UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
RADIOBIOLOGICAL LABORATORY
BEAUFORT, NORTH CAROLINA 28516

September 27, 1965

Mr. John Newell
Div. of Licensing & Regulations
U.S. Atomic Energy Commission
Washington, D. C. 20545

50-237

Dear John:

As per our telephone conversation, I am enclosing six copies of page 6 for enclosed report.

already inserted

Sincerely yours,

T. R. Rice
Director

Enclosures: 6

Report dated May 11, 1965

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May 11, 1965

A PRELIMINARY EVALUATION OF POSSIBLE EFFECTS ON FISH AND SHELLFISH OF THE PROPOSED DRESDEN NUCLEAR POWER STATION, UNIT 2 GRUNDY COUNTY, ILLINOIS (DOCKET 50-237)

By

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and

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1. Introduction

The Commonwealth Edison Company of Chicago has applied to the Atomic Energy Commission for a construction permit and license to operate a nuclear power reactor in Grundy County, Illinois. The proposed reactor will be the second one erected at this site, which comprises 953 acres at the confluence of the Des Plaines and Kankakee Rivers. The first reactor (Dresden No. 1), a dual cycle boiling water type, has been in operation since 1960.

We understand that the jurisdiction of the AEC in the licensing and regulation of nuclear power reactors is limited to matters pertaining to radiological safety. For that reason, our comments in this report are divided into two categories. The first category pertains to radiological safety considerations, which are involved in the pending licensing proceeding. The second category contains our comments on the possible effects of increased water temperature on fishery organisms. Although these considerations are not within the jurisdiction of the AEC and are not involved

in the pending AEC licensing proceeding, they may be of interest to appropriate state and local agencies and to the applicant.

The entry of radioactive materials into the aquatic environment, either by design or by accident, might conceivably result in adverse effects on the fisheries of the area. It was deemed advisable therefore that the Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service review the proposal and evaluate the possible effects of the operation of the proposed reactor on the fisheries. The present evaluation is based in part on information presented in "Plant Design and Analysis Report of Dresden Nuclear Power Station, Unit 2, vol. III" by the Commonwealth Edison Company, Chicago, Illinois.

2. Description of the Facility

Unit no. 2 will be a single cycle, forced circulation, boiling water reactor substantially similar, except for an increase in size and capability, to those authorized for construction at the Oyster Creek site in New Jersey and at Nine Mile Point in New York. The proposed reactor will operate initially at a power level of approximately 2,300 megawatts, thermal. Through the use of jet pumps, the recirculation coolant flow will require only a two-loop system. The reactor vessel and the recirculation system will be contained within a sealed steel pressure vessel, the drywell. The turbine, generator, feedwater heaters, condensate pumps and condensate mineralizer will be situated in the turbine building west of and adjacent to the turbine building for Dresden no. 1.

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3. Radioactive Waste Treatment Facilities

The waste treatment facility will be located in the radwaste building next to the reactor building. The radwaste building will be a two-floor concrete structure containing the control, processing and storage areas necessary to operate the solid and liquid waste processing equipment.

Radioactive wastes will be gaseous, liquid and solid in form. Gases will be held up for decay of short-lived isotopes then routed to the existing Dresden stack for dispersion to the atmosphere. Liquid wastes will be collected, treated, stored and either returned to the condensate system, stored offsite or diluted with cooling water and discharged into the Illinois River. Wastes discharged into the river will not exceed maximum permissible concentrations listed in the Code of Federal Regulations, Title 10, part 20. Solid radioactive wastes will be shipped to an offsite disposal facility.

4. Hydrology

The Des Plaines and Kankakee Rivers comprise the upper part of the Illinois River system. The normal pool elevation due to the adjacent Dresden Island Lock and Dam is 505 feet. Nominal ground elevation at the site location of Unit 2 is about 516 feet. River flow data applicable to the Dresden site 1961-1964 show that river flow exceeded 3,000 cubic feet per second (CFS) or 90% of the days, and 6,000 cfs on 48% of the days.

The Des Plaines River below Lockport and the Illinois River are used for navigation, sewage disposal and dilution, and condenser cooling water for power plants. At and below Peoria, the Illinois River is also used for domestic water supply. The Kankakee River is not navigable and is used for domestic supply.

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Detailed studies on chemical composition and biological conditions during 1961-1962 indicated that the lower river system was biologically degraded. The Dresden analysis states that the U. S. Public Health Service reported in 1963 that the upper portion of the river system shows a 9°C. net rise in temperature due to river usage.

5. Fisheries of the Illinois River System

Commercial fisheries of the Illinois River and its tributaries produced 2,208,600 pounds of fish during 1962, mostly carp, buffalofish, catfish, and crappie. (Power and Lyles, 1962). However, the contribution from the upper Illinois River to these catches was presumably small, judging from the reported difficulty in collecting fish samples in the vicinity of the Dresden site. Also, it has been reported by the Public Health Service that from July 1961 through July 1962 all stations from Wilmette, Chicago Harbor, and Calumet Harbor to a station 105 miles below the Dresden Dam were biologically degraded.

6. Radioactivity Monitoring Programs

Three agencies are involved in some phase of monitoring for the presence of radioactivity in the Dresden site environs. The Argonne National Laboratory has one monitoring point at Channahon, 3 miles north of the Dresden site. The State of Illinois Department of Health analyzes air and water from near the reactor site and from a point 9 miles downstream from the site. The Commonwealth Edison Company awarded a contract to Controls for Radiation, Inc. in 1962 to conduct a continuing monitoring program. A total of 3000 to 4000 radiochemical analyses are made yearly and include samples of air, water, slime, plankton, silt, vegetation, fish, and milk. Silt, slime, plankton, and fish samples are collected on a quarterly schedule and analyzed for gross alpha and gross beta radioactivity.

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7. Fate of Radionuclides in the Aquatic Environment

When radionuclides are released into the aquatic environment various factors tend to dilute and disperse them while other factors tend to concentrate them. If the rate of dilution were the only consideration undoubtedly the maximum permissible concentrations of radionuclides which can be disposed of as wastes would be adequate criteria in determining the maximum safe rate of discharge. However, radioactive isotopes are adsorbed onto sediments and are concentrated by organisms which require many of the stable forms of these elements for their normal metabolic activities. In addition, some organisms concentrate radioisotopes not normally required but which are chemically similar to elements essential for metabolism. Furthermore, distribution of radionuclides can occur by their transmission from one organism to another through various trophic levels of the food web and by the migration of organisms from the area.

8. Conclusions and Recommendations Concerning Radioactive Effluents

The proposed reactor has been designed to operate with a minimum of environmental contamination by radioactive materials. However, these radioactive liquids must be released at a rate which will not exceed the maximum permissible limits set forth in title 10, part 20 of the Code of Federal Regulations.

It is concluded that the proposed nuclear reactor can be operated without harmful effects to the fisheries provided that a radiological monitoring program remains in effect during reactor operation, and the findings of this program are used to govern the discharge of radioactive material.

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Although it is well established that certain levels of radioactive wastes can be discharged into the aquatic environment without adverse effects on the fisheries, it is essential to determine whether such discharge adversely affects the organisms in each specific area.

To insure that adequate safeguards are followed which will protect the fisheries from harm, certain requirements must be met. Therefore, it is recommended:

a. That ecological surveys be conducted 2 years prior to plant operation and continued on a regular basis after the plant starts operation to determine the effects of reactor effluents on plant and animal communities.

b. That extensive radiological monitoring of the biota, water, and sediments of the proximal aquatic environment be continued on a regular basis.

c. That hydrologic studies, such as those already carried out in the vicinity of the plant, be continued during plant operation to determine the extent of any changes which may occur due to discharge of radioactive effluents.

d. That consideration be given to the combined effects of effluent discharge from all existing and planned reactors along the shores of the river.

e. That the Radiobiological Laboratory be placed on the distribution list to receive copies of the survey and monitoring reports for review to assist other organizations in determining whether or not unsafe levels of radioactivity have been found in the water, sediments, or biota.

POSSIBLE EFFECTS OF INCREASED WATER TEMPERATURE ON FISHERY ORGANISMS

Large volumes of heated water discharged into an aquatic environment from a nuclear steam generating plant could result in a significant increase in the temperature of the environment near the plant. The temperature rise may or may not be sufficient to cause mortality among the organisms present, but subtle biological changes could occur causing long-term changes in the fisheries.

The thermal requirements of a fishery organism cannot be stated with any degree of accuracy. By "thermal requirements" here is meant the temperature limits which will permit survival at a level which allows for continuity of the species. These limits are influenced by season, age, size and other factors so that the thermal requirements would be quite variable and difficult to ascertain. As a controlling factor, the thermal requirement of a particular species becomes a level which will permit sufficient difference between resting and active metabolism to provide for essential activities (Brett, 1960). The increased energy demand of resting metabolism during elevated temperatures may rob an organism of the agility needed to capture its food. It has been proposed that the upper limit of required temperature for any species of fish should not exceed that which would curtail activity below 3/4 of the optimum, i.e., 3/4 of the maximum difference between active and resting metabolism (Brett, 1960).

Although a temperature rise in the aquatic environment may result in a change in species composition, increases in total productivity near warm water outlets from conventional power plants have been observed. Therefore it will be necessary to follow carefully any changes in total productivity in order to properly evaluate the effects on fishery organisms from discharged heated water.

LITERATURE CITED

Brett, J. R. 1960. Thermal requirements of fish - 3 decades of study, 1940-1970. In Biological Problems in Water Pollution. U. S. Public Health Service, Robert A. Taft Sanitary Engineering Center, Technical Report W60-3, p. 110-117.

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