cooling is accomplished by once-through cooling for all three units. Unit 1 discharges a heated effluent directly into the Illinois River, and the heated condenser water from Units 2 and 3 is cooled through a spray canal and a 1275 acre cooling lake which discharges to the Illinois River via a discharge canal.

The draft statement indicates that, as soon as the rad-waste system is operable, the applicant intends to utilize a closed-cycle cooling system for Units 2 and 3. The estimated time for the closed-cycle operation for Units 2 and 3 is February 1974. Based on information in the statement, however, it appears that in some situations the closed-cycle system will not be used. The statement should detail the frequency and circumstances which would require operation in other than the closed-cycle mode, and evaluate the potential impacts on the biological and physical characteristics of the river.

At the present time the upstream temperatures on the Des Plaines River are sufficiently high during some periods of the year that the operation of the Dresden Nuclear Power Plant as planned will probably

violate the Water Pollution Regulations for the State of Illinois, which constitute existing federally approved water quality standards. Standards have been adopted for the lower Des Plaines River from the I-55 bridge to the confluence with the Kankakee River. These standards require that the following temperatures may not be exceeded: January, February - 60°F; March - 70°F; April - 77°F; May - 85°F; June, July, August, September, October - 90°F; November - 76°F; December - 70°F. The present standards for the Illinois River require the following temperatures not be exceeded: January, February, March and December - 60°F; all other months - 90°F. In addition, temperatures increases caused by thermal discharges must not exceed 5°F above ambient.

The State of Illinois is considering revising the lower Des Plaines limits to a somewhat more lenient standard. We have expressed our reservations whether such action would be Federally approvable in a letter dated June 15, 1973, to Mr. Samuel Lawton, Acting Chairman of the Illinois Pollution Control Board. In addition, our agency recommended in a letter to Mr. William Blaser, formerly of the Illinois EPA, dated December 14, 1972, a new and more stringent thermal standard for the Illinois River. Copies of both letters and the recommended standards are attached.

During the recent hearings by the Illinois Pollution Control

Board on the proposed amendment to the temperature standard for the Des Plaines River the applicant's witness indicated that temperatures at the Joliet Yacht Club (immediately upstream from Dresden) are already sufficiently high to violate the present standards. Considering this testimony and information related to the thermal discharge from Dresden in the draft statement, we must conclude that the operation of the three Dresden Units results in even worse temperature conditions downstream from the plant. An adequate evaluation of the impact of the waste heat contribution from Dresden requires additional information on the waste heat contributions upstream. We recommend that the applicant perform an evaluation of the waste heat loads and resultant stream impact created by the applicant's Joliet and Will County fossil fuel plants upstream of Dresden on the Des Plaines River. This evaluation should be included in the final statement. It is possible that the applicant may have to consider limiting the thermal input of the Joliet and Will County plants as well as controls at Dresden.

Since EPA has recommended that Illinois adopt even stricter standards than the present ones, the situation concerning compliance of the Dresden discharge could be even more critical in the future. This fact, coupled with the provisions of the FWPCA requiring "best practicable control technology currently available" by July 1, 1977, and "best available technology economically achievable" by July 1, 1983,

argue for modifications of the proposed cooling system. Although the guidelines defining the above terms have not yet been promulgated by EPA, it is likely they will require some form of closed-cycle evaporative cooling. Thus, we recommend that serious consideration be given to converting the once-through system currently employed for Dresden Unit 1 to closed-cycle as will be used for the other two units. In addition, we recommend that blowdown from all three units be taken from the cold side of the cooling system (i.e., after the water has been cooled by the cooling lake).

The final statement should include a detailed analysis of the operation of all three Dresden units with closed-cycle cooling and pertinent information should be submitted as part of the application for a Section 402 permit under the FWPCA (i.e., a permit under the National Pollutant Discharge Elimination System).

Information in the draft statement indicates to us that, if Dresden until continues operation with once thorough cooling, the water requirements from the Kankakee River will be equivalent to 117% of the 7-day-10-year-low-flow; under extreme conditions, this could rise as high as 260% of the river flow. These additional water requirements will be obtained from backflows from the Illinois and Des Plaines Rivers. Aside from recycling of heated discharge water which would hamper plant cooling, this backflow would result

in relatively poor quality water from these two rivers partially or totally infiltrating the mouth of the Kankakee River, which has water of much higher quality and supports a good fish and aquatic biota population. This problem argues in support of the recommendation made above that the cooling system for Unit 1 be coverted to closed-cycle whereby the water demands would be reduced to a fraction of that necessary for the once-through system.

We also understand that there has been difficulty with the operation of the spray modules in the cooling canal. Additional discussion of the performance of the closed-cycle system and the impact of failures of the spray system on the Illinois River thermal loads should be included in the statement.

Biological Effects

The discharge from the operation of the Dresden facility will aggravate the dissolved oxygen sag caused by the effluent from the Metropolitan Sanitary District of Greater Chicago and high temperatures from the Joliet and Will County Stations. Any reduction in dissolved oxygen of the Kankakee water will cause further standards

violation. In our opinion, this operation also violates the non-degradation clause of the Water Pollution Regulations of Illinois since increased temperatures and lowered dissolved oxygen will further degrade the river.

The statement repeatedly rationalizes environmental impacts with the argument that the Illinois River as a whole will not be seriously affected. We do not agree with this supposition. The Illinois River is 439.25 kilometers (273 miles) long with numerous tributaries. An impact at its source may be hard to measure at its mouth. Nevertheless, any impact at any point along the river is important and must be considered individually and evaluated in the immediate area as well as further downstream.

A major concern in plant operation is the impact on the fish populations in the Kankakee River as a result of cooling water intake. The statement in Table 2.7 shows that there is a good fish population in the river with a significant number of small mouth bass and green sunfish as well as many minnows that serve as a food source for these game fish. Because of its good quality, (dissolved oxygen 10.7 mg/l, pH 7.1, total phosphorus 0.8 mg/l, and COD 6 mg/l) the Kankakee supports a high quality fishery. The statement on page 5-23 mentions that most fish populations can stand a certain harvest rate, and loss of fish through the predation of the traveling

screens can be considered part of the harvest. In our opinion, however, power plant traveling screens should not be considered as a useful tool in fisheries management. We recommend that the applicant be required to protect all life stages of important game and forage fishes, using whatever technology is necessary at the intake structure to do this. Therefore, it is our opinion that a bypass be provided on both the canals in order to minimize fish loss and injury.

Furthermore, Section 316(b) of the FWPCA requires that intake structures reflect the best technology available for minimizing environmental impact. It is noted that velocities at the bar rack and traveling screens for Unit 1 are approximately .152 m/sec (0.5 ft/sec.). Also, it is noted that reference is made to the operation of Indian Point Nuclear Generating Plant No. 1 where data indicated that reducing the intake velocity from .366 m/sec to .244 m/sec (1.2 ft/sec to 0.8 ft/sec.) considerably reduced the number of fish killed. It is our opinion that the intake velocity should be reduced from the design value of .567 m/sec (1.85 ft/sec.) to .152 m/sec (0.5 ft/sec.).

Chemical Effects

Chlorination of the condenser cooling water for slime control, and chlorination of the effluent from the sanitary sewage trickling

filter plant may result in continuous discharge of chlorine to the Illinois River. The expected concentrations of chlorine in the receiving water from this source should be indicated in the final statement. In our opinion, the discharge of chlorine should be monitored to insure that the concentration in the river is limited to the following EPA recommendations:

Type of Criteria	Recommendation for Residual Chlorine
Continuous	0.002 mg/l
Intermittent	(1) 0.2 mg/l Not to exceed 30 minutes per day (2) 0.10 mg/l Not to exceed 2 hours per day

In addition, no mention is made of the handling and disposal of sludges arising from the treatment of the sanitary sewage. Sludge disposal procedures should be detailed. Also, the characteristics of the sanitary effluent are not included in the statement and no mention is made that the system conforms to the requirements of the State of Illinois.

The statement makes reference in the chemical and waste processing sections of operating procedures that waste will be held and monitored before release for either re-use or discharge to the Illinois River. It is not clear as to what reporting procedures will be developed and/or to whom these reports will be submitted. A very close surveillance of the monitoring program is necessary and should be coordinated with the AEC and the State Regulatory Agency. Assurance of

discharges within the allowable limits is important and can only be met if the reporting procedures are followed.

ADDITIONAL COMMENTS

In certain instances the draft statement does not provide sufficient information to substantiate the conclusions presented. We recognize that much of this information is not of major importance in evaluating the environmental impact of the Dresden Nuclear Power Station. The cumulative importance however, could be significant. It would, therefore, be helpful in determining the impact of the plant if the folloiwng topics were addressed in the final statement.

1. The bases for the AEC's estimate of the direct dose rate from the station should be presented. This information should include the type of concrete shielding around the turbines, the source-term in the turbine system, and the method used to calculate the direct shine doses at locations offsite. It would also be helpful if actual dose measurements of the direct dose are presented in the final statement. Even though direct shine doses should be low near the site, the statement should provide criteria governing offsite exposure to direct doses.

2. The environmental report for Dresden Unit 3 (Supplement 1 page 15) indicates the reactor's modified main condenser air ejector gaseous waste treatment system will include a spare recombiner system. However, the draft statement does not mention spare recombiners for either Dresden Unit 2 or Unit 3. This

discrepancy should be clarified. If Units 2 and 3 do not have spare recombiners, then Table 3.8 of the draft statement should include the gaseous discharge estimates for the periods of recombiner downtime, as has been previously included in similar cases.

3. Table 3.6 of the draft statement contains estimates of cesium discharges from the existing and modified liquid waste treatment system for Units 2 and 3. The table indicates that cesium discharges to the environment increase when the modified waste treatment system becomes operational. This apparent discrepancy should be resolved in the final statement, especially since the discharge of cesium to the environment results in the main contribution to whole body doses via the liquid discharge pathways.

4. The draft statement has contradicting information on the date of completion of the modified gaseous waste treatment system, and this should be clarified in the final statement.

5. The applicant indicates in the environmental report, Supplement IV (AEC Question 3) for Dresden Unit 3, that two waste concentrators will be included in the floor drain system of the

Dresden Units 2 and 3 liquid radwaste treatment system. The draft statement does not discuss or indicate the provision of the two waste concentrators. The final statement should clarify this discrepancy.

6. The final statement should present the primary coolant concentration of I-131 that was assumed in calculating I-131 releases from Dresden Units 2 and 3. Using assumptions presented in the draft statement for the proposed Appendix 1 and adjusting for plant size, we estimate releases that are twice those presented in Table 3.8 of the draft statement for Units 2 and 3.

7. The AEC detailed in the draft statement the applicant's environmental surveillance program that had been operating for fourteen years. The final statement should discuss the results of this extensive program and indicate any significant radiological findings.

8. Table 5.2 of the Statement presents estimates of the residential population near the site that were utilized for the integrated population doses presented in Table 5.4. However, there are many industrial workers employed within five miles of the site that were not considered in the population dose estimates.

The final statement should include estimates of the population and the population dose for these workers.

9. Information for pollutant emissions of hydrocarbons, aldehydes, and organic acids that result from operations of diesel generators, space-heating boilers and fire pumps was not provided. The final statement should provide information concerning fuel use rate, fuel analysis, equipment operation time, and individual pollutant emission factors for each type of equipment in order that independent calculations can be made to verify the applicant's air pollutant emission and ambient air estimates.

10. The subject of non-radioactive wastes are not given adequate consideration. Only one paragraph of Section 3.7.2 is devoted to this subject. Provisions for storage of non-radioactive solid wastes and means by which non-radiactive storage containers are identified to prevent accidental placing of radioactive contaminated materials in them are not discussed. Frequency of pick-up and contractual arrangements with the commercial contractor are not mentioned. Any contract with a private waste disposal company should clearly require that all non-radioactive wastes must be taken to a sanitary landfill or disposal facility holding a valid license for operation from the Illinois Environmental Protection Agency. Disposal of wastes at any other site should be grounds for

immediate cancellation of the contract.

11. Much of the information provided in this statement seems to be the "opinion of the staff." Section 4.2 Impacts on Water Use, Section 4.3 Ecological Effects, Section 5.1.3 Transmission Lines, and Section 5.2.1 Ground Water are some examples: Important data and conclusions, especially those concerning environmental matters, should be further substantiated.

12. The statement states on page 2-8 that the Kankakee-Des Plaines area is quite important archeologically and that one site is located on Dresden property. What is the status and importance of this site? How will the site be affected by future operations at Dresden?

13. On page 2-13 the statement states that the Dresden cooling lake and dike are partially located over an abandoned coal mine. Further, on page 3-15, it states that the extent of this mine is not known. Severe water pollution problems could result from a cave-in or seepage into or out from this mine. Problems of groundwater contamination and flood problems that may result from damage to the dike should receive additional study.

14. Erosion and sedimentation problems would be primarily

associated with construction activities, dike failures, concentration of constituents, and silt deposits from flow-through volumes in the cooling facilities. The latter category appears to be the most significant, since the silt deposits will tend to accumulate on the lake bottom and will require periodic dredging of the lake to maintain its effective volume. The problem of disposal of the dredged material has not been considered in the statement. While it is stated that "There are methods of disposal that will have no adverse impact," no specific method is stated.

15. The section entitled "Excessive Growth of Algae" (page 5-33) should be expanded. The disposal methods for algae and weeds removed from the cooling lake, the algicide to be used, the method of containment in the lake and the impacts of the algicides on the Illinois River should be addressed.

copy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

June 15, 1973

Mr. Samuel Lawton,
Acting Chairman
Illinois Pollution Control Board
309 West Washington, Suite 300
Chicago, Illinois 60606

Dear Mr. Lawton:

We have reviewed the proposed final draft with respect to R 72-4 Water Quality Standards revisions. We oppose the proposed revisions to the temperature standards for the lower Des Plaines River. In view of our present efforts to generally upgrade State water quality standards, it seems most inappropriate for Illinois to downgrade this stretch of river.

We believe that detailed review of the hearing record will reveal serious defects in the arguments used to support the proposed change. We note for instance, that the effects of increased temperature upon the dissolved oxygen levels in the Illinois River were not addressed in any great detail furing the hearing.

It is our opinion that the record does not justify the proposed changes, and that the changes, if accepted by the Board may not be Federally approvable.

Sincerely yours,

/s/

Francis T. Mayo
Regional Administrator

c o p y

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

December 14, 1972

Mr. William L. Blaser, Director
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Dear Mr. Blaser:

Enclosed you will find the temperature criteria for the Illinois River developed by our Duluth National Water Quality Laboratory, based upon the included list of indigenous fish species to be protected. We hope that you will agree to submit the criteria to the Illinois Pollution Control Board for consideration as State standards.

With a copy of this letter, the enclosed criteria are also being sent to Mr. John Parker, of the Illinois Pollution Control Board, for inclusion as exhibits to the testimony being received in the Commonwealth Edison's water quality standards proposal.

Sincerely yours,

/s/

Robert E. Pearson, Acting Chief
Water Quality Standards

Enclosure a/s

December 14, 1972

Mr. William L. Blaser, Director
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

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Sincerely yours,

Robert E. Pearson, Acting Chief
Water Quality Standards

Enclosure a/s

CPotos/bc

cc: Pye (IEPA)
Parker (IPCB)

McDonald
Zeller
Schneider
Hirt
Potos
WQS

UNITED STATES GOVERNMENT

Memorandum

National Water Quality Laboratory
6201 Congdon Boulevard
Duluth, Minnesota 55804

Mr. Francis T. Mayo, Regional Admin.
Region V, EPA

DATE: December 11, 1972

FROM : Director, NWQL

SUBJECT: Recommended Temperature Criteria for the Illinois River

Enclosed is a copy of a memorandum to Mr. Chris Potos of your staff giving to him our recommendations for temperature criteria for the Illinois River. I want to emphasize that the list of species to be protected was selected by Region V as indicated in the memorandum from Dale Bryson dated October 11, 1972, and I also wish to emphasize that the inclusion of sauger and walleye in this list has caused the recommended permissible temperatures to be substantially lower than they otherwise might have been. In this memorandum it will be possible for you to select other weekly average temperatures, and by plotting them on the figure you can determine which species will be impaired by so doing.

I also wish to emphasize that these recommendations are in the form of maximum weekly average temperatures for the various months. This is a shift which is going to be recommended in the new "Green Book," but the other half of the standard, namely a maximum temperature which is time dependent, has not been included in our recommendations, but is definitely a part of the new "Green Book" temperature criteria formulation that will be forthcoming soon. It will be important for your staff to avoid matching these weekly average temperatures against maximum instantaneous values which we have so often used in the past. We are planning to do work on the sauger, but we remain firmly convinced at the present time, based on the data available, that 83 is the absolute upper maximum average temperature which should be permitted if sauger are to be protected.

Donald I. Mount

Donald I. Mount, Ph. D.

Enclosures

cc:
Chris Potos ✓

Memorandum

TO : Mr. Chris Potos, Chief
Water Quality Stds, Enforcement Div., Region V

DATE: December 8, 1972

FROM : Dr. Donald I. Mount, Director
NWQL, Duluth, MN

SUBJECT: Recommended temperature criteria for Illinois River fishes

The following recommended temperature criteria for Illinois River fishes are based on temperature requirements for reproduction and growth of species to be protected for which data are available. The recommended maximum weekly average temperatures for maintenance of reasonably good populations of most species to be protected (Appendix I) in the Illinois River are:

January	40	July	83
February	40	August	83
March	48	September	78
April	60	October	68
May	72	November	50
June	78	December	40

The recommended maximum weekly average temperatures were derived from data in Tables 1 and 2. Table 1 contains optimum temperatures for growth, lethal temperatures, and calculated maximum weekly average temperatures suitable for good fish production according to Dr. C. C. Coutant in the draft revision of Water Quality Criteria, 1968. Table 2 contains temperature requirements for the reproductive functions of gonad development, spawning and incubation. The data for gonad

development and spawning in Table 2 are plotted in Figure 1 with a superimposed curve showing the recommended criteria in relation to requirements for reproduction of the various species. Incubation data are not plotted in Figure 1 since temperatures near the maximum for spawning, for most species, will be within the range of tolerance of the embryo. Data are not available for all species. However, it seems reasonable to expect conditions suitable for yellow perch which require prolonged exposure to low temperature in winter for development of gonads and successful spawning to be suitable for walleye and sauger. Extrapolation among species is also necessary to some extent among the bass-panfish, catfish and redhorse-buffalo groups.

Following recommendations forthcoming in the revised Water Quality Criteria, 1968 to provide maximum protection to indigenous fish populations, it is further recommended that (1) artificially induced temperatures above the maximum weekly average should not exceed short-term, time-dependent levels of temperature that permit survival of the species of concern. Acceptable time-dependent levels of lethal temperatures may be determined from the procedure and data set forth in the draft revision, Water Quality Criteria 1968 or additional research, (2) fish attracted to thermal plumes or canals by warm water should not be subjected to rapid drop in temperature of lethal proportions due to planned or accidental plant shutdown. The maximum weekly average temperature in thermal plumes or canals in winter should not exceed the normal ambient water temperature for

the season by more than about 12 C or an increment known to be within the range of tolerance minus 2 C of the species of concern, (3) thermal plumes should not block movement of fish, and (4) daily and seasonal temperature fluctnations that existed before addition of heat from artificial sources should be maintained.

Observed maximum temperatures by months for the Illinois River are tabulated in Table 3 for selected stations above and below mile point 196, at and below which river water temperatures are generally lower.

Should a less restrictive criteria providing a lesser degree of protection to fish populations be desired for certain stretches of the Illinois River, the curve for such criteria could also be plotted on Figure 1 to reveal the probable adverse effect on fish populations.

Donald I. Mount, Ph.D.

TABLE 1

Optimum Growth and Lethal Temperatures of Some Fishes of the Illinois River and Calculated Maximum Weekly Average Temperatures for good fish production[1]

Species	Optimum for Growth °F	Ultimate Upper Incipient Lethal Temp. °F	Maximum Weekly Average °F
Yellow Perch	80[2] McCormick, INQL unpublished	89.5 Hart 1947	81.8
Northern Pike	69.8[3] Roberson, et. al., INQL unpublished	91.8 Scott 1964	77.1
Northern Redhorse[4]	80.6 McCormick, et al. INQL unpublished	84.7 Hart 1947	82.0
Largemouth Bass	81.5 Strawn 1961	97.2 Hart 1952	86.7
Bluegill	84.6 McComish 1971 Anderson 1959	92.0 Hart 1952	88.3
Channel Catfish	86 Strawn 1970 Andrew & Stickney 1971	100.4 Allen & Strawn 1968	90.9
Smallmouth Bass	78.2 Fleming & Peterson INQL unpublished	95.0 Fleming & Peterson INQL unpublished	84.2

[1]Calculations and data, unless otherwise noted, are from draft revision, Water Quality Criteria, 1968, Dr. C. C. Coutant.

[2]Estimated from good growth of juvenile perch.

[3]MS in press, Trans. Am. Fish. Soc., 1973

[4]Based on data for the white sucker.

TABLE 2

Maximum Temperatures for Reproductive Functions of Some Fishes of the Illinois River

Species	Gametogenesis °F	Spawning °F	Incubation °F
Yellow Perch	40[1] Jones, et al, INHS	59 Calhoun, 1966	66 Nekanson, et al, INHS, unpublished
Sauger		58 Hall TVA, 1972	
Northern Pike		55 Rawson, 1932	66 Nekanson, et al, INHS, unpublished
Northern Redhorse		64[2] Duncan, DSPW, 1969	69[3] McCormick, et al, INHS, unpublished
Largemouth Bass	73 Caldwell, 1955	60 Clugston, 1966	66 Kelly, 1969
Smallmouth Bass		70 Rawson 1945	77 Webster, 1948
Bluegill		67 Morgan, 1951	9T INHS Contract
Channel Catfish		80 Clemens & Sneed 1957	82 Clemens & Sneed 1957
White Bass		79 Riggs, 1955	
Freshwater Drum		72 Wren TVA, 1959	78 Wren TVA, 1969
Smallmouth Buffalo		70 Wren TVA, 1969	
Rock Bass		79 Raney, 1965	
White Crappie		73 Siefert, 1968	73 Siefert, 1968

[1] Optimum temperature for exposure of approximately six months; spawning success substantially reduced at 43F and approximately five months exposure.

[2] Based on data for golden redhorse.

[3] Based on data for white sucker.

FIGURE 1

MAXIMUM TEMPERATURES FOR REPRODUCTION

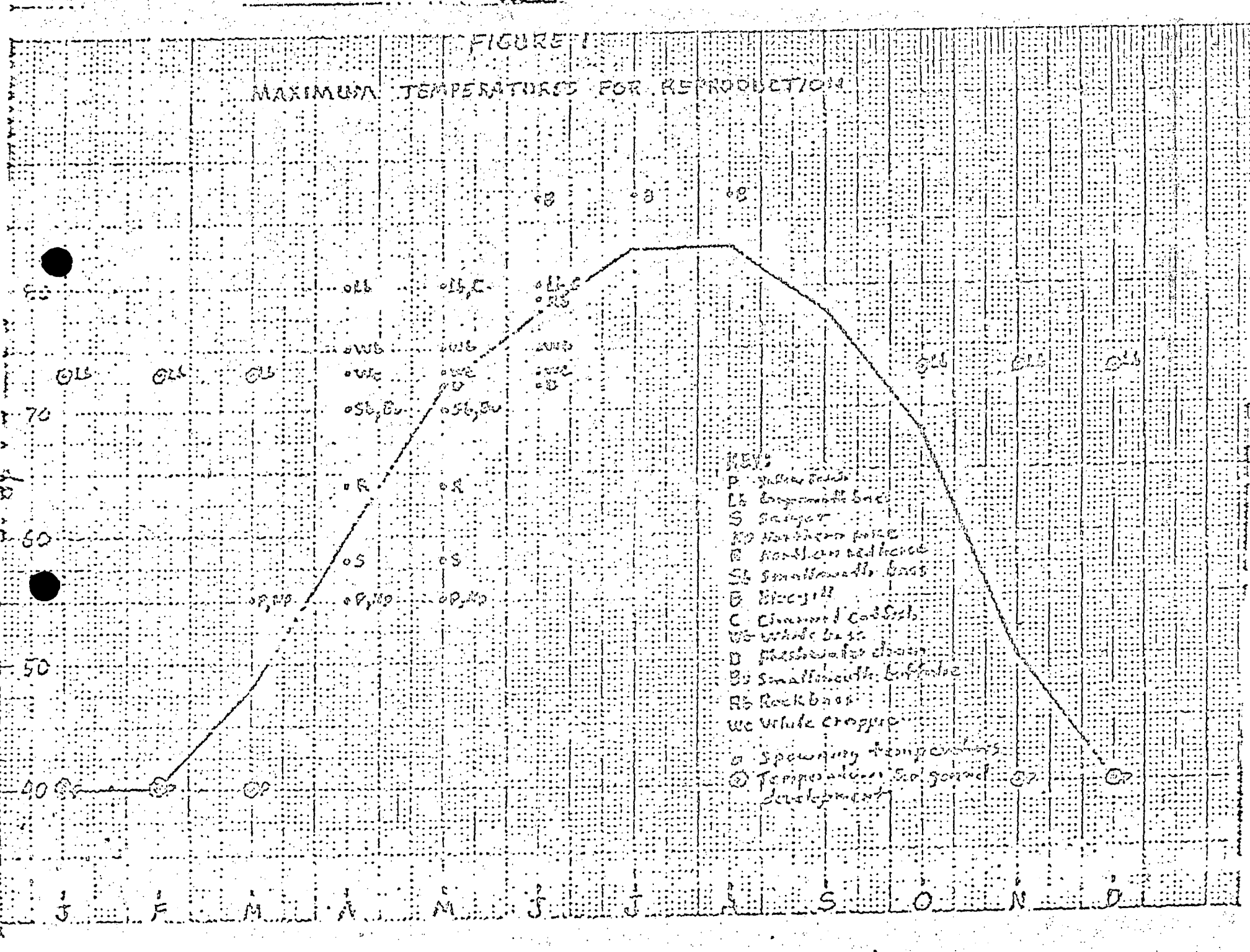

TABLE 3

Approximate Highest and Lowest Maximum Temperatures at Selected Points in the Illinois River[1]

Mile Point		Monthly Maximum Temperature											
		J	F	M	A	M	J	J	A	S	O	N	D
80 LaGrange Lock	highest	38	43	50	68	76	87	87	88	85	73	56	49
	lowest	33	33	40	42	59	66	75	76	66	51	39	34
162 Peoria	highest	40	45	52	67	78	84	87	86	84	73	60	47
	lowest	34	35	45	55	66	74	77	79	72	62	48	35
195 Henry	highest	40	49	57	65	74	84	88	87	84	74	62	46
	lowest	34	34	45	52	69	72	77	77	74	64	48	35
231 Starved Rock	highest	43	50	59	68	79	86	86	87	85	75	59	52
	lowest	32	32	37	44	59	69	72	75	63	54	38	34
272 Dresden Island	highest	45	48	62	68	78	94	92	92	87	78	65	54
	lowest	36	35	37	43	58	64	72	79	64	53	41	32
291 Lockport	highest	51	52	58	66	74	83	89	90	86	76	66	58
	lowest	42	45	52	59	68	73	78	79	77	70	57	45

[1]Data from Figures 1, 4, 7, 8, 10, 12 in Technical Memorandum, "Maximum Water Temperatures in the Illinois River" HMM-72-1, Illinois State Water Survey.

TO : Director, National Water Quality Laboratory

DATE: OCT 11 1972

FROM : Deputy Director, Enforcement Division

SUBJECT: Temperature Standards for the Illinois River

As you requested in your memo of 10/2/72, the following species are to be protected in the Illinois River:

1. Shovelnose Sturgeon
2. Paddlefish
3. Northern Pike
4. Smallmouth Buffalo
5. Bigmouth Buffalo
6. Northern-Redhorse
7. Blue Catfish
8. Channel Catfish
9. Flathead Catfish
10. White Bass
11. Rock Bass
12. Bluegill
13. Smallmouth Bass
14. Largemouth Bass
15. White Crappie
16. Black Crappie
17. Yellow Perch
18. Sauger
19. Walleye
20. Freshwater Drum

We are enclosing a copy of a letter to Mr. Jacob Dumelle of the Illinois Pollution Control Board, which confirms that the temperature criteria will be developed for these species.

Regulatory File Cy.