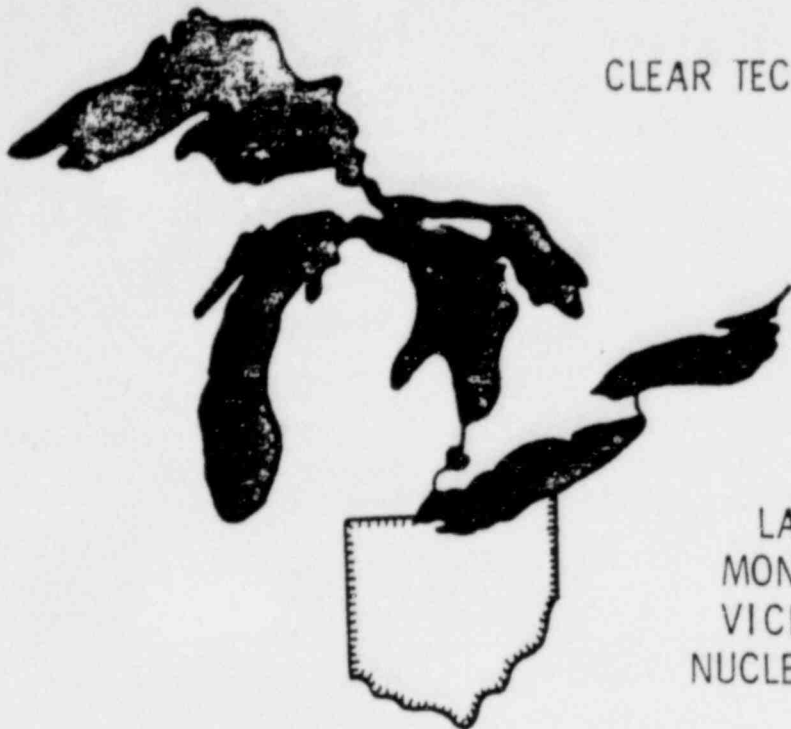


CLEAR TECHNICAL REPORT NO. 102



LAKE ERIE WATER QUALITY
MONITORING PROGRAM IN THE
VICINITY OF THE DAVIS-BESSE
NUCLEAR POWER STATION FOR 1978

Environmental Technical Specifications
Sec. 3.1.1. a.1 Water Quality Analysis

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Prepared for

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3.1.1.a.1 Water Quality Analysis

Procedures

Water quality samples were collected and related sensor measurements were made at six stations (Fig.1) in Lake Erie during the ice-free period of 1978 (May through November). Because of the severe winter of 1977-78, spring sampling was delayed until May. The nineteen parameters measured and the analytical methods employed for these determinations are listed in Table 1.

Field Measurements. Water quality measurements were made monthly in the field at Stations 1, 8, and 13 (Fig. 1). Temperature, dissolved oxygen and conductivity were measured from a small survey boat with submerged sensors and shipboard readout meters. Dissolved oxygen was determined with a YSI model 51 meter and conductivity with a Beckman RB3-3341 solubridge temperature-compensated meter; each meter was equipped with a thermistor for temperature readings. Sensor readings were taken 10 cm below the surface and approximately 50 cm above the bottom. Transparency was determined with a 30 cm diameter Secchi disk lowered on a marked line until it was no longer visible (Welch, 1948, Limnology, McGraw-Hill). Solar radiation was measured at four stations (1, 3, 8, and 13) from June to November with a Protomatic underwater photometer, at the surface and at one-half meter depth intervals. This meter measures the amount of sunlight, expressed in foot-candles, reaching various depths. Malfunctions of this meter were detected in May and July 1978.

Laboratory Determinations. Surface and bottom (50 cm above) water samples were taken at Stations 1, 8, and 13 with a 3-liter Kemmerer sampler at the same time that field measurements were being made. These samples were placed in polyethylene containers and taken to the laboratory for analysis; in most cases, analyses were completed within 24 hours of the sampling time. Fifteen water quality parameters (Table 1) were determined in the Toledo Edison Company chemical laboratory using the procedures prescribed in Standard Methods for the Examination of Water and Wastewater, 14th Edition (American Public Health Association, 1975); "ASTM Standards, Part 23, Water" (American Society for Testing and Materials, 1973); and Water Analysis Procedures (U.S. Environmental Protection Agency, 1974).

Results

The results of the monthly 1978 water quality determinations at Stations 1, 8, and 13 are presented in Tables 2-8. The results of solar radiation measurements at Stations 1, 3, 8, and 13 are given in Table 9. Mean annual values and ranges for the monthly water quality determinations (May through November) are listed in Table 10 and a summary of solar radiation means and ranges are presented in Table 11. The monitoring stations

were selected to characterize Lake Erie water quality at several areas within the vicinity of the Davis-Besse Nuclear Power Station. Station 1 is only 500 feet offshore and is positioned to monitor nearshore water masses. Station 3 is located 2000 feet offshore and is used as a control station for the power station discharge which is located 3000 feet to the southeast. Station 8 is 3000 feet offshore and Station 13 is 1500 feet offshore; these stations are located in the vicinity of the power station water intake and discharge, respectively. All of these stations lie within Exceeded Area "B" for Lake Erie water quality standards, established by the Ohio Environmental Protection Agency in 1978. Results of the 1978 monitoring program indicated that none of the parameters examined exceeded the Ohio EPA standards.

Analysis

Seasonal Variations. The quality of the water in the vicinity of the Davis-Besse Nuclear Power Station during the period May through July 1978 was typical for the south shore of western Lake Erie and showed normal seasonal trends. Average temperature rose nearly 15°C from early May to late June, then varied only 3°C until mid-September, and finally dropping over 10°C by mid-October (Fig. 2). Average dissolved oxygen concentrations fell from over 12 ppm in May to a low of 7.4 ppm in late June, then rose again to over 12 ppm in early November (Fig. 2). Hydrogen-ion concentrations remained fairly stable throughout the year with the average pH varying only 0.6 units. A slight rise in pH was noted during June and the late summer months corresponding to higher levels of primary production by phytoplankton species (Fig. 2).

Mild turbulence in late spring and early fall is reflected by the higher turbidity and suspended solids measurements for these periods (Fig. 3). The decreased sediment load during the summer months accounts for the higher transparency readings in June and July (Fig. 3). A 3-fold improvement in the water clarity was noted between May and August and a corresponding 2-fold decrease in clarity was observed from August to November. Biochemical oxygen demand levels were relatively low during the year, even during periods of high turbidity, indicating that the suspended material was largely of an inorganic nature. Slightly elevated BOD values in October correspond with the fall plankton pulse. Major dissolved ions, including calcium, chloride and sulfate, yielded the highest concentrations in the spring with a gradual decrease through the summer and early fall (Fig. 4). Sulfate showed a significant increase in November but the other major ions remained fairly stable. In a like manner, biological nutrients, such as phosphorus, nitrate and silica, has the highest concentrations in the spring, but they decreased markedly through the summer and early fall. This decrease is attributed to the utilization of these nutrients by photosynthesizing plankton. In November, when primary production was at a lower rate, nitrate concentration rose to much higher levels (Fig. 5). Alkalinity, largely due to bicarbonate ions, total dissolved solids and conductivity, all of which are measures of dissolved materials in the water were relatively stable through the year, showing slightly higher values in the spring and slightly lower in the fall (Fig. 6).

In June 1978, the dissolved oxygen concentration dropped to 5.7 ppm (Station 13), the lowest value recorded during the 1978 monitoring program. This represents improvement over the lowest concentration observed in 1977 and is consistent with concentration measured earlier in the program:

<u>Year</u>	<u>DO Range</u>
1974	5.7-14.1 ppm
1975	7.2-13.6
1976	5.0-12.5
1977	3.0-12.2
1978	5.7-12.5

The International Joint Commission recommends a minimum DO level of 6.0 ppm for Lake Erie water (U.S.-Canada Water Quality Agreement of 1978). However, Ohio EPA (1978) has established a minimum DO standard of 4.0 ppm for the nearshore waters of Lake Erie within the vicinity of the Davis-Besse Nuclear Power Station.

Station Variations. Stations, 1, 8, and 13 are located approximately 500, 3,000, and 1,500 feet offshore, respectively. In general, no consistent significant difference in water quality was noted between stations. A slight depression in the dissolved oxygen concentration was noted at Station 13 for June in comparison to the other stations. Conductivity values were also slightly higher at this station for a few months. This may be related to the proximity of the power station discharge. However, no elevation in water temperature was noted at Station 13 in relation to the other stations. Solar radiation, suspended solids and turbidity measurements indicated a general increase in water clarity from the most in-shore station (1) to the most offshore station (8), but differences are normally small.

Differences between the surface and bottom water quality were also slight because of the shallowness of this portion of Lake Erie (2.0-4.5 meters). Some depression in the level of DO and small increases in the concentrations of suspended and dissolved materials were noted near the bottom. This may be due to the high oxygen demands of the sediments and the disturbance of these sediments by currents and wave action.

Water Quality Trends. The Ohio State University, Center for Lake Erie Area Research initiated water quality studies at Locust Point in July 1972. Over the past six years most parameters have shown typical seasonal trends with only small variations from year to year. Trends for eight water quality parameters from July 1972 through November 1978 are shown on Figures 7, 8, and 9. Temperature and dissolved oxygen show normal seasonal trends for each year with only minor variations from one year to the next or over the entire period. DO appears to have undergone more depletion in 1976 and 1977 than in previous years or in 1978. Hydrogen-ion concentration (pH) and alkalinity remained fairly stable over the period. Transparency, turbidity, phosphorus and conductivity have shown some radical variations which are probably due to storms and dredging activities that have disturbed the bottom sediments. Phosphorus levels were low in 1977 and 1978, compared to earlier years. In general however, no significant deviations from the normal quality of the water in this part of western Lake Erie have been observed during the past seven years.

T A B L E S

TABLE 1

ANALYTICAL METHODS FOR WATER QUALITY DETERMINATIONS

<u>Parameter</u>	<u>Units</u>	<u>References for Analytical Methods</u>
1. Temperature	°C	APHA (1975): Sec. 212
2. Dissolved Oxygen	ppm	APHA (1975): Sec. 422B
3. Conductivity	µmhos/cm (25°C)	ASTM (1975): D1125-64
4. Transparency	meters	Welch (1948): Secchi disk
5. Calcium (Ca)	mg/l	APHA (1975): Sec. 306C
6. Magnesium (Mg)	mg/l	APHA (1975): Sec. 313C
7. Sodium (Na)	mg/l	ASTM (1973): D1428-64
8. Chloride (Cl)	mg/l	APHA (1975): Sec. 408B
9. Nitrate (NO ₃)	mg/l	ASTM (1973): D992-71
10. Sulfate (SO ₄)	mg/l	ASTM (1973): D516-68C
11. Phosphorus (Total as P)	mg/l	APHA (1975): Sec. 425F
12. Silica (SiO ₂)	mg/l	ASTM (1973): D859-68B
13. Alkalinity (Total as CaCO ₃)	mg/l	APHA (1975): Sec. 403
14. Biochemical oxygen demand	mg/l	APHA (1975): Sec. 507
15. Suspended solids	mg/l	APHA (1975): Sec. 208D
16. Dissolved solids	mg/l	USEPA (1974)
17. Turbidity	F.T.U.	APHA (1975): Sec. 214A
18. Hydrogen-ion conc.	pH units	ASTM (1973): D1293-65
<u>Field Procedure</u>		
19. Solar radiation	foot - candles	Protomatic underwater photometer (Rich, P.R. and R.G. Wetzel, 1969. A simple, sensitive underwater photometer. Limnology & Oceanography 14: 611-613)

TABLE 2

LAKE ERIE WATER QUALITY ANALYSES FOR MAY 1978

Dates:

Field 11 May 1978Laboratory 12 May 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature ($^{\circ}\text{C}$)	10.0	10.0	10.8	10.3	11.0	10.4	10.0-11.0	10.4	0.5
Dissolved Oxygen (ppm)	12.0	12.0	12.4	12.4	12.0	12.0	12.0-12.4	12.1	0.2
Conductivity (umhos/cm)	270	280	300	300	310	310	270 - 310	295	16.4
Transparency (m)	0.20		0.20		0.20		-	0.20	0
Depth (m)		2.0		4.0		3.0	2.0-4.0	3.0	1.0
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	37.2	36.4	38.4	38.4	41.2	36.0	36.0-41.2	37.9	1.9
Magnesium (mg/l)	8.4	9.6	8.6	8.6	8.4	8.6	8.4-9.6	8.7	0.5
Sodium (mg/l)	9.0	7.6	7.6	8.5	8.0	8.0	8.0-9.0	8.1	0.6
Chloride (mg/l)	19.0	18.5	20.5	21.0	21.0	21.0	18.5-21.0	20.6	1.1
Nitrate (mg/l)	12.0	12.8	12.0	14.2	14.2	12.0	12.0-14.2	12.9	1.1
Sulfate (mg/l)	26.0	26.0	26.0	26.0	26.0	26.0	-	26.0	0
Phosphorus (mg/l)	0.01	0.01	0.01	0.01	0.01	0.01	-	0.01	0
Silica (mg/l)	0.99	0.91	1.36	1.36	1.36	1.41	0.91-1.41	1.23	0.22
Total Alkalinity (mg/l)	89	89	90	89	91	91	89-91	89.8	0.98
B.O.D. (mg/l)	2	3	3	2	2	2	2-3	2.3	0.5
Suspended Solids (mg/l)	56	58	45	50	56	49	45-58	52	5
Dissolved Solids (mg/l)	176	194	190	186	196	192	176-196	189	7
Turbidity (F.T.U.)	48	50	47	46	53	52	46-53	49	3
pH	8.5	8.5	8.1	8.0	8.3	8.3	8.0-8.5	8.3	0.2
Conductivity (umhos/cm)	315	315	312	320	325	320	312-325	318	4.7

TABLE 3

LAKE ERIE WATER QUALITY ANALYSES FOR JUNE 1978

Dates:

Field 29 June 1978Laboratory 3 July 197

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature (°C)	25.4	25.0	25.0	24.2	26.0	24.7	24.2-26.0	25.1	0.6
Dissolved Oxygen (ppm)	8.2	7.8	9.0	7.2	6.4	5.7	5.7-9.0	7.4	1.2
Conductivity (umhos/cm)	310	312	300	300	315	312	300 -315	308	7
Transparency (m)	0.30		0.35		0.30		0.30-0.35	0.32	0.03
Depth (m)		2.0		4.0		3.0	2.0-4.0	3.0	1.0
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	38.4	38.4	36.8	36.8	37.6	36.8	36.8-38.4	37.5	0.8
Magnesium (mg/l)	9.1	9.1	9.1	9.6	9.8	10.1	9.1-10.1	9.5	0.4
Sodium (mg/l)	9.5	9.2	8.9	9.2	9.2	9.2	8.9-9.5	9.2	0.2
Chloride (mg/l)	20.5	20.5	21.0	20.5	21.0	20.5	20.5-21.0	20.7	0.3
Nitrate (mg/l)	9.8	9.4	7.6	8.7	10.6	11.5	7.6-11.5	9.6	1.4
Sulfate (mg/l)	35.0	35.0	32.5	33.5	32.5	32.5	32.5-35.0	33.5	1.2
Phosphorus (mg/l)	0.04	0.04	0.02	0.04	0.04	0.04	0.02-0.04	0.04	0.01
Silica (mg/l)	0.51	0.55	0.59	0.55	0.66	0.62	0.51-0.66	0.58	0.05
Total Alkalinity (mg/l)	90	89	90	89	90	90	89-90	89.7	0.5
B.O.D. (mg/l)	4	3	3	3	4	3	3-4	3.3	0.5
Suspended Solids (mg/l)	38	53	30	63	44	44	38-63	45	12
Dissolved Solids (mg/l)	186	190	178	180	190	194	178-194	186	6
Turbidity (F.T.U.)	48	56	39	57	51	54	39-57	51	7
pH	8.6	8.6	8.5	8.6	8.6	8.6	8.5-8.6	8.58	0.04
Conductivity (umhc./cm)	296	295	293	295	303	303	293-303	298	4

TABLE 4

LAKE ERIE WATER QUALITY ANALYSES FOR JULY 1978

Dates:

Field 25 July 1978Laboratory 27 July 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature ($^{\circ}\text{C}$)	24.5	24.5	24.5	24.0	24.2	23.5	23.5-24.5	24.2	0.4
Dissolved Oxygen (ppm)	8.4	8.4	7.3	6.1	8.8	8.3	6.1- 8.8	7.9	1.0
Conductivity (umhos/cm)	350	350	370	380	350	350	350 - 380	358	13
Transparency (m)	0.70		0.75		0.55		0.55-0.75	0.67	0.1
Depth (m)		2.0		4.5		3.0	2.0-4.5	3.2	1.3
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	35.2	35.2	36.8	36.0	37.2	38.8	35.2-38.8	36.5	1.4
Magnesium (mg/l)	10.6	10.6	11.5	11.0	10.6	11.5	10.6-11.5	11.0	0.4
Sodium (mg/l)	10.7	10.7	10.1	10.7	10.7	10.1	10.1-10.7	10.5	0.3
Chloride (mg/l)	22.0	22.0	22.0	23.0	22.0	22.0	22.0-23.0	22.2	0.4
Nitrate (mg/l)	4.8	5.5	4.8	5.1	5.1	4.5	4.5- 5.5	5.0	0.3
Sulfate (mg/l)	20.0	20.0	23.0	23.5	23.5	23.0	20.0-23.5	22.2	1.7
Phosphorus (mg/l)	0.01	0.01	0.02	0.02	0.01	0.02	0.01-0.02	0.02	0.01
Silica (mg/l)	0.51	0.47	0.51	0.44	0.51	0.47	0.44-0.51	0.49	0.03
Total Alkalinity (mg/l)	100	100	100	100	100	100	-	100	0
B.O.D. (mg/l)	2	3	2	3	3	3	2-3	2.7	0.5
Suspended Solids (mg/l)	15	13	13	14	18	18	13-18	15	2
Dissolved Solids (mg/l)	186	178	180	174	166	160	160-186	174	10
Turbidity (F.T.U.)	15	14	14	14	14	15	14-15	14.3	0.5
pH	8.2	8.5	8.4	8.4	8.4	8.1	8.1-8.5	8.3	0.2
Conductivity (umhos/cm)	305	310	305	300	300	300	300-310	303	4

TABLE 5

LAKE ERIE WATER QUALITY ANALYSES FOR AUGUST 1978

Dates:

Field 17 August 1978Laboratory 18 August 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature (°C)	23.0	23.0	23.5	23.0	23.5	23.0	23.0-23.5	23.2	0.3
Dissolved Oxygen (ppm)	8.6	8.4	8.4	8.4	8.5	8.2	8.2-8.6	8.4	0.1
Conductivity (umhos/cm)	265	265	270	265	265	265	265-270	266	2
Transparency (m)	0.75		0.95		0.70		0.70-0.95	0.80	0.1
Depth (m)		2		4.0		3.0	2.0-4.0	3.0	1.0
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	34.4	34.4	36.0	35.6	35.6	35.6	34.4-36.0	35.3	0.7
Magnesium (mg/l)	10.6	10.6	9.6	9.8	9.4	9.6	9.4-10.6	9.9	0.5
Sodium (mg/l)	9.5	9.5	10.1	10.1	10.1	10.1	9.5-10.1	9.9	0.3
Chloride (mg/l)	19.5	20.0	19.5	19.5	19.0	19.0	19.0-20.0	19.4	0.4
Nitrate (mg/l)	2.9	2.3	1.4	1.4	2.0	2.3	1.4-2.9	2.1	0.4
Sulfate (mg/l)	27.5	27.5	26.5	28.0	27.5	27.5	26.5-28.0	27.4	0.5
Phosphorus (mg/l)	0.03	0.003	0.03	0.02	0.01	0.01	0.01-0.03	0.02	0.01
Silica (mg/l)	0.23	0.19	0.16	0.23	0.23	0.19	0.16-0.23	0.20	0.03
Total Alkalinity (mg/l)	96	96	96	96	96	98	96-98	96.3	0.8
B.O.D. (mg/l)	2	2	2	2	2	2	-	2	0
Suspended Solids (mg/l)	10	15	11	11	17	12	10-17	12.7	2.7
Dissolved Solids (mg/l)	168	170	168	174	182	178	168-182	173	6
Turbidity (F.T.U.)	18	22	11	18	17	17	11-22	17	4
pH	8.4	8.4	8.8	8.7	8.7	8.7	8.4-8.8	8.6	0.2
Conductivity (umhos/cm)	295	295	285	295	285	295	285-295	292	5

TABLE 6

LAKE ERIE WATER QUALITY ANALYSES FOR SEPTEMBER 1978

 Dates:
 Field 13 September 1978
 Laboratory 18 Sept. 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature (°C)	22.1	22.1	21.7	21.7	22.5	22.1	21.1-22.5	22.0	0.3
Dissolved Oxygen (ppm)	8.9	8.5	8.9	8.2	9.1	8.7	8.2-9.1	8.7	0.3
Conductivity (umhos/cm)	285	285	285	285	305	300	285 - 305	291	9
Transparency (m)	0.40		0.40		0.40		-	0.40	0
Depth (m)		2.0		4.0		3.0	2.0-4.0	3.0	1.0
<u>Laboratory Determinations.</u>									
Calcium (mg/l)	34.8	34.8	34.0	34.8	34.8	32.0	32.0-348	34.2	1.1
Magnesium (mg/l)	8.4	9.1	7.9	7.0	7.9	9.1	7.0-9.1	8.2	0.8
Sodium (mg/l)	9.5	9.5	10.5	10.5	9.5	10.5	9.5-10.5	10.0	0.6
Chloride (mg/l)	17.5	18.0	17.5	17.5	17.5	19.5	17.5-19.5	17.9	0.8
Nitrate (mg/l)	1.7	1.7	1.7	1.7	1.7	1.7	-	1.7	0
Sulfate (mg/l)	27.0	27.0	24.5	22.0	22.0	22.0	22.0-27.0	24.1	2.5
Phosphorus (mg/l)	0.03	0.08	0.01	0.02	0.04	0.07	0.01-0.08	0.04	0.03
Silica (mg/l)	0.16	0.40	0.10	0.10	0.10	0.23	0.10-0.40	0.18	0.12
Total Alkalinity (mg/l)	98	98	95	95	98	96	95-98	97	1.5
B.O.D. (mg/l)	2	3	1	1	1	2	1-3	1.3	0.5
Suspended Solids (mg/l) *	38	238	24	30	30	104	30-238	77	84
Dissolved Solids (mg/l)	180	198	180	180	192	196	180-198	188	9
Turbidity (F.T.U.)	36	77	17	18	18	47	17-77	36	24
pH	8.7	8.6	8.6	8.6	8.6	8.5	8.5-8.7	8.6	0.06
Conductivity (umhos/cm)	291	294	283	280	296	315	280-296	293	12

* Sampler may have disturbed bottom sediments at Stations 1 and 13.

TABLE 7

LAKE ERIE WATER QUALITY ANALYSES FOR OCTOBER 1978

Dates:

Field 17 Oct. 1978Laboratory 20 Oct. 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature (°C)	12.0	11.0	11.8	11.2	12.5	11.5	11.0-12.5	11.7	0.6
Dissolved Oxygen (ppm)	11.2	11.0	11.3	11.2	11.3	11.2	11.0-11.3	11.2	0.1
Conductivity (umhos/cm)	260	270	270	270	285	275	260-285	272	8
Transparency (m)	0.55		0.55		0.50		0.50-0.55	0.53	0.03
Depth (m)		2.0		2.5		2.4	2.0-2.5	2.3	0.3
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	31.2	32.8	32.8	32.8	32.8	32.8	31.2-32.8	32.5	0.7
Magnesium (mg/l)	8.2	7.2	7.2	7.2	6.7	8.2	6.7-8.2	7.5	0.6
Sodium (mg/l)	8.9	8.9	8.0	8.0	8.4	8.4	8.0-8.9	8.4	0.4
Chloride (mg/l)	16.0	16.0	16.0	16.0	16.5	16.0	16.0-16.5	16.1	0.2
Nitrate (mg/l)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	-	<0.3	0
Sulfate (mg/l)	18.0	18.0	18.0	18.0	19.0	20.0	18.0-20.0	18.5	0.8
Phosphorus (mg/l)	0.01	0.01	0.01	0.01	0.01	0.10	0.01-0.10	0.03	0.04
Silica (mg/l)	0.11	0.09	0.05	0.05	0.09	0.10	0.05-0.11	0.08	0.03
Total Alkalinity (mg/l)	96	95	96	96	97	95	95-97	96	0.8
B.O.D. (mg/l)	4	4	4	4	4	4	-	4	0
Suspended Solids (mg/l)	45	49	26	27	38	30	26-49	36	10
Dissolved Solids (mg/l)	176	156	150	156	158	152	150-176	158	9
Turbidity (F.T.U.)	26	25	12	13	17	21	12-26	19	6
pH	8.0	8.0	8.0	8.0	8.0	8.0	-	8.0	0
Conductivity (umhos/cm)	265	270	265	265	265	265	265-270	266	2

TABLE 8

LAKE ERIE WATER QUALITY ANALYSES FOR NOVEMBER 1978

Dates:

Field 1 Nov. 1978

Laboratory 2 Nov. 1978

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
<u>Field Measurements:</u>									
Temperature (°C)	10.2	10.2	11.1	10.2	10.9	10.1	10.1-11.1	10.5	0.4
Dissolved Oxygen (ppm)	12.1	12.1	12.5	12.1	12.2	11.9	11.9-12.5	12.2	0.2
Conductivity (umhos/cm)	265	260	270	270	270	265	260-270	267	4
Transparency (m)	0.40		0.70		0.50		0.40-0.70	0.50	0.15
Depth (m)		2.0		3.7		2.7	2.0-3.7	2.8	0.9
<u>Laboratory Determinations:</u>									
Calcium (mg/l)	32.0	32.0	33.6	32.8	32.0	32.8	32.0-33.6	32.5	0.7
Magnesium (mg/l)	8.2	8.2	7.7	8.2	8.2	8.2	7.7-8.2	8.1	0.2
Sodium (mg/l)	13.3	14.8	14.8	14.8	14.4	14.8	13.3-14.8	14.5	0.6
Chloride (mg/l)	14.0	14.0	15.0	15.0	15.5	17.3	14.0-17.3	15.1	1.2
Nitrate (mg/l)	6.1	5.8	5.1	5.1	6.1	6.5	5.1-6.5	5.8	0.6
Sulfate (mg/l)	29.0	29.0	29.0	29.0	29.0	29.0	-	29.0	0
Phosphorus (mg/l)	0.01	0.01	0.01	0.01	0.01	0.01	-	0.01	0
Silica (mg/l)	0.06	0.09	0.09	0.07	0.09	0.11	0.6-0.11	0.09	0.02
Total Alkalinity (mg/l)	39	89	89	90	91	92	89-92	90	1
B.O.D (mg/l)	2	3	2	2	2	1	1-3	2	0.6
Suspended Solids (mg/l)	57	58	47	48	60	40	40-57	52	8
Dissolved Solids (mg/l)	152	152	158	158	152	162	152-162	156	4
Turbidity (F.T.U.)	11	28	9	12	8	12	8-28	13	7
pH	8.1	8.3	8.2	8.0	8.0	7.8	7.8-8.3	8.1	0.2
Conductivity (umhos/cm)	260	260	260	270	265	270	260-270	264	5

TABLE 9
SOLAR RADIATION MEASUREMENTS AT LOCUST POINT IN 1978*
(IN FOOT CANDLES)

Station \ Time	Deck	Surface	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
24 June 1978										
1 1200	9000	4500	2000	550	200	50		-	-	-
8 1235	10200	8000	2800	1100	500	300	120	65	-	-
13 1305	10000	6000	2000	400	1200	30	10	3	-	-
18 August 1978										
1 1135	9000	5100	2000	400	-	32	-	-	-	-
3 1300	8500	5000	1900	310	-	43	-	7.2	-	-
8 1230	8000	4600	1600	360	-	49	-	8.2	-	2.5
13 1030	9500	5000	1800	250	-	52	-	4.2	-	-
15 Sept. 1978										
1 1145	10000	5000	1500	350	-	40	-	-	-	-
3 1330	10000	5000	1600	440	-	53	-	-	-	-
8 1030	10000	4200	2600	700	-	140	-	47	-	20
13 1230	8500	4400	800	270	-	21	-	2.9	-	-
17 Oct. 1978										
1 1610	7000	3100	1100	100	-	14	-	-	-	-
3 1530	7500	3500	1300	100	-	12	5.5	-	-	-
8 1633	6500	2600	1200	100	-	19	7.2	-	-	-
13 1645	5700	1600	410	44	-	2	2	-	-	-
1 Nov. 1978										
1 1105	9300	4000	1500	300	-	50	-	-	-	-
8 1200	7300	9000	2000	350	-	55	-	10	-	-
13 1140	6000	5000	1500	300	-	250	-	-	-	-

* Submarine photometer malfunctioned in May and July 1978

TABLE 10
MEAN VALUES AND RANGES FOR WATER QUALITY
PARAMETERS TESTED IN 1978

Parameter	May - November 1978		Units
	Mean	Range	
1. Temperature	18.2	10.0-26.0	°C
2. Dissolved Oxygen	9.7	5.7-12.5	ppm
3. Conductivity (field)	294	260-380	umhos/cm
4. Transparency	0.50	0.30-0.95	m
5. Calcium	35.2	31.2-41.2	mg/l
6. Magnesium	9.0	6.7-11.5	mg/l
7. Sodium	10.1	8.0-14.8	mg/l
8. Chloride	18.9	14.0-23.0	mg/l
9. Nitrate	5.3	1.4-14.2	mg/l
10. Sulfate	25.8	18.0-35.0	mg/l
11. Phosphorus	0.02	0.01-.10	mg/l
12. Silica	0.41	0.05-1.41	mg/l
13. Total Alkalinity	94	89-98	mg/l
14. BOD	2.5	1-4	mg/l
15. Suspended Solids	41	10-238	mg/l
16. Dissolved Solids	175	150-198	mg/l
17. Turbidity	28	8-77	F.T.U.
18. Hydrogen-ions	8.4	7.8-8.8	pH
19. Conductivity (lab)	291	260-325	umhos/cm

TABLE 11
 SUMMARY OF JUNE TO NOVEMBER
 SOLAR RADIATION MEASUREMENTS AT LOCUST POINT
 (IN FOOT CANDLES)

Station	Range	Mean	Standard Deviation
Station 1			
Deck	10000 - 7000	8825	1287
Surface	5100 - 3100	4300	942
0.5	2000 - 110	1278	813
1.0	400 - 200	288	132
1.5	- -	-	-
2.0	50 - 14	34	15
Station 3			
Deck	10000 - 7500	8667	1475
Surface	5000 - 3500	4500	707
0.5	2000 - 130	1408	868
1.0	550 - 100	350	193
1.5	- -	200	0
2.0	53 - 12	40	19
2.5	20 - 5.5	13	10
3.0	- -	7.2	0
Station 8			
Deck	10200 - 6500	8400	1642
Surface	9000 - 2600	5680	2704
0.5	2800 - 120	1824	1065
1.0	1100 - 100	522	387
1.5	- -	500	0
2.0	300 - 19	113	114
2.5	120 - 7.2	64	80
3.0	65 - 8.2	33	28
3.5	- -	0	0
4.0	20 - 2.5	11	12
Station 13			
Deck	10000 - 5700	7940	1986
Surface	6000 - 1600	4400	1667
0.5	2000 - 410	1302	675
1.0	400 - 44	253	130
1.5	- -	1200	0
2.0	250 - 2	71	102
2.5	10 - 2	6	6
3.0	4.2 - 2.9	3	1

F I G U R E S

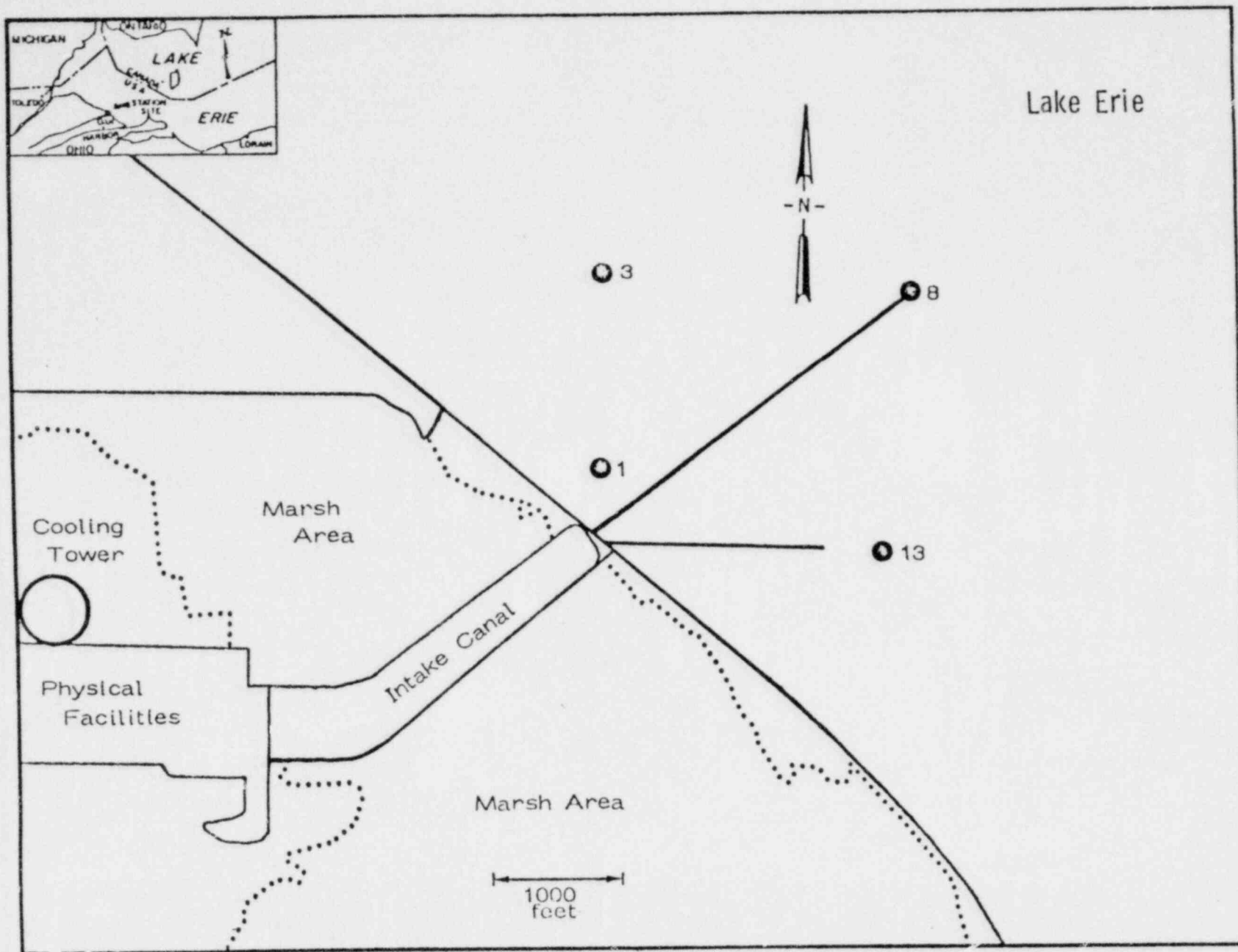


FIGURE 1. SAMPLING STATIONS AT THE DAVIS-BESSE NUCLEAR POWER STATION

FIGURE 2. MEAN MONTHLY HYDROGEN ION, TEMPERATURE AND DISSOLVED OXYGEN MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1978.

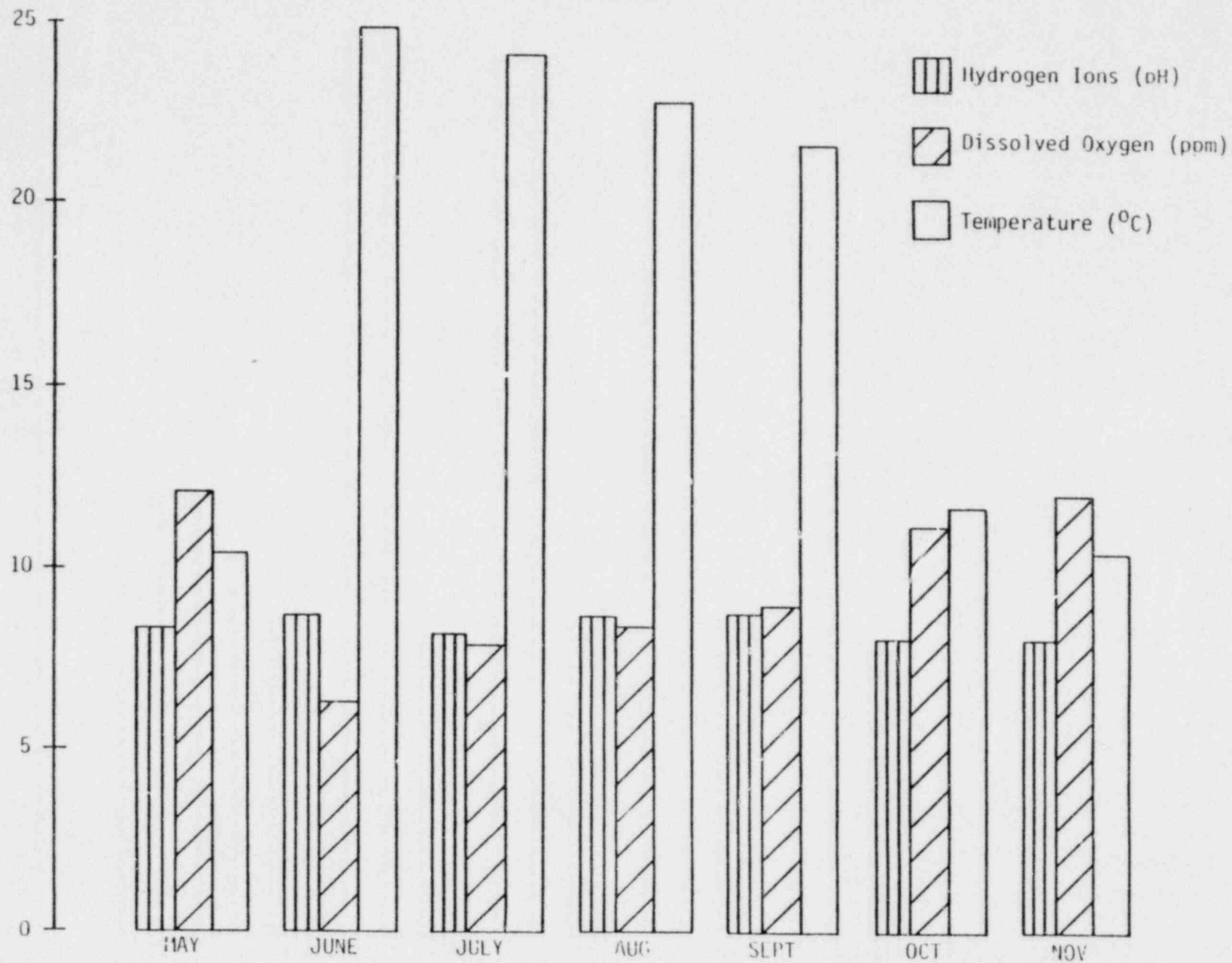


FIGURE 3. MEAN MONTHLY TURBIDITY, SUSPENDED SOLIDS, AND TRANSPARENCY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1978.

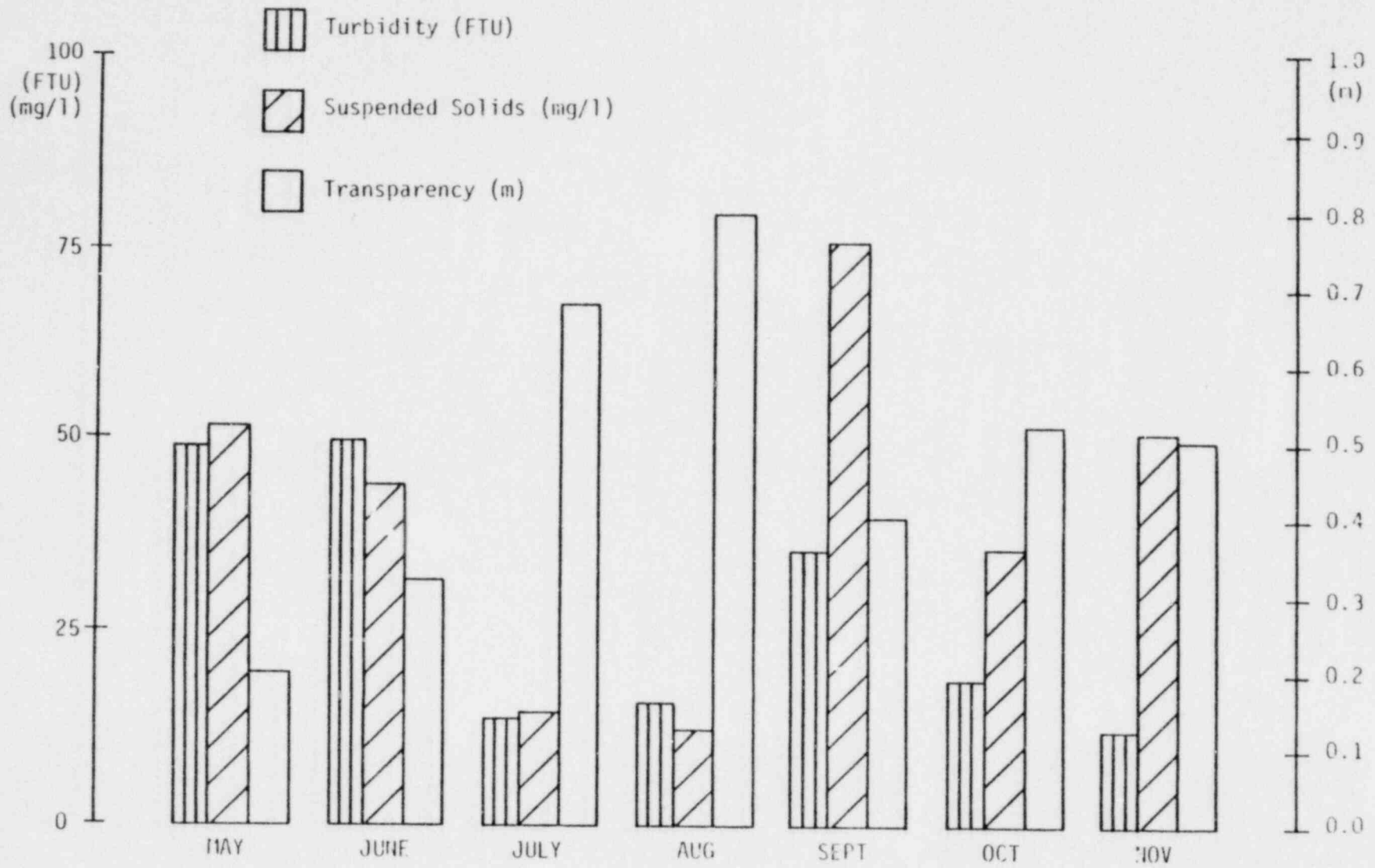


FIGURE 4. MEAN MONTHLY CALCIUM, CHLORIDE AND SULFATE CONCENTRATIONS IN LAKE ERIC AT LOCUST POINT DURING 1973.

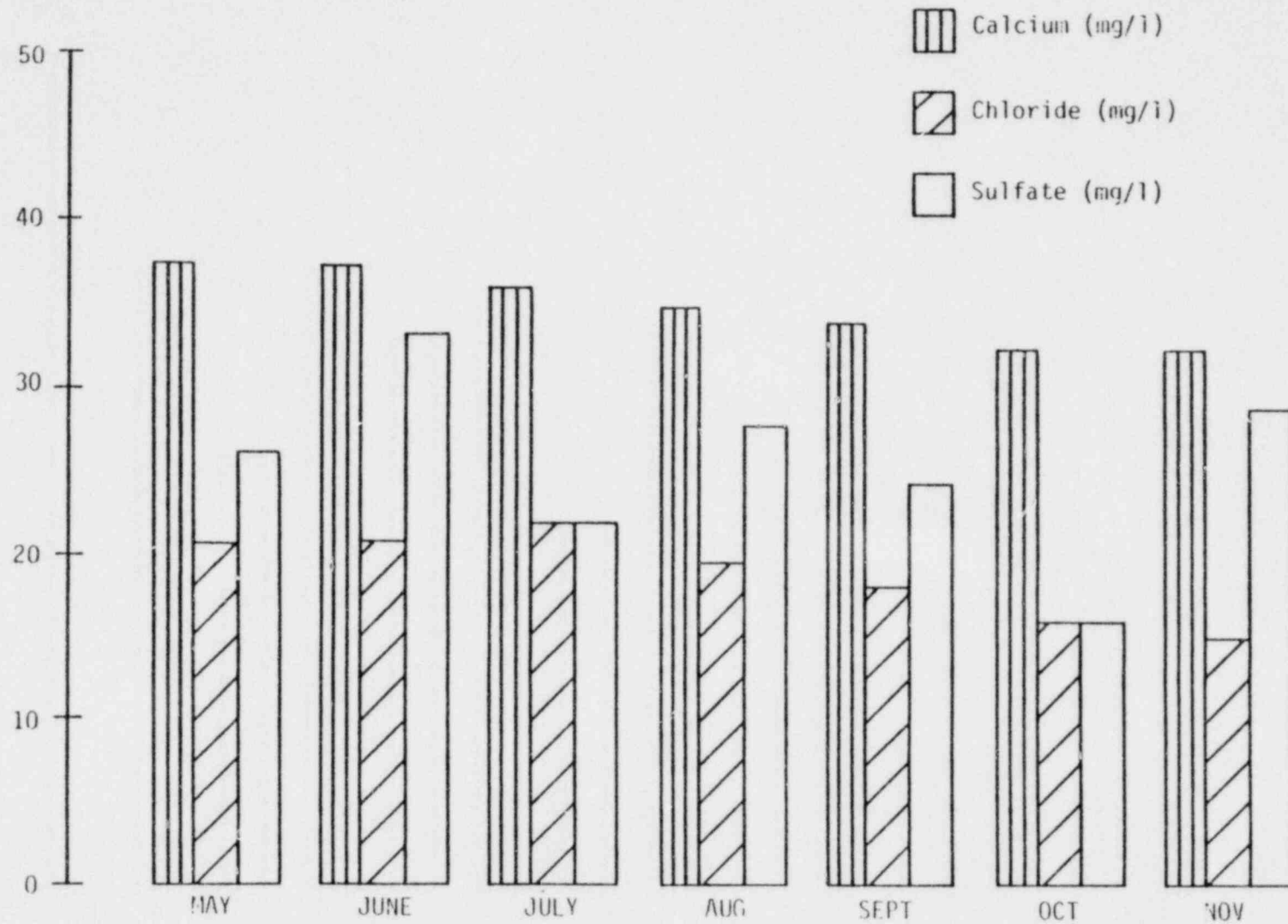


FIGURE 5. MEAN MONTHLY NITRATE, PHOSPHORUS, AND SILICA CONCENTRATIONS IN LAKE ERIE AT LOCUST POINT DURING 1973.

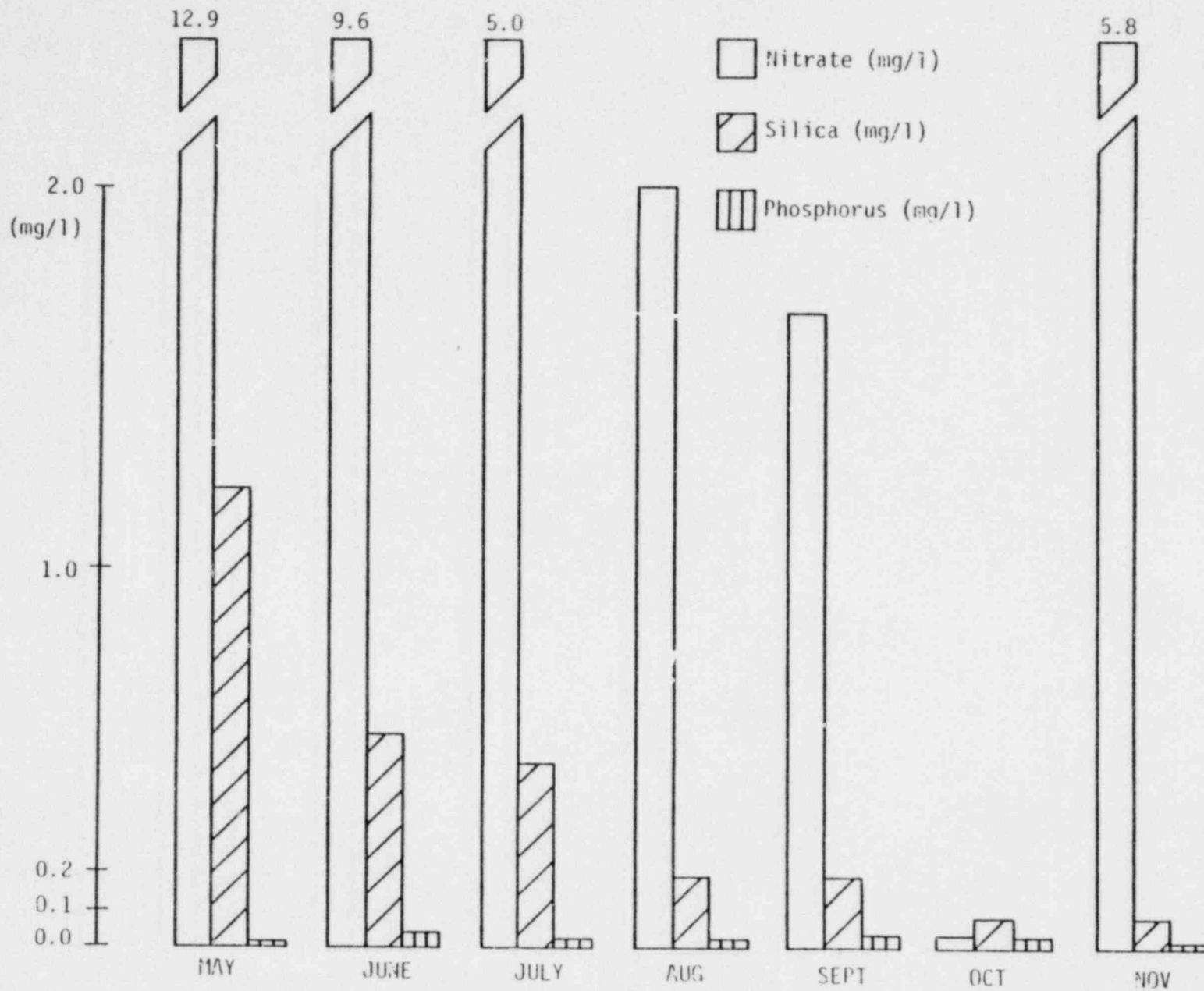


FIGURE 6. MEAN MONTHLY ALKALINITY, DISSOLVED SOLIDS AND CONDUCTIVITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1978.

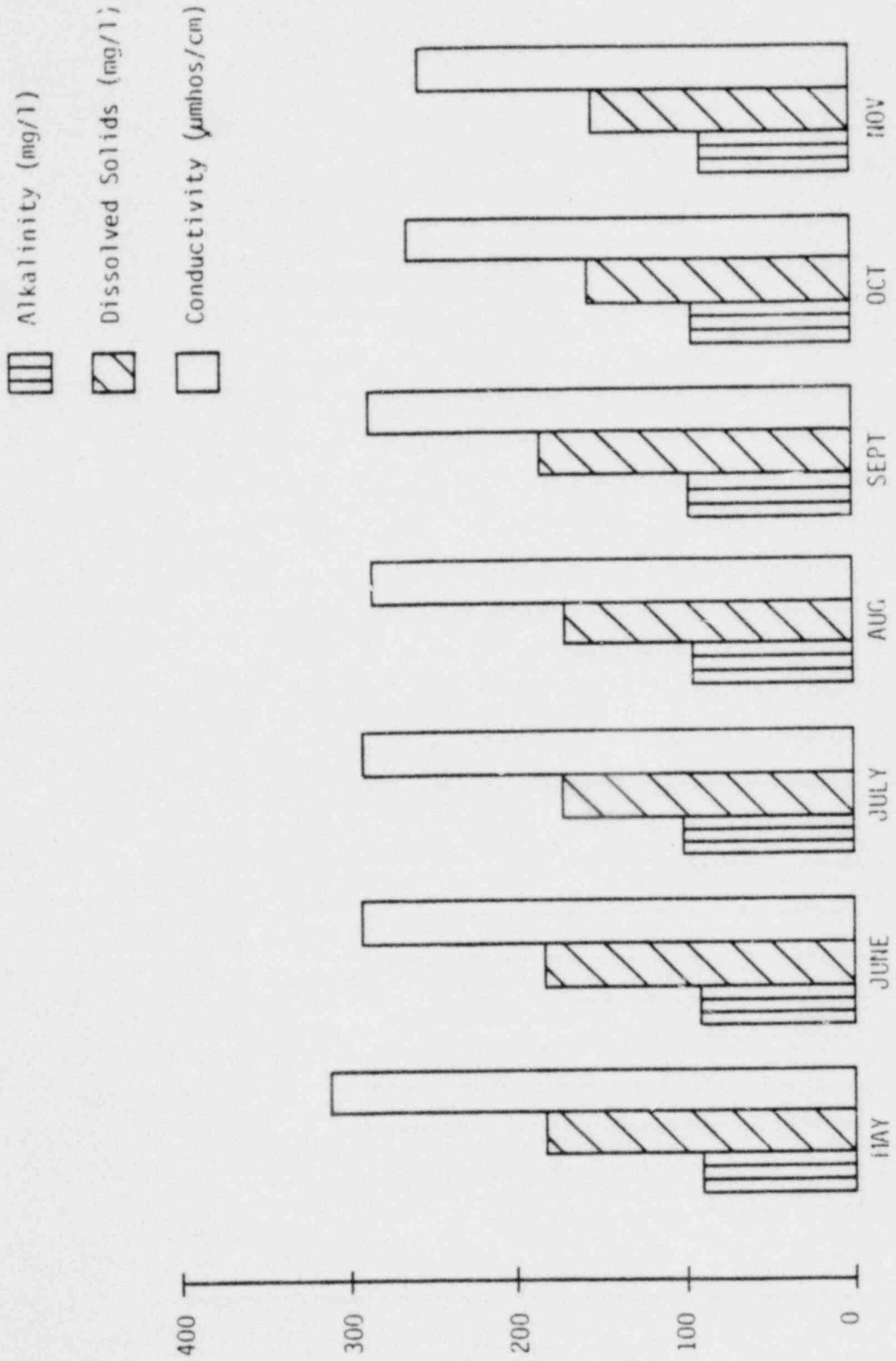


FIGURE 7. TRENDS IN MEAN MONTHLY TEMPERATURE, DISSOLVED OXYGEN, AND HYDROGEN ION MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1978.

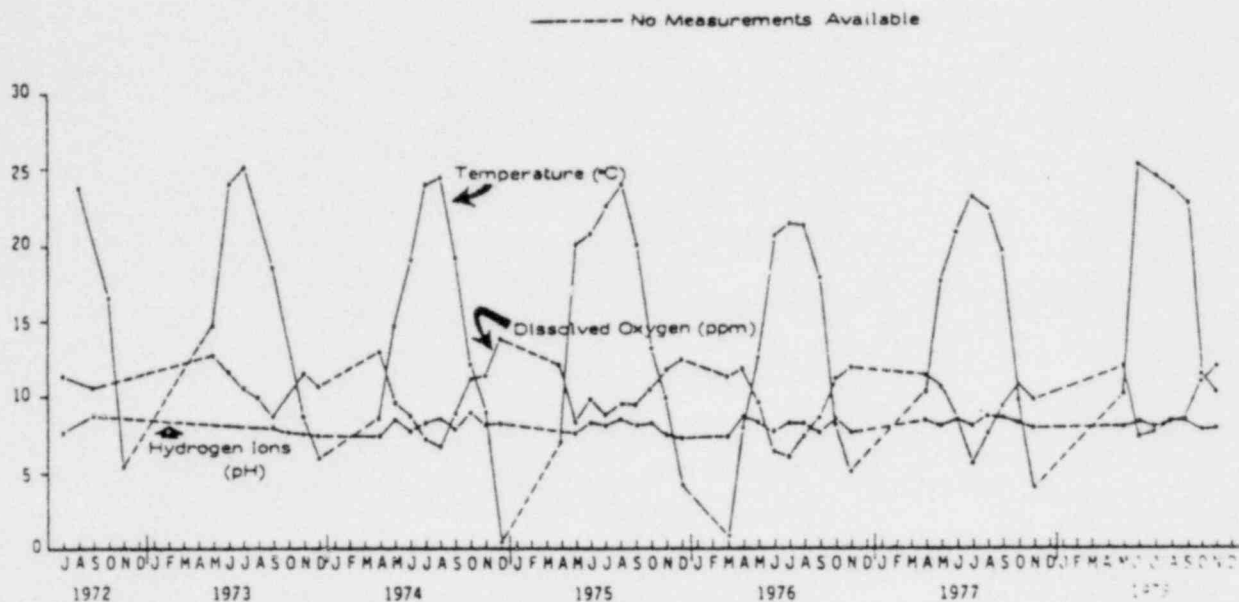


FIGURE 8. TRENDS IN MEAN MONTHLY CONDUCTIVITY, ALKALINITY AND TURBIDITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1978.

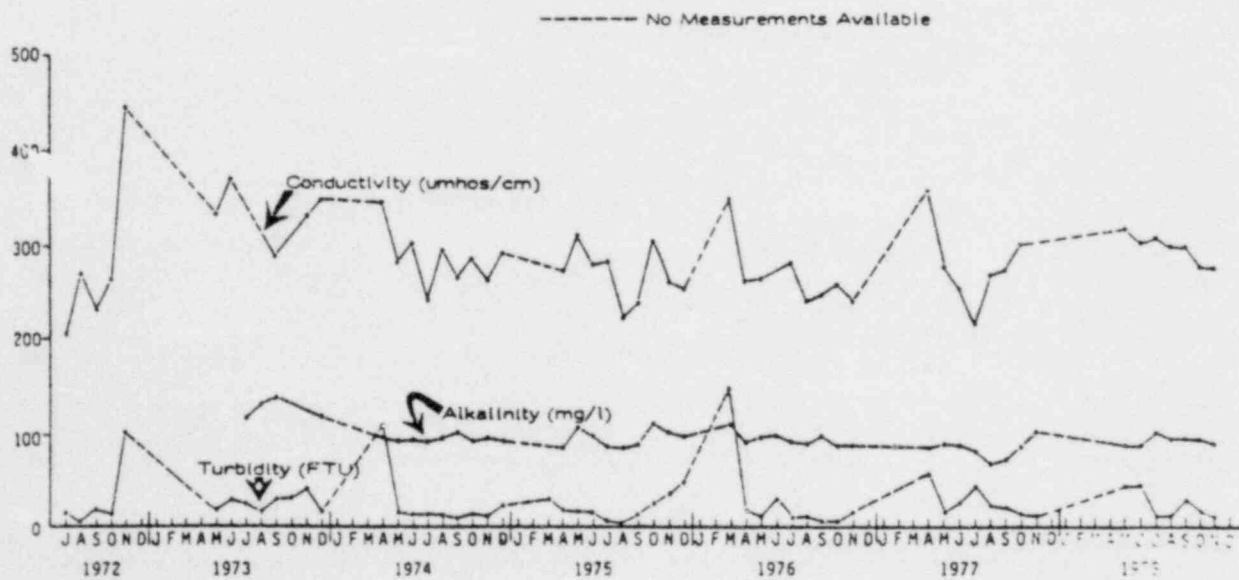
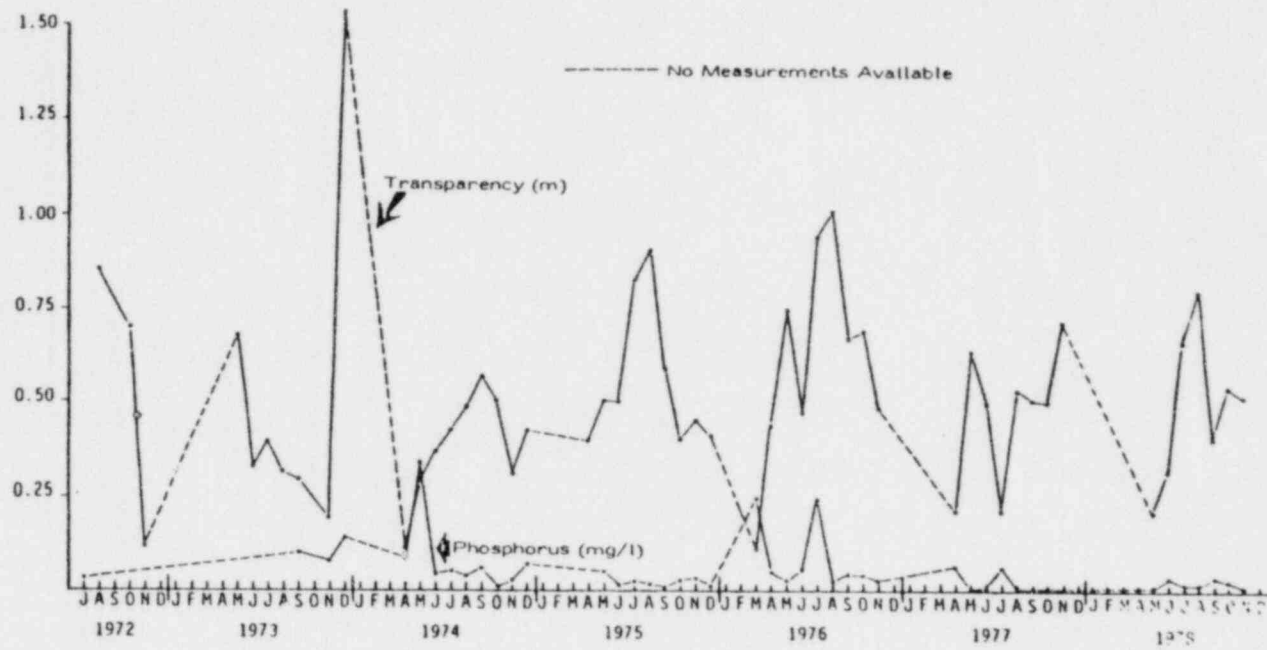


FIGURE 9. TRENDS IN MEAN MONTHLY TRANSPARENCY AND PHOSPHORUS MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1978.



VII

SECTION 3.1.1.A.2
CHEMICAL USAGE

Table 3.1-1
DAVIS-BESSE NUCLEAR POWER STATION
UNIT NO. 1

CHEMICAL USAGE FOR 1978

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Chlorine	Circulating Water	Biocide	63,558#	N/A	Unit discharge via cooling tower blowdown
Chlorine	Service Water	Biocide	80,626#	Cooling Tower Makeup	Unit discharge via cooling tower blowdown
Chlorine	^a Cooling Tower Makeup	Biocide	None	Cooling Tower Makeup	Unit discharge via cooling tower blowdown
Chlorine	Water Treatment	Disinfection	3,587#	N/A	Water dist. sys.
Sulfuric Acid	Circulating Water	Alkalinity Control	90,049 gal.	Reacts with circulating water	Unit discharge via cooling tower blowdown
Sulfuric Acid	Demineralizers	Regeneration	8,992 gal.	Neutralizing tank for neutralization	Unit discharge
Sulfuric Acid	Water Treatment	Stabilization	None	N/A	Water dist. sys.
Sulfuric Acid	Neutralizing Tank	Neutralization	21 gal.	N/A	Unit discharge

DS-1

^aOnly used when the unit is operating and service water is being returned to the forebay.

TABLE 3.1-1 (Con't.)

1978 Chemical Usage

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Sodium Hydroxide	Dem mineralizers	Regeneration	37,021 gal.	Neutralizing Tank for neutralization	Unit discharge
Sodium Hydroxide	Neutralizing Tank	Neutralization	41,716 gal.	N/A	Unit discharge
Calcium Hydroxide	Water Treatment	Clarification and Softening	58,550#	Sludge to the Settling Basin	Supernatant from the settling basin to the unit discharge
Sodium Aluminate	Water Treatment	Clarification and Softening	5,600#	Sludge to the Settling Basin	Supernatant from the settling basin to the unit discharge
Nalco 607	Water Treatment	Clarification and Softening	None	Sludge to the Settling Basin	"
Nalco 8184	Water Treatment	Clarification and Softening	179 #	Sludge to the Settling Basin	"
Sodium Hydroxide	Water Treatment	Clarification and Softening	1,550 #	Sludge to the Settling Basin	"
Sodium Hypochlorite	Water Treatment	Disinfection	12# Avail Cl ₂	N/A	Water distribution system
Sodium Hypochlorite	Sewage Treatment	Disinfection	338# Avail Cl ₂	N/A	Unit Discharge

TABLE 3.1-1 (Con't.)
1978 Chemical Usage

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Hydrazine	Secondary Coolant	Oxygen Scavenging	505 gal.	N/A	N/A
	Reactor Coolant	Oxygen Scavenging	1 gal.	N/A	N/A
	Component Cooling	Oxygen Scavenging	2 gal.	N/A	N/A
	Auxiliary Boiler	Oxygen Scavenging	4 gal.	N/A	N/A
	Heating System	Oxygen Scavenging	1 gal.	N/A	N/A
Ammonia	Secondary Coolant	pH Control	125 gal.	N/A	N/A
	Auxiliary Boiler	pH Control	4 gal.	N/A	N/A
Boric Acid	Reactor Coolant	Neutron Moderator	32,825#	N/A	N/A
Lithium Hydroxide	Reactor Coolant	pH Control	17,100 grams as Lithium	N/A	N/A
Morpholine	Component Cooling	pH Control	None	N/A	N/A
Halco 39L	Turbine Plant Cooling	Corrosion Inhibitor	165 gal.	N/A	N/A
	Chilled Water	Corrosion Inhibitor	5 gal.	N/A	N/A

TABLE 3.1-1 (Con't.)

1978 Chemical Usage

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Nalco 7320	Turbine Plant Cooling	Microbiological Control	None	N/A	N/A
	Chilled Water	Microbiological Control	None	N/A	N/A
Nalco 7326	Turbine Plant Cooling	Microbiological Control	236 gal.	N/A	N/A
Sodium Hydroxide	Turbine Plant Cooling	pH Control	52#	N/A	N/A

VIII

SECTION 3.1.1.A.3
CHLORINE MONITORING

3.1.1.a.3 Chlorine Monitoring

Chlorine Monitoring is covered by the Station's NPDES Permit.
The limits of the permit were never exceeded.

IX

SECTION 3.1.2.A.J
PLANKTON STUDIES