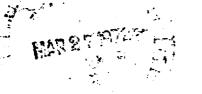
Appendix A. Agency Comments on the Draft

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Environmental Statement



FEDERAL POWER COMMISSION WASHINGTON, D.C. 20426

IN REPLY REFER TO:

FWR-ER March 22, 1972

50-254 50.265

Mr. Lester Rogers
Director, Division of Radiological and Environmental Protection
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

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This is in response to your letter dated March 6, 1972, requesting the comments of the Federal Power Commission on the AEC's Draft Detailed Statement on Environmental Considerations Related to the Proposed Issuance of an Operating License to the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company for the Quad Cities Nuclear Power Station Units 1 and 2.

Comments of the Federal Power Commission on the Quad Cities facilities in relation to area power needs were submitted previously in a letter dated December 20, 1971, and are referenced in the Draft Detailed Statement as References Section I, (6). Thus the following comments will update the earlier ones to reflect changes occasioned by later developments.

The Commonwealth Edison Company's evaluation of its 1972 summer peak situation without the Quad Cities units and without the Zion unit yields a reserve margin of 5.4 percent. This is comparable to the 7.1 percent margin shown for the similar situation in the FPC December 20, 1971 report noted above. The difference in reserve margin percentages results from the difference of 224 megawatts of net dependable capacity between the Company's projected 13,189 megawatts and the 13,423 megawatts used in the FPC staff analysis. The staff used the full capability of the Dresden Plant rather than the restricted output capability imposed by the Illinois Pollution Control Board. The 23.5 percent reserve shown for the Company for the 1972 summer period in Table 1 (referred to in the text on page 1 of the Draft Detailed Statement) was predicated upon the Company's early plans which included the availability of the Quad Cities and Zion units. It is worthy of note that the erosion of the reserve margin from the earlier projected level of 23.5 percent to the currently anticipated level of only 5.4 percent has been caused by the delays in bringing the new nuclear units into commercial operation.

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Mr. Lester Rogers

The Commonwealth Edison Company is a member of the Mid-America Interpool Network (MAIN), a major power planning group and also one of the nine regional electric reliability councils organized in response to the Federal Power Commission's April 1970 Statement of Policy on the Adequacy and Reliability of Electric Service (Order No. 383-2). The Draft Detailed Statement illustrates the effect of the delay of the Ouad Cities nuclear units upon the Commonwealth Edison Company, the Iowa Power Pool and the Iowa-Illinois Gas and Electric Company, which is related to the Commonwealth Edison Company by formal contract relations, but the equally relevant impact of unit delays upon the MAIN systems as a whole is not included. The December 20, 1971 report of the FPC Bureau of Power included this analysis, and it indicated a reserve margin for the MAIN area of only 8.9 percent without the Quad Cities and Zion units. This becomes 8.1 percent if the 224-megawatt reduction of Commonwealth Edison capacity heretofore noted is subtracted. Also of great importance are the seven large fossil-fueled units in the MAIN area included in the capacity resources which have suffered some delays and are not now expected to be in commercial operation until May and June 1972. These units and their sizes are: Cayuga 2 - 500 megawatts, Edwards 3 - 350 megawatts, Coffeen 2 - 600 megawatts, Powerton 5 - 840 megawatts, Neal 2 - 321 megawatts, Labadie 3 - 555 megawatts, and New Madrid 1 -600 megawatts. Recent experience with large new units has indicated a relatively high degree of unavailability during initial service periods, with a consequent added threat to the adequacy and reliability of electric service. Also included in the area capacity are two other nuclear units, the operating 497-megawatt Point Beach 1 and the not yet operating 497-megawatt Point Beach 2. Because of the logistics of current licensing procedures, the latter unit may not be available for the 1972 summer peak. Excluding the two Quad Cities units, the seven fossil-fueled units and the Point Beach No. 2 unit, not yet in operation, total 4,263 megawatts of new capacity which was included in the originallyplanned summer 1972 total.

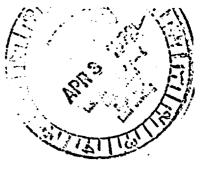
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The staff of the Bureau of Power concludes that developments subsequent to its December 20, 1971 report, as indicated above, serve to further emphasize the need for the power output of the two Quad Cities units for the 1972 summer period and beyond.

Very truly yours,

Chief, Bureau of Power





STATE OF ILLINOIS POLLUTION CONTROL BOARD

309 West Washington Street Suite 300

CHICAGO, ILLINOIS 60606

DAVID P. CURRIE, CHAIRMAN SAMUEL R. ALDRICH JACOB D. DUMELLE RICHARD J. KISSEL SAMUEL T. LAWTON, JR. TELEPHONE 312-793-3820

March 30, 1972

Mr. Lester Rogers Director Atomic Energy Commission Division of Radiological Environmental Washington, D.C. 20545

> Re: Quad-Cities Nuclear Power Station Draft Environmental Impact Statement Docket Nos. 50-254, 50-265

Dear Mr. Rogers:

As I understand it we have until April 5 to file comments on the draft environmental impact statement dated March 6, 1972 and sent to us by the U.S. Environmental Protection Agency.

The following remarks are my own and not necessarily those of the Illinois Pollution Control Board as a body.

The impact statement was disturbing to me because it revealed apparent inconsistencies in information which had been previously given the Board under oath by Commonwealth Edison Company. My memorandum to the Board of March 23, 1972 which is enclosed, outlines these differences and I request that you consider them to be part of my comments.

The Board, in its order of March 28, 1972 also enclosed, has now made these inconsistencies part of an ongoing proceeding and they will be thus examined in detail in the near future.

In addition to the matters mentioned in my memorandum and the Board order I find little in the impact statement on three other matters:

First, the impact statement makes no mention of the permit issued by this Board on November 15, 1971 in its listing of State approvals on pp. 10-11. Yet on

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March 30, 1972

Mr. Lester Rogers Subject: Quad-Cities Nuclear Power Station Draft Environmental Impact Statement Docket Nos. 50-254, 50-255

page 35 the impact statement mentions the side-jet variance granted by my Board to permit operation until April 1, 1972. Since the Board permit of November 15, 1971 sets tighter radioactive emission limits than those mentioned in your statement (p.89) it seems important to me that all limiting provisions of the Illinois permit be discussed in the impact statement.

Second, the impact statement fails to recognize the fatal consequences of a loss-of-coolant (LOCA) accident. In Table 19, p. 102, a "large break" is expected to give only <0.001 of 500 mrem whole body dose. Yet Dr. Henry Kendall, a nuclear physicist at Massachusetts Institute of Technology who is versed in nuclear weapons effects, in testimony before my Board on November 11, 1971, postulated actual human fatalities should a LOCA occur. The fatal dose to humans is generally taken as being about 500,000 mr and certainly would not be <0.001 of 500 mr or <0.5 mr. The New York Times article of March 12, 1972 (enclosed) quotes Philip L. Rittenhouse of your Oak Ridge National Laboratory as stating that at least 30 nuclear safety experts which he identified by name have stated their concerns about nuclear safety.

Third, and last, the impact statement does not discuss the concern that fish may not actually traverse the diffuser jets (pp. 73-74 under 2.) because of turbulence and noise. See my dissenting opinion (PCB 71-20) filed November 19, 1971 (pp. 3-4 "The Jet Diffuser as a Barrier to Fish"). This concern over the diffuser may be somewhat moot in view of an announced agreement today by Commonwealth Edison to install complete spray cooling by May 1974. However, the jet diffuser would still be in use for two years and ill effects to the environment might occur even in that short period if fish in fact refuse to pass through the diffuser's discharge.

One minor point remains. On page "x" the "June 1, 1971" date in the bottom line should probably be "June 1,1972" since the report referred to was written on January 24, 1972.

Very truly yours, Mr. 2le

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Jacob D. Dumelle Board Member

JDD:rj Encls. (3)

cc: Council on Environmental Quality

ILLINOIS POLLUTION CONTROL BOARD March 28, 1972

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JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD CITIES PERMIT)

In the matter of

PCB 71-20

Preliminary Opinion and Order of the Board on Petition to Modify Permit (by Jacob D. Dumelle)

Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Company (hereafter "Utilities") petitioned the Board on March 1, 1972 to modify the Permit issued on November 16, 1971 with respect to Paragraph 5 which dealt with the operation of the power generating station's cooling water discharge to the Mississippi River. Paragraph 5(b) of the permit prohibits operation of the station after April 1, 1972 in violation of the Mississippi River Thermal Standard adopted on November 23, 1971 (R70-16). At the time of the issuance of the Permit it was thought that the diffuser discharge system would be in operation by April 1, 1972 and that the station would be operating within the thermal standard. On March 7, 1972 we voted to hold a hearing on the Utilities request for variance to be able to exceed the temperature limits in the Mississippi River Thermal Standard.

Since the filing of the petition the U.S. Atomic Energy Commission has issued its Draft Detailed Statement on Environmental Considerations (draft impact statement) for the station (March 6, 1972). Several inconsistencies between the draft impact statement and the record on which the Permit was based are apparent. Among the inconsistencies are the site boundary dose to people, the station release rate of radioactive gaseous emissions, the quantity of liquid radioactive releases and the anticipated date of operation of the station with the diffuser discharge system. Rather than initiate a separate hearing on the questions raised with the publication of the impact statement we shall order that the subject be dealt with in the previously authorized hearing.

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IT IS HEREBY ORDERED that the Utilities in addition to presenting evidence in support of their Petition to Modify Permit address themselves to the apparent inconsistencies between the draft impact statement and the previous record in this case on which the issuance of the Permit was based and show the Board why the Permit issuance should not be re-examined.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the Board adopted the above Preliminary Opinion and Order on the <u>28th</u> day of March by a <u>5-0</u> vote.

Christan L. Moffett, Clerk Illinois Pollution Control Board

THE NEW YORK TIMES, SUNDAY, MARCH 13, 1972

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singer carly this year from the A.E.C.'s Advisory Committee on Reactor Solequards repeated-ly advocated increased studies of the cooling system because present theoretical data was inadequate.

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XII. DISCUSSION OF COMMENTS

A. <u>COMMENTS RECEIVED ON THE DRAFT DETAILED STATEMENT ON ENVIRONMENTAL</u> CONSIDERATIONS

Pursuant to paragraphs A.6 and D.1 of Appendix D to 10 CFR Part 50, the draft detailed statement was transmitted, with a request for comment, to:

Environmental Protection Agency Federal Power Commission Department of the Army, Corps of Engineers Department of the Interior Department of Commerce Department of Health, Education, and Welfare Department of Agriculture Department of Housing and Urban Development Department of Transportation Advisory Council on Historic Preservation Governor of Illinois Iowa Pollution Control Commission Supervisor of Rock Island County.

In addition, the AEC requested comments on the draft detailed statement from interested persons by a notice published in the <u>Federal</u> Register on March 9, 1972 (37 F.R. 5073).

Comments in response to the requests referred to in the preceding paragraph were received from:

Environmental Protection Agency Federal Power Commission Department of Commerce Department of Agriculture Department of the Army (Corps of Engineers) Department of Transportation Department of the Interior Department of Health, Education and Welfare Illinois Environmental Protection Agency Illinois Pollution Control Board, Mr. Dumelle Illinois Pollution Control Board, Mr. Kissel Univerity of Wisconsin (Professor Nees). Our consideration of comments received is reflected in part by revised text in other sections of this statement and in part by the following discussion. The comments may be found in Appendix A.

1. Spray-Canal

The spray-canal is the applicants' planned closed-cycle cooling system. The canal will be 170 to 200 feet wide and about 14,000 feet long. In the course of flowing through the canal, the water will be sprayed in the air through hundreds of spray heads. This action will cool the water to a degree which makes the water suitable for pumping back into the condenser. Operation of the canal will involve adding about 100 cfs into the canal from the river, and "blowing down" about 50 cfs to the river.

The canal operation removes almost all of the station's dump heat load from the Mississippi River. The canal may result in occasional fogging along Illinois Route 84. However, its overall beneficial effect should override the adverse affect of the fog.

2. Reduction in River Flow

The operation of the Quad-Cities plant constitutes a local diversion and return of river water. While a certain amount of change in river quality occurs in this diversion, the loss of water <u>per se</u> to river flow is only that amount of additional water evaporated as a result of heat dissipation. This amounts to less than 50 cfs, or less than 0.45% of the lowest flow of record of the Mississippi at this location (11,000 cfs). It is also a small loss compared to the annual evaporation from bodies of water in this area: 31 to 43 inches/yr.

3. Chemical Releases to River

The present discussion in section III.D.3 characterizes in quantitative terms the sources, controls, and releases of chemicals to the river. These data appear to indicate low impact on the river, because the incremental additions to the river are small, both as an added fraction of the present (pre-Quad-Cities) chemical content of the river and as compared with applicable present standards. The uncertainties as to quantitative amounts and concentrations in the dispersion of chemical effluents will be reduced by the implementation of Technical Specifications regarding standard operating procedures and schedules of the monitoring of river water quality.

4. Non-Radioactive Solid Waste

Waste in this category includes debris picked up from river water intakes (including any trapped fish), and trash and garbage from plant operation. The applicants' commitment to suitable off-site burial and to no on-site burning for these items (Section III.D.3) appears to conform to present practices and not to constitute any appreciable environmental insult. Because the quantities involved are believed to be very small (especially for trapped fish), but quite variable, no quantitative estimate has been made. However, such handling procedures would appear to be practical even for very large disposals, which are not expected here.

5. Transmission Line Effects

The transmission lines traverse mainly farm lands. Less than a mile of woodland was lost in installing the lines. Most of the land can be used for agricultural purposes for crops may be planted or cattle grazed up to the towers. The lines were built to minimize adverse effects on railroad signals and communication lines.

6. Impact of Thermal and Chemical Releases on the Biota of Pool 14

It is anticipated that the operation of Quad-Cities will affect the ecology of Pool 14, primarily as a result of condenser entrainment and thermal discharges during operation of the side-jet or diffuser discharge. As much as 20% of the planktonic organisms may be destroyed in the condensers during extreme low flow periods. However, the infrequency of extreme low flows mitigates this effect. The most likely effects to be observed are: (1) changes in downstream species diversity during critical summer periods; (2) fish attraction to effluent areas, creating the potential for thermal and chemical effects; and (3) changes in primary production rates compared to preoperational conditions. The staff concludes that these effects are not likely to permanently alter the ecological stability of Pool 14 since they are reversible when the spray-canal is installed.

7. Biological Monitoring Program

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In addition to the proposed non-radiological monitoring (Bio-Test), a number of specific additional monitoring studies will be required of the applicants. The total monitoring requirements are outlined in the Technical Specifications. The staff concludes that the Bio-Test programs are of sufficient detail to detect any long-term ecological changes in Pool 14. The additional studies to be required deal with specific effects of station operation on each biological community.

8. Radiological Impact

There were numerous comments on this section which led to a rather complete reevaluation of the radiological impact. The gaseous source term was re-computed and the dose values were re-computed without the radwaste system improvements and with the radwaste system improvements. These results are given in Sections III D and V D.

The applicants are required to comply with 10 CFR Part 20 and Part 50 regulations concerning radwaste releases to the environment. Both gaseous and liquid releases will be reported in accordance with AEC Safety Guide No. 21, "Measuring and Reporting of Effluents from Nuclear Power Reactors." In addition, the applicant will be asked to make every reasonable effort to limit effluent releases to the lowest practicable level.

In the evaluation of the radiological impact average doses are listed for the convenience of the reader and are not expected to be misleading, since the maximum individual doses are listed as well. All doses are below the limits set forth in 10 CFR Part 20 indicating that under normal circumstances, no member of the general population will be over-exposed.

A number of comments have been made regarding radioactive wastes from fuel reprocessing and their disposal. Any licensing action by the Commission for fuel processing or waste disposal facilities will involve special considerations of environmental impacts. In addition, the AEC intends to treat generically the entire fuel cycle at a later date.

The AEC is supporting the study of the effects of nuclear power generation on the environment. In addition to the individual analysis done on the effects of each plant in its Environmental Statements, a program is being carried out to project the effects of nuclear power generation in the year 2000 from all United States facilities. The results of the latter study will be published when it is completed.

9. Station Accidents

The doses calculated as consequences of the postulated accidents are based on airborne transport of radioactive materials resulting in both a direct and an inhalation dose. Our evaluation of the accident doses assumes that the applicants' environmental monitoring program and appropriate additional monitoring (which could be initiated subsequent to an incident detected by in-plant monitoring) would detect the presence of radioactivity in the environment in a timely manner such that remedial action could be taken if necessary to limit exposures from other potential pathways to man. The small quantities of dispersed radioactive material which might enter the food chain would not be significant in terms of endangering aquatic life.

A comment was made that no specific information on meteorology was given for accident conditions. The meteorological assumptions used in the accident calculations are indicated in the proposed Annex to Appendix D published on December 1, 1971. The conditions assumed for the analysis approximate the dispersion conditions which would prevail at least 50% of the time.

The station Technical Specifications, which are part of the license for facility operation, prohibit facility startup unless all the Emergency Core Cooling Systems (ECCS) are proven operable. If a part of the ECCS becomes inoperable during facility operation, continued operation is permissible for a specified limited period of time provided adequate redundancy is proven to be available.

In addition, the Illinois Pollution Control Board Permit* requires that "The permittees shall not operate any reactor at Quad-Cities if any of the reactors emergency core cooling systems are unable to operate."

10. Cost-Benefit Analysis

Comments received on the cost-benefit analysis have been considered in connection with the revision of subsection 5 on "Cost-Benefit Balance" and Table 22 on "Cost-Benefit Summary" in Section XI. With regard to the question of the economic effect of operating a Quad Cities unit at less than the full capacity of 800 megawatts, the applicants have calculated the cost of replacement energy as varying proportionally to the extent of derating from \$61,000 per week for a 10% derating to \$486,000 per week for an 80% derating (minimum load).

*Illinois Pollution Control Board Hearing 71-20 Supplementary order (by Mr. Dumelle) December 9, 1971.

B. <u>COMMENTS RECEIVED ON THE ADDENDUM TO THE DRAFT ENVIRONMENTAL</u> STATEMENT

Pursuant to paragraphs A.6 and D.1 of Appendix D to 10 CFR Part 50, an Addendum to the Draft Environmental Statement, describing a major change in the station cooling system, was transmitted, with a request for comment, to the:

Environmental Protection Agency Federal Power Commission Department of the Army, Corps of Engineers Department of the Interior Department of Commerce Department of Health, Education, and Welfare Department of Agriculture Department of Housing and Urban Development Department of Transportation Advisory Council on Historic Preservation Governor of Illinois Iowa Pollution Control Commission Supervisor of Rock Island County.

In addition, the AEC requested comments on the Draft Environmental Statement from interested persons by a notice published in the <u>Federal</u> Register on June 9, 1972 (37 F.R. 11598).

Comments in response to the requests referred to in the preceding paragraph were received from the:

Environmental Protection Agency Federal Power Commission Department of Agriculture Department of the Army, Corps of Engineers Department of Transportation Department of Health, Education and Welfare Department of the Interior Illinois Department of Conservation.

Our consideration of comments received is reflected in part by revised text in other sections of this statement and in part by the following discussion. The comments may be seen in Appendix B.

1. Chlorine Discharge

Measurements of total free and combined chlorine in the discharge canal have been made by the applicants. The limit of the total

XII-6

free and combined chlorine permitted in the discharge bay has been reduced to ≤ 0.1 ppm. This value has been incorporated into the Technical Specifications.

2. Spray-canal Leakage

Currently the applicants plan to seal the canal to avoid water loss through seepage. The water loss referred to would be from the cooling system and, if occurring, would not represent a loss of water on the river, since it could return to the river through the seepage. The Technical Specifications will be revised to cover matters such as these more specifically before the license is issued for spraycanal operation.

3. Operation of the Diffuser After the Spray Canal Is Installed

The effects of spray-canal operation that could be detrimental to health and safety of the public include fog over the nearby road and railroad and leakage of radioactivity (not normally expected to be present). In any case the conditions under which operation of the diffuser-pipe will be permitted after installation of the spray-canal will be delineated in the revised Technical Specifications. These Technical Specifications will accompany the amendment of the license which permits the operation of the station with the spraycanal cooling system.

C. LOCATION OF PRINCIPAL CHANGES IN THE STATEMENT IN RESPONSE TO COMMENTS

Topic Commented Upon	Section Where Topic Is Addressed
Population Density (new figures 5a, 5b and 5c)	II-C
Buffalo Bill Birthplace	II-D
River Temperatures	II-E
Spray-Canal Operation	III-D-1, V-B-3
Interim Open Cycle Cooling	III-D-1, VIII
Spray-Canal Characteristics	III-D-1
Chlorination, Closed Cycle Cooling	III-D-1
Reports on Diffuser-Pipe Operation	III-D-1
Gaseous Radioactive Waste (New tables 6a, 6b and 6c)	III-D-2
Utilization of the Radwaste System	III-D-2
Chemical Wastes (New table 8)	III-D-3
Chlorination	III-D-3, V-C-2
Non-Radioactive Gaseous Wastes	III-D-4
Non-Radioactive Solid Wastes	III-D-4
Diffuser-Pipe Installation	IV-A, V-B-1
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STATE OF ILLINOIS POLLUTION CONTROL BOARD

309 WEST WASHINGTON STREET SUITE 300

CHICAGO, ILLINOIS 60606

DAVID P. CURRIE, CHAIRMAN SAMUEL R. ALDRICH JACOB D. DUMELLE RICHARD J. KISSEL SAMUEL T. LAWTON, JR.

TELEPHONE 312-793-3620

March 23, 1972

ALL BOARD MEMBERS

Jacob D. Dumelle

Quad-Cities Draft Environmental Impact Statement

I have carefully reviewed the draft environmental impact statement of March 6, 1972 and am appalled at the apparent serious inconsistencies between its contents and the evidence adduced in PCB 71-20. Several of the differences are as follows:

- 1. Site boundary dose to people in the impact statement is stated to be 120 mrem per year. This is 100% of background and much too high in my opinion. Depending on the shielding factor (not stated in the impact statement) the fencepost dose would be either 24% or 360 mrem per year. This latter would be compared to the 157 mrem/yr. expressed to be the "worst official site fence post" in the 71-20 hearing (R. 475) er 52 Mr to people using the usual shielding factor of 3.
- 2. The expected station release rate of radicactive gaseous emissions is stated as being 190,000 microcuries per sec. in the draft statement (n.89). In the permit issued in 71-20 an upper limit of 110,000 microcuries per sec. was set on the basis that such a figure would represent the upper limit for anticipated plant emissions (R. 475). Other testimony should that expected emissions would be in the area of 100.000 microcuries per sec. and below that figure (R. 549-550) in the area of 25,000 microcuries per sec. (R. 578-584, 587).
- 3. In the granted permit liquid radjoactive releases are limited to 26 Ci/yr. exclusive of tritium with an additional 30 Ci/yr. being allowed for tritium. The anticipated releases reported in the impact statement are 30 Ci/yr. less tritium, plus an additional 40 Ci/yr. for tritium (p.59).

1829

TO: All Board Members -2- March 23, 1972 Subject: Quad-Cities Draft Environmental Impact Statement

4. Apparently notwithstanding any action or prohibition by the IPCB or expecting acquiesence from the Board as a foregone conclusion the applicants seem to intend to operate both units until Januarv 1973 with the side-jet discharge (p.37). Further the statement states, "In order for the station to adhere to the Illinois standard...the station power would have to be limited to about 25% of full station output" (p.44). The 1973 date is considerably at variance with the August 1972 date which the applicants recently petitioned the IPCB to grant as a modification of the date in the permit (Petition to Modify Permit, filed March 1, 1972).

The unreconciled differences between testimony at the IPCB hearings and statements in this later draft environmental statement pose several/questions:

- 1. Should not the differences be reconciled before the plant is allowed to operate? I would suggest that these matters be added to the pending Quad-Cities permit modification.
- 2. Since the plant cannot operate until after the publication of a final draft statement shouldn't we wait for such publication in future similar cases, i.e. Zion, GE MERP?

R.S. M.

Jacoh D. Dumelle Board Member

JDD:rj

ILL.NOIS POLLUTION CONTROL BOAND November 15, 1971

In the matter of

71-20 177 11 113

JOINT APPLICATION OF COMMCNWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD CITIES PERMIT)

Opinion of the Board (by Mr. Currie):

Like in 70-21, Application of Commomwealth Edison Co. (Dresden #3), decided March 3 and April 28, 1971, this is an application under Title VI-A of the Environmental Protection Act for a permit to operate a new nuclear generating station, this one consisting of two 809-mw boiling-water reactors at the Quad-Cities plant near Cordova on the Mississippi River in northwestern Illinois. We grant the permit on terms similar to those imposed in the Dresden case, with differences indicated below. We note that there are environmental considerations on both sides in this case. Petitioner Towa-Illinois operates an old, smoky coal-fired power plant in Moline that cannot be retired until Quad-Cities is in operation. Every day's delay in bringing Quad-Cities on line means another day of dirty air in Moline. See Iowa-Illinois Gas & Electric Co. V. EPA, # 71..65 (Sept. 16, 1971).

The statutory framework, the operation of a reactor, the environmental problems and their means of control, the federal radiation standards, their derivation, and their relation to state law, are all explained in detail in our March 3 Dresden opinion and will not be repeated here. The utilities raise once again the argument that federal law deprives us of authority to set standards for radioactive reactor discharges; we adhere to the contrary position for reasons given in the first Dresdon opinion, and to the other jurisdicational and statutory interpretation conclusions there reached.

As held in Dresden, our authority in this proceeding extends to all environmental aspects of the Quad-Cities station, the most critical of which are gaseous and liquid radioactive wastes, protection against radiation resulting from accident, and thermal discharges to the river. We also must examine provisions for disposal of solid radioactive wastes, for ordinary chemical. waste and sewage, and for control of any conventional air pollutants that may be generated by such sources as boilers. If construction had not yet begun, we should be concerned with plant siting as well. But construction is all but complete. Pursuant to permission granted July 22 (see transcript of Board meeting of that date), fuel loading has been completed in Unit #1, testing at significant power loads is ready to begin, and full commercial service is expected in the near future. Unit 12 is to be loaded in November, with a similar testing schedule contemplating full operation not long after the first of the year. We shall discuss the several points of 11 environmental concern separately. 1829

1. <u>Gaseous Radioactive Emissions.</u> Each of the two generating units is designed to emit no more than 100,010 microcuries per second (uCi/sec) of gross activity, and with fair fuel performance is expected to emit no more than 25,000 uCi/sec as a long-term average (R. 451, 584, 593; Environmental Feasibility Report, p. 21), with monthly averages possibly ranging as much as 4 1/2 times as high (R. 454). Emissions from other sources are far smaller; the principal one is the turbine gland seals, which are expected to emit only 525 uCi/sec (R. 477).

Original AEC emission limits were designed in individual cases so as to assure that the annual radiation dese to a hypothetical person spending all his time in the open air at the plant boundary ("fencepost") would not exceed 500 millirem (mr). In the case of Quad-Cities this standard could be met if emissions (except for the small ventilation stack emissions) were limited to 350.000 uCi/sec when both units are operating at full power and 250,000 when one is (R. 474). Anticipating much better performance than this, Edison and Iowa-Illincis have proposed annual emission limits of 110,000 uCi/sec and of 80,000, for both units or for one, respectively, which would produce a fencepost dose of 157 mr per year (R. 26, 474). As the companies point out, the actual dose to persons living or passing through the vicinity will be significantly lower, since most people live inside houses that provide some shielding, most do not live at the property line, and most spend part of the time away from the site. Natural background radiation in the area is said to yield an annual dose of 100 to 140 millirems (R. 146: Environmental Feasibility Report, r. 22). Moreover, at instantaneous emission levels just under half the annual average limits proposed (52,500 and 37,500 uli/sec for both units and for one), the companies pledge to make operational changes if possible to reduce emissions at once and to look toward early fuel replacement if necessary, since several months may be required to rectify the situation without unduly interfering with power production (R. 26, 50-52).

Beyond this, however, as at Dresden, the utilities have begun the design and are committed to the construction of additional control facilities, consisting of a device for recombining hydrogen with oxygen and sight charcoal bads to afford a substantially longer delay before discharge so that short-lived isotopes may decay to insignificance. These facilities will cost \$3,500,000 for each of the two generating units (R. 365-72); they will be completed within thirty months after design was started, or about December 1973 (R. 28, 54); they will reduce design level off-gas emissions from each unit from 100,000 uCi/sec to less than 2500 (a factor of 40) (R. 469, 473), and the annual fencepost off-gas dose from both units operating at full power to 2.4 millinets, with an

-2-

additional 0.08 mr/yr [0.8] from the gland seals, which cannot be routed through the charcoal system (R. 365-72, 478). Utilizing the expected annual average emissions rather than the design figures, the additional facilities would reduce single-unit emissions to 625 and emissions from both units operating together to 1250, which when added to the gland seal emissions of 625 [each unit?] would yield an approximate site emission of only 2500 uCi/sec and a total fencepost dose clearly less than 5 millirems per year.

The utilities contend that exposure to 170 millirems per year is quite safe, as the AEC standards themselves incorporate substantial margins of safety below dose levels at which adverse s matic or genetic effects have been found (R. 324). There is of course a school of thought that the effects of radiation are in linear proportion to the dose and that there is no threshold (see the March 3 Dresden opinion for discussion). Because of this possibility, and in order to be especially safe in dealing with such a dangerous phenomenon as radioactivity, we adopted in the Dresden case, and reaffirm here, the policy of requiring use of the best practicable technology for controlling radioactive emissions, even though a lesser degree of control might suffice to avoid doses set to give breathing space below levels at which harm has so far been discovered. Accordingly in Fr. We convert thrite chose effort were the register the addition of a 1 problem and eight charges. News, and we do the stree here, is the despendes have agreed to do. They have aqueed that a function at the 5 millirems, which will be achieved by this system, is a desirable and achievable goal (R. 324, 474). The AEC has recently required, as a numerical translation of the requirement of best practicable control, that the dose to persons living near the site (Which should be less than that at the fencepost) be limited to 5 mr/yr (AEC Release #778, June 7, 1971).

The companies propose an interim emission limit of 110,000 uCi/sec for all sources then both units operate and S0,000 when one operates. The recombiner and charcoal beds will reduce . total site emissions by a factor of 30. Therefore, in light of the reasons given above, we shall reduce the proposed limits by a factor of 30, ellowing a small leeway in rounding off, to 4000 and 3000 uCi/sec, respectively, as annual avorages. These standards, based on poorer than expected fuel performance, will , allow some room for less than optimal operation, since the - resultant doses are quite small. We do not, however, agree with the companies that we should give such leeway (10,000 uCi/sec) as to ignore the problem of excessive fuel leakage; the policy of best practicable treatment requires both good fuel and good controls. We do agree that there is no need for monthly averages, since at these low levels only long-term exposures are relevant and since monthly values fluctuate enough that meeting a strict monthly standard might impose a significant hardship (R. 454 Very high, short-term emissions of course must be prevented; we think this problem can be adequately handled by the AEC's accident provisions and by requiring the companies. as agreed, to take action when high emission levels (57,500 or 37,500 uCi/sec) are exceeded on an instantaneous basis.

We are urged by the Attorney General to require still further control systems for gaseous emissions. It is said that freon systems, for example, can provide even greater degrees of control than can charcoal, at lower cost, and can in addition remove from the effluent gas long-lived radioisotopes of xenon and krypton, which are not reduced by the system planned for Quad-Cities (R. 630-31). The companies respond that such systems have not yet been shown commercially feasible for facilities as large as Quad-Cities and that it may be more undesirable to concentrate and store the small quantities of long-lived isotopes produced than to disperse them, highly diluted, to the atmosphere (R. 402-06). We need not decide the tricky issue of commercial availability, for we believe the charcoal system will reduce emissions to a very prudent level indeed insofar as gross activity is concerned. The problem of the long-lived isotope, however, is one as to which we wish to express some additional caution for future guidance. Krypton 85, which will be emitted

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years and takes a century to decay to insignificance (R. 650-51). One witness predicted that, unless control measures are instituted, a worldwide buildup of radicactive krypton will occur so that the annual dose to people everywhere from this source will reach 1.7 millirems by the year 2000 and 17-20 millirems 20 to 30 years thereafter (R. 650-51, 664-65). Even these projected levels are rather modest so far as current knowledge of adverse effects goes, and certainly there is no cause for immediate fear. It is not too soon to warn, however, that we do not intend to allow the long-lived radiation problem to become another DDT situation, in which emissions so dilute or so small as to be insignificant in the vicinity of the discharge persist and accumulate to create widespread concentrations of possible adverse ecological significance. We do not today require the capture of Krypton 85 or other long-lived isotopos released from Quad-Cities in presently nogligible quantities; but we may well require such capture before many more years have elapsed.

Along similar lines, it is worth noting the companies' observation that, while gland seal emissions are small in relation to those from the main system as originally designed, they are comparable in magnitude to those from the charcoal bed system (R. 395-97, 477). Moreover, while in plants already built it is impracticable to divert such emissions to the charcoal control facilities, new plants can be built so as to make control of gland seals feasible (R. 395-97). Though the gland seal emissions are small, they should be controlled in the future if they can be without exorbitant expense, in light of the policy of avoiding any unnecessary emissions. 14

Construction of the recombiner and charcoal beds at Quad-Cities will not be complete until December 1973, and the plant is ready for operation this year. It is badly needed both to provide more adequate reserve capacity to guard against interruptions of electric service that would impose significant hardships on innocent customers (see the detailed discussion in the April Dresden opinion) and to relieve the load on olier fossil-fuel plants that contribute significantly to air pollution. Most significantly, the operation of Quad-Cities will make possible the greatly reduced use of coal at an inadequately controlled station in Moline (see Iowa-Illinois Gas & Electric Co. v. EPA, # 71-165, Sept. 16, 1971). At the same time the emissions from Quad-Cities during the interim before completion of the additional control facilities will be low enough to affort a substantial safety margin below dose levels at which adverse effects have been detected. While we have required that those Levels be greatly reduced for additional safety in the future because they reasonably can be, we hold as in the Dresden case that the plant should be allowed to operate in the meantime subject to interim limits, namely, that not more than the proposed 110,000 uCi/sec be emitted from both units, or 80,000 from either alone.1

2. Liquid Radioactive Wastes. The planned discharge of gross activity to the Mississippi River from various sources of liquid waste at Quad-Cities is 26 curies per year plus 30 curies of tritium (R. 384). The utilities intend to dilute these radioactive wastes with cooling water to a concentration of 1 x 10^{-8} uCi/cc (excluding tritium) in the discharge canal. In the river further dilution will reduce concentrations to 7 x 10^{-10} uCi/cc, affording a safety factor of 2300 below the drinking-water standard of 1 x 10^{-7} uCi/cc (which is based on a 500 mr/yr dose to a hypothetical person drinking river water exclusively), so that the dose to one drinking solely from the river would be 0.2 millirems per year. Dilution would also leave a large margin below the drinking-water tritium standard of 3 x 10^{-3} uCi/cc (R. 481-83). On the basis of these facts the companies contend that the expected faces are so insignificant that no further treatmant is worthwhile.

Confronted with a similar situation in the Dresdan case, we pointed out that dilution is not an adequate substitute for treatment because it is better to keep harmful materials out of the environment than to dilute them. This is especially true of materials, such as certain radioisotorss, that retain their dangerous properties for long times after discharge and that can be biologically concentrated by organisms as they move up the food chain. A utility witness acknowledged that cesium, for example, concentrates in fish by a factor of 100 or 1000 (R. 333-34); A zoologist for the Attorney Seneral testified

1. These figures were substantially confirmed by additional testimony in the Dresden case, #70-21 (Oct. 19, 1971), which predicted annual emissions in the neighborhood of 57,500 uCi sec from one unit.

that strontium 90 is concentrated 20,000 to 30,000 times (R. 2168). It may therefore be that the most limiting aspect of liquid waste discharges is not drinking water but aquatic life. It is true that the total quantity of activity to be discharged to the water is quite small as compared with that to be discharged to the air (26 curies per year as compared with several thousand microcuries per second, even after maximum control). But the discharge is to a much more limited receptacle, the river, not to the enormous atmospheric reservoir; and, in light of the policy of keeping as much radiation out of the environment as we reasonably can, we think it important to consider possibilities for reducing liquid radioactive discharges still further.

In response to our concern over this issue, the utilities have with accustomed thoroughness described for us two alternative systems that would provide dramatic additional reductions in radioactive discharges to the river. Neither system will remove tritium from water, for the evidence is that cannot be done. But the "maximum recycle" plan, by the addition of extra ionexchange demineralizers in the floor drain system, would reduce non-tritium activity to 2 x 10-5 uCi/cc before mixing, reduce the total non-tritium discharge from 26 Ci/yr to 1.2, and reduce the non-tritium dose to a hypothetical river drinker from 0.2 to 0.009 millirems per year. This system would cost \$5,000,000 and require 24 months to construct (R. 372-77, 483). Or, with the "maximum treatment" plan, utilizing further concentration, distillation, and ion exchange, the companies think it probable they could meet the effluent standards without any dilution (except for tritium). With this alternative, non-tritium releases would be only 0.0004 Ci/yr and the dose to a river drinker 0.000003 millirems per year. The estimated cost of this alternative would be \$9,000,000 and the time for construction 36 months (R. 377-83, 483).

We think the "maximum recycle" system is a desirable addition to the Quad-Cities plant, in that for a price that is only 2 1/2% of total plant cost it will reduce radioactive discharges from 26 Ci/yr to 1.2. The companies have agreed to the installation of a similar system at Dresden (#70-21, hearings, Oct. 19, 1971, Although the need for such a system is greater there in Ex. 1). order to avoid radiation buildup in the largely closed cooling system planned to meet the thermal standards for the Illinois River, we agree with the Attorney Generil's witness Dr. Devolpi that this additional caution is worth the money in dealing with something so dangerous as radiation (R. 630). On the other hand, we shall not be degmatic in insisting on a complete absence of dilution irrespective of the costs and benefits of so doing. The important policy is that dilution not be employed in lieu of reasonably practicable treatment; when all reasonable means of treatment have been applied, and the costs of further treatment are excessive, dilution should not be forbidden. In the Dresden case we announced the general policy against unnecessary dilution. In the light of additional evidence received since that decision, we think the further reductions below the already small discharges from the proposed "maximum recycle" system that would be afforded by the "maximum treatment" system would not at the present time be worth the \$4,000,000 extra cost.

Thus we shall order Edison and Iowa-Illinois to reduce gross activity discharges, exclusive of tritium, to 1.2 Ci/yr and to 2 x 10^{-5} Ci/cc before mixing, by December 1, 1973, and in the meantime to meet the gross activity limit of 1 x 10^{-7} uCi/cc after dilution, at the point of discharge to the river. As in the case of gaseous discharges, there is no serious risk from the discharges during the interim, and to require the stricter standard to be met at once would keep the plant closed for two years, imposing an unjustified hardship.

Heat. Two thirds of the heat generated in a nuclear 3. power plant cannot be translated into electricity; it is a waste product that presents its own disposal problems. The companies' original plan was simply to discharge the heated cooling water (which at low flow will comprise 1/4 to 1/5 of the river's entire flow and which will be 23° warmer than the river) into the main river channel (R. 698-99, 715, 731, 768). In the summer of 1970, however, a study demonstrated that this scheme would violate the then existing water quality standard (SWB-12) (R. 768), which limited stream temperatures to 90° F. and to 5° above natural temperatures outside a mixing zone extending 600 feet in any direction from the point of discharge. So the companies proposed to install a diffuser, a pipe extending most of the way across the river, discharging heated water at various points in order to maximize rapid mixing with the cooler river water (R. 722). It was their contention that with such an arrangement the standard could be met (R. 824).

But the old standard, we concluded in a recent rule-making proceeding (#R 70-16, Mississippi River Thermal Standards, adopted Nov. 15, 1971), was inadequate to protect the river against a substantial risk of ecological alteration, since it would allow the whole river to be raised by 5° nearly all the time. For this reason we adopted a new standard that imposes monthly maximum temperatures, based upon federal recommendations derived from provailing temperatures and the requirements of the biota at various seasons, that must be met during all but a few days each year at the edge of the 600-foot mixing zone. The companies' evidence, not substantially contradicted, is that they can meet the new standard too with their diffuser alone, avoiding the expenditure of \$40,000,000 or more for cooling towers or spray ponds. We find it probable on this record that they can and therefore will not require the installation of alternative cooling devices at this time. We do require that the companies conduct a detailed study of the effects of discharges and that additional measures be taken if significant harm is shown to occur.

A more difficult issue is what to prescribe while the diffuser is being built. As in the Dresden case, we find it somewhat surprising that the companies did not discover until 1970 that the long-existing standards would require even so much as a diffuser pipe, with the unhappy result that even the diffuser will not be

available before February, 1972 (R. 9). Indeed, later dalays resulting from permit proceedings before the federal government and the Iowa water pollution agency have so far prevented construction of the diffuser and put its operation off until later in the Spring. However, as noted above, the plant is badly needed, and right away, if innocent consumers (and the air-breathing public) are not to suffer. The harm to the river in the meantime, if we impose certain conditions to keep it within bounds, is a risk rather than a certainty; while we would not allow it over the long term, the great probability is that any harm that does occur will be undone naturally by repopulation from unaffected areas after adequate cooling is provided.

So we will allow Unit #1 to be operated, with the discharge improvements promised by the companies, as soon as it is ready. With only one unit in operation, the increase in temperature through the plant will be only 13° (R. 30), and river dilution will be adequate to assure that the whole stream not be raised by 5° even at low water.²

Moreover, we shall require the companies to report on the feasibility of installing spray modules in the discharge canal, as at Dresden, to reduce the heat discharged to the river. Unit #2 may be tested during this period, as the utilities request, in order to assure its availability for the peak domands of summer 1972 (R. 31), but, to avoid a full heat load on the river without even rapid mixing, which might do considerable damage, the total station output shall not exceed 809 mw--that of either unit alone--until the diffuser pipe is in operation to assure that large areas are not raised more than 5°.

4. <u>Nuclear Accident</u>. The Attorney General raised the question of the adequacy of safeguards against the possible escape of radioactive materials in the event of an accident. In light of recent controversy over the adequacy of certain systems for cooling reactor cores in the event of a coolant loss, we scheduled an additional two days of hearings, after the record had been closed, to sursue the question. On the basis of the record we cannot find such a significant danger of failure of the emergency cooling system as to lead us to dalay further the operation of this needed facility.

^{2.} The companies say the area raised by more than 5° will be only 20 acres (R. 791).

A highly qualified witness from General Electric, manufacturer of the reactors, testified in great detail as to the integrity of normal controls making the need for emergency cooling highly improbable; to the guadruple emergency systems provided, each independently capable of quelling any foreseeable problem; and to the extensive testing that had been and would be performed to determine and to maintain the adecuacy of the systems. He assured the Board that the problems encountered in recently publicized tests were specific to an entirely different type of emergency system that had never been used or planned for boiling water reactors (R. 2336-2426). Dr. Alexander DeVolpi of Argonne National Laboratory suggested that a 1970 incident at Dresden raised questions as to the adequacy of BWR emergency cooling systems, but he was unable to demonstrate that the incident was one in which an emergency cooling system would be expected to operate. Dr. Henry Kendall of MIT emphasized the desirability of further testing of these systems but agreed that the problems recently encountered with cooling systems had no application to the BWR's and had no suggestions for improving the Quad-Cities system. Neither he nor Dr. DeVolpi asked that the permit be delayed or withheld; the latter expressly said that "inherent safety features make water reactors extremely safe" and that the "probability of failure necessitating emergency core cooling is very small" (R. 2428-2542).

While we shall maintain a continuing concern for this and all other matters related to possible radiation hazards, and while we shall provide that the permit may be modified or revoked if this is proved necessary by new information, we do not perceive a justification today for withholding the permit.

Other Issues. Because of the advanced stage of 5. construction, siting considerations are of little consequence in this proceeding; suffice it that we see no reason to require that this plant be dismantled and repuilt somewhere else. Solid radioactive wastes will be contained and shipped to an established burial site (Environmental Feasibility Report, p. 36), and we have no evidence to indicate any undue dangers in the plans for this operation, either at Quad-Cities, in transit, or at the ultimate disposal site. The appropriate disposal of such dangerous wastes, however, is an important subject with which we expect to have more to do in the near future. The Attorney General raises the cuestion of nuclear accidents, but we think the evidence insufficient to show the need for 19 additional precautions on this score beyond those already

provided. The gaseous radiation controls agreed to by the utilities will add significantly to accident protection (R. 641-42). The sewage treatment system and the gas-fired boilers are designed to comply with all relevant regulations, and there is no indication that any nonradioactive solid wastes generated at the site will be improperly disposed of. No chemical water contaminant problems appear; the use of sodium hypochlorite for condenser cleaning will add some chlorine to the river, and chlorine and its compounds can be toxic to fish; but the undisputed testimony is that the small amount of chlorine added will be rendered innocuous within two minutes by the chlorine demand in the river (R. 285-87).

The Attorney General moved on November 11 that we further delay decision in this case pending study of the transcript of a recent Iowa hearing with respect to the effects of the proposed diffuser. We denied this motion 4-1, Mr. Dumelle dissenting, on the ground that ample opportunity had already been afforded for the presentation of evidence and that there was no justification for the extraordinary course of reopening and further delay.

In conclusion, we should like to commend the applicants for a thorough and lucid presentation of the relevant facts, and to thank the Attorney General for his participation, which provided the adversary proceeding that is so necessary to adequate resolution of the issues by the Board.

Mr. Dumelle dissents for reasons to be stated in a separate opinion.

This opinion constitutes the Board's findings of fact and conclusions of law.

ORDER

After due notice and hearing, and for the reasons given in the Board's opinion, a permit is hereby issued to Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Co. to operate Units ##1 and 2 at the Quad-Cities Nuclear Power Station near Cordova, Illinois, subject to the following conditions:

-11-

General Conditions

1. This permit shall not release the permittees from any liability or obligation imposed by Illinois statutes or local ordinances and shall remain in force subject to all conditions and limitations now or hereafter imposed by law. The permit shall be permissive only and shall not be construed as estopping or limiting any claims against the permittees for damage or injury to person or property resulting from any acts, operations, or omissions of the permittees, their agents, contractors or assigns, nor as estopping or limiting any legal claim of the state against the permittees, their agents, contractors or assigns, for damage to state property, or for any violation of subsequent regulations or conditions of this permit.

2. This permit is subject to modification or revocation, and may be suspended at any time for failure to comply with the terms stated herein or with the provisions of any other applicable present or future regulations or standards of the IPCB or its predecessors or successors, and is issued with the understanding that it does not estop the Board from subsequent establishment of further requirements for treatment or control at any time. The Board upon notice and opportunity to be heard may reopen this proceeding at any time for the purpose of such revocation or modification in order to prevent or reduce pessible pollution of the environment.

3. The permittees or their assigns shall defend, indemnify and hold harmless the State of Illinois, its officers, agents and employees, officially or personally, equinot any and all actions, claims or demands whatsoever which may arise from or on account of the issuance of this permit, or the construction or maintenance of any facilities hereunder.

Special Conditions Pelating to Radioactive Discharces

[1. Policy of the Board]

It is the policy of the IPCB that all radioactive pollution of the environment shall be held to the lowest level that is attainable within the limitations imposed by technological feasibility and economic reasonableness. In no case shall rembers of the public be exposed to radiation beyond the limits recommended by the International Cormission on Padiclogical Protection, nor shall radioactive emissions ever exceed the limits imposed by the United States Atomic Energy Cormission. In addition, the actual levels

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of radiation exposure of members of the public shall be kept as far below those limits as possible, consistent with technological feasibility and reasonableness of cost.

[2. Radioactive Discharges Generally]

In keeping with the above policy of the IPCB, all practical measures for treatment, control and containment of radioactive wastes from Quad-Cities Units 1 & 2 nuclear generating plant of the Commonwealth Edison Company shall be employed for the purpose of preventing the release of radioactivity to the environment. Such measures shall include at least, but not be limited to; all measures for the treatment, control and containment of liquid and gaseous radioactive effluents that are indicated in the Final Safety Analysis Report of the Quad-Cities Units 1 & 2 nuclear generating plant.

[3. Liquid Radioactive Discharges]

(a) The annual average gross beta-gamma radioactivity of liquid effluents released to the Mississippi River shall not exceed 10-7 uCi/ml (100 pCi/l).

(b) Total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 26 curies.

(c) Tritium discharged to the Mississippi River in any year shall not exceed 30 curies.

(d) On and after December 1, 1973, total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 1.2 curies, and gross activity exclusive of tritium shall be reduced to 2×10^{-5} Ci/cc before dilution.

[4. Gaseous Radioactive Discharges]

(a) Gross beta-gamma radicactivity of gaseous emissions released to the atmosphere from either Unit 1 or Unit 2 shall not exceed an annual average of 80,000 microcuries per second, and emissions from both units operating at the same time shall not exceed an annual average of 110,000.

(b) If gaseous radioactive emissions at any time exceed 37,500 uCi/sec from either Unit 1 or Unit 2, or exceed 57,500 uCi/sec from both units operating at the same time, the permittees shall initiate operating procedures, to the extent permitted by power demand, to reduce such release.

(c) On and after September 1, 1973, gaseous radioactive emissions from either Unit 1 or Unit 2 shall not exceed an annual average of 3000 uCi/sec, nor shall emissions from both units operating at the same time exceed an annual average of 4000 uCi/sec.

[5. Heated Water Discharges]

(a) With the discharge improvements described in the Supplement to Appendix C of the Application as Amended, Units 1 and/or 2 may be operated until April 1, 1972, at a total output not to exceed 809 mw, without regard to the heat limitations of regulations SWB-12 as amended by #R 70-16 or of successor regulations, provided that:

- .(i) until operation of the diffuser is achieved, effluents shall not exceed ambient river temperatures by more than 12°F; and
- (ii) within thirty days after receipt of this permit, the permittees shall submit a statement regarding the feasibility and cost of installing spray modules to reduce the heat discharged in the interim before completion of the diffuser. The Board upon receipt of such statement will take such further action as appears appropriate.

(b) On and after April 1, 1972, Units 1 and 2 shall be operated only in full compliance with all provisions of SWB-12 as amended by #R 70-16 or of successor regulations, with regard to heated discharges.

[6. Reporting and Monitoring]

(a) Liquid discharges. Prior to any release of radioactivity in liquid effluents, each batch will be counted for gross beta activity, excluding tritlum. Records of the radioactive concentration and volume of each batch of effluent shall be maintained as well as records of the amount of circulating water available for mixing. At least once per month a gamma scan of typical batches of effluent shall be performed to determine the gamma energy peaks of these batches. Isotopic analyses of representative batches of effluent, including determination of tritium, shall be performed and recorded at least once per guarter. If the monthly gamma scan reveals energy peaks other than those determined by the previous isotopic analyses and if the difference is significant, a new set of isotopic analyses will be performed and recorded.

(b) Airborne activity. Radioactive gases released from the reactor building stack and plant chimneys shall be continuously monitored. To accomplish this, at least one reactor building stack monitoring system and plant chimney monitoring system shall be operable at all times. Daily samples of the air ejector effluent will be taken. Within one month after initial

commercial operation of the unit, an isotopic analysis will be made. From this analysis a ratio of long lived to short lived activity will be computed. If a ratio based on any daily sample indicates a change greater than 20 per cent from the previous isotopic analysis, a new isotopic analysis will be performed and recorded. In any event, a new isotopic analysis will be performed at least quarterly. Gaseous releases of tritium shall be calculated monthly from measured data. Records from the continuous monitors, the daily samples and the isotopic examinations shall be maintained.

(c). All effluent and environmental monitoring program results shall be reported monthly by the Permittees to the Environmental Protection Agency (EPA). All monitoring program results shall also be available for inspection by the Environmental Protection Agency at the plant site at any time.

[7. Emergency Situations]

The Permittees shall cooperate to the full extent necessary with the EPA and with the Illinois Department of Public Health for purposes of development by those agencies of an adequate and effective emergency protection plan designed to immediately control and minimize the effects of any accidental release of unexpectedly large quantities of radioactivity from the Quad-Cities nuclear generating plant. In particular, the permittees shall immediately notify both the EPA and the Illinois Department of Public Health of any uncontrolled release of unexpectedly large quantities of radioactivity to the offsite air and/or water environment due to operational failure of any of the power plant systems, and shall report monthly to the Board and EPA any activation of the emergency core cooling system, whether spurious or real, exclusive of today.

[8. Time of Permit]

This permit shall expire on Novembor 15, 1973. If the permittees wish to continue operation of Quad-Cities Units 1 and 2 beyond that date they shall file with the IPCS an application for a renewal permit on or before August 15, 1973. Said application shall contain complete information and data:

(a) concerning the radioactive emissions, gaseous and liquid, up to that date,

(b) concerning the status of the construction and installation of the radioactive control facilities required by this permit, and

(c) concerning thermal discharges and their effects on the Mississippi River. Said application shall also include such other information and data as required by the Board to evaluate the impact on the environment of Quad-Cities Units 1 and 2.

[9. Compliance with Existing Laws]

The permittees shall conform to all existing and future laws and regulations in other aspects of the operation of Quad-Cities Units 1 and 2, including among other things the operation of boilers, the operation of sewage treatment facilities, and the disposal of solid waste, and shall procure from the Environmental Protection Agency such permits as may be required for various aspects of that operation.

Church matter

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POLLUTION CONTROL BC (D ORDER

Opinion PCB71-20

I DISSENT I CONCUR David F. Curris David F. Currie Chairman Choirman uduet. Samuel R. Aldric Samuel R. Aldrich Board Member Board Member Jacob D. Dumelle Jacob D. Dumelle Board Member Board Herber Richard J. Kissel Board Member Board Member Samuel Lawion, Jr. Samuel T. Lawton, Board Member Board Member-

November 25, 1971

ILLINOIS POLLUTION CONTROL BOARD November 15, 1971

in the matter of



JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD-CITIES PERMIT) PCB 71-20

Dissenting opinion by Mr. Dumelle:

The Board, by a 3-1 vote on this date has granted the permit for the Quad-Cities reactors to operate. I dissented for the following reasons in this order of importance.

- 1. The lack of time in which to adequately assess the Emergency Core Cooling System (ECCS) testimony received only eight working hours previous to the decision.
- 2. The excessive and unnecessary radiation dcsage to the public in the vicinity of the Quad-Cities nuclear plant under the permit.
- 3. The opinion that the jet diffuser will serve as a barrier to the passage of fish in the Mississippi River.

I. The Emergency Core Cooling System

On Thursday, November 11, the Board heard Dr. Kenry Kendall, Chairman of the Union of Concerned Scientists, and a physicist at the Massachusetts Institute of Technology, tell why his group feels that present Evergency Core Cooling System design is not adequate. His testimony, which was well researched and impressive, detailed the consequences of an ECCS failure.

If a Loss of Coolant Accident occurs, the uncovered fuel rods in the cone would heat up, distort, maximum and thus block cocleant flow into the hot opots of the core. Metal-water reactions will add to the heat present; embrittlement of the cladding will occur and subjectic alloys will form. All of this could lead to an irreversible reaction--a molten core at 3,000F. to 5,000F, which would rupture both the inner and outer contaminant vessels and release clouds of radioactive gases to the atmosphere. Depending

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upon the winds at the time, these lethal clouds could travel over highly populated areas and cause lethal doses of radiation within a 60-70 mile radius. Hundreds of thousands of people might be killed if such a sequence occurred at either Quad-Cities or its twin at Dresden (R. 2467-8, 2527-30).

Commonwealth Edison Company and Iowa-Illinois Gas & Electric Company (the Utilities) and their vendor, General Electric Company, point to the several core cooling or feedwater systems which would energize and cool the core before the fatal 60 seconds of uncovered core has passed. Accepting as true the uncontroverted testimony that after the initiation of an incident requiring Emergency Core Cooling, 30 seconds elapse before the core sprays are activated, leaving only another 30 seconds for the ECCS to do its job (R.2475, 2491) we must take note of the import of Dr. Kendall's testimony.

Dr. Kendall tells us that even if the ECCS system functions it may not stop the excursion and consequent disaster. The ECCS system is like the emergency brake system on our cars. We may put it on and the brakes may engage but just as the mechanical momentum impels the car forward so too may the reaction in the core be unstoppable and proceed to total core meltdown. That is the meaning of all the testimony by Dr. Kendall about test results and computer codes and blithe assumptions that are not realistic.

The next logical question is "What are the chances of a Loss-of-Ceolant-Accident?" Dr. Kendali puts them at being very high when he says "I expect an incident (of core uncovering) in the next few years" (R. 2532). If we take a "few years" as being three years and compare the seven existing power reactors in Illinois soon to be on line (Dresden 3, Quad-Cities 2, Zion 2) with the 121 reactors listed by Dr. Kendall (Bd. Ex. #2 Supp. 2 p.1) the chances are simply 7 in 121 that this incident will occur in Illinois or a 1:17 chance. These are very high odds. And if the "brake" does not work then monumental tragedy may ensue.

The short time left after Dr. Kendall's testimony was finished was simply not enough to read the Final Safety Analysic Report or the Edison report to the Atomic Energy Commission of the previously not publicly known ECCS activiation incident at Dresden 2 on June 5, 1970. From these documents, at the very least, a fuller picture would have emerged that night have resulted in some core temperature restriction or, a speedup in the sensor testing program, or both. I had asked to defer consideration of the permit application until the next Board meeting a week hence and that motion, by a 2-2 vote was lost. With so much at stake the Board should have granted the additional study time.

II. Excessive Radiation Doses to the Public

The permit as passed by the Board will permit dosages to the public living nearby of 80 millirems when full power on both reactors

is achieved, supposedly after April 1, 1972. From this date, until September 1973, the amended date at which the gas cleaning system is to be operative, an approximate 120 millirems dose will be delivered to the public living nearby. In other words, these people will receive an unnecessary dose of radiation equal to a year's normal background level. Put another way, in the yearand a half of full power, the nearby public will receive two and one half years of radiation. Since most scientists hold that no acceptable threshold values exist for unnecessary radiation exposure, it follows that there is some unnecessary risk of induction of leukemia, other cancers and genetic defects.

If it were necessary that this radiation occur then the balance might be somewhat easier. The Board could then balance the effects from the smoke from the Moline power plant and the leukemia-cancergenetic defects against the necessity for power. But it is wholly unnecessary. Edison's own witness, Mr. Harold Williamson testified that fuel rods did not deteriorate in storage and could be used again (Dresden Record, October 19, 1971 p. 75-79). All that would be necessary for the Utilities to do would be to refuel when emissions exceeded 25,000 pCi/sec. per reactor at full load, retain the "dirty" fuel, load with new fuel, and use the "dirty" fuel after September 1973 when the off-gas control system would be operative. The only cost to the Utilities would be the interest on the fuel rod investment plus the cost of the additional down time required for refueling. Since we have been told by Edison that it took the unusual step of completely refueling Dresden 2 after the June 5, 1970 incident, refueling as a precaution is certainly possible and indeed has been done in the past.

I would have retained the 25,000 µCi/sec. limit on the uncontrolled Quad-Cities reactors as a maximum, similar to the limit we set on the Dresden 3 reactor in March 1971. I think the Board has now set a precedent, in parmitting 30.000 µCi/sec. for a single Quad-Cities reactor (more than a 200% increase) that will haunt the Board. The Board next week may decide a further order on Dresden 3 and the pressure will be on to relax the limit in that permit and to go with the looser (and "dirtier") Quad-Cities level.

III. The Jet Diffuser as a Barrier to Fish

The Board has given its permission to the Utilities to use a jet diffuser to dissipate the heat from their operation. The effluent is permitted to be 23°F. above river temperature. It has not been proven to me that fish will in fact go through the diffuser's considerable turbulence (which is the reason for its effectiveness as a heat spreader). Just because there may be interstices of cool water between the individual hot plumes does not mean that a fish will seek them out any more than a horse may willingly run between burning trees in a forest fire. Furthermore, the jets will create some underwater noise and fish are notoriously

sensitive to noise. What is called for and what is lacking, are actual experiments with full-width diffusers to determine if fish will in fact willingly go through them. The Board should not permit a barrier to be constructed and then be under the considerable pressure of making worthless this substantial investment if it is shown to greatly impair natural fish movement.

IV. Conclusion

Between the November 11 testimony of Dr. Kendall and the Board action of November 15 the Chicago Daily News (November 13) ran a perceptive editorial as follows:

Nuclear power dilemma

From the testimony adduced so far there appears no reason to deny the Commonwealth Edison Co. a permit to build its projected new Quad Cities nuclear plant Edison, speaking through Asst. to the at Cordova. President Byron Lee, told the Illinois Pollution Control Board that at no time during a pre-operational accident at the Dresden plant in June, 1970, was there any hazard to the public. At that time a safety valve was accidentally opened by a "spurious" electronic The steam turbine and reactor were shut signal. down instantly. Had the water level receded enough to expose the reactor fuel core, the core could have overheated and sent radioactive gas clouds over the adjacent countryside.

Members of the Union of Concerned Scientists have testified that, while "fail-safe" mechanisms operated in this case, the sum-total of existing precautions are not sufficient to ensure such an accident will not recur and "lead to complete core uncovery". It questions the feasibility of proceeding with new plants of the Dresden design until and unless greater safety can be built into the designs.

Con Ed says that this is the only time a safety valve has failed to function properly, and there is no reason to suppose that if it ever did fail again, the built-in precautions wouldn't operate as they did in this case.

Wrapped up in this single example is the whole dilemma facing government, industry and the public: Granting the deadly potentials of the fuels used in nuclear power plants, how safe is "safe enough?" There can hardly be any turning back from the course of development charted by the power companies. Increasingly, the public is being locked into absolute dependency upon the power from the great nuclear plants that are mushrooming adjacent to the principal lakes and rivers. In Illinois the Pollution Control Board and nationally the Atomic Energy Commission have the job of making as certain as possible that the risk of contamination is kept at the absolute minimum. In a situation where disasters can result either from too little or too much caution, the public can only hope that their judgment is good.

The Board by its Dresden decision in March 1971 and under Title VI-A of the Environmental Protection Act has responsibilities in the area of nuclear plant regulation. With these responsibilities comes the "job of making as certain as possible that the risk of contamination is kept at the absolute minimum". I feel that we should have done more in this proceeding to be "certain".

Jacob D. Dumelle

I, Christan Moffett, Acting Clerk of the Illinois Pollution Control Board, hereby certify that the above Dissenting Opinion was submitted on the <u>A</u> day of November, 1971.

Christan Koffett, Acting Clerk Illinois Pollution Control Bcard

THE UNIVERSITY OF WISCONSIN MADISON 53706

DEPARTMENT OF ZOOLOGY BIRGE HALL 50 - 254

50 - 265

April 3, 1972

Dr. Peter A. Morris, Director Division of Licensing U. S. Atomic Energy Commission 1717 H Street, N. W. Washington, D. C.

Dear Sir;

Enclosed are evaluative comments on "Draft Detailed Statement on Environmental Considerations by the U. S. Atomic Energy Commission, Division of Radiological and Environmental Protection Related to the Proposed Issuance of an Operating License to the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company Quad-Cities Nuclear Power Station Units 1 & 2, Docket Nos. 50-254 and 50-265." issued March 6, 1972.

Comments are submitted by me on behalf of the League of Women Voters of Moline, Illinois and Scott County, Iowa, at whose request I have studied the Draft Statement, prepared the comments, and forwarded them to you, pursuant to certain provisions of Section 102, NEPA.

I would like to state here that I hold the degree Ph. D. in Zoology and Statistics from the University of Wisconsin, that I have been a member of the permanent faculty (Zoology) in the University of Wisconsin, Madison, Wisconsin, since 1951, and that my professional specialties are Ecology and Aquatic Biology.

Very sincerely yours, ohne Neens.

John C. Neess Professor of Zcology

cc C. E. Q., Washington, D.C. L. W. V., Moline, Illinois



U. S. ATOMIC ENERGY COMMISSION

DRAFT DETAILED STATEMENT ON ENVIRONMENTAL CONSIDERATIONS BY THE U.S. ATOMIC EMERGY COMMISSION DIVISION OF RADIOLOGICAL AND ENVIRONMENTAL PROTECTION RELATED TO THE PROPOSED ISSUANCE OF AN OPERATING LICENSE TO THE COMMONNEALTH EDISON COMPANY AND THE IOWA-ILLINOIS GAS AND ELECTRIC COM-PANY QUAD-CITIES MUCLEAR POWER STATION UNITS 1 & 2

Docket Nos. 50-254 and 50-265

COMMENTS ON SAID DRAFT STATEMENT SUBMITTED ON BEHALF OF LEAGUE OF WOMEN VOTERS OF MOLINE, ILLINOIS AND SCOTT COUNTY, IOWA

Comments here are directed primarily at certain parts of sections V., VI., VII., VIII., IX., and X. of the Draft Statement. They will be arranged under those headings. Also included, under "Summary", are comments concerning the Statement as a whole.

V. Environmental Impacts of Plant Operation.

A.3. Transmission Lines

The station will require about 80 miles of high transmission lines that would not be built if the station were not in operation. It is stated that these lines will pass primarily through flat farmland. No information is given of the reduction in productivity of these lands following from the presence of the lines; it is apparently assumed that there will be none. Such lines interfere seriously with the following practices, all of which may now or later be used in the area: installation of self-

propelled irrigating systems and their operation, aerial seeding, fertilizing, and distribution of insecticides. As much as 5,000 acres of farmland may be affected by 80 miles of transmission lines, depending upon how the lines are laid out, and the reduction in yield may be substantial if aircraft cannot be used in working the land.

B.1. Water Use; River Water

See comments below on isolation of the effects of this single plant. No diminution of flow volume due to operation of this plant can be considered insignificant as long as it is recognized that the existence or later installation of other plants of the same sort will steadily add to its effect. Even small reductions in flow volume may have profound effects in redistribution of bed-load, changes in the contours of the channel, changes in the seasonal deposition of sediment, etc. The question of flow-reduction is dismissed with insufficient attention.

C.l. Biological Impact; Terrestrial

There is no evidence for the stated expectation that the habitat for land animals on adjacent islands or in the nearby wildlife refuge will not be affected by operation of the plant. Many of the terrestrial vertebrates inhabiting the islands and the refuge depend upon aquatic invertebrates and fish as a supply of food. Such an expectation could only be supported 34

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by the results of a careful study of the food-habits of the animals in question, compilation of a census of species and numbers, and computation of the reduction in food yield from the river as affected by operation of the plant. As will be noted below, information on the effects of the plant's operation on the river organisms is completely inadequate for the purpose of deciding whether they will be adversely affected; it follows that no conclusion concerning the welfare of the terrestrial animals can be drawn with any confidence.

C.2. Biological Impact; Aquatic

Comments here will be directed at the section as a whole rather than at its individual subsections.

The only substantial information in this section is in restatements of the expected thermal effects already described in Part III. Beyond this, there is little of a substantial nature in the entire section. It does not appear to be known what impact the expected temperature changes will have <u>on the aquatic organisms</u> <u>actually in Pool 14 or in the vicinity of the plant</u>. There does not appear to be available even a complete list of the species of fish present in Pool 14, or any information on their numbers. Without this very basic information, how can one begin to try to appraise the effects of the plant on fish populations? Also lacking are inventories of the other animals and plants present, any classification or mapping of habitat-types, of major areas of benthic production, of spawning grounds

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or principal feeding areas. There has been no investigation of principal pathways of food interchange.

Such deficiencies suggest a serious misunderstanding concerning the nature of the evidence required to support conclusions about biological impact. With regard to fish, for example, the following principles need to be taken into account. No serious attempt has been made to take account of them in this section of the Statement.

- 1. The direct effects of water temperature in killing adults is only one of the ways in which heat discharge will affect a fish population. There are others
 - a. direct lethal effects on other stages: egg, larva, pre-adult
 - b. changes in metabolic rate, leading to changes in growth and disturbance of patterning of reproductive cycle; leading also to changes in oxygen demand
 - c. change in accessibility of normal spawning grounds or any spawning grounds, or of feeding grounds for young stages
 - d. change in response to toxic substances, e.g. Chlorine, produced by the plant itself or already present, or in the ultimate ability of these substances to be harmful to the fish through, for example, changes in their rates of decomposition or in the decomposition products formed.

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2. Sites for reproduction of fish of particular species

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in extensive reaches of a river may be extremely localized. No evidence is adduced that areas adjacent to the plant and strongly affected by temperature change are not vital to reproduction in populations of some species for the entire extent of Pool 14.

- 3. Survival of a fish population depends upon availability of adecuate food for all stages. No information on the food of any species in Pool 14 appears to be available.
- 4. The welfare of a population of fish or other organisms is likely to depend upon the extreme conditions which it actually experiences, rather than upon average conditions, which are abstractions, possibly never experienced.

In my opinion, the nature of the biological impact of this plant on aquatic organisms, fish and all others, remains entirely conjectural. I do not believe the Statement contains any substantial evidence supporting the conclusion that the impact will be anything less than severe. Most of this section consists of "expectations" that there will be no harmful effects for which, because of an extreme lack of relevant data, no convincing arguments can be adduced.

D. Radiological Impact

The computation of average dose (rem/yr) by dividing cumulative dose (man-rem/yr) by population is objectionable and provides misleading results, for reasons which Iam

certain are obvious to the authors of this statement. If a sufficiently large under-exposed moiety is included in the population upon which the computation is based, a situation in which a certain fraction of the population is bound to be over-exposed can always be made to look harmless.

F. Environmental Monitoring 2. Non-Radiological

I have not had access to the relevant Bio-Test "Study Plan", However, there is no suggestion among the nine items listed as components of non-radiological monitoring of any regular recurrent measurement of a biological variable that would indicate change or deterioration in the environment following from adverse affects of the plant and its discharges. There is no indication of continued examination of terrestrial organisms on shores or islands below the plant, or of examination on a regular and systematic basis of the status of the sport commercial fisheries that might be affected. Until or these matters are clarified, it is necessary to conclude that plans for non-radiological monitoring of later environmental impact are unsatisfactory, and will not lead to detection of widespread biological shanges resulting from plant operation.

VII, Adverse Effects Which Cannot be Avoided

A serious deficiency of this section is a statement concerning the impact or risk of impact consequent on the storage or disposal of radioactive solid waste exported from the plant site. This would amount to approx-

imately 19,000 curies/yr for routine wastes, and an unspecified amount, probably very much larger, in irradiated fuel elements removed from the plant and exported from the site. Adverse environmental impacts and costs associated with storage, disposal, and surveillance of the exported radioactivity comprise probably the largest single unavoidable adverse effect of the plant, but no information is provided in this Statement that would lead to proper evaluation. The following items are particularly important:

- le What are the locations and local environmental effects
 of "licensed burial grounds"?
- 2. What is the disposition of waste resulting from refining of irradiated fuel elements? What is the environmental impact of such refining? Where will the resulting waste be stored or disposed of, and what environmental impact or risk of impact are associated with its disposal?
- 3. Over how long a time will it be necessary to exercise surveillance over stored radioactive solid waste?
- 4. (for a later section) What costs are assignable to such disposition?

VIII. Short-Term Uses and Long-Term Productivity

Other comments given above and below apply here. This section is completely inadequate. There is no consideration of the matters dealt with under VII. above, for example.

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X. Alternatives to Proposed Action and Cost-Benefit
 Analysis of their Environmental Effects
 B. Summary of Cost-Benefit Analysis 3. Biological Impact

The total impact of this installation on fish, for example, is hardly likely to be dtermined by the ratio of condenser-water flow to total river flow. There is no scientific----biological, ecological or other---basis that I know of for adopting such a measure, even as a first approximation. Its use in this Statement is to be taken as an admission of complete ignorance concerning the effects on fish or the fisheries. The same comment is applicable to other organisms, only more emphatically, since these are not discussed in the Statement to even the small extent that fish are.

B. Summary of Cost-Benefit Analysis 5. Cost-Benefit Balance The cost-benefit balance summarized in Table 22
(p. 116a) is woefully incomplete and very misleading.
Following are particular comments on it:
1. Benefits, line 1: "Electrical Power Produced and Sold". Is this total capacity, or capacity corrected for unsold reserve? If the latter, it should be reduced by at least 15%, to about \$1,500,000,000.
Is the value given based on price at retail? If so, a) prices at retail should be used in figuring costs; b) the item for local taxes should be deducted if such taxes are to be listed in the balance: retail price already includes local taxes paid as an

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operating expense.

- 2. Costs. The entire section is incomplete; at least the following items should be corrected or listed as costs based upon appropriate retail prices:
 - a. (using estimates of losses to fishery given, which may be too low by a factor of 20; see above) Sports Fish. Assuming \$5.00 per fish angler's contribution to local economy, we obtain for 1972-1973, costs of \$25,000.; after 1973, \$375,000.
 Commercial Fish. Assuming \$0.75 per lb retail, costs for 1972-1973 are \$11,250.; after 1973, \$169,000.
 Total for Fish, \$580,250. This may well be a minimum; in any case, costs assignable to loss of fish may well be a very minor item in the balance. Other items to be included are as follows:
 - b. Loss of employment in the commercial fishery
 - c. Loss of production on 560 acres of farmland assignable to life of the installation
 - d. Loss of taxes paid on 560 acres of farmland assignable to life of the installation
 - e. Costs of waste storage for total waste accumulated over life of installation, for as long as this must be stored and guarded (not a plant pperating cost)
 - f. Costs assignable to excesses in radiation doses produced by operation and accidents (prorated by probabilities of various classes of accidents); prorated share of costs of accumulation of radioactive noble gases in the atmosphere 41

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- g. Costs assignable to reduced productivity of something like 5,000 acres of farmland affected by transmission lines
- h. Ground rent for an indefinite period after expiration of the plant's economic life for approximately
 100 acres of plant site affected by unremovable
 buildings and equipment.

Summary

- 1. There is substantial evidence that, with the diffuser pipe installed and in operation, the entire crosssection of the river for some distance downstream from the plant will be affected by a rise in temperature.
- 2. The magnitude of the rise, under conditions near the extreme of an expected range (low river-flow of about l1,000 CFS, spray canal inoperative, 2 units operating at full power) would reach values of about 5°F.
- 3. The temperature rise will dissipate at varying distances downstream from the plant, depending upon certain variables external to the river system (V.P.D. of the atmosphere, wind velocity and direction, etc.).
- 4. A high-temperature barrier would therefore be placed across the river in the vicinity of the plant, and a hightemperature zone would be present in a varying reach of Pool 14.
- 5. The effects of such barrier and zone on organisms within the river and near it are essentially unknown because of a dearth of information, but are potentially very great. Significant declines in populations of fish and

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other organisms in Pool 14, and significant declines in populations of terrestrial animals in the vicinity of the plant cannot be excluded as possibilities resulting from its operation by any data or evidence provided in this Statement.

6.

This Statement consideracthe impact of this particular project as though it were the only one of its kind, and restricts itself to consideration of its effects against a presumed constant background. For example, in looking at the effects of this plant in increasing radioactivity of the water in the Mississippi (as in Table14), no allowance is made for residual effects of discharges from the Monticello reactor upstream. Cited studies of 1968 background in the River at the plant are now obsolete. The same is true of evaluation of the effects of release of radioactive noble gases into the atmosphere. This criticism of A.E.C. management of radiation hazards has been made before; I mention it here so that its importance is not forgotten. Every time the environmental impact of an additional installation of this kind is examined, the accumulative effects, potential and actual, must be taken into account.

Respectfully submitted,

JOHN C. NIEE3S

JOHN C. REES Professor of Zoology University of Wisconsin Madison, Wisconsin



DEPARTMENT OF TRANSPORTATION UNITED STATES COAST GUARD

MAILING ADDRESS. 5 S. COAST GUARD(WS) 40) SEVENTH STREETSW WASHINGTON. D.C. 20590 PHONE 202-420-2202

Mr. Lester Rogers, Director Division of Radiological and Environmental Protection U. S. Atomic Energy Commission Washington, D. C. 20545 APR 10 1972 - 6 APR 1072 RECEIVED APR 10 1972 - 9 50 -MAR Sector Wall Sector MAR Sector

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Dear Mr. Rogers:

This is in response to your letter of 6 March 1972 addressed to Mr. Herbert F. DeSimone, Assistant Secretary for Environment and Urban Systems of the Department of Transportation. Your letter concerned the draft environmental impact statement, environmental report and other pertinent papers on the Quad Cities Nuclear Power Station, Units 1 and 2, Rock Island County, Illinois.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material presented. Noted in the review by the Office of Hazardous Materials is the following:

"We have no specific comment to offer on the report. We find no information in the statement regarding the transport of radioactive material which is inconsistent with existing DOT or AEC regulatory requirements."

Noted in the review by the Federal Railroad Administration is the following:

"Referring to page 68, item 3 of the Draft Detailed Statement on Environmental Considerations we note that there will be some 125 miles of new transmission lines constructed. In the small section dealing with the effect of these lines there is no mention of the possible impact upon existing railroad signal and communication lines. It is suggested that some indication be given that the new lines will not come in close proximity to existing rail facilities or that consideration has been given to the problem of inductive coupling and direct faulting."

As indicated in our previous review of this project and the letter report addressed to Mr. Harold L. Price dated 16 February 1971, it remains our determination that the impact of this project is fairly minimal upon transportation.

It is first that the concerns of the Federal Wailroad Administration engaphing transmission lines that the undressed in the rinks statement. This Department has no further commont to offer and has no chapters returned to the fond Cities Project.

The opportunity for the Department of Transportation to review and comment on the draft environmental impact Statement and other papers submitted on the Quad Cities Nuclear project is appreciated.

Sincerely,

Illust.

J. M. AUSTIX Gaptain, R. S. Geast Guard Acting Chief, Office of Marina Environment and Systems



THE ASSISTANT SECRETARY OF COMMERCE Washington, D.C. 20230



April 7, 1972

Mr. Lester Rogers, Director
Division of Radiological &
Environmental Protection
U.S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rogers:

The Draft Detailed Statement on the Environmental Considerations by the U.S. Atomic Energy Commission Related to the Proposed Issuance of an Operating License to the Commonwealth Edison Company and the Iowa - Illinois Gas and Electric Company Quad Cities Nuclear Power Stations, Units 1 and 2, Docket Numbers 50-254 and 50-265, which accompanied your letter of March 6, 1972, has been received by the Department of Commerce for review and comment.

In order to give you the benefit of the Department's analysis, the following comments are offered for your consideration.

The statement on the Quad Cities Nuclear Power Station, Units 1 & 2 seems to consider a number of the factors contributing to the probable impact and potential adverse effects of operation of this nuclear power plant on the aquatic environment and biota of the Mississippi River in the vicinity of the plant site. However, additional discussion may be warranted on the following points.

In the section on "Ecology of site and Environs," it would be helpful to refer, on page 27, to the specific organisms sampled and the parameters measured.

It is stated (page 27, second paragraph) that "the benthos population appeared to be dominated by pollution-tolerant tubificid worms at a few stations but generally consisted of organisms such as burrowing mayfly nymphs that are considered to be indicative of relatively unpolluted water." We question the accuracy of this statement. It would be preferable to state that either tubificids were found to be more numerous than other organisms, or they were not found to be more numerous.

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Secondly, in view of the fact that there are both pollutedwater and clean-water species of tubificids, we believe that the description should indicate whether these organisms were identified to a level that would permit this distinction to be made. Finally, if the tubificids referred to here were actually the pollution-tolerant forms, the stations at which they were found should be specified.

On page 38, second paragraph, the statement is made that the floating boom "... may also help to reduce the entrainment of floating fish eggs, larvae and fry." That this statement should be modified or deleted is suggested by a contradictory statement on page 75, first paragraph, that "... there is no evidence available that indicates the effectiveness of the barrier in reducing the flow of fish eggs and larvae into the intake canal ..."

The information on Pool 14 used in Table 7, page 29, is now 14 years old, and probably does not reflect the present increase in sport fishing activity in this area. Citation of more recent information for all the pools mentioned in this Table would be desirable.

The discussion of the environmental impact of plant operation on the downstream area, page 81 stresses that the island area comprises less than 5 percent of the total downstream area of Pool 14. It should be pointed out, however, that even though the island area is only 5 percent of the downstream area of this pool, it is the last downstream habitat of this type in the pool and is an important bluegill-largemouth bass spawning area. Even though the area is relatively small, it is important in the production of fishes in the entire pool and should be evaluated as such.

The updating of fish hatching in the downstream area, in conjunction with reduced availability of prey organisms serving as food for developing fish larvae, could have serious adverse consequences on survival of fish larvae. Lack of documented evidence does not eliminate the possibility of this type of adverse effect. This problem is presently being studied by the Environmental Protection Agency and the Bureau of Sport Fisheries and Wildlife, and the results to date indicate that fish populations are adversely affected by premature hatching and lack of food as a result of abnormally elevated temperatures.

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The small contribution of the downstream island area is again referred to on page 38, first paragraph, and it is concluded that loss of the entire area would have no adverse effect on the total fish population of Pool 14. As we contend above, the importance of this island area may be relatively greater than its small size would imply. The relative importance of cumulative effects of similar environmental impacts in the past and future, might be considered in this section.

A statement appears on page 85, fourth paragraph, to the effect that the diffuser-pipe minimizes the adverse effects of waste heat disposal. This statement may be misleading from an eco-The diffuser-pipe accomplishes the logical point of view. task of reducing the temperature of the discharge water by pulling additional water into the diffuser and discharging the total volume at high velocity. Because of the high velocity and turbulence created in the discharge region, more organisms may be entrained and affected than if the discharge velocity were less. Some discussion of this problem as related to adverse effects due to increased temperature, as well as the potential problem of increasing the incidence of gas-bubble disease, might be warranted.

The discussion of the adverse effects of chlorine on page 86 could be expanded to cover chloramines and other by-products that would be released to the environment. In addition, the effect of discharging these chemicals through the diffuserpipe could be compared with discharge into the spray-canal.

The outline for the non-radiological monitoring program provides no specific information regarding the conduct of the various projects that propose to evaluate and define the physical, chemical and biological conditions that exist in the Mississippi River in the vicinity of the Station prior to operation, after start-up of Unit 1, and after both units are operational. It is concluded on pages 28 and 74 that the aquatic ecology of Pool 14 has not been studied adequately by the consultants. In view of this conclusion, we suggest that additional detailed information regarding the monitoring program be included (pages 97 and 108) to support the claim that the proposed monitoring program will be adequate to detect any undesirable biological effects that may occur downstream as a result of plant operation.

We see no additional information in the subject statement that would cause us to change our comments submitted October 27, 1971, on what was called a Final Detailed Statement (dated July 2, 1971). As a matter of fact, the subject draft contains no specific information on diffusion meteorology and on the probability of atmospheric diffusion rates from which we could assess the environmental impact of accidental or routine radiological releases to the atmosphere.

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Although the applicant refers to future reductions in radwaste operation it is possible to comment only on what is presented in the document. It is noted that while the annual average radiation doses to individuals, as listed in table 14, page 88, are less than the requirements of 10 CFR Part 20, at some locations they are not greatly less and at the site boundary are comparable to natural radiation background. With respect to table 14 further information is needed. What assumptions were made in table 14 to determine the whole body dose of 120mrem/ year? What fractional occupancy and shielding from living part-time indoors was assumed? What is the expected whole body dose to individuals at different distances from the site boundary? (Note that a location 2 miles SW of the station was stated in table 14 to be the site of maximum deposition in determining thyroid dose from ingestion of milk.)

The very brief description of an environmental radiation monitoring program given in section V.F.1, page 96, is inadequate considering that the expected initial average annual environmental radiation dose from the facility as given in table 14 is within a factor of 4 of 10 CFR 20 limits. A complete environmental radiation monitoring program should be described. Additionally, an on-site monitoring program should be described in the draft statement.

With regard to Table 22, Cost-Benefit Summary, it appears that the cost-benefit summary probably could be made more meaningful. Specifically, on the benefit side, the derivation of the estimated employment and tax benefits should be documented or explained, either in the table or in the text. In addition, on the cost side, the loss of fish should be translated into dollar terms. In the case of commercial fish, it should be possible to use average market values to derive an order of magnitude estimate.

We hope these comments will be of assistance to you in the preparation of the final statement.

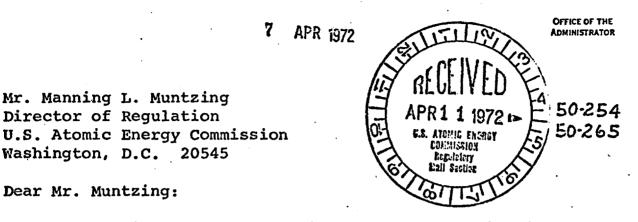
Sincerely,

Ing R. Gulia

Sidney R/Galler Deputy Assistant Secretary for Environmental Affairs

ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460



The Environmental Protection Agency has reviewed the draft environmental impact statement for the Quad-Cities Station.

We appreciate the difficult circumstances and time restrictions under which the Atomic Energy Commission must prepare a series of complex impact statements. We also recognize the difficulty in determining the appropriate degree to which an agency should go in developing and providing data to support conclusions reached in the impact statement. It is our judgment, however, that this statement should contain additional information in order to evaluate fully the environmental impact of the operation of the Quad-Cities Station. We therefore recommend that the final impact statement contain the additional information outlined in our detailed comments. Our detailed comments are enclosed.

The major impact of Quad-Cities Station prior to May 1975, when the complete closed-cycle cooling system for both units is to be operational, will result from thermal discharges. Although these discharges may exceed Iowa and Illinois standards, we accept interim operation of the Quad-Cities Station at an environmentally acceptable level of power output using the side jet and diffuser system with the understanding that the proposed closed-cycle cooling system will be installed in accordance with the schedule set forth in "Quad-Cities Agreement."

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Page 2 - Mr. Manning L. Muntzing

The most significant radiological impact due to routine operation of the Quad-Cities Station will be from gaseous discharges from secondary sources. In order to achieve low as practicable discharges, we recommend that the final statement discuss the feasibility of treating the ventilation air to remove radioiodine.

We will be pleased to discuss our comments with you or members of your staff.

Sincerely yours,

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Lheldon Meyers Director Office of Federal Activities

Enclosure

ENVIRORMENTAL PROTECTION AGENCY

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Washington, D.C. 20460

April 1972

EPA #D-AEC-0042-27

ENVIRONMENTAL IMPACT STATEMENT COMMENTS

Quad-Cities Station Units 1 & 2

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INTRODUCTION AND CONCLUSIONS

The Environmental Protection Agency has reviewed the draft environmental impact statement for the Quad-Cities Nuclear Station Units 1 & 2 prepared by the U.S. Atomic Energy Commission and issued on March 6, 1972. Following are our major conclusions:

1. We commend the applicant for the recent commitment to a closedcycle cooling system for both units at the Quad-Cities Station and recommend that the system be made operational at the earliest possible date.

2. With regard to the operation of the side jet while the closed cycle system is being installed, we note the following:

a. Operation at power levels up to approximately 25% will protect the biota in the island area.

b. Although operation at power levels up to approximately 30% may meet Illinois water quality standards, levels greater than
50% will not.

c. Interim side jet operation will probably not cause irreparable damage. Prolonged operation at higher power levels (i.e., greater than 30%), however, could have a significant adverse impact, but may be possible if river flow and temperature are closely monitored to insure compliance with standards.

3. We are concerned about the environmental consequences of using chlorine as an antifouling chemical in conjunction with the proposed diffuser system.

4. In order to achieve lowest practicable radwaste discharge levels until the augmented system becomes operational, it will be necessary to employ all available components of the present system and to route waste streams so as to optimize treatment.

5. The dose reduction factor attributable to the augmented radwaste system should be revised to consider the doses from all secondary sources.

RADIOLOGICAL ASPECTS

The draft statement indicates that the station will operate with the originally designed liquid and gaseous radioactive waste treatment systems until approximately December 1, 1973, when the augmented systems will be operational.

Current Systems

The present waste treatment systems are not capable of reducing the Quad-Citics Station radioactive discharges to levels which can be considered "as low as practicable." Therefore, until the augmented systems are operational, the minimization of radioactive effluent discharge will primarily depend on administrative controls over the operation of the radwaste systems.

Historically, boiling water reactors have experienced increased emission levels with time. Although initial plant operation will be with new fuel, without significant cladding failures, the fission of tramp uranium, neutron activation of corrosion products, and some fuel cladding failures will occur progressively.

According to the AEC analyses, condenser air ejector releases after 30 minutes decay will account for 6,000,000 Ci/year of radioactive gascous discharges (90% of the total), while gland seal leakage will contribute 30,000 Ci/year. Based on these figures, other secondary sources (e.g., the reactor building exhaust system, the drywell and torus purge system, the turbine building exhaust system, and the radwaate building exhaust system) will contribute an additional 570,000 Ci/year.

In order to minimize radioactive effluent releases, the existing waste management equipment should be utilized to its design capabilities. This position is consistent with 10 CFR Part 50.36a. Some administrative procedures which would restrict release to "as low as practicable" levels are mentioned in the draft statement and include:

1. Routing of the reactor building exhaust system through the standby gas treatment system (SGTS) for treatment and release through the main stack instead of through the reactor building vent stack.

2. Routing of the drywell and torus purge system through the SGTS and out the main stack.

3. Operating the chemical radioactive waste subsystem with emphasis on the solidification of the wastes to minimize discharge of liquid activity to the river.

The final statement should address the feasibility of utilizing these systems in the manner described.

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Augmented Systems

The proposed augmented gaseous radioactive waste treatment system apparently will only treat the condenser air ejector source. If this source, which accounted for 90% of the original total source, is reduced by a factor of 40, as assumed in the statement, then it would constitute about 20% of the total source after the augmented system is operational. If the 3 mrem/year site boundary dose given in the draft statement for the augmented system refers specifically to the condenser air ejector system dose, then the total from all gaseous sources would be approximately 15 mrem/year. The final statement should reevaluate the gaseous releases and include a complete analysis of the expected effluent levels from all gaseous sources. It should contain a reassessment of the overall dose reduction benefit gained from the use of the augmented off-gas system and should include the design bases of the new system. The feasibility of making further modifications to the gaseous waste treatment system, such as providing clean steam for the gland seal system, and providing routine treatment for the secondary sources (e.g., providing iodine filtration and discharging ventilation air through the main stack) should be considered.

The "maximum recycle" liquid radwaste system, described in the draft statement and other referenced documents, appears to have the theoretical capability of satisfying the "as low as practicable" criteria. The actual attainment of this goal is greatly dependent on how the system is actually used. For example, the chemical waste sample tank proposed for the chemical waste system, will not, by

itself, reduce the effluent levels. Its effectiveness in reducing releases will be a function of how it is used as a decision point for deciding whether the wastes should be discharged to the river, retreated, or solidified.

Transportation and Reactor Accidents

In its review of nuclear power plants, EPA has identified a need for additional information on two types of accidents which could result in radiation exposure to the public: (1) those involving transportation of spent fuel and radioactive wastes and (2) in-plant accidents. Since these accidents are common to all nuclear power plants, the environmental risk for each type of accident is amenable to a general analysis. Although the AEC has done considerable work for a number of years on the safety aspects of such accidents, we believe that a thorough analysis of the probabilities of occurrence, and the expected consequences of such accidents, is necessary. A general study would result in a better understanding of the environmental risks than would a less-detailed examination of the questions on a case-by-case basis in individual impact statements. For this reason we have reached an understanding with the AEC that they will conduct, concurrent with reviews of impact statement for individual facilitics, such general analyses with EPA participation and will make the results public in the near future. We believe that any changes in equipment or operating procedures for individual plants required as a result of the investigations can be included without

appreciably changing the overall plant design. If major redesign of the plants to include engineering changes were expected, or if an immediate public or environmental risk were being taken while these two issues are being resolved, we will, of course, make our concerns known, and a new impact statement may be necessary.

The statement concludes "...that the environmental risks due to postulated radiological accidents at the station are exceedingly small and need not be considered further." This conclusion is based on the standard accident assumptions and guidence issued by the AEC for light-water-cooled reactors as a proposed Amendment to Appendix D of 10 CFR Part 50 on December 1, 1971. EPA commented on this proposed amendment in a letter to the Commission on January 13, 1972. These comments essentially stated the necessity for a detailed discussion of the technical bases of the assumptions involved in determining the various classes of accidents and expected consequences. We believe that the general analyses mentioned above will be adequate to resolve these points and that the AEC will apply the results to all licensed facilities.

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THERMAL STANDARDS

We understand that a recent agreement involving the utilities, arrived at after the draft statement was released, calls for closed-cycle operations of unit one by May 1974 and of both units by May 1975. We endorse closed-cycle operations for this facility as a cooling alternative that will permit the plant to operate in accordance with existing and proposed standards and will minimize the impact on the environment.

Analysis of the available data (particularly figure 11C) indicates that operations under present design (side-jet) should be limited to a range of 25-31 percent of capacity at a 30,000 cfs flow in order to meet Illinois water quality standards. The 25% is arrived at by calculating the maximum operating level that will produce a 5°F temperature rise above ambient at the edge of the islands located downstream from the plant. The 31% is arrived at by calculating the maximum operating level that will produce a 5°F temperature rise above ambient at the edge of a mixing zone equivalent to an area contained within a 600 foot radius circle. Since the plant will employ the side jet cooling system during part of the interim period (until the spray canal system is operational), the AEC should further define the extent of operational restrictions required to meet existing standards.

We are also concerned about the ability of the plant to meet Iowa Pollution Control Commission criteria which set maximum temperatures of 85°F in July and August, except that 3°F above maximum limits shall be permitted for periods not to exceed eight hours in any one day or more

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than 40 hours in any given sonth. Observed maximum ambient temperatures have reached 88°F at Dubuque, Iowa, 87°F at Clinton, Iowa, and 88°F at Bettendorf, Iowa.

As indicated on page 39 of the statement, at 50% of power and river flows between 13,500 and 30,000 cfs, water temperature 4,000 feet downstream will rise $5^{\circ} - 8^{\circ}F$ above ambient at the surface and $2^{\circ} - 6^{\circ}F$ above ambient at a depth of six feet.

Assuming the plant can meet Illinois standards at 30,000 cfs while operating at 31% of capacity, the final statement should also clarify the percentage of power that can be reached at 30,000 cfs without violating lowa standards. In addition, the percentage of operational capacity that can be maintained during periods of low flow without violating lowa or Illinois standards should also be discussed in the final statement.

We understand that the utility intends to construct a diffuser system in order to permit operations at increased capacities without violating applicable standards. With the agreement to use a spray canal system, the construction of the diffuser would permit increased power output during the interim period of operation. EPA is concerned, however, about the environmental consequences resulting from installation and operation of the diffuser and from using chlorine as an antifouling chemical in conjunction with the diffuser system. It is therefore recommended that the AEC thoroughly investigate alternatives that will either preclude the need to install the diffuser or limit the environmental damage resulting from the use of chlorine during interim operation with the diffuser.

THERMAL AND BIOLOGICAL FUFECTS

Nost of the concerns listed below relate to the use of the side jet and will be obviated by installation of the spray canal system. The draft statement does not discuss the behavior of the side jet plume at flows above 30,000 cfs. Inasmuch as average flow is 46,800 cfs, such a discussion would be appropriate, especially in view of the inference one can draw from figures 11A through 11D that flows above 30,000 cfs might force the plume more closely against the shoreline, and, thus, increase the water temperature in the vicinity of the downstream islands.

The statement (p. 51) indicates that 85°F was used in temperature predictions. If a lower figure had been used, one more closely approximating the average water temperature, the heat loss rate would have been less than implied. This is due to a reduced energy exchange coefficient for the lower temperature.

The statement discusses the effect of solar radiation on the slough areas and indicates that the effects of additional heat from the plant will be small. Based on the data on page 81, it can be calculated that maximum temperatures in slough areas now vary from approximately 85°F to 98°F. Any heat addition could create a critical or lethal environment in the sloughs.

The discussion on page 82 of temperature requirements for spawning of yellow perch, walleye and sauger does not address the critical "chill period" required for gonad development. These species are near the southern limit of their geographical distribution, and small increases in temperature could effect their maturation and reproduction. This is particularly important in the slough areas and the waters surrounding the islands.

Tests conducted at the National Sector Quality Laboratory, Duluth, indicate the importance of the "chill periods." Those tests indicate that the level of reproductive success enong perch held at 39°F for about six months (70 percent fertile eggs, 52 percent normal larvae) was approximately twice as great as for fish held at 43°F for about six months (35 percent fertile eggs, 31 percent normal larvae) and approximately four times as great as for fish held at 46° to 58°F for about six months (16 and 21 percent fertile eggs, 13 and 7 percent normal larvae). Exposure to the above higher temperatures for periods less than six months lowered reproductive success at each temperature. Further, the data indicate substantial impairment of yellow perch reproduction by an increase in winter temperature of approximately 4°F above 39°F, the lowest temperature tested. It is expected that reproduction of closely related species, such as sauger and walleye, may be impaired by similar increases in winter temperature.

The loss of spawning areas for bass, bluegill, and catfish, described on page 83, may be serious and should be more thoroughly discussed. The statement on page 28 implies that the sloughs south of the facility are relatively unimportant spawning and nursery areas. The applicant's report, however, implies that they are somewhat more important. Since these areas constitute about 20 percent of the bluegill and bass spawning area in the pool, the effect of heated discharges on spawning will, at the very least, shift the spawning season to an earlier date.

It is stated on page 77 that the overall ecological balance of Pool 14 will not be adversely affected. This does not agree with the statement on page 28 that ". . . The biology of Pool .14 is not adequately characterized is

make a complete analysis of the impact of station operation." This difference should be resolved in the final statement.

The final statement should specifically discuss the availability of free passage for fish past the thermal plume. If some fish are repelled by the plume, they will be forced to change their movements upstream or downstream, which may have adverse effects upon their feeding and reproductive habits. The statement indicates that fish will not stay in the discharge canal area if the temperature is above laboratory determined thermal tolerences. The basis for this conclusion should be given.

According to Mackenthun and Ingram (ref: Mackenthun, K.M. and W.M. Ingram, 1967, "Biological Associated Problems in Freshwater Environments," U.S. Dept. of the Interior, Federal Water Pollution Control Administration, page 47) "Some fish will swim into hot water in which they are killed although they might easily have swum into water which would have been harmless. Fish acclimated to warm water are rapidly killed when they swim into cold water." This should be recognized in the discussion and in Table 21 of the draft statement.

No prediction is made of the reversibility of island effects from operation of the side jet. Such analysis and prediction would be appropriate It is noted that exposure time for drifting plankton, fish eggs, and larvae entrained in the diffuser discharge is calculated and evaluated, but that no such calculation is made for the side jet discharge. In view of the probable higher exposure time associated with the side jet, an analysis and discussion of this phenomenon should be contained in the final statement.

The draft statement notes that very few fish kills have been definitely attributed to thermal discharges from steam electric plants. It should be recognized that indirect effects, such as loss of spawning areas, avoidance of certain areas, slower growth, loss of habitat, and entrainment loss, can be as significant as direct thermal kills. As indicated in the statement, the entrainment loss will be very significant at low flow periods, reaching 20 percent of the microorganisms in that area. This is an significant biological loss and corrective action should be discussed in the final statement. The analysis of the effects of plankton entrainment fails to note that while plankton populations may recover downstream, the impact on the area surrounding the islands could be significant.

EPA shares AEC concern over the possible promotion of gas bubble disease as a result of diffuser operation. The final statement should provide a plan for monitoring this situation and taking corrective action should the problem develop.

Any plans by the Corps of Engineers to change the pool configuration of the Upper Mississippi River should be discussed in the final statement since any such changes could have significant impact on all cooling water data.

Spray Canal Effects

Since there has been little operating experience with large spray cooling systems, there is little data to evaluate their potential for producing steam fogs, icing potentials, and visible plumes near a local site under critical meteorological conditions. However, applying the results of only one winter prototype test in New Hampshire and a wintertime

observation from the Dresden, Illinois plant to the Quad-Cities site appears too subjective. To obtain a more quantitative estimate of the fog and icing potential from the Quad-Cities spray canal, it would be helpful to determine the wintertime atmospheric conditions (temperature, vapor pressure, etc.) causing these situations. Then, using local data from the Quad-Cities meteorological tower, observe the frequency and magnitude of the problem as a function of surface wind data. The results of this approach could be a graphical indication of potential areas of concern downwind from the canal.

As discussed above, because needed parameters are not known, quantitative estimates of fog and icing potential from the spray canal are not possible. However, a statement on page 68 indicates that "Deposits of 1/4 to 1/2 inches of light rime ice can be expected on fences, poles, and vegetation along highways. . ." on cold winter mornings (temperature less than 10°F). The statement further states that ". . .no ice layer should form on the roadbed fiself." An estimate should be made of the temperature at which ice will form on roadbeds in the area, and information should be presented on precautions which will be taken to protect the public from fog and ice conditions on the affected highways caused by spray canal operations.

Although the sulfur dioxide level was low at the one station cited, which would indicate little likelihood of the possibility of interaction with the spray caual plume to form an acid mist, the proximity of the Cordova Industrial Park and the possibility of it as a future source of SO_2 should be recognized. Plans for dealing with the potential problem should be prepared.

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NON-RADIOLOGICAL AND CHEMICAL WASTES

Air Quality Effects

The draft statement mentions that the present Quad-Cities air quality is "Approximately at or below national primary ambient standard levels for SO, and suspended particulates." In order to assess the impact of the operation of the Quad-Cities Station on these and other air quality parameters, the final statement should be expanded to include information describing any potential increase in air contaminants from the operation of the station. Information should be provided concerning the employment of auxiliary diesel engines and boilers, their numbers and sizes, and the annual quantity and types of fuel consumed. Also, the final statement should describe any disposal methods proposed for use at the station for non-radioactive solid wastes generated during plant operation, which may affect air quality. Even though the emission of air conteminants from this station may be small in comparison to other impacts on the environment, it is appropriate that air quality considerations be included in the statement.

Chemical and Sanitary Wastes

The statement (p. 70) that "...the station chemical discharge will not have an adverse impact on the environment," needs to be supported. For example, the quantities of wastes and the expected composition should be presented. Also, the discussion of chemical waste discharges indicates that treatment will be by dilution. In our opinion,

dilution will not adequately protect the environment. Other treatment methods based on removal of wastes should be discussed in the final statment. In addition, the final statement should provide details on blowdown from the spray canal including a list of the chemicals and their expected concentrations and indicating any treatment methods that may be necessary.

Additional information should be provided concerning the sewage treatment plant. Specifically, the final statement should contain a map which shows the location of the outfall and indicate whether the effluent will be mixed with the once-through cooling system discharge. Also, it is mentioned that sanitary wastes will receive secondary treatment and chlorination before discharge to the river. The final statement should explain the type of treatment, BOD and suspended solids removal efficiency, and the method of sludge disposal. This information is necessary to determine the impact of the sewage treatment plant on the river and to identify and analyze any possible cumulative effects of the effluents.

We recommend that further consideration be given to the use of mechanical antifouling techniques to replace application of hypochlorite or other biocides. Biocides may be necessary occasionally, however, to support mechanical methods should these methods become ineffective in cleaning condenser tubes. In addition, we are concerned about the environmental impact that could result from the use of chlorine, particularly in conjunction with proposed diffuser systems. We suggest that the potential environmental consequences

warrant a thorough evaluation of alternatives that would preclude this undesirable combination. If the use of chlorine is necessary in the once-through cooling system or the spray canal, it is recommended that residual chlorine in the receiving waters be limited to the values specified in the attached appendix.

The statement does not provide information as to the expected concentration of chemical wastes prior to dilution. Since the Illinois effluent standards are applicable prior to dilution, information on such concentrations is needed to determine compliance. In addition, the statement should discuss any chemicals to be used for algal control in the spray canal system, the concentrations to be expected, and adverse effects, if any, on aquatic organisms in the river.

CONSTRUCTION EFFICIS

General Construction

The environmental effects from the remaining general construction activities can be reduced or eliminated by proper planning. Attention should be given to the elimination of open burning of foliage from land clearing operations and disposing of other debris that is collected during construction in sanitary land fills. In addition, the spoil bank described in the draft statement could become a source of polluted runoff if not properly graded and seeded to prevent erosion. The types and quantities of materials contained in this bank and a more complete description of erosion control measures to be employed should be included in the final statement.

Spray Canal Construction .

The construction of the spray canal system will result in a significant impact on the environment and should be carefully reviewed. Thus, information concerning the precautions that will be taken to mitigate the impact on the environment should be included in the final statement.

General Development

We realize that any problems caused by increased population and development in the area are not a direct result of the Quad-Cities plant. To ensure the quality environment that exists in Nock Island County, however, we recommend that the Commonwealth Edison Company and the lowa-Illinois Gas and Electric Company, as regional power suppliers, join municipal, state, and Federal agencies in developing a land and water plan based on land capabilities in the area.

This plan should be designed to achieve a balance between population, land use and resources of the region, which will permit high star ards of living and a quality environment.

COST-BUNEFIT ANALYSIS AND AUTERNATIVES

The cost-benefit assessment in the draft statement does not consider all of the important environmental costs attributable to the operation of the Qued-Citics Station.

The draft statement indicates that there is a power shortage in the regions which are serviced by Commonwealth Edison Company and Io.:a-Illinois Gas and Electric Company and that, because of this shortage, the Quad-Citics Station is necessary. The utilities have agreed, however, to operate at reduced power in order to mitigate the effects of the plant on the environment and to satisfy the states' standards for thermal discharges. Furthermore, until the plant is backfitted with the charcoal beds to reduce the levels of radioactive gaseous emissions, the Quad-Cities Station will not be in conformance with the regulations specified in the proposed draft Appendix I to 10 CFR Part 50. These aspects constitute the most immediate and major environmental impacts for the Quad-Cities Station and yet, neither has been adequately considered in the cost-benefit assessment in the draft statement.

The statement presents a limited assessment of the number of fish kills anticipated prior to and after installation of the proposed diffuser. This assessment, based on a ratio of station condenser flow to average river flow, is not adequately supported in the draft statement. The prime considerations--thermal effects in the slough areas--have been discussed, but no consideration to aquatic life effects has been given in the cost-benefit section.

The cost-benefit assessment does not reflect either the costs or benefits of the reduced power operations. The spray cooling system is expected to have some effect on the environment. Although the actual impact of this system is not known the cost-benefit assessment should reflect the potential impact after all backfit items are installed in the plant.

The draft statement does not present a cost-benefit study of alternate radioactive waste treatment systems, but rather presents the liquid treatment system as the "ultimate" in conjunction with the alternate cooling systems. There is no basis upon which to make a cost-benefit assessment of the proposed systems.

In the applicant's supplemental environmental report the benefits accruing to the region from the Quad-Citics Station have been considered. The distribution of costs and benefits, however, is limited and not considered in the draft statement.

The draft environmental impact statement concludes that,"...the benefits exceed the cost." This conclusion is not clearly justifed on the basis of the cost-benefit assessment as presented.

Appendix I

CHLORINE RECOMMENDATIONS AND THEIR BASES.

Table 1

Recommended Total Residual Chlorine in Receiving Waters for the Protection of Freshwater Aquatic Life

Type of Criteria	Residual Chlorine	Level of Protection
Continuous	0.01 mg/liter	This level would probably not protect trout re- production, some importan- fish food organisms, and could be partially lethal to sensitive life stages of sensitive fish species
Continuous	0.002 mg/liter	This level should protect most aquatic organisms.

A. 0.1 mg/liter not to exceed 30 minutes per day.

> B. 0.05 mg/liter not to exceed 2 hours per day.

These levels should not result in significant kills of aquatic organisms or adversely affect the acuatic ecology.

Level of Protection

(The above recommendations require the use of the amperemetric titration method that is among the most accurate for the determination of free or combined available chlorine in clean water. The method is largely unaffected by the presence of common oxidizing agents, temperature variations and turbidity and color, which interfere with the accuracy of the other nethods. Simpler methods, such as orthotoludine, are best suited for the routine measurement of total residual chlorine but are commonly affected by the above interferences and provide appreciably lower values than accually occur (Standard Methods, 1971). These colorimetric methods may provide a measure as low as 10% or less than the real level depending upon interference:

Intermittent

Recommendation for Total Residual Chlorine

mise. initial kill 15 min 0.28 Truchan, 1971 mise. erratic swimming 6 min 0.09 Truchan, 1971 trout fry lethal instantly 0.3 Coventry, et sl., 193 chinbok salmon first death 2.2 hrs 0.25 Holland, et al., 1968 white sucker lethal 30-60 min 0.5 Fyle, 1960 smallnouth bass median mortality 90 min 0.5 Fyle, 1960 rainbow trout slight avoidance 10 min 0.001 Sprague & Brury, 1961 rainbow trout lethal 2 hrs 0.25 Taylor & James, 1928 fingerling rainbow trout lethal 2 hrs 0.3 Taylor & James, 1928 fathead minnors TL50 ^h . 1 hr 0.79 Arthur, 1972 yellow perch TL50 12 hrs 0.26 Arthur, 1972 yellow perch TL50 1 hr 0.88 Arthur, 1972 largemouth bass TL50 1 hr 0.365 Arthur, 1972 largemouth bass TL50 1 hr 0.35 Dandy, 1967 broo	Species	Effect Endroint	Time	Residual Chlorine Concentration ^a <u>mg/liter</u>	Reference
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Summary of Results of Brief Exposures of Fish to Total Residual Chlorine

Table 2

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a. All concentrations are measured data

b. 7L50 maximum teleronce limit

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DEPARTMENT OF AGRICULTURE OFFICE OF THE SECRETARY WASHINGTON, D. C. 20250



April 10, 1972

50-254 50-265

Mr. Lester Rogers, Director Division of Radiological and Environmental Protection Atomic Energy Commission Washington, D. C. 20545

Dear Mr. Rogers:

We have had the draft environmental impact statement for the Quad Cities Nuclear Power Station of Commonwealth Edison Company and Iowa-Illinois Gas and Electric Company reviewed in the relevant agencies of the Department of Agriculture, and comments from the Forest Service, an agency of the Department, are enclosed.

Sincerely,

yerli T. C. BYER

Assistant Director Science and Education

Enclosure

1969

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

We have reviewed the subject statement prepared by the U. S. Atomic Energy Commission in relation to the proposed issuance of an operating license to the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company for the operation of the Quad-Cities Nuclear Power Station.

The Station is located in Rock Island County on the east bank of the Mississippi River, about 3 miles north of Cordova, Illinois. statement indicates that location of the Station involved a reassignment of about 560 acres from agricultural and woodland use to industrial use. This loss is unavoidable and has been reported as an adverse effect. Likewise it is reported that an additional quantity of farmland will be traversed by the 125 miles of transmission lines that are required to transmit the power. In each case we believe that the acreage of forest land that will be cleared should be included in the statement. This is needed as a basis to consider forest resource values (timber, recreation, wildlife, esthetic) foregone as a result of the project. The statement should also be more specific as to criteria that was employed in locating lines that assured adequate consideration of environmental values. The statement also should discuss measures that must be undertaken to minimize soil erosion and sedimentation during and following construction of the lines.

On page 105, the disposal of solid radioactive wastes to a disposal site is discussed. The report is quite clear as to shipping safeguards but is not clear as to how solid waste would be shielded to prevent radioactive contamination to subsurface and groundwater at the disposal site. It would seem important to also include information on the location and site characteristics of the disposal area.

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STATE OF ILLINOIS POLLUTION CONTROL BOARD

309 West Washington Street Suite 300 Chicago, Illinois 60606

DAVID P. CURRIE, CHAIRMAN SAMUEL R. ALDRICH JACOB D. DUMELLE RICHARD J. KISSEL SAMUEL T. LAWTON, JR.

April 12, 1972

Mr. Lester Rogers, Director Atomic Energy Commission Division of Radiological and Environmental Protection Washington, D.C. 20545



TELEPHONE

Re: Draft Environmental Impact Statement, Quad-Cities Nuclear Power Station, Units #1 and #2, Docket Nos. 50-254 and 50-265

Dear Mr. Rogers:

In a letter dated March 8, 1972 addressed to Mr. David Currie, Chairman, Illinois Pollution Control Board, Merrill B. Gamet forwarded a copy of the Draft Environmental Impact Statement regarding the Quad-Cities nuclear power station. Although comments were not requested, the letter indicated that the Board could comment on that statement and refer such comments to you. The purpose of this letter is to make the AEC aware of the comments of the majority of the Illinois Pollution Control Board. The statements made in this letter have been approved by the Board for submission to the AEC.

As the Draft Impact Statement points out, on November 15, 1971 the Illinois Pollution Control Board issued a permit to Iowa-Illinois Gas & Electric Company and Commonwealth Edison Company (the "Utilities") allowing the operation of the Quad-Cities Units 1 and 2 under the conditions more fully set forth in the permit, which is herein enclosed. The Board also rendered an opinion detailing its reasons for issuing the permit, and a copy of that opinion is also enclosed. Then, on December 9, 1971, the Board amended the conditions of the permit, as the enclosed supplementary order indicates. These three documents, plus the dissenting opinion of Mr. Pumelle, a member of the Board, constitute the decisions to date, which have been rendered by the Board regarding Quad-Cities. In addition, Edison and Iowa-Illinois Gas & Electric Company recently have petitioned the Board for a Mr. Lester Rogers, Director Atomic Energy Commission

variance from the thermal standards of the Mississippi River, which variance is also enclosed. A hearing of this matter was held last week and a decision is expected within the next month. When such a decision is made, it will be forwarded to the AEC so that the AEC will have a complete set of the decisions of the Board affecting the Quad-Cities plant. In making its many decisions in the Quad-Cities case, the Board has relied on the evidence obtained in open, public hearings held either in the Quad-Cities area, or in Chicago, Illinois. A rather extensive hearing record is available (as the Draft Statement points out) for review by anyone in the Board's offices at 309 West Washington Street, Chicago, Illinois. Copies of that hearing record are available to anyone upon request and upon payment of the cost of reproducing the record (about 10¢ per page).

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Before getting to substantive comments, one very important procedural point must be raised. Because of its intimate involvement in the review of the proposed operation of the Quad-Cities plant, the Dresden 3 plant, and other nuclear power plants or fuel reprocessing plants, the Board feels it is capable fo providing to the AEC intelligent comments on the Draft Statement regarding the Quad-Cities This capability apparently was not recognized by the AEC plant. because the Board was not included in the list of agencies from whom comment would be sought. In particular, paragraph 6 of the "Summary" (unnumbered page) lists a number of federal and state agencies from whom the AEC specifically sought comment. That list did include the Governor of Illinois and various state and local agencies, including the Water and Air Pollution Control Commissions of Iowa, but specifically did not include the Pollution Control Board of Illinois. While this may seem to be a trivial matter, we feel that it is absolutely essential that the AEC include the Board in this, and particularly, specifically request Board comment on other draft impact statements covering projects not only in Illinois, but those outside our state which would affect the environment in Illinois. We would like an indication from the AEC that in other projects the comments of the Board will be specifically sought.

Now to the substantive comments:

1. Radioactive gaseous discharges.

The Draft Statement points out that the anticipated normal release rate of noble gases for the total plant (Units 1 and 2 operating simultaneously) will be .19 curie/second and that the anticipated whole body dose to those individuals living nearest to the site would Mr. Lester Rogers, Director Atomic Energy Commission

be 120 millirem per year.^[1] We consider this exposure as not complying with the general premise that gaseous emissions be kept "as low as practicable". As was pointed out in our opinion, the Utilities agreed that during the interim period before the gaseous radioactive control devices are installed, the emissions from the units will be limited to a maximum of .ll ci/sec if both units are operating and .08 ci/sec if one unit is operating. Taking into account shielding and occupancy factors, the exposure from the emission at the lower level to the nearby persons is less than 50 mr/year. It seems prudent, therefore, that the AEC require that these interim emission limits be adhered to, as required by the Board's permit. See paragraph 4(a) of the Board's permit.

Another requirement which the Board has imposed on the interim gaseous radioactive emissions is found in paragraph 4(b) of the permit which provides:

"If gaseous radioactive emissions at any time exceed 37,500 uCi/sec from either Unit 1 or Unit 2, or exceed 57,500 uCi/sec from both units operating at the same time, the permittees shall initiate operating procedures, to the extent permitted by power demand, to reduce such release."^[2]

This paragraph places the burden on the Utilities to effectively do something to reduce emission levels within the confines of reasonableness. Nowhere in the Draft Statement is there any reference to a possible requirement that the Utilities take action at the designated emission levels. Imposing this requirement would seem imperative because it requires that the Utilities constantly review the instantaneous emission levels, and then take some affirmative action, i.e., reduction of power, early fuel rod replacement, etc., to reduce the emissions, which of course could significantly reduce the exposure level to individuals. We therefore request that this provision be included in any operating license issued by the AEC.

[1] This figure of 120 mr/year takes into account a factor reduction of between 2 and 3 for occupancy considerations and shielding from living part time indoors. See Draft Statement, p. 39.

[2] This provision was suggested by the Utilities themselves.

Mr. Lester Rogers, Director Atomic Energy Commission

One final point (and a major one) on the subject of gaseous radioactive emissions. The Board required the construction of control devices by September 1, 1972, which would reduce the emissions by a factor of 40. The system to be used is described in detail in the Draft Statement (see page 55). The record before our Board adequately demonstrates that the recombiner and the charcoal beds are both technically feasible and economically reasonable. The cost of \$3 million is justifiable to reduce the emissions to a millirem per year exposure which is less than the variation in natural background levels. We believe and recommend that the AEC require the construction of the outlined radioactive gaseous control systems, as required by our Board (see paragraph 4(c) of the Board's permit), as a condition to the issuance of any operating license to the Utilities. Further, the AEC should require, as the Board did, that the control equipment be installed by September 1, 1973. We were advised by the Utilities that the control equipment would take about 30 months to complete. In fact, Edison's experience with constructing the same equipment at the Dresden Unit 3 facility has indicated that the construction schedule can be improved upon somewhat. In any case, the September 1, 1973 deadline is certainly a reasonable one and should be required to be met. This control system is entirely consistent with Appendix I, proposed by the AEC, and according to the Utilities, has already been included in the technical specifications for the Quad-Cities plant.

2. Liquid radioactive emissions.

In its permit, the Board required that the Utilities install the "maximum recylce" system for controlling liquid radioactive discharges, at a cost of approximately \$4 million. This same system was required in the permit issued by the Board to Edison for the operation of Dresden Unit 3. This system is certainly technically feasible and economically reasonable, since there is a reduction in the curies released to the Mississippi from 26 ci/year to 1.2 ci/year. On this basis, we recommend that the installation of the "maximum recycle" system be required by the AEC to be installed by the Utilities by December 1, 1973, as a condition to the issuance of an operating license.

Mr. Lester Rogers, Director Atomic Erergy Commission

April 10, 1972

3. Core cooling systems.

The testimony received in our record demonstrated to the majority of the Board that the emergency core cooling systems were demonstrated to be adequate to meet the needs of cooling the core in case of a loss of coolant accident. We expect that the recent AEC hearings on the subject will serve to enlighten us all on the question of the adequacy of the system. Notwithstanding our position on the system, which position is detailed in the enclosed opinion, we did feel that it was important to impose a condition on the utilities - that the Quad-Cities units could not be operated "if any of the reactor's emergency core cooling systems are unable to operate". This kind of provision, we feel, is absolutely essential because it places the burden on the utilities to constantly check and double check to absolutely assure that the core cooling system will operate when it must operate. This provision should be a condition of the operating license issued by the AEC.

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We wish to thank the AEC for allowing the Board to submit these comments. We hope that the AEC will follow the recommendations made by the Board. γ

truly yours, Richard J. Kissel

RJK:am Encls.

ILLINOIS POLLUTION CONTROL BOARD

In the matter of	2	
JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND ICWA ILLINOIS GAS & ELECTRIC CO. (QUAD CITIES PERMIT)	PCB 71-20	

PETITION TO MODIFY PERMIT

Commonwealth Edison Co. and Iowa Illinois Gas & Electric Company petition for a modification of paragraph 5 of the permit granted to them on November 16, 1971, for operation of the Quad Cities Nuclear Power Station, stating:

1. Paragraph 5(a) of the permit authorizes operation of the station at approximately 800 mw until April 1, 1972, without having installed a diffuser pipe to discharge cooling water to the Mississippi River and without reference to the mixing zone limitation contained in the Mississippi River Thermal Standard adopted on November 23, 1971 (#R 70-16).

2. Paragraph 5(b) of the permit prohibits operation of the station after April 1, 1972 if the diffuser discharge has not been completed, except in compliance with the mixing zone limitation of the . Mississippi River Thermal Standards.

3. The provisions of paragraph 5 were premised on Edison's testimony that each of the Quad-Cities units could be tested over the winter without harm to the biota of the river, and they would then be operable when the diffuser was completed in the spring of 1972.

4. The Quad-Citics units were not tested during the biologically quiet winter months because the Attorney General of Illinois obtained an injunction from the United States District Court for the District of Columbia prohibiting the AEC from granting an interim operating license to the station (The cause is entitled <u>People of the State of Illinois, et al. v. Schlesinger, et al., Civil</u> Action No. 2208-71). That cause is presently on appeal to the United States Court of Appeals. The Attorney General refused to consent to expedited briefing and argument of the appeal. The Applicants have now requested that oral argument be scheduled the week of March 15. The Attorney General has opposed this motion also.

5. As a result of the injunction, the Quad-Cities units can be made ready for operation during the summer of 1972 only by testing them during the spring and early summer, both comparatively active biological periods.

6. Construction of the diffuser discharge has not been begun because the Iowa Conservation Commission has not granted a permit for its construction. The application for a construction permit was denied on September 7, 1971, without prejudice to a renewal of that application after public hearings. A renewal of that application was filed in January, 1972 and will be heard by the Commission on March 7, 1972. If a permit is then granted, a construction permit will be needed from the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act of 1899.

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7. Construction work in the river can begin only after water levels in the river recede from the high spring flood flows since construction machinery cannot be operated in the river during flood flows. Applicants estimate that work on the diffuser can begin on about April 15, 1972, assuming all necessary permits have been received.

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8. If construction of the diffuser begins approximately April 15, completion is expected approximately August 1, 1972.

9. These delays in testing the units and in construction of the diffuser now require, if the units are to be made operable prior to the summer 1972 peak load, that the units be tested even though the cooling water discharge will not meet the mixing zone limitation of the Mississippi River Thermal Standard. After testing is completed, operation of the units will be required at varying capacity levels in order to meet the applicants' load requirements. At some capacity levels, the mixing zone limitation of the standards will be exceeded. The applicants propose to operate the station in the following manner:

> a) Each Quad-Cities unit must be tested at power levels of approximately 10, 25, 50, 75 and 100 per cent power. A unit cannot be operated at levels above those at which it has successfully completed all tests. Successful completion of all tests for one unit, if no complications arise, can

be completed in approximately fifty-five days. Testing of Unit 2 at lower power levels may proceed while Unit 1 is between tests, or operating at low power levels. The applicants therefore anticipate that if testing of Unit 1 begins by April 1, 1972, both Quad-Cities units can be fully tested, without at any time operating the station at a power level in excess of 809 mw.

b) Once the two units have been fully tested, the applicants propose to operate at approximately 200 mw per unit, the lowest power level from which they can be raised to full power within a reasonable period of time (estimated at five hours).

c) Operating levels would be raised above 200 mw, to not more than 500 mw, for one or both units only on those days in which, in the judgment of the system load dispatchers, total demand is likely to exceed available capacity (including that of Powerton units 1-4) even if all available emergency power were purchased.

d) Operation at station capacities above 1000 mw, or unit capacities above 500 mw, will occur for not more than
8 hours in any 24 hour period, and only after, in the judgment of the system load dispatchers, capacity in excess

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of that amount will be required to meet system demand even after all available emergency power has been purchased and Powerton Units 1-4 placed in service.

10. Operation of the Quad-Cities station at power levels above approximately 350 mw without the diffuser will mean that the area of the Mississippi River raised 5°F. or more above the ambient water temperature will be larger than 26 acres. At flows above 25,000 cfs, water more than 5° above ambient (but not, even at full power, more than approximately 15° above ambient) will flow along the Illinois shore, and, depending on ambient water temperatures, may be harmful to young of the year fish and that portion of their food supply located along that shore downstream from the station.

11. Unless the Quad-Cities station is in operation, neither of the applicants will have capacity available to it sufficient to meet the projected 1972 summer peak load. In the case of Iowa-Illinois, the deficiency will exist even if every unit it owns is in service during the peak period. In the case of Commonwealth Edison Company, the deficiency will exist because it is likely that equipment outages during the summer will approach the aggregate outages which occurred during the summer of 1971.

12. The harm which will result from involuntary interruption of electrical supply so far outweigh the potential for injury to the biota that it is embittery and unreasonable not to allow operation of

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-5-

the station in accordance with the proposal outlined in paragraph 9 even though operation will require a mixing zone larger than allowed by the Mississippi River Thermal Standards.

Isham, Lincoln & Beale Attorneys for Applicants A. Daniel Feldman Michael I. Miller John W. Rowe

Isham, Lincoln & Beale One First Nat'l. Plaza Suite 4200 Chicago, Illinois 60670 786-7500

AFFIDAVIT OF SERVICE

Jill Gamlin on oath states: On March 1, 1972, I served this notice by mailing a copy to David Landgraff, Esq., 188 W. Randolph Street, Chicago, Ill., 60606.

Jill Gamlin

Signed and sworn to before me this 1st day of March, 1972.

Notary Public

ILLINOIS POLLUTION CONTROL BOARD November 15, 1971 In the matter of JOINT APPLICATION OF COMMONWEALTH EDISON CC. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD CITIES PERMIT)

Opinion of the Board (by Mr. Currie):

Like in 70-21, Application of Commonwealth Edison Co. (Dresden #3), decided March 3 and April 28, 1971, this is an application under Title VI-A of the Environmental Protection Act for a permit to operate a new nuclear generating station, this one consisting of two 809-mw boiling-water reactors at the Quad-Cities plant near Cordova on the Mississippi River in northwestern Illincis. We grant the permit on terms similar to those imposed in the Dresden case, with differences indicated below. We note that there are environmental considerations on both sides in this case. Petitioner Iowa-Illinois operates an old, smoky coal-fired power plant in Mcline that cannot be retired until Quad-Cities is in operation. Every day's delay in bringing Quad-Cities on line means another day of dirty air in Moline. See Towa-Illinois Gas & Electric Co. v. EPA, f 71-65 (Sept. 16, 1971).

The statutory framework, the operation of a reactor, the environmental problems and their means of control, the federal radiation standards, their derivation, and their relation to state law, are all explained in detail in our March 3 Dresden opinion and will not be repeated here. The utilities raise once again the argument that federal law deprives us of authority to set standards for radioactive reactor discharges; we adhere to the contrary position for reasons given in the first Dresden opinion, and to the other jurisdicational and statutory interpretation conclusions there reached.

As held in Dresden, our authority in this proceeding extends to all environmental aspects of the Quad-Cities station, the most critical of which are gaseous and liquid radioactive wastes, protection against radiation resulting from accident, and thermal discharges to the river. We also must examine provisions for disposal of solid radioactive wastes, for ordinary chemical waste and sewage, and for control of any conventional air pollutants that may be generated by such sources as boilers. If constitution had not yet begun, we should be concerned with plant siting as well. But construction is all but complete. Pursuant to permission arouted unit 22 (gen transmint of Board meeting of that data)

in his most frug a. what we do be loaded on Noverbery with a similar testing schedule contemplating full operation not long after the first of the year. We shall discuss the several points of environmental concern separately. 2028 90

1. <u>Gaseous Radioactive Erissions.</u> Each of the two generating units is designed to emit no more than 100,000 microcuries per second (uCi/sec) of gross activity, and with fair fuel performance is expected to emit no more than 25,000 uCi/sec as a long-term average (R. 451, 584, 593; Environmental Feasibility Report, p. 21), with monthly averages possibly ranging as much as 4 1/2 times as high (R. 454). Emissions from other sources are far smaller; the principal one is the turbine gland seals, which are expected to emit only 625 uCi/sec (R. 477).

Original AEC emission limits were designed in individual cases -so as to assure that the annual radiation dose to a hypothetical person spending all his time in the open air at the plant boundary ("fencepost") would not exceed 500 millirem (mr). In the case of Quad-Cities this standard could be met if emissions (except for the small ventilation stack emissions) were limited to 350,000 uCi/sec when both units are operating at full power and 250,000 when one is (R. 474). Anticipating much better performance than this, Edison and Iowa-Illinois have proposed annual emission limits of 110,000 uCi/sec and of 80,000, for both units or for one, respectively, which would produce a fencepost dose of 157 mr per year (R. 26, 474). As the companies point out, the actual dose to persons living or passing through the vicinity will be significantly lower, since most people live inside houses that provide some shielding, most do not live at the property line, and most spend part of the time away from the site. Natural background radiation in the area is said to yield an annual dose of 100 to 140 millirems (R. 146; Environmental Feasibility Report, p. 22). Moreover, at instantaneous emission levels just under half the annual average limits proposed (52,500 and 37,500 uCi/sec for both units and for one), the companies pledge to make operational changes if possible to reduce emissions at once and to look toward early fuel replacement if necessary, since several months may be required to rectify the situation without unduly interfering with power production (A. 26, 50-52).

Beyond this, however, as at Dresden, the utilities have begun the design and are committed to the construction of additional control facilities, consisting of a device for recombining hydrogen with oxygen and eight charcoal beds to afford a substantially longer delay before discharge so that short-fived isotopes may decay to insignificance. These facilities will cost \$3,500,000 for each of the two generating units (N. 315-72); they will be completed within thirty months after design was started, or about December 1973 (R. 28, 54); they will reduce design level off-gas emissions from each unit from 100,000 uCi/sec to less than 2500 (a factor of 40)

additional 0.08 mr/yr [0.8] from the gland seals, which cannot be routed through the charcoal system (R. 365-72, 478). Utilizing the expected annual average emissions rather than the design figures, the additional facilities would reduce single-unit emissions to 625 and emissions from both units operating together to 1250, which when added to the gland seal emissions of 625 [each unit?] would yield an approximate site emission of only 2500 uCi/sec and a total fencepost dose clearly less than 5 millirems per year.

The utilities contend that exposure to 170 millirems per year is quite safe, as the AEC standards themselves incorporate substantial margins of safety below dose levels at which adverse simatic or genetic effects have been found (R. 324). There is of course a school of thought that the effects of radiation are in linear proportion to the dose and that there is no threshold (see the March 3 Dresden opinion for discussion). Because of this possibility, and in order to be especially safe in dealing with such a dangerous phenomenon as radioactivity, we adopted in the Dresden case, and reaffirm here, the policy of requiring use of the best practicable technology for controlling radioactive emissions, even though a lesser degree of control might suffice to avoid doses set to give breathing space below levels at which harm has so far been discovered. Accordingly the Prode the conversion of the conversion of the require the radiation of a conversion we do the reactive model of the conversion of the reactive model (

5 millirems, which will be achieved by this system, is a desirable and achievable goal (R. 324, 474). The AEC has recently required, as a numerical translation of the requirement of best practicable control, that the dose to persons living near the site (which should be less than that at the fencepost) be limited to 5 mr/yr (AEC Release #778, June 7, 1971).

The companies propose an interim emission limit of 110,000 uCi/sec for all sources when both units operate and 80,000 when one operates. The recombiner and charcoal beds will reduce total site emissions by a factor of 30. Therefore, in light of the reasons given above, we shall reduce the proposed limits by a factor of 30, allowing a small leeway in rounding off, to 4000 and 3000 uCi/sec, respectively, as annual averages. These standards, based on poorer than expected fuel performance, will allow some room for less than optimal operation, since the receivant desce are quite small. We do not, however, same with the companies that we should give such leeway (10,000 uCi/sec) as to ignore the problem of excessive fuel leakage; the reliant of best practicable treatment requires both good fuel

a strict monthly standard might impose a significant hardship (R. 454

Very high, short-term emissions of course must be prevented; we think this problem can be adequately handled by the AEC's accident provisions and by requiring the companies, as agreed, to take action when high emission levels (57,500 or 37,500 uCl/sec) are exceeded on an instantaneous basis.

We are urged by the Attorney General to require still further control systems for gasecus emissions. It is said that freon systems, for example, can provide even greater degrees of control than can charcoal, at lower cost, and can in addition remove from the effluent gas long-lived radioisotopes of xenon and krypton, which are not reduced by the system planned for Quad-Cities (R. 630-31). The companies respond that such systems have not yet been shown commercially feasible for facilities as large as Quad-Cities and that it may be more undesirable to concentrate and store the small quantities of long-lived isotopes produced than to disperse them, highly diluted, to the atmosphere (R. 402-06). We need not decide the tricky issue of commercial availability, for we believe the charcoal system will reduce emissions to a very prudent level indeed insofar as gross activity is concerned. The problem of the long-lived isotope, however, is one as to which we wish to express some additional caution for future guidance. Krypton 85, which will be emitted on the CARL HER RECEIVED AND AND

years and takes a century to decay to insignificance (R. 650-51). One witness predicted that, unless control measures are instituted, a worldwide buildup of radioactive krypton will occur so that the annual dose to people everywhere from this source will reach 1.7 millirems by the year 2000 and 17-20 millirems 20 to 30 years thereafter (R. 650-51, 664-65). Even these projected levels are rather modest so far as current knowledge of adverse effects goes, and certainly there is no cause for immediate fear. It is not too soon to warn, however, that we do not intend to allow the long-lived radiation problem to cacome another DDT situation, in which emissions so dilute or so small as to be insignificant in the vicinity of the discharge persist and accumulate to create widespread concentrations of possible adverse ecological significance. We do not today require the capture of Krypton 35 or other long-lived isotopes released from Qudd-Cities in presently negligible quantities; but we may well require such capture before many more years have elapsed.

Along similar lines, it is worth noting the companies' observation that, while gland soal emissions are small in relation to those from the main system as originally designed, they are comparable in magnitude to those from the charcoal bed system (R. 395-97, 477). Moreover, while in plants already built it

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Construction of the recombiner and charcoal beds at Quad-Cities will not be complete until December 1973, and the plant is ready for operation this year. It is badly needed both to provide more adequate reserve capacity to guard against interruptions of electric service that would impose significant hardships on innocent customers (see the detailed discussion in the April Dresden opinion) and to relieve the load on older fossil-fuel plants that contribute significantly to air pollution. Most significantly, the operation of Quad-Cities will make possible the greatly reduced use of coal at an inadequately controlled station in Moline (see Iowa-Illinois Gas & Electric Co. v. EPA, #·71-165, Sept. 16, 1971). At the same time the emissions from Quad-Cities during the interim before completion of the additional control facilities will be low enough to afford a substantial safety margin below dose levels at which adverse effects have been While we have required that those levels be greatly detected. reduced for additional safety in the future because they reasonably can be, we hold as in the Dresden case that the plant should be allowed to operate in the meantime subject to interim limits, namely, that not more than the proposed 110,000 uCi/sec be emitted from both units, or 80,000 from either alone.1

Licuid Radioactive Wastes. The planned discharge of 2. gross activity to the Mississippi River from various sources of liquid waste at Quad-Cities is 26 curies per year plus 30 curies of tritium (R. 384). The utilities intend to dilute these radioactive wastes with cooling water to a concentration of 1 x 10^{-3} uCi/cc (excluding tritium) in the discharge canal. In the river further dilution will reduce concentrations to 7 x 10^{-10} uCi/cc, affording a safety factor of 2300 below the drinking-water standard of 1 x 10^{-7} uCi/cc (which is based on a 500 mr/yr dose to a hypothetical person drinking river water exclusively), so that the dose to one drinking solely from the river would be 0.2 millirems per year. Dilution would also leave a large margin below the drinking-water tritium standard of 3 x 10^{-3} uCi/cc (R. 481-83). On the basis of these facts the companies contend that the expected doses are so insignificant that no further treatment is worthwhile.

Confronted with a similar situation in the Dresden case, we pointed out that dilution is not an adequate substitute for treatment because it is better to keep harmful materials out of the environment than to dilute them. This is especially true of materials, such as certain radioisotopes, that retain their dangerous properties for long times after discharge and that can be biologically concentrated by organisms as they move up the food chain. A utility witness acknowledged that cesium, for example, concentrates in figh by a factor of 100 or

 These figures were substantially confirmed by additional testimony in the Dresden case, #70-21 (Oct. 19, 1971), which predicted annual 'emissions in the neighborhood of 67,500 uCi/sec from one unit. 94

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that strontium 90 is concentrated 20,000 to 30,000 times (R. 2168). It may therefore be that the most limiting aspect of liquid waste discharges is not drinking water but aquatic life. It is true that the total quantity of activity to be discharged to the water is quite small as compared with that to be discharged to the air (26 curies per year as compared with several thousand microcuries per second, even after maximum control). But the discharge is to a much more limited receptacle, the river, not to the enormous atmospheric reservoir; and, in light of the policy of keeping as much radiation out of the environment as we reasonably can, we think it important to consider possibilities for reducing liquid radioactive discharges still further.

In response to our concern over this issue, the utilities have with accustomed thoroughness described for us two alternative systems that would provide dramatic additional reductions in radioactive discharges to the river. Neither system will remove tritium from water, for the evidence is that cannot be done. But the "maximum recycle" plan, by the addition of extra ionexchange demineralizers in the floor drain system, would reduce non-tritium activity to 2×10^{-5} uCi/cc before mixing, reduce the total non-tritium discharge from 26 Ci/yr to 1.2, and reduce the non-tritium dose to a hypothetical river drinker from 0.2 to 0.009 millirems per year. This system would cost \$5,000,000 and require 24 months to construct (R. 372-77, 483). Or, with the "maximum treatment" plan, utilizing further concentration, distillation, and ion exchange, the companies think it probable they could meet the effluent standards without any dilution (except for tritium). With this alternative, non-tritium releases would be only 0.0004 Ci/yr and the dose to a river drinker 0.000003 millirems per year. The estimated cost of this alternative would be \$9,000,000 and the time for construction 36 months (R. 377-83, 483).

We think the "maximum recycle" system is a desirable addition to the Quad-Cities plant, in that for a price that is only 2 1/2% of total plant cost it will reduce radioactive discharges from 26 Ci/yr to 1.2. The companies have agreed to the installation of a similar system at Dresden (#70-21, hearings, Oct. 19, 1971, Ex. 1). Although the need for such a system is greater there in order to avoid radiation buildup in the largely closed cooling system planned to meet the thermal standards for the Illinois River, we agree with the Attorney General's witness Dr. Devolpi that this additional caution is worth the money in dealing with something so dangerous as radiation (R. 630). On the other hand, we shall not be dogmatic in insisting on a complete absence of dilution irrespective of the costs and benefits of so doing. The important policy is that dilution not be employed in lieu of reasonable practicable treatment; when all reasonable means of treatment have been applied, and the costs of further treatment are excessive, dilution should not be forbidden. In the Dresdon date we appoinded the general policy against unnecessary

disch ages true the proposed 'maximum recycle' system that would be afforded by the "maximum treatment" system would not at the present time be worth the \$4,000,000 extra cost.

Thus we shall order Edison and Iowa-Illinois to reduce gross activity discharges, exclusive of tritium, to 1.2 Ci/yr and to 2 x 10^{-5} Ci/cc before mixing, by December 1, 1973, and in the meantime to meet the gross activity limit of 1 x 10^{-7} uCi/cc after dilution, at the point of discharge to the river. As in the case of gaseous discharges, there is no serious risk from the discharges during the interim, and to require the stricter standard to be met at once would keep the plant closed for two years, imposing an unjustified hardship.

Heat. Two thirds of the heat generated in a nuclear 3. power plant cannot be translated into electricity; it is a waste product that presents its own disposal problems. The companies' original plan was simply to discharge the heated cooling water (which at low flow will comprise 1/4 to 1/5 of the river's entire flow and which will be 23° warmer than the river) into the main river channel (R. 698-99, 715, 731, 768). In the summer of 1970, however, a study demonstrated that this scheme would violate the then existing water quality standard (SWB-12) (R. 768), which limited stream temperatures to 90° F. and to 5° above natural temperatures outside a mixing zone extending 600 feet in any direction from the point of discharge. So the companies proposed to install a diffuser, a pipe extending most of the way across the river, discharging heated water at various points in order to maximize rapid mixing with the cooler river water (R. 722). It was their contention that with such an arrangement the standard could be met (R. 824).

But the old standard, we concluded in a recent rule-making proceeding (#R 70-16, Mississippi River Thermal Standards, adopted Nov. 15, 1971), was inadequate to protect the river against a substantial risk of ecological alteration, since it would allow the whole river to be raised by 5° nearly all the time. For this reason we adopted a new standard that imposes monthly maximum temperatures, based upon federal recommendations derived from prevailing temperatures and the requirements of the biota at various seasons, that must be met during all but a few days each year at the edge of the 600-foot mixing zone. The companies' evidence, not substantially contradicted, is that they can meet the new standard too with their diffuser alone, avoiding the expenditure of \$40,000,000 or more for cooling towers or spray ponds. We find it probable on this record that they can and therefore will not require the installation of alternative cooling devices at this time. We do require that the companies conduct a detailed study of the cifects of discharges and that additional measures be taken if significant harm is shown to occur.

long-existing standards would require even so much as a diffuser pipe, with the unhappy result that even the diffuser will not be

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available before February, 1972 (R. 9). Indeed, later dalays resulting from permit proceedings before the federal government and the Iowa water pollution agency have so far prevented construction of the diffuser and put its operation off until later in the Spring. However, as noted above, the plant is badly needed, and right away, if innocent consumers (and the air-breathing public) are not to suffer. The harm to the river in the meantime, if we impose certain conditions to keep it within bounds, is a risk rather than a certainty; while we would not allow it over the long term, the great probability is that any harm that does occur will be undone naturally by repopulation from unaffected areas after adequate cooling is provided.

So we will allow Unit #1 to be operated, with the discharge improvements promised by the companies, as soon as it is ready. With only one unit in operation, the increase in temperature through the plant will be only 13° (R. 30), and river dilution will be adequate to assure that the whole stream not be raised by 5° even at low water.²

Moreover, we shall require the companies to report on the feasibility of installing spray modules in the discharge canal, as at Dresden, to reduce the heat discharged to the river. Unit #2 may be tested during this period, as the utilities request, in order to assure its availability for the peak demands of summer 1972 (R. 31), but, to avoid a full heat load on the river without even rapid mixing, which might do considerable damage, the total station output shall not exceed 809 mw--that of either unit alone--until the diffuser pipe is in operation to assure that large areas are not raised more than 5°.

4. <u>Nuclear Accident</u>. The Attorney General raised the question of the adequacy of safeguards against the possible escape of radioactive materials in the event of an accident. In light of recent controversy over the adequacy of certain systems for cooling reactor cores in the event of a coolant loss, we scheduled an additional two days of hearings, after the record had been closed, to pursue the question. On the basis of the record we cannot find such a significant danger of failure of the emergency cooling system as to load us to dalay further the operation of this needed facility.

2. The dompanies say the area raised by more than 5° will be only 20 acres (R. 791).

A highly gualified witness from General Electric, manufacturer of the reactors, testified in great detail as to the integrity of normal controls making the need for emergency cooling highly improbable; to the guadruple emergency systems provided, each independently capable of quelling any foreseeable problem; and to the extensive testing that had been and would be performed to determine and to maintain the adequacy of the systems. He assured the Board that the problems encountered in recently publicized tests were specific to an entirely different type of emergency system that had never been used or planned for boiling water reactors (R. 2336-2426). Dr. Alexander DeVolpi of Argonne National Laboratory suggested that a 1970 incident at Dresden raised questions as to the adecuacy of BWR emergency cooling systems, but he was unable to demonstrate that the incident was one in which an emergency cooling system would be expected to operate. Dr. Henry Kendall of MIT emphasized the desirability of further testing of these systems but agreed that the problems recently encountered with cooling systems had no application to the BWR's and had no suggestions for improving the Quad-Cities system. Neither he nor Dr. DeVolpi asked that the permit be delayed or withheld; the latter expressly said that "inherent safety features make water reactors extremely safe" and that the "probability of failure necessitating emergency core cooling is very small" (R. 2428-2542).

While we shall maintain a continuing concern for this and all other matters related to possible radiation hazards, and while we shall provide that the permit may be modified or revoked if this is proved necessary by new information, we do not perceive a justification today for withholding the permit.

5. Other Issues. Because of the advanced stage of construction, siming considerations are of little consequence in this proceeding; suffice it that we see no reason to require that this plant be dismantled and rebuilt somewhere else. Solid radioactive wastes will be contained and shipped to an established burial site (Environmental Feasibility Report, p. 36), and we have no evidence to indicate any undue dangers in the plans

Which is subject to have acts to do in the near fature. She Attorney General raises the question of nuclear accidents, but we think the evidence insufficient to show the need for additional precautions on this score beyond those already

provided. The gaseous radiation controls agreed to by the utilities will add significantly to accident protection (R. 641-42). The sewage treatment system and the gas-fired boilers are designed to comply with all relevant regulations, and there is no indication that any nonradioactive solid wastes generated at the site will be improperly disposed of. No chemical water contaminant problems appear; the use of sodium hypochlorite for condenser cleaning will add some chlorine to the river, and chlorine and its compounds can be toxic to fish; but the undisputed testimony is that the small amount of chlorine added will be rendered innocuous within two minutes by the chlorine demand in the river (R. 285-87).

The Attorney General moved on November 11 that we further delay decision in this case pending study of the transcript of a recent Iowa hearing with respect to the effects of the proposed diffuser. We denied this motion 4-1, Mr. Dumelle dissenting, on the ground that ample opportunity had already been afforded for the presentation of evidence and that there was no justification for the extraordinary course of reopening and further delay.

In conclusion, we should like to commend the applicants for a thorough and lucid presentation of the relevant facts, and to thank the Attorney General for his participation, which provided the adversary proceeding that is so necessary to adequate resolution of the issues by the Board.

Mr. Dumelle dissents for reasons to be stated in a separate opinion.

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This cpinion constitutes the Board's findings of fact and conclusions of law.

ORDER

After due notice and hearing, and for the reasons given in the Board's opinion, a permit is hereby issued to Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Co. to operate Units ##1 and 2 at the Quad-Cities Nuclear Power Station near Cordova, Illinois, subject to the following conditions:

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General Conditions

1. This permit shall not release the permittees from any liability or obligation imposed by Illinois statutes or local ordinances and shall remain in force subject to all conditions and limitations now or hereafter imposed by law. The permit shall be permissive only and shall not be construed as estopping or limiting any claims against the permittees for damage or injury to person or property resulting from any acts, operations, or omissions of the permittees, their agents, contractors or assigns, nor as estopping or limiting any legal claim of the state against the permittees, their agents, contractors or assigns, for damage to state property, or for any violation of subsequent regulations or conditions of this permit.

2. This permit is subject to modification or revocation, and may be suspended at any time for failure to comply with the terms stated herein or with the provisions of any other applicable present or future regulations or standards of the IPC3 or its predecessors or successors, and is issued with the understanding that it does not estop the Board from subsequent establishment of further requirements for treatment or control at any time. The Board upon notice and opportunity to be heard may reopen this proceeding at any time for the purpose of such revocation or modification in order to prevent or reduce possible pollution of the environment.

3. The permittees or their assigns shall defend, indemnify and hold harmless the State of Illinois, its officers, agents and employees, officially or personally, against any and all actions, claims or demands whatsoever which may arise from or on account of the issuance of this permit, or the construction or maintenance of any facilities hereunder.

Special Conditions Pelating to Radioactive Discharges

[1. Policy of the Board]

It is the policy of the IPCB that all radioactive pollution of the environment shall be hold to the lowest level that is attribute within the limitations imposed by technological feasibility

radioactive emissions over exceed the limits imposed by the United States Atomic Energy Commission. In addition, the actual levels of radiation exposure of members of the public shall be kept as far below those limits as possible, consistent with technological feasibility and reasonableness of cost.

[2. Radioactive Discharges Generally]

In keeping with the above policy of the IPCB, all practical measures for treatment, control and containment of radioactive wastes from Quad-Cities Units 1 & 2 nuclear generating plant of the Commonwealth Edison Company shall be employed for the purpose of preventing the release of radioactivity to the environment. Such measures shall include at least, but not be limited to; all measures for the treatment, control and containment of liquid and gaseous radioactive effluents that are indicated in the Final Safety Analysis Report of the Quad-Cities Units 1 & 2 nuclear generating plant.

[3. Liquid Radioactive Discharges]

(a) The annual average gross beta-gamma radioactivity of liquid effluents released to the Mississippi River shall not exceed 10^{-7} uCi/ml (100 pCi/l).

(b) Total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 26 curies.

(c) Tritium discharged to the Mississippi River in any year shall not exceed 30 curies.

(d) On and after December 1, 1973, total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 1.2 curies, and gross activity exclusive of tritium shall be reduced to 2×10^{-5} Ci/cc before dilution.

[4. Gaseous Radioactive Discharges]

(a) Gross beta-gamma radioactivity of gaseous emissions released to the atmosphere from either Unit 1 of Unit 2 shall not exceed an annual average of 80,000 microcuries per second, and emissions from both units operating at the same time shall not exceed an annual average of 110,000.

(b) If gaseous radioactive emissions at any time exceed 37,500 nCi from from wither Unit 1 or Unit 2, or exceed 57,500 uCi/sec from both units operating at the same time, the permittees shall initiate operating procedures, to the extent permitted by power demand, to reduce such roleage.

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of 3000 uCl/sec, nor shall emissions from both units operating at the same time exceed an annual average of 4000 uCl/sec.

[5. Heated Water Discharges]

(a) With the discharge improvements described in the Supplement to Appendix C of the Application as Amended, Units 1 and/or 2 may be operated until April 1, 1972, at a total output not to exceed 809 mm, without regard to the heat limitations of regulations SWB-12 as amended by #R 70-16 or of successor regulations, provided that:

- (i) until operation of the diffuser is achieved. effluents shall not exceed ambient river temperatures by more than 12°F; and
- (ii) within thirty days after receipt of this permit, the permittees shall submit a statement regarding the feasibility and cost of installing spray modules to reduce the heat discharged in the interim before completion of the diffuser. The Board upon receipt of such statement will take such further action as appears appropriate.

(b) On and after April 1, 1972, Units 1 and 2 shall be operated only in full compliance with all provisions of SWB-12 as amended by #R 70-16 or of successor regulations, with regard to heated discharges.

[6. Reporting and Monitoring]

(a) Liquid discharges. Prior to any release of radioactivity in liquid effluents, each batch will be counted for gross beta activity, excluding tritium. Records of the radioactive concentration and volume of each batch of effluent shall be maintained as well as records of the amount of circulating water available for mixing. At least once per month a gamma scan of typical batches of effluent shall be performed to determine the gamma energy peaks of these batches. Isotopic analyses of representative batches of effluent, including determination of tritium, shall be performed and recorded at least once per quarter. If the monthly gamma scan reveals energy peaks other than these determined by the previous isotopic analyses and if the difference is significant, a new set of isotopic analyses will be performed and recorded.

stack monitoring system and plant chimney monitoring system shall be operable at all times. Daily samples of the air ejector effluent will be taken. Within one month after initial

commercial operation of the unit, an isotopic analysis will be made. From this analysis a ratio of long lived to short lived activity will be computed. If a ratio based on any daily sample indicates a change greater than 20 per cent from the previous isotopic analysis, a new isotopic analysis will be performed and recorded. In any event, a new isotopic analysis will be performed at least guarterly. Gaseous releases of tritium shall be calculated monthly from measured data. Records from the continuous monitors, the daily samples and the isotopic examinations shall be maintained.

(c). All effluent and environmental monitoring program results shall be reported monthly by the Permittees to the Environmental Protection Agency (EPA). All monitoring program results shall also be available for inspection by the Environmental Protection Agency at the plant site at any time.

[7. Emergency Situations]

The Permittees shall cooperate to the full extent necessary with the EPA and with the Illinois Department of Public Health for purposes of development by those agencies of an adequate and effective emergency protection plan designed to immediately control and minimize the effects of any accidental release of unexpectedly large quantities of radioactivity from the Quad-Cities nuclear generating plant. In particular, the permittees shall immediately notify both the EPA and the Illinois Department of Public Health of any uncontrolled release of unexpectedly large quantities of radioactivity to the offsite air. and/or water environment due to operational failure of any of the power plant systems, and shall report monthly to the Board and EPA any activa tion of the emergency core cooling system, whether spurious or real, exclusive of today.

[8. Time of Permit]

This permit shall expire on November 15, 1973. If the permittees wish to continue operation of Quad-Cities Units 1 and 2 beyond that date they shall file with the IPCB an application for a renewal permit on or before August 15, 1973. Said application shall contain complete information and data:

(a) concerning the radioactive emissions, gaseous and liquid, up to that date,

(b) concerning the status of the construction and installation of the radioactive control facilities required by this permit,

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Mitsissippi River. Suid application shall also include such other information and data as required by the Board to evaluate the impact on the environment of Quad-Cities Units 1 and 2.

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[9. Compliance with Existing Laws]

The permittees shall conform to all existing and future laws and regulations in other aspects of the operation of Quad-Cities Units 1 and 2, including among other things the operation of boilers, the operation of sewage treatment facilities, and the disposal of solid waste, and shall procure from the Environmental Protection Agency such permits as may be required for various aspects of that operation.

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POLLUTION CONTROL BOARD ORDER

Opinion PC371-20

I CONCUR I DISSENT. LISA David F. Currie David P. Curris Che Frian Chairman email & Chulicen Samuel R. Aldrich Samuel R. Aldrich Board Member Board Member Jacob D. Dumelle Jacob D. Dumelle Board Member Bogrd Member Richard J. Kissel Richard J. Elsse Board Member Board Member Semuel T. Lawton, Jr. Samuel Lawton, Jr. Board Member Board Homber

DATED: November 23, 1971

ILLINOIS POLLUTION CONTROL BOAKI November 15, 1971

in the matter of

JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD-CITIES PERMIT) PCB 71-20

Dissenting opinion by Mr. Dumelle:

The Board, by a 3-1 vote on this date has granted the permit for the Quad-Cities reactors to operate. I dissented for the following reasons in this order of importance.

- 1. The lack of time in which to adequately assess the Emergency Core Cooling System (ECCS) testimony received only eight working hours previous to the decision.
- 2. The excessive and unnecessary radiation dosage to the public in the vicinity of the Quad-Cities nuclear plant under the permit.
- 3. The opinion that the jet diffuser will serve as a barrier to the passage of fish in the Mississippi River.

I. The Emergency Core Cooling System

On Thursday, November 11, the Board heard Dr. Henry Kendall, Chairman of the Union of Concerned Scientists, and a physicist at the Massachusetts Institute of Technology, tell why his group feels that present Emergency Core Cooling System design is not adequate. His testimony, which was well researched and impressive, detailed the consequences of an ECCS failure.

If a Loss of Coolant Accident occurs, the uncovered fuel rods in the core would heat up, distort, rupture and thus block coolant flow into the hot spots of the core. Metal-water reactions will add to the heat present; embrittlement of the cladding will occur and eutectic alloys will form. All of this could lead to an irreversible reaction--a molten core at 3,000F. to 5,000F, which would rupture both the inner and outer contaminant vessels and release clouds of radioactive gases to the atmosphere. Depending upon the winds at the time, these lethal clouds could travel over highly populated areas and cause lethal doses of radiation within a 60-70 mile radius. Hundreds of thousands of people might be killed if such a sequence occurred at either Quad-Cities or its twin at Dresden (R. 2467-8, 2527-30).

Commonwealth Edison Company and Iowa-Illinois Gas & Electric Company (the Utilities) and their vendor, General Electric Company, point to the several core cooling or feedwater systems which would energize and cool the core before the fatal 60 seconds of uncovered core has passed. Accepting as true the uncontroverted testimony that after the initiation of an incident requiring Emergency Core Cooling, 30 seconds elapse before the core sprays are activated, leaving only another 30 seconds for the ECCS to do its job (R.2475, 2491) we must take note of the import of Dr. Kendall's testimony.

Dr. Kendall tells us that even if the ECCS system functions it may not stop the excursion and consequent disaster. The ECCS system is like the emergency brake system on our cars. We may put it on and the brakes may engage but just as the mechanical momentum impels the car forward so too may the reaction in the core be unstoppable and proceed to total core meltdown. That is the meaning of all the testimony by Dr. Kendall about test results and computer codes and blithe assumptions that are not realistic.

The next logical question is "What are the chances of a Loss-of-Coolant-Accident?" Dr. Kendall puts them at being very high when he says "I expect an incident (of core uncovering) in the next few years" (R. 2532). If we take a "few years" as being three years and compare the seven existing power reactors in Illinois soon to be on line (Dresden 3, Quad-Cities 2, Zion 2) with the 121 reactors listed by Dr. Kendall (Bd. Ex. #2 Supp. 2 p.1) the chances are simply 7 in 121 that this incident will occur in Illinois or a 1:17 chance. These are very high odds. And if the "brake" does not work then monumental tragedy may ensue.

The short time left after Dr. Kendall's testimony was finished was simply not enough to read the Final Safety Analysis Report or the Edison report to the Atomic Energy Commission of the previously not publicly known ECCS activiation incident at Dresden 2 on June 5, 1970. From these documents, at the very least, a fuller picture would have emerged that might have resulted in some core temperature restriction or, a speedup in the sensor testing program, or both. I had asked to defer consideration of the permit application until the next Board meeting a week hence and that motion, by a 2-2 vote was lost. With so much at stake the Board should have granted the additional study time.

II. Excessive Radiation Doses to the Public

is _______ From this date, until September 1973, the amendal date at which the gas cleaning system is to be operative, an approximate 120 millirems dose will be delivered to the public living nearby. In other words, these people will receive an unnecessary dose of radiation equal to a year's normal background level. Put another way, in the yearand a half of full power, the nearby public will receive two and one half years of radiation. Since most scientists hold that no acceptable threshold values exist for unnecessary radiation exposure, it follows that there is some unnecessary risk of induction of leukemia, other cancers and genetic defects.

If it were necessary that this radiation occur then the balance might be somewhat easier. The Board could then balance the effects from the smoke from the Moline power plant and the leukemia-cancergenetic defects against the necessity for power. But it is wholly unnecessary. Edison's own witness, Mr. Harold Williamson testified that fuel rods did not deteriorate in storage and could be used again (Dresden Record, October 19, 1971 p. 75-79). All that would be necessary for the Utilities to do would be to refuel when emissions exceeded 25,000 pCi/sec. per reactor at full load, retain the "dirty" fuel, load with new fuel, and use the "dirty" fuel after September 1973 when the off-gas control system would be operative. The only cost to the Utilities would be the interest on the fuel rod investment plus the cost of the additional down time required for refueling. Since we have been told by Edison that it took the unusual step of completely refueling Dresden 2 after the June 5, 1970 incident, refueling as a precaution is certainly possible and indeed has been done in the past.

I would have retained the 25,000 uCi/sec. limit on the uncontrolled Quad-Cities reactors as a maximum, similar to the limit we set on the Dresden 3 reactor in March 1971. I think the Board has now set a precedent, in permitting \$0,000 µCi/sec. for a single Quad-Cities reactor (more than a 200% increase) that will haunt the Board. The Board next week may decide a further order on Dresden 3 and the pressure will be on to relax the limit in that permit and to go with the looser (and "dirtier") Quad-Cities level.

III. The Jet Diffuser as a Barrier to Fish.

The Board has given its permission to the Utilities to use a jet diffuser to dissipate the heat from their operation. The effluent is permitted to bo 23°F. above river temperature. It has not been proven to me that fish will in fact go through the diffuser's considerable tubulence (which is the reason for its effectiveness as a heat spreader). Just because there may be interstices of cool water between the individual het plumes does not mean that a fish will sack ther put any more than a horse may

sensitive to noise. What is called for and what is lacking, are actual experiments with Jull-width diffusers to detarmine if fish will in fact willingly to through them. The Board should not permit a barrier to be constructed and then be under the considerable pressure of making worthless this substantial investment if it is shown to greatly impair natural fish movement.

IV. Conclusion

Between the November 11 testimony of Dr. Kendall and the Board action of November 15 the Chicago Daily News (November 13) ran a perceptive editorial as follows:

Nuclear power dilemma

From the testimony adduced so far there appears no reason to deny the Commonwealth Edison Co. a permit to build its projected new Quad Cities nuclear plant at Cordova. Edison, speaking through Asst. to the President Byron Lee, told the Illinois Pollution Control Board that at no time during a pre-operational accident at the Dresden plant in June, 1970, was there any hazard to the public. At that time a safety valve was accidentally opened by a "spurious" electronic signal. The steam turbine and reactor were shut down instantly. Had the water level receded enough to expose the reactor fuel core, the core could have overheated and sent radioactive gas clouds over the adjacent countryside.

Members of the Union of Concerned Scientists have testified that, while "fail-safe" mechanisms operated in this case, the sum-total of existing precautions are not sufficient to ensure such an accident will not recur and "lead to complete core uncovery". It guestions the feasibility of proceeding with new plants of the Dresden design until and unless greater safety can be built into the designs.

Com Ed says that this is the only time a safety valve has failed to function properly, and there is no reason to suppose that if it ever did fail again, the built-in precautions wouldn't operate as they did in this case.

Wrapped up in this single example is the whole dilemma , industry and the public: Granting the deadly potentials of the fuels used in nuclear power plants, how safe is "safe enough?" There can havdly be any turning back from the course of a publication charted by the power companies. Increasingly, the public is being locked into absolute dependency upon the power from the great nuclear planes that are much coming adjacent to the principal lokes and rivers. In Illinois the Pollution Control Board and nationally the Atomic Energy Commission have the job of making as certain as possible that the risk of contamination is kept at the absolute minimum. In a situation where disasters can result either from too little or too much caution, the public can only hope that their judgment is good.

The Board by its Dresden decision in March 1971 and under Title VI-A of the Environmental Protection Act has responsibilities in the area of nuclear plant regulation. With these responsibilities ' comes the "job of making as certain as possible that the risk of contamination is kept at the absolute minimum". I feel that we should have done more in this proceeding to be "certain".

Jacob D. Dumelle

I, Christan Moffett, Acting Clerk of the Illinois Pollution Control Board, hereby certify that the above Dissenting Opinion was submitted on the <u>set day</u> of November, 1971.

Christan Moffett, Acting Clerk Illinois Pollution Control Board

ILLINOIS POLLUTION CONTROL BOARD February 22, 1972

APPLICATION OF CONTRALTH EDISON CO. AND IGNA-ILLINOIS GAS & ELECTRIC CO. (QUAD-CITIES)

71-20

Supplementary Order of the Board (by Mr. Currie):

The applicants by letter of February 15 have informed us that pursuant to Iowa requirements they plan to construct a spray canal to accommodate one-half of the plant's cooling water discharge. They ask whether additional proceedings before us are necessary to obtain permission to construct this canal. We say no.

The original hearings preceding our issuance of the Quad-Cities permit contained ample evidence as to the good and bad effects of spray canals, as a serious issue in that proceeding was whether or not such a canal should be required. Our conclusion was that no such canal was necessary at the time, not that it was undesidable. As we understand the new plan, it will give further assurance that the Illinois standards for river temperature will be met. The evidence does not indicate that fogging or other side effects will be so great as to forbid the use of the canal. No modification of the initial permit is necessary.

The applicants further state their intention to seek a modification of the permit to allow operation without the diffuser pipe during the spring of 1972 because of regulatory delays in obtaining permits to construct the diffuser. We do not construe the February 15 letter as that request; when the applicants are ready they may submit such a request and we shall entertain it. It appears likely that a hearing will be necessary on such an application, and we urge that its filing not be unduly delayed.

I, Christen Moffett, Clerk of the Pollution Control Board, certify

-ILLINOIS POLLUTION CONTROL BOARD Decamber 9, 1971

In the matter of

JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD-CITIES PERMIT) PCB 71-20



Supplementary Order (by Mr. Dumelle)

On November 15, 1971 the Board issued the permit in this proceeding. On November 23, 1971 the Board in PCB 70-21 modified a permit issued on March 3, 1971 for Dresden Unit 3 of the Dresden Nuclear Power Station near Morris, Illinois. The two Quad-Cities reactors and Dresden 3 are identical reactors in design and size.

The order which follows merely conforms the Quad-Cities permit of November 15, 1971 to the newer language of the Dresden 3 permit of November 23, 1971 with regard to the prohibition of reactor operation if emergency core cooling systems are inoperable that a change in the language regarding the 57,500 address. For a single reactor and 57,500 uCi/sec. for both reactors action levels for gaseous radioactive emission reduction.

ORDER

The November 15, 1971 permit issued by the Board is modified as follows:

The phrase "to the extent permitted by power domand" is deleted and the phrase "to the extent permitted without interrupting electric service" is substituted in its stead in 4(b).

The following sentence is added to 7.

"The perhibteds shall not operate any reactor at Quad-Cities if any of the reactor's emergency core cooling systems are unable to operate."

I, Christan Moffett, Acting Clerk of the Illinois Pollution Control Board, cortify the Board adopted the above Order on the _____day of

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Christan Horlett, Acting Clerk Illinois Pollution Control Board

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ILLINOIS POLLUTION CONTROL BOARD March 28, 1972



In the matter of

JOINT APPLICATION OF COMMONWEALTH EDISON CO. AND IOWA-ILLINOIS GAS & ELECTRIC CO. (QUAD CITIES PERMIT)

PCB 71-20

Preliminary Opinion and Order of the Board on Petition to Modify Permit (by Jacob D. Dumelle)

Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Company (hereafter "Utilities") petitioned the Board on March 1, 1972 to modify the Permit issued on November 16, 1971 with respect to Paragraph 5 which dealt with the operation of the power generating station's cooling water discharge to the Mississippi River. Paragraph 5(b) of the permit prohibits operation of the station after April 1, 1972 in violation of the Mississippi River Thermal Standard adopted on November 23, 1971 (R70-16). At the time of the issuance of the Permit it was thought that the diffuser discharge system would be in operation by April 1, 1972 and that the station would be operating within the thermal standard. On March 7, 1972 we voted to hold a hearing on the Utilities request for variance to be able to exceed the temperature limits in the Mississippi River Thermal Standard.

Since the filing of the petition the U.S. Atomic Energy Commission has issued its Draft Detailed Statement on Environmental Considerations (draft impact statement) for the station (March 6, 1972). Several inconsistencies between the draft impact statement and the record on which the Permit was based are apparent. Among the inconsistencies are the site boundary dose to people, the station release rate of radioactive gaseous emissions, the quantity of liquid radioactive releases and the anticipated date of operation of the station with the diffuser discharge system. Rather than initiate a separate hearing on the questions raised with the publication of the impact statement we shall order that the subject be dealt with in the previously authorized hearing. IT IS HEREBY ORDERED that the Utilities in addition to presenting evidence in support of their Petitica to Modify Permit address themselves to the apparent inconsistencies between the draft impact statement and the previous record in this case on which the issuance of the Permit was based and show the Board why the Permit issuance should not be re-examined.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the Board adopted the above Preliminary Opinion and Order on the 28th day of March by a 5-0 vote.

1.1.

Christan L. Moffett, Clerk Illinois Pollution Control Board



DEPARTMENT OF THE ARMY ROCK ISLAND DISTRICT, CORPS OF ENGINEERS CLOCK TOWER BUILDING ROCK ISLAND, ILLINOIS 61201

IN REPLY REFER TO NCRED-PB

Division of Radiological and Environmental Protection Washington, D. C. 20545

United States Atomic Energy Commission

13 April 1972

50 - 265

50 - 254 MISSIO Zulatory

Dear Mr. Rogers:

Mr. Lester Rogers

This is in response to your letter of 6 March requesting review and comments on your draft environmental impact statement for the Commonwealth Edison plant at Cordova, Docket numbered 50-254 and 50-265 (Quad City Nuclear Power Station). The following are the comments of this office.

On page 16, Section II, paragraph E, the site elevation is reported as nine feet above the highest flood level during the 92 years of record. It is suggested that the final statement indicate whether this meets AEC design flood protection criteria.

On page 63 the quantities of material to be removed are not in conformance with the quantities stated in the applicant's most recent revision, dated 3 June 1971. These quantities were changed to 99,950 cubic yards of unconsolidated alluvium and 504 cubic yards of rock. It is suggested that the final statement also state that a minimum depth of 18.0 feet will be provided from flat pool elevation 572.0 to top most point of the diffuser pipes in the navigation channel. This will clearly indicate that no restrictions will be placed on present or future planned commercial navigation traffic on the upper Mississippi River. It is also suggested that the final statement make reference to the amount of turbulence that may be expected near the diffuser pipes as related to small boat safety.

Since preparation of the draft statement there have been two new legal developments; namely, settlement of the litigation involving the Illinois Attorney General, and issuance of a permit by the Iowa Conservation Commission. The final statement should update the draft to show these developments.

NCRED-PB Mr. Lester Rogers 13 April 1972

On page 16, paragraph D, the discussion of historical and archaeological aspects is rather limited. Although the site proper probably does not have an impact on any particular archaeology site, construction of the spray-channel may involve minor archaeological sites. It is suggested that this aspect be considered in more detail in the final statement.

On page 25, paragraph 2, the aquatic habitat is discussed. It is suggested that a percentage relationship of the various habitats be given in the final statement. This would allow for a better evaluation of aquatic conditions in Pool 14 above and below the plant site.

Sincerely yours,

JAMES E.

Colonel, Corps of Engineers District Engineer



United States Department of the Interior

OFFICE OF THE SECRETARY WASHINGTON, D.C. 20240

MAY 1 1972

50-254 50-265

Dear Mr. Muntzing:

This is in response to Mr. Rogers' letter of March 6, 1972, requesting our comments on the Atomic Energy Commission's draft detailed statement dated March 6, 1972, on environmental considerations for Quad-Cities Nuclear Power Station, Units 1 and 2, Rock Island County, Illinois.

General

It is our understanding that the applicants have changed their plans for waste heat dissipation since the environmental statement was prepared and they now plan to install spray canals for both units. This change in plans substantially reduces our former concerns that this plant will have an adverse impact on the environment.

Our specific comments follow on a sectional basis.

Historical Significance

Our review reveals that operation of the power station will not affect existing or proposed units of the National Park System nor any historical or archeological values.

Condenser Cooling Water Intake

The trash racks and traveling screens in the condenser cooling water intake are described, and observations are reported concerning debris that accumulated on these facilities on pages 38 and 75. However, a description of the method to be used for the removal and disposal of fish and other accumulations is not given. We think this information should be included in the environmental • statement.

Solid Waste Disposal

The final statement should include the location of the disposal site and method of disposal of solid radioactive

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wastes. This lack of information is acknowledged in the statement but there were no indications that it would be included in the final statement.

Environmental Impacts of Plant Operation

It is stated on page 65 that no public access or recreational functions are to be provided and none existed previously. We do not think that a public utility with rights of condemnation actions in its interest has a right to prohibit public access to the property obtained through condemnation or which could have been obtained through condemnation proceedings if such visitations would not materially interfere with the intended use.

Furthermore, the educational and recreational benefits obtainable from visiting nuclear power stations have proven to be significant. In order to optimize the use of these resources, we suggest that a comprehensive site plan be developed. This plan should be included in the final environmental statement.

Land Use

The first paragraph of page 65 contains the following statement, "The 560 acre site . . . has been committed to the station. No plans have been announced for the remainder of the property." Based on statements at the bottom of page 13 and in the second paragraph on page 16, it appears that the area of the site is 560 + 160 or 720 acres; however, the Summary and pages 63 and 65 imply that the total area is 560 acres. We suggest that this be clarified in the final statement.

It appears that the portion of lands not used by the applicant could be managed for recreational and educational purposes. It is suggested that the applicants consult with State and local planning groups in the development of a plan to utilize this resource.

Biological Impact

According to a statement on page 74, AEC will require the applicants to monitor the environment in order to determine the impacts on aquatic life. We suggest that the applicants

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work cooperatively with the appropriate State biologists in making onsite observations of entrained fish and other organisms in the intake structure and discharge canal. We also point out that compliance with State and Federal standards does not preclude environmental damages or remove the applicants' responsibility for the environment.

Plant Shutdown

It is mentioned on page 82 that cold shock from station shutdown during winter could occur to resident animal species in the island area. Cold shock could also occur to fish living in or near the thermal plume when the side-jet and diffuser-pipe methods are used. We suggest that a shutdown of both units be avoided except in emergencies and that a gradual shutdown procedure be utilized even when only one unit is involved, particularly during the winter months.

Diffuser Pipe

We have considerable concern for the possible effects of the diffuser system even though it will only be used until the spray canal is completed. This pipe, as planned, will extend about 3/4 of the distance across the river, thus preventing the free movement of fish. This action also violates the "zone of passage" requirement suggested in the Report of the Committee on Water Quality Criteria of about 75% of the cross sectional area and/or volume of flow of the stream. We recommend that additional consideration be given to the design of this system.

The warmed water moving from the jets of the diffuser will form a heated-water barrier or curtain across most of the river. The effects of this barrier on the movement of fish should be given.

Pages 44 - 51 contain a discussion of the areas involved of temperatures greater than 3°F; however, these areas are not estimated for temperature rises of 1° or 2°F. Many fish and aquatic organisms are acutely sensitive to small temperature changes during certain periods of their life cycles. Thus, a degree or two increase in water temperature throughout the year for a 50, 100, or 200-mile reach of river could exert a significant environmental

impact. These areas should be estimated in this section and the impacts on the environment resulting from these changes in temperatures should be included in the appropriate section.

Cumulative Effects

No mention is made of the effects of this plant combined with those of other sources of heat or chemical discharges. This is a requirement of NEPA and this Department thinks that this analysis is highly desirable in assessing the environmental impacts.

Transportation Impact

As stated on page 94, the probability of accidental releases of low level contaminated material has been calculated and found to be sufficiently small that the likelihood of significant exposure is extremely small. We suggest that emergency procedures be developed to insure maximum containment of the spill and minimum personal exposure to contamination. These procedures should be given in the final environmental statement.

Environmental Impact of Postulated Accidents

The radiological effects of accidents are given only in terms of estimated doses to the population from air borne emissions at various distances from the plant. However, the environmental effects of releases to water is lacking. We think that the final environmental statement should include estimates of the pathways of the escaping radionuclides and quantities involved.

We also think that Class 9 accidents resulting in radioactive releases to both air and water should be described and the impact on human life and the remaining environment discussed as long as there is any possibility of occurrence. The consequences of an accident of this severity could have far-reaching effects which last for centuries.

Irreversible and Irretrievable Commitment of Resources

This section should describe the annual losses of fish and wildlife resources resulting from project construction and operation.

Cost-Benefit Analysis

This section does not adequately include the effects of the proposed plant or its alternatives on the environment. An evaluation of sport and commercial fish was made on page 114; but the total plankton and terrestrial life is essentially ignored in this section. A quantitative estimation of environmental costs and benefits should be given in the final invironmental statement.

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Sincerely yours,

Deputy Assistant

Secretary of the Interior

Mr. L. Manning Muntzing Director of Regulation U. S. Atomic Energy Commission Washington, D. C. 20545 **ENVIRONMENTAL PROTECTION AGENCY • STATE OF ILLINOIS**



William ' Blaser, Director • Richard B. Ogilvie, Governor

July 12, 1972

50-254/265

ENVIRONMENTAL IMPACT STATEMENT-Commonwealth Edison Company Quad-Cities Nuclear Power Station

U. S. Atomic Energy Commission Division of Radiological and Environmental Protection Washington, D.C. 20545

Gentlemen:

The Permit Section of the Division of Water Pollution Control has reviewed the Draft Environmental Impact Statement for the Quad-Cities Nuclear Power Station Units 1 and 2 prepared by the U. S. Atomic Energy Commission, issued on March 6, 1972, and the Environmental Impact Statement Comments prepared by the Federal Environmental Protection Agency, issued in April, 1972.

We find that we are in agreement with the Environmental Impact Statement Comments prepared by the Federal Environmental Protection Agency. As stated in the FEPA comments, the use of chlorine as an anti-fouling agent in the condenser cooling water system may show cause for concern due to its possible environmental, consequences. When ammonia is present, chlorine can combine with it to form cloramines which are more toxic than chlorine to the aquatic environment. However, due to the low concentration and intermittent discharging, we feel that the impact on the environment would normally be insignificant except possibly during periods of low flow.

Very truly yours,

DIVISION OF WATER POLLUTION CONTROL

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Robert A. Weiss, P.E. Manager Permit Section

JRL/1ce

co; Federal Environmental Protection Agency Commonwealth Edison Company R. S. Nelle

3933

2200 Churchill Road

Springfield, Illinois 62706

Telephone: 217-525-3397



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

50-254 50-265

OFFICE OF THE SECRETARY WASHINGTON, D.C. 20201

JUL 1 3 1972



Mr. L. Rogers Director Division of Radiological and Environmental Protection U.S. Atomic Energy Commission Washington, D. C. 20545

Dear Mr. Rogers:

This is in response to your letter of March 6, 1972, wherein you requested comments on the draft environmental impact statement for the Quad-Cities Nuclear Power Station, Units 1 and 2, Commonwealth Edison Company and Iowa-Illinois Gas and Electric Company.

This Department has reviewed the health aspects of the above project as presented in the documents submitted. The following comments are offered:

- 1. Proper construction methods should be used during future construction activities and during placement of dredge materials to assure that mosquito breeding areas are not created.
- 2. Operation of the spray canal will create fog and icing on Illinois Route 84 increasing the potential for highway accidents. Present accident rates due to fog and icing in the vicinity of the power station should be determined. If accident rate due to these reasons increases after the spray canal is operational, control measures should be initiated.

The opportunity to review this draft environmental impact statement is appreciated.

Sincerely yours,

Ululin Mug.

Merlin K. DuVal, M.D. Assistant Secretary for Health and Scientific Affairs

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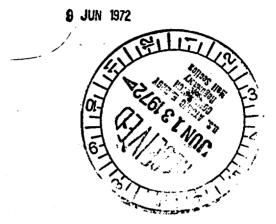
Appendix B. Agency Comments on the Addendum to the

Draft Environmental Statement

FEDERAL POWER COMMISSION WASHINGTON, D.C. 20426

50-254 50-265

IN REPLY REFER TO:



Mr. Daniel R. Muller
Assistant Director for
Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter dated June 7, 1972, requesting review and comments by the Federal Power Commission on an Addendum dated June 1972 to the AEC's Draft Environmental Statement for the Quad Cities Nuclear Power Station Units 1 and 2, which includes proposed changes to the Station's condenser cooling system.

The Federal Power Commission's Bureau of Power has previously commented on the AEC's Draft Environmental Statement in its letter dated March 22, 1972. These comments discussed the needs for additional power supply capability in the Applicants' areas and are not affected by the Addendum to the Draft Environmental Statement. Therefore, we shall appreciate your using the March 22, 1972 comments to fulfill whatever needs may arise for Federal Power Commission information in the case covered by Addendum I to the Quad Cities Draft Detailed Statement.

Very truly yours,

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Stewart P. Crum Acting Chief, Bureau of Power

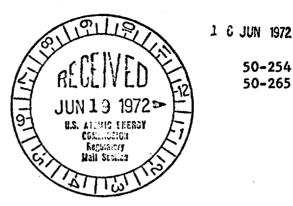


DEPARTMENT OF TRANSPORTATION

UNITED STATES COLST GUAND

MAILING ADDRESS: U.S. COAST GUARD(WS) 409 SEVENTH STREET RM. WASHINGTON, D.L. 2123 PHONE: 202-426-2262

Mr. Daniel R. Muller Assistant Director for Environmental Projects Directorate of Licensing U. S. Atomic Energy Commission Washington, D. C. 20545



50-254 50-265

Dear Mr. Muller:

This is in response to your letter of 7 June 1972 addressed to Mr. Herbert F. DeSimone, Assistant Secretary for Environment and Urban Systems. Your letter concerned an addendum to the draft environmental impact statement for Quad-Cities Nuclear Power Station Units 1 and 2, Rock Island County, Illinois.

We have reviewed the additional material presented and we have no comments to offer.

This Department previously reviewed this project as indicated in our letter dated 6 April 1972 to Mr. Lester Rogers of the Atomic Energy Commission. It is our determination that the impact of this project upon transportation remains minimal and we have no objections to the Quad-Cities project.

The opportunity to review and comment on this addendum to the draft statement for Quad-Cities Nuclear project is appreciated.

Sincerely,

OD Binen

W. M. DECAULT Ever Admiral, U. S. Coart Guard Chief, Cilice of Marine Environment and Syctems



DEPARTMENT OF THE ARMY ROCK ISLAND DISTRICT CORPS OF ENGINEERS CLOCK TOWER BUILDING ROCK ISLAND, ILLINOIS 61201 50-254 50-265

IN REPLY REFER TO

22 June 1972



Mr. Daniel R. Muller, Assistant Director for Environmental Projects Directorate of Licensing United States Atomic Energy Commission Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter of 7 June requesting review and comments on Addendum I to the Draft Environmental Statement for the Commonwealth Edison plant at Cordova, Docket numbered 50-254 and 50-265 (Quad-Cities Nuclear Power Station). Inclosed with the Addendum was Supplement 5 to the Applicant's Environmental Report. Both documents discuss spray canal design changes to enlarge its capacity. The notice of the Addendum published in the Federal Register we found in the issue of June 9.

On 13 April 1972 we submitted our comments on the Draft Environmental Statement in a letter addressed to Mr. Lester Rogers, a copy of which we inclose. Although Addendum I does not appear to be intended as the document responsive to solicited comments, we do note it supplies one item we requested, namely, updating to show settlement of the lawsuit which the Illinois Attorney General brought. The remaining 13 April comments we see no need to add to or change.

Sincerely yours,

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JAMES E. BUNCH Colonel, Corps of Engineers District Engineer

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13 April 1972

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NCLED-PB

Mr. Lester Rogers United States Atomic Energy Commission Division of Endiological and Environmental Protection Washington, D. C. 20545

Dear lir. Rogers:

This is in response to your letter of 6 March requesting review and comments on your draft environmental impact statement for the Commonwealth Edison plant at Cordova, Docket numbered 50-254 and 50-265 (Quad City Nuclear Power Station). The following are the comments of this office.

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Since preparation of the draft statement there have been two new legal developments; namely, settlement of the litigation involving the Illinois Attorney General, and issuance of a permit by the Iowa Conservation Cormission. The final statement should update the draft to show these developments.

PLANNING & REPORTS BR FWCollins/tfb

NCAED-PB Fr. Lester Rogers

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13 April 1972

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On page 25, paragraph 2, the aquatic habitat is discussed. It is sugcested that a percentage relationship of the various habitats be given in the final statement. This would allow for a better evaluation of aquatic conditions in Pool 14 above and below the plant site.

Sincerely yours,

JAIES E. BUNCH Colonel, Corps of Engineers District Engineer

cc: Dist File Ofc of Counsel Operations Div Engrg Div Flanning & Rpts (2)

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STATE OF ILLINOIS DEPARTMENT OF CONSERVATION Springfield 62706 50-254 50-265

HENRY N. BARKHAUSEN

RICHARD B. OGILVIE GOVERNOR

June 20, 1972

Mr. Daniel R. Muller Assistant Director for Environmental Projects Directorate of Licensing United States Atomic Energy Commission Washington, D. C. 20545 0110

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Dear Mr. Muller:

Addendum I to the Draft Detailed Statement on Environmental Considerations has been reviewed, and I can say that we are extremely happy that the change has been made from the diffuser pipe cooling water discharge system to the spray canal system. This, we believe will definitely reduce the adverse environmental effects on the river ecology.

A couple of comments appear to be in order. On page 8, Item VI, last sentence of paragraph 2, it states, "---the transient time through the canal may be sufficient (underlining added) to reduce the residual chlorine to very low value." It would be good to know that this would be the case but I assume it can't be positively determined at this time.

On page 7 under "B. Water Use" the statement is made that blowdown could be achieved----through the canal leakage into the ground water---. However, in Supplement No. 5, page 4, Economic Consideration, the second and third sentences read, "The soils in the vicinity of the Quad-Cities Station, in general, are very permeable. To avoid a large water loss, sealing of the spray canal will be required."

These statements in the Addendum and in Amendment No. 5 appear to be in conflict.

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We appreciate the opportunity to comment on these documents and are generally pleased with the revisions that have been made in the original plans for the Quad-Cities Station.

Sincerely yours, Henry Ny Barkhausen Director

HNB:ns

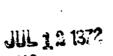
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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY WASHINGTON, D.C. 20201

50-254 50-265





Mr. Daniel R. Muller
Assistant Director for Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter dated June 7, 1972, wherein you requested comments on an Addendum to the Draft Detailed Environmental Statement for Quad-Cities Nuclear Power Station Units 1 and 2.

The Department of Health, Education, and Welfare has reviewed the health aspects of the above project as presented in the documents submitted. We offer no comments.

The opportunity to review the draft statement is appreciated.

Sincerely yours,

Sail tu q.

Merlin K. DuVal, M.D. Assistant Secretary for Health and Scientific Affairs

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY 50-254 WASHINGTON, D.C. 20460 50-265

1 8 JUL 1972

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

Dear Mr. Muntzing:

The Environmental Protection Agency has reviewed the Addendum I to the draft environmental impact statement for the Quad Cities Nuclear Power Station Units 1 and 2.

Our review of the draft environmental statement for the Quad Cities Nuclear Power Station Units 1 and 2, forwarded to the Atomic Energy Commission on 7 April 1972, recognized the changes to that statement spelled out in Addendum I. We commend the applicant for the commitment to a closed-cycle cooling system for both units.

We concur in the AEC's requirement that the applicant define an environmental (chemical, biological, and thermal) monitoring program to determine any impacts of plant operation. This program should be presented in detail in the final environmental impact statement.

On page 2 of Supplement 5, submitted by the applicant (April 24, 1972) there is reference to operation with the diffuser "if operation of the spray canal would be detrimental to the health and safety of the public." This statement should be clarified. The final impact statement should indicate the criteria which will be applied to determine when the spray canal would be "detrimental to the public health and safety;" who will make the determination to go to the diffuser; and the enforcement procedures which will govern diffuser operation.

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DEPARTMENT OF AGRICULTURE OFFICE OF THE SECRETARY WASHINGTON, D. C. 20250

July 11, 1972

Mr. Daniel R. Muller Assistant Director for Environmental Projects Directorate of Licensing Atomic Energy Commission Washington, D. C. 20545

Dear Mr. Muller:

We have had Addendum I to the draft environmental statement on Environmental Considerations Related to the Proposed Issuance of an Operating License to the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company, Quad-Cities Nuclear Power Station Units 1 and 2 reviewed in the relevant agencies of this Department. We have no comments to offer on the Addendum.

Sincerely,

y erly T. C. BYERLY

Coordinator, Environmental Quality Activities



United States Department of the Interior

OFFICE OF THE SECRETARY WASHINGTON, D.C. 20240

ER-72/266

50-254/265



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Dear Mr. Muller:

This is in response to your letter of June 7, 1972, requesting our comments on the Atomic Energy Commission's Addendum 1, dated June 1972, to the draft statement on environmental considerations for Quad-Cities Nuclear Power Station Units 1 and 2, Rock Island County, Illinois.

General

We are gratified that the applicant ultimately abandoned the objectionable once-through method of condenser cooling and now plans to use a closed-cycle spray canal system. This removes the ominous threat of extensive damages to the important aquatic resources of the Mississippi River which the once-through and jet diffuser systems formerly posed. Consequently, this Department's concerns and objections to the plant operation as expressed in previous letters are significantly reduced.

There are, however, several items in the addendum which lack sufficient detail regarding the effects that project operations will have on aquatic resources if operated . at the power level permissible with the diffuser cooling system during the interim period prior to May 1, 1979, when the spray canal system becomes operational for both units and also following that time if the diffuser system is used in emergencies which cover extended periods of time.

Environmental Study

Since the diffuser system will be used for a period of nearly three years, there exists the opportunity for a study of the effects of this type operation on aquatic life in the Mississippi River. This Department suggests that such a study, to include a reach of the river beginning at the plant and extending about 200 miles downstream be initiated immediately in cooperation with the appropriate State agencies and the Bureau of Sport Fisheries and Wildlife. The study should include onsite observations of entrained fish and other aquatic organisms in the intake system and the canal and the thermal effects of the project operation on fish and wildlife and their habitat. Empirical environmental data on this type of discharge system is greatly needed to serve as a basis for future projections of effects on aquatic life.

Historical Significance

The addendum describes a 2 1/2 mile long by 170-200 feet wide spray canal which will be constructed to provide cooling area for Unit No. 2. If archeological resources are located in this area they would be affected adversely during construction. The draft environmental statement issued on March 6, 1972, indicates that no known archeological materials are on the site; however, we believe that the presence or absence of archeological resources should be determined by consultation with experts in this field. In this regard we suggest that the final environmental statement reflect consultation with Mr. Charles J. Bareis, Department of Anthropology, 109 Davenport Hall, University of Illinois, Urbana, Illinois 63801.

We hope these comments will be helpful to you in the preparation of the final environmental statement.

Sincerely yours,

Deputy Assistant

Mr. Daniel R. Muller Assistant Director for Environmental Projects Directorate of Licensing Atomic Energy Commission Washington, D.C. 20545 Secretary of the Interior

Appendix C. - Organisms in the Mississippi River in the

Vicinity of the Quad-Cities Station

Table C-1 Planktonic Organisms

I. PHYTOPLANKTON

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- A. Green and Blue-green algae species list
- Mostoc cf. sphaerium Gleocystis vesicalosa Cladophora glomerata Oscillatoria rubescens Mertsmopedia punctata Coelosphaentum naeglianum Microcystis aereginosa Dictyosphaerium pulchillum Micratinium pusilium Actinostrum hantzschil var flurifile Oscillatoria tenuis Merismopedia punctata Coelosphaerium naegelianum Microcystis aeruginosa Phormidium tenue Lyngbya spp Oscillatoria spp Stigeoclonium tenue Sphaerotilus natans Plectonema notatum
- B. Distom species list
- Achnathes lanctolata Gyrosigma scalpriodes Gyrosigma scalpriodes G. Spencerti Melosita varians Melosita spp Navicula spp Nitzschia spp Nitzschia spp Stephanodiscus spp Gyclotella spp Gyclotella spp Cyclotella spp Gyclotella spp Cyclotella spp Cyclotella spp Cyclotella spp

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N. fonticola Mitzachia clausii Achnanthes minutisaima Distons vulgare Rhoicosphenia uiriata sidingms .N Nitzschia acicularia Navicula mutica Gomphonema lancedatum var insignis sulucibed elenocool Synedra ulna Cymbella tumida Distoma elongatum eilevo stodqmA Gomphonema oltvaceum Melosira granulata sigidms srieolsM Stephanodiscus hantzahii-tenuis Nitzschia dissipata Navicula atomus Gomphonema parvulum

ZOOPLANKTON •11

<u>eurodosh</u>) Lachnura Bactisca Potamanthus <u>etres</u>) Llyalella <u>Sebixiro</u>ð Aelosomatidae **Stenonena** Baetts Hydropsychidae Stenelmis <u>ttsoa</u> Potamyia Chydorous sphaericus sumorderd SUTODORUD Hyalella azteca Hexagenta Bosmina longirostris Cyclops vernalis III. BENTHOS

A. Ephemeroptera (Mayflies)

<u>Hexagenia</u> <u>Stenonema</u> <u>Isonychia</u> <u>Neocloeon</u>

B. Diptera (Flies)

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<u>Microcricotopus</u> <u>Coelotanypus</u> <u>Polypexilum</u> <u>Ablasbesinyia</u>

Tendipedidae (= chironomidae) (Bloodworm or midge fly larvae)

Stenochironomus Chironomus Cryptodeionomus Tendipes Glyptotendipes

C. Tricoptera (caddisflies)

Hydropsyche Cheumatopsyche Neureclipsis Potamyia Cyrnellus

D. Oliogochaeta

Limnodrilus hoffmeistera Oligochata

E. Mollusca (snails and clams)

Campeloma Lioplax subcarinata Somatogyrus depressus

Sphaeriidae (fingernail clams)

Sphaerium transversum

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F. Amphipoda (scuds)

Нуалледа агтеса

IV. PERIPHYTON

Microcystis
nonsmortnsedA
Reloated
Cladophora Cladophora
Sphaerottlus natans
Phormtdium tenue
Lyngoya
Oscillatoria
Plectonema
Stigeoclonium cf tenue

Table C-2 Species of Fish

Families and Scientific Names

Petromyzontidae (lampreys) Ichthyomyzon castaneus Ichthyomyzon unicuspis

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Acipenseridae (sturgeons) Scaphirhynchus platorynchus

Polyodontidae (paddlefishes) Polyodon spathula

Lepisosteidae (gars) Lepisosteus osseus Lepisosteus platostomus

Amiidae (bowfins) Amia calva

Clupcidae (herrings) Alosa chrysochloris Dorosoma cepedianum

Hiodontidae (mooneyes) Hiodon tergisus

Esocidae (pikes) Esox americanus Esox lucius

Cyprinidae (minnows and carps) <u>Cyprinus carpio</u> <u>Hybognathus nuchalis</u> <u>Hybopsis aestivalis</u> <u>Hybopsis storeriana</u> <u>Notemigonus crysoleucas</u> <u>Notropis atherinoides</u> <u>Notropis blennins</u> <u>Notropis buchanani</u> <u>Notropis hudsonins</u> <u>Notropis spilopterus</u> Chestnut lamprey Silver lamprey

Shovelnose sturgeon

Paddlefish

Longnose gar Shortnose gar

Bowfin

Skipjack herring Gizzard shad

Mooneye

Grass pickerel Northern pike

Carp Silvery minnow Speckled chub Silver chub Golden shiner Emerald shiner River shiner Ghost shiner Spottail shiner Spotfin shiner

Common Names

Table C-2 (Cont'd)

Families and Scientific Names	Common Names	
Cyprinidae (continued)		
	Bluntnose minnow	
Pimephales notatus	Fathead minnow	
Pimephales promelas	Bullhead minnow	
Pimephales vigilax	Builnead minnow	
Catostomidae (suckers)		
Carpiodes carpio	River carpsucker	
Carpiodes cyprinus	Quillback	
Catostomus commersoni	White sucker	
Ictiobus bubalus	Smallmouth buffalo	
Ictiobus cyprinellus	Bigmouth buffalo	
Minytrema melanops	Spotted sucker	
Moxostoma anisurus	Silver redhorse	
Moxostoma macrolepidotum	Shorthead redhorse	
Ictaluridae (catfishes)	Black bullhead	
Ictalurus melas	Yellow bullhead	
Ictalurus natalis		
Ictalurus punctatus	Channel catfish	
Noturus flavus	Stonecat	
Noturus gyrinus	Tadpole madtom	
Pylodictis olivaris	Flathead catfish	
Atherinidae (silversides)		
Labidesthes sicculus	Brook silversides	
Percichthyidae (temperate basses)		
Morone chrysops	White Bass	
Centrarchidae (sunfishes)		
Amboplites rupestris	Rock bass	
Lepomis gulosus	Warmouth	
Lepomis cyanellus	Green sunfish	
Lepomis gibbosus	Pumpkinseed	
Lepomis humilis	Orangespotted sunfis	
Lepomis macrochirus	Bluegill	
Micropterus dolomicui	Smallmouth bass	
Micropterus salmoides	Largemouth bass	
Pomoxis annularis	White crappie	
Pomoxis nigromaculatus	Black crappie	

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Table C-2 (Cont'd)

Families and Scientific Names

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Common Names

Percidae (perches and darters) <u>Ammocrypta clara</u> <u>Etheostema asprigene</u> <u>Ethcostoma nigrum</u> <u>Perca flavescens</u> <u>Percina caprodes</u> <u>Percina shumardi</u> <u>Stizostedion canadense</u> <u>Stizostedion vitreum</u>

Sciaenidae (drums) Aplodinotus grunniens Western sand darter Mud darter Johnny darter Yellow perch Logperch River darter Sauger Walleye

Drum

Table C-3 Number of Fish Collected in the Mississippi River Illinois Island Area vs. All Sampling Locations Quad-Cities Station 1971

BowfinAmiaShortnose garLepiLongnose garLepiGizzard shadDoroMooneyeHiodGrass pickerelEsonGrass pickerelEsonCarpCypiGolden shinerNoteSilver chubHyboSilvery minnowHyboRiver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	ntific Name sosteus platostomus sosteus osseus soma cepedianum lon tergisus americanus t lucius cinus carpio emigonus crysoleucas opsis storeriana	Area 2 2 1 116 9 6 5 101 1	Locations ^{1/} 30 79 7 1137 79 8 22 887
Shortnose garLepiLongnose garLepiGizzard shadDoroMooneyeHiodGrass pickerelEsonGrass pickerelEsonNorthern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctQuillbackCar	sosteus platostomus sosteus osseus soma cepedianum lon tergisus americanus i lucius rinus carpio emigonus crysoleucas	2 1 116 9 6 5 101	79 7 1137 79 8 22
Shortnose garLepiLongnose garLepiGizzard shadDoroMooneyeHiodGrass pickerelEsonGrass pickerelEsonNorthern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctQuillbackCar	sosteus platostomus sosteus osseus soma cepedianum lon tergisus americanus i lucius rinus carpio emigonus crysoleucas	2 1 116 9 6 5 101	79 7 1137 79 8 22
Longnose gar Lepi Gizzard shad Doro Mooneye Hiod Grass pickerel Eson Northern pike Eson Carp Cypi Golden shiner Note Silver chub Hybo Silvery minnow Hybo Silvery minnow Hybo River shiner Note Spottail shiner Note Spottail shiner Note Spotfin shiner Note Spotfin shiner Note Ghost shiner Note Bullhead minnow Pinn Smallmouth buffalo Ict Bigmouth buffalo Ict	sosteus osseus soma cepedianum lon tergisus americanus i lucius rinus carpio emigonus crysoleucas	1 116 9 6 5 101	7 1137 79 8 22
Gizzard shadDoroMooneyeHiodGrass pickerelEsonGrass pickerelEsonNorthern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilver chubHyboSilver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctQuillbackCar	osoma cepedianum lon tergisus americanus t lucius tinus carpio emigonus crysoleucas	116 9 6 5 101	1137 79 8 22
MooneyeHiodGrass pickeralEsonGrass pickeralEsonNorthern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilvery minnowHyboRiver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctQuillbackCar	lon tergisus americanus Lucius cinus carpio emigonus crysoleucas	9 6 5 101	79 8 22
Grass pickerelEsonNorthern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilvery minnowHyboSilvery minnowHyboSilvery shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctQuillbackCar	americanus lucius inus carpio migonus crysoleucas	6 5 101	8 22
Northern pikeEsonCarpCypiGolden shinerNoteSilver chubHyboSilvery minnowHyboRiver shinerNoteSpottail shinerNoteSpotfin shinerNoteEmerald shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	inus carpio migonus crysoleucas	5 101	22
CarpCypiGolden shinerNoteSilver chubHyboSilvery minnowHyboRiver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	rinus carpio emigonus crysoleucas	101	
Golden shinerNoteSilver chubHyboSilvery minnowHyboRiver shinerNoteSpottail shinerNoteSpotfin shinerNoteGhost shinerNoteBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	migonus crysoleucas		
Silver chubHyboSilvery minnowHyboRiver shinerNotaSpottail shinerNotaSpotfin shinerNotaSpotfin shinerNotaGhost shinerNotaBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar			32
Silvery minnowHyboRiver shinerNotaSpottail shinerNotaSpotfin shinerNotaSpotfin shinerNotaGhost shinerNotaBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	meia atoreriana		639
River shinerNotiSpottail shinerNotiSpotfin shinerNotiEmerald shinerNotiGhost shinerNotiBullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar		82	
Spottail shinerNot:Spotfin shinerNot:Emerald shinerNot:Ghost shinerNot:Bullhead minnowPimeSmallmouth buffaloIct:Bigmouth buffaloIct:QuillbackCar	gnathus nuchalis	10	52
Spotfin shinerNot:Emerald shinerNot:Ghost shinerNot:Bullhead minnowPimeSmallmouth buffaloIct:Bigmouth buffaloIct:QuillbackCar	ropis blennius	770	2379
Emerald shinerNotGhost shinerNotBullhead minnowPimSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	ropis hudsonius	52	134
Ghost shinerNot:Bullhead minnowPimSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	ropís spilopterus	267	312
Bullhead minnowPimeSmallmouth buffaloIctBigmouth buffaloIctQuillbackCar	ropis atherinoides	215	842
Smallmouth buffalo <u>Ict</u> Bigmouth buffalo <u>Ict</u> Quillback <u>Car</u>	ropis buchanani	1	1
Bigmouth buffalo Ict Quillback Car	ephales vigilax	41	125
Bigmouth buffalo Ict Quillback Car	iobus bubalus	5	141
Quillback Car	Lobus cyprinellus	3	59
	piodes cyprinus	9	30
KIVEL CALDSUCKEL OGL	piodes carpio	113	554
	ostoma macrolepidotum	2	19
	alurus punctatus	12	° 225
	alurus melas	1	9
	idesthes sicculus	2	32
	one chrysops	14	293
Orangespotted			
	omis humilis	17	76
	omis macrochirus	165	617
	omis culosus	1	1
Largemouth bass Mic	ropterus salmoides	56	353
White crappie Pom	oxis annularis	115	820
	oxis nigromaculatus	79	1055
	eostoma nigrum	6	18

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Table	C-3	(Cont	'd)
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Common Name	Scientific Name	Island Area	All 12 Sampling Locations ¹⁷
Log perch	Percina caprodes	2	38
Yellow perch	Perca flavescens	1	11
Sauger	Stizostedion canadense	32	561
Walleye	Stizostedion vitreum	10	65
Drum	Aplodinotus grunniens	87	516

 $\frac{1}{1}$ Total of 12 sampling locations for fishery studies performed by BIO-TEST in the vicinity of Quad-Cities Station during 1971.

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