

PRELIMINARY SAMPLING SURVEY
WAUKEGAN AND ZION POWER PLANT SITES

October 9 and 10, 1969

U. S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER QUALITY ADMINISTRATION
Lake Michigan Basin Office
Chicago, Illinois

April, 1970

EPA 950-F-70-002

Introduction

A preliminary sampling survey of the Commonwealth Edison power plant sites at Waukegan and Zion was performed on October 9 and 10, 1969. The objectives of the study were (1) to determine the species and number of benthic organisms at the two sites and assess the effects of the heated discharge at Waukegan, (2) to obtain radiological background data at Zion for both water and sediments, and (3) to obtain temperature data at Waukegan to augment that collected in May 1968.

The Waukegan plant is a fossil fueled steam electric generator of 1086.7 megawatts capacity. The Zion plant will consist of two pressurized water reactors, each of 1050 megawatts capacity, and is scheduled to begin operation in 1972.

Summary

1. Waukegan bottom samples within the thermal plume showed generally lower concentrations of pollution sensitive organisms.
2. Zion bottom samples contained a large number of both pollution sensitive and pollution tolerant organisms.
3. Dissolved oxygen levels were uniformly high at both sites.
4. Temperature data at Waukegan was insufficient for more than a rough profile of plume shape.
5. Radiological results are comparable to other analyses from stations across the United States and reflect background conditions.
6. More intensive study of the relationship between heat, benthic fauna, and scour at Waukegan is needed before definite conclusions about thermal effects can be drawn.

Field Sampling and Laboratory Methods, Biology

Benthic samples were collected by means of Pettersson dredge. The samples were washed through a 30 mesh screen. The material remaining on the screen was placed into a 16 ounce polystyrene jar containing enough formalin to effect a 10 percent solution.

Laboratory procedures for benthos followed those outlined in the Water Pollution Biology Field and Laboratory Manual prepared by the Biology Unit, GLIRB Project, Department of Health, Education and Welfare, February 1966.

Biological Findings

Tables 1 and 2 show the numbers of benthic organisms collected during the Waukegan and Zion studies. Figures 1 and 2 show the sampling points; Figures 6 and 7, the numbers of pollution sensitive organisms.

Considerable numbers of pollution-tolerant and pollution sensitive organisms were noted at all Zion stations. In general, numbers of organisms in the sampling area increased with depth (Figure 7).

In the Waukegan study, pollution sensitive organisms such as scuds were found in generally lower quantities within the thermal plume (Figures 3, 4 and 6). No organisms were found at stations 47 and 50, where average temperature increase is the greatest.

Though the plume and benthos patterns at Waukegan are similar, the data are too limited to allow certainty about adverse thermal effects. Field observations (Table 3) show a large volume of fine sand at station 47, perhaps indicating unconsolidated shifting sand which has covered the benthic organisms. Gravel, noted at station 50, may indicate scouring due to cooling water flow, wave interaction with the breakwater, etc. Further study of the relationship between heat and benthos at Waukegan is needed and should include cores or Shipek Dredge samples to allow better assessment of dynamical effects such as scouring. Additional sampling south of Light "A" is needed to establish the influence of the Waukegan Sewage Plant effluent.

⊗ Winthrop Harbor
Water Tower

ZION NUCLEAR POWER PLANT

Sampling Stations- Oct. 8, 1969
Lake Michigan Basin Office

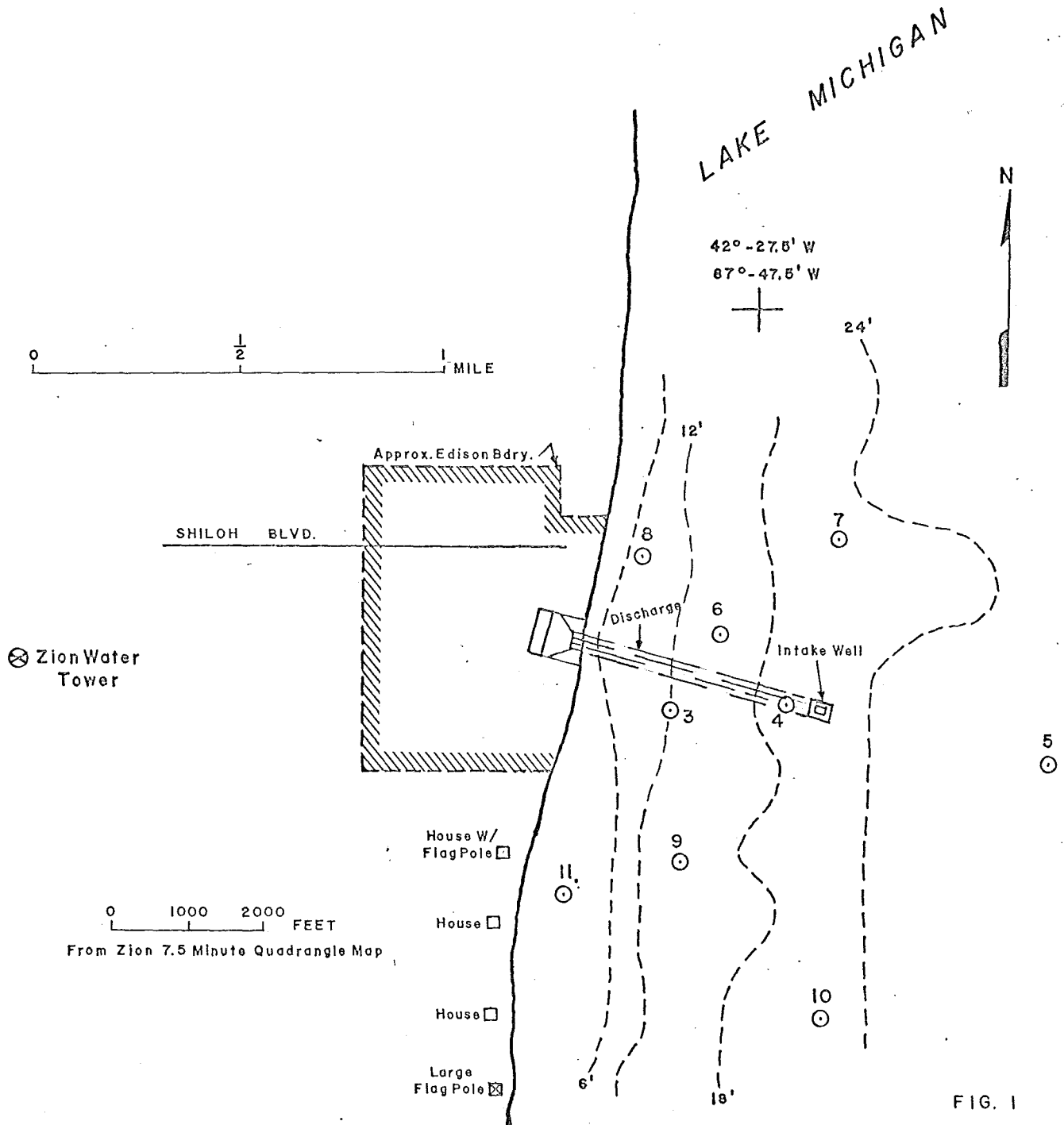


FIG. 1

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Biology Unit

Ref: Figure 1
 Date: 1-26-70
 Page 1 of 2 Pages

Table 1
 BIOLOGICAL DETERMINATIONS, BENTHIC FAUNA
 Sample Source: Zion Study - Thermal Pollution
 Study Period: 10-8-69

Results Expressed in Numbers of Organisms
 per Square Meter*

| LMBO # | 5139 | 5140 | 5141 | 5142 | 5143 |
|---|---------|---------|---------|---------|---------|
| Station | 3 | 4 | 5 | 6 | 7 |
| Depth of Station | 18' | 235' | 30.5' | 14.5' | 24.5' |
| Date of Collection | 10-8-69 | 10-8-69 | 10-8-69 | 10-8-69 | 10-8-69 |
| Date of Analysis | 1-20-70 | 1-20-70 | 1-13-70 | 1-20-70 | 1-14-70 |
| Oligochaeta (sludgeworms) | 2490 | 2400 | 350 | 6020 | 70 |
| Sphaeriidae (fingernail clams) | 270 | 330 | 390 | 190 | |
| Tendipedidae (bloodworms) | 30 | | 10 | 10 | |
| Hirudinea (leeches) | | | | | |
| Pulmonata (lung breathing snails) | | | 20 | | |
| Isopoda (aquatic sowbugs) | | | | | |
| Nematoda (roundworms) | | | | | |
| Amphipoda (scuds) | 260 | 1380 | 1730 | 100 | 1690 |
| Mysidacea (opossum shrimo) | | | | | |
| Prosobranchia (gill- breathing snails) | | | | | 10 |
| Turbellaria (flatworms) | | | | | |
| Unionidae (unionid clams) | | | | | |
| Ephemeroptera (mayfly larvae) | | | | | |
| Cladocera (water fleas) | | | | | |
| | | | | | |
| | | | | | |
| Total | 3050 | 4110 | 2500 | 6320 | 1770 |

Methods Reference: Preservative Formalin 10%

Remarks: *Numbers of organisms collected times ten.

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Biology Unit

Ref: Figure 1
 Date: 1-26-70
 Page 2 of 2 Pages

Table 1
 BIOLOGICAL DETERMINATIONS, BENTHIC FAUNA
 Sample Source: Zion Study - Thermal Pollution
 Study Period: 10-8-69

Results Expressed in Numbers of Organisms
 per Square Meter

| LMBC # | 5144 | 5145 | 5146 | 5147 | |
|---|---------|---------|---------|---------|--|
| Station | 8 | 9 | 10 | 11 | |
| Depth of Station | 11' | 20' | 25' | 10' | |
| Date of Collection | 10-8-69 | 10-8-69 | 10-8-69 | 10-8-69 | |
| Date of Analysis | 1-21-70 | 1-15-70 | 1-19-70 | 1-21-70 | |
| Oligochaeta (sludgeworms) | 8900 | 290 | 350 | 170 | |
| Sphaeriidae (fingernail clams) | 30 | 70 | 740 | 40 | |
| Tendipedidae (bloodworms) | 50 | 10 | 10 | 120 | |
| Hirudinea (leeches) | | | | | |
| Pulmonata (lung breathing snails) | | 10 | | | |
| Isopoda (aquatic sowbugs) | | | | | |
| Nematoda (roundworms) | | | | | |
| Amphipoda (scuds) | 20 | 290 | 3180 | 110 | |
| Mysidacea (opossum shrimp) | | | | | |
| Prosobranchia (gill- breathing snails) | | | 10 | | |
| Turbellaria (flatworms) | | | | | |
| Unionidae (unionid clams) | | | | | |
| Ephemeroptera (mayfly larvae) | | | | | |
| Cladocera (water fleas) | | | | | |
| Hydrasoa | | 90 | | | |
| Total | 9000 | 770 | 4290 | 340 | |

Methods Reference:

Preservative Formalin 10%

Remarks:

LMBO Form 8/4/69

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Biology Unit

Ref: Figure 2
 Date: 1-26-70
 Page 1 of 2 Pages

Table 2
 BIOLOGICAL DETERMINATIONS, BENTHIC FAUNA
 Sample Source: Waukegan Study - Thermal Pollution
 Study Period: 10-9-69

Results Expressed in Numbers of Organisms
 per Square Meter*

| LMBO # | 5148 | 5149 | 5150 | 5151 | 5152 |
|---|---------|---------|---------|---------|---------|
| Station | 46 | 47 | 48 | 6 | 50 |
| Depth of Station | 5' | 11' | 8.5' | 8' | 8' |
| Date of Collection | 10-9-69 | 10-9-69 | 10-9-69 | 10-9-69 | 10-9-69 |
| Date of Analysis | 1-6-70 | 1-6-70 | 1-12-70 | 1-12-70 | 1-12-70 |
| Oligochaeta (sludgeworms) | | | | | |
| Sphaeriidae (fingernail clams) | | | | | |
| Tendipedidae (bloodworms) | 90 | | 10 | 30 | |
| Hirudinea (leeches) | | | | | |
| Pulmonata (lung breathing snails) | | | | | |
| Isopoda (aquatic sowbugs) | | | | | |
| Nematoda (roundworms) | | | | | |
| Amphipoda (scuds) | 20 | | 10 | 50 | |
| Mysidacea (opossum shrimo) | | | | | |
| Prosobranchia (gill- breathing snails) | | | | | |
| Turbellaria (flatworms) | | | | | |
| Unionidae (unionid clams) | | | | | |
| Ephemeroptera (mayfly larvae) | | | | | |
| Cladocera (water fleas) | | | | | |
| | | | | | |
| | | | | | |
| Total | 110 | 0 | 20 | 80 | 0 |

Methods Reference: Preservative Formalin 10%

Remarks: *Number of organisms collected times ten.

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Biology Unit

Ref: Figure 2
 Date: 1-26-70
 Page 2 of 2 Pages

Table 2
 BIOLOGICAL DETERMINATIONS, BENTHIC FAUNA
 Sample Source: Waukegan Study - Thermal Pollution
 Study Period: 10-9-69

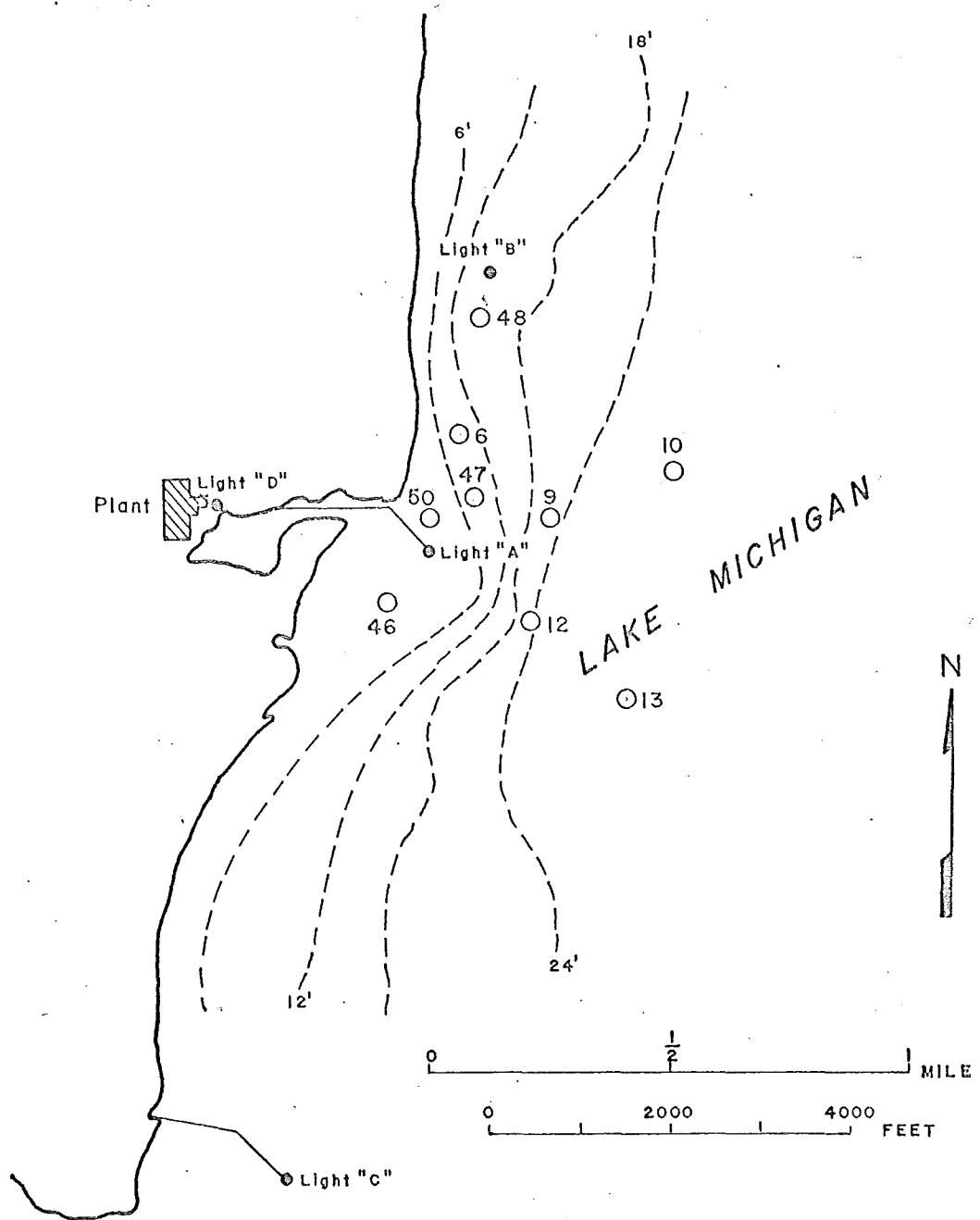
Results Expressed in Numbers of Organisms
 per Square Meter

| LMBO # | 5153 | 5154 | 5155 | 5156 | |
|---|---------|---------|---------|---------|--|
| Station | 9 | 10 | 12 | 13 | |
| Depth of Station | 15' | 24' | 23' | 27' | |
| Date of Collection | 10-9-69 | 10-9-69 | 10-9-69 | 10-9-69 | |
| Date of Analysis | 1-12-70 | 1-7-70 | 1-8-70 | 1-7-70 | |
| Oligochaeta (sludgeworms) | | 880 | 3670 | 2080 | |
| Sphaeriidae (fingernail clams) | | 600 | | 137 | |
| Tendipedidae (bloodworms) | | 40 | 100 | 110 | |
| Hirudinea (leeches) | | | | | |
| Pulmonata (lung breathing snails) | | 60 | 290 | 90 | |
| Isopoda (aquatic sowbugs) | | | | | |
| Nematoda (roundworms) | | | | | |
| Amphipoda (scuds) | 90 | 1650 | 1410 | | |
| Mysidacea (opossum shrimo) | | | | | |
| Prosobranchia (gill- breathing snails) | | 240 | 420 | 210 | |
| Turbellaria (flatworms) | | | | | |
| Unionidae (unionid clams) | | | | | |
| Ephemeroptera (mayfly larvae) | | | | | |
| Cladocera (water fleas) | | | | | |
| | | | | | |
| | | | | | |
| Total | 90 | 3470 | 5890 | 4120 | |

Methods Reference:

Preservative Formalin 10%

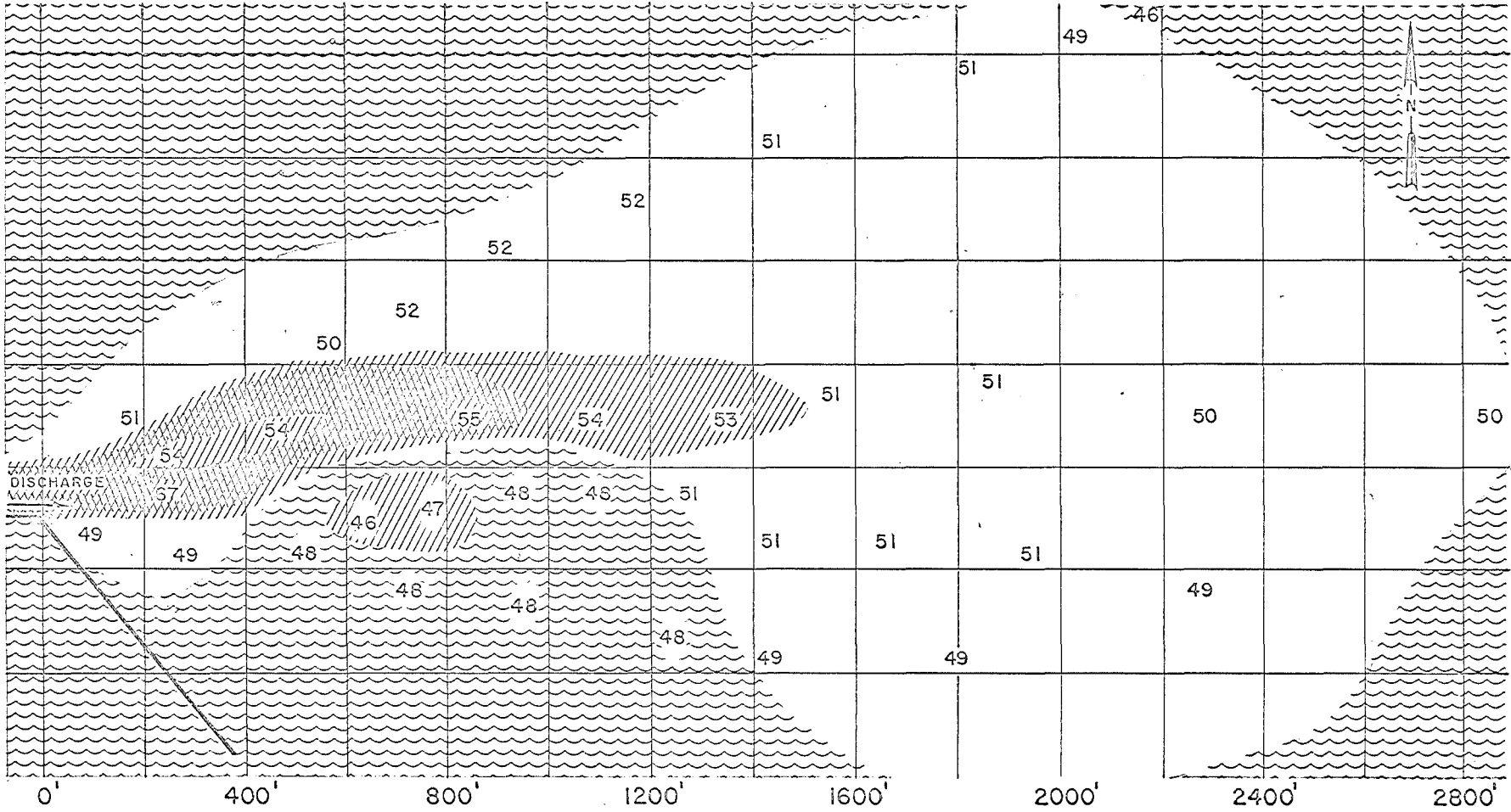
Remarks: _____



WAUKEGAN POWER PLANT
 Sampling Stations-Oct.9,1969
 Lake Michigan Basin Office

FIG. 2

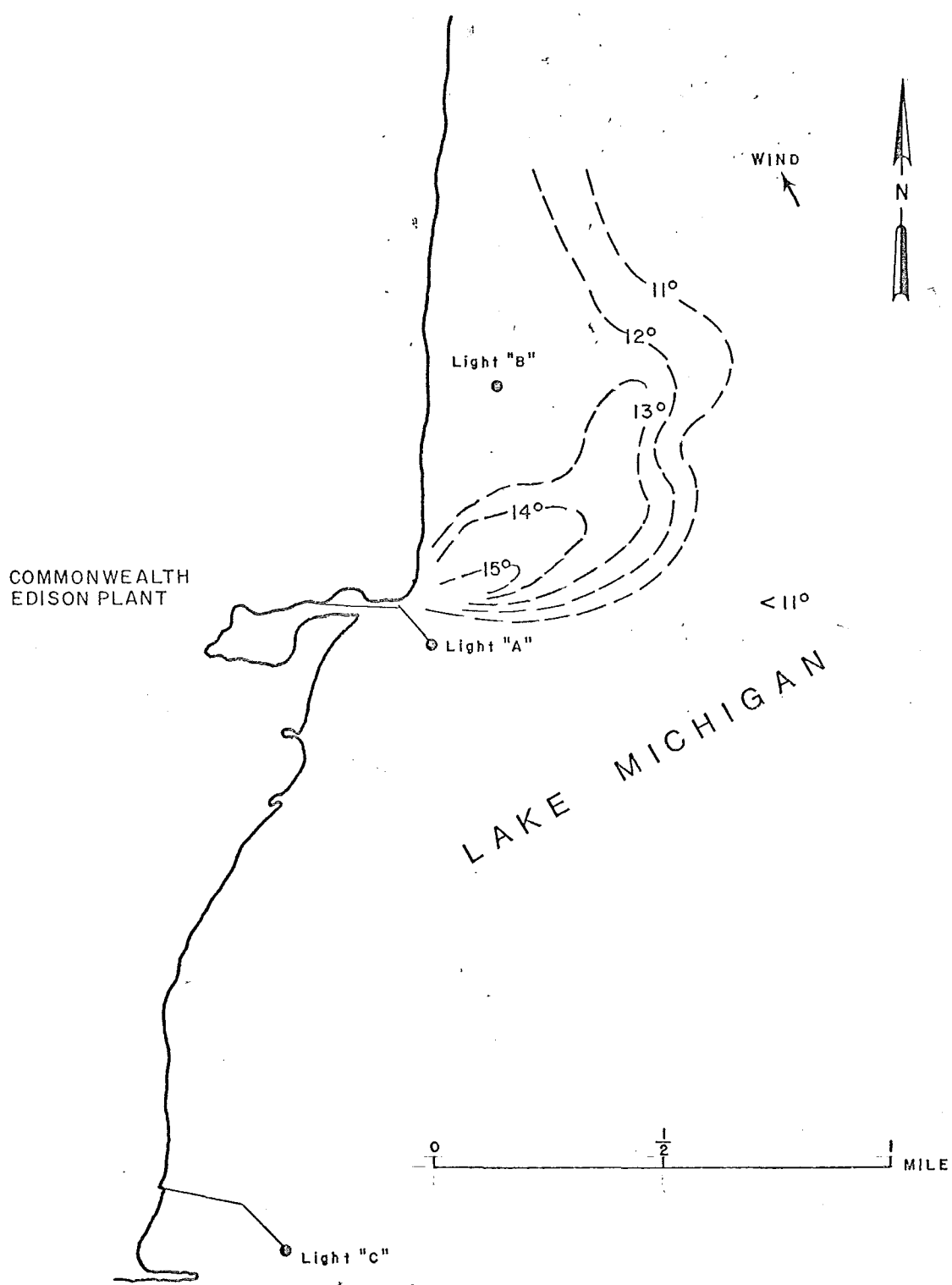
TEMPERATURE STUDY · WAUKEGAN STATION · APRIL 1968



Commonwealth Edison Data

FIG. 3

1' BELOW SURFACE



WAUKEGAN POWER PLANT
Surface Isotherms In °C
May 22, 1968
Lake Michigan Basin Office

FIG. 4

ROUGH TEMPERATURE PROFILE IN °C
 WAUKEGAN POWER PLANT- Oct.9,1969
 Lake Michigan Basin Office

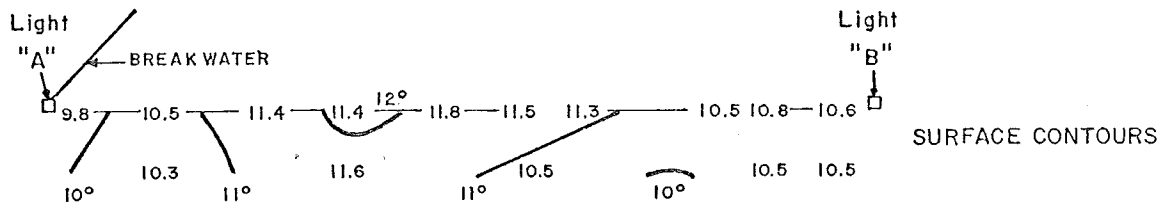
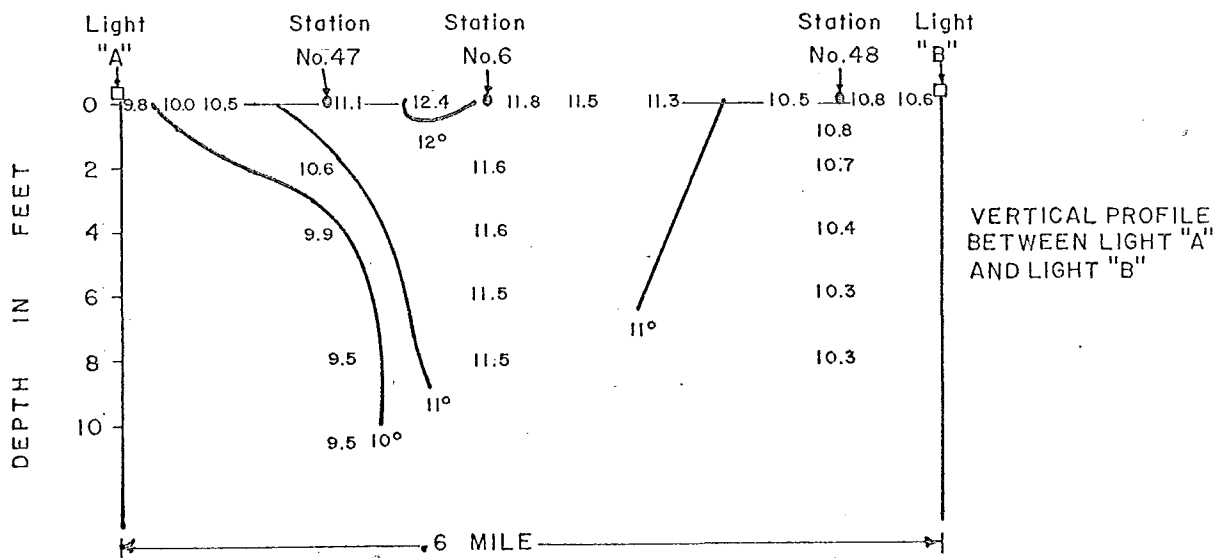


FIG. 5

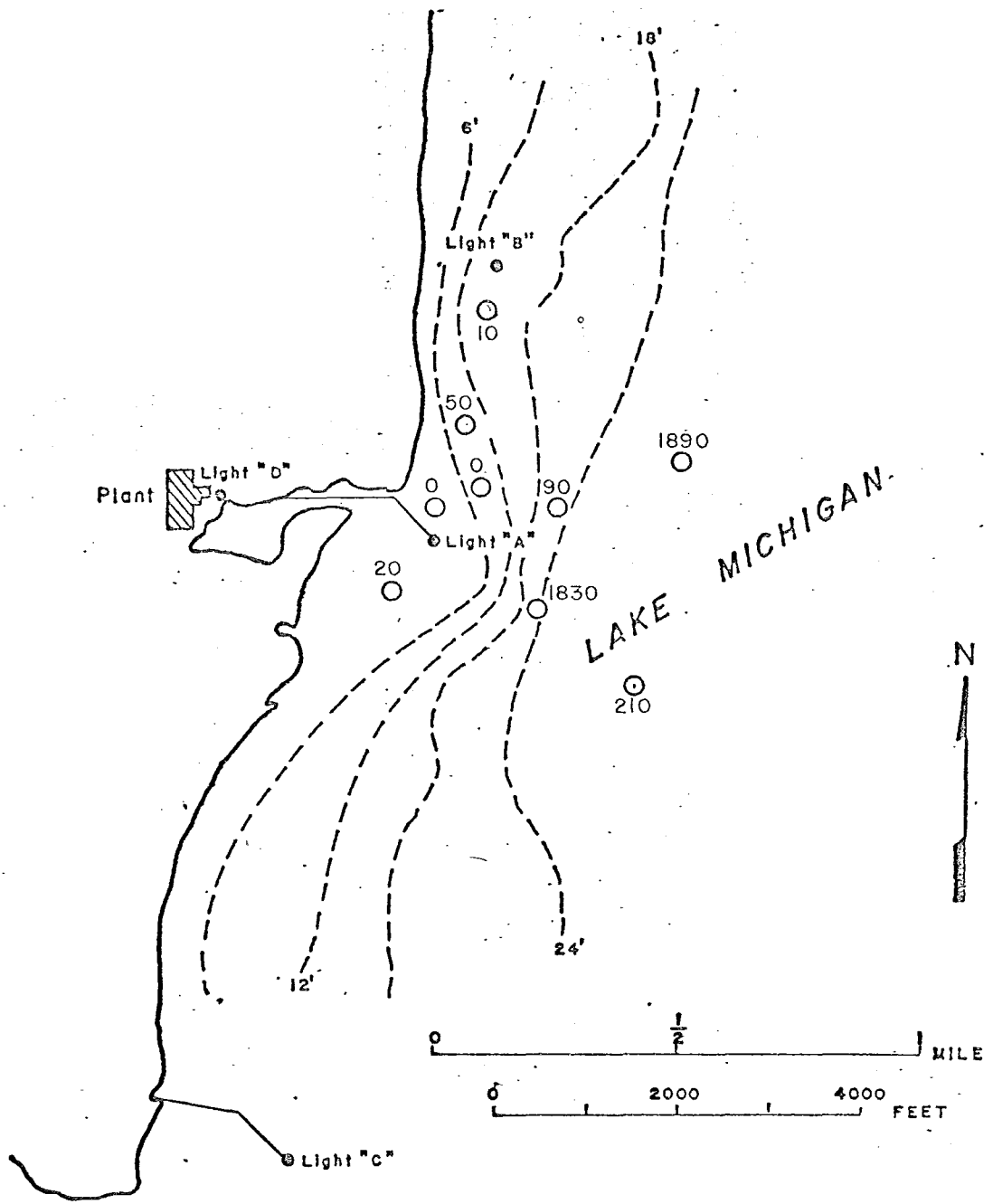
TABLE 3
FIELD OBSERVATIONS

| <u>Site</u> | <u>Station</u> | <u>Depth</u> | <u>Bottom</u> | <u>Bottom Temperature</u> | <u>pH</u> | <u>Odor</u> | |
|-------------|----------------|--------------|----------------------------|---------------------------|-----------|-------------|--|
| Waukegan | 6 | 8' | | 11.5°C | 7.4 | Normal | |
| | 9 | 15' | Sand | 9.7°C | 7.6 | Normal | |
| | 10 | 24' | Sand | 9.6°C | 7.4 | Normal | |
| | 12 | 23' | Fine Sand | 9.9°C | 7.3 | Normal | |
| | 13 | 27' | Fine Sand | 9.9°C | 7.3 | Normal | |
| | 46 | 5' | Fine Sand | 9.0°C | 7.6 | Normal | |
| | 47 | 11' | Fine Sand, Large Sample | 9.5°C | 7.2 | Normal | |
| | 48 | 8.5' | Sand | 10.3°C | 7.3 | Normal | |
| | 50 | 8' | Fine Sand, Gravel | 9.5°C | 7.6 | Normal | |
| | | | | Av. = 9.9°C | | | |
| Zion | 3 | 18' | Fine Sand | 8.5°C | 7.5 | Normal | |
| | 4 | 23.5' | Fine Sand | 8.1°C | 7.5 | Normal | |
| | 5 | 30.5' | | 8.5°C | 7.5 | | |
| | 6 | 14.5' | Fine Sand | 8.0°C | 7.6 | Normal | |
| | 7 | 24.5' | Med. Sand | 8.0°C | 7.4 | Normal | |
| | 8 | 10' | Fine Sand | 9.0°C | 7.6 | Normal | |
| | 9 | 20' | Fine Sand | 8.5°C | 7.5 | Normal | |
| | 10 | 25' | | 8 °C | 7.5 | Normal | |
| | 11 | 10' | Fine Sand | 9 °C | 7.6 | Normal | |
| | | | | Av. = 8.4°C | | | |

Temperature

Surface and depth temperatures were taken at Waukegan on October 9, 1969 with a Yellow Springs Instrument Company Model 43TD Tele-thermometer, Serial No. 6026. Calibration was performed in the laboratory and found to be accurate to within $\pm 0.3^{\circ}\text{C}$. A weighted probe was used to obtain temperature profiles. Another probe was hand held at the stern of the boat to obtain surface temperatures while underway. At the time of sampling, air temperature was 13 degrees centigrade, winds were SSE and about 20 knots, waves were about 3 feet.

Gale warnings prevented the crew from performing most of the intended temperature measurements. Several depth profiles and surface runs were obtained, however, on a line between lights A&B (Figure 2). A diagram of an admittedly "rough" temperature profile is given in Figure 5 for the cross-section between lights A&B.



WAUKEGAN POWER PLANT
 Numbers Of Pollution Sensitive Organisms
 Lake Michigan Basin Office
 Oct. 9, 1969

FIG. 6

Winthrop Harbor
Water Tower

ZION NUCLEAR POWER PLANT

Numbers Of Pollution Sensitive Organisms
Lake Michigan Basin Office
Oct. 8, 1969

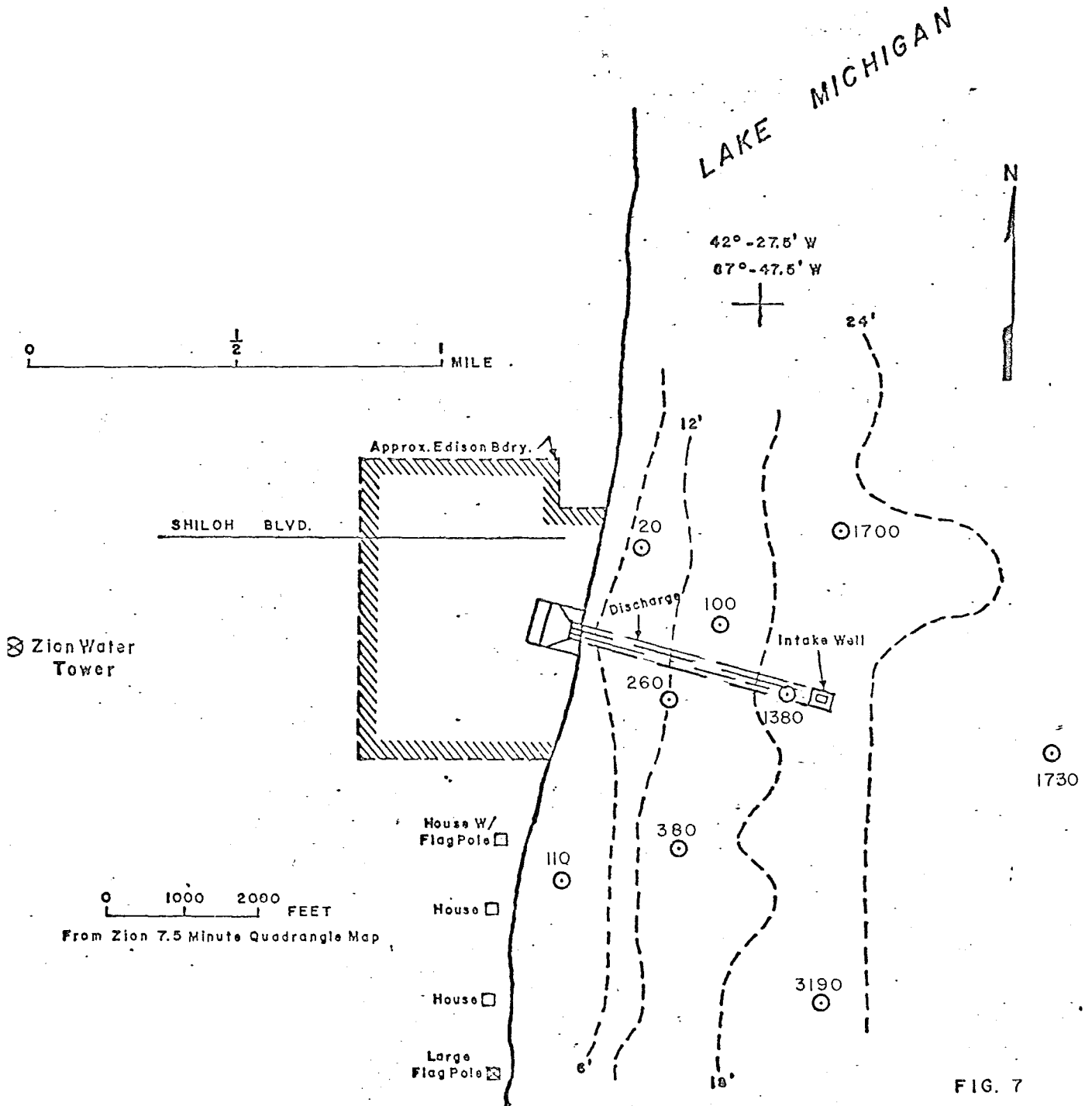


FIG. 7

Dissolved Oxygen

Dissolved oxygen levels were determined for bottom waters at each one of the Waukegan and Zion stations. Values were uniformly high and showed no effects of the thermal discharge.

The data are as follows:

| <u>Zion Station</u> | <u>DO in mg/l</u> | <u>%Sat.</u> | <u>Waukegan Station</u> | <u>DO in mg/l</u> | <u>%Sat.</u> |
|---------------------|-------------------|--------------|-------------------------|-------------------|--------------|
| 3 | 9.6 | 81.2 | 6 | 9.8 | 88.9 |
| 4 | 9.8 | 82.1 | 9 | 9.9 | 86.1 |
| 5 | 9.75 | 82.4 | 10 | 9.7 | 84.2 |
| 6 | 9.8 | 81.9 | 12 | 9.7 | 84.8 |
| 7 | 9.6 | 80.2 | 13 | 9.7 | 84.8 |
| 8 | 9.8 | 83.9 | 46 | 10.15 | 86.8 |
| 9 | 9.7 | 82.0 | 47 | 9.85 | 85.3 |
| 10 | 10.3 | 86. | 48 | 9.6 | 84.7 |
| 11 | 9.9 | 84.7 | 50 | 9.3 | 80.5 |

Radioactivity

Gross Alpha and Beta activity were determined at the Lake Michigan Basin Office from nine surface water samples obtained at Zion. All samples were filtered through a 1.2 micro-membrane filter. Data is recorded in Table 4.

The highest levels of Alpha and Beta for both suspended and dissolved solids were obtained at station 3. None of the values are considered significant.

Radiological analyses were performed at the National Field Investigations Center, Cincinnati, on additional water and sediment samples obtained at Zion. The sediments analyzed were one quart aliquots taken from the surface of a Pettersson dredge sample. The water samples were taken at the surface in one gallon quantities. Results of these analyses are included in an appendix.

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Radiochemistry Unit

Ref: Figure 1
 Date: 10-26-69
 Page 1 of 3 Pages

Table
 RADIOCHEMICAL DETERMINATIONS
 Sample Source: Lake Michigan, Zion, Illinois
 Study Period: 10-8-69

| LMRO # | Station | Station Depth, m | Sample Depth, m | Collection | | Analysis | | Sample Type | Parameter Measured | Error | | Units |
|--------|---------|---------------------|--------------------|------------|------|----------|------|----------------|-----------------------|----------|-------------------|-------|
| | | | | Date | Time | Date | Time | | | Activity | ± E ₉₅ | |
| 5139 | 3 | 0 | 0 | 10-8-69 | 1410 | 10-20-69 | 1355 | S.S. | | .7 | .4 | PCi/l |
| | | | | | | | | S.S. | | 1.8 | 1.2 | |
| | | | | | | | | D.C. | | 2.0 | 1.1 | |
| | | | | | | | | D.S. | | 5.7 | 1.9 | |
| 5140 | 4 | | | | 1430 | | | S.S. | | .6 | .4 | |
| | | | | | | | | S.S. | | .8 | 1.1 | |
| | | | | | | | | D.S. | | 1.5 | .8 | |
| | | | | | | | | D.S. | | 4.4 | 1.7 | |
| 5141 | 5 | | | | 1500 | | | S.S. | | .5 | .3 | |
| | | | | | | | | S.S. | | .8 | 1.1 | |
| | | | | | | | | D.S. | | 1.7 | 1.0 | |
| | | | | | | | | D.S. | | 3.8 | 1.8 | |

Methods Reference: GLR Radiochemistry Manual

Sampling Method: Sampler

Calibration Standard: 90Sr

Instrument Used: LB - II

LMBO Form 8/4/69

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Radiochemistry Unit

Ref: Figure 1
 Date: 10-26-69
 Page 2 of 3 Pages

Table
 RADIOCHEMICAL DETERMINATIONS
 Sample Source: Lake Michigan, Zion, Illinois
 Study Period: 10-8-69

| LMBO # | Station | Station Depth, m | Sample Depth, m | Collection | | Analysis | | Sample Type | Parameter Measured | Error | | Units |
|--------|---------|---------------------|--------------------|------------|------|----------|------|----------------|-----------------------|----------|--------------|-------|
| | | | | Date | Time | Date | Time | | | Activity | $\pm E_{95}$ | |
| 5142 | 6 | 0 | 0 | 10-8-69 | 1330 | 10-20-69 | | S.S. | | .4 | .3 | PCi/l |
| | | | | | | | | | | .9 | 1.1 | |
| | | | | | | | | | | .9 | .7 | |
| | | | | | | | | | | 1.8 | 1.6 | |
| 5143 | 7 | | | | | | | S.S. | | .3 | .3 | |
| | | | | | | | | | | .8 | 1.1 | |
| | | | | | | | | | | .8 | .7 | |
| | | | | | | | | | | 4.4 | 1.8 | |
| 5144 | 8 | | | | | | | S.S. | | .2 | .2 | |
| | | | | | | | | | | .5 | 1.1 | |
| | | | | | | | | | | 1.0 | .7 | |
| | | | | | | | | | | 2.9 | 1.6 | |

Methods Reference: GLR Radiochemistry Manual

Sampling Method: Sampler

Calibration Standard: 90Sr

Instrument Used: LB - II

LMBO Form 8/4/69

Lake Michigan Basin Office, FWPCA
 1819 W. Pershing Road
 Chicago, Illinois 60609
 Radiochemistry Unit

Ref: Figure 1
 Date: 10-26-69
 Page 3 of 3 Pages

Table
 RADIOCHEMICAL DETERMINATIONS
 Sample Source: Lake Michigan, Zion, Illinois
 Study Period: 10-8-69

| LMRO # | Station | Station Depth, m | Sample Depth, m | Collection | | Analysis | | Sample Type | Parameter Measured | Error | | Units |
|--------|---------|---------------------|--------------------|------------|------|----------|------|----------------|-----------------------|----------|--------------|-------|
| | | | | Date | Time | Date | Time | | | Activity | $\pm F_{95}$ | |
| 5145 | 9 | 0 | 0 | 10-8-69 | 1545 | 10-20-69 | | S.S. | | .3 | .3 | PCi/l |
| | | | | | | | | S.S. | | .8 | 1.1 | |
| | | | | | | | | D.S. | | .6 | .6 | |
| | | | | | | | | D.S. | | 4.9 | 1.8 | |
| 5146 | 10 | | | | 1325 | | | S.S. | | .3 | .2 | |
| | | | | | | | | S.S. | | 0 | 1.0 | |
| | | | | | | | | D.S. | | .7 | .6 | |
| | | | | | | | | D.S. | | 4.5 | 1.8 | |
| 5147 | 11 | | | | 1715 | | | S.S. | | 0 | 0 | |
| | | | | | | | | S.S. | | .8 | 1.1 | |
| | | | | | | | | D.S. | | .5 | .5 | |
| | | | | | | | | D.S. | | 3.3 | 1.7 | |

Methods Reference: GLR Radiochemistry Manual

Sampling Method: Sampler

Calibration Standard: 90Sr

Instrument Used: LB - II

LMBO Form 8/4/69

Appendix

Radioactivity Analyses by

National Field Investigations Center
Cincinnati, Ohio

UNITED STATES GOVERNMENT

U. S. Department of the Interior
Federal Water Pollution Control Administration
5555 Ridge Avenue, Cincinnati, Ohio 45213

Memorandum

TO : Jacob D. Dumelle
Director, Lake Michigan Basin Office
Great Lakes Region, FWPCA, Chicago, IL

FROM : R. J. Velten, Chemist
Nat'l. Field Investigations Center, FWPCA

DATE: January 26, 1970

SUBJECT: Radioactivity Data for Samples in the Vicinity of Zion, Illinois

Dr. Lammering has requested that I forward the data on the radioactivity background levels for samples submitted by your office. These samples are water and sediment samples collected from each station in the vicinity of Zion, Illinois.

The data are as follows:

| Sample Number | Laboratory Number | Water pCi/l | | | | | Sediment pCi/g | |
|---------------|-------------------|-------------|--------|---------------|-----|-----------------------|----------------|-------------------|
| | | Sr-90 | Cs-137 | H-3 | U* | Total α Radium | U* | Total α Ra |
| 69-3 | 5139 | 0.5 | < 0.1 | < 350 | 0.2 | < 0.3 | 0.2 | 1.3 \pm 0.3 |
| -4 | 5140 | 1.0 | < 0.1 | < 350 | 0.2 | < 0.3 | 0.3 | 0.7 \pm 0.2 |
| -5 | 5141 | 0.7 | < 0.2 | 480 \pm 150 | 0.3 | < 0.3 | 0.2 | 1.9 \pm 0.4 |
| -6 | 5142 | 0.9 | 0.2 | < 350 | 0.2 | < 0.3 | 0.2 | 1.4 \pm 0.2 |
| -7 | 5143 | 0.7 | < 0.2 | < 350 | 0.2 | < 0.3 | 0.1 | 0.6 \pm 0.2 |
| -8 | 5144 | 0.7 | 0.2 | 783 \pm 154 | 0.2 | < 0.3 | 0.2 | 1.0 \pm 0.1 |
| -9 | 5145 | 0.5 | < 0.2 | 585 \pm 152 | 0.2 | < 0.3 | 0.2 | 2.1 \pm 0.2 |
| -10 | 5146 | 0.9 | < 0.2 | < 350 | 0.1 | < 0.3 | 0.3 | 2.4 \pm 0.2 |
| -11 | 5147 | 0.7 | < 0.2 | < 350 | 0.2 | < 0.3 | 0.3 | 0.7 \pm 0.1 |

* Uranium concentrations are expressed in $\mu\text{g/l}$ for water and $\mu\text{g/g}$ for sediments.

The error terms associated with the tritium and total alpha radium concentrations represent only the counting error at the 1 sigma confidence level.

The concentrations of Sr-90, Cs-137, and H-3 in the water samples are comparable to other analyses from stations collected across the continental United States, and reflect the fallout patterns. Normal Sr-90 concentrations vary from non-detectable to about 2 pc/l in our surface waters. Tritium levels are reported to 2000 pc/l and generally run from 200 to 1500 pc/l, except in waters associated with the nuclear industries releasing tritium in their wastewaters.



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

Cesium-137 levels are generally less than Strontium-90 concentrations since these two radionuclides are produced nearly equally in fissioning and have nearly equal half-lives. However, Cesium-137 can be absorbed by suspended matter, and thus can be removed to some degree from solution.

The uranium and total alpha radium data represent radionuclides naturally present in the environment. The total alpha radium data include Ra-223, Ra-224, and Ra-226 concentrations. If these radium daughters are not supported by their respective parents, the concentrations would reflect only Ra-226 levels because of the short half-lives of Ra-223 and Ra-224 - 11.7 and 3.6 days, respectively.

Further data on the concentration of Sr-90 and Cs-137 in the sediments will follow as soon as necessary laboratory equipment is received.

UNITED STATES GOVERNMENT

U. S. Department of the Interior
Federal Water Quality Administration
5555 Ridge Avenue, Cincinnati, Ohio 45213

Memorandum

Jacob D. Dumelle, Director

TO : Lake Michigan Basin Office, GLR, FWQA, USDI
Chicago, Illinois

DATE: April 21, 1970

Attn: Howard B. Zar, Oceanographer

FROM : Milton W. Lammering, Chief *M/L*
Water Quality Engineering Sec.,
NFIC, FWQA

SUBJECT: Radioactivity Data for Sediment Samples - Vicinity of Zion Nuclear Power Plant

Cesium-137 concentrations in bottom sediment samples collected in the vicinity of the Zion power station are tabulated below. For each sample, the strontium-90 concentration was less than 0.1 pCi per gram dry weight.

| <u>Location</u> | <u>Number</u> | <u>Cesium-137</u> <u>(pCi/g dry weight)</u> |
|-----------------|---------------|--|
| 69-3 | 5139 | < 0.12 |
| 69-4 | 5140 | 0.12 [±] 0.02 |
| 69-5 | 5141 | 0.13 [±] 0.05 |
| 69-6 | 5142 | < 0.15 |
| 69-7 | 5143 | 0.12 [±] 0.03 |
| 69-8 | 5144 | 0.13 [±] 0.04 |
| 69-9 | 5145 | 0.19 [±] 0.05 |
| 69-10 | 5146 | 0.30 [±] 0.05 |
| 69-11 | 5147 | 0.18 [±] 0.03 |

Error term is the counting error at the one sigma level.

These data represent the completion of work on the Lake Michigan samples.

