SUPPLEMENTAL TESTIMONY

TO FINAL ENVIRONMENTAL STATEMENT
related to construction of
DAVIS-BESSE NUCLEAR POWER STATION
TOLEDO EDISON COMPANY and
CLEVELAND ELECTRIC ILLUMINATING COMPANY

Docket No. 50-346

Issue 8

THERMAL PLUME EFFECTS

Fish will probably be attracted to the thermal plume when plume temperatures are nearer the fishes' preferred temperatures. This will occur primarily during the winter. Little is known about the distributions of fish during the winter as the western basin of Lake Erie is usually ice-covered, thereby making sampling difficult. The plume area where fish could be expected to congregate is that area within the 3°F isotherm. In the area near the discharge slots, water velocities will be too great for fish to become resident, thus, the thermal plume area in Lake Erie of interest is less than 0.7 acres. Therefore, any discussion of direct or indirect thermal effects (reduced reproductive success, decreased resistance to disease, depletion of local food supplies, etc.) would pertain to fish moving in and out of the warmer water. The staff is not able to quantify these effects, to determine the number of fish likely to be involved, or to determine the exact impact on whole populations of fish. It is the staff's judgement, however, that it is unlikely that whole populations will be adversely affected. The monitoring program should detect any impact on fish populations. During winters when conditions permit, monitoring studies should include investigation of fish in the plume.

CHEMICAL EFFECTS

The existing total dissolved solids concentration (TDS) of the inshore lake water is slightly greater than the 200 mg/l objective for Lake Erie. Operation of the Station will result in a concentration of dissolved solids by a factor slightly less than 2 through loss of water by evaporation in the cooling tower. A small zone of higher TDS will therefore exist close to the discharge, but no significant effects on human use or on aquatic life from this cause are expected (FES Sections 5.2.7 and 5.5.3). Some of the evaporated water will return to the lake through precipitation over tributary watersheds, but even if the water loss is considered irretrievable, the effect on TDS of the lake as a whole will be undetectable.

The TDS of the Station effluent will be entirely dependent on the TDS of the intake water which controls not only the blowdown concentration but also the amounts of impurities to be removed by the demineralizers. Operation of the Station will not have a detectable effect on the total mass of dissolved solids present in the lake. The quoted mass of chemicals discharged, 8700 tons annually, is actually the total dissolved solids content of the effluent under average conditions (blowdown rate 9225 gpm, TDS 427 ppm). The dissolved solids taken into the Station under the same average conditions will be about 9100 tons annually (make-up rate 18,450 gpm, TDS 225 ppm). In addition, a relatively small quantity of sodium sulfate (estimated as 58.4 tons in Table 3.6) will be added to the lake annually from demineralizer regeneration.

If the small reduction in solids is ignored, the only effect of the Station on the average TDS concentration in Lake Erie will be due to the evaporation of water in the cooling tower at an approximate rate of about 21 cfs. In considering the water balance in Section 5.2.2 it was stated that this represents only about 0.1% of the natural evaporation rate of the lake (225,000 cfs). Since this evaporation is approximately replaced by precipitation over the lake, the rate of flow into and out of the lake is the important factor in considering the effect of the Station on the TDS concentration. The average flow is approximately 200,000 cfs, and it is clear that the effect of the 21cfs loss will be quite negligible compared to normal fluctuations and analytical precision.

Apart from the increased TDS, the only important change in composition produced by the Station will be the addition of sulfate ion. Most of the added sulfate will be the result of neutralizing the cooling system water with sulfuric acid to avoid scaling in the condenser. Under average conditions the mass of sulfate added will be about 4.5 tons per day. Demineralizer regeneration will add a further ~ 320 lbs per day. If the water flowing into Lake Erie (principally from the Detroit River) contains a sulfate concentration similar to that observed at the site (37 ppm) the mass of sulfate ion entering Lake Erie daily is about 19,000 tons. By comparison, the effect of the Station on the lake as a whole will be negligible.

In spite of the above, it is still appropriate to consider whether the chemical effects of the Station could be reduced by reasonable and practicable measures. The major chemical effects are the discharging

of concentrated blowdown with the addition of sulfate, and the concentration of salts in the cooling water making it necessary to add sulfuric acid to avoid scaling. The cooling tower evaporates 9225 gpm (average), and if the solids contained in this volume of water (~12.5 tons per day) were not returned to the lake, they would have to be separated in some way and disposed of on land. The separation of dissolved salts from large quantities of water presents a desalination problem similar to that involved in obtaining potable water from saline or brackish water supplies, except that in these latter cases there is generally no objection to returning the separated salts to the original low quality water. Reverse osmosis, a process which has received much attention in recent years, appears promising for these purposes, and commercial units are available for providing up to several hundred thousand gallons of treated water per day. This is still considerable less than the requirements of a cooling system such as that of the Davis-Besse Station where the quantity of water required to replace evaporation is about 13 million gallons per day. Further, the concentrated effluent from the reverse osmosis plant would have to be disposed of, perhaps by evaporation to dryness for storage on land. At the present time, such methods appear impractical on the scale required.

Reverse osmosis is being used successfully as a first stage in the production of high purity water, to remove a large fraction of the dissolved salts before demineralization by ion exchange, thus reducing the ion exchange capacity required and the quantities of

chemicals used for regeneration. This method would probably be applied to the demineralizing system of a power plant, and would greatly reduce the quantities of waste chemicals and resins to be disposed of. In the Davis-Besse Station, however, the regenerated wastes represent only small fraction of the total chemical discharge, so little advantage would be gained.

Chlorine will be added to the condenser cooling water periodically in amounts sufficient to "shock" defoul the system of slime growths. There is no known way to determine the minimum effective quantity of chlorine other than by direct experiments on site.

At the point of discharge of circulating water into Lake Erie all or nearly all of the free chlorine added will have been converted to harmless chloride ion or to combined chlorine ("chloramines"; Section III.D). The concentration of these chloramines will quickly be reduced by dilution. In addition, natural decay of the chloramines will occur due to reaction with reducing substances in the lake water and due to evaporation to the atmosphere of volatile chloramine species such as dichloramine($NHCl_2$) from the floating heated plume. The rates of decay cannot be predicted accurately due to lack of data and dependence on variable water quality parameters (concentrations of fast-acting reducing species and of ammonia nitrogen, and the pH).

There have been a number of studies of the effect of chlorine on aquatic organisms. The most thorough review has been carried out by Brungs, of the Environmental Protection Agency's Duluth, Minnesota Laboratory.

On the basis of the available knowledge, he has developed interim criteria which, if not consistently exceeded, will protect fresh-water aquatic life. In the absence of significant free chlorine, the appropriate criteria for receiving waters containing only "warm water" fish species (i.e., the western basin of Lake Erie) is that, for a period of 2 hours a day, total residual chlorine may be up to but not exceed 0.2 mg/l.

In view of the fact that the Davis-Besse Nuclear Power Station is designed for closed cycle operation, it is the staff's evaluation that Davis-Besse has been designed using the best existing technology for chemical effluents, and thermal effluents.

With regard to the non-degradation aspects of water quality, the Staff concludes that the Applicant has taken all reasonable and practicable measures (Subject to meeting the Staff's restriction on total residual chlorine) to maintain existing water quality levels.

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of

TOLEDO EDISON COMPANY AND THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

(Davis-Besse Nuclear Power Station)

Docket No. 50-346

CERTIFICATE OF SERVICE

I hereby certify that copies of "Supplemental Testimony," dated July 17, 1973, in the captioned matter, have been served on the following by deposit in the United States mail, first class or air mail, this 17th day of July, 1973:

John B. Farmakides, Esq., Chairman
Atomic Safety and Licensing
Board Panel
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dr. Cadet H. Hand, Jr., Director
Bodega Marine Laboratory
University of California
P.O. Box 247
Bodega Bay, California 94923

Mr. Frederick J. Shon
Atomic Safety and Licensing
Board Panel
U.S. Atomic Energy Commission
Washington, D.C. 20545

Gerald Charnoff, Esq.
Shaw, Pittman, Potts & Trowbridge
910 17th Street, N.W.
Washington, D.C. 20006

George W. Pring, Chief
Environmental Enforcement Division
800 Seneca Towers
361 East Broad Street
Columbus, Ohio 43215

Donald H. Hauser, Esq.
Corporate Solicitor
The Cleveland Electric
Illuminating Company
Post Office Box 5000
Cleveland, Ohio 44101

Atomic Safety and Licensing
Appeal Board
U.S. Atomic Energy Commission
Washington, D.C. 20545

Atomic Safety and Licensing
Board Panel
U.S. Atomic Energy Commission
Washington, D.C. 20545

Mr. Frank W. Karas
Chief, Public Proceedings Staff
Office of the Secretary of the
Commission
U.S. Atomic Energy Commission
Washington, D.C. 20545

Russell Z. Baron, Esq.
Brannon, Ticktin, Baron & Mancini
930 Keith Building
Cleveland, Ohio 44115

Myron Karman
Counsel for AEC Regulatory Staff