Docket No. 50-346

License No. NPF-3

Serial No. 1-333

TOLEDO EDISON
RICHARD P. CROUSE
Vice President
Nuclear
(419) 259-5221

March 7, 1983

E 2.20.1
RR P-7-82-01
A83-165B

Mr. James G. Keppler
Regional Director, Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60136

Dear Mr. Keppler:

Under separate cover, we are transmitting two (2) copies of the 1982 Annual Environmental Operating Report for the Davis-Besse Nuclear Power Station Unit No. 1. This report is submitted in accordance with Section 5.4.1 of Appendix B, Davis-Besse Technical Specifications.

Sincerely,

RPC:JSW:yml

Enclosure

cc:
Victor Stello, Jr., Director
Office of Inspection and Enforcement
USNRC
Washington, D.C. 20555 (20 copies)

Norman Haller, Director
Office of Management and Program Analysis
USNRC
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Harold Denton, Director
Office of Nuclear Reactor Regulation
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Tom Peebles, Resident NRC Inspector
Davis-Besse Nuclear Power Station
(1 copy)

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Section 2.1.1

Maximum Temperature Differential

2.1.1 TEMPERATURE DIFFERENTIAL, °F 1982

1982	Minimum	Maximum	Average
January	6	18	12
February	5	15	10
March	1	16	7
April	0	6	2
May	0	5	2
June	0	5	2
July	0	3	1
August	0	6	2
September	1	11	7
October	8	14	11
November	7	19	13
December	8	19	13

Section 2.3.1

Biocides

2.3.1 BIOCIDES

Chlorine was the only biocide used in the circulating water at Davis-Besse during the 1982 period. Monitoring of chlorine residuals is covered by the Station's National Pollutant Discharge Elimination System (NPDES) Permit. The limits of the permit were not exceeded in 1982.

SECTION 2.3.2

pH MONITORING

2.3.2 pH MONITORING 1982

1982	Minimum	Maximum
January	7.2	8.1
February	7.1	8.5
March	7.2	8.6
April	6.4	8.2
May	6.5	8.5
June	7.7	8.5
July	7.1	8.1
August	7.6	8.2
September	7.8	8.6
October	7.7	8.5
November	7.5	8.5
December	8.0	8.4

The pH limit of 6-9 was not exceeded in 1982.

SECTION 2.3.3

SULFATES MONITORING

2.3.3 SULFATE 1982

mg/l

1982	Minimum	Maximum	Average
January	55	120	74
February	50	85	68
March	57	100	72
April	65	100	89
May	57	75	62
June	55	70	63
July	50	77	61
August	60	70	65
September	60	75	67
October	60	78	66
November	55	100	70
December	73	125	84

The sulfate limit of 1500 mg/l was not exceeded during 1982.

Section 3.1.1.a.2

Chemical Usage

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

CHEMICAL USAGE FOR 1982

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Chlorine	Circulating Water	Biocide	36,833#	N/A	Unit discharge via cooling tower blowdown
Chlorine	Service Water	Biocide	27,892#	Cooling Tower Makeup	Unit discharge via cooling tower blowdown
Chlorine	[a]Cooling Tower Makeup	Biocide	NONE	Cooling Tower Makeup	Unit discharge via cooling water blowdown
Chlorine	Water Treatment	Disinfection	3,563#	N/A	Water Dist. sys.
Sulfuric Acid	Circulating Water	Alkalinity Control	NONE	Reacts with circulating water	Unit discharge via cooling tower blowdown.
Sulfuric Acid	Demineralizers	Regeneration	3,128 gal	Neutralizing tank for neutralization	Unit discharge
Sulfuric Acid	Water Treatmenc	Stabilization	NONE	N/A	Water dist. sys.
Sulfuric Acid	Neutralizing Tank	Neutralization	NONE	N/A	Unit discharge

[a]Only used when the unit is operating and service water is being returned to the forebay.

Table 3.1-1 (Cont'd.)

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Sodium Hydroxide	Demineralizers	Regeneration	19093 gal	Neutralizing tank for neutralization	Unit discharge
Sodium Hydroxide	Neutralizing tank	Neutralization	4948 gal	N/A	Unit discharge
Calcium Hydroxide	Water treatment	Clarification and Softening	51150#	Sludge to the Settling Basin	Supernatant from the settling basin to the unit discharge
Sodium Aluminate	Water treatment	Clarification and softening	3900#	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	Supernatant from the settling basin to the unit discharge
Nalco 8184	Water treatment	Clarification and softening	12 gal	Sludge to the Settling Basin	Supernatant from the settling basin to the unit discharge

Table 3.1-1 (Cont'd)

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Morpholine	Component Cooling	pH Control	NONE	N/A	N/A
Nalco 39L	Turbine Plant Cooling	Corrosion Inhibitor	55 gal	N/A	N/A
	Chilled Water	Corrosion Inhibitor	4 gal	N/A	N/A
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	80 gal	N/A	N/A
Sodium Hydroxide	Turbine Plant Cooling	pH Control	50#	N/A	N/A
Nalco 810	Water Treatment	Clarification and softening	32 gal	Sludge to the settling basin	Supernatant from the settling basin to the unit discharge
Nalco 7330	Turbine plant cooling	Microbiological Control	130 gal	N/A	N/A

Table 3.1-1 (Cont'd)

CHEMICAL	SYSTEM	USE	QUANTITY	DISCHARGE	
				INTERMEDIATE	FINAL
Sodium Hydroxide	Water Treatment	Clarification and softening	515#	Sludge to the Settling Basin	Supernatant from the settling basin to the unit discharge
Sodium Hypochlorite	Water Treatment	Disinfection	NONE	N/A	Water distribution system
Sodium Hypochlorite	Sewage Treatment	Disinfection	1575#	N/A	Unit discharge
Hydrazine	Secondary Coolant	Oxygen Scavenging	419 gal	N/A	N/A
	Reactor Coolant	Oxygen Scavenging	NONE	N/A	N/A
	Component Cooling	Oxygen Scavenging	1 gal	N/A	N/A
	Auxiliary Boiler	Oxygen Scavenging	7 gal	N/A	N/A
	Heating System	Oxygen Scavenging	1 gal	N/A	N/A
Ammonia	Secondary Coolant	pH Control	60 gal	N/A	N/A
	Auxiliary Boiler	pH Control	11 gal	N/A	N/A
Boric Acid	Reactor Coolant	Neutron Moderator	19775 gal	N/A	N/A
Lithium Hydroxide	Reactor Coolant	pH Control	7034 grams	N/A	N/A

SECTION 3.1.1.A.3

CHLORINE MONITORING

3.1.1.a.3 CHLORINE MONITORING

Chlorine monitoring is covered by the Davis-Besse Station's National Pollutant Discharge Elimination System (NPDES) Permit. The limits of the permit were not exceeded during 1982.

Section 3.2

Environmental Radiological Monitoring

HAZLETON
ENVIRONMENTAL SCIENCES
A DIVISION OF HAZLETON LABORATORIES AMERICA, INC.
1500 FRONTAGE ROAD, NORTHBROOK, ILLINOIS 60062, U.S.A.

REPORT
TO
TOLEDO EDISON COMPANY
TOLEDO, OHIO

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING FOR THE DAVIS-BESSE NUCLEAR POWER STATION UNIT NO. 1 OAK HARBOR, OHIO

ANNUAL REPORT - PART I
SUMMARY AND INTERPRETATION
JANUARY - DECEMBER 1982

FOR SUBMITTAL TO THE NUCLEAR
REGULATORY COMMISSION

PREPARED AND SUBMITTED
BY
HAZLETON ENVIRONMENTAL SCIENCES CORPORATION

PROJECT NO. 8003-100

Approved by: L. G. Huebner
L. G. Huebner, M.S.
Director, Nuclear Sciences

1 February 1983

PHONE (312) 564-0700 o TELEX 28-9483 (HAZES NBRK)

PREFACE

The staff of the Nuclear Sciences Department of Hazleton Environmental Sciences (Hazleton) was responsible for the acquisition of the data presented in this report. Samples were collected by members of the staff of the Davis-Besse Nuclear Power Station and by local sample collectors.

The report was prepared by C. R. Marucut, Section Supervisor, under the direction of L. G. Huebner, Director, Nuclear Sciences. She was assisted in the report preparation by L. Nicia, Group Leader, and other staff members of the Nuclear Sciences Department.

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1.0 INTRODUCTION

Because of the many potential pathways of radiation exposure to man from both natural and man-made sources, it is necessary to document levels of radioactivity and the variability of these levels which exist in an area prior to the anticipated release of any additional radioactive nuclides.

To meet this objective, an extensive preoperational environmental radiological monitoring program was initiated for the Toledo Edison Company in the vicinity of the Davis-Besse Nuclear Power Station site. This program included collection (both onsite and offsite) and radiometric analyses of airborne particulates, airborne iodine, ambient gamma radiation, milk, groundwater, meat and wildlife, fruits and vegetables, animal and wildlife feed, soil, surface water, fish, and bottom sediments. Approximately 5 years of preoperational monitoring were completed in April 1977 by the same laboratory that currently operates under the name Hazleton Environmental Sciences (HES).

Fuel elements were loaded in Unit 1 on 23 through 27 April 1977 and the initial criticality was achieved on 12 August 1977. Unit 1 achieved one hundred percent of its operational capacity on 4 April 1978. Approximately 5-1/2 years of operational monitoring was completed by the end of December 1982.

This report presents the fifth full year of operational data for the Environmental Radiological Monitoring at the Davis-Besse Nuclear Power Station.

The program was conducted in accordance with the Davis-Besse Nuclear Power Station Unit No. 1 Technical Specifications: Appendix B to License No. NPF-3, Section 3.2.

2.0 EXECUTIVE SUMMARY

Operational Nuclear Stations are required by Federal Regulations to submit Annual Operational Reports to the U.S. NRC. The reports must also include the results of the Radiological Environmental Monitoring Program.

This report summarizes the results of such a program. The program was conducted in accordance with the Davis-Besse Nuclear Power Station Unit No. 1 Technical Specifications: Appendix B to License No. NPF-3 Section 3.2. This program included collection (both onsite and offsite) and radiometric analyses of airborne particulates, airborne iodine, ambient gamma radiation, milk, ground water, meat and wildlife, fruits and vegetables, animal and wildlife feed, soil, surface water, fish, and bottom sediments.

Results of sample analyses during the period January - December 1982 are summarized in Table 4.5. Tabulations of data for all samples collected during this period, additional statistical analyses of the data, and graphs of data trends are presented in a separate report to the Toledo Edison Company (HES 1983).

Radionuclide concentrations measured at indicator locations were compared with levels measured at control locations and in preoperational studies. The comparisons indicate background-level radioactivities in all samples collected. No station effect on the environment was indicated in any of the sampling media collected and analyzed.

3.0 ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

3.1 Methodology

The sampling locations for the Preoperational Environmental Radiological Monitoring Program at the Davis-Besse Nuclear Power Station are shown in Figures 4-1 and 4-2. Table 4.1 describes the locations, lists for each its direction and distance from the station, and indicates which are indicator and which are control locations.

The sampling program monitors the air, terrestrial, and aquatic environments. The types of samples collected at each location and the frequency of collections are presented in Table 4.2 using codes defined in Table 4.3. The collections and analyses that comprise the program are described in the following pages. Finally, the execution of the program in the current reporting annual period (January - December 1982) is discussed.

3.1.1 The Air Program

Airborne Particulates

The airborne particulate samples are collected on 47mm diameter membrane filters of 0.8 micron porosity at a volumetric rate of approximately one cubic foot per minute. The filters are collected weekly from eleven locations (T-1, T-2 T-3, T-4, T-7, T-8, T-9, T-11, T-12, T-23, and T-27), placed in individual glassine protective envelopes, and dispatched by mail to HES for radiometric analyses. The filters are analyzed for gross beta activity approximately five days after collection to allow for decay of naturally-occurring short-lived radionuclides. The quarterly composites of all air particulate samples from indicator locations (T-1, T-2, T-3, T-4, T-7, and T-8) and of all air particulate samples from control locations (T-9, T-11, T-12, T-23, and T-27) are gamma-scanned and analyzed for strontium-89 and -90.

Airborne Iodine

Each air sampler is equipped with a charcoal trap in-line after the filter holder. The charcoal trap at each location is changed at the same time as the particulate filter and analyzed for iodine-131 immediately after arrival at the laboratory.

Ambient Gamma Radiation

The integrated gamma-ray background from natural radiation is measured with thermoluminescent dosimeters (TLD). Monthly and quarterly TLDs are placed at thirteen locations (the eleven air sampling locations and locations T-5 and T-24).

On 1 January 1980 eighteen (18) new TLD sampling locations were added to the program. Twelve locations (T-38 - T-49) were established at the site boundary ranging in distance from 0.5 mi to 1.2 mi from the stack. Six locations were established at a distance of 3.7 mi to 5.0 mi from the stack. Since about 50% of the outer 5 mi ring is over Lake Erie, only six additional locations were required to cover all sectors on the land.

Each shipment of TLDs includes controls which are stored in a shield at the station and returned with the field TLDs after their removal. In-transit exposures are measured by the control TLDs and subtracted from the field TLD measurements to obtain their net exposure.

3.1.2 The Terrestrial Program

Milk

Two-gallon milk samples are collected twice a month during the grazing period (May through October) and monthly during the rest of the year from two indicator locations (T-8 and T-20) and one control location (T-24). The milk samples are analyzed for iodine-131, strontium-89 and -90, calcium, stable potassium, and are gamma scanned.

Groundwater

One-gallon well water samples are collected quarterly from two indicator locations (T-7 and T-17) and from one control location (T-27). The gross beta activity is determined on the suspended and dissolved solids of each sample. The samples are also gamma scanned and analyzed for strontium-89 and -90, and tritium.

Edible Meat

Semi-annually, domestic meat samples (chickens) are collected from one indicator location (T-32) and one control location (T-34) and one representative species of wildlife (muskrat or raccoon) is collected onsite (T-31). In addition, one water-fowl species and one snapping turtle are collected annually onsite (T-31) or in the site vicinity (T-33). Gamma-spectroscopic analysis is performed on the edible portions of each sample.

Fruits and Vegetables

Semi-annually, two varieties of fruits and vegetables are collected from each of the two indicator locations (T-8 and T-25) and from one control location (T-34). The edible portions are gamma scanned and analyzed for strontium-89 and -90.

Green Leafy Vegetables

Monthly, during the harvest season, green leafy vegetables are collected from one indicator location (T-36) and one control location (T-37). The samples are analyzed for iodine-131. Should green leafy vegetables from private gardens be unavailable, nonedible plants with similar leaf characteristics from the same vicinity may be substituted.

Animal-Wildlife Feed

Animal feed is collected semi-annually from one indicator location (T-8) and one control location (T-34). Cattlefeed is collected during the first quarter and grass is collected during the third quarter. Also, once a year, a sample of smartweed is collected from location T-31 (onsite). Gamma-spectroscopic analysis is performed on all samples.

Soil

Once a year, soil samples are collected from all eleven air sampling locations; six indicator locations (T-1, T-2, T-3, T-4, T-7, and T-8) and five control locations (T-9, T-11, T-12, T-23, and T-27). Gamma-spectroscopic analysis is performed on all samples.

3.1.3 The Aquatic Program

Treated Surface Water

Weekly grab samples of treated water are collected at one indicator location (T-28, Unit 1 treated water supply, onsite) and two control locations (T-11 and T-12, Port Clinton and Toledo filtration plants). The samples from each location are composited monthly and analyzed for gross beta activity in dissolved and suspended solids. Quarterly composites from each location are gamma scanned and analyzed for strontium-89 and -90, and tritium.

Untreated Surface Water

Weekly grab samples of untreated water from Lake Erie are collected from one indicator location (T-3) and from two control locations (T-11 and T-12, Port Clinton and Toledo filtration plants, untreated water tap). In addition, hourly grab samples are collected from one in-plant water supply (T-28, Unit 1 untreated water supply, onsite). The samples from each location are composited monthly and analyzed for gross beta activity in dissolved and suspended solids. Quarterly composites from each location are gamma scanned and analyzed for strontium-89 and -90, and tritium.

Fish

Two species of fish are collected semi-annually from each of two locations in Lake Erie; from one indicator location in the vicinity of the discharge (T-33) and one control location approximately 15 miles from the plant (T-34; Put-In-Bay area). The flesh is separated from the bones and analyzed for gross beta and gamma-emitting isotopes.

Bottom Sediments

Semi-annually, bottom sediments are collected from three locations in Lake Erie; at two indicator locations, intake (T-29) and discharge (T-30), and at one control location about 5.3 miles WNW from the plant (T-27). The samples are gamma scanned and analyzed for gross beta and strontium-89 and -90.

3.1.4 Program Execution

Program execution is summarized in Table 4.4. The program was executed as described in the preceding sections with the following exceptions:

1. There were no gross beta in air particulate and airborne iodine-131 data from locations T-1, T-2, and T-3 for the collection periods ending 6-28-82, 7-6-82, 7-12-82, 7-19-82, and 7-26-82 because a power line to the samplers was down.

2. There were no gross beta in air particulate and airborne iodine-131 data from Location T-7 for the collection period ending 3-15-82 because of pump malfunction.

3. There were no gross beta in air particulate and airborne iodine-131 data from location T-9 for the collection period ending 8-9-82 because the fuse was blown.

4. There were no gross beta in air particulate and airborne iodine-131 data from location T-23 for the collection period ending 1-11-82 because the location was inaccessable due to bad weather.

5. There were no gross beta in air particulate and airborne iodine-131 data from location T-23 for the collection periods ending 12-20-82 and 12-27-82 because the sample collector was on vacation and could not find a substitute.

6. Weekly samples of untreated surface water were not collected from Lake Erie (T-3) for three weeks in February, 1982 because the lake was frozen.

7. There was no TLD data from Location T-49 for the third quarter of 1982 because they were lost in the field.

3.1.5 Census of Milch Animals

In compliance with Appendix B, Section 3.2 of the Technical Specifications for the Davis-Besse Nuclear Power Station, the annual census of milch animals was conducted on May 25 and 27, 1982 and June 1, 1982 by the Environmental Monitoring Group personnel, Davis-Besse Nuclear Power Station.

The census results were as follows:

Goats

Allen Avery Farm, 4 miles S of the Station; 3 goats, 2 are milking.

Dan Biggert Farm, 3 miles SSW of the Station; 3 non-milking goats.

Clark Brown Farm, 4.5 miles SSE of the Station; 7 goats, 2 will be milking late August or early September.

Ralph A. Miller Farm, 4.5 miles SSE of the Station; 1 milk goat and 3 kids. Milk will be used for personal consumption after kids are weaned.

Mary Waugh Farm, 7.5 miles SE of the Station; 2 goats, could not be confirmed if milking or non-milking.

Lyle Wooley Farm, 2.5 miles SSW of the Station; 1 goat and 2 sheep, could not be confirmed if goat is milking or non-milking.

Arthur Bruns Farm, 4 miles SSE of the Station; 1 non-milking goat.

Milking Cows

Carl Gaeth Farm, 5.5 miles WSW of the Station; 35 milking cows.

Earl Moore Farm, 2.5 miles WSW of the Station; 35 milking cows.

Gordon Sandwisch Farm, 1 mile SSW of the Station; 1 milking cow steer, and a calf. The milk is used only to nurse the calf.

Non-Milking Cows and Cattle

David Appling Farm, 0.5 miles W of the Station; 5 beef cows.

Gerald Daup Farm, dairy cattle for breeding and marketing only.

Ed DeWitz Farm, 15 beef cattle.

Alvin Gates Farm, 4 miles SW of the Station; 4 beef steer.

3.2 Results and Discussion

The results for the reporting period January to December 1982 are presented in summary form in Table 4.5. For each type of analysis of each sampled medium, this table shows the annual mean and range for all indicator locations and for all control locations. The location with the highest annual mean and the results for this location are also given.

The discussion of the results has been divided into three broad categories; the air, terrestrial, and aquatic environments. Within each category, samples are discussed in the order listed in Table 4.4.

Any references to previous environmental data for the Davis-Besse Nuclear Power Station refer to data collected by HES (or its predecessor companies, NALCO Environmental Sciences and Industrial BIO-TEST Laboratories, Inc.).

The tabulated results of all measurements made during 1982 are not included in this section, although references to these results are made in the discussion. The complete tabulation of the results is submitted to the Toledo Edison Company in a separate report.

3.2.1 The Effect of Chinese Atmospheric Nuclear Detonation

There were no reported atmospheric nuclear tests in 1982. The last reported test was conducted by the People's Republic of China on 16 October 1980. The reported yield was in the 200 kiloton to 1 megaton range.

There was a moderate residual effect from this test on the gross beta levels in airborne particulates. The annual mean gross beta activity was three times lower than in 1981. The highest activity was reached in the first quarter and then declined steadily to the level observed in 1980.

3.2.2 The Air Environment

Airborne Particulates

Gross beta measurements yielded annual means that were nearly identical at the five control locations and at the six indicator locations (0.022 pCi/m^3 and 0.024 pCi/m^3, respectively). The annual mean activity in 1982 was approximately four times lower than in 1981 (0.090 pCi/m^3). The decrease in the activity is attributable to the cleansing of the atmosphere of the radioactive debris which was introduced into the atmosphere by the nuclear test conducted October 16, 1980. The highest annual mean (0.026 pCi/m^3) was measured at control location T-23, 14.3 miles ENE of the station.

Gross beta activities at all locations were also statistically analyzed by months and quarters. The highest averages were for the months of January and February and the first quarter. The elevated activity was due to an early spring peak, which has been observed almost annually (1976 and 1979 were exceptions) for many years (Wilson et al., 1969). The spring peak has been attributed to fallout of nuclides from the stratosphere (Gold et al., 1964). It was more pronounced in 1981 and, to a lesser degree, in 1982 because of the addition of the radioactive debris from the latest nuclear test.

Strontium-89 and strontium-90 activities were below their respective LLDs of 0.0005 and 0.0002 pCi/m^3 in all samples.

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded nearly identical results for indicator and control locations. The predominant gamma-emitting isotope was beryllium-7 which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955). A trace amount of cerium-144 was detected in one sample. Presence of cerium-144 in the atmosphere is attributable to the fallout from the most recent nuclear test conducted 16 October 1980. There was no indication of a station effect on the data.

Airborne Iodine

Weekly levels of airborne iodine-131 were below the lower limit of detection (LLD) of 0.02 pCi/m^3 in all samples.

Ambient Gamma Radiation

At thirteen (13) regular locations the monthly TLDs measured a mean equivalent dose of 13.5 mrem/91 days at the indicator locations and a mean of 14.4 mrem/91 days at control locations. These results were in agreement with the values obtained by quarterly TLDs and were nearly identical to the levels observed in 1980 (13.6 mrem/91 days and 14.5 mrem/91 days, respectively), and in 1981 (13.8 mrem/91 days and 14.9 mrem/91 days, respectively). The highest annual means for monthly TLDs (17.8 mrem/91 days) and for quarterly TLDs (19.3 mrem/91 days) occured at indicator location T-8.

At the twelve special locations established at the site boundary, the mean equivalents were essentially identical to those measured at the regular indicator locations (14.1 mrem/91 days and 13.9 mrem/91 days, monthly and quarterly, respectively).

At the six special locations established within 3.7 mi to 5.0 mi radius the mean dose equivalent was higher (17.3 mrem/91 days and 17.6 mrem/91 days, monthly and quarterly, respectively).

Higher gamma radiation levels measured at locations away from the lake were also observed in previous years and are attributed to the higher potassium-40 content in the soil.

The annual mean dose equivalent for all locations measured by monthly and quarterly TLDs was 14.5 mrem/91 days and was identical to that measured in 1980 and similar to mean dose measured in 1981 (14.8 mrem/91 days). This is lower than the average natural background radiation for Middle America, 19.5 mrad/quarter[1]; and is primarily due to the lower potassium-40 content in the soil in the area.

3.2.3 The Terrestrial Environment

Milk

A total of 54 analyses for iodine-131 in milk were performed during the reporting period. All samples contained less than 1.0 pCi/l of iodine-131.

Strontium-89 was below the LLD level of 1.7 pCi/l in all samples.

Strontium-90 activity was detected in all but four samples and ranged from 0.6 to 2.8 pCi/l. The annual mean value for strontium-90 was slightly higher at the indicator location (1.7 pCi/l) than at the control location (1.5 pCi/l). The location with the highest mean (1.8 pCi/l) was control location T-20. The mean values were similar to those measured in 1977, 1978, 1979, 1980, and 1981.

The activities of barium-140 and cesium-137 were below their respective LLDs in all samples collected.

Results for potassium-40 were nearly identical at control and indicator locations (1310 and 1300 pCi/l, respectively). Indicator location T-20 had the highest mean (1330 pCi/l).

Since the chemistries of calcium and strontium, and potassium and cesium are similar, organisms tend to deposit cesium-137 in muscle and soft tissue and strontium-89 and -90 in bones. In order to detect potential environmental accumulation of these radionuclides, the ratios of the strontium-90 activity to the weight of calcium and of the cesium-137 activity to weight of stable potassium were monitored in milk. The measured concentrations of calcium and stable potassium were in agreement with previously determined values of 1.16±0.08 g/l and 1.50±0.21 g/l, respectively (National Center for Radiological Health, 1968). No statistically significant variations in the ratios were observed.

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[1] This estimate is based on data on pp. 71 and 108 of the report Natural Background Radiation in the United States (National Council on Radiation Protection and Measurements, 1975). The terrestrial absorbed dose (uncorrected for structural and body shielding) ranges from 35 to 75 mrad/y and averages 46 mrad/y for Middle America. Cosmic radiation and cosmogenic radionuclides contribute 32 mrad/y for an average of 78 mrad/y or 19.5 mrad/ quarter.

Groundwater (Well Water)

Gross beta activities in suspended solids were below the LLD of 0.7 pCi/l in all samples. Gross beta activities in dissolved solids averaged 3.3 pCi/l at the indicator locations and 6.8 pCi/l at the control location. The location with the highest annual mean was the control location T-27 and averaged 6.8 pCi/l. The range of gross beta activities were similar to those observed in 1978, 1979, 1980, and 1981.

Tritium activity was below the LLD of 330 pCi/l in all samples.

Strontium-89 and strontium-90 activities were below the LLD's of 2.0 pCi/l and 1.2 pCi/l in all samples.

All samples were below the LLD of 10.0 pCi/l for cesium-137 activity.

The activities detected in well water were not significant when compared with the LLDs and were not attributable to the station operation.

Edible Meat

In the edible meat samples (chickens, muskrats, goose, and snapping turtle) the mean potassium-40 activity was 2.77 pCi/g wet weight for the indicator locations and 2.66 pCi/g wet weight for the control location. Cesium-137 activity was below the LLD of 0.078 pCi/g wet weight in all but one sample.

Fruits and Vegetables

Strontium-89 and strontium-90 activity was below the LLD of 0.011 pCi/g wet weight and 0.007 pCi/g wet weight respectively in all samples.

The only gamma-emitting isotope detected was naturally-occurring potassium-40. The mean activities were 1.45 pCi/g wet weight for the indicator locations and 1.38 pCi/g wet weight for the control locations. The activities detected were identical or similar to those detected in 1977, 1978, 1979, 1980, and 1981. All other gamma-emitting isotopes were below their respective LLDs.

Green Leafy Vegetables

Green leafy vegetables (cabbage) collected during harvest season were analyzed for iodine-131. All results were below the LLD of

0.023 pCi/g wet weight. All gamma-emitting isotopes, except potassium-40 and cerium-141, were below their respective LLDs. Potassium-40 activity averaged 1.49 pCi/g wet weight and 1.60 pCi/g wet weight for indicator and control locations, respectively. Cerium-141 was detected in one control sample and was 0.078 pCi/g wet weight. No plant effect was indicated.

Animal-Wildlife Feed

In grass, smartweed, and corn the only gamma-emitting isotope detected was potassium-40. The annual mean for control location T-34 was (2.04 pCi/g wet weight) nearly identical to the mean value for indicator locations (2.10 pCi/g wet weight). All other gamma-emitting isotopes were below their respective LLDs.

Soil

Soil samples were collected in June 1982 and analyzed for gamma-emitting isotopes. The predominant activity was potassium-40 which had a mean value of 17.2 pCi/g dry weight at the indicator locations and 21.0 pCi/g dry weight at the control locations. Cesium-137 activiy was above the LLD of 0.048 pCi/g in eight of the eleven samples. The mean activity at the indicator locations was 0.246 pCi/g dry weight and 0.705 pCi/g dry weight at the control locations. The highest cesium-137 activity, 0.986 pCi/g, was detected at the control location T-23, 14.3 miles ENE of station. The level of activities and distribution pattern was very similar to those observed in 1978, 1979, 1980, and 1981. Beryllium-7 was detected in one control sample and the activity was 1.54 pCi/g dry weight.

3.2.4 The Aquatic Environment

Water Samples - Treated

In treated water samples the gross beta activity in suspended solids was below the LLD of 0.9 pCi/l in all samples. Gross beta activity in dissolved solids averaged 2.3 pCi/l at indicator locations and 2.6 pCi/l at control locations. The values are similar to those measured in 1975, 1976, 1977, 1978, 1979, 1980, and 1981. Annual mean tritium activities were similar at indicator and control locations (<330 and 370 pCi/l, respectively).

Strontium-89 and strontium-90 activities were below the LLD levels of 3.2 and 1.7 pCi/l, respectively in all samples. Cesium-137 level was below the LLD of 10 pCi/l in all samples. Essentially identical results were obtained in 1979, 1980, and 1981.

Water Samples - Untreated

In untreated water samples the mean gross beta activity in suspended solids was 1.8 pCi/l at indicator locations and below the LLD of 1.0 pCi/l at control locations. In dissolved solids the mean activity was 3.1 pCi/l at indicator and 2.9 pCi/l at control locations. For total residue, the mean activities were 3.4 pCi/l at indicator locations and 3.0 pCi/l at control locations. None of these results show statistically significant differences between indicator and control locations.

The mean tritium activities for indicator and control locations were essentially identical (<330 and 420 pCi/l, respectively). These results were slightly higher than those obtained for treated water, (<330 and 370 pCi/l, respectively) but differences are not statistically significant since the counting uncertainty is larger than the difference (140-160 pCi/l).

Strontium-89 level was below the LLD of 2.1 pCi/l in all samples. Strontium-90 activity was nearly identical at indicator and control locations, 0.8 pCi/l and 0.9 pCi/l, respectively.

Cesium-137 activity was below the LLD of 10.0 pCi/l for all locations. No plant effect was indicated.

Fish

The mean gross beta activity in fish muscle was similar for indicator and control locations (2.84 and 3.13 pCi/g wet weight, respectively).

Potassium-40 was the only gamma-emitting isotope detected. The mean potassium-40 activity was 2.81 pCi/g wet weight for the indicator location and 2.77 pCi/g wet weight for the control location. Cesium-137 activity was below the LLD level of 0.040 pCi/g wet weight in all samples. The levels of activities were similar to those observed in 1978, 1979, 1980, and 1981. No plant effect was indicated.

Bottom Sediments

The mean gross beta activity in bottom sediments was 19.3 pCi/g dry weight for indicator locations and 20.5 pCi/g dry weight for the control location. The location with the highest mean was control Location T-27 (20.5 pCi/g dry weight). Control Location T-27 also had the highest mean potassium-40 activity (15.3 pCi/g dry weight) which was the major contributor to the gross beta activity at all locations.

Strontium-89 activity was below the LLD level of 0.041 pCi/g dry weight in all but two samples, one indicator and one control. The activities were 0.081 and 0.063 pCi/g dry weight, respectively.

The mean strontium-90 activity was 0.028 pCi/g dry weight for indicator locations and 0.016 pCi/g dry weight for control location. The location with the highest mean was indicator Location T-29 (0.031 pCi/g). The difference between these values is insignificant.

Cesium-137 activity was detected in one of six samples and was 0.124 pCi/g dry weight at control location T-27. Similar levels, distribution, and composition of detected radionuclides were detected in 1978, 1979, 1980, and 1981.

3.2.5 Summary and Conclusions

Results of sample analyses during the period January - December 1982 are summarized in Table 4.5. Tabulations of data for all samples collected during this period, additional statistical analyses of the data, and graphs of data trends are presented in a separate report to the Toledo Edison Company (HES 1983).

Radionuclide concentrations measured at indicator locations were compared with levels measured at control locations and in pre-operational studies. The comparisons indicate background-level radioactivities in all samples collected. No station effect on the environment was indicated in any of the sampling media collected and analyzed.

4.0 FIGURES AND TABLES

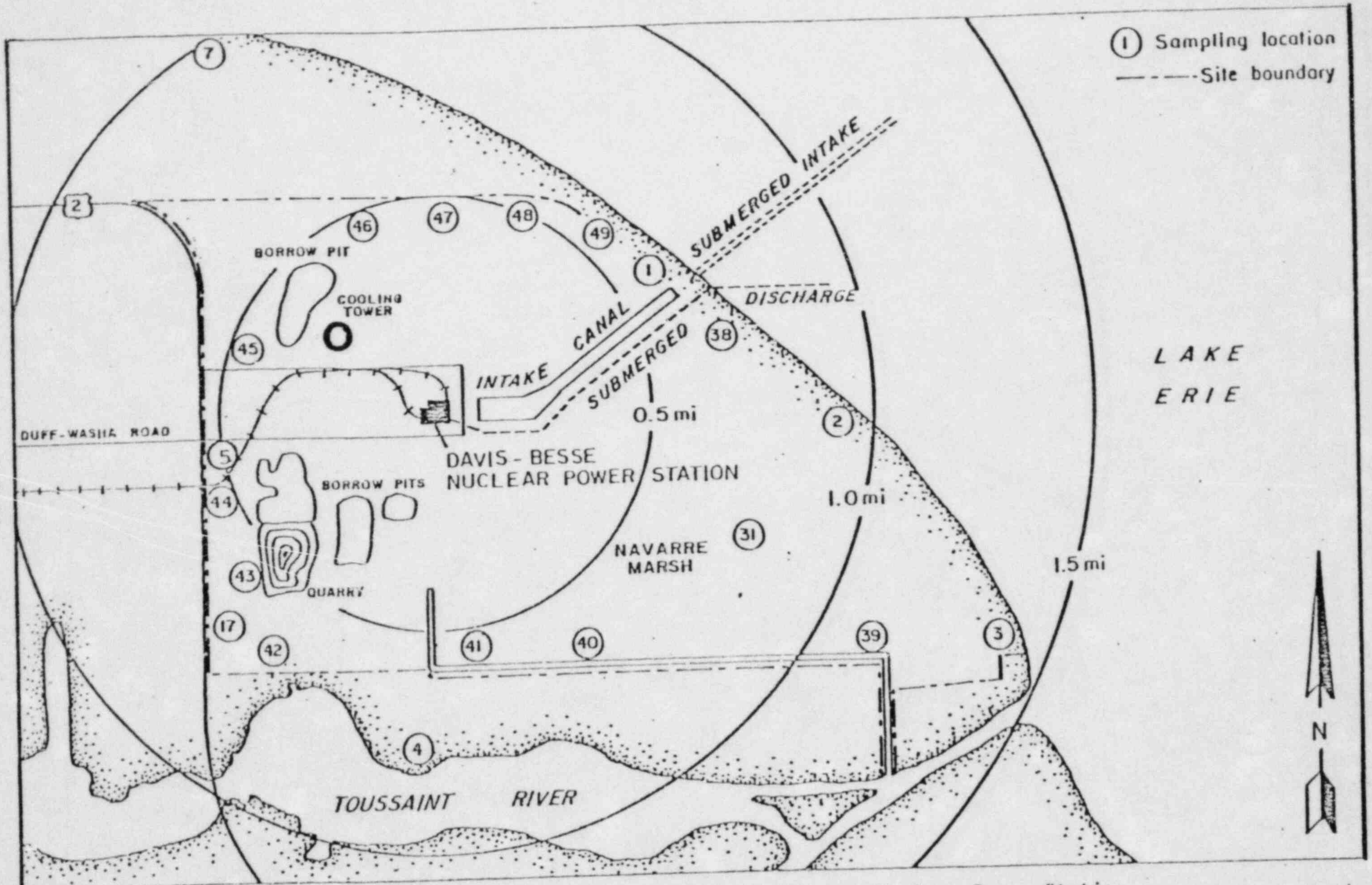

Figure 1. Sampling locations on the site periphery of the Davis-Besse Nuclear Power Station.

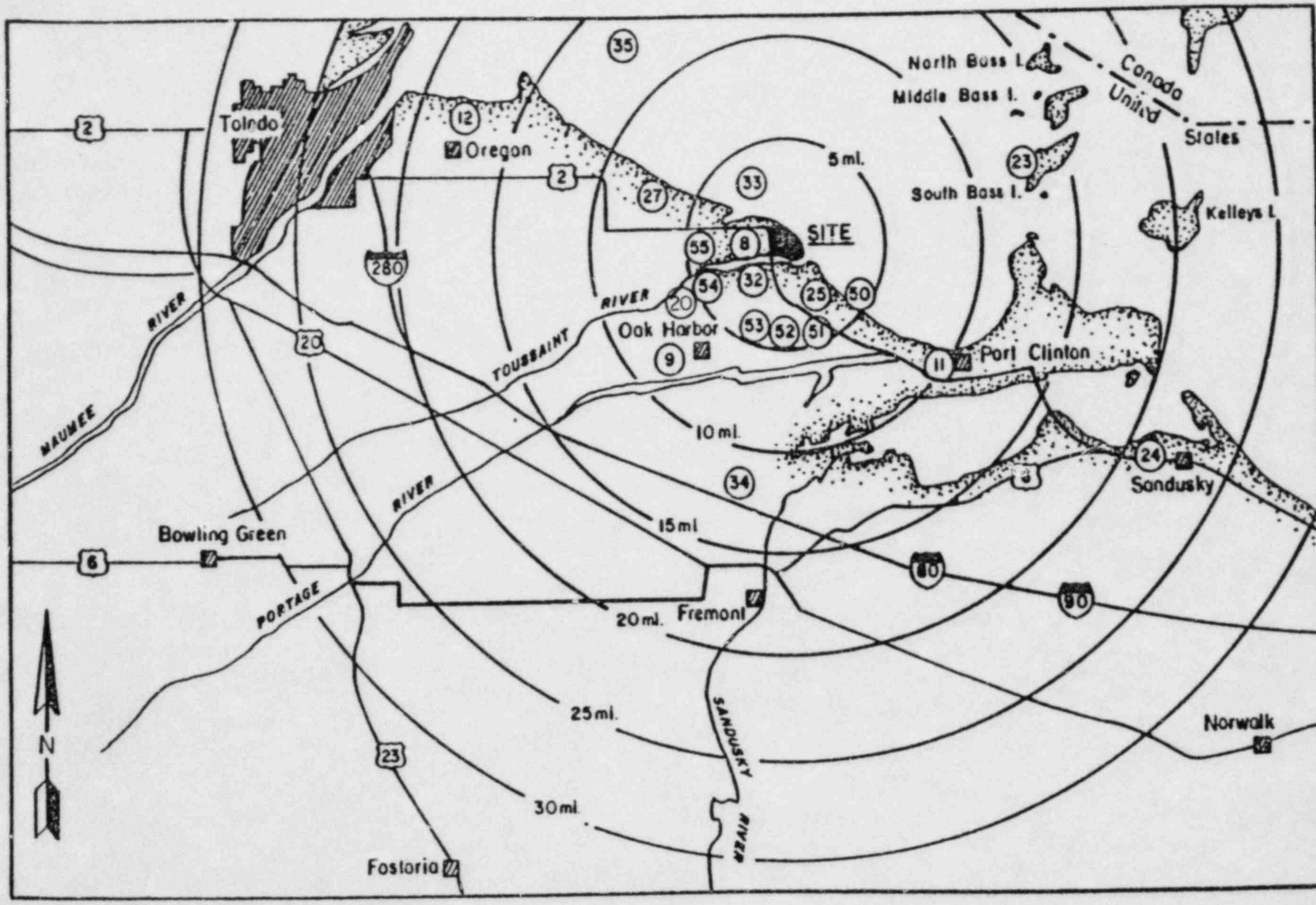

Figure 2. Sampling locations (excepting those on the site periphery), Davis-Besse Nuclear Power Station, Unit No. 1.

Table 4.1. Sampling locations, Davis-Besse Nuclear Power Station, Unit No. 1.

Code	Type of Location[a]	
T-1	I	Site boundary, 0.6 miles NE of station. near intake canal.
T-2	I	Site boundary, 0.9 miles E of station.
T-3	I	Site boundary, 1.4 miles SE of station, near Toussaint River and storm drain.
T-4	I	Site boundary, 0.8 miles S of station, near Locust Point and Toussaint River.
T-5	I	Main entrance to site, 0.5 miles W of station.
T-7	I	Sand Beach, 0.9 miles NNW of station.
T-8	I	Earl Moore Farm, 2.7 miles WSW of station.
T-9	C	Oak Harbor, 6.8 miles SW of station.
T-11	C	Port Clinton, 9.5 miles SE of station.
T-12	C	Toledo Water Treatment Station. Airborne particulate and iodine collected 23.5 miles WNW of site and water samples taken from intake crib 11.25 miles NW of site.
T-17	I	Irv Fick's well onsite, 0.7 miles SW of station.
T-20	I	Gaeth Farm, 5.5 miles WSW of station.
T-23	C	Put-In-Bay Lighthouse. 14.3 miles ENE of station.
T-24	C	Sandusky, 24.9 miles SE of station.
T-25	I	Miller Farm, 3.7 miles S of station.
T-27	C	Magee Marsh. 5.3 miles WNW of station.
T-28	I	Unit 1 treated and untreated water supply, onsite.
T-29	I	Lake Erie, intake area, 1.5 miles NE of station.
T-30	I	Lake Erie, discharge area, 0.9 miles ENE of station.

Table 4.1. (continued)

Code	Type of Location[a]	
T-31	I	Onsite.
T-32	I	Land, within 5 miles radius of station.
T-33	I	Lake Erie, within 5 miles radius of site.
T-34	C	Land, greater than 10 miles radius of site.
T-35	C	Lake Erie, greater than 10 miles radius of site.
T-36	I	The private garden or farm having the highest X/Q.
T-37	C	The farm 10 to 20 miles from the site in the least prevalent wind direction.
T-38	I	Site boundary, 0.6 ENE of station near lake.
T-39	I	Site boundary, 1.2 miles ESE of station near ditch to Toussaint.
T-40	I	Site boundary, 0.7 miles SE of station near ditch to Toussaint.
T-41	I	Site boundary, 0.6 miles SSE of station near ditch to Toussaint.
T-42	I	Site boundary, 0.8 miles SSW of station by ECC.
T-43	I	Site boundary, 0.5 miles SW of station along Route 2 fence.
T-44	I	Site boundary, 0.5 miles W of station by railroad tracks.
T-45	I	Site boundary, 0.5 miles WNW of station on access road behind cooling tower.
T-46	I	Site boundary, 0.5 miles NW of station along access road.
T-47	I	Site boundary, 0.5 miles N of station along access road by gate.

Table 4.1. (continued)

Code	Type of Location[a]	
T-48	I	Site boundary, 0.5 miles NNE of station by lake.
T-49	I	Site boundary, 0.5 miles NE of station along access road by lake.
T-50	I	Erie Industrial Park, 4.5 miles ESE of station by Water Tower.
T-51	I	Daup Farm, 600 Tettau Road. Port Clinton, Ohio 4.5 miles SSE of the station.
T-52	I	Miller Farm, 3.7 miles S of site on West Camp Perry Western Road.
T-53	I	Nixon Farm, 4.5 miles SSE of site on West Camp Perry Western Road.
T-54	I	M. Beier Farm, 4.8 miles WSW of site on Genzman Road
T-55	I	Lenke Farm, 5 miles west of site on Route 2.

[a]I-Indicator locations: C = Control locations.

Table 4.2. Type and frequency of collection.

Sampling Location	Type	Weekly				Monthly		Quarterly		Semi-Annually				Annually	
1	I	AP	AI			TLD		TLD							SO
2	I	AP	AI			TLD		TLD							SO
3	I	AP	AI	SWU		TLD		TLD							SO
4	I	AP	AI			TLD		TLD							SO
5	I					TLD		TLD							
7	I	AP	AI			TLD		TLD	WW						SO
8	I	AP	AI			TLD	M[a]	TLD			VE[b]		AF[c]		SO
9	C	AP	AI			TLD		TLD							SO
11	C	AP	AI	SWU	SWT	TLD		TLD							SO
12	C	AP	AI	SWU	SWT	TLD		TLD							SO
17	I								WW						
20	I						M[a]								
23	C	AP	AI			TLD		TLD							SO
24	C					TLD	M[a]	TLD							
25	I										VE[b]				
27	C	AP	AI			TLD		TLD	WW			BS			SO
28	I			SWU	SWT										
29	I											BS			
30	I											BS			
31	I									WL					SMW
32	I									ME					
33	I											F[d]		WF	ST
34	C									ME	VE[b]		AF[c]		
35	C											F[d]			
36	I					GLV									
37	C					GLV									
38-55	I					TLD		TLD							

[a] Semi-monthly during the grazing season, May through October.
[b] Two varieties from each location.
[c] Cattlefeed collected during the 1st quarter grass collected during 3rd quarter.
[d] Two species from each location.

Table 4.3. Sample codes used in Table 4.2.

Code	Description
AP	Airborne Particulate
AI	Airborne Iodine
TLD (M)	Thermoluminescent Dosimeter - Monthly
TLD (Q)	Thermoluminescent Dosimeter - Quarterly
M	Milk
WW	Well Water (Ground Water)
ME	Domestic Meat
VE	Fruits and Vegetables
GLV	Green Leafy Vegetables
AF	Animal Feed (silage, grain, grass)
SMW	Smartweed
SWT	Surface Water - Treated
SWU	Surface Water - Untreated
F	Fish
BS	Bottom Sediments
SO	Soil
WL	Wildlife (muskrat or raccoon)
ST	Snapping Turtle
WF	Water fowl (goose)

Table 4.4. Sampling summary.

Sample Type	Collection Type and Frequency[a]	Number of Locations	Number of Samples Collected	Number of Samples Missed	Remarks
Air Environment					
Airborne particulates	C/W	11	563[b]	20	See text p. 3.2-7
Airborne iodine	C/W	11	563[b]	20	See text p. 3.2-7
TLDs	C/M	31	372	0	
	C/Q	31	123	1	See text p. 3.2-7
Terrestrial Environment					
Milk (May-Oct)	G/SM	3	36	0	
(Nov-Apr)	G/M	3	18	0	
Groundwater	G/Q	3	12	0	
Edible Meat					
a. Domestic meat	G/SA	2	4	0	
b. Wildlife (one species)	G/SA	1	2	0	
c. Waterfowl	G/A	1	1	0	
d. Snapping Turtle	G/A	1	1	0	
Fruits and Vegetables (two varieties from each location)	G/SA	3	12	0	
Green leafy vegetables (during harvest season)	G/M	2	6	0	
Animal-wildlife feed					
a. Cattlefeed	G/A	2	2	0	Collected 1st Q
b. Grass or corn	G/A	2	2	0	Collected 3rd Q
c. Smartweed	G/A	1	1	0	
Soil	G/A	11	11	0	
Aquatic Environment					
Treated surface water	G/WM	3	156[b]	0	
Untreated surface water	G/WM	3	153[b]	3	See text p. 3.2-7
	G/HM	1	52[b]	0	
Fish (two species)	G/SA	2	8	0	
Bottom sediments	G/SA	3	6	0	

[a] Type of collection is coded as follows: C/ = continuous; G/ = grab. Frequency is coded as follows: /HM = hourly grab composited monthly; /WM = weekly grab composited monthly; /W = weekly; /SM = semi-monthly; /M = monthly; /Q = quarterly, /SA = semi-annually; /A = annually.

[b] Samples are sent to laboratory weekly.

Table 4.5 Environmental Radiological Monitoring Program Summary.
Name of facility Davis-Besse Nuclear Power Station Docket No. 50-346
Location of facility Ottawa, Ohio (County, state) Reporting period January - December 1982

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Airborne Particulates (pCi/m³)	GB	563[f]	0.002[g]	0.024 (298/302) (0.006-0.073)	T-23, Put-in-Bay Lighthouse 14.3 mi ENE	0.026 (48/53) (0.010-0.066)	0.022 (255/261) (0.008-0.066)	0
	Sr-89	8	0.0005	<LLD	-	-	<LLD	0
	Sr-90	8	0.0002	<LLD	-	-	<LLD	0
	GS	8						
	Be-7		0.0054	0.058 (4/4) (0.057-0.065)	NA[h]		0.075 (4/4) (0.065-0.089)	0
	K-40		0.0068	<LLD	-	-	<LLD	0
	Nb-95		0.0006	<LLD	-	-	<LLD	0
	Zr-95		0.0013	<LLD	-	-	<LLD	0
	Ru-103		0.0012	<LLD	-	-	<LLD	0
	Ru-106		0.0031	<LLD	-	-	<LLD	0
	Cs-134		0.0004	<LLD	-	-	<LLD	0
	Cs-137		0.0005	<LLD	-	-	<LLD	0
	Ce-141		0.0020	<LLD	-	-	<LLD	0
	Ce-144		0.0028	0.005 (1/4)	NA	-	<LLD	0
Airborne Iodine (pCi/m³)	I-131	563	0.02[i]	<LLD	-	-	<LLD	0
TLD (Monthly) (mrem/91 days)	Gamma	156	1.0	13.5 (84/84) (9.3-18.9)	T-8, Earl Moore Farm 2.7 mi WSW	17.8 (12/12) (16.5-18.9)	14.4 (72/72) (10.5-17.4)	0
TLD (Quarterly) (mrem/91 days)	Gamma	52	1.0	14.0 (28/28) (9.2-21.3)	T-8, Earl Moore Farm 2.7 mi WSW	19.3 (4/4) (18.4-21.3)	15.5 (24/24) (10.0-20.5)	0

Table 4.5 (continued)
Name of Facility Davis-Besse Nuclear Power Station

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
TLD (Monthly)[i] (mrem/91 dyas) (Inner Ring Site Boundary)	Gamma 143	1.0	14.1 (143/143) (8.4-19.9)	T-45, Site boundary 0.5 mi WNW	19.2 (12/12) (17.9-19.9)	None	0
TLD (Quarterly) (mrem/91 days) (Inner Ring Site Boundary)	Gamma 47	1.0	[illegible].9 (47/47) (8.5-21.3)	T-45, Site boundary 0.5 mi WNW	18.9 (4/4) (14.1-21.3)	None	0
TLD (Monthly) (mrem/91 days) (Outer Ring, app. 5 mi distant)	Gamma 72	1.0	17.3 (72/72) (12.4-18.9)	T-50, Erie Industrial Park, 4.5 mi ESE of Station by Water Tower	16.3 (12/12) (14.3-18.9)	None	0
TLD (Quarterly) (mrem/91 days) (Outer Ring, app. 5 mi distant)	Gamma 24	1.0	17.6 (24/24) (12.4-22.3)	T-50, Erie Industrial Park, 4.5 mi ESE of Station by Water Tower	18.8 (4/4) (16.3-20.3)	None	0
Milk (pCi/l)	I-131 54	1.0	<LLD	-	-	<LLD	0
	Sr-89 54	1.7	<LLD	-	-	<LLD	0
	Sr-90 54	0.5[j]	1.7 (32/36) (0.6-2.6)	T-20, Gaeth Farm 5.5 mi WSW	1.8 (18/18) (1.4-2.6)	1.5 (18/18) (1.0-2.8)	0
	GS 54						
	K-40	100	1300 (36/36) (1080-1590)	T-20, Gaeth Farm 5.5 mi WSW	1330 (18/18) (1240-1590)	1310 (18/18) (1030-1820)	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Ba-140	10	<LLD	-	-	<LLD	0
(g/l)	Ca 54	0.5	1.2 (36/36) (0.9-1.4)	No highest location, all are identical	1.2 (54/54) (0.7-1.4)	1.2 (18/18) (0.7-1.4)	0
	K (stable) 54	0.04	1.52 (36/36) (1.33-1.81)	T-20, Gaeth Farm 5.5 mi WSW	1.51 (18/18) (1.38-1.81)	1.49 (18/18) (1.17-2.07)	0
(pCi/g)	Sr-90/Ca 54	0.8	1.4 (36/36) (0.9-2.2)	T-20, Gaeth Farm 5.5 mi WSW	1.5 (18/18) (0.9-2.2)	1.3 (18/18) (0.9-2.4)	0
(pCi/g)	Cs-137/K 54	9.1	<LLD	-	-	<LLD	0

Table 4.5 (continued)
Name of Facility Davis-Besse Nuclear Power Station

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Well Water (pCi/l)	GB (SS)	12	0.7	<LLD	-	-	<LLD	0
	GB (DS)	12	1.0[k]	3.3(8/8) (2.4-4.7)	T-27, Magee Marsh 5.3 mi WNW	6.8 (1/4) -	6.8 (1/4) -	0
	GB (TR)	12		3.4 (8/8) (2.7-4.7)	T-27, Magee Marsh 5.3 mi WNW	6.8 (1/4) -	6.8 (1/4) -	0
	H-3	12	330	<LLD	-	-	<LLD	0
	Sr-89	8	2.0	<LLD	-	-	<LLD	0
	Sr-90	8	1.2	<LLD	-	-	<LLD	0
	GS	8						
	Cs-137		10.0	<LLD	-	-	<LLD	0
Edible Meat (pCi/g wet)	GS	8						
	K-40		0.1	2.77 (6/6) (2.24-3.48)	T-32, Lieske Farm 3.0 mi W	2.94 (2/2) (2.58-3.30)	2.66 (2/2) (2.62-2.70)	0
	Cs-137		0.078	<LLD	-	-	<LLD	0
Fruits and Vegetables (pCi/g wet)	Sr-89	12	0.011	<LLD	-	-	<LLD	0
	Sr-90	12	0.007	<LLD	-	-	<LLD	0
	GS	12						
	K-40		0.50	1.45 (8/8) (1.02-2.93)	T-8, Earl Moore Farm 2.7 mi WSW	1.65 (4/4) (1.05-2.93)	1.38 (4/4) (0.84-1.89)	0
	Nb-95		0.036	<LLD	-	-	<LLD	0
	Zr-95		0.064	<LLD	-	-	<LLD	0
	Ru-106		0.33	<LLD	-	-	<LLD	0
	Cs-137		0.033	<LLD	-	-	<LLD	0
	Ce-141		0.093	<LLD	-	-	<LLD	0
	Ce-144		0.20	<LLD	-	-	<LLD	0

Table 4.5 (continued)
Name of Facility Davis-Besse Nuclear Power Station

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean(F) Range	Number of Non-routine Results[e]
				Location[d]	Mean(F) Range		
Green Leafy Vegetables (pCi/g wet)	I-131 6	0.023	<LLD	-	-	<LLD	0
	GS 6						
	K-40	0.1	1.49 (3/3) (1.33-1.59)	T-37, Fruit Stand 12.0 mi SW	1.60 (3/3) (1.41-1.78)	1.60 (3/3) (1.41-1.78)	0
	Nb-95	0.026	<LLD	-	-	<LLD	0
	Zr-95	0.036	<LLD	-	-	<LLD	0
	Cs-137	0.028	<LLD	-	-	<LLD	0
	Ce-141	0.031	<LLD	T-37, Fruit Stand 12.0 mi SW	0.078 (1/3) -	0. 078 (1/3) -	0
	Ce-144	0.14	<LLD	-	-	<LLD	0
Animal-Wildlife Feed (pCi/g wet)	GS 5						
	Be-7	1.33	<LLD	-	-	<LLD	0
	K-40	0.1	2.10 (3/3) (1.10-2.86)	T-31, Onsite 0.6 mi NE	2.86 (1/1) -	2.04 (2/2) (1.27-2.80)	0
	Nb-95	0.15	<LLD	-	-	<LLD	0
	Zr-95	0.25	<LLD	-	-	<LLD	0
	Ru-103	0.18	<LLD	-	-	<LLD	0
	Cs-137	0.11	<LLD	-	-	<LLD	0
	Ce-141	0.27	<LLD	-	-	<LLD	0
	Ce-144	0.62	<LLD	-	-	<LLD	0
Soil (pCi/g dry)	GS 11						
	Be-7	1.5	<LLD	T-9, Oak Harbor 6.8 mi SW	1.54 (1/1) -	1.54 (1/5) -	0
	K-40	1.0	17.2 (6/6) (11.5-24.6)	T-9, Oak Harbor 1.8 mi SW	25.4 (1/1) -	21.0 (5/5) (12.1-25.4)	0
	Zr-95	0.13	<LLD	-	-	<LLD	0
	Nb-95	0.10	<LLD	-	-	<LLD	0

Table 4.5 (continued)
Name of Facility Davis-Besse Nuclear Power Station

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Soil (pCi/g dry) (cont'd)	Ru-103	0.16	<LLD	-	-	<LLD	0
	Ru-106	0.67	<LLD	-	-	<LLD	0
	Cs-137	0.048	0.246 (3/6) (0.163-0.292)	T-23, Put-in-Bay 14.3 mi ENE	0.986 (1/1) -	0.705 (5/5) (0.385-0.986)	0
	Ce-141	0.14	<LLD	-	-	<LLD	0
	Ce-144	0.34	<LLD	-	-	<LLD	0
Treated Surface Water (pCi/l)	GB (SS) 36	0.9	<LLD	-	-	<LLD	0
	GB (DS) 36	1.0	2.3 (12/12) (1.1-3.2)	T-11, Port Clinton 9.5 mi SE	2.7 (12/12) (2.1-3.8)	2.6 (24/24) (1.7-3.8)	0
	GB (TR) 36	1.0	2.3 (12/12) (1.1-3.2)	T-11, Port Clinton 9.5 mi SE	2.8 (12/12) (2.1-3.8)	2.6 (24/24) (1.7-3.8)	0
	H-3 12	330	<LLD	T-12, Toledo Tap 23.5 mi WNW	370 (2/4) (340-400)	370 (4/8) (340-400)	0
	Sr-89 8	3.2	<LLD	-	-	<LLD	0
	Sr-90 8	1.7	<LLD	-	-	<LLD	0
	GS 8						
	Cs-137	10.0	<LLD	-	-	<LLD	0
Untreated Surface Water (pCi/l)	GB (SS) 47	1.0	1.8 (2/23) (1.2-2.3)	T-3, Lake Erie Site boundary, 1.4 mi SE of Station near Toussaint R. and storm drain	1.8 (2/11) (1.2-2.3)	<LLD	0
	GB (DS) 47	1.0	3.1 (23/23) (1.8-3.8)	T-3, (see above)	3.1 (11/11) (2.2-3.7)	2.9 (24/24) (2.1-3.8)	0
	GB (TR) 47	1.0	3.4 (23/23) (1.8-5.5)	T-3 (see above)	3.6 (11/11) (2.2-5.5)	3.0 (24/24) (2.2-4.2)	0
	H-3 16	330	<LLD	T-12, Toledo Tap 23.5 mi WNW	430 (1/4) -	420 (3/8) (410-430)	0
	Sr-89 8	2.1	<LLD	-	-	<LLD	0

Table 4.5 (continued)
Name of Facility Davis-Besse Nuclear Power Station

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean(F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean(F) Range	Number of Non-routine Results[e]
				Location[d]	Mean(F) Range		
Untreated Surface Water (pCi/l)	Sr-90 8	0.3	0.8 (4/4) (0.6-1.0)	NA	NA	0.9 (4/4) (0.4-1.4)	0
	GS 8						
	Cs-137	7.8	<LLD	-	-	<LLD	0
Fish (pCi/g wet)	GB 8	0.1	2.84 (4/4) (2.10-3.20)	T-35, Lake Erie 15 mi NE	3.13 (4/4) (2.76-3.38)	3.13 (4/4) (2.76-3.38)	0
	GS 8						
	K-40	0.1	2.81 (4/4) (2.59-3.02)	T-33, Lake Erie 1.5 mi NE	2.81 (4/4) (2.59-3.02)	2.77 (4/4) (2.48-3.36)	0
	Cs-137	0.040	<LLD	-	-	<LLD	0
Bottom Sediments (pCi/g dry)	GB 6	1.0	19.3 (4/4) (17.2-22.6)	T-27, Magee Marsh 5.3 mi WNW	20.5 (2/2) (20.0-21.1)	20.5 (2/2) (20.0-21.1)	0
	Sr-89 6	0.041	0.081 (1/4) -	T-30, Lake Erie Discharge Area 0.9 mi ENE	0.081 (1/1) -	0.063 (1/1) -	0
	Sr-90 6	0.005	0.028 (4/4) (0.015-0.048)	T-29, Lake Erie Intake Area 1.5 mi NE	0.031 (2/2) (0.015-0.048)	0.016 (2/2) (0.010-0.021)	0
	GS 6						
	K-40	0.1	14.0 (4/4) (13.1-15.5)	T-27, Magee Marsh 5.3 mi WNW	15.3 (2/2) (14.1-16.5)	15.3 (2/2) (14.1-16.5)	0
	Cs-137	0.056	<LLD	T-27, Magee Marsh 5.3 mi WNW	0.124 (1/2) -	0.124 (1/2) -	0

[a] GB = gross beta, SS = suspended solids, DS = dissolved solids, TR = total residue.
[b] LLD = nominal lower limit of detection based on 3 sigma counting error for background sample.
[c] Mean based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (F).
[d] Locations are specified by station code (Table 4.1) and distance (miles) and direction relative to reactor site.
[e] Non-routine results are those which exceed ten times the control station value.
[f] Five results have been excluded in the determination of the means and ranges of gross beta in air particulates. The results were unreliable due to pump malfunction.
[g] Three results have been excluded in the determination of the LLD for gross beta. Higher than norman LLD's resulted from pump malfunction or low volume.
[h] Quarterly composites of all samples from indicator locations and control locations were gamma scanned separately. Thus, the location with the highest annual mean cannot be identified.
[i] Thirty-eight results have been excluded in the determination of the LLD of airborne iodine-131. These results have been excluded due to apparent pump malfunction or low volume.
[j] Two high LLD values of 1.2 and two LLD values of 1.1 and 1.0 resulting from low chemical recovery have been excluded from determination of LLD.
[k] Three high LLD values (4.9, 7.2, and 7.3 pCi/l) have been excluded from the determination of LLD. High values resulted from high dissolved solids content necessitating the use of small volume for analysis.

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Appendix A

Crosscheck Program Results

Appendix A

Crosscheck Program Results

The Nuclear Sciences Department of Hazleton Environmental Sciences has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental-type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentrations of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk and water samples during the period 1975 through 1982. This program has been conducted by the U. S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for thermoluminescent dosimeters (TLD's) during the period 1976, 1977, 1979, 1980, and 1981 through participation in the Second, Third, Fourth, and Fifth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Hazleton ES results for milk and water samples, 1975 through 1982[a].

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STM-40	Milk	Jan. 1975	Sr-89	<2	0±15
			Sr-90	73±2.5	75±11.4
			I-131	99±4.2	101±15.3
			Cs-137	76±0.0	75±15
			Ba-140	<3.7	0±15.0
			K(mg/l)	1470±5.6	1510±228
STW-45	Water	Apr. 1975	Cr-51	<14	0
			Co-60	421±6	425±63.9
			Zn-65	487±6	497±74.7
			Ru-106	505±16	497±74.7
			Cs-134	385±3	400±60.0
			Cs-137	468±3	450±67.5
STW-47	Water	Jun. 1975	H-3	1459±144	1499±1002
STW-48	Water	Jun. 1975	H-3	2404±34	2204±1044
STW-49	Water	Jun. 1975	Cr-51	<14	0
			Co-60	344±1	350±53
			Zn-65	330±5	327±49
			Ru-106	315±7	325±49
			Cs-134	291±1	304±46
			Cs-137	387±2	378±57
STW-53	Water	Aug. 1975	H-3	3317±64	3200±1083
STW-54	Water	Aug. 1975	Cr-51	223±11	225±38
			Co-60	305±1	307±46
			Zn-65	289±3	281±42
			Ru-106	346±5	279±57
			Cs-134	238±1	256±38
			Cs-137	292±2	307±46
STW-58	Water	Oct. 1975	H-3	1283±80	1203±988

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ , n=1[d]
STM-61	Milk	Nov. 1975	Sr-90	68.9±2.1	74.6±11.2
			I-131	64.6±3.8	75±15
			Cs-137	75.6±20	75±15
			Ba-140	<3.7	0
			K(Mg/l)	1435±57	1549±233
STW-63	Water	Dec. 1975	H-3	1034±39	1002±972
STW-64	Water	Dec. 1975	Cr-51	<14	0
			Co-60	221±1	203±30.5
			Zn-65	215±6	201±30.2
			Ru-106	171±9	181±27.2
			Cs-134	198±2	202±30.3
			Cs-137	152±4	151±22.7
STW-68	Water	Feb. 1976	H-3	1124±31	1080±978
STW-78	Water	Jun. 1976	H-3	2500±44	2502±1056
STW-84	Water	Aug. 1976	H-3	3097±21	3100±1080
STM-91	Milk	Nov. 1976	I-131	83±0.6	85±15
			Ba-140	<4	0
			Cs-137	12±1.7	11±15
			K(mg/l)	1443±31	1510±228
STW-93	Water	Dec. 1976	Cr-51	105±15	104±15
			Co-60	<4	0
			Zn-65	97±4	102±15
			Ru-106	87±3	99±15
			Cs-134	85±4	93±15
			Cs-137	103±4	101±15
STW-94	Water	Dec. 1976	H-3	2537±15	2300±1049
STM-97	Milk	Mar. 1977	I-131	55±2.5	51±15
			Ba-140	<6	0
			Cs-137	34±1	29±15
			K(mg/l)	1520±35	1550±233
STW-101	Water	Apr. 1977	H-3	1690±62	1760±1023

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STM-130	Milk	May 1977	Sr-89	38±2.6	44±15
			Sr-90	12±2.1	10±4.5
			I-131	59±2.1	50±15
			Ba-140	53±4.4	72±15
			Cs-137	14±1.2	10±15
			K(mg/l)	1533±21	1560±234
STW-105	Water	Jun. 1977	Cr-51	<14	0
			Co-60	29±1	29±15
			Zn-65	74±7	74±15
			Ru-106	64±8	62±15
			Cs-134	41±1	44±15
			Cs-137	35±3	35±15
STW-107	Water	Jun. 1977	Ra-226	4.7±0.3	5.1±2.42
STW-113	Water	Aug. 1977	Sr-89	13±0[e]	14±15
			Sr-90	10±2[e]	10±4.5
STW-116	Water	Sep.1977	Gross Alpha	12±6	10±15
			Gross Beta	32±6	30±15
STW-118	Water	Oct. 1977	H-3	1475±29	1650±1017
STW-119	Water	Oct. 1977	Cr-51	132±14	153±24
			Co-60	39±2	38±15
			Zn-65	51±5	53±15
			Ru-106	63±6	74±15
			Cs-134	30±3	30±15
			Cs-137	26±1	25±15
STW-136	Water	Feb. 1978	H-3	1690±270	1680±1020
STW-137	Water	Feb. 1978	Cr-51	<27	0
			Co-60	36±2	34±15
			Zn-65	32±4	29±15
			Ru-106	41±2	36±15
			Cs-134	47±2	52±15
			Cs-137	<2	0

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-138g	Water	Mar. 1978	Ra-226	5.4±0.1	5.5±0.6
			Ra-228	NA[f]	16.7±2.5
STW-150	Water	Apr. 1978	H-3	2150±220	2220±1047
STW-151	Water	Apr. 1978	Gross Alpha	20±1	20±15
			Gross Beta	56±4	59±15
			Sr-89	19±2	21±15
			Sr-90	8±1	10±4.5
			Co-60	19±3	20±15
			Cs-134	16±1	15±15
			Cs-137	<2	0
STM-152	Milk	Apr.1978	Sr-89	85±4	101±15
			Sr-90	8±1	9±4.5
			I-131	78±1	82±15
			Cs-137	29±3	23±15
			Ba-140	<11	0
			K(mg/l)	1503±90	1500±225
STW-154g	Water	May 1978	Gross Alpha	12±1	13±15
			Gross Beta	21±4	18±15
STW-157g	Water	Jun. 1978	Ra-226	4.0±1.0	3.7±0.6
			Ra-228	NA[f]	5.6±0.8
STW-159g	Water	Jul. 1978	Gross Alpha	19±3	22±6
			Gross Beta	28±3	30±5
STW-162	Water	Aug. 1978	H-3	1167±38	1230±990
STW-165g	Water	Sep. 1978	Gross Alpha	4±1	5±5
			Gross Beta	13±1	10±5

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STW-167	Water	Oct. 1978	Gross Alpha	19±2	19±15
			Gross Beta	36±2	34±15
			Sr-89	9±1	10±15
			Sr-90	4±0	5±2.4
			Ra-226	5.5±0.3	5.0±2.4
			Ra-228	NA[f]	5.4±2.4
			Cs-134	10±1	10±15
			Cs-137	15±1	13±15
STW-170	Water	Dec. 1978	Ra-226	11.5±0.6	9.2±1.4
			Ra-228	NA[f]	8.9±4.5
STW-172	Water	Jan. 1979	Sr-89	11±2	14±15
			Sr-90	5±2	6±4.5
STW-175	Water	Feb. 1979	H-3	1344±115	1280±993
STW-176	Water	Feb. 1979	Cr-51	<22	0
			Co-60	10±2	9±15
			Zn-65	26±5	21±15
			Rn-106	<16	0
			Cs-134	8±2	6±15
			Cs-137	15±2	12±15
STW-178	Water	Mar. 1979	Gross Alpha	6.3±3	10±15
			Gross Beta	15±4	16±15
STW-195g	Water	Aug. 1979	Gross Alpha	6.3±1.2	5±5
			Gross Beta	42.7±7.0	40±4
STW-193	Water	Sep. 1979	Sr-89	5.0±1.2	3.0±1.5
			Sr-90	25.0±2.7	28.0±4.5
STW-196	Water	Oct. 1979	Cr-51	135±5.0	113±18
			Co-60	7.0±1.0	6±5
			Cs-134	7.3±0.6	7±15
			Cs-137	12.7±1.2	11±15
STW-198	Water	Oct. 1979	H-3	1710±140	1560±1111

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STW-199	Water	Oct. 1979	Gross Alpha	16.0±3.6	21±15
			Gross Beta	36.3±1.2	49±15
			Sr-89	10.7±0.6	12±15
			Sr-90	5.7±0.6	7±15
			Ra-226	11.1±0.3	11±5
			Ra-228	1.6±0.7	0
			Co-60	35.0±1.0	33±15
			Cs-134	50.7±2.3	56±15
			Cs-137	<3	0
STW-206	Water	Jan. 1980	Gross Alpha	19.0±2.0	30.0±8.0
			Gross Beta	48.0±2.0	45.0±5.0
STW-208	Water	Jan. 1980	Sr-89	6.1±1.2	10.0±0.5
			Sr-90	23.9±1.1	25.5±1.5
STW-209	Water	Feb. 1980	Cr-51	112±14	101±5.0
			Co-60	12.7±2.3	11±5.0
			Zn-65	29.7±2.3	25±5.0
			Ru-106	71.7±1.5	51±5
			Cs-134	12.0±2.0	10±5.0
			Cs-137	30.0±2.7	30±5.0
STW-210	Water	Feb. 1980	H-3	1800±120	1750±340
STW-211	Water	March 1980	Ra-226	15.7±0.2	16.0±2.4
			Ra-228	3.5±0.3	2.6±0.4
STM-217	Milk	May 1980	Sr-89	4.4±2.6[g]	5±5
			Sr-90	10.0±1.0	12±1.5
STW-221	Water	June 1980	Ra-226	2.0±0.0	1.7±0.8
			Ra-228	1.6±0.1	1.7±0.8

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STW-223	Water	July 1980	Gross Alpha	31±3.0	38±5.0
			Gross Beta	44±4	35±5.0
STW-224	Water	July 1980	Cs-137	33.9±0.4	35±5.0
			Ba-140	<12	0
			K-40	1350±60	1550±78
			I-131	<5.0	0
STW-225	Water	Aug. 1980	H-3	1280±50	1210±329
STW-226	Water	Sept. 1980	Sr-89	22±1.2	24±8.6
			Sr-90	12±0.6	15±2.6
STW-228	Water	Sept. 1980	Gross Alpha	NA[f]	32.0±8.0
			Gross Beta	22.5±0.0	21.0±5.0
STW-235	Water	Dec. 1980	H-3	2420±30	2240±604
STW-237	Water	Jan. 1981	Sr-89	13.0±1.0	16±8.7
			Sr-90	24.0±0.6	34±2.9
STM-239	Milk	Jan. 1981	Sr-89	<210	0
			Sr-90	15.7±2.6	20±3.0
			I-131	30.9±4.8	26±10.0
			Cs-137	46.9±2.9	43±9.0
			Ba-140	<21	0
			K-40	1330±53	1550±134
STW-240	Water	Jan. 1981	Gross alpha	7.3±2.0	9±5.0
			Gross beta	41.0±3.1	44±5.0
STW-243	Water	Mar. 1981	Ra-226	3.5±0.06	3.4±0.5
			Ra-228	6.5±2.3	7.3±1.1

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STW-245	Water	Apr. 1981	H-3	3210±115	2710±355
STW-249	Water	May 1981	Sr-89	51±3.6	36±8.7
			Sr-90	22.7±0.6	22±2.6
STW-251	Water	May 1981	Gross alpha	24.0±5.29	21±5.25
			Gross beta	16.1±1.9	14±5.0
STW-252	Water	Jun. 1981	H-3	2140±95	1950±596
STW-255	Water	Jul. 1981	Gross alpha	20±1.5	22±9.5
			Gross beta	13.0±2.0	15±8.7
STW-259	Water	Sep. 1981	Sr-89	16.1±1.0	23±5
			Sr-90	10.3±0.9	11±1.5
STW-265	Water	Oct. 1981	Gross alpha	71.2±19.1	80±20
			Gross beta	123.3±16.6	111±5.6
			Sr-89	14.9±2.0	21±5
			Sr-90	13.1±1.7	14.4±1.5
			Ra-226	13.0±2.0	12.7±1.9
STW-269	Water	Dec. 1981	H-3	2516±181	2700±355
STW-270	Water	Jan. 1982	Sr-89	24.3±2.0	21.0±5.0
			Sr-90	9.4±0.5	12.0±1.5
STW-273	Water	Jan. 1982	I-131	8.6±0.6	8.4±1.5
STW-275	Water	Feb. 1982	H-3	1580±147	1820±342
STW-276	Water	Feb. 1982	Cr-51	<61	0
			Co-60	26.0±3.7	20±5
			Zn-65	<13	15±5
			Ru-106	<46	20±5
			Cs-134	26.8±0.7	22±5
			Cs-137	29.7±1.4	23±5
STW-277	Water	Mar. 1982	Ra-226	11.9±1.9	11.6±1.7
STW-278	Water	Mar. 1982	Gross alpha	15.6±1.9	19±5
			Gross beta	19.2±0.4	19±5

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ , n=1[d]
STW-280	Water	Apr. 1982	H-3	2690±80	2860±360
STW-281	Water	Apr. 1982	Gross alpha	75±7.9	85±21
			Gross beta	114.1±5.9	106±5.3
			Sr-89	17.4±1.8	24±5
			Sr-90	10.5±0.6	12±1.5
			Ra-226	11.4±2.0	10.9±1.5
			Co-60	<4.6	0
STW-284	Water	May 1982	Gross alpha	31.5±6.5	27.5±7
			Gross beta	25.9±3.4	29±5
STW-285	Water	June 1982	H-3	1970±1408	1830±340
STW-286	Water	June 1982	Ra-226	12.6±1.5	13.4±3.5
			Ra-228	11.1±2.5	8.7±2.3
STW-287	Water	June 1982	I-131	6.5±0.3	4.4±0.7
STW-290	Water	Aug. 1982	H-3	3210±140	2890±619
STW-291	Water	Aug. 1982	I-131	94.6±2.5	87±15
STW-292	Water	Sept 1982	Sr-89	22.7±3.8	24.5±8.7
			Sr-90	10.9±0.3	14.5±2.6
STW-296	Water	Oct. 1982	Co-60	20.0±1.0	20±8.7
			Zn-65	32.3±5.1	24±8.7
			Cs-134	15.3±1.5	19.0±8.7
			Cs-137	21.0±1.7	20.0±8.7
STW-297	Water	Oct. 1982	H-3	2470±20	2560±612
STW-298	Water	Oct. 1982	Gross alpha	32±30	55±24
			Gross beta	81.7±6.1	81±8.7
			Sr-89	<2	0
			Sr-90	14.1±0.9	17.2±2.6
			Cs-134	<2	1.8±8.7
			Cs-137	22.7±0.6	20±8.7
			Ra-226	13.6±0.3	12.5±3.2
			Ra-228	3.9±1.0	3.6±0.9

Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l[b] HES Result ±2σ [c]	EPA Result ±3σ, n=1[d]
STW-301	Water	Nov. 1982	Gross alpha	12.0±1.0	19.0±8.7
			Gross beta	34.0±2.7	24.0±8.7
STW-302	Water	Dec. 1982	I-131	40.0±0.0	37.0±10

[a]Results obtained by the Nuclear Sciences Department of Hazleton Environmental Sciences as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, (EPA), Las Vegas, Nevada.

[b]All results are in pCi/l, except for elemental potassium (K) data which are in mg/l.

[c]Unless otherwise indicated, the HES results given as the mean ±2σ standard deviations for three determinations.

[d]USEPA results are presented as the known values ± control limits of 3σ for n=1.

[e]Mean ± 2σ standard deviations of two determinations.

[f]NA = Not analyzed.

[g]Analyzed but not reported to the EPA.

Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLD's).

Lab Code	TLD Type	Measurement	mR: Hazleton Result ±2σ [a]	mR: Known Value	mR: Average ±2σ [d] (all participants)
2nd International Intercomparison[b]					
115-2[b]	CaF_2:Mn Bulb	Gamma-Field	17.0±1.9	17.1[c]	16.4±7.7
		Gamma-Lab	20.8±4.1	21.3[c]	18.8±7.6
3rd International Intercomparison[e]					
115-3[e]	CaF_2:Mn Bulb	Gamma-Field	30.7±3.2	34.9±4.8[f]	31.5±3.0
		Gamma-Lab	89.6±6.4	91.7±14.6[f]	86.2±24.0
4th International Intercomparison[g]					
115-4[g]	CaF_2:Mn Bulb	Gamma-Field	14.1±1.1	14.1±1.4[f]	16.09.0
		Gamma-Lab (Low)	9.3±1.3	12.2±2.4[f]	12.0±7.6
		Gamma-Lab (High)	40.4±1.4	45.8±9.2[f]	43.9±13.2
5th International Intercomparison[h]					
115-5A[h]	CaF_2:Mn Bulb	Gamma-Field	31.4±1.8	30.0±6.0[i]	30.2±14.6
		Gamma-Lab at beginning	77.4±5.8	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	96.6±5.8	88.4±8.8[i]	90.7±31.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	mR: Hazleton Result ±2σ[a]	Known Value	Average ± 2σ[d] (all participants)
115-5B[h]	LiF-100 Chips	Gamma-Field	30.3±4.8	30.0±6[i]	30.2±14.6
		Gamma-Lab at beginning	81.1±7.4	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	85.4±11.7	88.4±8.8[i]	90.7±131.2

[a]Lab result given is the mean ±2σ standard deviations of three determinations.
[b]Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.
[c]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[d]Mean ±2σ standard deviations of results obtained by all laboratories participating in the program.
[e]Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.
[f]Value ±2σ standard deviations as determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[g]Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.
[h]Fifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.
[i]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

1982 LAND-USE AND MILK ANIMAL CENSUS

by

Gary Downing

and

Kelly Clayton

TOLEDO EDISON COMPANY

DAVIS-BESSE NUCLEAR POWER STATION

DECEMBER 1982

PURPOSE

The Toledo Edison Company performs an annual land-use and milk animal census to satisfy the requirements of Section 3.2 of Appendix B Davis-Besse Technical Specifications and Section IV B.3 of Appendix I, 10CFR50. The location of all dairy cows, meat animals and vegetable gardens within 5 miles of the Davis-Besse Nuclear Power Station were determined. Locations of dairy goats within a 15-mile radius were also determined.

BACKGROUND AND METHODS

Appendix I to 10CFR50 states "The licensee shall establish an appropriate surveillance and monitoring program for evaluating doses to individuals from principal pathways of exposure." Appendix B to Davis-Besse Technical Specifications states "An annual census of animals producing milk for human consumption shall be conducted at the start of the grazing season to determine their location and number with respect to the site". Pathways are defined as any means by which radionuclides can get into the human food chain. Pathways recorded in the land-use and milk animal census are residences, vegetable gardens, milk animals and beef animals. The dose is determined by: (1) release rate - the actual amount released to the environment; (2) meteorology - the actual meteorological conditions during the time of release (includes atmospheric stability class, wind velocity and wind direction).

A preliminary land-use census was done in September, 1981. The 1982 land-use census field work was done June 15 - June 18, 1982, while the milk animal census was done May 25 and 27, 1982. Local agencies such as the Goat Dairyman Association, and the Ottawa County and Sandusky County Cooperative Extension Agencies provided lists of dairy animal owners in their areas. The Ottawa County agency confirmed the presence of all beef cattle, milk cows and milk goats reported within the 5-mile radius of the station.

RESULTS

The results of the 1982 land-use and milk animal census are presented in Table 1.

REFERENCES

Nuclear Regulatory Commission, 1982

Code of Federal Regulations" 10CFR Part 50, Appendix I, Section IV B.3

Nuclear Regulatory Commission, 1979

"Davis-Besse Unit No. 1 Technical Specifications". Appendix B to License No. NPF-3

Nuclear Regulatory Commission, 1979

"Radiological Effluent Technical Specifications for PWR's". NUREG 0472

NUS Corporation, June 4, 1976

"Davis-Besse Nuclear Power Station Unit No. 1" Evaluation of Compliance with Appendix I to 10CFR50

TABLE 1

PATHWAY IDENTIFICATION

Sector	Distance (meters)	Receptor
N	870	residence
NNE	870	residence
NE	900	residence
ENE *	---	-----
E *	---	-----
ESE *	---	-----
SE *	---	-----
SSE	2030	residence
	2680	residence, vegetable garden
	7320	residence, vegetable garden, dairy goat
S	1130	residence
	1610	residence, vegetable garden
	4420	residence, vegetable garden, beef cattle
SSW	1000	residence, vegetable garden
	1610	residence, vegetable garden, beef cattle
	5270	residence, vegetable garden, dairy goat
SW	990	residence, vegetable garden
	4970	residence, vegetable garden, beef cattle
WSW	2650	residence, vegetable garden
	4250	residence, vegetable garden, dairy cow
W	980	residence, vegetable garden, beef cattle
WNW	1730	residence
	2830	residence, vegetable garden
NW	1160	residence
	2210	residence, vegetable garden
NNW	1250	residence, vegetable garden

*Sectors over Lake Erie and marsh areas

Evaluation of Compliance With
Appendix I to 10CFR50: Updated
Population, Agricultural, Meat-Animal,
and Milk Production Data Tables
for 1982

Prepared by

Kelly L. Clayton

PURPOSE

Within the guidelines of Appendix I to 10CFR50 are recommendations to perform a survey of the 50-mile region surrounding any nuclear power reactor. This survey should determine the number of people, meat-animals, milk-animals, and crop production for this region. These factors were determined to be key receptors in an environmental assessment of the effects of a nuclear power station on the environment.

Therefore, Toledo Edison personnel have updated data tables containing the following information for the Davis-Besse Nuclear Power Station: population, annual vegetation production, annual meat production, and annual milk production. The main purpose of updating this information is to incorporate the results of the 1980 United States Census statistics now available.

METHODS

Several methods were used to determine the distribution of population; annual crop production, meat production, and milk production for a 50-mile region surrounding the Davis-Besse Nuclear Power Station. First, the 50-mile region was divided into 160 subregions (segments) formed by sectors centered on the 16 cardinal compass directions and annuli of 0-1, 1-2, 2-3, 3-4, 4-5, 5-10, 10-20, 20-30, and 40-50 miles. The 50-mile region centered at the Davis-Besse Nuclear Power Station covers the State of Ohio, the State of Michigan, and the Province of Ontario, Canada. Sixteen counties are included within this region with 9 located in Ohio, 4 in Michigan, and 2 in Ontario. County agricultural statistics for 1981 were used in distributing crop, meat, and milk production throughout the 50-mile subregions.

Subregions located over water (Lake Erie), State or National parks, refuges, or wildlife preserves were removed from this study. In similar fashion, segments within highly urbanized areas were eliminated from agricultural distribution since crops, meat-animals, and milk-animals would be in extremely low concentrations.

Crop production throughout the entire 50-mile region was determined from county statistics. The crop statistics used for this distribution were: corn, soybeans, wheat, oats, hay, sugarbeets, tomatoes, and cucumbers. The annual meat production and milk production was determined from county statistics on beef-cattle and sheep marketed annually and the number of pounds of milk sold annually. However, county statistics were used for meat and milk production only within subregions located 5-50 miles from the station.

Due to the 0-5 mile region from the Davis-Besse Nuclear Power Station being a more critical area, an accurate distribution was important. Meat, milk, and population distribution were determined from 1982 field work data and confirmed by the Ottawa County Cooperative Agriculture Extension Agency. Meat-animal distribution was derived from the number of beef cattle located in each 0-5 mile subregion. Similarly, milk production was determined by the number of milk-cows and milk goats in each subregion. Milk production was calculated from the average daily production rates for these animals.

Population located in subregions of 0-5 miles was determined by the number of houses within each subregion. The number of houses per subregion was multiplied by the average number of individuals occupying such households (2.0). The number of individuals per household in these subregions had been previously determined by the Emergency Planning Group for their evacuation procedures. Again 1980 census statistics were used.

Finally, population distribution in 5-50 mile subregions was performed by a computer program designed by the Control Data Corporation. This program used 1980 U.S. census statistics plus 1976 Canadian population figures.

The final data on population and agricultural distribution were put into tabular form where the vertical columns represent the cardinal compass directions and the horizontal columns represent the number of miles each subregion is located from Davis-Besse Nuclear Power Station. The final results were converted into the following units: Annual vegetable production in kilograms, annual meat production in kilograms, and annual milk production in liters.

REFERENCES

Agricultural Ministry of Ontario, 1980.
"Agricultural Statistics and Livestock Marketing Account, 1980."

Agricultural Ministry of Ontario, 1980.
"Agricultural Statistics for Ontario - 1980." Publication 21, 1980.

Michigan Department of Agriculture, July, 1981.
"Michigan Agricultural Statistics, 1981.

NUS Corporation, 1976.
"Davis-Besse Nuclear Power Station, Unit No. 1, Evaluation of Compliance with Appendix I to 10CFR50, June 4, 1976.

Ohio Crop Reporting Service, 1981.
"Ohio Agricultural Statistics, 1981."

U.S. Nuclear Regulatory Commission, 1977.
"Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, October 1977." Revision 1 to Regulatory Guide 1,109.

POPULATION DATA

TABLE I.

D I S T A N C E (MILES)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	TOTAL
1	11.	0.	0.	0.	0.	0.	0.	9884.	47104.	335801.	392800
2	30.	0.	0.	0.	0.	0.	0.	11508.	13871.	12514	37923
3	4.	0.	0.	0.	0.	0.	0.	133.	12514.	12707.	25358
4	0.	0.	0.	0.	0.	0.	556.	131.	0.	0.	687
5	0.	0.	0.	0.	0.	0.	1905.	124.	0.	14282.	16311
6	0.	0.	0.	0.	0.	0.	7626.	44516.	20191.	83075.	155408
7	0.	0.	0.	0.	101.	6490.	3712.	7785.	27402.	8745.	54225
8	5.	42.	58.	75.	65.	1931.	4882.	18495.	5370.	15380.	46303
9	34.	20.	60.	43.	105.	333.	26617.	12438.	29221.	4940.	73811
10	49.	10.	35.	63.	95.	4576.	3390.	6069.	24257.	11215.	49759
11	16.	0.	36.	56.	62.	462.	8394.	9649.	6481.	46510.	71666
12	4.	6.	6.	45.	60.	1181.	4541.	7737.	39542.	10182.	63304
13	22.	58.	22.	54.	104.	831.	15254.	231753.	63179.	17601.	328878
14	1.	31.	164.	2.	9.	200.	6929.	185936.	48282.	13815.	255360
15	1.	147.	42.	0.	0.	0.	0.	44307.	14525.	18908.	77930
16	64.	20.	0.	0.	0.	0.	0.	15168.	47565.	191783.	254600
TOTAL	241	334	423	338	592	15994	83806	605633	399504	797458	1904323

VEGETABLE PRODUCTION DATA, Kilograms

TABLE II

D I S T A N C E (MILES)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	TOTAL
1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1280E+06	0.8720E+07	0.1020E+08	0.1900E+08
2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4130E+06	0.8370E+07	0.1430E+08	0.2310E+08
3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.6490E+05	0.6520E+06	0.1090E+07	0.5250E+07	0.7060E+07
4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.9900E+06	0.8090E+06	0.0000E+00	0.0000E+00	0.1800E+07
5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1440E+07	0.1570E+06	0.0000E+00	0.0000E+00	0.1600E+07
6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2210E+07	0.3800E+07	0.6940E+07	0.9410E+07	0.2240E+08
7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8690E+05	0.9570E+06	0.5710E+07	0.8360E+07	0.1200E+08	0.1060E+08	0.3770E+08
8	0.0000E+00	0.3630E+05	0.6050E+05	0.1930E+06	0.1450E+06	0.1180E+07	0.9320E+07	0.1290E+08	0.1450E+08	0.1750E+08	0.5570E+08
9	0.0000E+00	0.4950E+05	0.8030E+05	0.1130E+06	0.1450E+06	0.1370E+07	0.9320E+07	0.1260E+08	0.1580E+08	0.2000E+08	0.5950E+08
10	0.9900E+04	0.4180E+05	0.8140E+05	0.1130E+06	0.1450E+06	0.1210E+06	0.8580E+07	0.1390E+08	0.3780E+08	0.1160E+08	0.7240E+08
11	0.1650E+05	0.2860E+05	0.7810E+05	0.1130E+06	0.1450E+06	0.1210E+06	0.7910E+07	0.1410E+08	0.1910E+08	0.2300E+08	0.6460E+08
12	0.1650E+05	0.4840E+05	0.6050E+05	0.4400E+05	0.1320E+06	0.1210E+06	0.8130E+07	0.1380E+08	0.1630E+08	0.2560E+08	0.6430E+08
13	0.1650E+05	0.4950E+05	0.8140E+05	0.9900E+05	0.1440E+06	0.1100E+07	0.4970E+07	0.8550E+07	0.8500E+07	0.2330E+08	0.4680E+08
14	0.1650E+05	0.4950E+05	0.4510E+05	0.0000E+00	0.0000E+00	0.4200E+06	0.1560E+07	0.6910E+07	0.1030E+08	0.1540E+08	0.3470E+08
15	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4900E+07	0.1000E+08	0.9650E+07	0.2460E+08
16	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2250E+07	0.5050E+07	0.6300E+06	0.7930E+07
TOTAL	0.7600E+05	0.3040E+06	0.4870E+06	0.5850E+06	0.9430E+06	0.5390E+07	0.6020E+08	0.1040E+09	0.1740E+09	0.1960E+09	0.5420E+09

DAVIS-BESSE 50 MILE DEMOGRAPHIC DATA

BEEF PRODUCTION DATA, Kilograms

TABLE III

SECTOR	DISTANCE (MILES) 0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	TOTAL
1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1530E+05	0.1040E+07	0.1220E+07	0.2280E+07
2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4950E+05	0.1000E+07	0.2210E+06	0.1270E+07
3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4360E+04	0.7810E+05	0.1300E+06	0.9000E+06	0.1110E+07
4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.6650E+05	0.9700E+05	0.0000E+00	0.0000E+00	0.1640E+06
5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1270E+06	0.2500E+05	0.0000E+00	0.0000E+00	0.1520E+06
6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2170E+06	0.6050E+06	0.1090E+07	0.2280E+07	0.4190E+07
7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.6430E+05	0.6610E+06	0.1190E+07	0.1750E+07	0.1610E+07	0.5280E+07
8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.7250E+04	0.8210E+05	0.9150E+06	0.1400E+07	0.1810E+07	0.3360E+07	0.7570E+07
9	0.0000E+00	0.0000E+00	0.2900E+04	0.0000E+00	0.0000E+00	0.1020E+06	0.9150E+06	0.1380E+07	0.1840E+07	0.2650E+07	0.6890E+07
10	0.1450E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.2420E+04	0.8160E+05	0.8180E+06	0.1440E+07	0.2420E+07	0.2890E+07	0.7650E+07
11	0.0000E+00	0.0000E+00	0.0000E+00	0.6290E+04	0.0000E+00	0.8160E+05	0.7290E+06	0.1650E+07	0.1700E+07	0.2000E+07	0.6170E+07
12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8160E+05	0.6690E+06	0.1230E+07	0.1360E+07	0.2900E+07	0.6240E+07
13	0.2420E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.6440E+05	0.3390E+06	0.5950E+07	0.5400E+06	0.6030E+07	0.1290E+08
14	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1950E+05	0.7250E+05	0.6510E+06	0.1410E+07	0.3850E+07	0.6000E+07
15	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.5430E+06	0.2920E+07	0.2800E+07	0.6260E+07
16	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2500E+06	0.5420E+06	0.8360E+05	0.8760E+07
TOTAL	0.3870E+04	0.0000E+00	0.2900E+04	0.6290E+04	0.9670E+04	0.5770E+06	0.5530E+07	0.1660E+08	0.1960E+08	0.3280E+08	0.7510E+08

DAVIS-BESSE 50 MILE DEMOGRAPHIC DATA

TABLE IV

COW MILK PRODUCTION DATA, Liters

DISTANCE (MILES)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	TOTAL
1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3280E+05	0.2230E+07	0.2610E+07	0.4870E+07
2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1060E+06	0.2140E+07	0.4720E+05	0.2720E+07
3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.7690E+03	0.1670E+06	0.2790E+06	0.1060E+07	0.1510E+07
4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1170E+05	0.2070E+06	0.0000E+00	0.0000E+00	0.2190E+06
5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1080E+06	0.4500E+05	0.0000E+00	0.0000E+00	0.1530E+06
6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2890E+06	0.1090E+07	0.2130E+07	0.6700E+07	0.1020E+08
7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1130E+05	0.1020E+07	0.2400E+07	0.4860E+07	0.4400E+07	0.1270E+08
8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1500E+04	0.2420E+05	0.1300E+07	0.2340E+07	0.3900E+07	0.4860E+07	0.1240E+08
9	0.0000E+00	0.0000E+00	0.0000E+00	0.1000E+04	0.0000E+00	0.5650E+05	0.1300E+07	0.2300E+07	0.3320E+07	0.3050E+07	0.1000E+08
10	0.5000E+04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1440E+05	0.1090E+07	0.2370E+07	0.2340E+07	0.4610E+07	0.1040E+08
11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1440E+05	0.9040E+06	0.1020E+07	0.8610E+06	0.1380E+07	0.4180E+07
12	0.0000E+00	0.0000E+00	0.1750E+06	0.0000E+00	0.1750E+06	0.1440E+05	0.3920E+06	0.6090E+06	0.6240E+06	0.2010E+07	0.4000E+07
13	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.7560E+04	0.9340E+05	0.2050E+06	0.3540E+06	0.4680E+07	0.5340E+07
14	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8770E+06	0.2380E+07	0.7630E+07	0.1090E+08
15	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8400E+06	0.1730E+07	0.5520E+07	0.8090E+07
16	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3870E+06	0.1100E+07	0.6400E+07	0.7890E+07
TOTAL	0.5000E+04	0.0000E+00	0.1750E+06	0.1000E+04	0.1760E+06	0.1430E+05	0.6510E+07	0.1500E+08	0.2820E+08	0.5540E+08	0.1050E+09

BIOLOGICAL MONITORING

1982 STUDIES OF THE ASIATIC CLAM (<u>CORBICULA</u>)

ENVIRONMENTAL IMPACT APPRAISAL OF THE DAVIS-BESSE
NUCLEAR POWER STATION, UNIT 1 ON THE
AQUATIC ECOLOGY OF LAKE ERIE 1973-1979

1982 STUDIES

OF

THE ASIATIC CLAM (*CORBICULA*)

by

Jennifer Scott-Wasilk

Jeffrey S. Lietzow

Gary Downing

Kelly L. Clayton

January 1983

SUMMARY

The purposes of this investigation were to determine growth rates and patterns for the Asiatic clam (Corbicula) in Lake Erie and to determine if Corbicula had spread to any waters immediately adjacent to the Davis-Besse Nuclear Power Station.

For the growth study, clam specimens were collected once per month from the discharge of the Bay Shore Generating Station. A Needham scraper with 9mm mesh was used to collect the specimens, and a vernier caliper was used to measure the clams to the nearest tenth millimeter. Sample size ranged from 67 to 248 individuals. The 1982 results indicate that there is only one peak spawning season for this population, and it has a growth rate of about 0.1mm per day from June through September and a growth rate of less than 0.05mm per day in the colder months beginning in October.

To determine if the clam had migrated to the vicinity of Davis-Besse, the adjacent Lake Erie shoreline and the intake channel were sampled. No Corbicula specimens were found at either location.

INTRODUCTION

The Asiatic clam (Corbicula) was first noted in North America when specimens were taken from the Columbia River in 1938. The clam gradually migrated eastward (Ingram et al., 1964; Britton and Murphy, 1977), and by 1957, specimens were being collected from the Ohio River Basin (Sinclair and Isom, 1963). By 1971, the clam was found in the Atlantic drainage in Georgia and began to move northward (Fuller and Powell, 1973; Sickel, 1973, Trama, 1982). As the Asiatic clam spread, it occasionally caused blockage of industrial and municipal raw water systems (Ingram, 1959; McMahon, 1977; Goss et al., 1979; Harvey, 1981). Concern that nuclear power plants might be adversely affected caused the United States Nuclear Regulatory Commission (USNRC, 1981) to note that under certain conditions the Asiatic clam might pose a significant threat to power plants due to colonization and subsequent blockage of raw water systems. The USNRC requested that all nuclear power plants determine if the Asiatic clam was found in the source water and if there was a potential problem with flow blockage at the plants due to the clams. Since there were two recent reports of this clam being found in the western basin of Lake Erie (Detroit Edison, 1981; Clarke, 1981) we decided to conduct a survey to better quantify the distribution of the clam in the areas around the three Toledo Edison power plants. In 1981, our initial surveys revealed that Corbicula were found in the thermal plumes of the Acme and Bay Shore Generating Stations. Population densities ranged between 33 and 78 individuals per square meter. No Corbicula were found in the vicinity of the Davis-Besse Nuclear Power Station (Scott-Wasilk et al., 1982).

The monitoring program continued into 1982, and this report describes the results of that monitoring. In 1982, we continued to closely monitor the area around Davis-Besse for Corbicula. We also began a study of growth rate and patterns of the Corbicula population in the Bay Shore discharge. Bay Shore was chosen for the growth study because it has a large, apparently stable population and the discharge is readily accessible to sampling equipment and people.

Sampling was also conducted at the Acme Generating Station and the Cleveland Electric Illuminating Company's Eastlake Power Plant.

MONITORING LOCATIONS

Surveys were conducted in the vicinity of four power plants. Three plants are operating by the Toledo Edison Company - Acme Generating Station, Bay Shore Generating Station and Davis-Besse Nuclear Power Station. One plant is operated by the Cleveland Electric Illuminating Company - Eastlake Power Plant.

The Davis-Besse Nuclear Power Station is a nuclear-fueled generating facility with a net electrical capacity of 890 megawatts. It is located near Locust Point at the mouth of the Toussaint River. The condenser cooling water system is closed cycle with a natural-draft cooling tower used to dissipate heat into the atmosphere. A submerged cooling water intake crib is located about 900 meters from the shoreline. Water from the cooling tower blowdown and other plant systems is discharged through a submerged pipe 370 meters offshore in Lake Erie. The discharge is about

1200 meters from the intake and has a typical flow rate of 0.6 cubic meters per second (20 cfs). Under conditions of maximum heat discharge, the plume of water warmer then 1.6°C (3°F) above ambient covers about 3600 m^2 (0.9 acres). Approximately 30,000 m^2 (73 acres) are contained within the 0.6°C (1°F) isotherm (USNRC, 1975). The circulating water is normally chlorinated four times per day for one half hour each time.

At the Bay Shore Generating Station - a 623 megawatt coal-fired facility, the once-through condenser cooling water is discharged at a maximum flow rate of 33 cubic meters per second (1150 cfs) with a typical area of about 450,000 m^2 (112 acres) within the 2.8°C (5°F) isotherm of the thermal plume (Wapora, 1977b). Chlorination at Bay Shore is conducted twice per day for two hours each time. Bay Shore has had a continuous discharge of heated water during all seasons for the past decade. Bay Shore is located on the Maumee Bay at the mouth of the Maumee River.

The Acme Generating Station is coal-fired and has a once-through condenser cooling system. Acme is located on the Maumee River across from downtown Toledo. Since operation of Davis-Besse began, Acme has been increasingly used as a peaking station with a maximum load capacity of more than 300 megawatts. Because its load is variable, the circulating water flow rate also varies. In past years, the flow rate has been about 9 cubic meters per second (380 cfs), and a typical thermal plume contained 125,000 m^2 (31 acres) within the 2.8°C (5°F) isotherm (Wapora, 1977a). Chlorination at Acme is done twice per day for 20 minutes each time. Chlorination is not performed on weekends or when the station is off-line.

The Eastlake Power Plant is a 1300 megawatt coal-fired electric generating station with a once-through condenser cooling system. It is located on the southern shore of the central basin of Lake Erie.

LAKE ERIE ENVIRONMENT

Water temperatures in the western basin of Lake Erie remain below 4.5°C (40°F) from December through March with temperatures remaining at 0°C (32°F) for the entire months of January and February. Temperatures above 16-17°C, the temperature at which *Corbicula* spawning has been noted to begin (Gardner *et al*., 1976; Eng, 1979), occur from mid-May through September.

The thermal plumes of the power plants cause a localized alteration in this temperature scheme. In general, the water temperature in the Bay Shore thermal plume remains above 4.5°C all year long. Water temperatures in the plume above 16°C occur from April through mid-October. The benthic substrate in the Maumee Bay and River tends to be muck and silt which reflects the great quantities of agricultural runoff from the Maumee River Basin (Fraleigh *et al*., 1979). The substrate near Locust Point is sandier although there is some silt mixed in with the sand. In the central basin, the substrate is sandy with very little silt. Water clarity is higher than in the western basin. The western basin is eutrophic. The central basin is somewhat oligotrophic.

METHODS AND MATERIALS

Qualitative sampling and sampling for growth study specimens was done with a Needham scraper (after Needham and Needham, 1962) custom made by Wildlife Supply Company. Mesh size of the scraper was 9mm.

Quantitative sampling was done with a 15.4cm x 15.4cm x 22.9cm Wildco Tall Ekman Bottom Dredge. The Ekman grab removes a known area ($232cm^2$) of sediment, and the number of clams per square meter could then be determined.

Specimens for the growth study were taken at about one month intervals beginning in June, 1982. Shell size was measured with a vernier caliper to the nearest tenth millimeter across the widest part of the shell parallel to the hinge.

Growth rates were determined from the modal width from each monthly sample. The julian sampling date was then plotted against the modal shell width to obtain growth rates.

RESULTS

No Corbicula were found in the vicinity of Davis-Besse or Eastlake, and none were found in the intakes of either Acme or Bay Shore. A few specimens were collected from the Acme discharge which indicates that there is still an established population there. The majority of the specimens were collected from the Bay Shore discharge (see Table 1).

The sample distribution for the specimens collected at Bay Shore for the growth studies can be seen in Figure 1. The modal shell widths for these samples can be seen in tabular (Table 1) and graphical (Figures 1 and 2) form.

Growth rates were calculated for two separate time periods. The first period was comprised of data from the warmer months - June, July, August and September. The growth rate was 0.106mm per day ($r^2 > 0.9$). For the second period when the water temperature was colder - October, November, and December the growth rate was 0.034mm per day ($r^2 > 0.9$).

DISCUSSION

From this study, we found that the growth rate of Corbicula slowed considerably when the water temperature fell below 13°C. This finding confirms that of Eng (1979), who found that growth rate slowed below about 14°C.

The Corbicula colony in the discharge of the Bay Shore Generating Station had only one peak spawning season in the spring. No fall peak was observed. In fact, beginning in August, no specimens of shell width less than or equal to 6mm were collected. These preliminary results indicate that spawning probably ends in July in this region. This interpretation means that spawning has ceased when temperatures are about 25°C. This contradicts the statement of Gardner and coworkers (1976) in which they indicate that the Corbicula spawning season begins when the water temperature reaches approximately 16-17°C and continues until the temperature falls below that level. This finding may demonstrate a selective adaptation on the part of Corbicula for coping with the rigors of the cold temperatures of this region. McMahon (1982) believes that with its introduction into the Great Lakes (Clarke, 1981), Corbicula have probably reached the extent of their northern distribution in North America. From a survival standpoint, this mid-summer cut-off in spawning may reflect the inability of the clam larvae produced after that time to reach a size sufficient to allow for over-winter survival.

Consistent with our 1981 findings, there is no indication that Corbicula have spread beyond the confines of the plumes of the Acme or Bay Shore Generating stations. With the temperatures outside the thermal plumes of these two power plants remaining at 0°C for the entire months of January and February, no Corbicula would be expected to survive over-winter in other Lake Erie locations. Past investigations (Mattice, 1976) have found that the ultimate lower lethal temperature is about 2°C.

We found no indication that Corbicula are established in the vicinity of the Davis-Besse Nuclear Power Station.

ACKNOWLEDGEMENTS

The authors wish to thank Dr. Henry van der Schalie for his guidance in this study.

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TABLE [illegible] SAMPLING RESULTS
1982

Date	Power Plant	Location	No. of Samples	Equipment	No. of clams	Temp.	Substrate
Dec. 28, 82	Bay Shore	Discharge	~15	Needham	73	10°C	muck/ash
Nov. 30, 82	Bay Shore	Discharge	10-15	Needham	114	9°C	muck/ash
Nov. 3, 82	Bay Shore	Discharge	15	Needham	209	13°C	muck/ash
Oct. 1, 82	Bay Shore	Discharge	18	Needham	130	18°C	--
Sept. 9, 82	Eastlake	Discharge	8-10	Needham	0	25°-27°C	sand
Sept. 9, 82	Eastlake	Discharge	6	Ekman	0	25°-27°C	sand
Sept. 9, 82	Eastlake	Y-between intake & discharge	20-30	Needham	0	23°-24°C	sand
Sept. 1, 82	Bay Shore	Discharge	17	Needham	248	23°-25°C	sand/silt
Sept. 1, 82	Acme	Discharge	7	Needham	~15	30°C	rocky
Aug. 16, 82	Davis-Besse	Intake	11	Ekman	0	25°C	muck/silt/clay
Aug. 16, 82	Davis-Besse	Lake Erie shore	7	Needham	0	25°C	sandy
Aug. 2, 82	Bay Shore	Discharge	6	Ekman	6	25°C	muddy sand/silt
Aug. 2, 82	Bay Shore	Intake Channel	6	Ekman	0	23°C	very clayey muck
Aug. 2, 82	Acme	Discharge	4	Ekman	0	26°C	rocky
Aug. 2, 82	Bay Shore	Discharge	--	Needham	118	25°C	mud/silt/clay
July 7, 82	Bay Shore	Discharge	9	Ekman	16	24°C	sandy/clay
July 7, 82	Bay Shore	Discharge	30-50	Needham	144	24°C	clay/sandy/ash

TABLE 1. SAMPLING RESULTS
1982

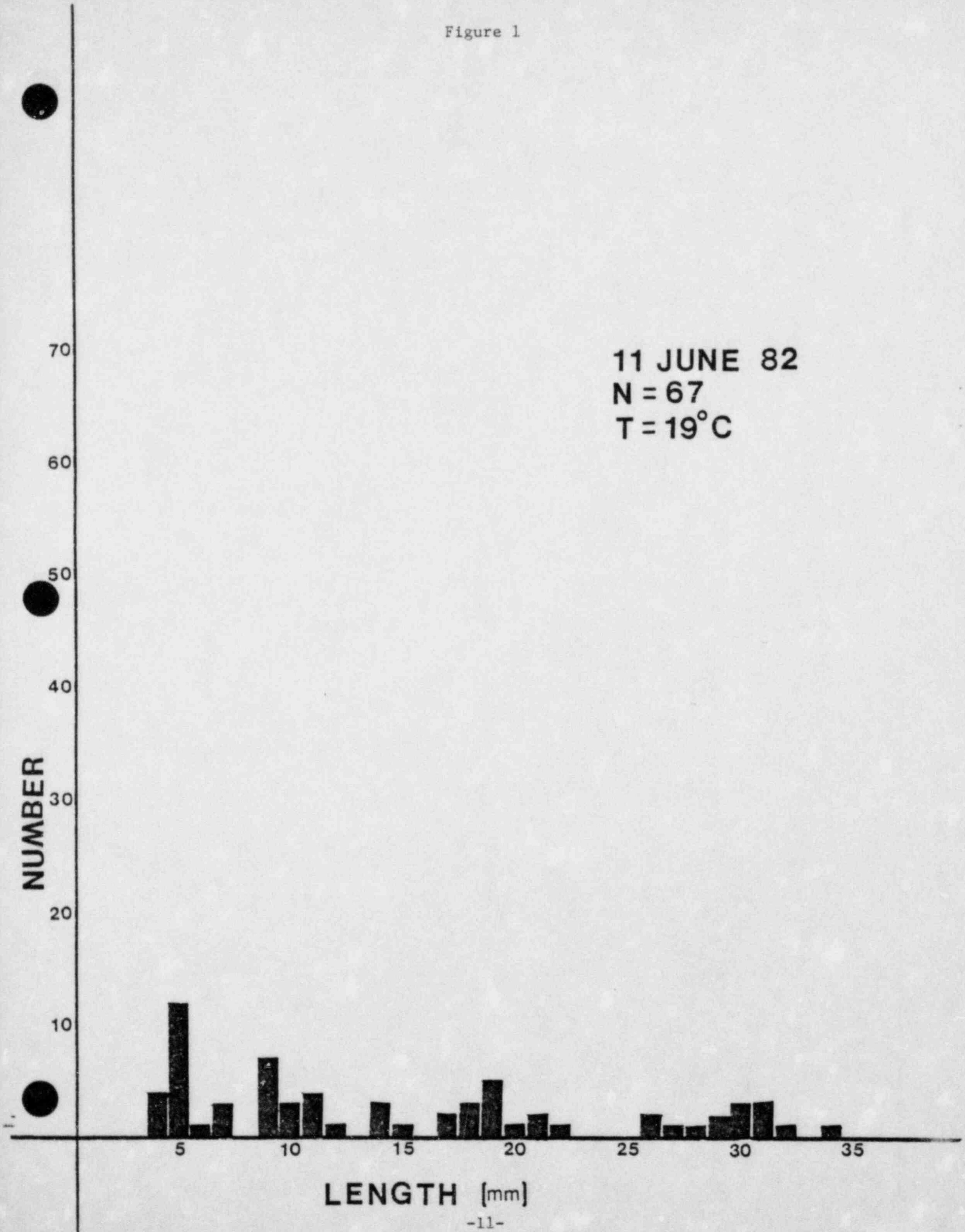
Date	Power Plant	Location	No. of Samples	Equipment	No. of clams	Temp.	Substrate
June 11, 82	Bay Shore	Discharge	20	Ekman	6	19°-20°C	rocky
June 5, 82	Acme	Discharge	20	Ekman	6	19°-20°C	rocky
June 5, 82	Acme	Intake	8	Ekman	0	17°C	loose sand/clay/muck
Ju[illegible] 5, 82	Bay Shore	Intake	8	Ekman	0	18°C	sand and clay

TABLE 2. MODAL SHELL WIDTHS (1982)

Date	Julian Date	Mode (mm)	Water Temperature °C
June 11, 82	162	5	19
July 7, 82	188	9	24
Aug. 2, 82	214	11	25
Sept. 1, 82	244	14	23-25
Oct. 1, 82	274	14	18
Nov. 3, 82	307	15	13
Nov. 30, 82	334	16	9
Dec. 28, 82	362	17	10

DBP 4306B

Figure 1



11 JUNE 82
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T = 19°C
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10
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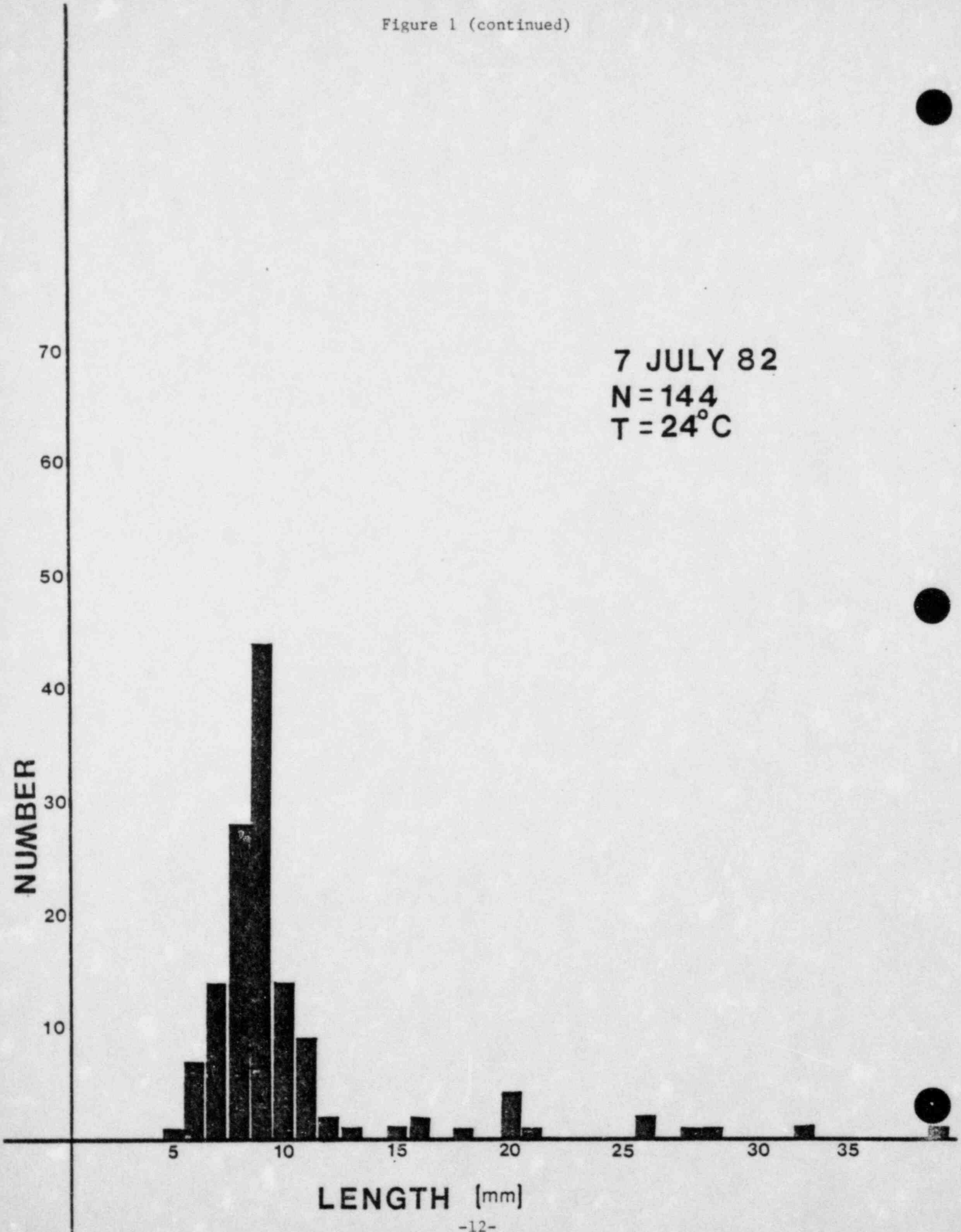
20
25
30
35
LENGTH [mm]

Figure 1 (continued)



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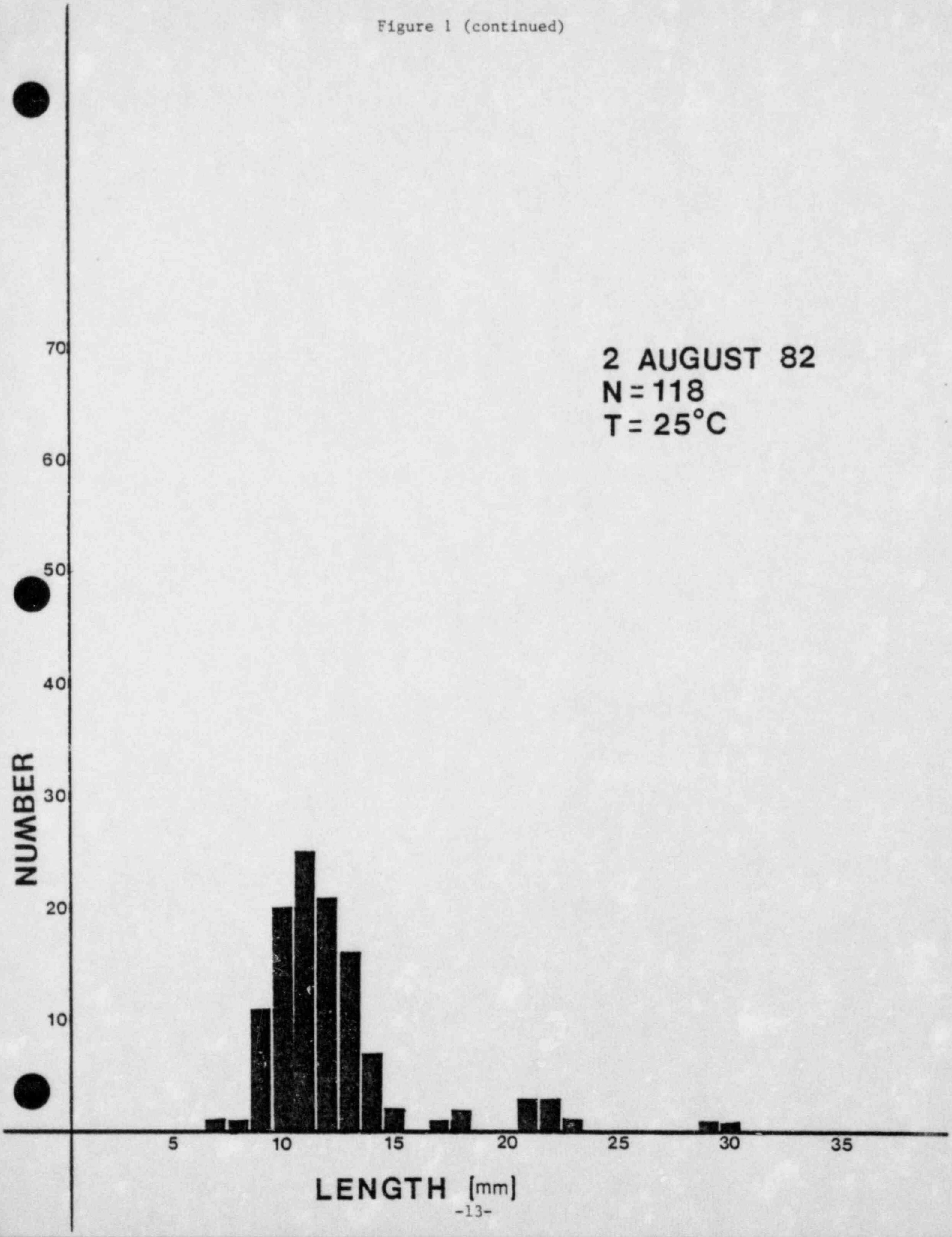

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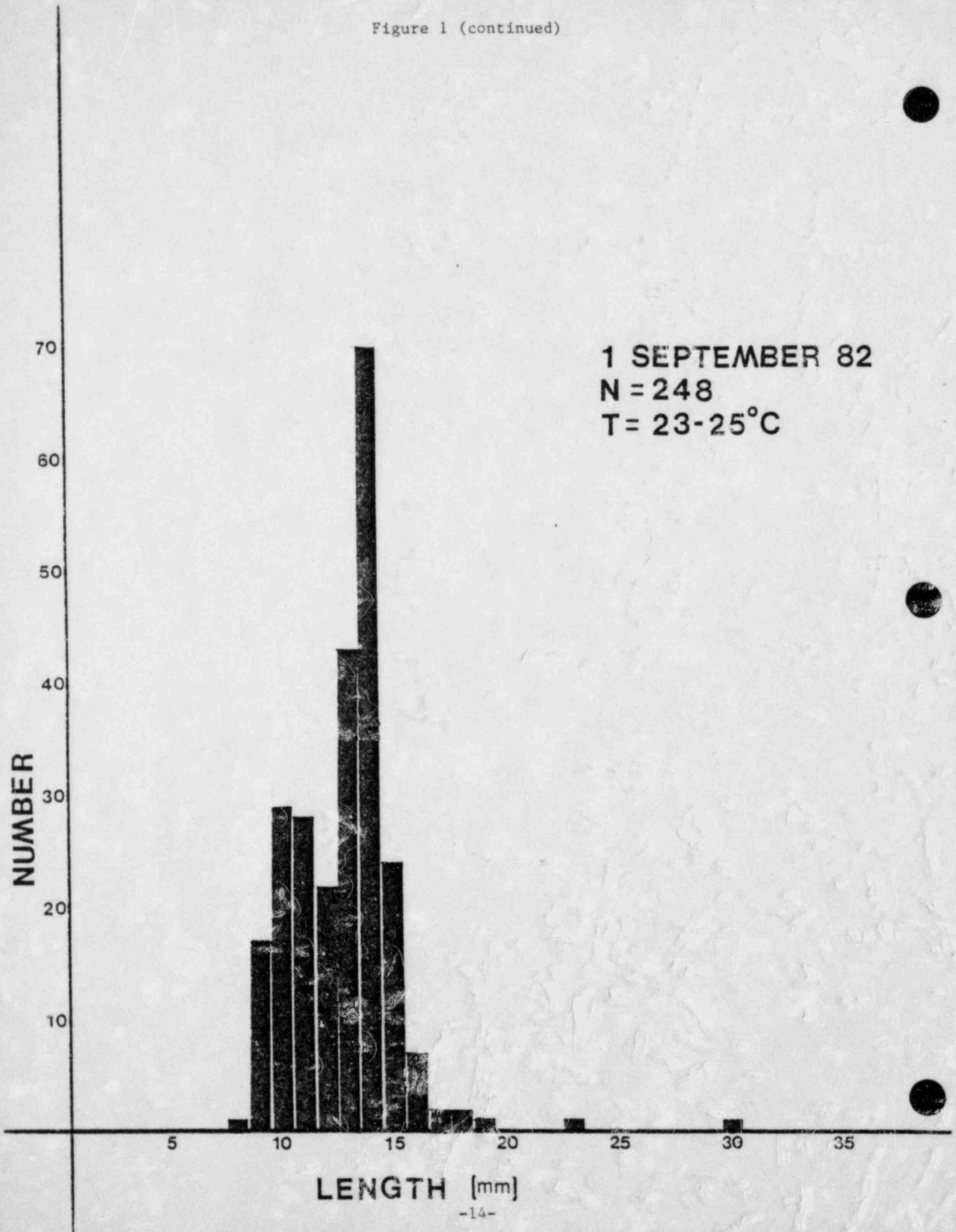

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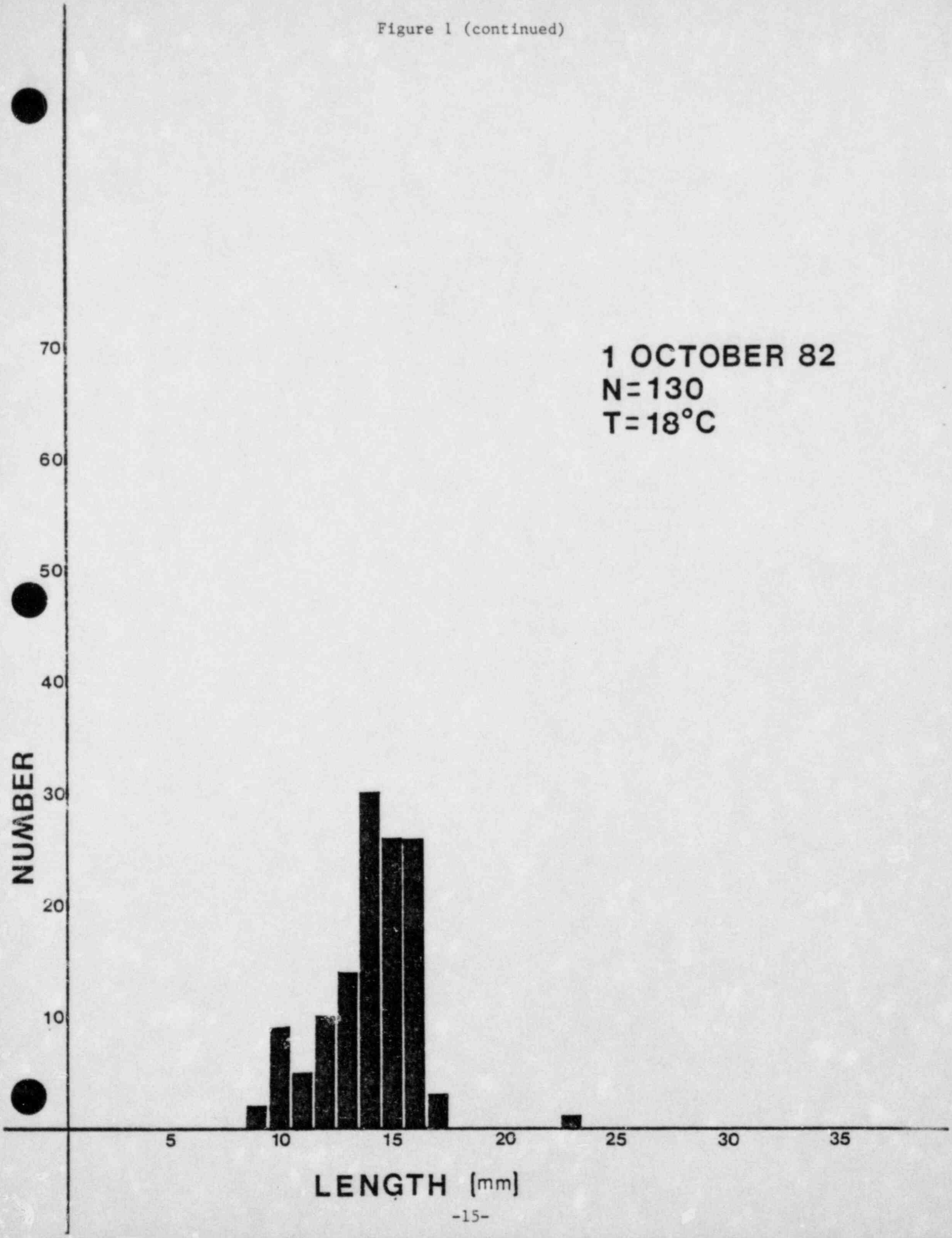

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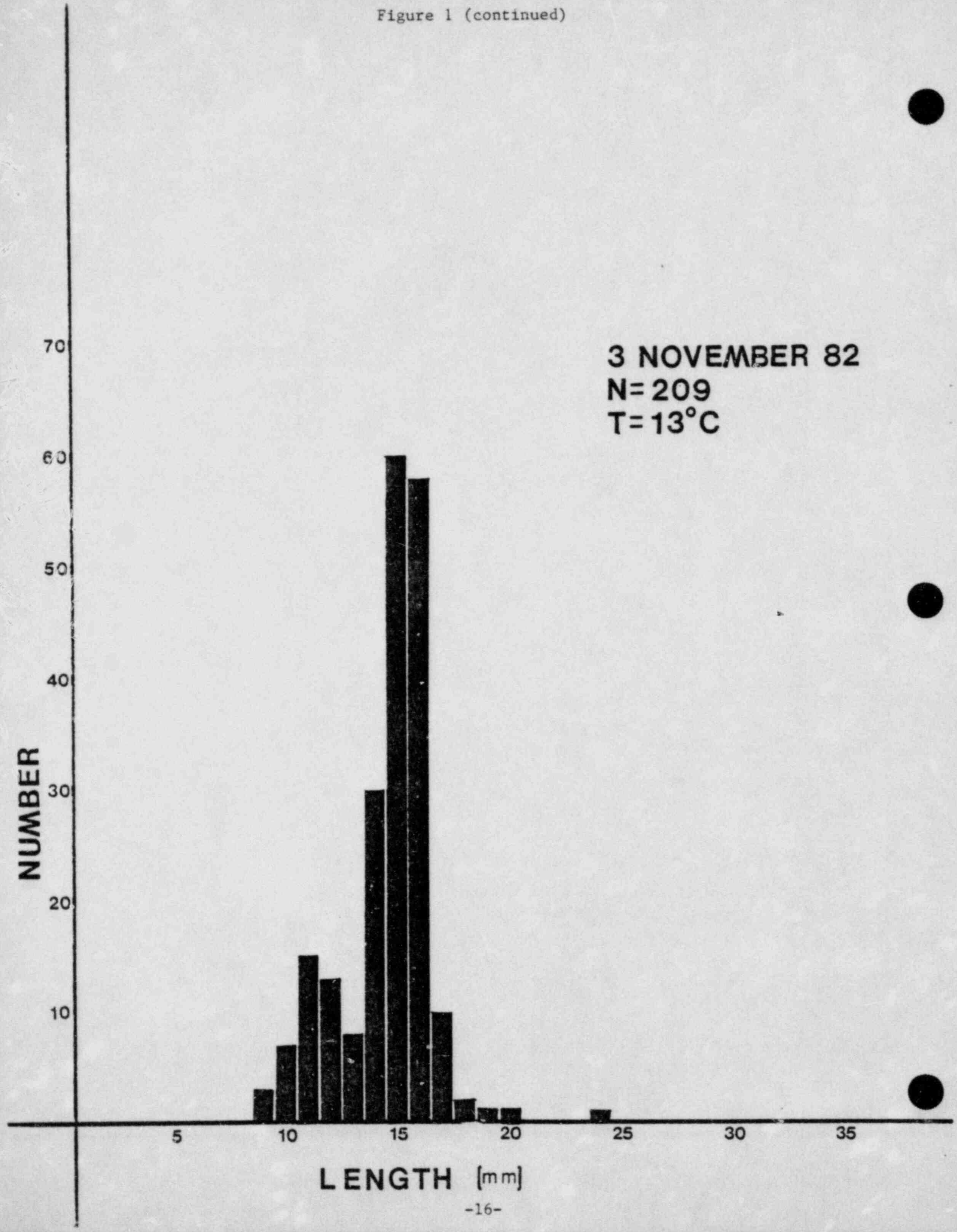

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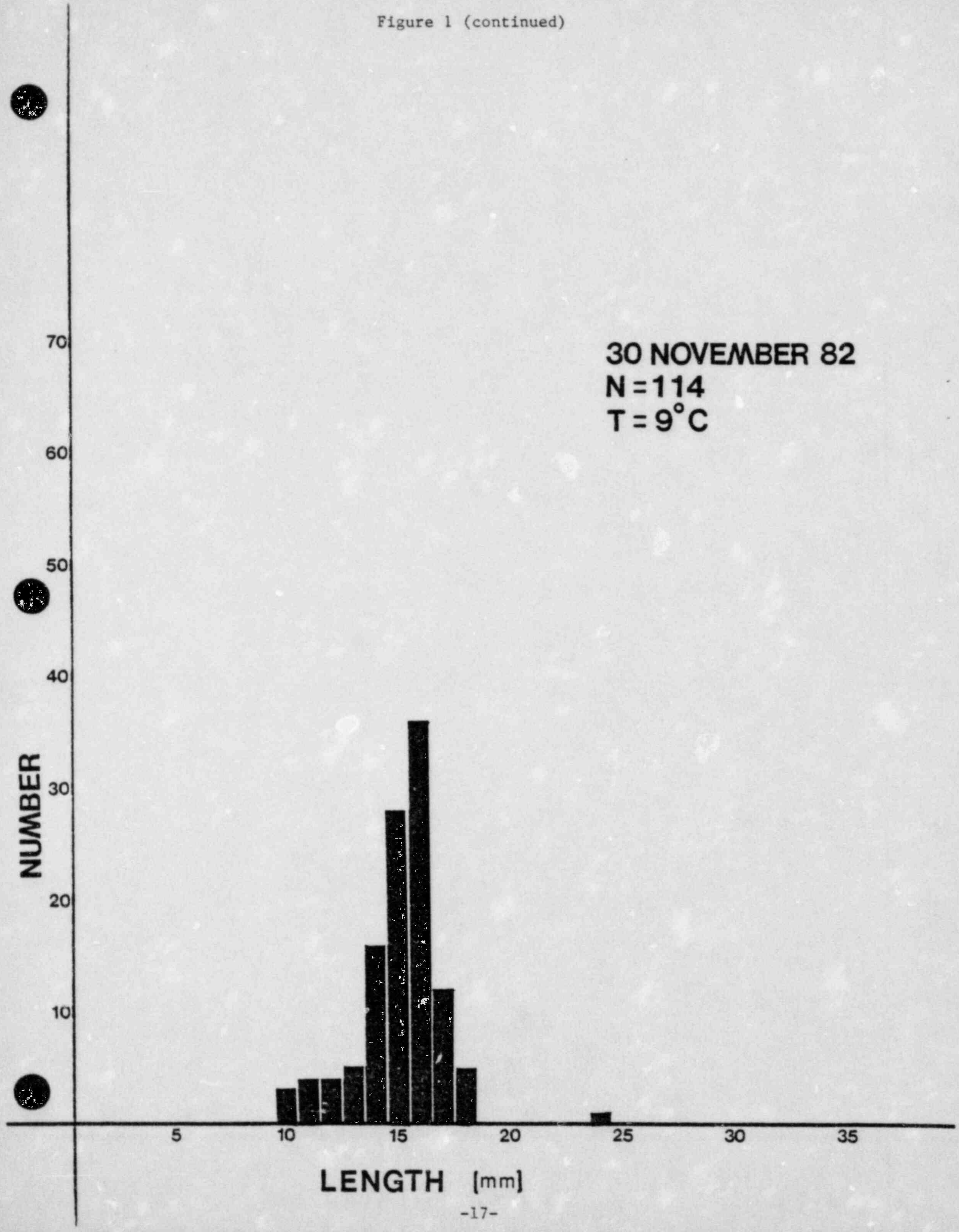

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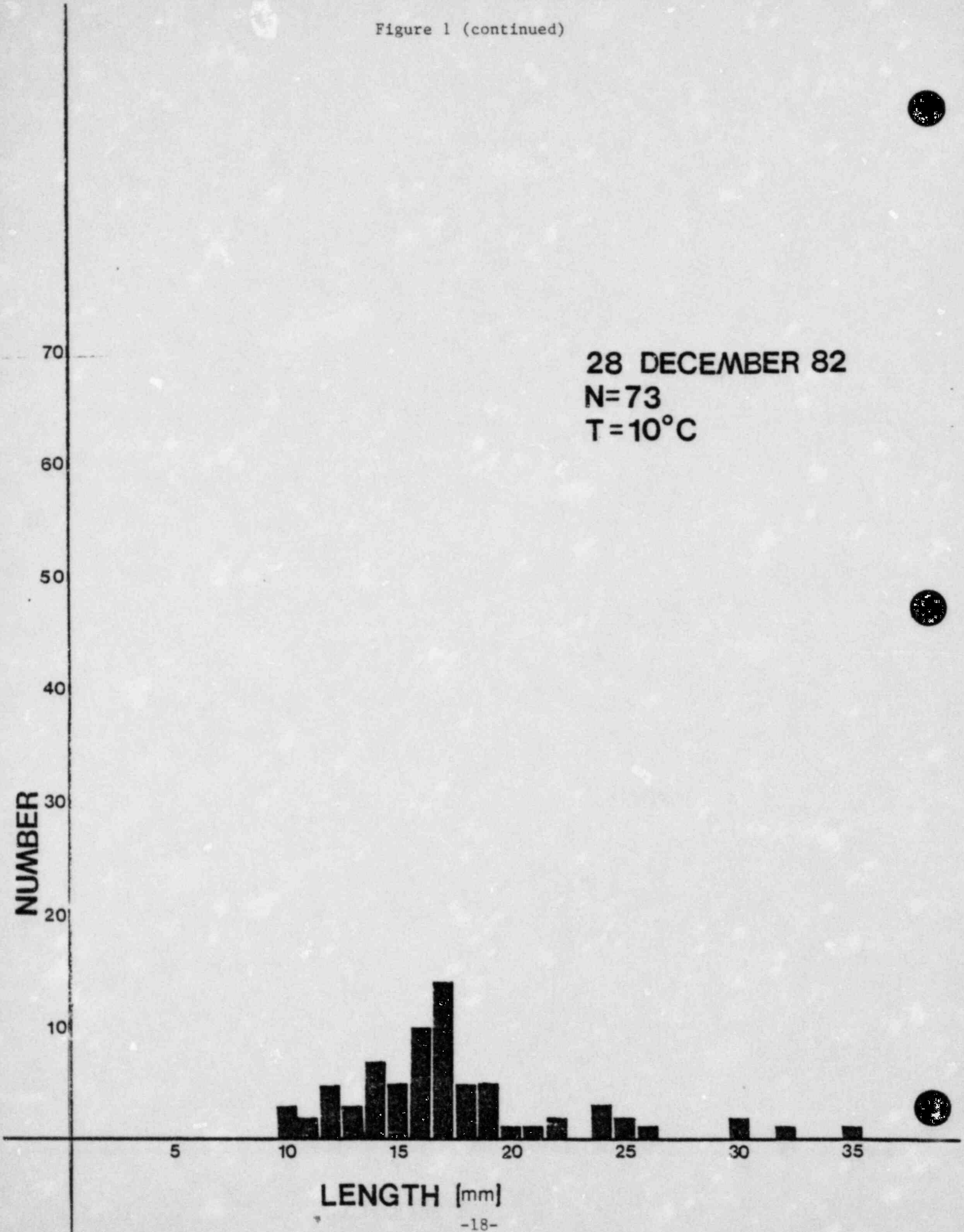
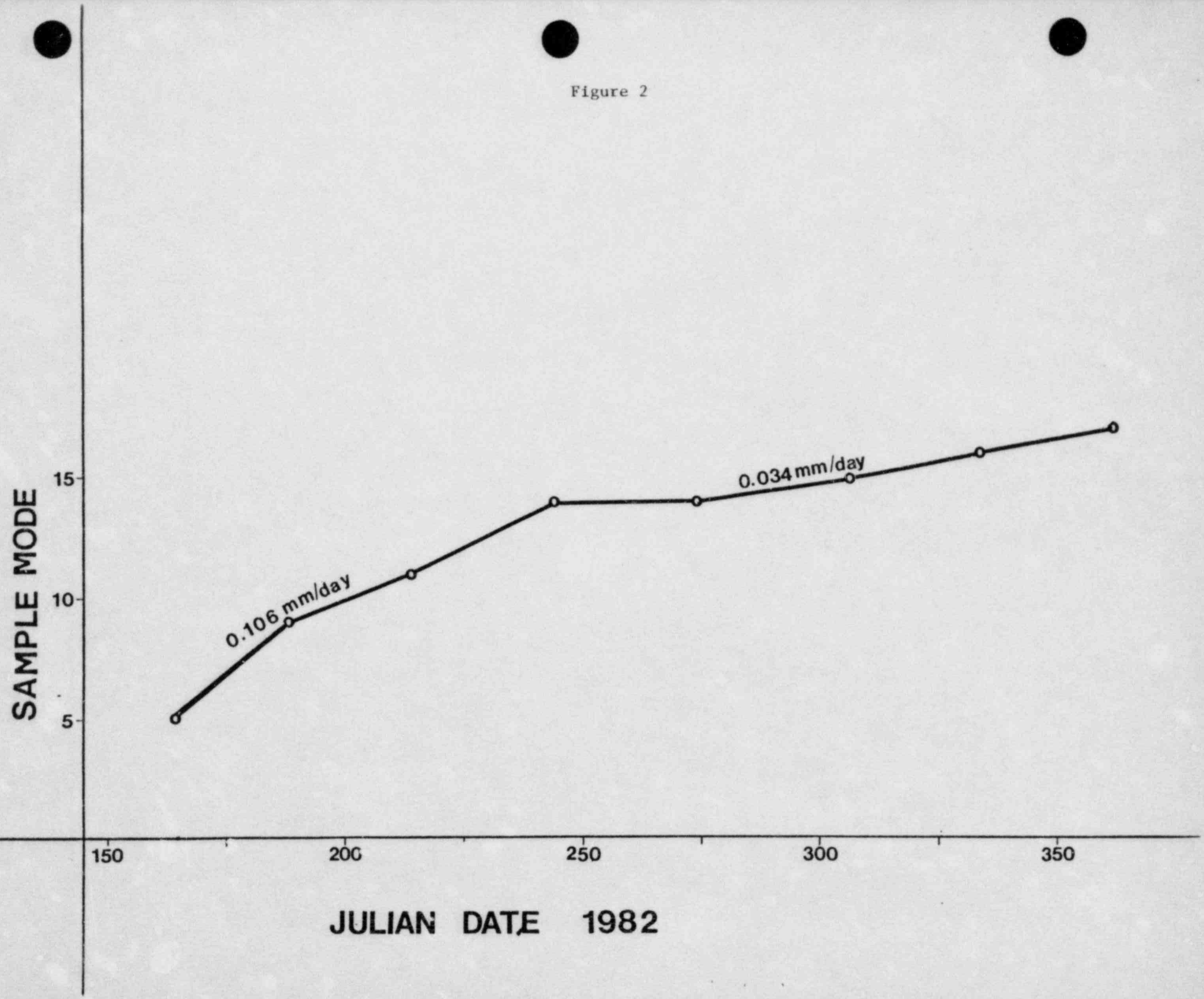


Figure 2



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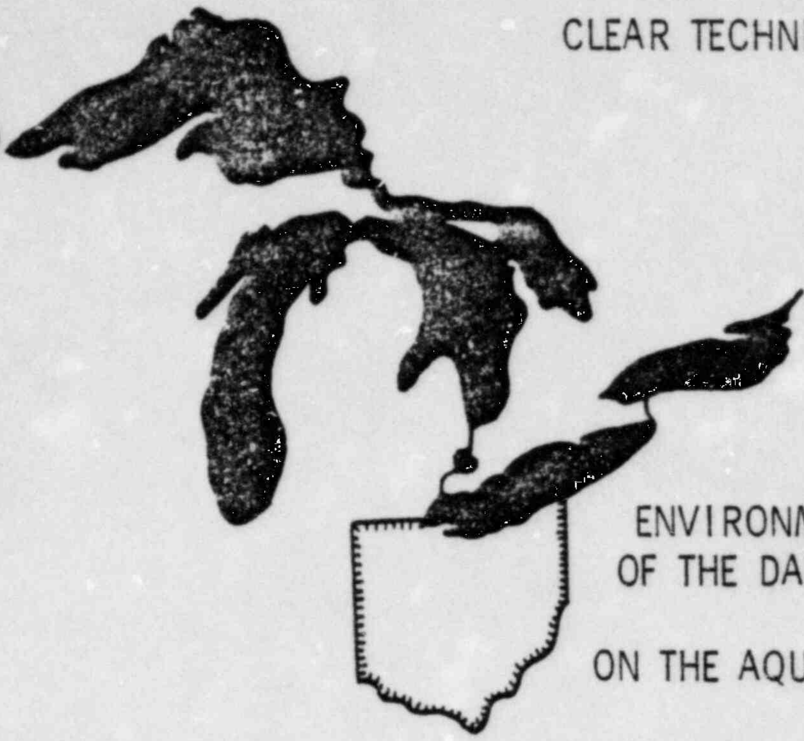
JULIAN DATE 1982

CLEAR TECHNICAL REPORT NO. 172



ENVIRONMENTAL IMPACT APPRAISAL OF THE DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1 ON THE AQUATIC ECOLOGY OF LAKE ERIE 1973 - 1979

Prepared by

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Prepared for

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Toledo, Ohio

THE OHIO STATE UNIVERSITY
CENTER FOR LAKE ERIE AREA RESEARCH
COLUMBUS, OHIO

June 1980

PREFACE

The Ohio State University's Center for Lake Erie Area Research has conducted an aquatic ecology monitoring program in Lake Erie in the vicinity of the Davis-Besse Nuclear Power Station for the Toledo Edison Company since April 1973. This effort has been supervised by Drs. Charles E. Herdendorf and Jeffrey M. Reutter. Dr. Herdendorf took responsibility for water quality analyses, and Dr. Reutter was responsible for biological analyses.

The following report provides an appraisal of the impacts of the operation of the Davis-Besse Nuclear Power Station, Unit 1, on the aquatic environment of Lake Erie in the vicinity of the Station. The primary responsibility for the preparation of the various components of the report are designated below:

<u>Charles E. Herdendorf</u>

1. Introduction
2. Station Description
3. Aquatic Environment
4. Impact Appraisal
   -- Water Quality

<u>Jeffrey M. Reutter</u>

1. Executive Summary
2. Station Description
3. Impact Appraisal
   -- Plankton Studies
   -- Benthic Studies
   -- Fisheries Population Studies
   -- Ichthyoplankton
   -- Fish Egg and Larvae Entrainment
   -- Fish Impingement

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EXECUTIVE SUMMARY

The Davis-Besse Nuclear Power Station is located in Ottawa County, Ohio, at Locust Point on the southwest shore of Lake Erie, about 21 miles east of Toledo. Unit 1 has a net electrical capacity of 906 MWe and a closed cycle cooling system which dissipates heat to the atmosphere by means of a natural-draft cooling tower, 493 feet high and 415 feet in diameter at its base. Make-up water for cooling purposes is drawn from Lake Erie from a submerged intake crib 3000 feet offshore through a buried eight-foot diameter conduit to a closed, but uncovered, intake canal. The canal is approximately 2950 feet long and terminates at the trash racks of the intake structure. Water is drawn through the intake crib and conduit by gravity. Design capacity for Unit 1 is 42,000 gpm with a resultant approach velocity through the crib ports of 0.25 ft/sec. Cooling tower blowdown is discharged at a point approximately 1200 feet offshore through a six-foot diameter buried conduit which terminates in a high velocity nozzle to promote rapid mixing. The maximum allowable ΔT is $20^{o}F$.

Studies of the aquatic environment in Lake Erie in the vicinity of the intake and discharge of this station were initiated in 1973. From 1973 to 1979, with few exceptions, the following parameters were sampled, during ice-free times, at approximately monthly intervals: water quality, phytoplankton, zooplankton, benthic macroinvertebrates (60-day intervals in 1977, 1978, and 1979), fish, and ichthyoplankton (approximately 10-day intervals during the spring spawning season). Ichthyoplankton entrainment studies and fish impingement studies were initiated after the plant began operating in August 1977. As is to be expected when a new unit first goes "on line", Unit 1 was operated sporadically from August 1977 through December 1979. It is the purpose of this report to appraise the impact of unit operation on the aquatic environment by comparing results obtained prior to unit operation with those obtained from September 1977 through December 1979.

Water Quality. Eighteen water quality parameters were monitored at approximately monthly intervals beginning in April 1974. In general the quality of Lake Erie water in the vicinity of the Station's discharge structure has remained relatively constant over the past seven years. The concentrations of dissolved and suspended substances were slightly higher during the operational period, particularly: chloride, magnesium, silica, sulfate, nitrate, turbidity, and suspended solids. Dissolved oxygen and phosphorus were slightly lower after operation. The magnitude of these differences was not great and appeared to be caused by the general condition of the nearshore waters of western Lake Erie rather than Unit operation.

Phytoplankton. Quantitative estimates of phytoplankton densities at Locust Point were obtained at approximately monthly intervals from 1974 through 1979. Operational phytoplankton densities were larger during the spring and fall than pre-operational densities. This was a natural phenomenon occurring throughout the nearshore waters of western Lake Erie and not caused by unit operation.

Zooplankton. Quantitative estimates of zooplankton densities in Lake Erie at Locust Point were obtained at approximately monthly intervals from 1973 through 1979. With the exception of cladoceran densities, which were very similar during the pre-operational and operational studies, zooplankton operational densities, though generally similar to pre-operational densities, were somewhat lower than the corresponding pre-operational monthly density. However, these differences appeared to be due to natural phenomena occurring along the south shore of the Western Basin and not related to unit operation.

Benthic Macroinvertebrates. Benthic macroinvertebrate densities in Lake Erie at Locust Point were observed at approximately 30-day intervals from 1973-1976 and 60-day intervals from 1977-1979. Operational densities were within the ranges established during the pre-operational study for every month except September. Differences were attributable to natural variation.

Fish. Monthly gill net catches from Lake Erie near Locust Point from 1973-1979 were used to evaluate the impact of unit operation. Fish populations for each of the eight major species at Locust Point, alewife, channel catfish, freshwater drum, gizzard shad, spottail shiner, walleye, white bass, and yellow perch, and the density of all species combined showed little or no variation between pre-operational and operational results.

Ichthyoplankton. Ichthyoplankton densities from Lake Erie in the vicinity of the intake and discharge were monitored at approximately 10-day intervals from 1974 through 1979. Tremendous variability was observed from year to year. However, due to the similarity in densities observed at the intake and discharge and control stations, there is indication that the activities of the Power Station have not significantly altered these populations.

Entrainment. Ichthyoplankton entrainment estimates were not developed until the spring of 1978 as entrainment is an operational phenomenon, and there were few, if any, ichthyoplankters in Lake Erie to be entrained during the first fall and winter of the operational period (September 1977 - March 1978). During 1978 and 1979, the number of ichthyoplankters entrained was insignificant compared to lake populations. Furthermore, the off-shore intake, where larvae densities are lower, and the low intake water volume due to the cooling tower and closed cycle cooling system, result in a very low-level impact on western Lake Erie fish populations.

Impingement. Fish impingement at the Davis-Besse Nuclear Power Station was estimated from measurements of approximately 24 hours taken approximately 3 times per week from January 1, 1978 to December 31, 1979. Goldfish was the species most commonly impinged, representing 49.9 percent (1978) and 78.6 percent (1979) of the total number of fish impinged. By number, the 6,607 fish impinged during 1978 were 0.04 percent of the Ohio 1978 sport fishing harvest, while the 4,385 fish impinged during 1979 were

0.03 percent of the Ohio 1978 sport fishing harvest. By weight, impingement was less than 0.001 percent (both years) of the Ohio 1978 sport fishing harvest. These figures become even less significant when one realizes that the Ohio sport catch was only 83.4 percent of the Ohio 1978 commercial catch and only 15.9 percent of the 1978 commercial catch from all of Lake Erie.

Conclusion. Based upon the results obtained to date, there are indications that operation of the Davis-Besse Nuclear Power Station, Unit 1, has had no short-term deleterious effects on the Lake Erie ecosystem. Therefore, it is the conclusion of this appraisal that the Station has not significantly altered the aquatic environment at Locust Point and that long-term deleterious impacts are unlikely.

INTRODUCTION

The Davis-Besse Nuclear Power Station, Unit 1, initiated commercial operation on August 29, 1977 (Table 1). The purpose of this report is to provide an appraisal of the impacts of station operation on the aquatic environment of Lake Erie. A pre-operational aquatic ecology monitoring program at the Station was begun in 1973-1974 and continued through the construction period. The program consisted of monitoring 18 water quality parameters and biological populations, including plankton, benthos and fish. Normally samples were taken monthly during the ice-free seasons on Lake Erie. Once commercial operation was started, the monitoring program continued essentially unchanged, except for the addition of fish impingement/entrainment studies. This report will attempt to compare natural water quality/biological variability, as measured during the pre-operational period, with values obtained during the operational period. The details of the monitoring program are found in Appendix B to License NPF-3 "Environmental Technical Specifications".

For the purposes of this report, the pre-operational period is considered to be from 1973 or 1974 (depending on when monitoring for a particular parameter began) to August 31, 1977. The operational period considered is from September 1, 1977 to December 31, 1979. The Station's operating history, including: 1) reactor power record, 2) electrical power record, 3) intake and discharge temperature records, 4) water pumping record, and 5) water discharge record are presented in Figures 1 to 10. It can be seen from these figures that during the period of operation being considered, average generation was approximately 33% of its potential capacity. This circumstance was largely due to several months of maintenance outage during the summer of 1978 and the Three-Mile Island Incident in 1979. Of the 28 operational months being considered in 1977, 1978, and 1979 water quality/biological sampling and mean unit output of greater than 453 MWe (50% capacity) coincided during six months.

STATION DESCRIPTION

Station Location

The Davis-Besse Nuclear Power Station, Unit 1 is located in Ottawa County, Ohio, on the southwest shore of Lake Erie, about 21 miles east of Toledo. The 954-acre site is located in Carroll Township adjacent to the mouth of the Toussaint River (coordinates: $41^{o}35'57"$ N and $83^{o}05'28"$ W).The site has 7,250 feet of Lake Erie frontage (Figure 11). This section of shoreline is flat and marshy with a maximum elevation only a few feet above the lake level (U.S. Atomic Energy Commission, 1973).

General Station Description

Unit 1 is a nuclear-powered electric generating facility with a net electrical capacity of 906 MWe. The facility utilizes a pressurized water reactor (PWR) manufactured by Babcock and Wilcox Company. Most of the heat from the turbine steam condenser is dissipated to the atmosphere by means of natural-draft cooling tower, 493 feet high and 415 feet in diameter at its base.

Cooling Water Intake Design

The cooling water intake shown in Figure 12 is made up of three principle elements; the intake crib and conduit, intake canal, and intake structure. The Unit obtains its cooling water from Lake Erie through the intake crib. Water entering the intake crib flows by gravity through the eight-foot diameter intake conduit buried beneath the lake bottom to the intake canal. The water then flows through the intake canal to the intake structure located at the west end of the intake canal forebay. From the intake structure cooling water will be pumped to the various systems within the unit. These three principle components are described in detail in the following sections.

Intake Crib. The intake crib for the Davis-Besse Nuclear Power Station is located in the Western Basin of Lake Erie approximately 3000 feet offshore from the land area commonly known as Locust Point in approximately 11 feet of water at low water datum (568.6 ft. I.G.L.D.). The lake area off of Locust Point has been identified as an area of constant sand movement. The intake crib is a wooden cross shaped structure rising 3'-10" above the lake bottom with intake screens (ports) located in the ends of each of the four arms so that water enters the crib downward through the ports. At the design maximum flow of 42,000 gpm, the intake velocity has been calculated at 0.25 ft/sec (U.S. Nuclear Regulatory Commission, 1975). Table 2 shows calculated intake velocities for various pumping rates. At the 42,000 gpm design flow rate, the velocity through the eight-foot diameter conduit would be approximately 1.8 ft/sec. This design is similar to the one used at the Oregon, Ohio, and Port Clinton, Ohio, municipal water intakes. Figure 13 shows the similarities of these intakes.

Normal practice in intake design has been to locate intake cribs in 20 to 50 feet of water to avoid ice formation and the possibility of blockage from ice jams. Inlet ports should be located four to eight feet off the bottom to minimize the uptake of sand, silt, and other sediment. However, adherance to these practices has not always been possible in the Western Basin of Lake Erie because of its shallowness. This is the case with the design chosen for the Davis-Besse intake crib. The Davis-Besse intake crib is located in relatively shallow water, 11 feet below low water datum, and five feet below the lowest water level experienced at the site, 562.9 IGLD computed from the Toledo gauging station records corrected to the site. Therefore, the intake design must be such that the crib will not be exposed by low water and the intake ports have to be high enough off the bottom that sand and sediment are not drawn into the crib. Locating the crib in deeper water was investigated but found not to be a viable alternative. Water depths of 20 feet are not reached in the vicinity of the site until approximately four to five miles from shore. The design finally chosen utilized a downward flow of water into the crib so that the intake ports could be located as far off the lake bottom as possible and still be under water during low lake level conditions.

During the design of the intake crib, consideration was given to using velocity caps to change the direction of the intake flow from vertical to horizontal. However, this did not turn out to be feasible, since under low lake level conditions the upper portion of the velocity caps would have been above water. Also, since the velocity caps would protrude above the top of the intake crib, they would be subjected to winter ice conditions. These ice conditions, floating ice, and wind blown ice masses, would most likely damage the velocity caps annually and in doing so could cause structural damage to the intake crib itself.

Intake Canal. The intake canal is an open channel with earthen embankments to convey water from the intake conduit (bringing water from the intake crib) to the intake structure located immediately east of Unit No. 1. The intake canal is approximately 2950 feet long including the forebay and is separated from the lake by a sand beach and beachfront dike constructed of large limestone rip-rap. The canal is approximately 40 to 45 feet wide at the bottom, with 3:1 side slopes and a water depth of 13 to 14 feet at normal lake levels except in the vicinity of the intake structure where it widens to form the forebay. At a flow rate of 42,000 gpm, the calculated velocity in the intake canal is approximately 0.11 ft/sec. The intake canal forebay is approximtely 800 feet long, 200 feet wide, at the bottom, with 3:1 side slopes and a water depth of 16 to 17 feet at normal lake levels.

Intake Structure. The intake structure is shown in Figure 14 and is located at the western end of the intake canal forebay. All of the water which is used by the unit is pumped via the pumps located in the intake structure. The following pumps are located in the intake structure.

Service Water Pumps - 2 operating, 1 standby
Cooling Tower Makeup Pump - 2 used as required
Dilution Pump - 1 used as required
Water Treatment Feedpumps - 1 operating, 1 standby
Screen Backwash Pumps - 2 used as required

These pumps are preceded by the trash racks and traveling screens. The trash racks are fixed screens, have 4-inch by 26-inch openings, and will be manually cleaned. The traveling screens have ¼-inch square openings and will be automatically cleaned either on a pre-set time interval or differential pressure across the screens. The impinged material washed from these screens is sluiced through a trough to a holding basin with an overflow weir discharge to allow monitoring of this material. Collections of impinged fish were made by placing a basket within the trough itself.

Water Use

The quantity of water used for cooling at the Davis-Besse Nuclear Power Station, Unit No. 1, has been minimized by using a closed cycle cooling water system and a natural draft cooling tower. The unit's water usage is also minimized by recycling the heated discharge from the service water system and using it as makeup to the closed cycle cooling water system. This exceeds the requirement of 40 CFR 423.13, "Effluent limitation guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable" as well as 40 CFR 423.15, "New Source Performance Standards" which would permit the heated discharge from the service water system to be discharged, provided it meets chlorine limitations. Table 3 shows the unit's maximum, minimum, and average water usage for each month during 1978 at the intake crib.

Discharge System

All station effluents (except storm water drainage and certain building drains which go to the Toussaint River) are mixed in the collection box prior to discharge into Lake Erie. Most of this mixture is cooling tower blowdown water and its associated dilution water which is added so that the concentration of dissolved solids in the discharge will be less than twice the concentration in the lake. The collection box has a small volume compared with the flow rates into it, and, therefore, the box merely serves to mix the various effluents. From the collection box, the station discharge flows through a six-foot diameter buried pipe to the slot-type jet discharge structure (4.5 feet wide x 1.5 feet high) 1200 feet offshore in Lake Erie (Figure 12). The elevation of the collection box provides the necessary head for discharge through the pipe to the lake under all predicted water level conditions. The slot-type discharge has an exit water velocity of about 6.5 ft/sec at the design maximum discharge flow of 20,000 gpm. The nominal calculated water velocity of 3.6 ft/sec, at the typical discharge rate of 11,000 gpm, promotes rapid entrainment and mixing with lake water. The lake bottom has been rip-rapped with rock for about 200 feet in front of the slot discharge to minimize scouring of the lake bottom and associated turbidity.

Chemical Discharge. All of the makeup water to the recirculating system (cooling tower) is partially neutralized with sulfuric acid, releasing carbon dioxide, and thereby reducing the amount of scale formed in the condenser. The only other chemical added to the circuits is elemental chlorine for defouling. The recirculating cooling water blowdown contains the major fraction of all chemicals discharged to Lake Erie. Due to the evaporation of water in the cooling tower, the concentration of dissolved solids in the recirculating water is approximately double that in the lake. Because of the addition of sulfuric acid and the loss of carbon dioxide, the sulfate ratio is slightly higher and the carbonate ratio is slightly lower in discharge water while ratios for various other chemicals are the same as in lake water.

Thermal Discharge. The discharge of cooling tower blowdown from the station's submerged discharge structure generates a thermal plume in Lake

Erie. The plume is calculated to have a maximum surface area of 0.7 acres (U.S. Atomic Energy Commission, 1973). The temperature difference between cooling tower blowdown water and ambient lake water ranges as high as 30°F. Lake water is used to dilute the blowdown so that the effluent to the lake never exceeds 20°F above ambient lake water temperature.

AQUATIC ENVIRONMENT

Habitat Description

Locust Point and Western Lake Erie. Locust Point is a gently curving headland on the south shore of western Lake Erie, approximately ten miles west of Port Clinton, Ohio (Figure 15). The Davis-Besse Nuclear Power Station is located on a 954-acre tract of land on this point. The terrain of the point is relatively flat and contains about 600 acres of marshland. The Station has a 7,250-foot frontage on Lake Erie along the point. The point has a relatively stable barrier beach which separates Navarre marsh from the lake. The shore is not tending to straighten itself or advance over the wetland which is usual for barrier beaches with such a configuration. This may be in part due to the extensive rip-rap dike placed on the berm of the beach during the record-high water levels of the 1972 and 1973. The dike now protects the Station site, as well as the wetland, from the lake encroachment.

Hydrographic surveys show a very gentle slope of the lake bottom from the shore out for a distance of at least 4000 feet (Figure 15). Two sand bars typically lie in the nearshore zone, one at 120 feet offshore and the other at 280 feet from the beach. The deeper area between the beach and the first sand bar has a thin bottom layer of fluffy silt and shell fragments over the sand. The inshore slope of the first bar contains an abundant population of naiad clams. The sand bottom, generally medium- to fine-grained, extends to 800 feet offshore (5.0 feet water depth, IGLD, 1955). At this point the bottom deepens by 0.5 feet and is composed of hard, glaciolacustrine clay which forms a 500 to 700-foot wide strip around the point. Lakeward the bottom again becomes sandy and the sand increases in thickness in a lakeward direction. The lake reaches a depth of ten feet at a distance of 200 feet offshore and 12 feet at 4000 feet offshore. The sand and gravel bottom, underlain by hard clay persists lakeward to the rocky reefs about three miles offshore (Figure 16).

The offshore reefs consist of bedrock and associated rock rubble and gravel. The topography of the reef tops ranges from rugged surfaces caused by bedrock pinnacles and large angular boulders, to smooth slabs of horizontally bedded rock. In places the exposed bedrock has the appearance of low stairs with steps dipping slightly to the east from the crest to the fringe of the submerged reef. All of the bedrock formations that form the reefs and shoals are carbonate rocks which contain abundant solution cavities, in many cases up to one or two cm in diameter. The bedrock itself is commonly masked by rubble composed of both autochthonous and glacial origin and ranging from small pebbles to boulders up to five feet in diameter. On the reefs, isolated patches of sand and gravel fill vertical joint cracks and small depressions in the bedrock; at the fringes of reefs, sand and gravel beds or glacial till lap over the rock. During quiet periods the rocks are often covered by a thin layer of fluff, organic-rich silt, which can be several millimeters thick (Herdendorf, 1970).

Lakeward of the reefs the depths increase rapidly to 24 feet. Here the bottom is composed of mud (semi-fluid silt and clay-sized particles) and less than ten percent sand (Figure 16).

The lack of permanent siltation on the bedrock and gravel reefs make them the only suitable sites for "clean water" benthic organisms such as certain mayflies, caddisflies, isopods, and amphipods. These organisms are important in the food web of many of the commercial and game fish species of western Lake Erie. The absence of these invertebrate animals on or in the adjacent mud bottoms limits fish feeding to the reefs and inshore areas.

The reefs project above the bottom and they are generally areas of higher energy due to the force of waves and currents. These factors allow simulation of the environment found in the riffles of streams. Several species of fish, particularly walleye and white bass, appear to have enjoyed success in Lake Erie because of the availability of this type of habitat.

Because of the lack of shelter in the nearshore zone at Locust Point, except the intake and discharge structures, the area does not appear to support a large resident fish population. Monthly fish collections in this area (gill net, shore seine, and trawl) show great variability in species composition and relative abundance which strongly suggest a transient fish population. Results from 17 years of sampling at Locust Point indicate that 51 different species of fish have been captured (Table 4), but only ten species are of any real numerical or commercial significance. Alewife, carp, gizzard shad, white bass, emerald shiner, spottail shiner, yellow perch, channel catfish, freshwater drum, and walleye constitute over 97% of the total number that were captured (Reutter and Herdendorf, 1976).

The general flat or gently sloping lake bottom in the nearshore zone (within one mile of the shore) of Locust Point is broken only by the intake and discharge structures and uneven clay fill along the route of the buried pipelines. An ice barrier of rip-rap rock has been constructed on the lake side of the intake crib, and a scour prevention apron of similar material has been placed on the bottom lakeward of the discharge slot. In 1976, icthyoplankton sampling stations were established in the vicinity of the water intake discharge structure as well as control stations at similar distances offshore in an attempt to determine if these structures were inducing higher than normal fish spawning rates for their position offshore. The populations at these structures were within the normal range observed at the control station, indicating that the populations at the intake and discharge structures were not unusual for their position in the nearshore zone (Reutter and Herdendorf, 1976).

<u>Intake Canal.</u> In September 1974, the intake canal was poisoned to eliminate resident fish prior to the operation of the Station. During periods of 1972 and 1973 the intake canal was open to Lake Erie, and fish were free to enter the canal through an opening at the beachfront. In 1974 the canal was closed at the beach and the only water communication with the lake was via the 3000-foot-long, buried, intake pipe. Immediately prior to the poisoning, 22 trawls yielded 411 fish of 18 species. Trawls taken in the canal in October 1974, one month after poisoning, yielded only one

fish, an adult carp, indicating that the kill was essentially complete. The benthic population was also destroyed in the process (Reutter and Herdendorf, 1975). Later trawls, in summer 1975, yielded 420 individuals of 13 species indicating some fish were entering the crib and traveling via the pipeline to the intake canal. The most common species found in the canal were white crappie, bullhead, black crappie, carp, yellow perch, and sunfish.

Trawls in the intake canal were not continued after 1975. However, there is evidence that white crappie, goldfish, and other species have developed resident populations in the intake canal, and these populations represent a sizeable percentage of the fish impinged on the traveling screens. The size, age classes and relative abundance of species impinged at the Station are markedly different than individuals captured with trawls and gill nets in the vicinity of the intake crib.

The intake canal is constructed of earthen walls and has a mud bottom over hard clay. The steep-sided walls of the canal preclude the development of extensive aquatic vegetation. The entire surface of the canal is unshaded. Velocities in the canal during 1978, are calculated to have had a maximum, minimum, and mean velocity of 0.16, 0.02, and 0.06 feet/sec, respectively.

Hydrology

Circulation Patterns. Western Lake Erie is dominated by the large in-flow of the Detroit River with a mean flow of approximately 210,000 cfs. The mid-channel flow of this river penetrates deep into the Western Basin, at times reaching the vicinity of Locust Point. The Maumee River, with an average flow of 4,700 cfs, is the second largest stream flowing into the lake and carries 37 percent of the sediment loading to the basin, but accounts for less than three percent of the total water drainage to Lake Erie. Maumee River water enters the lake through Maumee Bay where it divides into a northern flow along the Michigan shore and an eastern flow along the Ohio shore toward Locust Point. The Toussaint River, with an average flow of only 76 cfs, is a minor contributor to circulation patterns in the vicinity of Locust Point.

East of the dominating effect of the Detroit River, the prevailing southwest winds produce a clockwise surface flow around the Bass Islands to the northeast of Locust Point. However, this surface flow is often altered by changes in the direction, intensity, and duration of the wind. Strong winds from any direction can drive the surface currents over most of the basin toward the windward shore (Herdendorf, 1975). Current maps of western Lake Erie in the vicinity of Locust Point for various wind conditions are presented by Herdendorf (1970). Bottom currents have essentially the same pattern as surface flows in that part of the basin influenced by the Detroit River. However, in other parts of the basin bottom currents are commonly the reverse of and compensate for strong, wind-driven, surface currents.

Herdendorf and Braidech (1972) measured currents at 68 stations in the vicinity of Locust Point and the offshore reefs during a three-year study. The average recorded velocity for surface currents was 0.28 knots

(0.48 feet/sec) and 0.15 knots (0.26 feet/sec) for bottom currents. These velocities are not capable of eroding bottom material, but are able to transport fine sand, silt, clay, and fish eggs or larvae once they have been placed in suspension. Velocities in excess of 0.5 knots (0.84 feet/sec) were recorded on the reefs but not in the nearshore zone at Locust Point. The mean intake velocity for the Station is approximately half of the average bottom current velocity measured by Herdendorf and Braidech (1972).

Littoral Drift. Locust Point is at a position of diverging littoral (alongshore) drifts of sand which ordinarily would result in the beach being starved of sand because of movement east and west away from the headlands which form the point. However, the shore is apparently maintained at near equilibrium by replenishment from an extensive sand and gravel deposit which lies north of a narrow strip of compact glaciolacustrine clay that fronts the point beyond the sandy nearshore zone. Transportation of this material from offshore to the beach can be accomplished by at least three forces: 1) currents induced by wind action of Detroit River flow; 2) wave action; and 3) ice shove. Most of the sand probably migrates shoreward by wave action and currents generated by northeast and northwest storms. Evidence for the shoreward movement of sand can be found in the position of bars before and after major storms. For example, fathometer profiles of the lake bottom at Locust Point before (13 June 1972) and after (28 June 1972) tropical storm Agnes revealed that two offshore bars migrated 20 to 25 feet shoreward as a result of wave attack from the northwest storm (Herdendorf and Hair, 1972).

Thermal Conditions. Water temperatures in western Lake Erie range from 32° F in the winter to about 75° in late summer. The Western Basin frequently freezes from shore to shore in December and the ice cover breaks up in March and April. A shallow epilimnion develops early during the spring, but because the basin is so shallow, wind action causes efficient vertical mixing and by June the water becomes vertically isothermal. Diurnal microthermoclines are common in the summer, but prolonged periods of hot, calm weather can cause temporary thermal stratification, due to the heating of the surface water without the benefit of mixing. In 1953, such a situation resulted in severe oxygen depletion in the bottom water (Britt, 1955).

Water Quality. Nutrient overenrichment is the most significant water quality problem in western Lake Erie. Locust Point, being within the nearshore zone, is also characterized by low transparency, high concentrations of dissolved solids and warmer water temperature when compared with offshore water quality studies at Locust Point in July 1972 (Figure 17). Over the past 8 years most parameters have shown typical seasonal trends with only small variations from year to year. Trends for 8 water quality parameters from July 1972 through November 1979 are shown on Figures 18, 19, and 20. 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 radical variations which are probably due to storms and dredging activities that have disturbed the bottom sediments. Phosphorus levels were low in 1977, 1978, and 1979 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.

IMPACT APPRAISAL

Water Quality

Procedures and Results

Water quality measurements during the period April 1974 to November 1979 were used for the purposes of this appraisal. The results of the water quality monitoring program are contained in semi-annual reports (1974-1976) and annual reports (1977 - 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. The data used included Station No. 13 (500 feet east of the discharge structure) and Station No. 8 (adjacent to the water intake crib). Station No. 13 serves as the station most likely to be impacted, while Station No. 8 serves as a control station (Figure 17). Each station was visited once a month during the ice-free period of the year (normally April-November). Surface and bottom water samples were taken at each station and were analyzed in accordance with the procedures listed in Table 5. Because the intake and discharge structures are located at or near the bottom, bottom samples were used for comparing pre-operational and operational conditions. Tables 6 to 23 summarize pre-operational and operational data for the 18 water quality parameters at the intake and discharge stations. These data are displayed graphically for the discharge station on Figures 21 to 38. The following discussion summarizes the comparison for each of the parameters.

Dissolved Oxygen. During both the pre-operational and operational period DO showed a typical trend of high values in the spring and fall with low concentrations in the summer. Operational concentrations were considerably lower than the pre-operational range in April and November, but not during the critical summer months (Figure 21).

Hydrogen-ions (pH). Throughout the pre-operational and operational period pH values remained relatively stable, never exceeding 9.0 or falling below 7.5. The operational values showed more variability than the nearly straight-line mean concentration for the pre-operational period (Figure 22). However, both periods had a mean pH of 8.3.

Transparency. Both the pre-operational and operational measurements showed the lowest water clarity in the spring, the best transparency in the summer, and intermediate clarity in the fall. In general, operational values were within the range of pre-operational values throughout the year (Figure 23).

Turbidity. Being somewhat the reciprocal of transparency, the lowest readings occurred in the summer, the highest in spring and intermediate values in the fall for the pre-operational period. Operational values showed a general decreasing trend throughout the year, with only a slight rise in the fall. However, values for May, June, and

September well exceeded the pre-operational ranges for those months (Figure 24).

Suspended Solids. This parameter, like turbidity showed a "U" shaped trend during the pre-operational period with summer concentrations being the lowest. Like transparency and turbidity, high particulate material in the water during the spring and fall months of the operational period yielded readings in excess of the pre-operational ranges for these months (Figure 25).

Conductivity. This parameter is a measure of the ionized material in the water and it also shows high concentrations in the spring for both the pre-operational and operational periods. Only conductivity values in April for the operational period exceed the range for this month during the pre-operational period (Figure 26).

Dissolved Solids. The concentrations of dissolved substances in the water during pre-operational and operational periods were relatively similar, with the operational data falling within or nearly within the pre-operational range for each month. Operational concentrations were somewhat lower than pre-operational conditions for April and October, while September was slightly higher (Figure 27).

Calcium. This element, one of the most common found in Lake Erie water, showed relatively consistent values during both the pre-operational and operational period. High concentrations typified the spring with considerably lower values in the summer and fall. Only in November did operational concentrations exceed the range of pre-operational data (Figure 28).

Chloride. Operational chloride concentrations were within the range of pre-operational concentrations during six of the eight months for which comparative data are available. The greatest discrepancy occurred in April and November. Pre-operational data show a progressive decrease in concentration throughout the year, while operational data indicate a more "U" shaped trend (Figure 29).

Sulfate. Both pre-operational and operational sulfate data show relatively consistent concentrations throughout the year with somewhat higher values in the spring. Operational data were more erratic, with four months above the pre-operational range and one month below the range (Figure 30).

Sodium. A trend similar to that of sulfate was noted for sodium. Operational data again showed greater variability with two months above and one month below the range for pre-operational data. April and November yielded the highest concentrations for the operational period, both beyond the pre-operational range (Figure 31).

Magnesium. This parameter showed the least agreement between pre-operational and operational data of any of those tested. Operational concentrations exceeded the range of pre-operational data for all months except May. In April, the operational mean value was nearly double the pre-operational mean concentration (Figure 32).

Total Alkalinity. This parameter showed considerable variability in both the pre-operational and operational data, with the highest values occurring in the spring and fall during the pre-operational period and in the spring and summer during operation. April, July, August, and November were periods when operational values exceeded pre-operational ranges, while May and June were months of relatively low operational alkalinity (Figure 33).

Nitrate. Serving as a biological nutrient, this parameter fluctuates widely in response to plankton productivity. Concentrations during both the pre-operational and operational periods were highest in the spring but decreased in the summer as this material was utilized by algae. Fall concentrations increased as algal productivity declined. Concentrations during both periods were relatively consistent, with operational values being somewhat higher, particularly in June, August, and November (Figure 34).

Phosphorus. This parameter is also an important biological nutrient and, like nitrate, shows seasonal variations such as high spring and low summer concentrations. Pre-operational and operational data were relatively consistent throughout the year, except for May which showed a considerably higher mean concentration during the pre-operational period (Figure 35).

Silica. As a necessary material for diatom cells, silica also undergoes seasonal changes in concentration. As the growing season progresses this material greatly declines in the water. Both pre-operational and operational data show the same seasonal trend. Operational concentrations exceeded the pre-operational ranges for May and November (Figure 36).

Biochemical Oxygen Demand. BOD levels were relatively consistent throughout the year for both the pre-operational and operational periods. Values were highest in the spring and lowest in the fall. All of the operational concentrations fall within the range of pre-operational data, except for June (Figure 37).

Temperature. Both pre-operational and operational data show typical seasonal temperature trends for Lake Erie; and both data sets are relatively consistent. Most of the operational values fall within the range of pre-operational data (Figure 38).

Appraisal

In general the quality of Lake Erie water in the vicinity of the Station's discharge structure has remained relatively constant over the past seven years (Figures 18, 19, and 20). In comparing the 18 water quality parameters during the ice-free months for the pre-operational versus the operational period (Figures 21 to 38), it can be seen that there is a 67% agreement (operational data within pre-operational range) between the two data sets. This is a relatively good agreement (Figure 39).

Table 24 summarizes this comparison and provides an indication of the degree of difference between the two periods. In general the concentrations of dissolved and suspended substances were higher during the operational period, particularly: magnesium, silica, nitrate, turbidity, and suspended solids. Dissolved oxygen was lower after operation. The magnitude of these differences was not great and seemed to be caused by the general condition of the nearshore waters of western Lake Erie rather than Station operation. For example, Table 17 shows that magnesium was not only high at the discharge (Sta. No. 13) but also high at the water intake (Sta. No. 8) which serves as a control station.

Table 25 indicates the percent change in water quality at the lake intake (Station 8) and discharge (Station 13) from the pre-operational period through the operational period. Dissolved oxygen and phosphorus showed the largest decreases in concentration (7 and 35 percent, respectively), while sulfate, magnesium, BOD, silica, chloride, turbidity, and suspended solids all had increases greater than 5%. In all cases where an increase in excess of 5% occurred at the discharge station, a similar increase was also observed at the control station. These observations further substantiate the conclusion that most of the changes are due to general lake conditions, and not localized changes resulting from Station operation. The decrease in phosphorus concentration is consistent with other nearshore measurements in western Lake Erie which indicate a decline in this substance as a result of pollution abatement programs.

Based on the results of this study, short-term degradation of Lake Erie water quality can not be demonstrated as a result of Station operation. The stability of water quality in the vicinity of Locust Point is well-documented; long-term deleterious impacts resulting from station operation are unlikely.

Plankton Studies

Procedures

Plankton monitoring at the Davis-Besse Nuclear Power Station has been completed approximately monthly during ice-free periods since 1973 (Table 26). The stations at which samples were collected each year are listed in Table 27 and shown on Figure 17. In 1973 only quantitative zooplankton samples were collected, while both quantitative zooplankton and phytoplankton samples were collected in all other years. The preservation techniques have been modified occasionally as new techniques to make specimen identification easier appeared in the literature. However, no modifications which would have quantitatively affected the results were made, and formalin was always the final preservative. Two vertical tows, bottom to surface, were collected at each station for phytoplankton and zooplankton with a Wisconsin plankton net (12 cm mouth; 0.064 mm mesh in 1973 and 1974 and 0.080 mm mesh from 1975-1979). Each sample was concentrated to 50 ml and preserved. The volume of water sampled was computed by multiplying the depth of the tow by the area of the net mouth. Three 1-ml aliquots were withdrawn from each 50-ml sample and placed in counting cells.

Whole organism counts of the phytoplankton were made from 25 random Whipple Disk fields in each of the three 1-ml aliquots from each of the 2 samples. When filamentous forms numbered 100 or more in 10 Whipple fields, they were not counted in the remaining 15 fields. Identification was carried as far as practicable, usually to the genus or species level.

All zooplankters within each of the three 1-ml aliquots from each of the 2 samples were counted by scanning the entire counting cell with a microscope. Identification was carried as far as practicable, usually to the genus or species level.

Phytoplankton Results

The results of the phytoplankton monitoring program were presented in the semi-annual reports (1974-1976) and annual reports (1977 - 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through graphic presentations of monthly densities of the major phytoplankton components, Bacillariophyceae, Chlorophyceae, and Myxophyceae, encountered yearly from 1974-1979 (Figures 40 -45). Figure 46 presents the monthly estimates of the total phytoplankton density from 1974 through 1979.

Table 28 and Figures 47 - 50 summarize the above data in a different manner by combining all monthly density estimates from all years and all stations and comparing pre-operational means, minima, maxima, and standard deviations with operational results. Table 29 and Figures 51 - 53 use this same technique to compare the total phytoplankton densities observed at Station 8 (intake structure), Station 13 (plume area), and Station 3 (control station). A discussion of these comparisons follows.

Diatoms. Both pre-operational and operational densities were high during the spring and fall, and low during the summer (Figure 47). Spring densities were highest. This is typical for western Lake Erie and as one would expect since diatoms are cold-water forms. Operational densities observed during the spring and fall were larger than the corresponding pre-operational values. However, operational standard deviations overlapped the pre-operational standard deviations.

Green Algae. Chlorophycean densities, in general, were much lower than diatom densities or blue-green algae densities during the pre-operational and the operational studies. Furthermore, these green algae population densities are much less predictable seasonally than diatoms. Reutter (1976) has demonstrated that green algae densities parallel transparency closely and are opposite to turbidity and, therefore, are often controlled by factors such as the wind, which affects transparency by suspending bottom sediments through wave action. However, most of the monthly samples collected during the operational period fell within the range established during the pre-operational period, and for those which were outside the range (July, September, and November), the standard deviation of the operational period overlapped the standard deviation of the pre-operational period (Figure 48).

Blue-Green Algae. Myxophycean populations during both the pre-operational and operational periods showed tendencies toward sudden, large, mid-summer pulses (Figure 49). Operational densities were generally larger than pre-operational densities. However, with the exception of October and November, the operational standard deviations always overlapped the pre-operational standard deviations.

Total Phytoplankton. The total phytoplankton density, i.e., the sum total of the 3 major component groups previously discussed and several other minor classes, was higher during most of the operational study than during the pre-operational study (Figure 50). However, with the exception of April and October, the standard deviations of the means observed during the operational study overlapped the standard deviations from the pre-operational study.

Zooplankton Results

The results of the zooplankton monitoring program were presented in the semi-annual reports (1974-1976) and annual reports (1973, 1977, 1978 and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through graphic presentations of the monthly densities of the total zooplankton population and its major components, rotifers, copepods, and cladocerans encountered yearly from 1972 -1979 (Figures 54 - 57).

Table 30 and Figures 58 - 61 summarize the data in a different manner by combining all monthly density estimates from all years and all stations and comparing pre-operational means, minima, maxima, and standard deviations with operational results. Table 31 and Figures 62 - 64 use this same technique to compare total zooplankton densities observed at Station 8 (intake structure), Station 13 (plume area), and Station 3 (control station). A discussion of these comparisons follows.

Total Zooplankton. The total zooplankton population density, i.e., a sum total of the major zooplankton groups (rotifers, copepods, and cladocerans) and any minor classes or orders, has usually exhibited two pulses, one in the late spring or early summer and a smaller pulse in the fall. This is true of both pre-operational and operational results, although operational densities were generally lower than pre-operational densities (Figure 58).

Rotifers. Rotifer densities at Locust Point during the operational period were lower for every month than the mean value from the pre-operational period for the same month (Figure 59). However, the operational monthly mean was below the pre-operational monthly range only during June and November, and the operational monthly mean was always less than two standard deviations from the pre-operational mean.

Copepods. Copepod densities at Locust Point during the pre-operational study generally exhibited spring pulses (Figure 60). This was also the case during the operational study, except the pulse was somewhat smaller than those observed during the pre-operational study. As observed with the rotifers, operational monthly densities were never more than two standard deviations from the pre-operational mean (Figure 60).

Cladocerans. Cladoceran densities at Locust Point during both the pre-operational and operational studies have exhibited spring (or early summer) and fall pulses (Figure 61). However, during the operational period the two pulses were less distinct. With the exception of August, none of the monthly operational densities were more than two standard deviations from the pre-operational mean.

Appraisal

Prior to the appraisal of the effects of unit operation on the zooplankton and phytoplankton communities, some assistance in interpreting these results is warranted. First, one should bear in mind that when sampling the same population eight months each year for seven years, and plotting data with monthly minima and maxima, as in this report, eight minima and eight maxima will be generated. That is, there will be seven values for each of the eight months, or one value for each month from each of the seven years. Each of the eight months will have a minimum value and a maximum value, and, since there are eight months, there will be a total of eight minimum values and eight maximum values (one of each for each month). If there is nothing unusual about the environmental conditions which existed during any of the seven years, then each year would have an equal chance (probability) of producing several monthly minimum or maximum values. Assuming each year does have an equal probability of producing these minima and maxima, and since there are eight monthly minimum values and eight monthly maximum values, each year of the seven years would produce 1.14 of the monthly minimum values and 1.14 of the monthly maximum values. This is pointed out to demonstrate that it is natural for any year to produce a population extreme (monthly minimum or maximum value). Consequently, it should not be automatically viewed as a unit produced effect if any operational variable is above or below the pre-operational range.

Another point useful in the interpretation of these results involves the distance of the operational monthly mean from the pre-operational mean. A general "rule-of-thumb" is that when dealing with a normal distribution, the area within one standard deviation on either side of the mean will contain approximately 66 percent of the values, two standard deviations would contain approximately 95 percent of the values, and three standard deviations would contain approximately 99 percent of the values.

As a final aid in interpreting these results, population densities are presented from a control station (unaffected) to allow comparison with the discharge where the impact should be greatest. This allows a distinction to be made between unusual values caused by unit operation and unusual results which are typical of the entire lake due to an unusual set of climatic or biological conditions -- natural variation.

Between September 1977 and the end of 1979, the operational period, plankton samples were collected on 18 occasions. On five of these dates, the station was operating at 90 percent capacity, 8 percent capacity, 100 percent capacity, 99 percent capacity, and 48 percent capacity, respectively. On the remaining 13 sampling dates the station was not operating.

Phytoplankton. Reutter and Fletcher (1980) summarized the results of phytoplankton sampling at Locust Point and concluded that "populations observed at Locust Point during 1979 are similar to those of previous years and appear typical for those occurring in the nearshore waters of the Western Basin of Lake Erie." This report has taken the results compiled by Reutter and Fletcher a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those of 1978 and 1979 to summarize the operational period.

Operational phytoplankton densities were somewhat larger than pre-operational densities (Figure 50). This appears to be a general trend, as the operational values of the three major phytoplankton groups were never below the pre-operational range and often above it. Due to the unusually harsh winters of 1978 and 1979, it is likely that these differences were caused by natural weather conditions.

Figures 51 - 53 present phytoplankton densities at the station intake (Station 8), discharge (Station 13), and a control station (Station 3). It would probably be safe to use the station intake as a control station, however, as an extra measure of caution Station 3, 3000 feet northwest of the discharge, was selected as a control. Using this comparative technique, any difference between pre-operational and operational data observed at the discharge which was also observed at the intake or Station 3 would obviously have been due simply to natural variation in population densities. The only large differences between operational and pre-operational data at the discharge were unusually high spring and fall population densities, and, since these were also observed at the intake and Station 3, they were obviously a natural phenomenon and not caused by unit operation.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie phytoplankton densities.

Zooplankton. Reutter and Fletcher (1980) summarized the results of zooplankton sampling at Locust Point through 1979 and concluded that "populations observed in 1979 should be considered typical for the south shore of the Western Basin of Lake Erie." This report has taken the results compiled by Reutter and Fletcher a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those of 1978 and 1979 to summarize the operational period.

Zooplankton operational densities, though generally similar to pre-operational densities, were often somewhat lower than the corresponding pre-operational monthly density (Figures 58 - 61). However, as with the phytoplankton, these differences should not be interpreted as due to unit operation, for it appears that zooplankton densities even in unaffected areas (control stations) were lower during the operational period (Figures 62-64). Consequently, these differences were obviously attributable to natural variation and not unit operation.

The obvious conclusion is that to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie zooplankton densities.

Benthic Studies

Procedures

Benthic macroinvertebrate densities in the vicinity of the Davis-Besse Nuclear Power Station were monitored at approximately monthly intervals during ice-free periods (normally April through November) from 1973 through 1976, and at invervals of approximately 60 days during the ice-free periods of 1977, 1978, and 1979 (Table 32). The stations at which samples were collected each year are listed in Table 33 and shown on Figure 17. Population densities were sampled with a Ponar dredge (Area=0.052 m^2). Three replicate grabs were collected at each station on each date from 1974 through 1979, whereas one sample was collected at each station on each date during 1973. Samples were sieved on the boat through a U.S. #40.soil sieve, preserved in 10% formalin, and returned to the laboratory for identification and enumeration. Individuals were identified as far as practicable (usually to genus; to species when possible). Results were reported as the number of organisms per m^2.

Results

The results of the benthos monitoring program were presented in the semi-annual reports (1974 - 1976) and annual reports (1973, 1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. This report summarizes the findings presented in these earlier reports through a graphic presentation of the monthly benthic macroinvertebrate densities encountered yearly from 1972 - 1979 (Figure 65).

Table 34 and Figures 66 - 70 summarize the data in a different manner by combining all monthly density estimates for the major benthic groups from all years and all stations during the pre-operational study, and comparing these pre-operational monthly means, minima, maxima, and standard deviations to operational results. Table 35 and Figures 71 - 73 use this same technique to compare total benthic macroinvertebrate densities observed at Station 8 (intake structure), Station 13 (discharge area), and Station 3 (control station). A discussion of these comparisons follows.

<u>Total Benthic Macroinvertebrates</u>. The population densities of all benthic macroinvertebrates, i.e., the sum total of the major benthic groups (Coelenterata, Annelida, Arthropoda, and Mollusca), were generally the highest in the late summer and fall during the pre-operational study. During the operational study the highest densities occurred slightly earlier in the summer and fall (Figure 66). Operational densities were

very close to the pre-operational mean during every month except September, when they were slightly lower than the pre-operational minimum.

Coelenterata. Pre-operational coelenterate population densities generally produced peaks in the spring and fall (Figure 67). During the operational study only a fall peak was observed. However, operational density estimates were always within one standard deviation of the pre-operational mean.

Annelida. Benthic annelid densities during both the pre-operational and operational studies showed peaks in late summer or early fall (Figure 68). However, all monthly operational results were within the pre-operational range or within one standard deviation of the pre-operational mean, except May and September, when the operational densities were slightly lower.

Arthropoda. Both pre-operational and operational benthic arthropod densities peaked during the summer and fall (Figure 69). Operational densities were above the pre-operational maxima during May, June, and July, and below the minimum during October.

Mollusca. Benthic mollusc densities were extremely low (five was maximum during the seven-year study period) and variable, and, consequently, pre-operational/operational differences are difficult to detect (Figure 70). However, nothing unusual was observed during the operational period.

Appraisal

Initially it should be pointed out, as discussed in the plankton appraisal (see page 18), that operational densities which fall outside the pre-operational range may be due to natural variation and not related to unit operation. To allow comparisons of ambient densities with densities at the unit discharge, population densities have been presented from Station 3, a control station located 3000 ft northwest of the unit discharge structure, the same distance from shore as the discharge and at approximately the same water depth. These comparisons allow one to more accurately assess the causes of observed differences - natural variation or unit operation.

During what is defined as the operational period, samples were collected on ten occasions. On these ten occasions, the unit was operating at 98 percent on one occasion, 100 percent on another, 99 percent on another, and not operating on the remaining seven dates. While this is very critical to water quality and plankton results, it is somewhat less important when observing benthic communities. Benthic communities are much less mobile than plankton or fish, and, therefore, are generally considered to be good pollution indicators, even of intermittent pollutants or environmental changes. The rationale is that even if the unit were not operating on the sampling date, a large portion of the community sampled would have been present when the unit was operating.

This is not true of plankters, and fish are capable of leaving when unfavorable conditions exist and then returning quickly when the conditions are improved.

Reutter (1980a) summarized the results of benthic macroinvertebrate sampling at Locust Point through 1979 and concluded that "populations found at Locust Point during 1979 must be considered typical for those of the nearshore waters of the Western Basin of Lake Erie . . . no significant environmental changes due to unit operation were observed." This report has taken the results compiled by Reutter a step farther by computing means, ranges, and standard deviations for the pre-operational period and by adding the results from the last portion of 1977 to those from 1978 and 1979 to summarize the operational period.

Benthic macroinvertebrate densities observed during the operational study were within the limits established during the pre-operational study on all but one occasion. A review of Figures 71 - 73 shows that variability in population densities was widespread and not related to unit operation. Operational densities observed at the discharge (Figure 72) more closely resembled pre-operational densities than did those observed at the intake (Figure 71) or Station 3 (Figure 73), which were designed to be the control stations. Results at Station 3, which is well away from the intake and discharge and where no construction has ever occurred, are graphic examples of the discussion at the beginning of this appraisal section, showing that natural variability can produce values far from the pre-operational densities. Furthermore, this type of variability is to be expected in the Locust Point vicinity, a shallow wave-swept zone with shifting substrate.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie benthic macroinvertebrate densities.

Fisheries Population Studies

Procedures

Fish populations in Lake Erie at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station were monitored at approximately monthly intervals during ice-free periods (normally April - November) from 1973 through 1979. Fish were collected by three sampling techniques, experimental gill nets, shore seines, and trawls.

Experimental gill nets (125 feet long, consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh) were set parallel to the intake pipeline at Station 8 (intake) and parallel to the discharge pipeline at Station 13 (discharge or plume area) from 1973 through 1979 (Table 36). During 1977, 1978, and 1979, nets were also placed at Stations 3 and 26 to serve as controls (Figure 17). Each net was fished at the lake bottom for approximately 24 hours. Results were reported as catch per unit effort (CPE), where one unit of effort was equal to one 24-hour set with one net.

Shore seining was conducted at Stations 23, 24, and 25 with a 100-ft bag seine (¼-inch bar mesh). The seine was stretched perpendicular to the shoreline until the shore brail was at the water's edge. The far brail was then dragged through a 90^{o} arc back to shore. Two hauls were made at each station in opposite directions.

Four 5-minute bottom tows with a 16-ft trawl (1/8-inch mesh bag) were conducted on a transect between Stations 8 (intake) and 13 (plume area) at a speed of 3 - 4 knots. Starting in 1977, tows were also made on a transect between Stations 3 and 26 for comparative purposes.

All fish captured by each technique were identified, enumerated, weighed, and measured (Trautman, 1957; Bailey, et al., 1970). All results were keypunched and stored on magnetic tape at The Ohio State University Computer Center.

Results

The results of the fisheries population monitoring program are contained in the semi-annual reports (1974 - 1976) and the annual reports (1973, 1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. These reports have shown gill netting to be the superior sampling technique for measuring the impact of unit operation for several reasons:

1. gill nets can be set right at the point of impact, are relatively unbiased sampling devices, and collect adequate sample sizes (quantities of fish);

2. shore seines sample mainly young-of-the-year fish and, consequently, are subject to sudden pulses following spawning;

3. shore seines sample at locations over 1000 feet from the point of discharge;

4. trawls have been shown to collect too few fish.

Consequently, although the results of shore seining and trawling have greatly increased our ability to interpret yearly results, gill nets have proven to be the most effective assessment tool, and, therefore, these results and discussions will pertain mainly to this gear type.

Fifty-one fish species have been collected at Locust Point since 1963 (Table 4). However, the fish community at Locust Point has consistently been dominated by seven species: alewife, emerald shiner, freshwater drum, gizzard shad, spottail shiner, white bass, and yellow perch. These seven species generally constitute well over 90 percent of the annual catch by the sampling program. The monthly mean, minimum, maximum, and standard deviation of the number of each of these species, except emerald shiner, collected in the gill net set at the discharge have been presented in Table 37 and Figures 74 - 81. Emerald shiners are seldom collected in gill nets of these mesh sizes, so they were not included in the tabulations. However, due to their economic importance, channel catfish and walleye were added to the list. Table 38 and Figures 82 - 85 summarize the gill net results by presenting pre-operational means, minima, maxima, and standard deviations and comparing them to operational results at Stations 8 (intake), 13 (discharge or plume area), 3 and 26 (controls).

Alewife. Alewife densities in the vicinity of the unit discharge during both the operational and pre-operational periods were generally highest during the late summer and early fall (Figure 74). The maximum pre-operational catch was 322, while 136 was the maximum catch during the operational period (Table 37). Although operational catches were generally lower than pre-operational catches, they were always within the pre-operational range.

Channel Catfish. Channel catfish catches during both the pre-operational and operational studies were greatest during the summer (Figure 75). They were seldom a significant component of the catch, as 18 was the maximum pre-operational catch and 6 was the maximum operational catch (Table 37). The pre-operational and operational catches were quite similar, and all operational means were within the pre-operational range.

Freshwater Drum. During both the pre-operational and operational studies, freshwater drum were most abundant during the summer (Figure 76). The maximum catch during the pre-operational study was 50, while 75 was the maximum operational catch (Table 37). With the exception of June, which was higher, all operational catches were within the range established during the pre-operational study.

Gizzard Shad. Gizzard shad densities during both the pre-operational and operational studies were always greatest during the late summer and fall (Figure 77). The maximum pre-operational catch was 184, while 291 was the maximum operational catch (Table 37). The monthly pre-operational and operational mean catches were generally quite similar, and all but one of the operational means were within the pre-operational range (Figure 77).

Spottail Shiner. Spottail shiners were always most abundant during the month of May (Figure 78). In fact, with the exception of April and June, the minimum catch in May was greater than the maximum catch of any of the other months during the pre-operational period. The operational catch was within the range established during the pre-operational period during all months but September.

Walleye. Walleye catches during both the pre-operational and operational studies were greatest during the summer (Figure 79). This species was never a significant portion of the catch, as 15 was the maximum prior to plant operation and 8 was the maximum afterwards (Table 37). With the exception of August, when the operational catch was above the range of pre-operational catches, all catches after the unit began operation were within the range of catches prior to unit operation.

White Bass. White bass were generally most abundant during the summer (Figure 80 and Table 37). The magnitude of the pre-operational and operational catches were very similar, but the pre-operational peak occurred in August whereas the operational peak occurred in June. With the exception of June and July, when the operational catch was above the pre-operational mean, all operational values were within the range established during the pre-operational study.

Yellow Perch. Yellow perch generally occurred in similar numbers from month to month during the pre-operational period with a slight increase in the early fall, followed by a decrease to low densities in November (Figure 81). Operational densities were of similar magnitude during all months but August when they were higher than the pre-operational mean but very close to the pre-operational maximum for September.

Appraisal

In the appraisals of the phytoplankton, zooplankton, and benthos sections, it was shown that extreme values, i.e., either maxima or minima, in addition to being potentially due to unit operation, will occur by chance alone, due to natural variation. Furthermore, the magnitude of the standard deviation gives one a good indication of the magnitude of natural variation to be expected.

The above statements are hardly necessary when evaluating the impact of unit operation on the fishery populations in the vicinity of the Davis-Besse Nuclear Power Station, for there was little or no variation out of the pre-operational range during the operational period for the eight major species (Figures 74 - 81). On the 17 sampling dates during the operational period, the unit was operating at above 90 percent capacity on four dates, 15.0 percent capacity on another, and not operating on the remaining twelve dates.

Another way to measure impact and an approach which allows us to include all species (not just the major eight) is to compare catches at the discharge (Station 13) and those at the intake (Station 8) with two control stations (Figures 82 - 85 and Table 38). This method shows that the only operational catches at the intake and discharge which were outside the pre-operational range occurred during November (Figures 82 and 83). Both of these catches were above pre-operational data which is an indication that it was either a lake-wide occurrance, or a case of fish being attracted to the rip-rap material which was placed around these structures to prevent bottom scouring and ice damage. However, since an identical November increase occurred at the control stations (Figures 84 and 85), natural variation, not unit operation, should be considered the cause.

In conclusion, to date, operation of the Davis-Besse Nuclear Power Station, Unit 1, has not had a significant effect on Lake Erie fish populations at Locust Point.

Ichthyoplankton

Procedures

Ichthyoplankton was sampled at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station from 1974 through 1979 with a 0.75-meter diameter oceanographic plankton net (No.00, 0.75 mm mesh). Each sample consisted of a 5-minute circular tow at 3 to 4 knots. Samples were collected at the surface and bottom of each station.

Sampling was conducted at the following stations during the following years: 1974, Stations 8 and 12; 1975, Stations 8, 12, and Toussaint Reef (Figure 15); 1976, Stations 3, 8, 13, 26, 28, 29, and Toussaint Reef; 1977, 1978 and 1979, Stations 3, 8, 13, 29, and Toussaint Reef. Toussaint Reef was used for comparisons since the Ohio Division of Wildlife considers it a spawning location. Each sample was preserved in 5 percent formalin and returned to the laboratory for sorting and analysis. Samples were generally collected at approximately 10-day intervals from April through August. Sampling was terminated at the end of August to add a margin of safety to the USEPA (Grosse Ile Office) sampling program for the Western Basin of Lake Erie which terminated each year in July (Table 39).

From 1974 to 1976, a single sample was collected at each depth of each station, and results were reported as the number of individuals per 5-minute tow. In 1977, 1978 and 1979, duplicate samples were collected at the surface and bottom of each station, and the net was equipped with a calibrated General Oceanics flowmeter to allow presentation of the results as the number of individuals per 100 m^3 of water. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975).

Results

The results of the ichthyoplankton analyses have been thoroughly described in the semi-annual reports (1974 - 1976) and annual reports (1977, 1978, and 1979) of the Toledo Edison Company to the U.S. Nuclear Regulatory Commission. Since the reporting of results changed (catch per unit effort vs. no./100 m^3) during the course of the study, direct comparisons of results from 1977, 1978, and 1979 with those of the early pre-operational years, 1974 - 1976, are not possible. However, comparisons of the relative portions of the total density constituted by each species are possible.

Ichthyoplankton populations varied greatly from 1974 - 1979. Emerald shiners constituted 81 percent of the 1974 larvae, 1 percent of the 1975 larvae, 60 percent of the 1976 larvae, 3 percent of the 1977 larvae, 14 percent of the 1978 larvae, and 3 percent of the 1979 larvae. Yellow perch constituted 5 percent of the 1974 larvae, 70 percent of the 1975 larvae, 4 percent of the 1976 larvae, 26 percent of the 1977 larvae, 2 percent of the 1978 larvae, and 11 percent of the 1979 larvae. Gizzard shad appear to have increased significantly, reaching 34 percent of the 1976 larvae, 56 percent of the 1977 larvae, 69 percent of the 1978 larvae, and 82 percent of the 1979 larvae. It is felt that the above described variability is largely due to the fact that schooling populations are being sampled. Consequently, when the net is drawn through a school the density appears quite high. This is also quite dependent on the seasonal frequency of sampling. For example, if the weather allows more frequent spring sampling but prohibits summer sampling, then spring species such as perch and walleye appear relatively more abundant.

Nineteen seventy-eight was the second year that walleye constituted a significant portion of the catch. However, as noted in 1977, adult populations throughout the Western Basin are increasing greatly (Scholl, 1978). These walleye larvae contributed to the 53 percent increase observed in larval densities from 1977 (mean density = 37.0/100 m^3) to 1978 (mean density = 56.6/100 m^3). However, gizzard shad were the major source of this increase as their mean densities increased from 20.7/100 m^3 in 1977 to 38.9/100 m^3 in 1978. Yellow perch densities decreased significantly from 9.5/100 m^3 in 1977 to 1.2/100 m^3 in 1978. This decrease is similar to that observed by the Ohio Division of Wildlife for the adult population (Scholl, 1979).

The 1979 ichthyoplankton density (66.79/100 m^3) was 18 percent greater than the 1978 density (56.6/100 m^3) (Reutter, 1979). Although walleye densities decreased from 6.1/100 m^3 to 0.15/100 m^3, the loss was more than offset by yellow perch densities which increased from 1.2/100 m^3 in 1978 to 7.46/100 m^3 in 1979 and gizzard shad densities which increased from 38.9/100 m^3 in 1978 to 54.64/100 m^3 in 1979. It appears that walleye and yellow perch densities will fluctuate yearly, however, a definite increasing trend is emerging for gizzard shad densities.

In 1976, control stations (3 and 29) were established on either side of the intake (Station 3)/discharge complex (Station 13) to determine if unusually large fish larvae populations were occurring due to possible spawning in the rip-rap material around these structures. This does not appear to be occurring to any significant degree as Station 13 (plume area) exhibited densities similar to Station 3 (control), and Station 8 (intake) exhibited the lowest densities. These lower densities observed at Station 8 are probably due to the fact that this station is the farthest from shore and in the deepest water.

Appraisal

Ichthyoplankton at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station, Unit 1, was sampled for two major reasons: 1) to determine if unit operation had a significant effect on densities in the area; and 2)to provide the ichthyoplankton densities to be used for the entrainment estimates. The first goal of the program is reasonable, and Reutter (1980b) stated, "due to the similarity between test and control stations, there is no indication that the activities of the plant have significantly altered these populations." To date, this assessment is true. However, on the 20 sampling dates during the operational study, the unit was operating at over 90 percent capacity on 3 dates, 40 percent capacity on another, 39 percent capacity on another one, 29 percent capacity on another, and not operating on the remaining 14.

The second reason for sampling ichthyoplankton is no longer valid as these results will not be used for entrainment estimates. Reutter and Cooper (1978) demonstrated that night samples at Locust Point produced density estimates 13.1 times greater than day estimates. Consequently, a night ichthyoplankton sampling program was initiated, the results of which were to be used to estimate entrainment losses at the unit.

Fish Egg and Larvae Entrainment

Procedures

Fish egg and larvae (ichthyoplankton) entrainment at the Davis-Besse Nuclear Power Station was computed by multiplying the ichthyoplankton concentration observed at Station 8 (intake) by the intake volume. Ichthyoplankton densities were determined at approximately 10-day intervals from April - August of 1978 and 1979 from four 3-minute, oblique (bottom to surface) tows at 3 - 4 knots made at night on each date (Tables 40 and 41) with a 0.75 meter diameter heavy-duty oceanographic plankton net (No. 00, 0.75 mm mesh) equipped with a calibrated General Oceanics flowmeter. Oblique tows were selected as this is the technique required at intakes on Lake Erie by U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service. Night sampling is also required by these agencies to minimize net avoidance by larvae and to more accurately assess populations of species which may cling to the bottom during daylight. Samples were preserved in 5% formalin and returned to the laboratory for sorting and analysis. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975). Densities were presented as number of ichthyoplankters per 100 m^3 of water.

From the above estimates it was possible to determine an approximate period of occurrence for each species and a mean density during that period. For example, during 1978 walleye were not found on April 30 or on June 7 or later (Table 40). They were present in samples from May 11 and May 21. Therefore, the period of occurrence was estimated to have been from May 6 (the midpoint between April 30 and May 11) to May 30 (the midpoint between May 21 and June 7) (Table 42). The mean density of walleye during this period was estimated to have been 41.6/100 m^3, computed from the concentration of 79.2/100 m^3 observed on May 11 and the concentration of 4.0/100 m^3 observed on May 21. It was this concentration, 41.6/100 m^3, which was multiplied by the volume of water drawn through the plant from May 6 to May 30. The same procedure was used in 1979 (Table 43). The daily intake volume was computed by multiplying the daily discharge volume by 1.3. The daily intake volumes were then added for all days within the period of occurrence of the species in question to determine the total intake volume during the period. All specimens were vouchered and all data were keypunched and stored at The Ohio State University's Center for Lake Erie Area Research, Columbus, Ohio.

Results

No pre-operational comparisons can be made since entrainment is associated with unit operation. Furthermore, since the operational period began in September 1977 (after the spawning season), no entrainment of fish and eggs occurred until 1978.

Ichthyoplankton densities observed at Station 8 (intake) during 1978 indicated that ichthyoplankters were entrained at the Davis-Besse Nuclear Power Station from May 6 to August 17 (Table 40). May 6 was selected as the first day since it is midway between April 30 and May 11. August 17 was selected as the last day because larvae were present in night samples on August 11 (Table 40) but were absent from day samples at Station 8 on August 23 and later.

During 1978 the mean larvae density from all night samples at Station 8 (47.5/100 m^3) was 49 percent greater than the mean density from all day samples collected at Station 8 (31.9/100 m^3). Gizzard shad constituted 69 percent of the night ichthyoplankton population, followed by walleye at 22 percent, and emerald shiners at 5 percent (Table 40).

Based on the above results (Table 40), it is estimated that 6,311,371 larvae and 44,278 eggs were entrained at the Davis-Besse Nuclear Power Station during 1978 (Table 42). Of this total, gizzard shad constituted 76 percent, walleye 15 percent, and emerald shiners 5 percent.

Ichthyoplankton densities observed at Station 8 (intake) during 1979 indicated that ichthyoplankters were entrained at the Davis-Besse Nuclear Power Station from 26 April to 9 August (Table 41). April 26 was selected as the first day because several walleye were collected on the first sampling date (1 May) and 26 April is half of one sampling interval (10 days) ahead of this first collection. It should also be noted that in 1978 no ichthyoplankters were collected prior to 11 May. August 9 was selected as the last day since it is midway between 3 August, the last sampling date on which larvae were present, and 15 August, a sampling date on which no ichthyoplankters were collected.

During 1979 the mean larvae density from all night samples at Station 8 (142.97/100 m^3) was 2.9 times greater than the mean density from all day samples collected at Station 8 (36.7/100 m^3). Gizzard shad constituted 50 percent of the night ichthyoplankton population, followed by emerald shiners at 32 percent, yellow perch at 8 percent, freshwater drum at 5 percent, and smelt at 4 percent (Table 41).

Based on the results in Table 41, it is estimated that 20,620,799 larvae and 101,405 eggs were entrained at the Davis-Besse Nuclear Power Station during 1979 (Table 43). Of this total, gizzard shad constituted 49 percent, emerald shiners 33 percent, yellow perch 8 percent, freshwater drum 5 percent, and rainbow smelt 4 percent.

Appraisal

Ichthyoplankton entrainment at the Davis-Besse Nuclear Power Station during 1978 and 1979 was typical for an intake on the south shore of the Western Basin of Lake Erie -- it was strongly dominated by gizzard shad. As explained in the ichthyoplankton section of this report, gizzard shad are on the increase and, consequently, it would not be surprising if they represented an even greater portion of the entrainment in future years. Walleye and perch populations appear to be fluctuating. They will obviously be entrained at this station. However, the number could vary greatly from year to year.

One way to put entrainment losses into perspective is to look at fecundity. Based on an average of 300,000 eggs/female gizzard shad (Hartley and Herdendorf, 1977), the 4,796,964 larvae entrained during 1978 could have been produced by 16 females; based on an average of 331,000 eggs/female walleye (Hartley and Herdendorf, 1977), the 916,738 larvae entrained during 1978 could have been produced by 3 females; and based on 44,000 eggs/female yellow perch (Hartley and Herdendorf, 1977) the 35,259 larvae entrained during 1978 could have been produced by 1 female. In actuality, the above estimates of the number of females required to produce the entrained larvae are quite low since they do not take mortality from eggs to larvae into account. If we assume 99 percent mortality from eggs to larvae to be safe (90 percent is probably more reasonable) then the entrained larvae could have been produced by 1,600 gizzard shad, 300 walleyes, and 100 perch. These values are less than 0.1 percent of the number of perch and walleye captured by Ohio sport fishermen in 1978 (Scholl, 1979). Furthermore, if one looks at the worst case, the value for the upper 95 percent confidence limit and assumes 99 percent mortality from eggs to larvae, the losses of perch and walleye larvae are still less than 0.25 percent of the number lost due to harvesting by Ohio sport fishermen.

Another way to determine the impact of entrainment losses is to estimate the number of adults the entrained larvae might have produced had they lived. This technique requires some knowledge of the mortality between larval stages and between year classes. Patterson (1976) has developed such estimates for yellow perch, and, since it is in the same family, the estimates will also be used here for walleye. Several assumptions are involved.

I. All entrained larvae are killed.

II. All larvae lost by entrainment are in their late larval stage. This provides a conservative or high estimate because it does not account for early larval mortality which may range from 83-96 percent (Patterson, 1976).

III. Yellow perch become vulnerable to commercial capture, and reach sexual maturity at age class III.

IV. A one percent survival rate from late larvae to age III adults is assumed. Again, this is conservative since survival rates from:

late larvae to YOY = 4 to 17 percent;
YOY to age class I = 12 to 33 percent;
age class I to age class II = 38 percent;
age class II to age class III = 38 percent (Patterson, 1976, and Brazo, _et al_., 1975).

This trend translates to a survivorship ranging from 0.1 percent to one percent over the period from the late larval stage to age class III.

Based on the above assumptions, in 1978 the 916, 738 entrained walleye larvae might have produced 917-9,167 age class III adults and the

35,259 entrained yellow perch larvae might have produced 35-353 age class III adults. In 1979, the 41,648 entrained walleye larvae might have produced 42 - 416 age class III adults and the 1,595,066 entrained yellow perch larvae might have produced 1,595 -15,951 age class III adults.

The author feels little weight should be placed on the above impact assessments since they are based on the number of entrained larvae which can vary greatly from year to year depending on the success of the hatch which in turn is dependent upon the size of the brood stock and weather conditions during spawning and incubation. In the case of Davis-Besse, the off-shore intake where larvae densities are lower and the low volume intake (1978 mean = 21,389 gpm) due to the cooling tower and closed cycle cooling system will always result in a very low-level impact on Western Basin fish populations.

Fish Impingement

Procedures

As was the case with entrainment, impingement is an operational phenomenon and, consequently, pre-operational comparisons are impossible. Furthermore, since estimates are available for only a small portion of 1977 (Reutter, 1978), and since impingement should be viewed for an entire year to allow for seasonal interpretations, only the 1978 and 1979 results will be discussed.

Between January 1 and December 31, 1978 the traveling screens at the Davis-Besse Nuclear Power Station were operated 221 times, while between January 1 and December 31, 1979 the screens were operated 272 times. The date, time, and duration of each screen operation were recorded and keypunched, even when the impinged fish were not collected (Tables 44 and 45). Collections of impinged fish were made by Toledo Edison personnel during 144 of the 221 screen operations during 1978 and on 134 of the 272 screen operations in 1979 by placing a screen having the same mesh size as the traveling screens (¼-inch bar mesh) in the sluiceway through which the backwashed material passed. Fish collected in this manner were placed in plastic bags, labeled with the date and time of screen operation, and frozen. The samples were picked up by personnel of The Ohio State University's Center for Lake Erie Area Research (CLEAR) weekly. All specimens, or a representative number thereof, were also weighed and measured.

In addition to the information pertinent to traveling screen operation, the total number and total weight of each species and the length and weight of each individual fish were also keypunched. All these data were stored on magnetic tape at The Ohio State University for use with the Statistical Analysis System: SAS (Barr et al., 1976) on an AMDAHL 370 computer.

Since the time and duration of every screen operation was known, it was possible to determine the number of hours represented by each collection. From this a rate, fish impinged/hour, was developed and used to estimate impingement on days when samples were not collected.

Results

A total of 6,607 fish representing 20 species was impinged on the traveling screens at the Davis-Besse Nuclear Power Station from January 1 through December 31, 1978 (Table 46). Goldfish was the dominant species impinged representing 49.9 percent of the total. Only 6 other species represented more than 1 percent of the total: yellow perch, 23.9 percent; emerald shiner, 15.0 percent; gizzard shad, 5.9 percent; black crappie, 1.2 percent; freshwater drum, 1.2 percent; and rainbow smelt, 1.0 percent.

A total of 4,385 fish representing 19 species was impinged on the traveling screens at the Davis-Besse Nuclear Power Station from January 1 through December 31, 1979 (Table 47). Goldfish was the dominant species impinged representing 78.6 percent of the total. Only 4 other species represented more than 1 percent of the total: yellow perch, 6.5 percent; emerald shiner, 4.9 percent; gizzard shad, 3.7 percent; and freshwater drum, 2.6 percent.

Impingement was also computed on a monthly basis (Tables 48 and 49). Most of the impingement during 1978 occurred during April (43.5 percent) and December (35.3 percent). Of the 2,875 fish estimated to have been impinged during April, 834 (29.0 percent) were emerald shiners, 799 (27.8 percent) were goldfish, and 1,098 (38.2 percent) were yellow perch. Of the 2,330 fish estimated to have been impinged during December, 1,870 (80.3 percent) were goldfish and 360 (15.5 percent) were gizzard shad.

Most of the impingement during 1979 occurred during January (55.4 percent) and April (17.2 percent). Of the 2,429 fish estimated to have been impinged during January, 2,218 (91.3 percent) were goldfish, 103 (4.2 percent) were freshwater drum, and 80 (1.8 percent) were gizzard shad. Of the 753 fish estimated to have been impinged in April, 333 (44.2 percent) were goldfish, 200 (26.6 percent) were yellow perch, and 184 (24.4 percent) were emerald shiners.

Appraisal

With the exception of the blackside darter and the bluntnose minnow, all species impinged at the Davis-Besse Nuclear Power Station have been captured within the past 17 years at Locust Point (Table 4). However, both the blackside darter and bluntnose minnow have been reported from the island area of Lake Erie and most of the tributaries, including the Toussaint River and Turtle Creek near Locust Point (Trautman, 1957).

With the exception of goldfish, black and brown bullheads, and black and white crappies, the impinged fish occurred in relative numbers which were not unusual for populations in Lake Erie at Locust Point. These five species occurred in relative proportions well above that of the open lake. This indicates probable use of the intake canal as a permanent residence for these species. Furthermore, due to the small sizes of these fish (they were young-of-the-year) and results from previous trawling efforts

(Reutter and Herdendorf, 1975), it appears that these species are also spawning within the intake canal and, consequently, these losses should not be considered as a negative impact on the lake populations of these species.

Impingement losses at the Davis-Besse Nuclear Power Station during 1978 and 1979 were extremely low even when compared to other plants on the Western Basin with lower generating capacities (Reutter et al., 1978). Tables 50 - 52 present sport and commercial fish landings from the Ohio waters of Lake Erie and commercial landings from all of Lake Erie. Table 50 presents only 1978 results because 1979 sport fishing harvest estimates are not available for all species. However, they would probably have been higher than 1978 because commercial fishing harvests increased by 13 percent from 1978 to 1979, and because the sport harvest of walleye increased from 1,652,000 in 1978 to 3,351,000 in 1979 (Ohio Department of Natural Resources, 1980). Although the fish impinged at Davis-Besse were primarily YOY (mean length, 74 mm and 71 mm in 1978 and 1979) and, consequently, much more abundant than the adults taken by commercial and sport fishermen, the total number impinged (including gizzard shad and goldfish which are not taken by sport fishermen) was only 0.04 percent (1978) and 0.03 percent (1979) of the number harvested by Ohio sport fishermen in 1978. This figure becomes even less significant when one realizes that the Ohio sport catch was only 83.4 percent of the Ohio 1978 commercial catch and only 15.9 percent of the 1978 commercial catch from all of Lake Erie (Tables 50 - 52).

The above comparisons make it obvious that impingement losses at the Davis-Besse Nuclear Power Station have an insignificant effect on Lake Erie fish stocks and further justification of this is unnecessary. However, it should be noted that although by number impingement losses were 0.04 percent (1978) and 0.03 percent (1979) of the Ohio 1978 sport fishing harvest, by weight impingement was less than 0.001 (1978 and 1979) percent of the Ohio sport harvest. Furthermore, based on the estimates of Patterson (1976) (see Entrainment Section) the impingement of 1,582 young-of-the-year yellow perch (1978), a species which is very important to sport and commercial fishermen, might result in the loss of only 28 - 75 adults which is from 0.0002 to 0.0007 percent of the number captured by Ohio sport fishermen in 1978, while the impingement of 285 young-of-the-year perch in 1979 might result in the loss of 5-16 adults, which is from 0.00004 to 0.0001 percent of the total number of perch captured by Ohio sport fishermen in 1978. It should also be noted that no walleye were impinged.

The obvious conclusion is that impingement losses at the Davis-Besse Nuclear Power Station, Unit 1, have an insignificant effect on Western Basin fish stocks. Furthermore, although the plant did not operate at full capacity during much of these years, the circulating pumps were operated, and consequently, impingement estimates are based on the entire 2-year period and not just dates of generator operation.

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T A B L E S

TABLE 1

MILESTONES FOR THE

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

Date	Event
February 1968	Public announcement of project
August 1, 1969	File PSAR with AEC
May 1, 1970	Site preparation begun
March 24, 1971	Construction permit issued
December 7, 1972	Reactor vessel arrived on site by barge
December 8, 1972	Operating license application (FSAR) filed with AEC
March 9, 1973	FSAR docketed (No. 50-346)
June 15, 1973	Initiated aquatic ecology monitoring program
December 8, 1975	Begin fuel receipt at station
August 29, 1977	Commence operation

TABLE 2
CALCULATED INTAKE CRIB VELOCITIES FOR UNIT 1
FOR VARIOUS PUMPING RATES

Pumping Rate		Intake Velocity
(gpm)	(mgd)	(ft/sec)
0	0	0.00
5,000	7.2	0.03
10,000	14.4	0.06
15,000	21.6	0.09
20,000	28.8	0.12
25,000	36.0	0.15
30,000	43.2	0.18
35,000	50.4	0.21
40,000	57.6	0.24
45,000	64.8	0.27
50,000	72.0	0.30
55,000	79.2	0.33
60,000	86.4	0.36
65,000	93.6	0.39
70,000	100.8	0.42
75,000	108.0	0.45
80,000	115.2	0.48
85,000	122.4	0.51
90,000	129.6	0.54
95,000	136.8	0.57
100,000	144.0	0.60

TABLE 3

MONTHLY PUMPING RATES AND
CALCULATED VELOCITIES AT THE DAVIS-BESSE
NUCLEAR POWER STATION WATER INTAKE CRIB
FOR 1978

Month	Maximum		Minimum		Mean		Total
	Pumping Rate (mgd)	Velocity (ft/sec)	Pumping Rate (mgd)	Velocity (ft/sec)	Pumping Rate (mgd)	Velocity (ft/sec)	Millions of gallons
January	34.6	0.14	23.4	0.10	29.6	0.12	918.8
February	40.0	0.17	21.5	0.09	32.0	0.13	895.4
March	52.4	0.22	22.1	0.09	34.2	0.14	1059.9
April	56.2	0.23	23.0	0.10	38.1	0.16	1142.7
May	44.3	0.18	21.5	0.09	25.4	0.11	785.9
June	23.0	0.10	14.7	0.06	21.3	0.09	639.6
July	43.2	0.18	21.5	0.09	33.4	0.14	1035.7
August	53.8	0.22	10.4	0.05	38.9	0.16	1205.0
September	107.5	0.45	49.8	0.21	73.5	0.31	2203.5
October	64.6	0.27	36.1	0.15	55.6	0.23	1724.8
November	69.3	0.29	41.7	0.17	55.3	0.23	1657.5
December	83.5	0.35	25.7	0.11	43.3	0.18	1341.6
Annual	107.5	0.45	10.4	0.05	40.0	0.17	13268.8

TABLE 4

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1979[1]

1972	1973	1974	1975	1976	1977	1978	1979	SCIENTIFIC NAME	COMMON NAME
								Amiidae	
*		*	*					Amia calva	bowfin
								Atherinidae	
		*	*	*	*	*		Labidesthes sicculus	brook silverside
								Catostomidae	
*				*	*	*	*	Carpiodes cyprinus	quillback
*	*	*	*	*	*	*	*	Catostomus commersoni	white sucker
		*						Minytrema melanops	spotted sucker
*								Moxostoma erythrurum	golden redhorse
					*		*	Moxostoma macrolepidotum	shorthead redhorse
*								Ictiobus cyprinellus	bigmouth buffalo
				*				Hypentelium nigricans	northern hogsucker
								Centrarchidae	
		*						Ambloplites rupestris	rockbass
	*	*	*					Lepomis cyanellus	green sunfish
		*	*					L. gibbosus	pumpkinseed
	*	*						L. humilis	orangespotted sunfish
		*	*					L. macrochirus	bluegill
	*							L. microlophus	redear sunfish
*	*	*				*		Micropterus dolomieui	smallmouth bass
	*	*						M. salmoides	largemouth bass
	*	*	*	*	*	*	*	Pomoxis annularis	white crappie
*	*	*	*	*	*	*	*	P. nigromaculatus	black crappie
								Clupeidae	
*	*	*	*	*	*	*	*	Alosa pseudoharengus	alewife
*	*	*	*	*	*	*	*	Dorosoma cepedianum	gizzard shad
								Cyprinidae	
*	*	*	*	*	*	*	*	Carassius auratus	goldfish
*	*						*	C. auratus x Cyprinus carpio	carp x goldfish hybrid
*	*	*	*	*	*	*	*	Cyprinus carpio	carp
	*	*	*	*	*	*	*	Hybopsis storeriana	silver chub
						*		Notemigonus crysoleucas	goldenshiner
*	*	*	*	*	*	*	*	Notropis atherinoides	emerald shiner
*	*	*	*	*	*	*	*	N. hudsonius	spottail shiner
	*		*	*	*		*	N. spilopterus	spotfin shiner
	*		*					N. volucellus	mimic shiner
							*	Pimephales notatus	bluntnose minnow
			*					P. promelas	fathead minnow

TABLE 4 (CON'T)

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1979[1]

1972	1973	1974	1975	1976	1977	1978	1979	SCIENTIFIC NAME	COMMON NAME
								Esocidae	
							*	Esox lucius	northern pike
				*				Esox masquinongy	muskellunge
								Ictaluridae	
		*	*		*	*		Ictalurus melas	black bullhead
*	*	*				*	*	I. natalis	yellow bullhead
*	*	*	*	*	*	*	*	I. nebulosus	brown bullhead
*	*	*	*	*	*	*	*	I. punctatus	channel catfish
								Noturus flavus	stonecat
								Lepisosteidae	
		*		*	*			Lepisosteus osseus	longnose gar
								Osmeridae	
*	*	*	*	*	*	*	*	Osmerus mordax	rainbow smelt
								Percidae	
			*		*			Etheostoma nigrum	johnny darter
*	*	*	*	*	*	*	*	Perca flavescens	yellow perch
		*	*	*	*	*	*	Percina caprodes	logperch
			*	*	*	*		Stizostedion canadense	sauger
*	*	*	*	*	*	*	*	S. v. vitreum	walleye
								Percichthyidae	
							*	Morone americana	white perch
*	*	*	*	*	*	*	*	M. chrysops	white bass
								Percopsidae	
	*	*	*	*	*	*	*	Percopsis omiscomaycus	trout-perch
								Petromyzontidae	
		*						Petromyzon marinus	sea lamprey
								Salmonidae	
*		*						Oncorhynchus kisutch	coho salmon
								Sciaenidae	
*	*	*	*	*	*	*	*	Aplodinotus grunniens	freshwater drum
23	28	34	30	26	27	26	27		

[1] Includes species collected in Federal Aid Project F-41-R at Locust Point

TABLE 5

PROCEDURES FOR WATER QUALITY DETERMINATION

Parameter	Units	References for Analytical Methods
1. Dissolved Oxygen	^{o}C	APHA (1975): Sec. 422B
2. Hydrogen-ions (pH)	pH units	ASTM (1973): D1293-65
3. Transparency	meters	Welch (1948): Secchi disk
4. Turbidity	F.T.U.	APHA (1975): Sec. 214A
5. Suspended Solids	mg/l	APHA (1975): Sec. 208D
6. Conductivity	umhos/cm(25^{o}C)	ASTM (9175): D1125-64
7. Dissolved Solids	mg/l	USEPA (1974)
8. Calcium (Ca)	mg/l	APHA (1975): Sec. 306C
9. Chloride (Cl)	mg/l	APHA (1975): Sec. 408B
10. Sulfate (SO_4)	mg/l	ASTM (1973): D516-68C
11. Sodium (Na)	mg/l	ASTM (1973): D1428-64
12. Magnesium (Mg)	mg/l	APHA (1975): Sec. 313C
13. Alkalinity (Total as $CaCO_3$)	mg/l	APHA (1975): Sec. 403
14. Nitrate (NO_3)	mg/l	ASTM (1973): D992-71
15. Phosphorus (Total as P)	mg/l	APHA (1975): Sec. 425F
16. Silica (SiO_2)	mg/l	ASTM (1973): D859-68B
17. Biochemical Oxygen Demand	mg/l	APHA (1975): Sec. 507
18. Temperature	^{o}C	APHA (1975): Sec. 212

TABLE 6
DISSOLVED OXYGEN DATA FOR BOTTOM WATER IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (ppm)				Operational Data (ppm)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.8	11.8	11.8	0.0	-	-	-	-
April	11.0	13.2	11.9	0.9	9.5	9.5	9.5	0.0
May	7.2	10.4	9.1	1.4	9.2	12.4	10.8	2.3
June	7.0	10.2	8.1	1.5	7.2	8.8	8.0	1.1
July	4.8	8.9	6.6	1.7	6.1	7.6	6.9	1.1
August	6.0	9.1	7.4	1.3	8.3	8.4	8.4	0.1
September	8.6	9.3	8.9	0.4	8.2	9.2	9.1	0.1
October	10.0	11.2	10.5	0.6	9.5	11.4	10.7	1.0
November	11.0	12.1	11.5	0.6	10.2	12.2	11.5	1.1
December	11.4	14.1	12.8	1.9	-	-	-	-
Mean			9.9	2.1			9.4	1.6

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.8	11.8	11.8	0.0		-	-	-
April	11.8	12.8	12.3	0.5	9.5	9.5	9.5	0
May	8.6	10.0	9.4	0.6	9.0	12.0	10.5	2.1
June	6.8	10.1	8.5	1.4	5.7	8.5	7.1	2.0
July	4.5	8.4	6.6	1.6	8.3	8.8	8.6	0.4
August	6.6	9.3	7.7	1.2	8.1	8.2	8.2	0.1
September	8.2	9.3	8.6	0.6	8.7	9.2	8.6	0.4
October	10.4	11.3	11.3	0.8	10.4	11.5	11.0	0.6
November	11.3	12.2	11.7	0.5	4.8	12.1	9.6	4.2
December	14.1	10.2	12.2	2.76		-	-	-
Mean			10.0	2.1			9.1	1.3

TABLE 7

HYDROGEN-IONS (pH) DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (pH units)				Operational Data (pH units)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	8.1	8.1	8.1	0.0	-	-	-	-
April	7.7	8.3	8.1	0.3	8.1	8.1	8.1	0.0
May	7.8	8.4	8.2	0.3	7.7	8.0	7.9	0.2
June	8.0	8.6	8.3	0.3	8.3	8.6	8.5	0.2
July	8.1	9.0	8.5	0.4	8.4	8.4	8.4	0.0
August	8.5	8.9	8.8	0.2	8.7	8.7	8.7	0.0
September	7.8	8.6	8.2	0.4	8.6	8.8	8.7	0.1
October	8.2	8.9	8.6	0.4	8.0	8.8	8.4	0.4
November	7.6	8.4	8.0	0.4	7.5	8.0	7.8	0.3
December	8.1	8.3	8.2	0.1	-	-	-	-
Mean			8.3	0.3			8.3	0.3

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	7.8	7.8	7.8	0.0	-	-	-	-
April	7.7	8.5	8.1	0.4	8.1	8.1	8.1	0.0
May	7.8	8.6	8.3	0.3	7.5	8.3	7.9	0.6
June	7.8	8.6	8.3	0.4	8.5	8.6	8.6	0.1
July	8.0	8.7	8.4	0.4	8.1	8.5	8.3	0.3
August	8.0	8.7	8.4	0.3	8.7	8.7	8.7	0.0
September	8.3	8.5	8.4	0.1	8.5	8.9	8.7	0.2
October	8.4	8.8	8.6	0.2	8.0	8.6	8.2	0.3
November	7.7	8.4	8.0	0.7	6.9	8.1	7.6	0.6
December	7.9	8.4	8.2	0.4	-	-	-	-
Mean			8.3	0.2			8.3	0.4

TABLE 8

TRANSPARENCY DATA FOR WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (m)				Operational Data (m)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.15	0.15	0.15	0.00	-	-	-	-
April	0.10	0.50	0.34	0.20	0.40	0.40	0.40	0.00
May	0.35	1.00	0.70	0.30	0.20	0.40	0.30	0.10
June	0.50	0.60	0.60	0.05	0.35	0.45	0.40	0.10
July	0.40	1.10	0.70	0.30	0.75	0.85	0.80	0.10
August	0.45	1.30	0.90	0.40	0.50	0.95	0.70	0.30
September	0.60	0.80	0.70	0.10	0.40	1.15	0.72	0.40
October	0.50	0.80	0.60	0.17	0.45	0.60	0.53	0.10
November	0.30	0.50	0.43	0.12	0.35	0.80	0.62	0.20
December	0.40	0.40	0.40	0.00	-	-	-	-
Mean			0.55	0.22			0.56	0.18
	DISCHARGE (STA. NO. 13)							
March	0.10	0.10	0.10	0.00	-	-	-	-
April	0.10	0.40	0.25	0.13	0.35	0.35	0.35	0.00
May	0.30	0.70	0.60	0.20	0.20	0.40	0.30	0.10
June	0.30	0.50	0.50	0.10	0.30	0.40	0.35	0.10
July	0.30	0.95	0.61	0.33	0.55	0.85	0.70	0.20
August	0.50	1.00	0.77	0.25	0.45	0.70	0.58	0.20
September	0.50	0.65	0.58	0.08	0.40	1.15	0.68	0.40
October	0.40	0.65	0.53	0.13	0.50	0.50	0.50	0.00
November	0.30	0.60	0.45	0.15	0.35	0.80	0.55	0.20
December	0.40	0.45	0.43	0.04	-	-	-	-
Mean			0.48	0.19			0.49	0.14

TABLE 9
TURBIDITY DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (F.T.U.)				Operational Data (F.T.U.)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	145.0	145.0	145.0	0.0	-	-	-	-
April	12.0	105.0	46.3	42.8	67.0	67.0	67.0	0.0
May	5.5	21.0	14.9	6.7	46.0	55.0	50.5	6.4
June	10.0	53.0	26.3	18.6	40.0	57.0	48.5	12.0
July	3.0	53.0	16.9	24.2	14.0	52.0	33.0	26.9
August	2.0	23.0	10.5	9.0	13.0	18.0	15.5	3.5
September	5.0	10.0	9.3	4.0	10.0	27.0	18.3	8.5
October	7.0	18.0	11.7	5.7	13.0	32.0	20.7	10.0
November	13.0	36.0	21.7	12.5	8.0	58.0	26.0	27.8
December	16.0	47.0	31.5	21.9	-	-	-	-
Mean			33.4	40.8			34.9	18.5

DISCHARGE (STA. NO. 13)

Month	Pre-Op Min	Pre-Op Max	Pre-Op Mean	Pre-Op Std Dev	Op Min	Op Max	Op Mean	Op Std Dev
March	148.0	148.0	148.0	0.0	-	-	-	-
April	18.0	110.0	54.5	42.7	75.0	75.0	75.0	0.0
May	8.5	28.0	17.9	8.0	52.0	75.0	63.5	16.3
June	7.0	25.0	17.5	8.2	49.0	54.0	51.5	3.5
July	4.5	45.0	19.4	18.6	15.0	34.0	24.5	13.4
August	2.0	24.0	12.3	9.5	16.0	17.0	16.5	0.7
September	4.0	16.0	10.0	6.0	11.0	47.0	28.7	18.0
October	9.0	22.0	13.7	7.2	7.0	42.0	23.3	17.6
November	13.0	33.0	19.7	11.6	8.0	64.0	28.0	31.2
December	21.0	54.0	37.5	23.3	-	-	-	-
Mean			35.1	41.9			38.9	21.5

TABLE 10
SUSPENDED SOLIDS DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	148.0	148.0	148.0	0.0	-	-	-	-
April	13.0	80.0	46.8	36.7	50.0	50.0	50.0	0.0
May	10.0	26.0	16.3	7.1	50.0	86.0	68.0	25.5
June	9.0	60.0	30.3	25.1	43.0	63.0	53.0	14.1
July	1.0	33.0	21.3	14.0	10.0	14.0	12.0	2.8
August	8.0	19.0	12.5	5.5	11.0	18.0	14.5	5.0
September	6.0	15.0	10.0	4.6	11.0	37.0	26.0	13.5
October	9.0	14.0	12.0	2.7	18.0	27.0	23.3	4.7
November	11.0	28.0	20.7	8.7	32.0	87.0	68.7	31.8
December	17.0	21.0	19.0	2.8	-	-	-	-
Mean			33.7	41.6			39.4	23.3

Month	DISCHARGE (STA. NO. 13)							
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	170.0	170.0	170.0	0.0	-	-	-	-
April	15.0	101.0	58.5	41.9	59.0	59.0	59.0	0.0
May	17.0	34.0	22.8	7.6	49.0	89.0	69.0	28.3
June	7.0	67.0	35.0	29.5	44.0	56.0	50.0	8.5
July	3.0	52.0	28.5	21.0	16.0	18.0	17.0	1.4
August	8.0	24.0	16.3	7.9	12.0	22.0	17.0	7.1
September	10.0	27.0	17.0	8.9	12.0	104.0	47.3	49.6
October	10.0	26.0	18.0	8.0	13.0	79.0	40.7	34.3
November	19.0	34.0	25.3	7.8	27.0	156.0	74.3	71.0
December	23.0	23.0	23.0	0.0	-	-	-	-
Mean			40.4	47.5			46.8	21.5

TABLE 11

CONDUCTIVITY DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

INTAKE (STA. NO. 8)

Month	Pre-Operational Data (μmhos/cm)				Operational Data (μmhos/cm)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	410.0	410.0	410.0	0.0	-	-	-	-
April	287.0	340.0	314.5	27.9	410.0	410.0	410.0	0.0
May	280.0	365.0	310.8	39.0	290.0	320.0	305.0	21.2
June	285.0	310.0	292.8	11.7	295.0	300.0	297.5	3.5
July	260.0	305.0	280.0	22.9	275.0	300.0	287.5	17.7
August	233.0	285.0	253.8	22.1	250.0	295.0	272.5	31.8
September	217.0	267.0	246.3	26.1	222.0	284.0	262.0	34.7
October	233.0	298.0	272.0	34.4	265.0	350.0	316.7	45.4
November	230.0	300.0	262.7	35.2	245.0	320.0	278.3	38.2
December	283.0	297.0	290.0	9.9	-	-	-	-
Mean			293.3	46.8			303.7	46.5

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	392.0	392.0	392.0	0.0	-	-	-	-
April	272.0	360.0	312.8	43.9	435.0	435.0	435.0	0.0
May	270.0	365.0	312.5	42.3	285.0	320.0	302.5	24.8
June	286.0	340.0	309.8	24.9	300.0	303.0	301.5	2.1
July	220.0	300.0	268.5	34.2	275.0	300.0	287.5	17.7
August	245.0	280.0	262.8	17.3	260.0	295.0	277.5	24.8
September	215.0	264.0	244.7	26.1	230.0	315.0	276.3	43.0
October	238.0	324.0	280.7	43.0	265.0	335.0	310.7	39.6
November	230.0	306.0	268.0	38.0	250.0	330.0	283.3	41.6
December	285.0	300.0	292.5	10.6	-	-	-	-
Mean			296.2	39.4			309.3	52.3

TABLE 12
DISSOLVED SOLIDS DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	318.0	318.0	318.0	0.0	-	-	-	-
April	158.0	284.0	206.0	55.3	140.0	140.0	140.0	0.0
May	124.0	230.0	178.0	47.2	186.0	236.0	211.0	35.4
June	89.0	178.0	131.3	45.3	164.0	180.0	172.0	11.3
July	136.0	180.0	164.5	20.8	174.0	174.0	174.0	0.0
August	152.0	226.0	171.5	36.4	174.0	184.0	179.0	7.1
September	128.0	214.0	166.0	43.9	146.0	180.0	168.0	19.1
October	158.0	186.0	170.7	14.2	146.0	190.0	164.0	23.1
November	140.0	174.0	156.0	17.1	158.0	184.0	172.7	13.3
December	140.0	160.0	150.0	14.1	-	-	-	-
Mean			181.2	51.8			172.6	19.5

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	310.0	310.0	310.0	0.0	-	-	-	-
April	182.0	396.0	244.0	102.4	150.0	150.0	150.0	0.0
May	116.0	232.0	176.0	51.3	192.0	224.0	208.0	22.6
June	90.0	194.0	137.0	51.1	174.0	194.0	196.0	20.7
July	136.0	190.0	164.0	27.0	160.0	182.0	171.0	15.6
August	150.0	228.0	170.0	38.7	178.0	194.0	186.0	11.3
September	140.0	170.0	153.3	15.3	158.0	196.0	176.7	19.0
October	176.0	194.0	182.0	10.4	152.0	178.0	163.3	13.3
November	142.0	184.0	158.0	22.7	162.0	192.0	178.0	15.1
December	148.0	164.0	156.0	11.3	-	-	-	-
Mean			185.0	52.4			178.5	18.3

TABLE 13
CALCIUM DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

INTAKE (STA. NO. 8)

Month	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	50.8	50.8	50.8	0.0	-	-	-	-
April	32.8	46.4	40.6	6.1	46.4	46.4	46.4	0.0
May	34.0	40.0	37.0	2.6	36.0	38.4	37.2	1.7
June	34.0	38.0	34.9	1.8	36.8	37.2	37.0	0.3
July	32.0	34.4	33.6	1.1	36.0	36.0	36.0	0.0
August	29.2	39.2	32.8	4.3	32.0	35.6	33.8	2.5
September	32.0	36.0	33.9	2.0	30.4	34.8	32.8	2.2
October	31.6	37.2	33.9	3.0	32.4	36.8	34.0	2.4
November	31.2	37.6	34.9	3.3	32.8	37.6	35.7	2.6
December	31.2	34.0	32.6	2.0	-	-	-	-
Mean			36.5	5.6			36.6	4.3

DISCHARGE (STA. NO. 13)

Month	Pre-Operational Min	Pre-Operational Max	Pre-Operational Mean	Pre-Operational Std Dev	Operational Min	Operational Max	Operational Mean	Operational Std Dev
March	50.4	50.4	50.4	0.0	-	-	-	-
April	33.6	50.4	41.7	7.0	50.0	50.0	50.0	0.0
May	34.0	41.6	37.4	3.5	36.0	36.0	36.0	0.0
June	34.0	38.4	35.9	1.9	36.8	37.6	37.2	0.6
July	32.0	36.4	34.1	1.9	33.6	38.8	36.2	3.7
August	29.6	40.4	33.6	4.7	33.2	35.6	34.4	1.7
September	32.0	36.0	33.3	2.3	31.2	33.2	32.1	1.0
October	32.0	41.2	34.2	3.9	32.8	36.0	34.1	1.7
November	31.2	34.8	33.2	1.8	32.8	38.3	36.1	3.1
December	31.2	35.2	33.2	2.8	-	-	-	-
Mean			36.7	5.5			37.0	5.5

TABLE 14

CHLORIDE DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	22.0	22.0	22.0	0.0	-	-	-	-
April	18.0	26.8	20.6	4.2	26.0	26.0	26.0	0.0
May	18.0	20.0	18.7	1.0	20.0	21.0	20.5	0.7
June	15.5	20.3	17.9	2.3	15.2	20.5	17.9	3.7
July	16.0	19.5	18.0	1.8	12.5	23.0	17.8	7.4
August	13.5	18.3	16.1	2.0	10.8	19.5	15.2	6.2
September	16.0	17.2	16.7	0.6	13.5	17.5	15.8	2.1
October	15.8	18.8	17.4	1.5	14.3	22.0	19.4	4.4
November	13.0	16.5	14.7	1.8	15.0	20.0	17.5	2.5
December	15.0	15.8	15.4	0.6	-	-	-	-
Mean			17.8	2.3			18.8	3.4

DISCHARGE (STA. NO. 13)

Month	Pre-Op Min	Pre-Op Max	Pre-Op Mean	Pre-Op Std Dev	Op Min	Op Max	Op Mean	Op Std Dev
March	22.0	22.0	22.0	0.0	-	-	-	-
April	18.0	26.5	20.8	3.9	27.3	27.3	27.3	0.0
May	17.6	20.0	18.9	1.3	17.8	21.0	19.4	2.3
June	16.3	22.5	18.8	2.9	15.5	20.5	18.0	3.5
July	16.8	20.0	18.2	1.7	12.5	22.0	17.3	6.7
August	13.5	18.3	16.1	2.0	12.3	19.0	15.7	4.7
September	14.5	17.2	15.9	1.4	14.0	19.5	16.7	2.8
October	16.8	21.0	18.4	2.3	15.8	21.0	19.3	3.0
November	13.0	16.0	14.7	1.5	17.3	21.5	19.0	2.2
December	15.0	16.3	15.7	0.9	-	-	-	-
Mean			18.0	2.4			19.1	3.6

TABLE 15

SULFATE DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/1)				Operational Data (mg/1)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	10.5	10.5	10.5	0.0	-	-	-	-
April	24.0	37.0	30.8	6.0	44.0	44.0	44.0	0.0
May	25.0	30.0	28.3	2.2	22.5	26.0	24.3	2.5
June	21.0	30.5	26.4	4.3	29.0	33.5	31.3	3.2
July	20.5	26.5	24.0	2.6	23.5	28.0	25.8	3.2
August	18.5	23.0	20.6	1.9	28.0	28.0	28.0	0.0
September	20.0	22.5	21.0	1.3	20.5	28.0	23.5	4.0
October	22.0	28.0	25.7	3.2	18.0	35.5	25.2	9.2
November	19.0	24.0	21.2	2.6	21.5	29.0	25.5	3.8
December	21.0	28.5	24.8	5.3	-	-	-	-
Mean			23.3	5.6			28.5	6.7
	DISCHARGE (STA. NO. 13)							
March	10.0	10.0	10.0	0.0	-	-	-	-
April	27.3	41.5	32.5	6.7	46.0	46.0	46.0	0.0
May	28.0	31.0	29.5	1.3	22.5	26.0	24.3	2.5
June	21.0	30.5	26.5	4.1	29.0	32.5	30.8	2.5
July	19.0	26.0	23.5	3.1	23.0	28.0	25.5	3.5
August	19.5	23.5	21.5	1.7	27.5	28.5	28.0	0.7
September	17.0	22.0	19.7	2.5	20.0	28.0	23.3	4.2
October	22.5	30.5	26.7	4.0	15.8	35.3	23.7	10.3
November	19.0	25.5	21.7	3.4	23.0	29.0	26.0	3.0
December	21.5	27.0	24.3	3.9	-	-	-	-
Mean			23.6	6.2			28.5	7.5

TABLE 16

SODIUM DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
INTAKE (STA. NO. 8)								
March	10.5	10.5	10.5	0.0	-	-		
April	9.2	12.7	10.8	1.5	13.2	13.2	13.2	0.0
May	10.1	12.6	11.2	1.1	8.5	8.6	8.6	0.1
June	8.4	10.7	9.9	1.0	9.2	9.2	9.2	0.0
July	7.0	11.9	9.6	2.0	8.0	10.7	9.4	1.9
August	6.4	10.3	8.6	1.6	7.5	10.1	8.8	1.8
September	9.2	10.2	9.7	0.5	8.0	10.5	9.0	1.3
October	9.0	15.3	12.2	3.2	7.6	13.5	9.7	3.3
November	7.1	10.4	8.3	1.8	8.0	14.8	11.3	3.4
December	8.5	9.3	8.9	0.6	-	-	-	-
Mean			10.0	1.2			9.8	1.2
DISCHARGE (STA. NO. 13)								
March	10.0	10.0	10.0	0.0	-	-	-	-
April	8.9	12.4	10.7	1.7	14.4	14.4	14.4	0.0
May	10.1	13.5	11.7	1.7	8.0	8.9	8.5	0.6
June	8.0	11.0	9.9	1.3	7.6	9.2	8.4	1.1
July	7.0	12.1	9.6	2.2	8.0	10.1	9.1	1.5
August	7.1	10.3	8.7	1.3	8.3	10.1	9.2	1.3
September	8.4	10.2	9.4	0.9	8.0	10.5	9.0	1.3
October	9.0	15.3	12.4	3.2	8.4	13.5	10.3	2.8
November	7.1	10.4	8.4	1.8	8.0	14.8	11.3	3.4
December	10.0	10.7	10.4	0.5	-	-	-	-
Mean			10.1	1.2			10.0	2.0

TABLE 17

MAGNESIUM DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.3	11.3	11.3	0.0	-	-	-	-
April	5.8	8.4	7.2	1.1	13.4	13.4	13.4	0.0
May	7.1	10.6	9.1	1.2	8.2	8.6	8.4	0.3
June	7.9	10.3	8.9	1.2	9.6	9.6	9.6	0.0
July	8.2	9.4	9.0	0.5	9.6	11.0	10.3	1.0
August	5.5	7.7	6.8	0.9	7.7	9.8	8.8	1.5
September	6.5	7.7	7.1	0.6	7.0	10.1	8.4	1.6
October	7.20	8.90	7.83	.93	7.2	10.3	8.5	1.6
November	5.0	7.7	6.7	1.5	8.2	9.8	9.1	0.8
December	5.3	8.4	6.9	2.2	-	-	-	-
Mean			8.1	1.5			9.6	1.7

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	11.5	11.5	11.5	0.0	-	-	-	-
April	5.8	9.1	7.1	1.5	13.4	13.4	13.4	0.0
May	7.7	10.3	9.0	1.1	8.6	8.6	8.6	0.0
June	7.7	9.6	8.5	0.8	9.8	10.1	10.0	0.2
July	8.9	9.4	9.2	0.2	11.5	12.2	11.9	0.5
August	5.3	7.2	6.7	1.0	8.4	9.6	9.0	0.8
September	6.7	7.7	7.4	0.6	7.7	9.8	8.9	1.1
October	7.9	8.2	8.0	0.2	8.2	10.1	8.9	1.0
November	7.2	8.6	7.8	0.7	8.2	10.8	9.5	1.3
December	7.4	7.9	7.7	0.4	-	-	-	-
Mean			8.3	1.4			10.0	1.7

TABLE 18

TOTAL ALKALINITY DATA FOR BOTTOM WATER IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	110.0	110.0	110.0	0.0	-	-	-	-
April	88.0	101.0	94.5	5.3	104.0	104.0	104.0	0.0
May	92.0	101.0	95.0	4.1	89.0	89.0	89.0	0.0
June	91.0	97.0	94.3	3.2	89.0	100.0	94.5	7.8
July	86.0	92.0	88.8	2.5	95.0	100.0	97.5	3.5
August	84.0	92.0	87.5	3.7	96.0	96.0	96.0	0.0
September	89.0	104.0	95.7	7.6	86.0	95.0	90.3	4.5
October	90.0	97.0	93.7	3.5	92.0	102.0	96.7	5.0
November	87.0	94.0	90.3	3.5	90.0	100.0	95.3	5.0
December	87.0	93.0	90.0	4.2	-	-	-	-
Mean			94.0	6.3			96.0	4.8

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	110.0	110.0	110.0	0.0	-	-	-	-
April	87.0	98.0	94.8	5.3	107.0	107.0	107.0	0.0
May	91.0	104.0	96.5	5.8	91.0	92.0	91.5	0.7
June	95.0	96.0	95.5	0.6	90.0	100.0	95.0	7.1
July	89.0	96.0	92.0	2.9	95.0	100.0	97.5	3.5
August	85.0	94.0	88.3	4.0	93.0	98.0	95.5	3.5
September	88.0	96.0	92.7	4.2	88.0	96.0	91.7	4.0
October	92.0	111.0	98.3	11.0	92.0	100.0	95.7	4.0
November	90.0	95.0	91.7	2.9	92.0	99.0	95.8	3.5
December	90.0	95.0	92.5	3.5	-	-	-	-
Mean			95.2	5.9			96.2	4.8

TABLE 19

NITRATE DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUC.'URES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	17.00	17.00	17.00	0.00	-	-	-	-
April	1.99	14.90	7.46	6.19	5.40	5.40	5.40	0.00
May	0.15	13.50	6.30	5.50	1.70	14.20	8.00	8.80
June	0.00	8.00	4.20	4.00	7.30	8.70	8.00	1.00
July	0.00	7.70	3.80	3.30	5.10	7.70	6.40	1.80
August	0.00	1.20	0.40	0.60	1.40	2.70	2.10	1.00
September	0.00	2.70	1.00	1.50	0.60	2.40	1.60	1.00
October	0.50	8.00	3.40	4.10	0.30	1.20	0.80	0.50
November	1.50	2.60	1.97	0.57	5.10	7.90	6.60	1.40
December	2.40	3.60	3.00	0.85	-	-	-	-
Mean			4.90	4.79			4.86	2.93
	DISCHARGE (STA. NO. 13)							
March	17.00	17.00	17.00	0.00	-	-	-	-
April	1.20	17.00	7.81	7.41	6.40	6.40	6.40	0.00
May	0.15	13.50	6.80	5.50	1.70	12.00	6.90	7.30
June	0.00	7.70	4.30	3.80	7.70	11.50	9.60	2.70
July	0.00	8.40	3.70	3.70	4.50	9.30	6.90	3.40
August	0.00	1.20	0.50	0.50	2.30	3.10	2.70	0.60
September	0.00	2.70	1.20	1.40	0.30	1.70	1.20	0.80
October	0.50	7.70	3.13	3.97	0.30	2.00	1.20	0.90
November	0.90	5.10	3.00	2.10	6.50	7.30	7.00	0.50
December	2.00	3.70	2.90	1.20	-	-	-	-
Mean			5.03	4.76			5.24	3.12

TABLE 20

PHOSPHORUS DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

INTAKE (STA. NO. 8)

Month	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.28	0.28	0.28	0.00	-	-	-	-
April	0.06	0.12	0.09	0.03	0.02	0.02	0.02	0.00
May	0.02	0.27	0.09	0.12	0.01	0.07	0.04	0.04
June	0.01	0.04	0.03	0.02	0.02	0.04	0.03	0.01
July	0.02	0.07	0.04	0.02	0.02	0.12	0.07	0.07
August	0.01	0.06	0.04	0.02	0.02	0.02	0.02	0.00
September	0.00	0.05	0.02	0.03	0.01	0.04	0.03	0.02
October	0.00	0.05	0.02	0.02	0.01	0.11	0.06	0.05
November	0.02	0.03	0.02	0.01	0.01	0.09	0.05	0.04
December	0.01	0.07	0.04	0.04	-	-	-	-
Mean			0.07	0.08			0.04	0.02

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	0.26	0.26	0.26	0.00	-	-	-	
April	0.02	0.10	0.06	0.04	0.02	0.02	0.02	0.00
May	0.02	0.44	0.13	0.21	0.01	0.08	0.05	0.05
June	0.01	0.05	0.04	0.02	0.03	0.04	0.04	0.01
July	0.03	0.09	0.06	0.03	0.02	0.12	0.07	0.07
August	0.01	0.06	0.03	0.02	0.01	0.02	0.02	0.01
September	0.00	0.07	0.03	0.04	0.02	0.07	0.0[illegible]	0.03
October	0.00	0.06	0.03	0.03	0.03	0.08	0.0[illegible]	0.04
November	0.02	0.03	0.03	0.01	0.01	0.11	0.0[illegible]	0.05
December	0.02	0.06	0.04	0.03	-	-	-	-
Mean			0.07	0.07			0.05	0.02

TABLE 21

SILICA DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	0.10	3.09	0.96	1.43	0.83	0.83	0.83	0.00
May	0.00	0.23	0.10	0.10	0.07	1.36	0.72	0.91
June	0.17	0.74	0.47	0.28	0.28	0.55	0.42	0.19
July	0.40	1.20	0.77	0.36	0.44	0.45	0.45	0.01
August	0.11	0.38	0.27	0.17	0.04	0.23	0.14	0.13
September	0.06	0.71	0.32	0.34	0.09	0.28	0.16	0.11
October	0.06	0.19	0.12	0.07	0.04	0.13	0.07	0.05
November	0.03	0.12	0.09	0.05	0.07	0.59	0.34	0.26
December	0.19	0.24	0.22	0.04	-	-	-	-
Mean			0.37	0.31			0.39	0.27

DISCHARGE (STA. NO. 13)

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	0.06	3.50	0.98	1.68	1.29	1.29	1.29	0.00
May	0.0	0.29	0.13	0.12	0.07	1.41	0.74	0.95
June	0.16	0.78	0.46	0.26	0.22	0.62	0.42	0.28
July	0.33	0.91	0.57	0.25	0.47	0.65	0.56	0.13
August	0.10	0.44	0.27	0.18	0.02	0.19	0.11	0.12
September	0.06	0.59	0.28	0.28	0.07	0.36	0.22	0.15
October	0.09	0.19	0.13	0.06	0.07	0.10	0.09	0.02
November	0.03	0.16	0.10	0.07	0.11	0.64	0.35	0.27
December	0.16	0.26	0.21	0.07	-	-	-	-
Mean			0.35	0.28			0.47	0.40

TABLE 22

BIOCHEMICAL OXYGEN DEMAND DATA FOR BOTTOM WATER
IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (mg/l)				Operational Data (mg/l)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	3.00	3.00	3.00	0.00	-	-	-	-
April	0.92	4.00	2.70	1.30	4.0	4.0	4.0	0.0
May	0.50	3.0	1.40	1.10	4.0	2.0	3.0	1.4
June	1.00	3.10	2.00	1.20	4.0	3.0	3.5	0.7
July	2.00	4.00	3.00	1.00	2.0	3.0	2.5	0.7
August	3.00	3.00	3.00	0.00	2.0	2.0	2.0	0.0
September	2.00	3.00	2.33	0.58	1.0	3.0	2.3	1.2
October	2.00	3.00	2.33	0.58	2.0	4.0	2.7	1.2
November	1.00	2.00	1.70	0.60	2.0	2.0	2.0	0.0
December	1.00	2.00	1.50	0.71	-	-	-	-
Mean			2.30	0.63			2.8	0.7
	DISCHARGE (STA. NO. 13)							
March	3.00	3.00	3.00	0.00	-	-	-	-
April	2.00	4.50	3.40	1.10	4.0	4.0	4.0	0.0
May	0.60	4.00	2.40	1.50	2.0	3.0	2.5	0.7
June	1.00	3.00	2.10	0.90	3.0	5.0	4.0	1.4
July	1.00	3.00	2.30	1.20	3.0	3.0	3.0	0.0
August	2.00	4.00	3.00	0.80	2.0	3.0	2.5	0.7
September	2.00	3.00	2.67	0.58	2.0	4.0	3.0	1.0
October	2.00	4.00	3.00	1.00	3.0	4.0	3.7	0.6
November	2.00	3.00	2.30	0.60	1.0	4.0	2.3	1.5
December	1.00	2.00	1.50	0.71	-	-	-	
Mean			2.57	0.56			3.13	0.7

TABLE 23

TEMPERATURE DATA FOR BOTTOM WATER

IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

Month	INTAKE (STA. NO. 8)							
	Pre-Operational Data (°C)				Operational Data (°C)			
	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	-	-	-	-	-	-	-	-
April	6.0	10.0	7.7	1.7	10.0	10.0	10.0	0.0
May	14.0	20.0	15.8	2.8	10.4	17.8	14.1	5.2
June	18.0	21.5	20.0	1.5	21.0	24.2	22.6	2.3
July	22.0	24.0	22.6	1 0	24.0	24.0	24.0	0.0
August	22.0	24.2	23.1	1.2	21.5	23.0	22.3	1.1
September	18.0	20.5	19.3	1.3	18.0	21.7	19.8	1.9
October	9.0	13.0	11.2	2.0	8.0	11.2	9.5	1.6
November	5.0	10.0	8.2	2.8	4.0	10.2	6.9	3.1
December	-	-	-	-	-	-	-	
Mean			16.0	6.3			16.2	6.8

Month	DISCHARGE (STA. NO. 13)							
March	-	-	-	-	-	-	-	-
April	7.5	10.0	8.6	1.1	10.5	10.5	10.5	0.0
May	14.0	20.0	15.8	2.8	10.4	18.0	14.2	5.4
June	19.0	21.0	20.2	1.1	21.5	24.7	23.1	2.3
July	22.0	24.1	22.9	0.9	23.5	25.0	24.3	1.1
August	21.5	24.5	23.0	1.5	21.5	23.0	22.3	1.1
September	18.0	20.5	19.2	1.3	18.5	22.1	19.9	1.9
October	8.5	13.0	11.0	2.3	8.5	11.5	9.9	1.5
November	5.0	10.5	7.9	2.8	4.0	10.1	6.9	3.1
December	-	-	-	-	-	-	-	-
Mean			16.1	6.2			16.4	6.8

TABLE 24

OPERATIONAL WATER QUALITY PARAMETERS FALLING OUTSIDE OF THE RANGE OF PRE-OPERATIONAL VALUES AT STATION 13

PARAMETER	Nearest Number of Standard Deviation Units Outside the Pre-operational Range										
	MONTH										
	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Sum of Difference
Dissolved Oxygen		-5	+1	0	0	0	0	0	-3		- 7
Hydrogen-ions(pH)		0	0	0	0	0	+2	-1	0		+ 1
Transparency		0	0	0	0	0	0	0	0		0
Turbidity		0	+4	+3	0	0	+2	0	0		+ 9
Suspended Solids		0	+5	0	0	0	+2	+2	+5		+14
Conductivity		+2	0	0	0	0	0	0	0		+ 2
Dissolved Solids		0	0	0	0	0	0	-1	0		- 1
Calcium		0	0	0	0	0	0	0	+1		+ 1
Chloride		0	0	0	0	0	0	0	+2		+ 2
Sulfate		+1	-3	0	0	+3	+1	0	0		+ 2
Sodium		+1	-1	0	0	0	0	0	+1		+ 1
Magnesium		+3	0	+1	+13	+2	+2	+4	+1		+26
Total Alkalinity		+2	0	0	+1	0	0	0	0		+ 3
Nitrate		0	0	+1	0	+3	0	0	+1		+ 5
Phosphorus		0	0	0	0	0	0	0	+3		+ 3
Silica		0	+4	0	0	0	0	0	+3		+ 7
Biochemical Oxygen Demand		0	0	+1	0	0	0	0	0		+ 1
Temperature		0	0	+2	0	0	0	0	0		+ 2

TABLE 25

MEAN WATER QUALITY VALUES FOR PRE-OPERATIONAL AND OPERATIONAL PERIODS IN THE VICINITY OF LAKE INTAKE AND DISCHARGE STRUCTURES

PARAMETER	UNITS	PRE-OPERATIONAL		OPERATIONAL		PERCENT CHANGE	
		Sta. 8	Sta. 13	Sta. 8	Sta. 13	Sta. 8	Sta. 13
Dissolved Oxygen	ppm	9.9	10.0	9.4	9.1	-5.1	-9.0
Hydrogen-ions	pH	8.3	8.3	8.3	8.3	0.0	0.0
Transparency	m	0.55	0.48	0.56	0.49	+1.8	+2.1
Turbidity	F.T.U.	33.4	35.1	34.9	38.9	+4.5	+10.8
Suspended Solids	mg/l	33.7	40.4	39.4	46.8	+17.0	+15.8
Conductivity	µmhos/cm	293.3	296.2	303.7	309.3	+3.5	+4.4
Dissolved Solids	mg/l	181.2	185.0	172.6	178.5	-4.7	-3.5
Calcium	mg/l	36.5	36.7	36.6	37.0	+0.3	+0.8
Chloride	mg/l	17.8	18.0	18.8	19.1	+5.6	+6.1
Sulfate	mg/l	23.3	23.6	28.5	28.5	+22.3	+20.8
Sodium	mg/l	10.0	10.1	9.8	10.0	-2.0	-1.0
Magnesium	mg/l	8.1	8.3	9.6	10.0	+18.5	+20.5
Total Alkalinity	mg/l	94.0	95.2	96.0	96.2	+2.1	+1.1
Nitrate	mg/l	4.90	5.03	4.86	5.24	-0.8	+4.2
Phosphorus	mg/l	0.07	0.07	0.04	0.05	-42.9	-28.6
Silica	mg/l	0.37	0.35	0.39	0.47	+5.4	+34.3
Biochemical Oxygen Demand (BOD)	mg/l	2.30	2.57	2.80	3.13	+21.7	+21.8
Temperature	C°	16.0	16.1	16.2	16.4	+1.3	+1.9

TABLE 26

PLANKTON AND WATER QUALITY SAMPLING DATES

Month \ Year	1973[1]	1974	1975	1976	1977	1978	1979
March				18			
April		18	22	14	26		
May	25	22	29	17	24	11	1 and 23
June	27	19	16	16	22	29	21
July	25	17	14	20	13	25	28
August	23	22	11	18	30	17	29
September	26	10	8	14	12	15	27
October		9	6	19	26	17	30
November	6	7	3	2	22	1	28
December	4		16				

[1] No phytoplankton collections.

TABLE 27

PHYTOPLANKTON AND ZOOPLANKTON SAMPLING STRUCTURE, 1973-1979[1]

Station	1973[2]	1974	1975	1976	1977	1978	1979
1	X	X	X	X	X	X	X
2							
3	X	X	X	X	X	X	X
4							
5	X						
6		X	X	X	X	X	X
7	X						
8	X	X	X	X	X	X	X
9	X	X	X				
10	X	X	X				
11							
12	X	X	X	X			
13	X	X	X	X	X	X	X
14		X	X	X	X	X	X
15							
16							
17	X						
18	X	X	X	X	X	X	X
19	X	X	X				
20	X						
21							
22							
23							
24							
25							
26				X			
27				X			
28				X			
29				X			
First Month Last Month	May December	April November	April December	March November	April November	May November	May November

[1] All samples were collected by a vertical tow with a Wisconsin plankton net; 12cm mouth 0.064 mm mesh in 1973 and 1974 and 0.080 mm mesh from 1975-1979.

[2] No phytoplankton sampling; Zooplankton only.

TABLE 28

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	BACILLARIOPHYCEAE							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	22404	---	---	---	---[3]	---
April	7531	216609	105938	85684	---	---	733663[3]	---
May	2080	167574	69785	78218	35855	408898	222377	263781
June	90	6573	2131	2991	1628	11078	6353	6682
July	285	2556	1206	1073	1830	10882	6356	6401
August	772	20481	7513	8870	3372	5712	4542	1655
September	907	17383	7577	8674	4996	18138	11688	6574
October	5958	34799	24927	16432	12505	89804	53004	38782
November	7993	13002	10584	2509	16471	105250	46563	50830
December	---	---	79879	---	---	---	---	---
Mean	3202	59872	33194	37727	10951	92823	135568	252388

CHLOROPHYCEAE

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	32	---	---	---	---[3]	---
April	102	2888	916	1323	---	---	261[3]	---
May	432	2110	1167	716	700	2416	1558	1213
June	904	8347	4604	3951	1574	5556	3565	2816
July	1024	3384	1955	1012	4092	26052	15072	15528
August	793	5910	2362	2194	3791	4192	3992	284
September	2921	9511	5780	3381	2843	10034	27956	37443
October	7366	21872	13686	7431	16665	27160	21208	5388
November	1691	21198	11544	9755	27141	117566	48414	61348
December	---	---	1522	---	---	---	---	---
Mean	1904	9528	4357	4706	8115	27568	15253	16785

[1]Results from samples collected from 1974 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 28 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	MYXOPHYCEAE							
	Pre-Operational Data[1]				Operational Data[2]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	82	---	---	---	---	---
April	81	954	358	402	---	---	842[3]	---
May	0	688	221	315	1221	1886	1554	470
June	13	12854	3471	6269	1243	45570	23407	31344
July	313	84901	37539	35129	28878	216958	122918	132993
August	35	315263	101877	146415	69043	96697	82870	19554
September	1881	17977	7902	8780	19954	75577	171276	215727
October	5109	14203	8394	5045	19629	60168	40973	20355
November	1504	2578	2179	588	28219	31652	20275	16820
December	---	---	1563	---	---	---	---	---
Mean	1117	56177	16359	32084	24027	75501	58027	62124

	TOTAL PHYTOPLANKTON							
March	---	---	22517	---	---	---	---	---
April	7860	224076	108178	88757	---	---	734777	---
May	4883	168899	71305	77644	39497	411501	225499	263047
June	1604	17817	10357	12247	4595	62414	33505	40884
July	3460	87260	41833	34760	59120	266502	162811	146641
August	1603	327915	112143	147757	76687	106244	91466	20900
September	5751	31352	21378	13705	48372	83480	211073	252015
October	19232	70129	47052	25778	99846	126796	115422	13958
November	17148	33499	24324	8357	161456	165699	115537	83236
December	---	---	82963	---	---	---	---	---
Mean	7693	121368	54205	37254	69939	174662	211261	220686

[1]Results from samples collected from 1974 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 29

PRE-OPERATIONAL AND OPERATIONAL PHYTOPLANKTON DATA[1] FROM THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
STATION 3								
March	---	---	---	---	---	---	---	---
April	5929	188717	91274	76544	---	---	737866[4]	---
May	3553	201735	74227	91342	45212	267882	156547	157451
June	1607	18380	6303	8079	8252	30840	19546	15972
July	2737	113803	48155	47231	57331	327506	192419	191043
August	1329	358252	125142	162782	48336	94904	71620	32929
September	3891	27850	16441	12020	40281	64617	207482	268801
October	12016	66619	46585	30064	152681	226943	175074	45060
November	12786	33484	20171	11552	149954	244023	138399	111850
December	---	---	---	---	---	---	---	---
Mean	5481	102539	53537	41018	71721	179531	212369	221533
STATION 8								
March	---	---	22747	---	---	---	---	---
April	8250	142686	72523	57337	---	---	872472[4]	---
May	1634	124782	58863	62864	28665	384544	206605	251644
June	1348	22427	7242	10174	1945	6778	4362	3417
July	2313	80734	39508	32224	31659	94904	63282	44721
August	1562	389417	133684	182880	116805	181824	149315	45975
September	5528	28524	19847	12473	36743	82952	200363	244475
October	14883	52375	35282	18963	71015	116363	96087	23051
November	15181	43947	26842	14813	93383	199435	103448	91371
December	---	---	79075	---	---	---	---	---
Mean	6337	111737	49561	37676	54316	152400	211992	275361
STATION 13								
March	---	---	21247	---	---	---	---	---
April	6657	193221	113796	78639	---	---	889947[4]	---
May	4224	191170	78251	87463	36594	429182	232888	277602
June	1597	23356	9191	10200	3961	85402	44682	57587
July	2139	53265	35461	23674	47743	260850	154297	150689
August	1679	405706	132161	186211	96672	119697	108185	16281
September	6444	40540	23973	17068	46421	89766	276358	361375
October	17977	98873	52447	41752	77695	136376	115918	33129
November	13995	26408	20205	6207	75855	111081	66422	50057
December	---	---	83306	---	---	---	---	---
Mean	6839	129067	57004	42833	54992	176051	236087	275701

[1]Data presented as number of whole organisms per liter.

[2]Data collected from 1974 through August 1977.

[3]Data collected from September 1977 through 1979.

[4]April sample actually collected May 1, 1979.

TABLE 30

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA FROM THE LOCUST POINT AREA

	ROTIFERS							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	27	---	---	---	---	---
April	39	362	169	138	---	---	200[3]	---
May	94	479	304	166	170	264	217	66
June	87	234	149	71	33	70	52	26
July	35	573	259	234	39	102	71	45
August	23	592	292	213	36	41	39	4
September	119	369	241	128	82	213	214	132
October	73	681	280	347	70	120	100	26
November	143	513	282	164	15	49	25	21
December	219	236	228	12	---	---	---	---
Mean	92	449	223	86	64	123	115	82
	COPEPODS							
March	---	---	5	---	---	---	---	---
April	24	46	35	9	---	---	44[3]	---
May	233	851	400	255	31	195	113	116
June	132	591	340	165	91	262	177	121
July	62	423	186	148	126	176	151	35
August	33	163	77	51	87	141	114	38
September	66	177	103	51	47	109	86	34
October	67	105	82	20	59	67	55	14
November	24	119	68	42	25	48	28	19
December	32	52	42	14	---	---	---	---
Mean	80	281	134	134	67	143	96	53

[1]Results from samples collected from 1973 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 30 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA FROM THE LOCUST POINT AREA

	CLADOCERAN							
	Pre-Operational Data[2] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	0.2	---	---	---	---	---
April	0	11	3	5	---	---	2[3]	---
May	8	130	45	49	1	162	82	114
June	103	335	198	90	64	360	212	209
July	39	188	134	61	73	122	98	35
August	2	39	25	15	72	92	82	14
September	29	205	104	74	30	192	90	89
October	26	211	101	97	27	56	37	16
November	17	58	34	18	16	26	14	13
December	12	24	18	8	---	---	---	---
Mean	26	133	66	65	40	144	77	66

TOTAL ZOOPLANKTON

Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	32	---	---	---	---	---
April	77	439	217	157	---	---	245[3]	---
May	555	1086	819	191	295	536	416	170
June	707	1365	902	266	483	518	501	25
July	306	1168	911	345	252	370	811	624
August	144	825	454	249	250	334	292	59
September	391	627	500	110	251	557	461	182
October	259	831	489	302	159	246	253	97
November	256	650	391	178	55	135	71	58
December	275	303	289	20	---	---	---	---
Mean	330	810	500	296	249	385	381	222

[1]Results from samples collected from 1973 through August 1977.

[2]Results from samples collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 31

PRE-OPERATIONAL AND OPERATIONAL ZOOPLANKTON DATA IN THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

	STATION 3 (Control)							
	Pre-Operational Data[1] (no/l)				Operational Data[2] (no/l)			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	---	---	---	---	---	---
April	54	323	177	118	---	---	207[3]	---
May	415	1007	682	261	327	568	448	170
June	640	1210	862	218	489	535	512	33
July	265	1211	642	360	550	802	676	178
August	223	731	371	244	257	271	264	10
September	386	742	507	163	230	541	378	156
October	214	855	492	329	112	265	254	137
November	248	520	367	138	42	151	72	69
December	---	---	280	---	---	---	---	---
Mean	306	825	487	215	287	448	351	192
	STATION 8 (Intake)							
March	---	---	30	---	---	---	---	---
April	56	318	151	115	---	---	218	---
May	265	846	656	268	124	657	391	377
June	504	1673	897	526	337	386	362	35
July	216	918	487	328	319	1285	802	683
August	100	435	303	148	228	291	260	45
September	243	564	394	133	263	412	329	76
October	256	513	354	139	154	252	247	91
November	225	489	323	144	34	137	64	63
December	---	---	234	---	---	---	---	---
Mean	233	720	383	250	208	489	334	215
	STATION 13 (Discharge)							
March	---	---	33	---	---	---	---	---
April	63	482	223	184	---	---	287	---
May	454	1421	894	350	243	354	299	78
June	621	1230	872	222	498	563	531	46
July	387	1243	808	413	337	1433	885	775
August	136	793	446	262	197	403	300	146
September	363	533	459	83	249	513	505	253
October	282	984	565	370	176	179	265	152
November	237	569	375	140	80	127	72	59
December	170	346	258	124	---	---	---	---
Mean	301	845	493	292	254	510	393	245

[1]Data collected from 1973 through August 1977.

[2]Data collected from September 1977 through 1979.

[3]April sample actually collected May 1.

TABLE 32

BENTHIC MACROINVERTEBRATE SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
March				18			
April		17-18	23	9	27		
May	25	22-23	21	4		11	30
June		19-20	19	7	22		
July	2, 26-1	17	17	5		26	29
August	23	14	19	5	16		
September	19-26	6	11	3		26	30
October		10	9	5	3		
November	2-7	7	6	1		1	4
December	4		16				

TABLE 33

BENTHIC MACROINVERTEBRATE SAMPLING STRUCTURE, 1973-1979[1]

Station	1973	1974	1975	1976	1977	1978	1979
1	X	X	X	X	X	X	X
2	X	X	X				
3	X	X	X	X	X	X	X
4	X	X	X				
5	X	X	X				
6	X	X	X	X			
7	X	X	X	X			
8	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X
10	X	X	X				
11	X	X	X	X			
12	X	X	X	X			
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	X	X			
17	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X				
20	X	X[2]					
21							
22							
23							
24							
25							
26				X	X	X	X
27				X			
28				X			
29				X			
First Month	May	April	April	March	April	May	May
Last Month	December	November	December	November	October	November	November
Frequency	Monthly	Monthly	Monthly	Monthly	Every-other-month	Every-other-month	Every-other-month

[1] Three replicate grab samples with a ponar dredge (A=0.052 m^2) were collected at the stations indicated each year except 1973 when only one grab was collected at each station.

[2] Samples were collected only in April as water at this station was removed after this date to allow construction on the intake pumps.

TABLE 34

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DENSITIES[1] FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	COELENTERATA							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	0	---	---	---	---	---
April	0	3	1	2	---	---	---	---
May	9	51	21	20	1	21	11	14
June	0	210	89	89	---	---	---	---
July	0	5	2	2	0	4	2	3
August	0	7	2	3	---	---	---	---
September	1	36	10	17	1	40	21	20
October	2	72	30	37	---	---	57	---
November	7	98	32	44	17	74	46	40
December	0	27	14	19	---	---	---	---
Mean	2	57	20	27	5	35	27	23
	ANNELIDA							
March	---	---	113	---	---	---	---	---
April	506	1448	923	473	---	---	---	---
May	368	1153	637	358	302	306	304	3
June	547	822	705	101	---	---	---	---
July	481	1417	918	397	564	1947	1256	978
August	212	2212	1254	736	---	---	---	---
September	1012	2715	1561	783	443	813	628	262
October	767	2226	1305	801	---	---	1371	---
November	654	1705	1157	509	496	1788	1142	914
December	140	1543	842	992	---	---	---	---
Mean	521	1693	942	409	451.2	1214	940	455
	ARTHROPODA							
March	---	---	11	---	---	---	---	---
April	29	149	89	68	---	---	---	---
May	71	107	120	60	257	330	294	52
June	105	700	449	218	---	---	---	---
July	243	1146	491	437	169	2346	1258	1539
August	109	1583	642	562	---	---	---	---
September	96	1035	602	407	275	601	438	231
October	270	729	440	252	---	---	180	---
November	124	3016	896	1415	239	737	488	352
December	30	217	124	132	---	---	---	---
Mean	120	976	386	290	235	1004	532	424

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 34 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DENSITIES[1] FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION

	MOLLUSCA							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	4	---	---	---	---	---
April	0	2	1	1	---	---	---	---
May	0	4	2	2	0	1	1	1
June	0	5	2	2	---	---	---	---
July	1	3	2	1	0	0	0	0
August	0	4	1	2	---	---	---	---
September	0	4	2	2	0	1	1	1
October	0	2	1	1	---	---	1	---
November	0	3	1	1	0	0	0	0
December	0	1	1	1	---	---	---	---
Mean	0	3	2	1	0	1	1	1
	TOTAL BENTHIC MACROINVERTEBRATE POPULATION							
March	---	---	127	---	---	---	---	---
April	540	1592	1018	535	---	---	---	---
May	537	1216	777	315	560	653	607	66
June	653	1557	1241	363	---	---	---	---
July	772	2559	1399	805	737	2346	1542	1138
August	321	2782	1893	1008	---	---	---	---
September	1254	3753	2179	1116	601	1090	846	346
October	1065	3027	1767	1094	---	---	1609	---
November	894	4492	2090	1675	737	2044	1391	924
December	170	1788	979	1144	---	---	---	---
Mean	690	2530	1347	649	659	1533	1199	447

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 35

PRE-OPERATIONAL AND OPERATIONAL BENTHIC MACROINVERTEBRATE DATA[1] FROM THE VICINITY OF THE INTAKE AND DISCHARGE STRUCTURES AND A CONTROL STATION

	STATION 3 (CONTROL)							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
March	---	---	---	---	---	---	---	---
April	172	1910	1044	816	---	---	---	
May	376	1662	824	604	923	955	939	23
June	1356	4181	2591	1451	---	---	---	---
July	1448	3565	2529	1008	19	204	112	131
August	0	2776	1248	1151	---	---	---	---
September	1191	2540	1828	648	280	382	331	72
October	1719	2903	2209	618	---	---	83	---
November	1573	3247	2320	739	96	4081	2089	2818
December	---	---	2660	---	---	---	---	---
Mean	979	2848	1917	711	330	1406	711	844
	STATION 8 (INTAKE)							
March	---	---	57	---	---	---	---	---
April	64	3361	1598	1642	---	---	---	---
May	255	1483	906	508	89	592	341	356
June	573	1598	1387	455	---	---	---	---
July	458	1834	1127	700	554	3031	1793	1752
August	18	4164	1328	1639	---	---	---	---
September	.1229	3095	2178	1003	618	1496	1057	621
October	414	2604	1488	1096	---	---	611	---
November	172	1995	1125	819	649	1706	1178	747
December	51	325	188	194	---	---	---	---
Mean	359	2273	1138	636	478	1706	996	559
	STATION 13 (DISCHARGE)							
March	---	---	191	---	---	---	---	---
April	83	1293	417	585	---	---	---	---
May	280	901	498	280	669	1178	924	360
June	337	1776	884	543	---	---	---	---
July	181	5068	2594	2374	649	1490	1070	595
August	89	3120	1319	1257	---	---	---	---
September	1827	3795	2701	851	140	1012	576	617
October	337	5100	2171	2563	---	---	592	---
November	337	1490	874	700	121	1834	978	1211
December	255	2497	1376	1585	---	---	---	---
Mean	414	2782	1303	907	395	1379	828	229

[1]Data presented as number of organisms per square meter.

[2]Data collected from 1973 through August 1977.

[3]Data collected from September 1977 through 1979.

TABLE 36

GILL NET SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
April		25-26	17-18	12-13	18-19		30-1 (May)
May		21-22	22-23	10-11	16-17	18-19	30-31
June		13-14	16-17	14-15	13-14	29-30	20-21
July	2-3	10-11	14-15	14-15	12-13	24-25	28-29
August	2-3, 30-31	19-20	11-12	11-12	9-10	17-18	28-29
September	28-29	12-13	8-9	30-1	13-14	24-25	29-30
October		16-17	6-7		20-21	17-18	27-28
November	12-13	25-26	3-4, 17-18	4-5		1-2	3-4
December			16-17				

TABLE 37

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	ALEWIFE							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	10	3	5	---	---	0	---
May	0	44	30	20	0	0	0	0
June	0	43	19	19	0	1	1	1
July	0	159	49	68	0	0	0	0
August	0	72	14	32	0	6	3	4
September	0	200	87	102	1	136	48	76
October	4	322	117	178	36	88	41	44
November	0	47	16	22	41	52	47	8
December	---	---	0	---	---	---	---	---
Mean	1	112	37	40	11	40	18	23
	CHANNEL CATFISH							
April	0	1	0	1	---	---	1	---
May	0	1	1	1	0	0	0	0
June	0	7	2	3	3	6	5	2
July	1	18	6	7	3	4	4	1
August	0	5	2	2	0	0	0	0
September	0	2	1	1	0	0	0	0
October	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	0	4	1	2	1	1	1	2
	FRESHWATER DRUM							
April	0	17	4	9	---	---	4	---
May	0	4	1	2	1	1	1	0
June	3	9	5	3	20	75	48	39
July	1	50	18	20	0	14	7	10
August	0	12	5	5	0	6	3	4
September	0	11	4	5	0	3	1	2
October	0	7	4	4	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	1	14	5	5	3	14	8	16

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 37 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	GIZZARD SHAD							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	3	1	1	---	---	1	---
May	0	9	4	4	1	5	3	3
June	4	9	8	3	9	22	16	9
July	7	50	30	15	3	13	8	7
August	40	184	103	63	7	109	58	72
September	3	168	76	68	1	114	55	57
October	24	155	106	71	0	291	103	162
November	1	51	26	26	9	11	10	1
December	---	---	7	---	---	---	---	---
Mean	10	79	40	43	4	81	32	37
	SPOTTAIL SHINER							
April	58	142	97	43	---	---	58	---
May	66	1331	482	574	12	224	118	150
June	0	85	29	39	0	4	2	3
July	0	29	8	12	0	14	7	10
August	2	58	15	24	4	21	13	12
September	0	25	10	11	18	75	44	29
October	31	35	33	2	4	27	15	12
November	0	64	21	29	24	26	25	1
December	---	---	5	---	---	---	---	---
Mean	20	221	78	154	9	56	35	38
	WALLEYE							
April	0	3	1	1	---	---	0	---
May	0	2	1	1	0	1	1	1
June	0	4	2	2	0	1	1	1
July	0	15	3	7	0	4	2	3
August	0	2	1	1	0	8	4	6
September	0	1	1	1	0	1	1	1
October	0	1	0	1	0	0	0	0
November	0	0	0	0	0	0	0	0
December	---	---	0	---	---	---	---	---
Mean	0	4	1	1	0	2	1	1

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 37 (cont'd)

PRE-OPERATIONAL AND OPERATIONAL GILL NET CATCHES[1] OF SELECTED SPECIES FROM LAKE ERIE IN THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION DISCHARGE (STATION 13)

	WHITE BASS							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	0	3	1	1	---	---	0	---
May	0	3	1	1	0	2	1	1
June	0	6	3	3	8	43	26	25
July	0	6	3	3	4	25	15	15
August	1	29	9	12	0	7	4	5
September	1	11	5	5	0	2	1	1
October	1	4	2	2	0	6	2	3
November	0	1	0	1	0	1	1	1
December	---	---	0	---	---	---	---	---
Mean	0	8	3	3	2	12	6	9
	YELLOW PERCH							
April	10	119	55	47	---	---	24	---
May	9	109	48	44	9	40	25	22
June	3	95	47	39	2	28	15	18
July	5	125	37	50	35	76	56	29
August	33	100	65	28	43	313	178	191
September	32	160	73	60	43	71	53	15
October	13	158	67	79	7	18	12	6
November	0	28	8	14	6	7	7	1
December	---	---	0	---	---	---	---	---
Mean	14	112	44	26	21	79	46	56

[1]Results presented as the number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bow mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 38

PRE-OPERATIONAL AND OPERATIONAL GILL NET DATA[1] FROM THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION INTAKE, DISCHARGE, AND TWO CONTROL STATIONS

	STATION 3							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	---	---	197	---	---	---	72	---
May	---	---	49	---	98	319	209	165
June	---	---	263	---	102	239	171	97
July	---	---	110	---	71	222	147	107
August	---	---	396	---	241	267	254	18
September	---	---	---	---	178	481	331	151
October	---	---	---	---	31	178	108	74
November	---	---	---	---	162	1371	577	688
December	---	---	---	---	---	---	---	---
Mean	---	---	203	135	126	440	234	161
	STATION 8							
April	0	52	26	19	---	---	33	---
May	32	2077	676	959	20	134	77	81
June	62	260	154	98	69	196	133	90
July	85	179	122	45	86	262	174	124
August	89	166	135	38	122	208	165	61
September	61	343	203	124	174	221	191	26
October	55	652	257	342	25	93	57	34
November	4	112	49	52	12	816	288	458
December	---	---	19	---	---	---	---	---
Mean	50	480	182	202	73	276	140	83

[1]Results presented as number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 38 (cont'd.)

PRE-OPERATIONAL AND OPERATIONAL GILL NET DATA[1] FROM THE VICINITY OF THE DAVIS-BESSE NUCLEAR POWER STATION INTAKE, DISCHARGE, AND TWO CONTROL STATIONS

	STATION 13							
	Pre-Operational Data[2]				Operational Data[3]			
Month	Min	Max	Mean	Std Dev	Min	Max	Mean	Std Dev
April	88	269	166	75	---	---	88	---
May	120	1381	573	558	29	270	150	170
June	49	232	125	77	112	122	117	7
July	94	254	163	82	85	138	112	37
August	136	327	237	84	186	387	287	142
September	73	382	270	141	122	366	206	138
October	104	691	337	312	7	433	178	225
November	6	208	76	94	85	1455	544	789
December	---	---	14	---	---	---	---	---
Mean	84	468	218	166	89	453	210	150
	STATION 26							
April	---	---	191	---	---	---	47	---
May	---	---	44	---	34	127	81	66
June	---	---	238	---	101	175	138	52
July	---	---	41	---	118	258	188	99
August	---	---	293	---	345	348	347	2
September	---	---	---	---	41	637	336	298
October	---	---	---	---	54	71	61	9
November	---	---	---	---	28	907	328	502
December	---	---	---	---	---	---	---	---
Mean	---	---	161	114	103	360	191	129

[1]Results presented as number of fish per unit effort, where one unit of effort equals a 24-hour bottom set with an experimental gill net 125 ft long consisting of five 25-ft contiguous panels of ½, 3/4, 1, 1½, and 2-inch bar mesh.

[2]Results from samples collected from 1973 through August 1977.

[3]Results from samples collected from September 1977 through 1979.

TABLE 39

ICHTHYOPLANKTON SAMPLING DATES

Month \ Year	1973	1974	1975	1976	1977	1978	1979
March							
April			22	6, 14, 30	20, 29	30	
May		21	12, 25	10, 17, 27	21	22	1, 9, 31
June		14	2, 15, 22	11, 17, 28	2, 13, 25	8, 20	5, 21
July		10	2, 13	8, 23, 29	5, 13, 20, 27	5, 19	5, 12, 20
August		19	4, 30	9, 20, 31	12, 22	1, 11, 23	3, 15
September		12			2		
October		16					
November		25					

TABLE 40

ICHTHYOPLANKTON DENSITIES IN THE VICINITY OF THE INTAKE OF THE DAVIS - BESSE NUCLEAR POWER STATION - 1978*

SPECIES	STAGE \ DATE	April 30	May 11	May 21	June 7	July 4	July 19	Aug. 1	Aug. 11	MEAN
Carp	Pro-larvae					0.3				0.04
	Post-larvae									
	Subtotal					0.3				C.04
Emerald Shiner	Pro-larvae					14.7				1.84
	Post-larvae					1.6		1.6	0.8	0.50
	Subtotal					16.3		1.6	0.8	2.34
Freshwater Drum	Pro-larvae			0.7		4.9				0.70
	Post-larvae					0.4				0.05
	Sub-total			0.7		5.3				0.75
Gizzard Shad	Pro-larvae				16.4				0.4	2.10
	Post-larvae				5.2	181.9	30.0	3.6	24.3	30.63
	Subtotal				21.6	181.9	30.0	3.6	24.7	32.73
Rainbow Smelt	Pro-larvae			0.7						0.09
	Post-larvae						4.2		0.6	0.60
	Subtotal			0.7			4.2		0.6	0.69
Spottail Shiner	Pro-larvae				0.3					0.04
	Post-larvae						0.4		0.2	0.08
	Subtotal				0.3		0.4		0.2	C.11
Walleye	Pro-larvae		79.2	4.0						10.40
	Post-larvae									
	Subtotal		79.2	4.0						10.40
Yellow Perch	Pro-larvae		1.4	1.8						0.40
	Post-larvae									
	Subtotal		1.4	1.8						0.40
TOTAL LARVAE	Pro-larvae		80.6	7.2	16.7	19.9			0.4	15.60
	Post-larvae				5.2	183.9	34.6	5.2	25.9	31.85
	Subtotal		80.6	7.2	21.9	203.8	34.6	5.2	26.3	47.45
EGGS					2.4					0.30

* Data presented as number of individuals per $100m^3$ and computed from 4 oblique tows (bottom to surface) collected at night.

TABLE 41
ICHTHYOPLANKTON DENSITIES IN THE VICINITY OF THE INTAKE OF THE DAVIS-BESSE NUCLEAR POWER STATION - 1979*

SPECIES	DATE / LARVAL STAGES**	May 1	May 31	June 5	June 21	July 5	July 11	July 19	August 2	August 15	MEAN
Carp	Stage 1				0.2	2.9	0.2				0.37
	Stage 2				0.1						0.01
	Stage 3										
	Subtotal				0.3	2.9	0.2				0.38
Emerald Shiner	Stage 1				10.5	144.2	1.6	0.5	0.2		17.44
	Stage 2				23.8	86.4	38.3	10.5			17.67
	Stage 3					43.3	7.9	38.3			9.94
	Subtotal				34.3	273.9	47.8	49.3	0.2		45.06
Freshwater Drum	Stage 1				3.1	7.7	38.3		0.2		5.48
	Stage 2					4.8			0.5		0.59
	Stage 3						1.0		4.8		0.64
	Subtotal				3.1	12.4	39.3		5.5		6.70
Gizzard Shad	Stage 1		33.3	82.5	61.8	91.8	25.2	8.7	0.3		33.73
	Stage 2		8.7	15.5	82.6	69.5	64.4	15.1	2.8		28.73
	Stage 3				7.8	39.4	22.1	9.5	5.5		9.37
	Subtotal		42.0	98.0	152.1	200.7	111.7	33.3	8.6		71.82
Logperch	Stage 1			3.6							0.40
	Stage 2					0.1					0.01
	Stage 3				0.1	0.1					0.02
	Subtotal			3.6	0.1	0.2					0.43
Rainbow Smelt	Stage 1		0.2	33.5				0.6			3.81
	Stage 2		9.0		0.1			2.8	1.3		1.47
	Stage 3				0.5	0.4					0.10
	Subtotal		9.2	33.5	0.6	0.4		3.4	1.3		5.38
Spottail Shiner	Stage 1					1.9					0.21
	Stage 2				0.5						0.06
	Stage 3										
	Subtotal				0.5	1.9					0.27
Unidentified	Stage 1				0.1						0.01
	Stage 2										
	Stage 3										
	Subtotal				0.1						0.01
Unidentified Percid	Stage 1										
	Stage 2		0.2								0.02
	Stage 3										
	Subtotal		0.2								0.02
Unidentified Shiner	Stage 1				0.1						0.01
	Stage 2					0.1					0.01
	Stage 3										
	Subtotal				0.1	0.1					0.02
Unidentified Sucker	Stage 1										
	Stage 2					0.1					0.01
	Stage 3										
	Subtotal					0.1					0.01
Walleye	Stage 1	0.7	0.2								0.10
	Stage 2		1.2								0.13
	Stage		0.3								0.03
	Subtotal	0.7	1.7								0.27
White Bass	Stage 1				0.1		0.3	0.3			0.08
	Stage 2		0.2		0.3	0.3	0.1	0.6			0.17
	Stage 3					0.8		0.1	0.2		0.12
	Subtotal		0.2		0.4	1.1	0.4	1.0	0.2		0.37
White Sucker	Stage 1						0.2				0.02
	Stage 2										
	Stage 3										
	Subtotal						0.2				0.02
Yellow Perch	Stage 1		7.0	16.4							2.60
	Stage 2		55.5	3.6							6.57
	Stage 3		14.7	5.0	0.2						2.21
	Subtotal		77.2	25.0	0.2						11.38
Freshwater Drum Egg					0.3	1.0	6.0				0.81
Total Ichthyoplankton	Stage 1	0.7	40.8	135.9	75.8	246.6	65.7	10.1	0.7		64.03
	Stage 2		75.0	19.1	107.4	163.2	102.8	29.1	4.5		55.68
	Stage 3		14.9	5.0	8.6	84.1	31.0	48.0	10.5		22.47
	Egg				0.3	1.0	6.0				0.81
	Subtotal	0.7	130.7	160.0	192.0	494.9	205.5	87.1	15.8		142.97

*Data presented as number of individuals per $100m^3$ and computed from 4 oblique tows (bottom and surface) collected at night.

**This is the subtotal of the larval stages. It is the mean of the surface and bottom densities. Stage 1 = proto-larvae, no rays in fin/finfold. Stage 2 = meso-larvae, first ray seen in median fins. Stage 3 = meta-larvae, pelvic fin bud is visible.

TABLE 42

ICHTHYOPLANKTON ENTRAINMENT AT THE
DAVIS-BESSE NUCLEAR POWER STATION - 1978

Species	Period During Which Entrainment Occurred[a]	Volume of Water ($100m^3$) withdrawn during period[b]	Larvae/$100m^3$ [c]			Number of Larvae Entrained		
			Mean	95% Confidence Interval		Mean	95% Confidence Interval[d]	
				Lower Limit	Upper Limit		Lower Limit	Upper Limit
Carp	21 June - 12 July	20,443	0.32	-0.69	1.32	6,542	0	26,985
Emerald Shiner	21 June - 17 August	73,704	4.68	-7.70	17.05	344,935	0	1,256,653
Freshwater Drum	16 May - 12 July	49,951	2.00	-5.15	9.15	99,902	0	457,052
Gizzard Shad	30 May - 17 August	91,598	52.36	-38.38	143.00	4,796,071	0	13,098,514
Rainbow Smelt	16 May - 17 August	103,211	0.92	-0.80	2.64	94,954	0	272,477
Spottail Shiner	30 May - 17 August	91,598	0.18	-0.04	0.40	16,488	0	36,639
Walleye	6 May - 30 May	22,037	41.60	-436.15	519.35	916,739	0	11,444,915
Yellow Perch	6 May - 30 May	22,037	1.60	-0.94	4.14	35,259	0	91,233
TOTAL LARVAE						6,310,890		
EGGS	30 May - 21 June	18,449	2.40	-5.24	10.04	44,278	0	185,228

[a] Estimated from Table 1. See discussion on page 1.

[b] Estimated by multiplying daily discharge rate by 1.3 and adding all daily estimates for the specified period.

[c] Average concentration during their period of occurrence.

[d] Values which would have been less than zero were rounded back to zero.

TABLE 43

ICHTHYOPLANKTON ENTRAINMENT AT THE
DAVIS-BESSE NUCLEAR POWER STATION - 1979

Species	Period During Which Entrainment Occurred[a]	Volume of Water ($100m^3$) Withdrawn During Period[b]	Larvae/$100m^3$ [c]			Number of Larvae Entrained		
			Mean	95% Confidence Interval		Mean	95% Confidence Interval	
				Lower Limit	Upper Limit		Lower Limit	Upper Limit
Carp	13 June-15 July	41,903	1.13	0.20	2.06	47,350	8,381	86,320
Emerald Shiner	13 June-9 August	84,023	81.11	33.83	128.39	6,815,106	2,842,498	10,787,713
Freshwater Drum	13 June-9 August	84,023	12.07	6.84	17.30	1,014,158	574,717	1,453,598
Gizzard Shad	16 May-9 August	110,283	92.37	62.66	122.08	10,186,841	6,910,333	13,463,349
Logperch	2 June-8 July	43,542	1.30	0.36	2.24	56,605	15,675	97,534
Rainbow Smelt	16 May-9 August	110,283	6.92	4.27	9.57	763,158	470,908	1,055,408
Spottail Shiner	13 June-8 July	32,771	1.17	-1.01	3.35	38,342	0	109,783
Unidentified	13 June-28 June	20,474	0.05	-0.10	0.20	1,024	0	4,095
Unidentified Percid	16 May-2 June	16,302	0.24	-0.52	1.00	3,912	0	16,302
Unidentified Shiner	13 June-8 July	32,771	0.08	- .05	0.21	2,622	0	6,882
Unidentified Sucker	28 June-8 July	13,477	0.12	-0.26	0.50	1,617	0	6,739
Walleye	26 April-2 June	34,138	1.22	0.64	1.80	41,648	21,848	61,448
White Bass	16 May-9 August	110,283	0.47	0.22	0.72	51,833	24,262	79,404
White Sucker	8 July-15 July	10,112	0.15	-0.33	0.64	1,517	0	6,472
Yellow Perch	16 May-28 June	46,735	34.13	27.67	40.59	1,595,066	1,293,157	1,896,974
TOTAL LARVAE						20,620,799		
F. Drum Eggs	13 June-15 July	41,903	2.42	0.85	3.99	101,405	35,618	167,153
TOTAL ICHTHYOPLANKTON						20,722,204		

[a]Estimated from Table 1. See discussion on page 1.

[b]Estimated by multiplying daily discharge rate by 1.3 and adding all daily estimates for the specified period.

[c]Average concentration during their period of occurrence.

[d]Values which would have been less than zero were rounded back to zero.

TABLE 44

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
2 January 1978	22.09	22.41	Y	46.41
4 "	21.30	22.00	Y	47.59
5 "	16.15	17.05	N	19.05
6 "	16.39	17.17	Y	24.12
8 "	16.01	16.37	Y	47.20
12 "	16.45	17.15	N	96.73
14 "	17.50	18.30	N	49.15
20 "	20.15	20.45	Y	146.15
22 "	17.30	18.00	Y	45.55
24 "	17.00	18.24	Y	48.24
28 "	18.00	19.30	Y	97.06
30 "	20.30	21.00	Y	49.70
1 February 1978	20.45	21.15	N	48.15
3 "	20.55	21.25	Y	48.10
5 "	16.45	17.16	Y	43.91
7 "	17.30	18.00	Y	48.84
9 "	21.00	21.30	Y	51.30
11 "	17.40	18.15	Y	44.85
13 "	20.00	20.40	Y	50.25
17 "	17.00	17.30	Y	92.90
19 "	17.12	17.45	Y	48.15
21 "	20.30	21.20	N	51.75
22 "	18.40	17.20	N	20.00
23 "	19.55	20.50	N	27.30
25 "	20.57	21.40	N	48.90
27 "	18.10	19.40	Y	46.00
1 March 1978	23.00	23.40	N	52.00
2 "	16.30	17.10	N	17.70
3 "	18.00	18.35	Y	25.25
5 "	20.30	21.00	Y	50.65
6 "	21.30	22.00	N	25.00
7 "	20.15	20.50	Y	22.50
10 "	19.40	20.10	Y	71.60
11 "	19.10	19.45	Y	23.35
12 "	17.20	17.50	N	22.05
13 "	17.30	18.00	N	24.50
15 "	17.50	18.22	Y	48.22
17 "	18.50	19.20	Y	48.98
19 "	20.40	21.12	Y	49.92
21 "	19.58	20.28	N	47.16
23 "	20.50	21.26	Y	48.98
25 "	22.40	23.10	Y	49.84
26 "	18.00	18.30	N	19.20
27	20.00	21.05	N	26.75
29 "	21.19	21.56	Y	48.51

TABLE 44 (Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
2 April 1978	19.06	19.40	Y	93.84
3 "	20.15	20.50	N	25.10
4 "	20.00	20.30	N	23.80
7 "	19.40	20.40	N	72.10
8 "	20.30	21.00	Y	24.60
9 "	20.10	20.40	N	23.40
10 "	21.00	22.00	Y	25.60
12 "	20.50	21.20	Y	47.20
13 "	20.30	21.00	N	23.80
14 "	20.30	21.00	Y	24.00
15 "	17.00	17.45	N	20.45
16 "	16.58	17.36	Y	23.91
17 "	16.30	17.45	N	24.09
18 "	17.25	17.55	Y	24.10
19 "	16.20	17.00	N	23.45
20 "	16.37	17.13	Y	24.13
22 "	18.00	18.35	Y	49.22
24 "	17.32	18.05	Y	47.70
26 "	17.15	17.45	Y	47.40
28 "	18.00	18.30	Y	48.85
30 "	23.20	23.50	Y	53.20
1 May 1978	18.30	19.00	N	19.50
2 "	18.45	19.15	Y	24.15
5 "	10.30	11.00	N	63.85
6 "	21.15	21.45	Y	34.45
8 "	20.25	20.55	Y	47.10
10 "	16.55	17.25	Y	44.70
12 "	22.00	22.30	Y	53.05
14 "	16.30	17.00	Y	42.70
16 "	16.35	17.05	Y	48.05
18 "	16.10	16.40	Y	47.35
20 "	17.00	17.30	N	48.90
22 "	19.00	20.30	Y	51.00
24 "	16.32	17.04	Y	44.74
26 "	14.40	15.10	Y	46.06
28 "	18.03	18.33	Y	51.23
30 "	15.45	16.15	Y	45.82
1 June 1978	16.25	17.00	Y	48.85
3 "	14.50	15.20	Y	46.20
5 "	18.55	19.35	Y	52.15
6 "	18.30	19.15	N	23.80
7 "	21.05	21.35	Y	26.20
9 "	21.36	22.06	Y	48.71
10 "	16.15	16.36	N	18.30
11 "	17.55	18.30	Y	25.94

TABLE 44(Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
12 June 1978	17.00	17.30	N	23.00
13 "	16.35	17.05	Y	23.75
15 "	12.52	13.24	Y	44.19
16 "	18.40	19.10	N	29.86
17 "	13.39	14.10	Y	19.00
19 "	18.45	19.25	N	53.15
20 "	16.25	16.55	N	21.30
21 "	16.07	16.37	Y	23.82
23 "	14.25	14.55	Y	46.18
25 "	16.10	16.50	Y	49.95
27 "	20.30	21.15	N	52.65
28 "	17.25	17.50	N	20.35
29 "	15.50	16.20	Y	22.70
30 "	16.00	16.30	N	24.10
2 July 1978	18.00	18.30	Y	50.00
4 "	17.15	17.45	Y	47.15
6 "	16.20	16.55	Y	47.10
8 "	14.20	14.50	Y	45.95
9 "	18.20	18.50	N	28.00
10 "	18.40	19.20	Y	24.70
11 "	20.45	21.16	Y	25.96
13 "	21.15	21.45	N	48.29
14 "	18.45	19.15	Y	21.70
15 "	16.25	16.55	N	21.40
16 "	16.30	17.00	Y	24.45
17 "	19.20	19.50	Y	26.50
20 "	20.15	20.50	Y	73.00
22 "	19.25	19.55	Y	47.05
24 "	17.00	17.30	Y	45.75
25 "	20.45	21.20	Y	27.90
26 "	20.15	20.45	Y	23.25
27 "	16.55	17.25	N	20.80
28 "	18.25	19.00	Y	25.75
30 "	17.16	17.46	Y	46.46
1 August 1978	17.00	17.30	Y	47.84
2 "	16.20	16.50	N	23.20
3 "	16.35	17.05	Y	24.55
4 "	19.00	19.30	N	26.25
5 "	19.02	19.37	Y	24.07
7 "	16.45	17.15	Y	45.78
9 "	19.30	20.00	Y	50.85
11 "	16.20	16.50	Y	44.50
13 "	16.43	17.18	N	48.68
14 "	22.00	22.30	N	29.12
17 "	20.20	21.30	N	71.00

TABLE 44 (Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
19 August 1978	18.55	19.29	Y	45.99
21 "	19.20	20.15	Y	48.86
23 "	20.15	20.45	Y	48.30
25 "	18.35	19.10	Y	46.65
26 "	18.05	18.50	N	23.40
27 "	17.37	18.14	Y	23.64
29 "	16.45	17.15	Y	47.01
31 "	17.30	18.00	Y	48.85
1 September 1978	16.38	17.08	N	23.08
3 "	16.13	16.43	Y	47.35
4 "	16.35	17.25	Y	24.82
6 "	16.52	17.23	Y	47.98
8 "	18.07	18.37	Y	49.14
10 "	17.20	18.00	Y	47.63
12 "	20.13	20.45	Y	50.45
14 "	19.15	19.50	Y	47.05
16 "	17.30	18.20	N	46.70
18 "	21.30	22.05	Y	51.85
19 "	22.15	22.50	N	24.45
20 "	20.00	20.30	Y	21.80
22 "	23.00	23.30	Y	51.00
24 "	17.20	18.05	N	42.75
25 "	20.35	21.05	N	27.00
28 "	19.00	19.35	Y	70.30
30 "	16.55	17.25	Y	45.90
2 October 1978	19.25	19.55	Y	50.30
3 "	18.20	18.40	N	22.85
4 "	17.45	18.15	Y	23.75
5 "	16.30	17.01	N	22.86
6 "	20.25	21.00	N	27.99
9 "	16.25	16.55	N	67.55
10 "	17.05	17.36	Y	24.81
11 "	15.05	15.35	N	21.99
12 "	18.43	19.17	Y	27.82
13 "	16.40	17.10	N	21.93
14 "	21.34	22.04	Y	28.94
16 "	17.00	17.30	Y	43.26
20 "	17.20	17.50	Y	96.20
22 "	21.45	22.20	Y	52.70
25 "	18.20	18.50	N	68.30
26 "	16.30	17.00	Y	22.50
28 "	20.05	20.40	Y	51.40
30 "	21.10	21.45	Y	49.05

TABLE 44(Con't.)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1978

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 November 1978	18.45	19.17	Y	45.72
3 "	20.45	21.18	Y	50.01
5 "	20.08	20.40	Y	47.22
6 "	16.25	16.55	N	20.15
7 "	16.48	17.12	Y	24.57
8 "	16.40	17.10	N	23.98
9 "	16.50	17.20	Y	24.10
11 "	18.25	18.55	Y	49.35
12 "	17.05	17.35	N	22.80
13 "	18.15	18.35	Y	25.00
14 "	16.26	17.00	N	22.65
15 "	18.30	19.00	Y	26.00
17 "	20.05	20.57	N	49.57
20 "	19.45	20.30	N	71.73
21 "	20.50	21.20	N	24.90
23 "	16.15	16.45	Y	43.25
24 "	19.00	20.08	N	27.63
25 "	20.00	20.30	Y	24.22
27 "	20.30	21.00	Y	48.70
29 "	20.15	20.45	Y	47.45
1 December 1978	19.15	19.45	Y	47.00
3 "	16.28	17.08	Y	45.63
5 "	16.00	17.34	N	48.26
6 "	17.55	18.25	Y	24.91
9 "	17.55	18.25	N	72.00
10 "	19.46	20.23	N	25.98
11 "	16.30	17.00	N	20.77
12 "	17.45	18.15	N	25.15
13 "	18.04	18.34	Y	24.19
15 "	17.20	17.50	Y	47.16
17 "	18.45	19.15	Y	49.65
18 "	17.34	18.10	N	22.95
19 "	22.20	22.50	Y	28.40
20 "	18.20	18.50	N	20.00
21 "	16.25	16.59	Y	22.09
23 "	19.45	20.15	Y	51.56
24 "	19.35	20.05	N	23.90
25 "	21.50	22.20	Y	26.15
27 "	17.30	18.00	N	43.80
28 "	19.37	20.07	N	26.07
29 "	20.20	20.50	Y	24.43
30 "	17.30	19.30	N	22.80
31 "	18.35	19.08	Y	23.78

TABLE 45

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 January	0.01	0.31	N	0.31
2 January	19.20	21.45	N	45.14
4 January	17.55	18.26	Y	44.81
6 January	20.25	20.55	Y	50.29
8 January	16.00	17.54	N	44.99
10 January	17.20	17.52	Y	47.98
12 January	17.40	18.15	Y	48.63
13 January	16.05	16.35	N	22.20
14 January	19.20	19.50	Y	27.15
16 January	18.26	18.56	Y	47.06
17 January	16.12	16.42	N	21.86
20 January	17.20	18.45	N	74.03
24 January	11.50	17.30	N	94.85
26 January	18.55	19.25	N	49.95
27 January	16.27	16.57	N	21.32
28 January	16.30	17.00	N	24.43
1 February	19.39	20.09	N	99.09
2 February	20.15	21.00	N	24.91
3 February	21.07	21.40	Y	24.40
5 February	17.30	18.00	Y	44.60
7 February	18.19	18.57	N	48.57
9 February	17.00	17.35	Y	46.78
11 February	19.32	20.05	Y	50.70
13 February	18.20	18.50	N	46.45
15 February	19.10	19.41	N	48.91
16 February	18.55	19.25	N	23.84
17 February	17.02	17.35	Y	22.10
19 February	17.50	18.25	Y	48.90
20 February	17.00	17.35	N	23.10
21 February	18.45	19.15	Y	25.80
23 February	19.10	19.40	Y	48.25
24 February	21.45	22.25	N	26.85
25 February	21.05	21.31	Y	23.06
26 February	21.00	21.30	N	23.99
27 February	17.50	18.25	Y	20.95
28 February	22.00	22.30	N	28.05
1 March	21.22	21.52	Y	23.22
3 March	19.33	20.03	Y	46.51
5 March	16.10	16.40	Y	44.37

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
7 March	16.52	17.22	Y	48.82
9 March	16.10	16.40	Y	47.18
10 March	21.15	21.45	N	29.05
11 March	19.30	20.00	Y	22.55
13 March	17.17	17.50	Y	45.50
17 March	19.50	20.25	N	98.75
18 March	16.45	17.15	N	20.90
19 March	20.15	20.45	Y	27.30
21 March	16.13	16.43	Y	43.98
22 March	17.03	17.33	N	24.90
23 March	19.50	20.20	Y	26.87
24 March	16.58	17.30	N	21.10
25 March	16.40	17.10	Y	23.80
26 March	16.03	16.36	N	23.26
27 March	18.40	17.12	Y	24.76
28 March	17.30	18.00	N	24.88
31 March	16.20	16.50	Y	70.50
2 April	18.10	18.42	Y	49.92
3 April	21.00	21.30	Y	26.88
4 April	20.50	21.26	N	23.96
6 April	21.40	22.10	Y	48.84
8 April	17.27	18.00	Y	43.90
9 April	19.45	20.20	N	26.20
10 April	18.10	18.40	Y	22.20
12 April	18.15	18.45	Y	48.05
13 April	19.44	20.20	N	25.75
14 April	16.30	17.00	N	20.80
16 April	18.55	19.27	N	50.27
18 April	20.45	21.15	N	49.88
19 April	22.30	23.00	N	25.85
20 April	22.00	22.38	Y	23.38
21 April	16.50	17.25	Y	18.87
22 April	18.40	19.10	N	25.85
23 April	17.20	18.00	Y	22.90
24 April	18.00	18.30	N	24.30
25 April	18.43	19.09	Y	24.79
26 April	16.35	17.06	N	21.97
27 April	16.50	17.25	N	24.19
28 April	16.55	17.30	N	24.05
29 April	19.30	20.00	Y	26.70
30 April	19.50	20.20	Y	24.20

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 May	19.45	20.21	N	24.01
3 May	19.30	20.02	Y	47.81
4 May	16.50	17.20	N	21.18
5 May	16.05	16.35	N	23.15
7 May	18.25	18.55	Y	50.20
8 May	16.45	17.15	N	22.60
9 May	18.20	18.50	Y	25.35
11 May	17.35	18.05	Y	47.55
12 May	20.10	20.40	N	26.35
13 May	18.36	19.06	Y	22.66
13 May	17.17	17.49	Y	46.43
16 May	19.55	20.30	N	26.81
17 May	19.16	19.46	Y	23.16
19 May	20.05	20.35	Y	48.89
20 May	17.18	17.48	N	21.13
21 May	17.17	17.48	Y	24.00
22 May	17.17	17.48	N	24.00
23 May	16.37	17.08	Y	23.60
24 May	15.30	16.00	Y	22.92
8 June	16.25	17.00	N	361.00
9 June	19.15	19.45	N	26.45
10 June	22.30	23.00	N	27.55
11 June	19.30	20.25	N	21.25
12 June	17.43	18.15	N	21.90
13 June	23.15	23.45	N	29.30
14 June	22.30	23.00	N	23.55
15 June	23.20	23.50	N	24.50
17 June	21.38	22.08	Y	46.58
19 June	18.45	19.15	Y	45.07
21 June	18.18	19.19	N	48.04
23 June	18.40	19.15	N	47.96
25 June	20.25	21.25	Y	50.10
26 June	16.15	17.15	N	19.90
27 June	17.45	18.35	Y	25.20
28 June	22.05	22.35	N	28.00
29 June	1.00	1.30	Y	2.95

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
1 July	20.55	21.25	Y	67.95
3 July	21.20	22.00	N	48.75
4 July	23.00	24.00	N	26.00
5 July	16.45	17.25	N	17.25
7 July	20.00	21.00	Y	51.75
8 July	22.00	23.00	N	26.00
9 July	18.35	19.35	Y	20.35
10 July	20.30	21.30	N	25.95
11 July	19.40	20.40	N	23.10
12 July	21.00	22.00	N	25.60
13 July	20.05	21.05	Y	23.05
14 July	18.15	18.45	N	21.40
15 July	18.30	19.00	Y	24.55
16 July	17.30	18.00	N	23.00
17 July	20.10	20.40	Y	26.40
18 July	17.20	17.50	N	21.10
19 July	19.10	21.00	Y	27.50
20 July	17.20	18.10	N	21.10
21 July	19.55	20.45	Y	26.35
22 July	20.00	20.30	N	23.85
25 July	20.12	20.42	Y	72.12
27 July	19.30	20.30	Y	47.88
28 July	16.45	17.15	N	20.85
29 July	16.15	19.16	Y	26.01
30 July	17.06	18.06	N	22.90
31 July	18.35	19.35	Y	25.29
1 August	16.30	17.30	N	21.95
2 August	16.45	17.45	Y	24.15
3 August	16.15	17.15	N	23.70
4 August	17.25	18.25	N	25.10
6 August	17.10	17.40	Y	47.15
7 August	16.00	17.00	N	23.60
8 August	17.35	18.05	Y	25.05
9 August	17.15	18.15	N	24.10
10 August	16.35	17.31	Y	23.16
11 August	18.45	19.15	N	25.84
13 August	21.45	22.15	Y	51.00
15 August	17.00	17.30	N	43.15
17 August	18.00	18.40	Y	49.10
18 August	20.05	20.40	N	26.00
19 August	16.45	17.45	Y	21.05

TABLE 45 (con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
20 August	20.30	21.30	N	27.85
21 August	17.00	18.00	Y	20.70
22 August	17.50	18.50	N	24.50
23 August	17.45	18.45	Y	23.95
24 August	20.55	22.00	N	27.55
25 August	17.00	18.00	Y	20.00
27 August	16.20	17.20	Y	47.20
28 August	18.50	19.50	N	26.30
29 August	16.45	17.45	Y	21.95
30 August	22.05	23.05	N	29.60
1 September	16.45	17.15	N	42.10
2 September	16.50	17.20	Y	24.05
3 September	16.45	17.15	N	23.95
4 September	16.50	17.20	Y	24.05
5 September	16.50	17.20	N	24.00
6 September	16.45	17.15	Y	23.95
7 September	17.00	17.40	N	24.25
8 September	18.12	19.18	Y	25.78
9 September	18.30	19.45	N	24.27
10 September	17.30	18.45	N	23.00
11 September	17.40	18.40	N	23.95
12 September	19.25	20.33	Y	25.93
13 September	16.40	18.15	N	21.82
14 September	16.38	17.40	Y	23.25
15 September	20.00	21.00	N	27.60
16 September	16.31	17.02	N	20.02
17 September	16.35	17.05	N	24.03
18 September	19.02	19.35	Y	26.30
20 September	18.40	19.10	Y	47.75
21 September	16.25	16.55	N	21.45
22 September	16.35	17.05	Y	24.50
23 September	16.15	16.50	N	23.45
24 September	16.54	17.27	Y	24.77
25 September	16.20	16.57	N	23.30
26 September	17.00	17.35	Y	24.78
28 September	16.40	17.10	N	23.75
29 September	16.11	16.44	Y	23.34
31 September	17.06	18.09	N	49.65
1 October	20.06	21.07	N	26.98
2 October	20.00	21.02	Y	23.95
4 October	17.14	18.25	Y	45.23
6 October	20.50	21.20	Y	50.95

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
7 October	18.35	19.05	N	21.85
8 October	20.11	20.41	Y	25.36
9 October	20.30	21.00	N	24.59
10 October	21.00	21.30	Y	24.30
11 October	23.00	23.30	N	26.00
13 October	16.50	18.05	N	42.75
14 October	17.08	18.10	Y	24.05
15 October	21.10	22.20	N	28.10
16 October	21.20	22.25	Y	24.05
17 October	21.05	22.10	N	23.85
18 October	22.05	23.10	Y	25.00
19 October	21.05	22.10	N	23.00
20 October	16.50	18.10	Y	20.00
21 October	16.35	17.35	N	23.25
22 October	16.38	17.38	Y	24.03
23 October	16.40	17.00	N	23.62
24 October	16.45	18.00	N	25.00
25 October	16.45	17.45	N	23.45
26 October	16.05	17.15	Y	23.70
30 October	16.06	17.15	Y	96.00
31 October	18.30	19.30	N	26.15
1 November	23.15	23.45	Y	28.15
2 November	20.40	21.10	N	21.65
3 November	17.10	17.43	Y	20.33
4 November	23.00	23.30	N	29.87
5 November	23.20	23.40	Y	24.10
7 November	21.10	22.40	Y	47.00
8 November	17.45	18.45	N	20.05
9 November	21.18	22.20	Y	27.75
10 November	22.00	23.00	N	24.80
11 November	18.00	19.00	N	20.00
12 November	17.07	18.07	N	23.07
13 November	17.22	18.25	Y	24.18
14 November	16.37	17.37	N	23.12
15 November	16.57	18.00	Y	24.63
16 November	19.13	20.25	N	26.25
17 November	21.15	22.20	Y	25.95
18 November	20.40	21.45	N	23.25
19 November	22.00	23.10	Y	25.65
20 November	19.20	19.50	N	20.40

TABLE 45(con't)

TRAVELING SCREEN OPERATION AT THE DAVIS-BESSE NUCLEAR POWER STATION
FROM 1 JANUARY TO 31 DECEMBER 1979

DATE	TIME OF SCREEN OPERATION		FISH COLLECTION YES/NO	HOURS SINCE LAST SCREEN OPERATION
	ON	OFF		
21 November	19.12	20.15	Y	24.65
22 November	19.07	20.25	N	24.10
23 November	17.15	18.30	Y	22.05
24 November	21.10	22.10	N	27.80
25 November	19.30	20.30	Y	22.20
26 November	20.55	22.05	N	25.75
27 November	18.40	19.40	Y	21.35
28 November	20.35	22.00	N	26.60
29 November	19.10	20.10	Y	22.10
30 November	21.00	22.30	N	26.20
3 December	19.45	20.00	Y	69.70
5 December	16.30	17.05	Y	45.05
7 December	21.12	21.45	Y	52.40
8 December	20.30	21.30	N	23.85
9 December	17.20	18.10	Y	20.80
10 December	20.40	21.30	N	27.20
11 December	21.00	21.30	Y	24.00
12 December	19.00	19.30	N	22.00
13 December	17.05	17.35	Y	22.05
15 December	21.12	21.42	Y	52.07
16 December	16.30	17.05	N	19.63
17 December	17.00	17.30	Y	24.25
19 December	19.07	19.37	Y	50.07
20 December	16.40	17.10	N	21.73
21 December	19.00	19.30	Y	26.20
22 December	20.43	23.10	N	27.80
23 December	21.20	23.00	Y	23.90
24 December	21.20	22.00	N	23.00
25 December	19.10	20.15	Y	22.15
26 December	19.30	20.10	N	23.95
27 December	27.20	22.30	Y	26.20
29 December	17.20	21.10	Y	46.80
31 December	22.00	23.30	Y	50.20

TABLE 46

FISH SPECIES IMPINGED AT THE DAVIS-BESSE NUCLEAR POWER STATION: 1 January through 31 December 1978

SPECIES	NUMBER IMPINGED			WEIGHT (grams)				LENGTH (mm)	
	Estimate	95% Confidence Interval		Mean	95% Confidence Interval		Mean	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
Alewife	4	1	9	4	0	8	75	39	110
Black Crappie	82	53	128	17	16	17	117	116	119
Blackside Darter	1	0.5	4	1	*	*	27	*	*
Bluegill Sunfish	5	3	9	10	9	10	68	67	68
Bluntnose Minnow	1	1	3	1	*	*	25	*	*
Carp	6	3	15	2	1	3	56	51	60
Channel Catfish	3	1	7	0.4	*	*	59	*	*
Emerald Shiner	991	636	1,545	1	1	1	60	60	61
Freshwater Drum	80	55	114	4	3	4	81	78	83
Gizzard Shad	391	201	758	7	6	8	88	87	90
Goldfish	3,299	2,435	4,468	5	5	6	72	71	73
Green Sunfish	5	3	11	12	9	16	58	48	68
Logperch Darter	12	8	21	2	1	2	63	60	67
Pumpkinseed Sunfish	9	3	24	11	9	13	82	77	87
Rainbow Smelt	69	45	107	1	1	1	60	59	61
Spottail Shiner	15	9	25	2	2	2	65	63	66
Stonecat Madtom	1	1	3	1	*	*	30	*	*
Trout-perch	29	20	41	4	4	5	80	77	82
White Crappie	22	15	31	8	8	8	88	85	91
Yellow Perch	1,582	1,082	2,312	5	5	5	83	83	84
TOTAL	6,607	5,447	8,015	5	5	5	74	74	75

* Confidence intervals could not be computed when no more than one representative of a given species occurred.

TABLE 47

FISH SPECIES IMPINGED AT THE DAVIS-BESSE NUCLEAR POWER STATION: 1 January through 31 December 1979

SPECIES	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
		95% Confidence Interval			95% Confidence Interval			95% Confidence Interval	
	Estimate	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound
Alewife	1	0	5	0	*	*	100	*	*
Black Bullhead	17	17	17	2	-1	5	59	57	60
Black Crappie	28	14	54	8	-27	44	81	70	91
Brown Bullhead	11	7	17	12	12	12	83	83	83
Carp	3	1	9	12	*	*	99	*	*
Emerald Shiner	214	90	511	1	1	1	55	54	55
Freshwater Drum	115	61	218	4	-1	8	82	79	84
Gizzard Shad	162	95	275	8	0	15	91	88	93
Goldfish	3449	2266	5248	5	1	9	70	70	71
Logperch Darter	21	13	34	2	-2	7	66	63	70
Pumpkinseed Sunfish	3	1	9	1	*	*	36	*	*
Rainbow Smelt	32	18	55	2	-8	12	64	58	70
Spottail Shiner	9	5	16	3	-17	24	69	58	81
Troutperch	5	2	15	4	-1	8	83	78	88
Unidentified Sunfish	1	0	5	1	*	*	32	*	*
White Bass	3	1	12	4	*	*	81	*	*
White Crappie	23	13	40	6	-16	28	69	62	75
White Perch	3	1	9	2	2	2	62	60	64
Yellow Perch	285	129	631	5	-3	13	76	73	78
TOTAL	4385	3128	6149	5	2	8	71	70	71

* Confidence intervals could not be computed when no more than one representative of a given species occurred.

TABLE 48

A SUMMARY OF MONTHLY FISH IMPINGEMENT
AT THE DAVIS-BESSE NUCLEAR POWER STATIONS: 1 January through 31 December 1978

MONTHS	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
	Estimate	95% Confidence Interval		Mean	95% Confidence Interval		Mean	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
January	45	31	66	13	12	14	104	102	106
February	17	9	31	5	5	6	76	72	79
March	13	7	25	4	4	4	72	70	73
April	2,875	2,157	3,833	5	5	6	79	78	79
May	648	479	874	5	4	5	79	78	79
June	45	29	69	12	7	17	92	86	98
July	7	5	11	9	9	9	79	77	81
August	4	2	8	12	9	14	100	90	110
September	19	12	32	11	9	12	83	80	87
October	28	18	43	10	9	11	59	55	64
November	576	314	1,058	3	3	3	62	61	63
December	2,330	1,594	3,406	3	3	3	68	67	69
TOTAL	6,607	5,447	8,015	5	5	5	74	74	75

TABLE 49

A SUMMARY OF MONTHLY FISH IMPINGEMENT
AT THE DAVIS-BESSE NUCLEAR POWER STATIONS: 1 January through 31 December 1979

MONTHS	NUMBER IMPINGED			WEIGHT (grams)			LENGTH (mm)		
		95% Confidence Interval			95% Confidence Interval			95% Confidence Interval	
	Estimate	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound	Mean	Lower Bound	Upper Bound
January	2429	1363	4335	4	1	6	71	70	71
February	30	17	52	3	-4	10	62	58	66
March	501	345	726	3	-0	7	64	63	65
April	753	498	1137	3	-1	7	66	65	67
May	16	9	29	3	0	5	63	61	64
June	20	6	66	7	-42	56	77	65	89
July	29	18	45	18	-18	53	108	100	116
August	54	39	76	17	-177	210	63	51	76
September	35	20	60	5	13	22	62	52	71
October	2	0	8	18			97		
November	147	83	269	11	1	21	83	81	86
December	367	172	786	9	5	13	84	83	85
TOTAL	4385	3128	6149	5	2	8	71	70	71

TABLE 50

ESTIMATED 1978 SPORT AND COMMERCIAL FISH HARVEST FROM THE OHIO WATERS OF LAKE ERIE[a]

SPECIES	SPORT HARVEST		COMMERCIAL HARVEST		TOTAL HARVEST	
	No. of Individuals	Weight (Kilograms)	No. of Individuals	Weight (Kilograms)	No. of Individuals	Weight (Kilograms)
Yellow Perch	11,483,000	1,116,386	9,178,000[b]	890,294	20,661,000	2,006,680
Walleye	1,652,000	1,515,906	0[f]	0	1,652,000	1,515,906
White Bass	1,533,000	334,825	3,380,000[b]	736,842	4,913,000	1,071,667
Freshwater Drum	668,000	363,200	981,000[b]	533,904	1,649,000	897,104
Channel Catfish	218,000	86,033	235,000[b]	92,843	453,000	178,876
Smallmouth Bass	32,000	20,203	0[f]	0	32,000	20,203
Others	c	c	—	1,867,983[d]	—	1,867,983[e]
TOTAL	15,586,000[e]	3,436,553[e]	—	4,121,866	—	7,648,419

[a] Scholl (1979).

[b] Estimated based on mean weight of sport fish.

[c] Data not available.

[d] Thirty-eight percent carp.

[e] Excludes weight of "Others" caught by sport fishermen.

[f] Closed to commercial fishing.

TABLE 51

COMMERCIAL FISH LANDINGS FROM THE OHIO
WATERS OF LAKE ERIE: 1974-1979*

SPECIES	1974	1975	1976	1977	1978	1979
Buffalo	14,528	14,982	13,620	15,890	16,344	14,982
Bullhead	12,258	14,074	19,522	29,056	32,688	24,062
Carp	1,284,366	1,265,298	1,196,290	1,249,408	701,430	883,938
Channel Catfish	136,200	117,566	101,242	115,316	92,843	107,144
Freshwater Drum	307,812	340,500	432,208	361,838	533,904	574,764
Gizzard Shad	**	**	274,216	228,816	706,878	863,962
Goldfish	29,510	23,608	60,836	250,154	343,678	98,064
Quillback	**	**	57,658	46,762	46,762	36,320
Rainbow Smelt	2,270	4,086	15,890	454	4,994	**
Sucker	39,952	24,516	28,602	14,982	14,982	17,706
White Bass	1,314,330	760,450	680,546	501,216	736,842	866,232
Yellow Perch	797,678	675,552	652,852	1,051,918	890,294	1,189,934
TOTAL	3,934,364	3,241,106	3,533,482	3,865,810	4,122,774	4,677,108

* Ohio Dept. of Natural Resources (1980). Data presented in kilograms.

** Data not available.

TABLE 52

COMMERCIAL FISH LANDINGS FROM LAKE ERIE: 1975 - 1979[a]

SPECIES	WEIGHT (Kilograms)				
	1975	1976	1977	1978	1979
Bowfin	c	c	15,000	12,000	10,000
Buffalo	30,000	43,000	34,000	25,000	24,000
Bullhead	69,000	64,000	77,000	54,000	47,000
Carp	1,491,000	1,444,000	1,439,000	871,000	1,091,000
Channel Catfish	197,000	155,000	160,000	148,000	151,000
Freshwater Drum	538,000	619,000	538,000	692,000	720,000
Gizzard Shad	1,000	301,000	229,000	707,000	888,000
Goldfish	26,000	61,000	250,000	344,000	89,000
Lake Whitefish	c	c	3,000	2,000	1,000
Quillback	60,000	58,000	47,000	47,000	38,000
Rainbow Smelt	7,688,000	7,845,000	9,700,000	11,002,000	10,148,000
Rock Bass	c	c	19,000	10,000	20,000
Sucker	52,000	48,000	31,000	33,000	43,000
Sunfish	c	c	33,000	23,000	21,000
Walleye[b]	114,000	138,000	261,000	295,000	489,000

TABLE 52 (Cont'd)

COMMERCIAL FISH LANDINGS FROM
LAKE ERIE: 1975 - 1979[a]

SPECIES	WEIGHT (Kilograms)				
	1975	1976	1977	1978	1979
White Bass	1,932,000	1,162,000	948,000	1,590,000	1,626,000
Yellow Perch	4,597,000	2,903,000	4,801,000	4,918,000	5,931,000
Others	927,000	833,000	928,000	796,000	639,000
TOTAL	17,722,000	15,674,000	19,513,000	21,569,000	21,976,000

[a] Muth (1980).

[b] Not taken commercially in Ohio and Michigan waters.

[c] Included with "Others" during this year.

F I G U R E S

Figure 1. Reactor Power Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

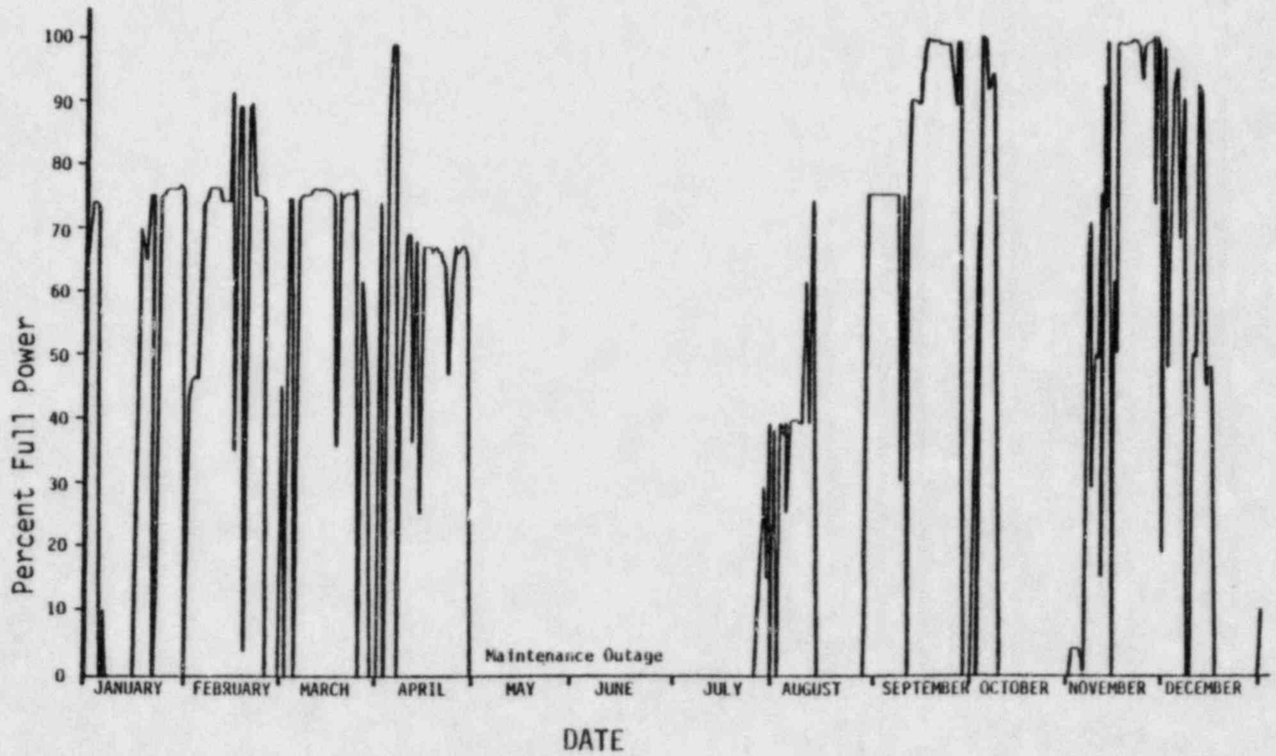


Figure 2. Reactor Power Record for the Davis-Besse Nuclear Power Station, Unit 1 (1979).

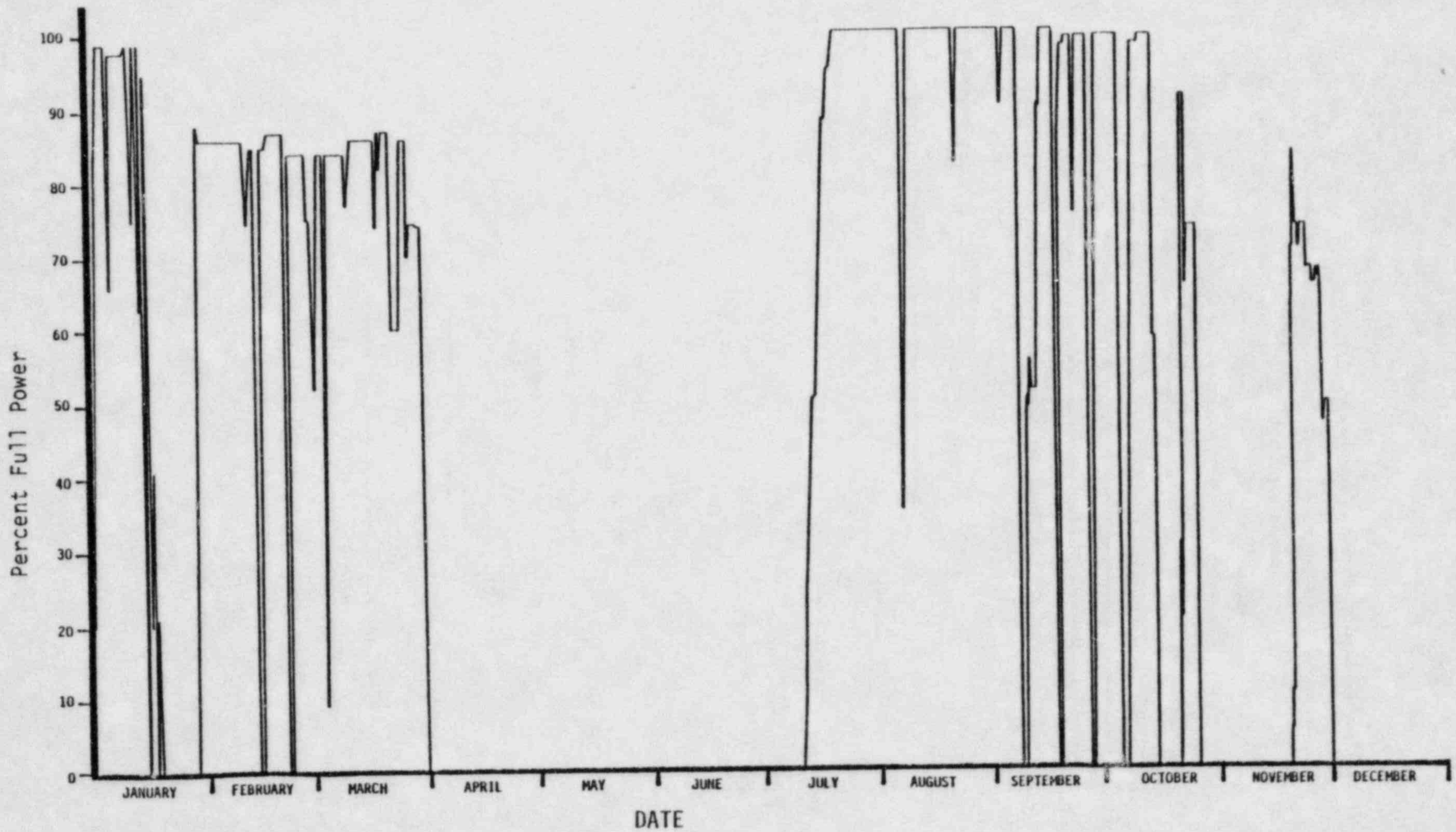


Figure 3. Gross Electric Power Generation Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

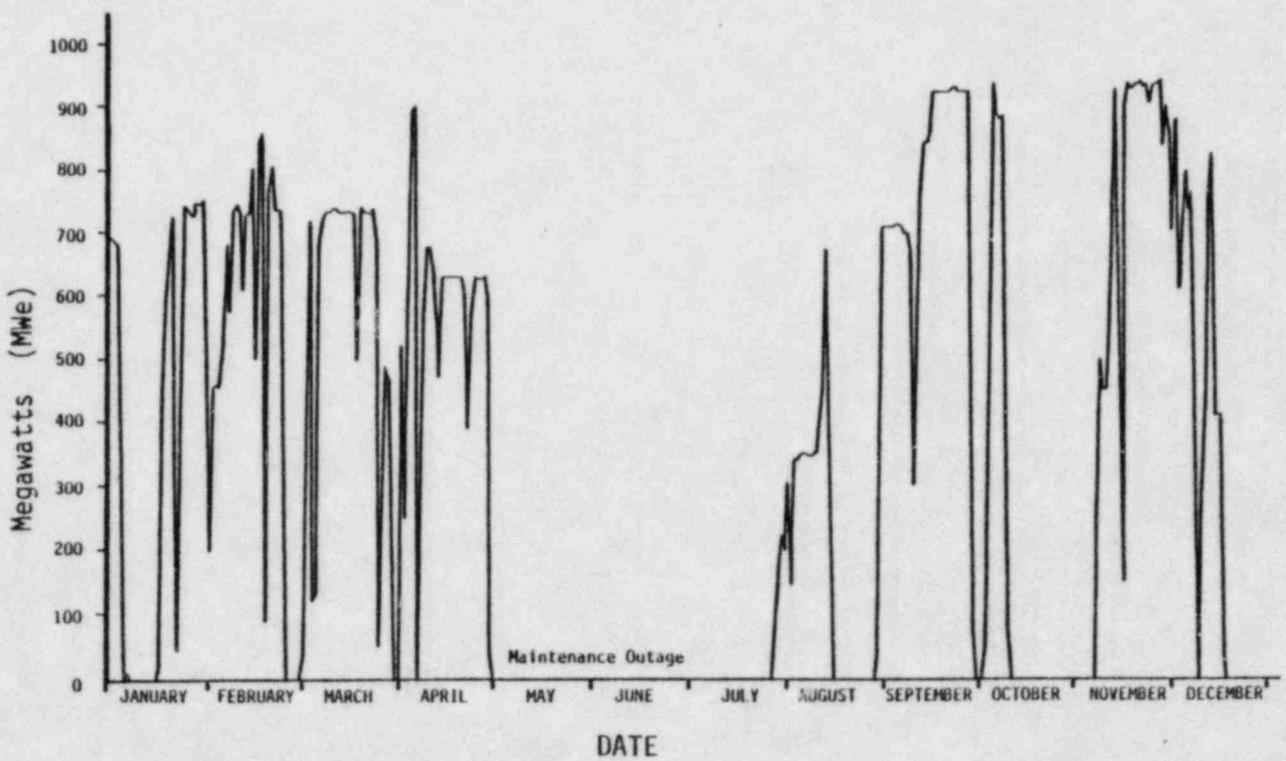


Figure 4. Gross Electric Power Generation Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).

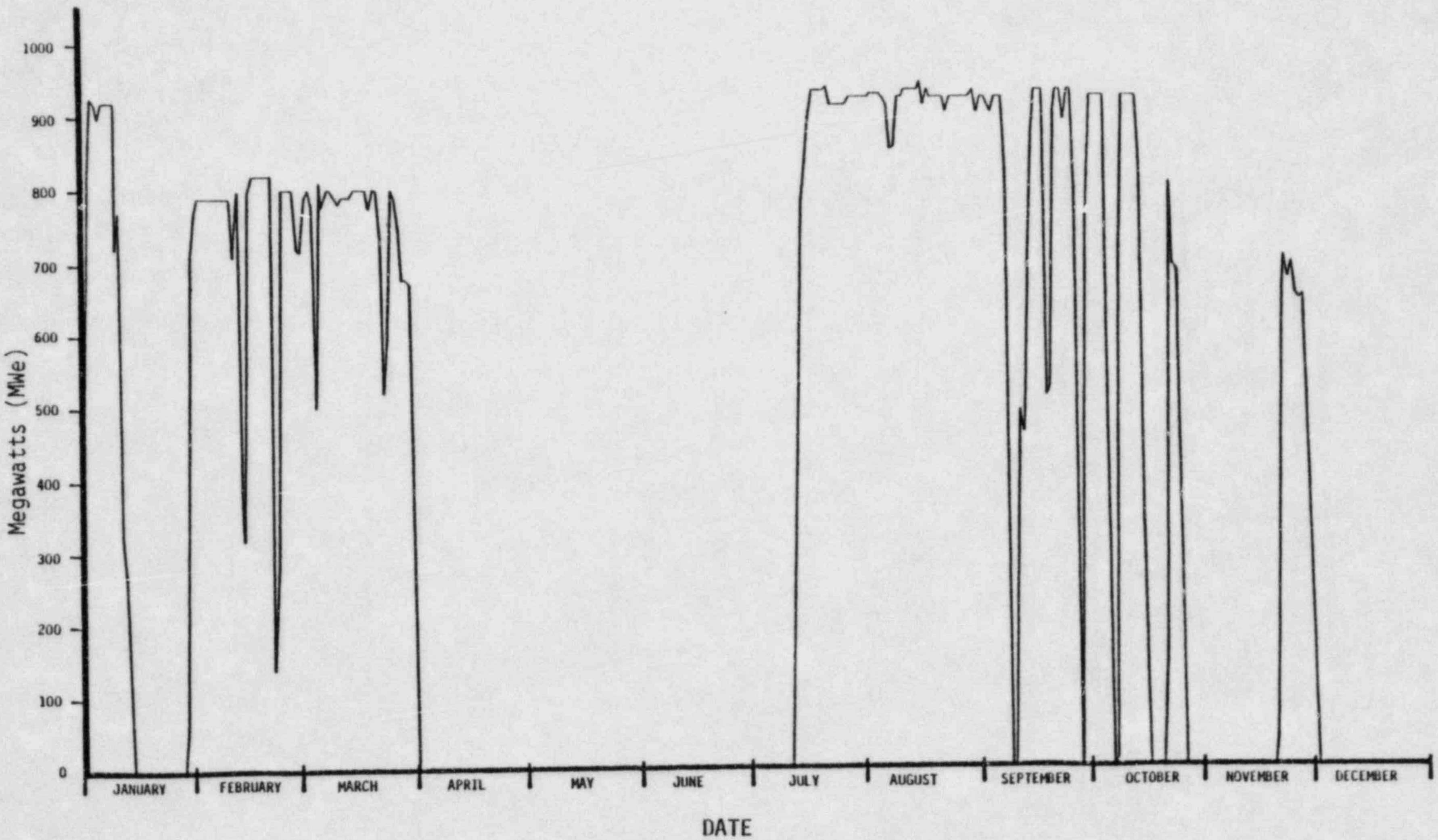


Figure 5. Water Temperature Record for Intake and Discharge for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

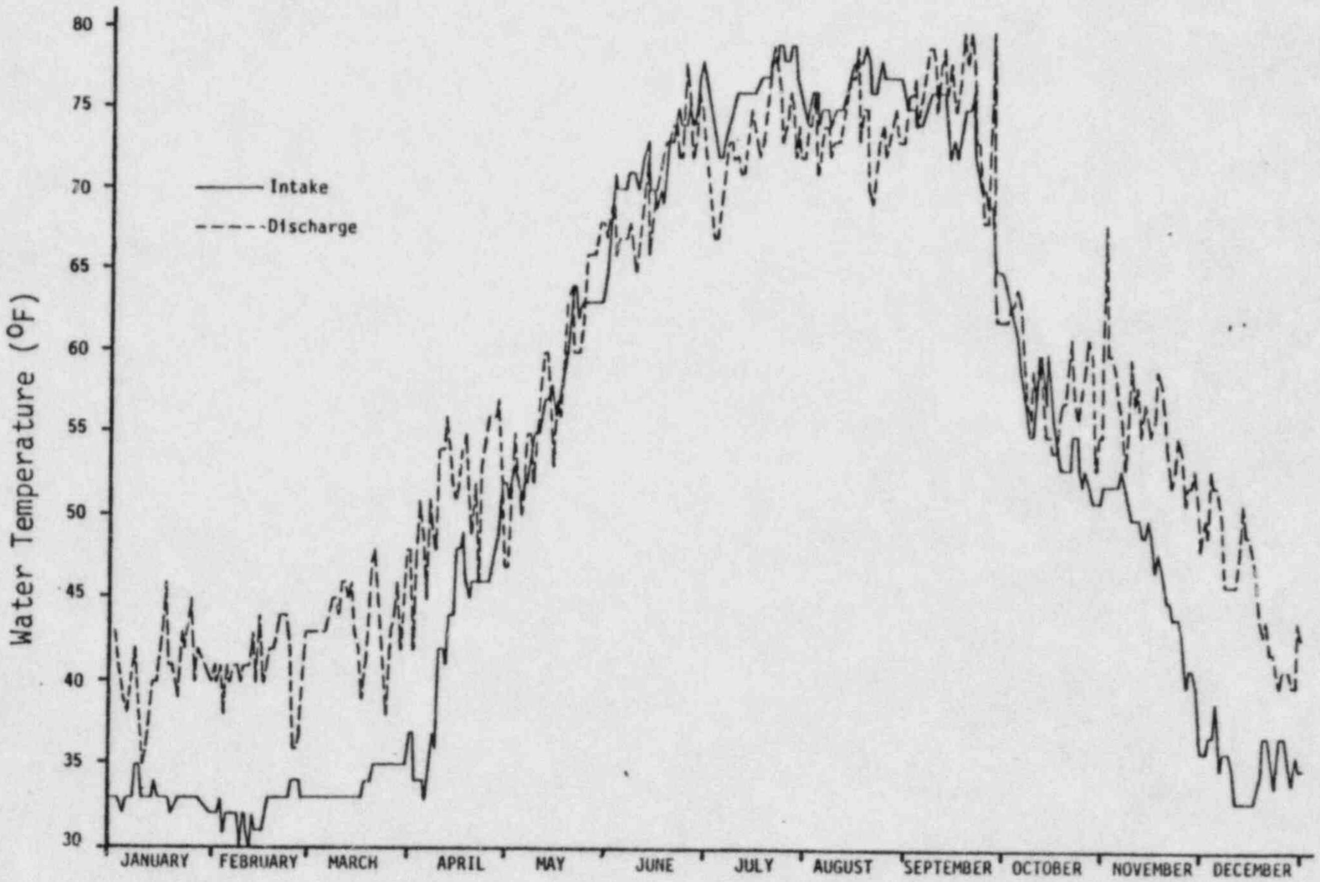


Figure 6. Water Temperature Record for Intake and Discharge for the Davis-Besse Nuclear Power Station, Unit 1 (1979).

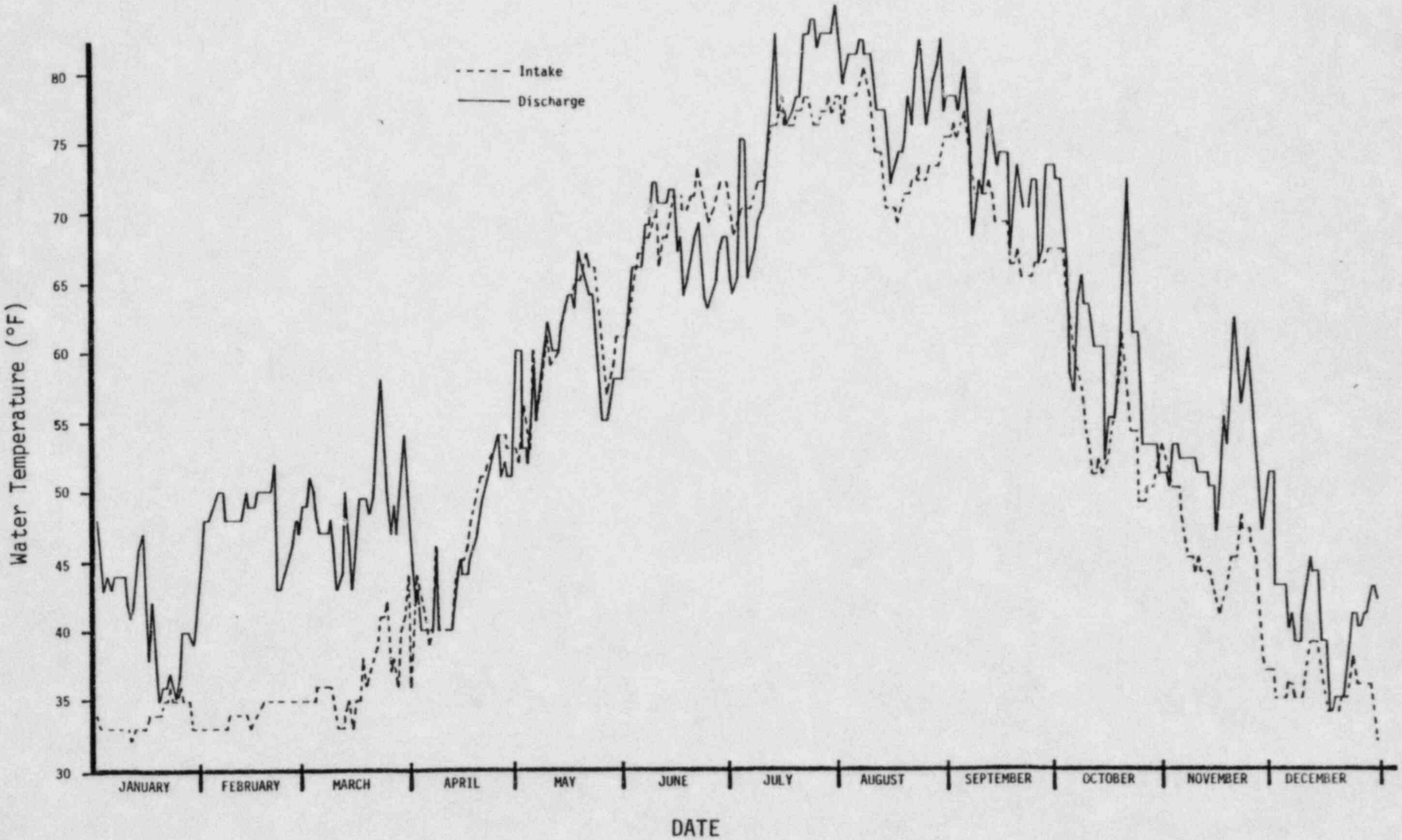


Figure 7. Water Intake Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

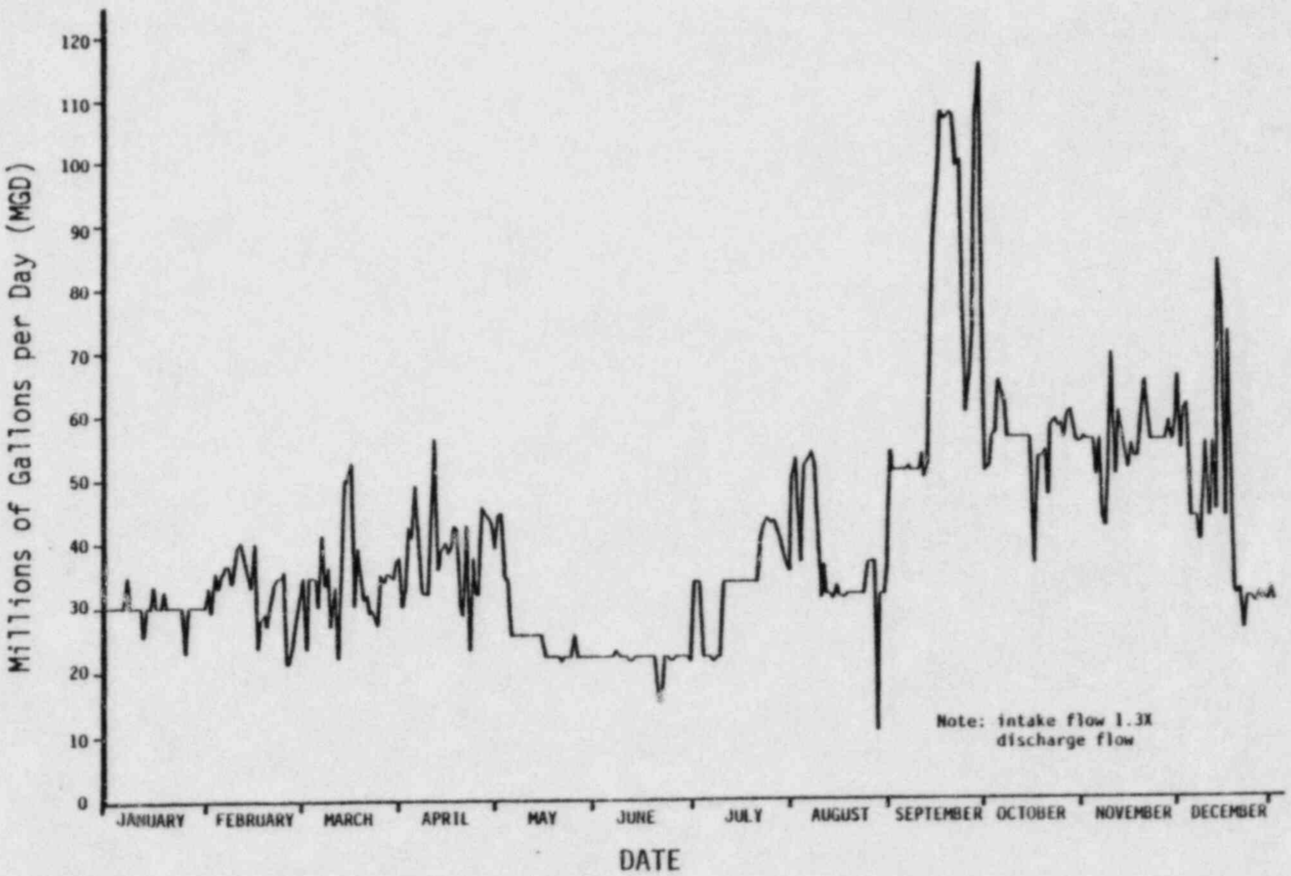


Figure 8. Water Intake Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).

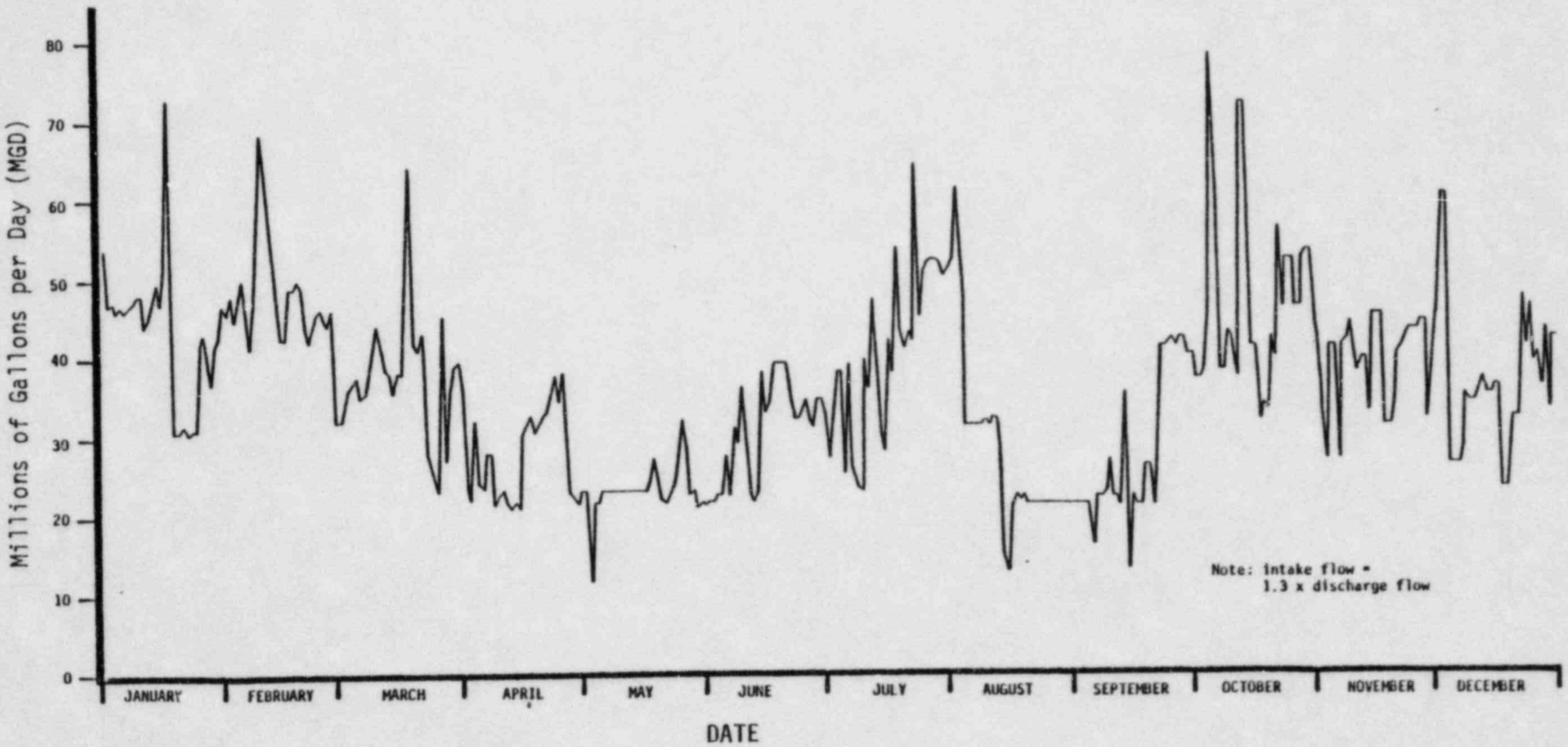


Figure 9. Discharge Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1 (1978).

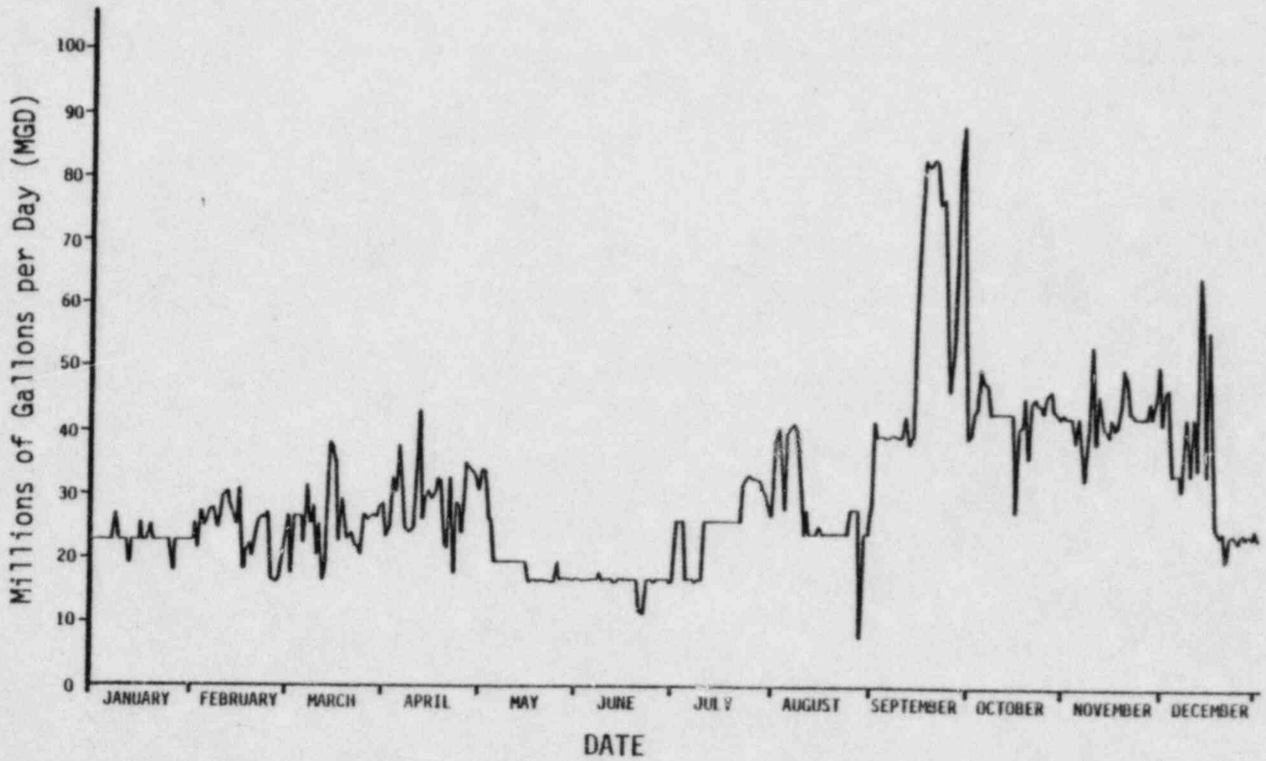
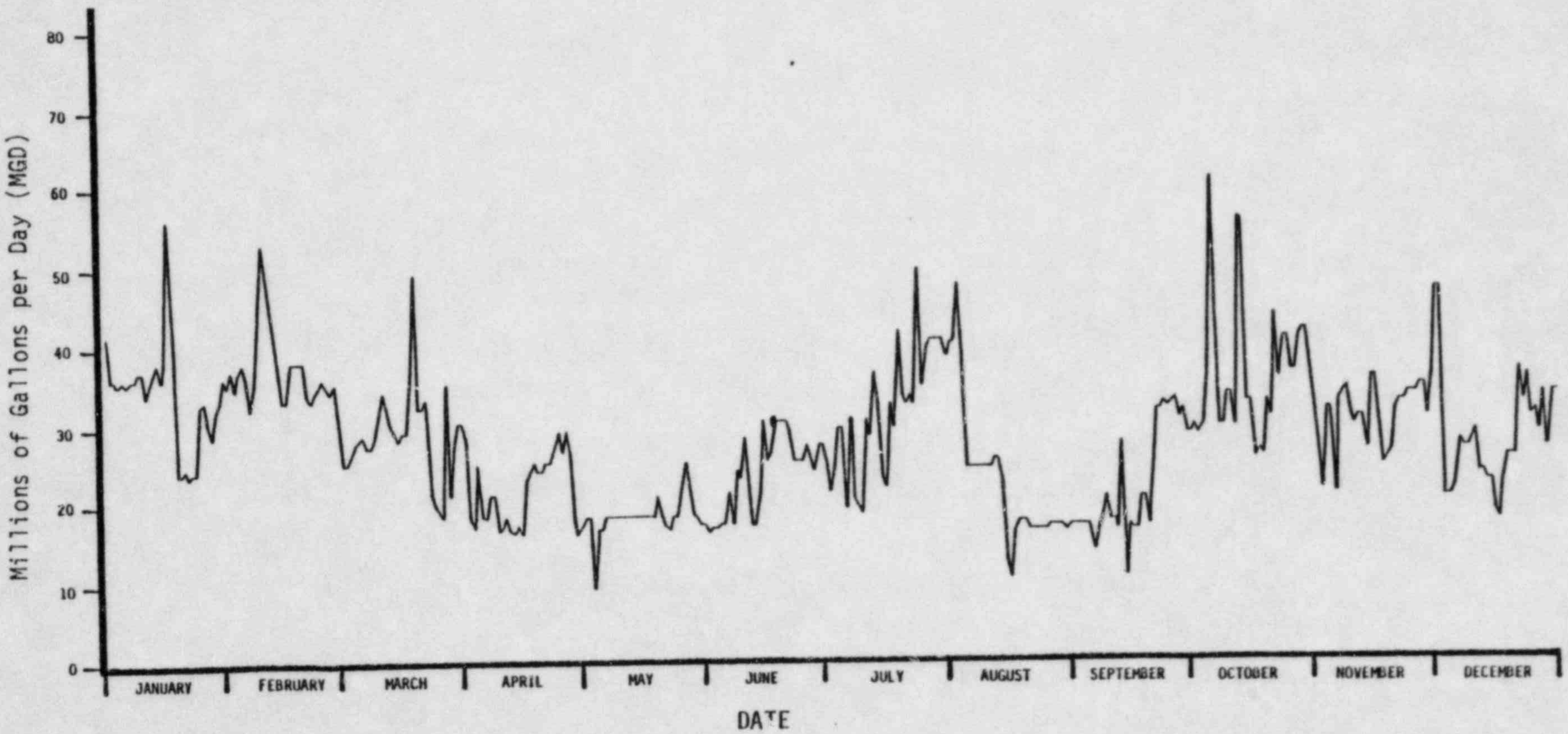
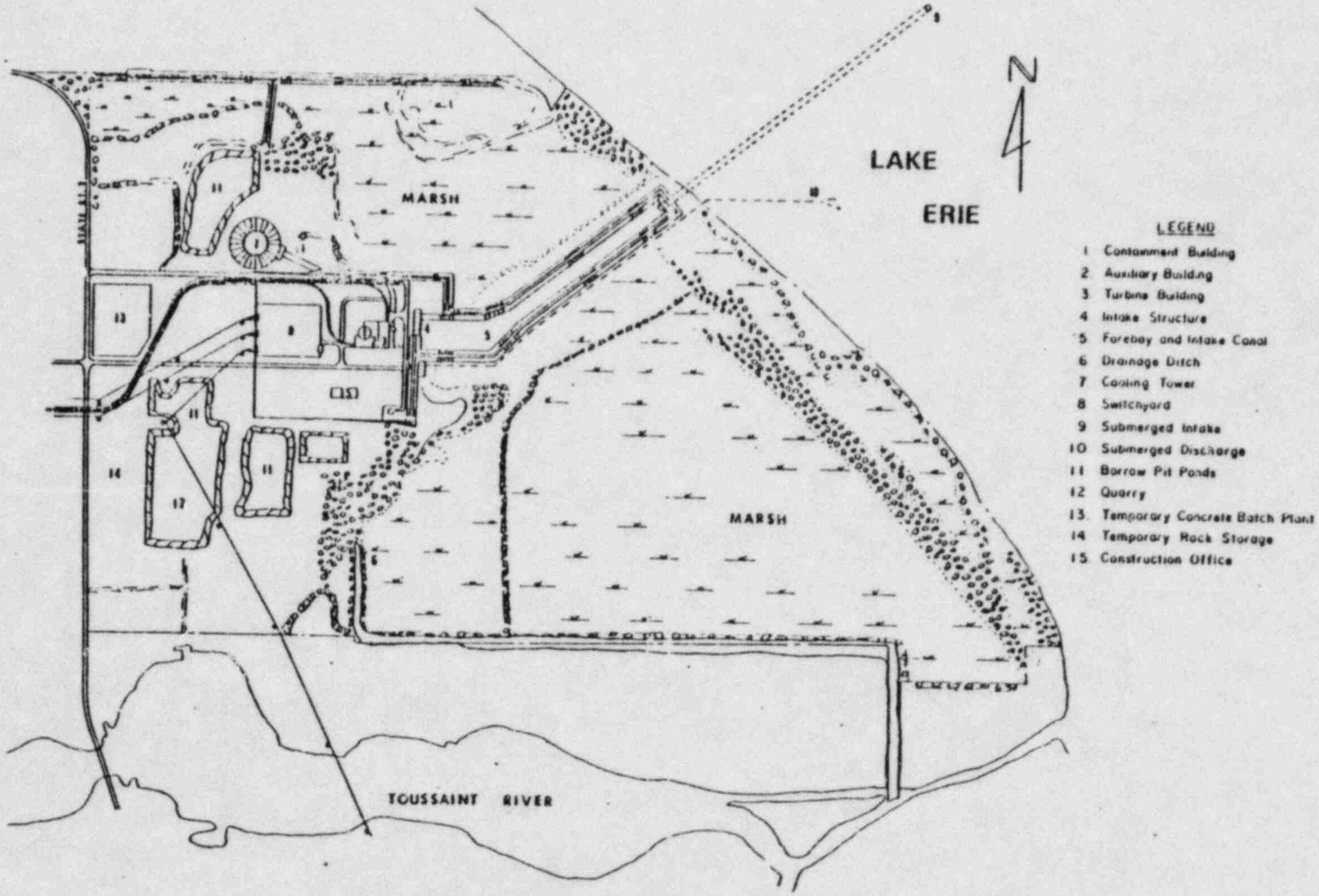


Figure 10. Discharge Conduit Flow Record for the Davis-Besse Nuclear Power Station, Unit 1, (1979).





DAVIS-BESSE NUCLEAR POWER STATION UNIT NO. 1

SITE PLAN

FIGURE 11. STATION LOCATION MAP

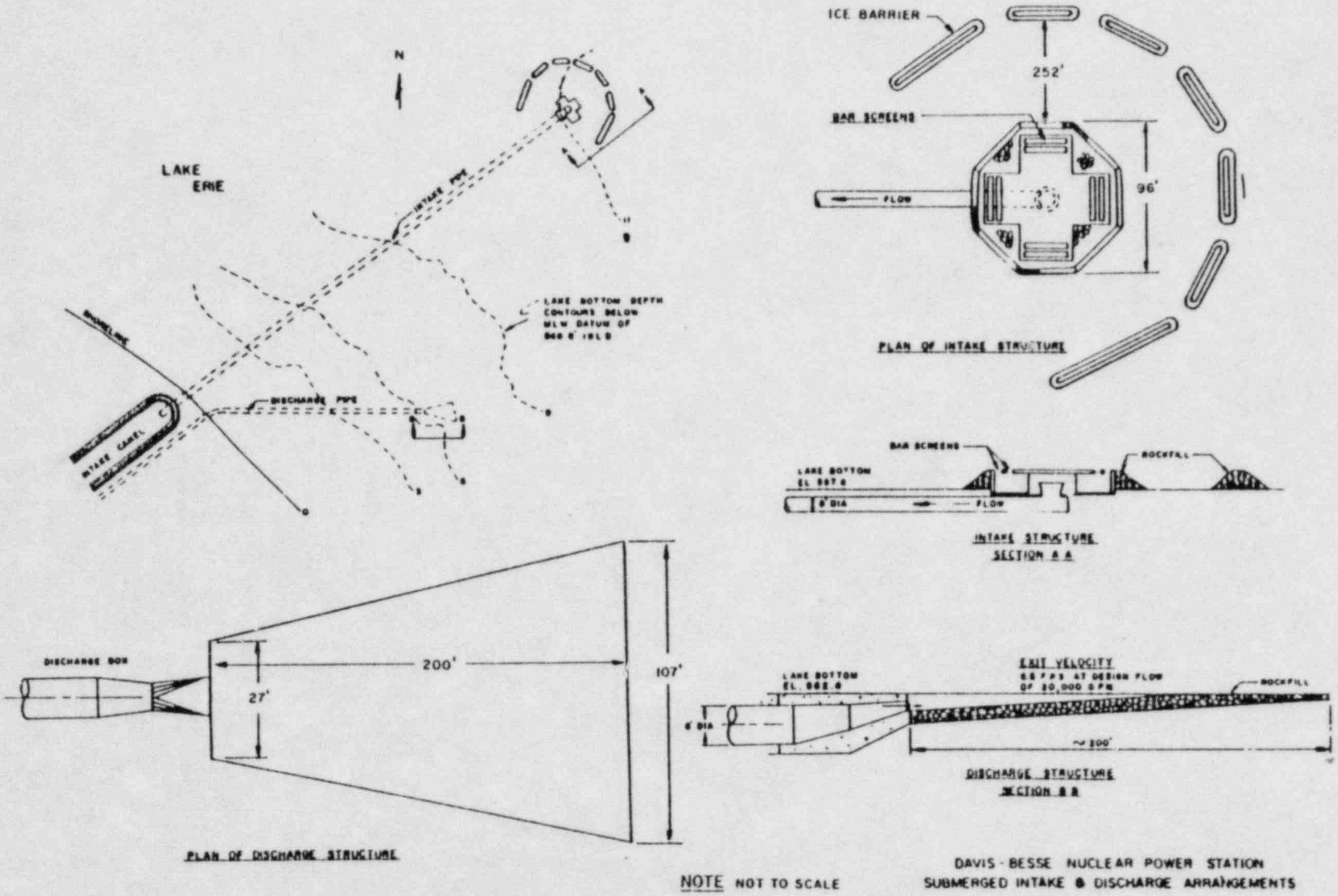
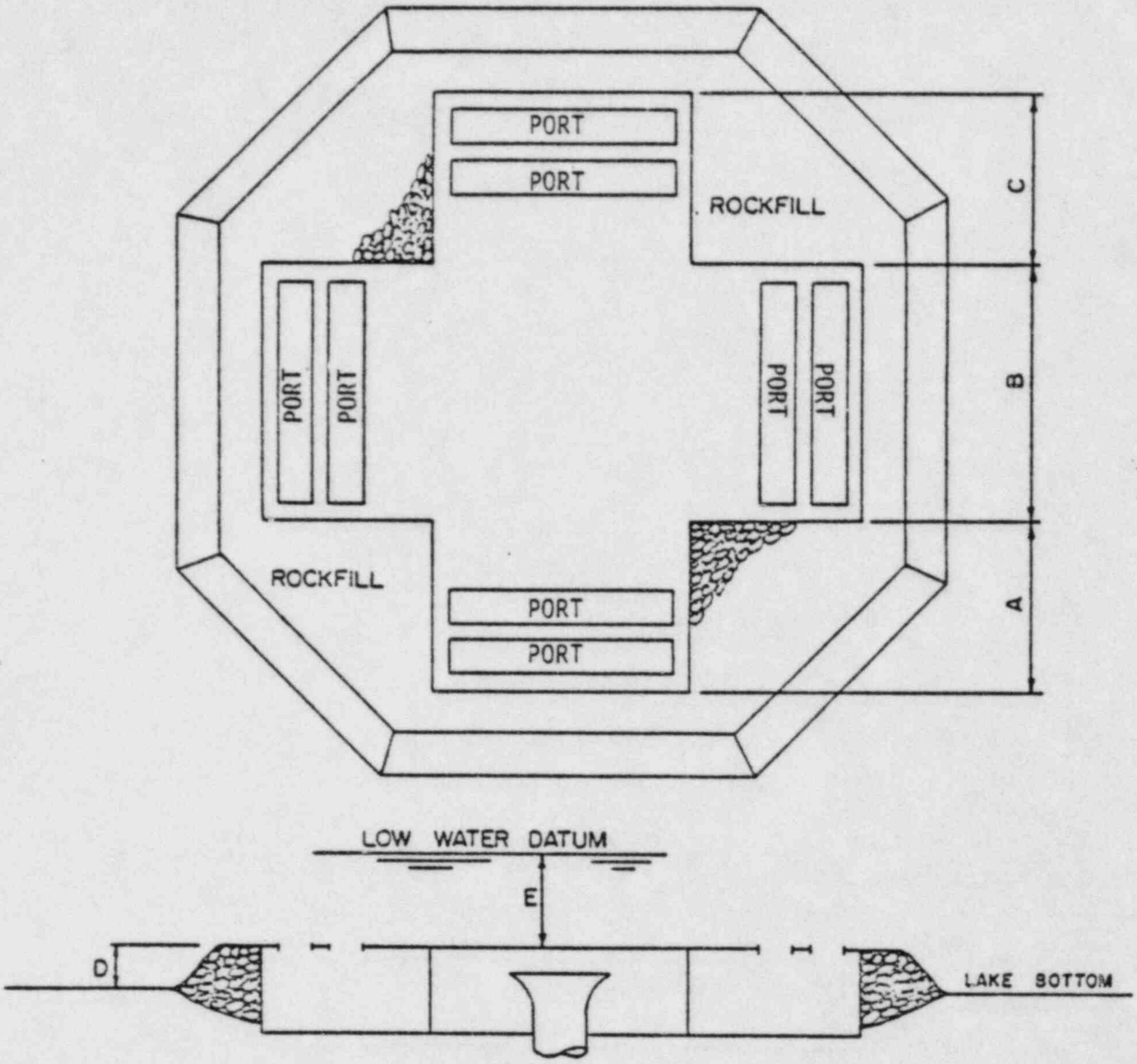


FIGURE 12. WATER INTAKE AND DISCHARGE STRUCTURES



INTAKE CRIB	A	B	C	D	E	DESIGN INTAKE VELOCITY
DAVIS-BESSE	18'-0"*	23'-0"	18'-0"*	3'-10"	6'-9"	0.25 FT/SEC
OREGON	13'-0"	16'-0"	13'-0"	5'-10"	8'-2"	0.25 FT/SEC
PORT CLINTON	11'-2"	9'-8"	11'-2"	3'-11"	6'-2"	0.25 FT/SEC

*18'-2" on the other side of the crib

FIGURE 13. DETAILS OF WATER INTAKE CRIB

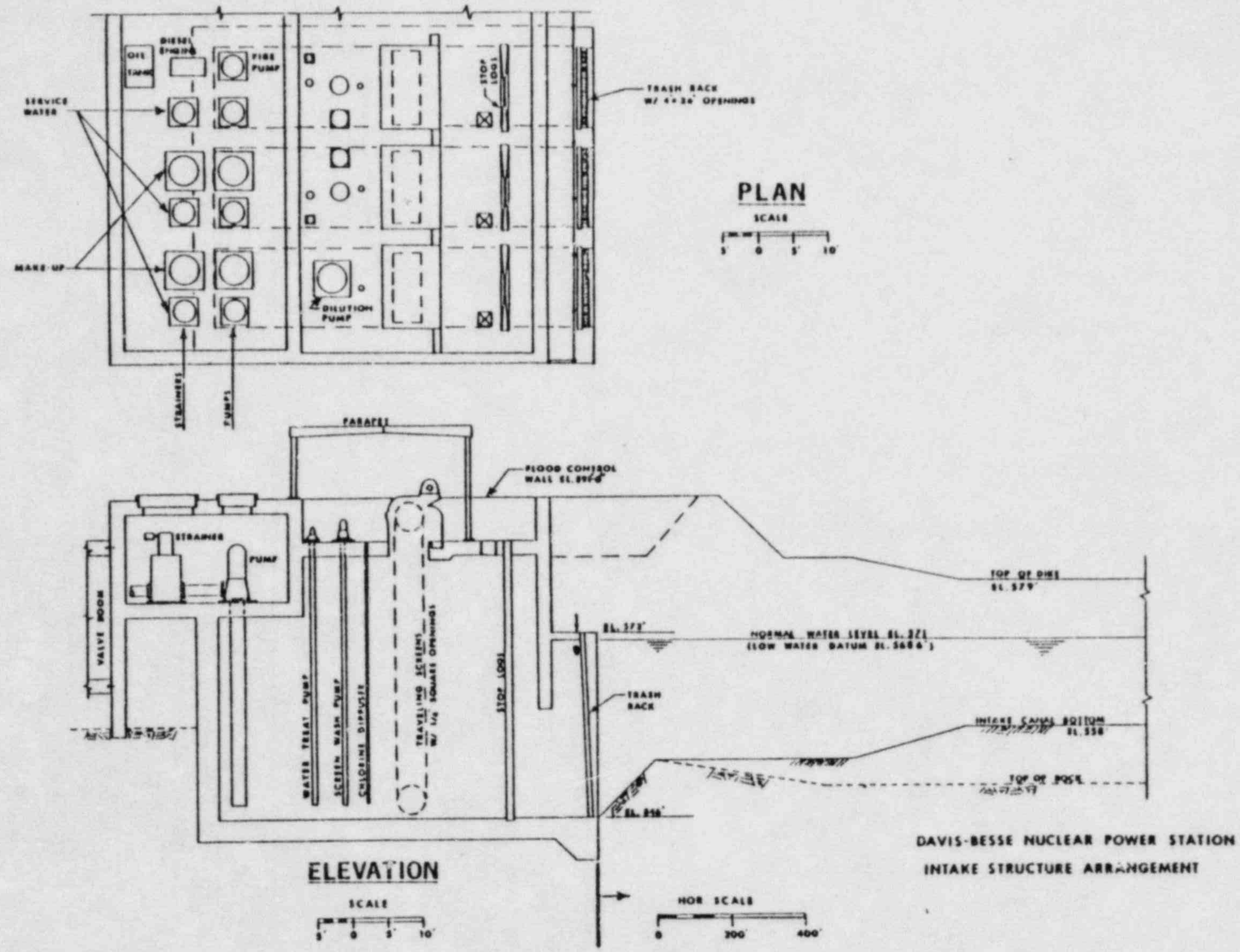


FIGURE 14. WATER INTAKE PUMPS AND SCREENS ARRANGEMENT

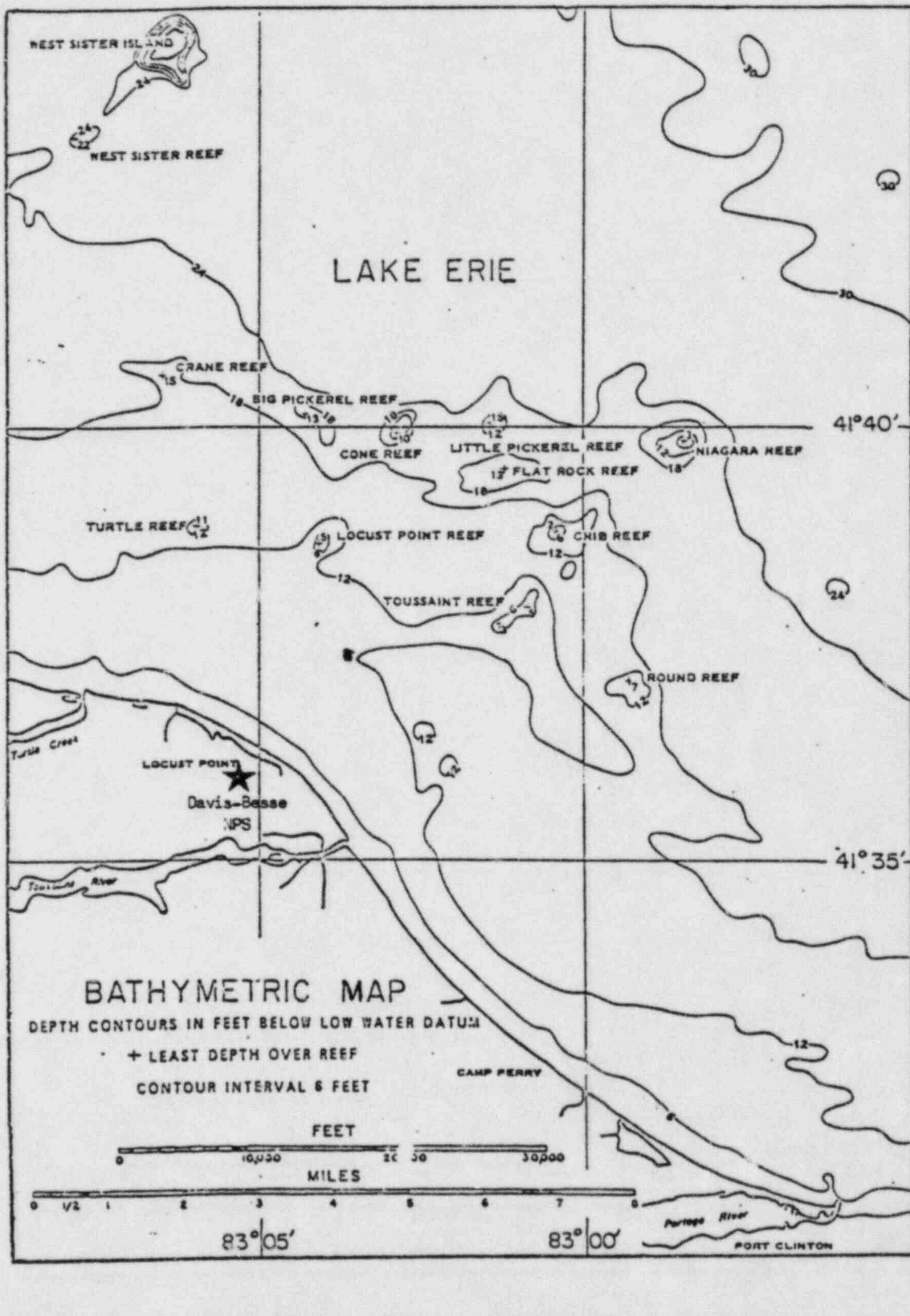


FIGURE 15. REEFS NEAR LOCUST POINT.

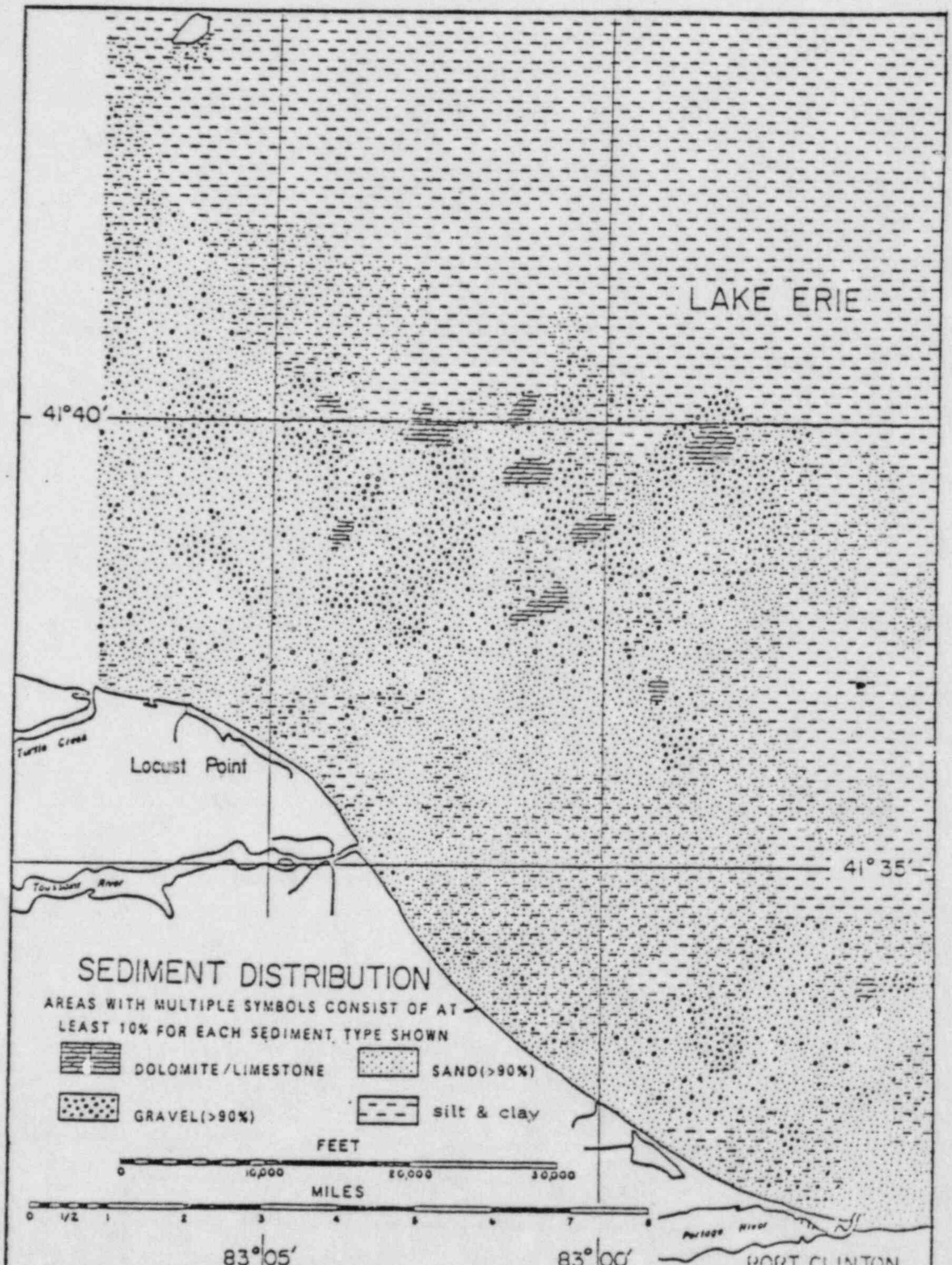


FIGURE 16. SEDIMENT DISTRIBUTION MAP OF WESTERN LAKE ERIE IN THE VICINITY OF LOCUST POINT

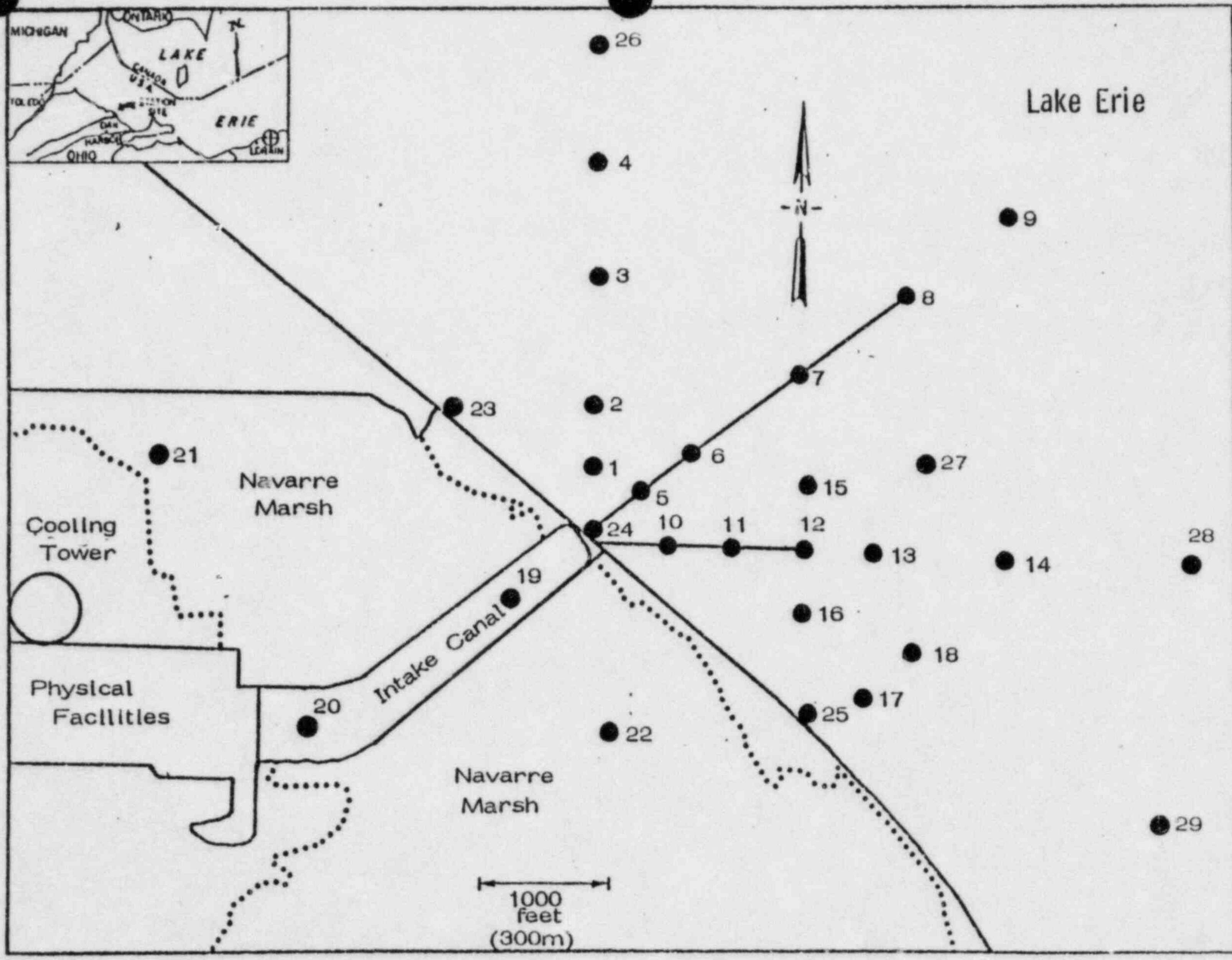


FIGURE 17. BIOLOGICAL SAMPLING STATIONS AT THE DAVIS-BESSE NUCLEAR POWER STATION.

FIGURE 18. TRENDS IN MEAN MONTHLY TEMPERATURE, DISSOLVED OXYGEN, AND HYDROGEN ION MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

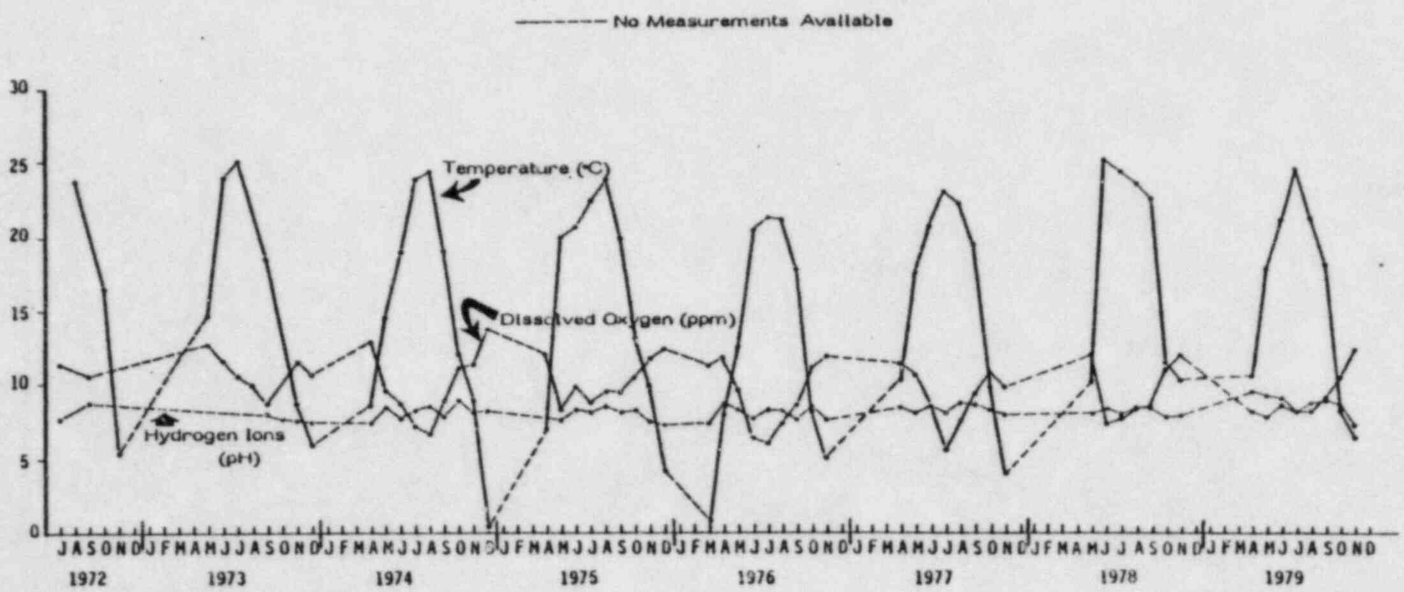


FIGURE 19. TRENDS IN MEAN MONTHLY CONDUCTIVITY, ALKALINITY AND TURBIDITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

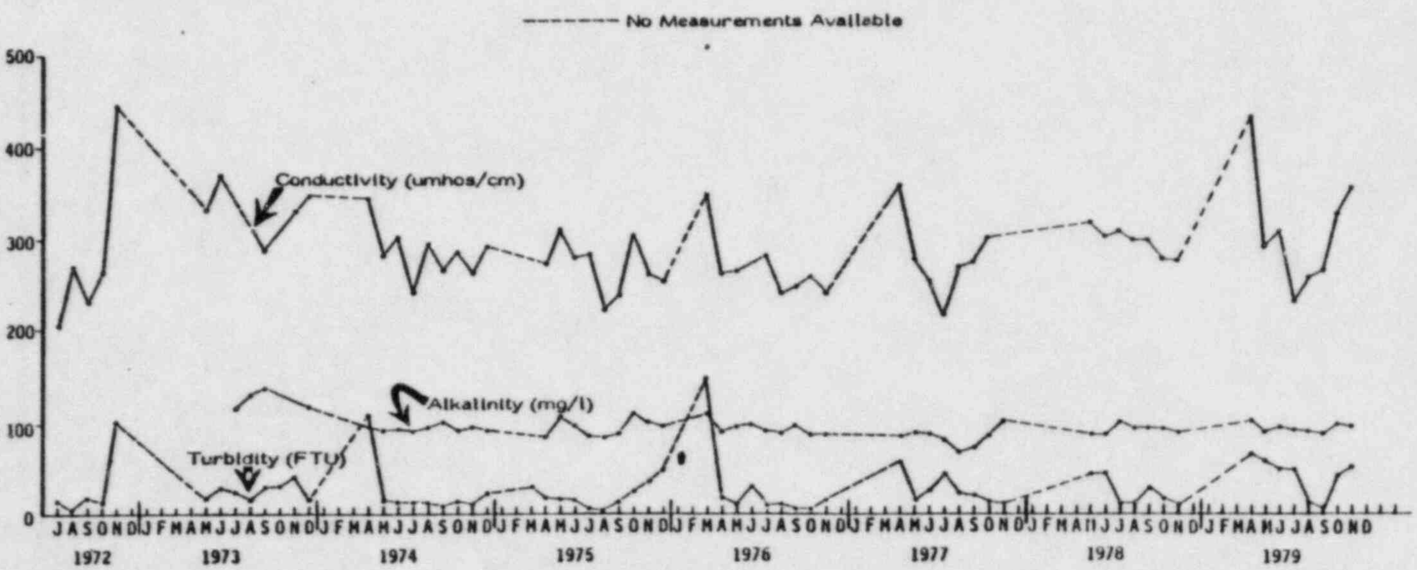


FIGURE 20. TRENDS IN MEAN MONTHLY TRANSPARENCY AND PHOSPHORUS MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1979.

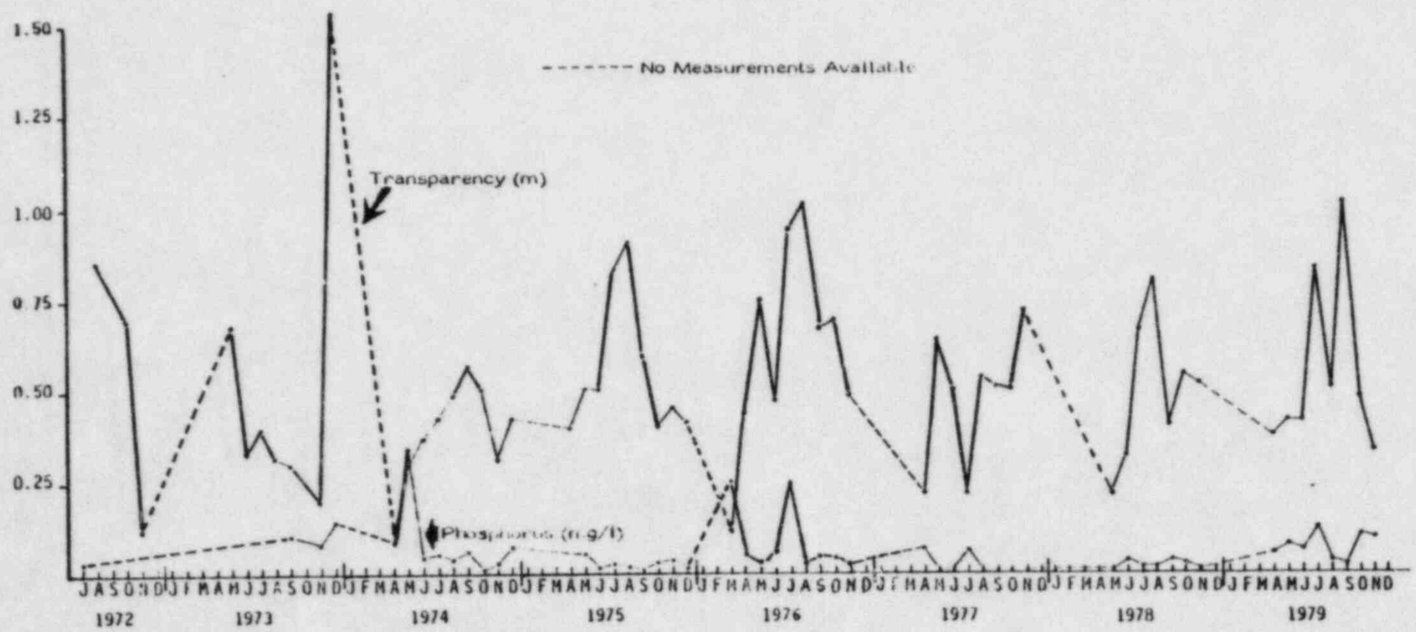


FIGURE 21. Comparison of Pre-operational and Operational Data for Dissolved Oxygen in Bottom Water at Station Discharge (Station No. 13).

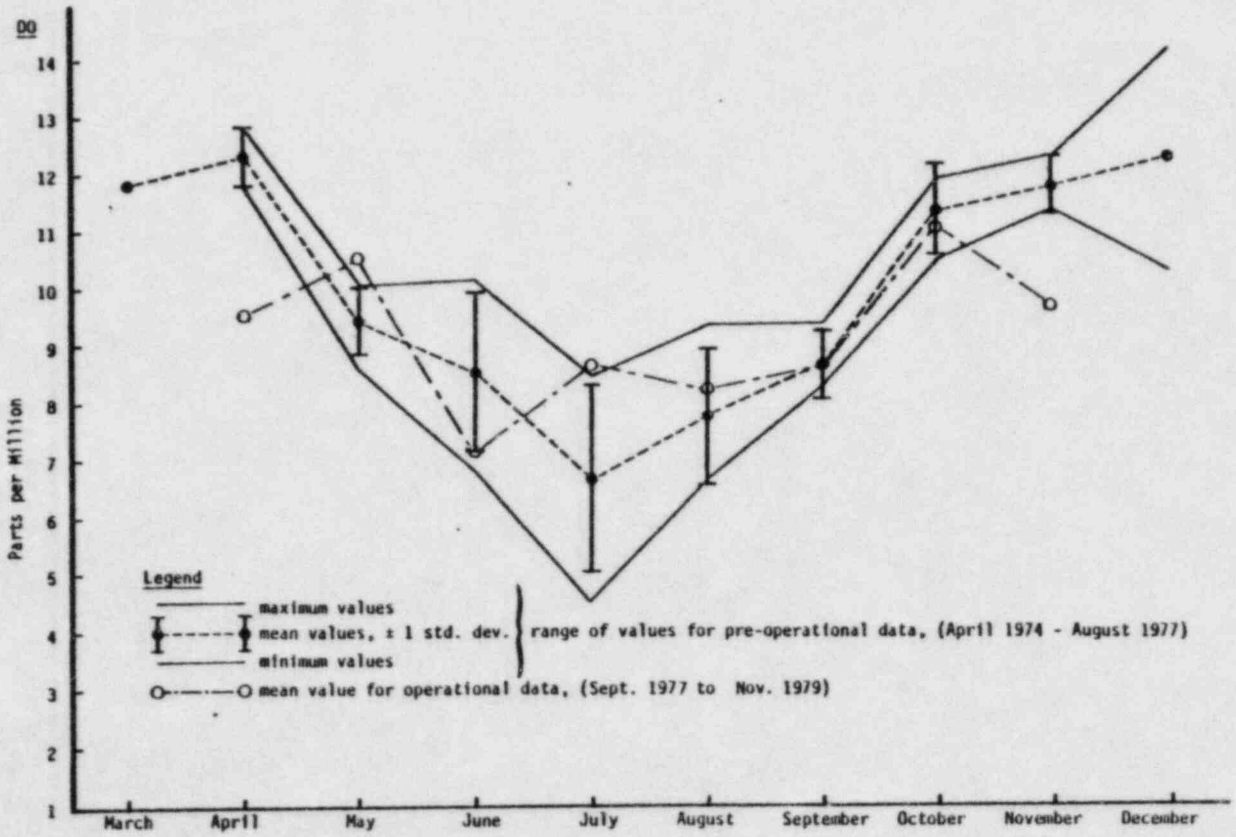


FIGURE 22. Comparison of Pre-operational and Operational Data of Hydrogen Ion Concentration (pH) in Bottom Water at Station Discharge (Station No. 13).

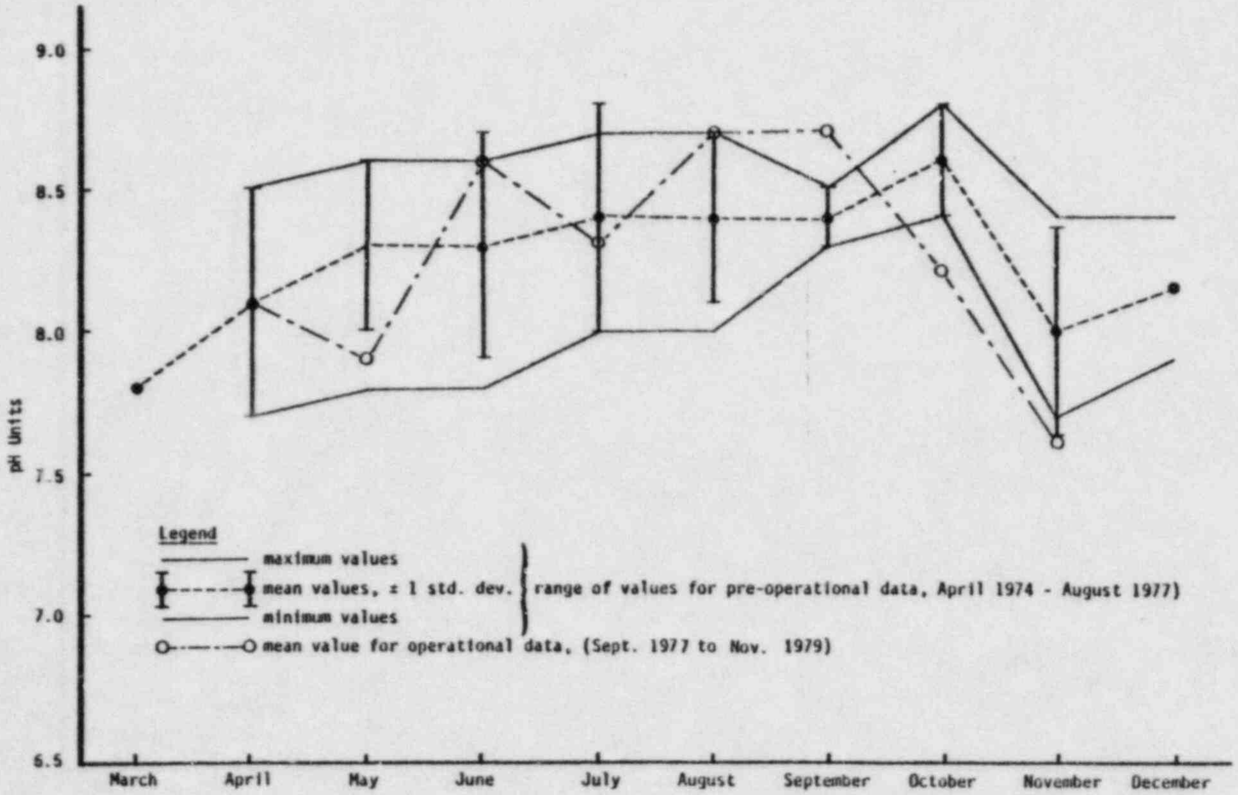


FIGURE 23. Comparison of Pre-operational and Operational Data for Transparency (Secchi Disk) of Water at Station Discharge (Station 13).

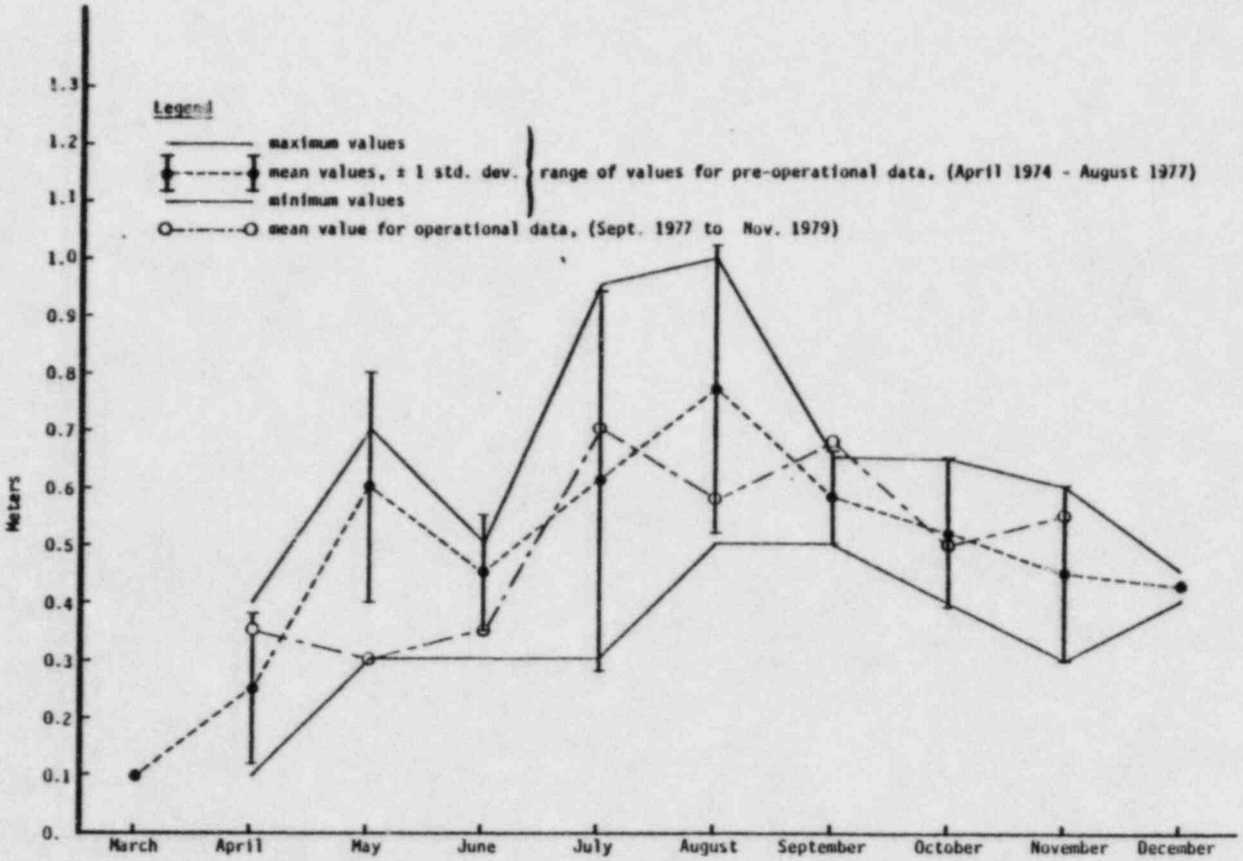


FIGURE 24. Comparison of Pre-operational and Operational Data for Turbidity of Bottom Water at Station Discharge (Station No. 13).

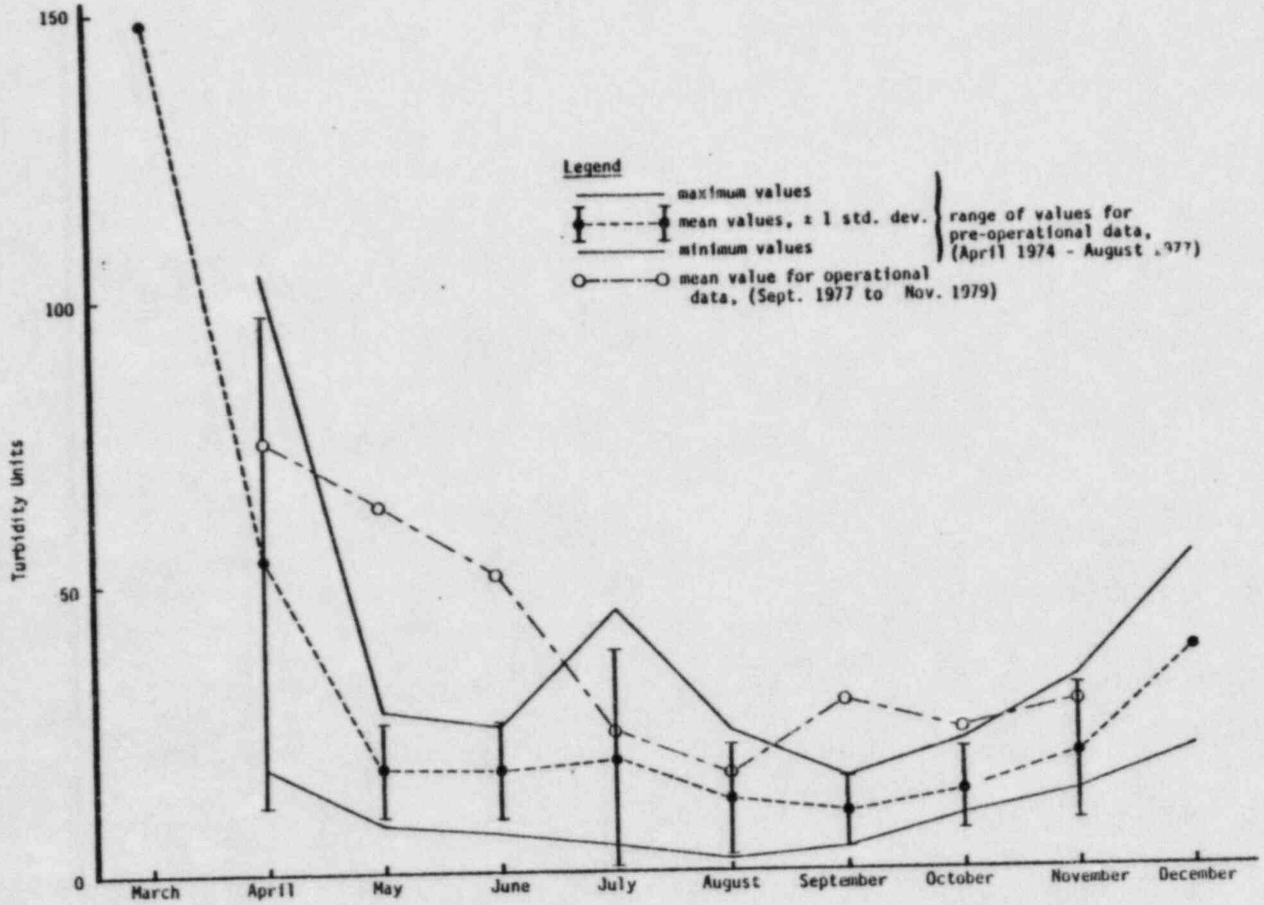


FIGURE 25 . Comparison of Pre-operational and Operational Data for Suspended Solids in Bottom Water at Station Discharge (Station No. 13).

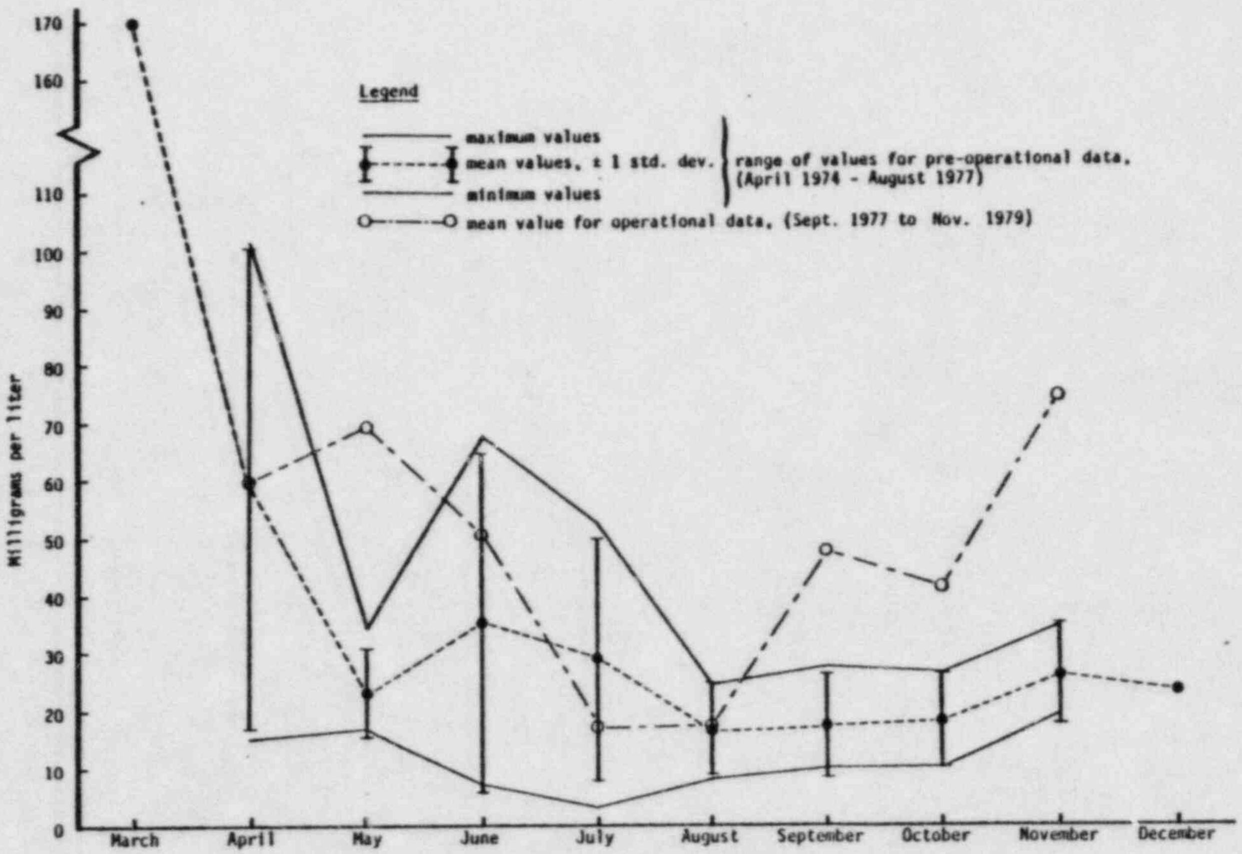


FIGURE 26. Comparison of Pre-operational and Operational Data for Conductivity of Bottom Water at Station Discharge (Station No. 13).

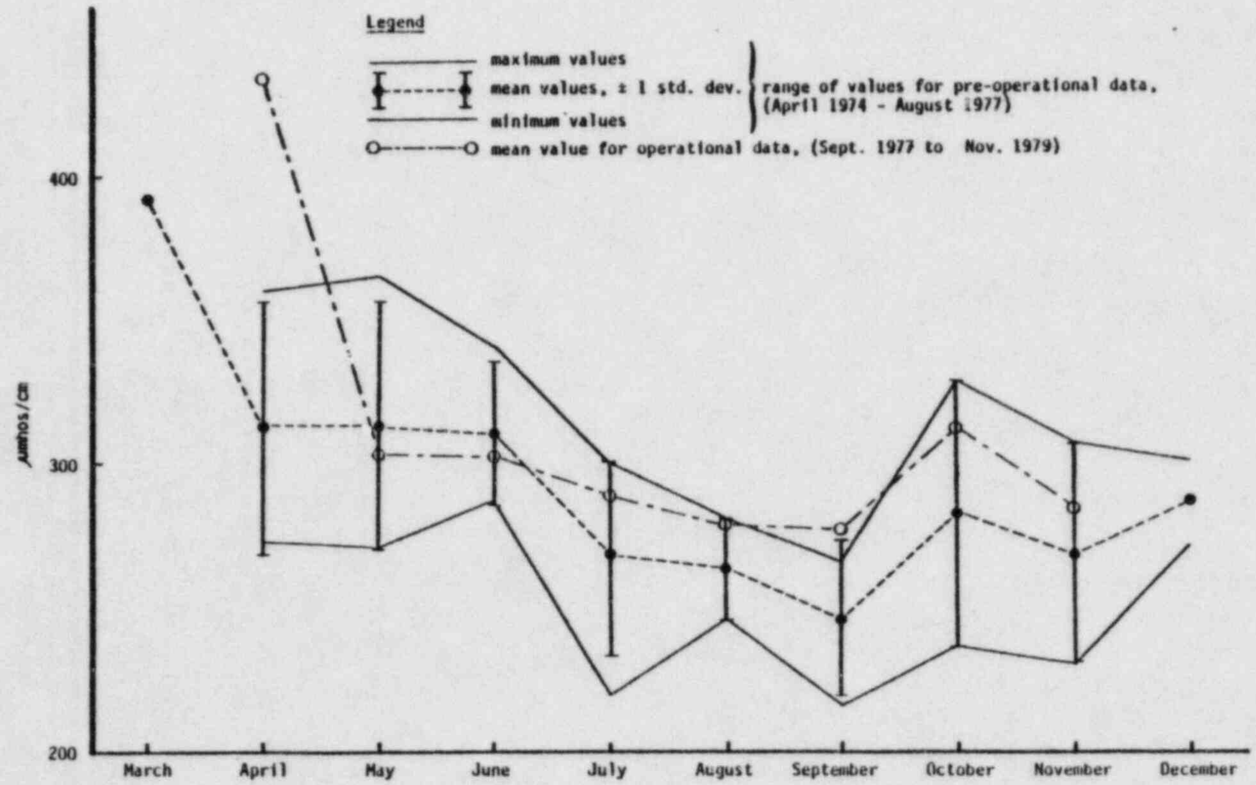


FIGURE 27. Comparison of Pre-operational and Operational Data for Dissolved Solids in Bottom Water at Station Discharge (Station No. 13).

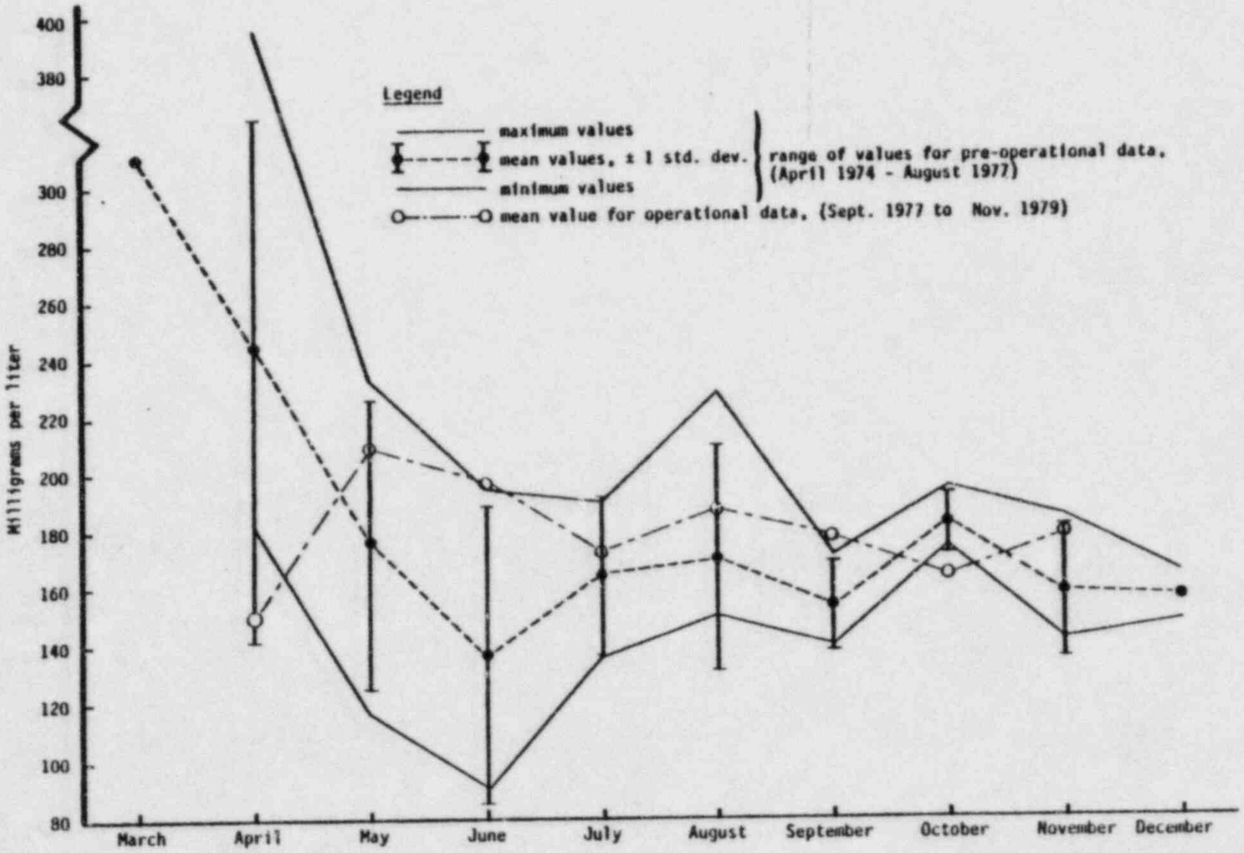


FIGURE 28. Comparison of Pre-operational and Operational Data for Calcium in Bottom Water at Station Discharge (Station No. 13).

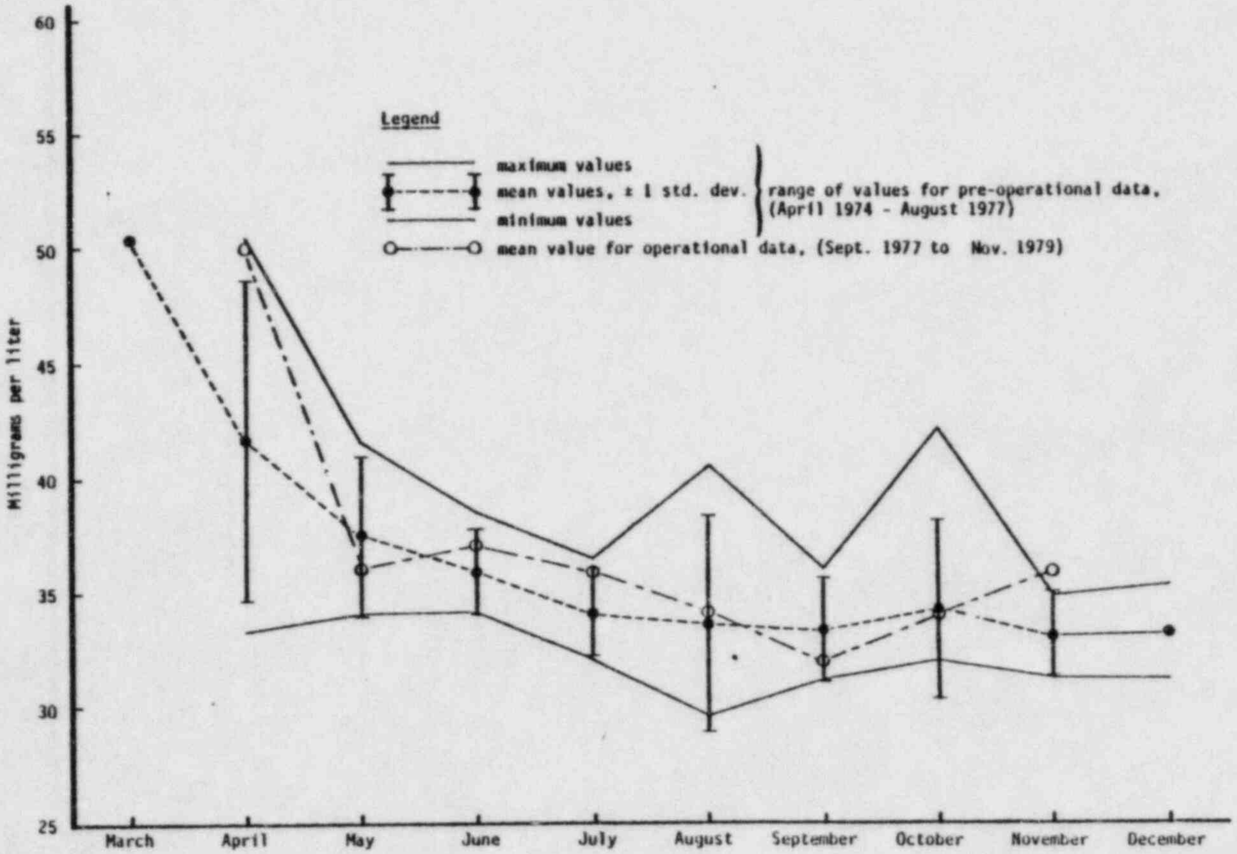


FIGURE 29. Comparison of Pre-operational and Operational Data for Chloride in Bottom Water at Station Discharge (Station No. 13).

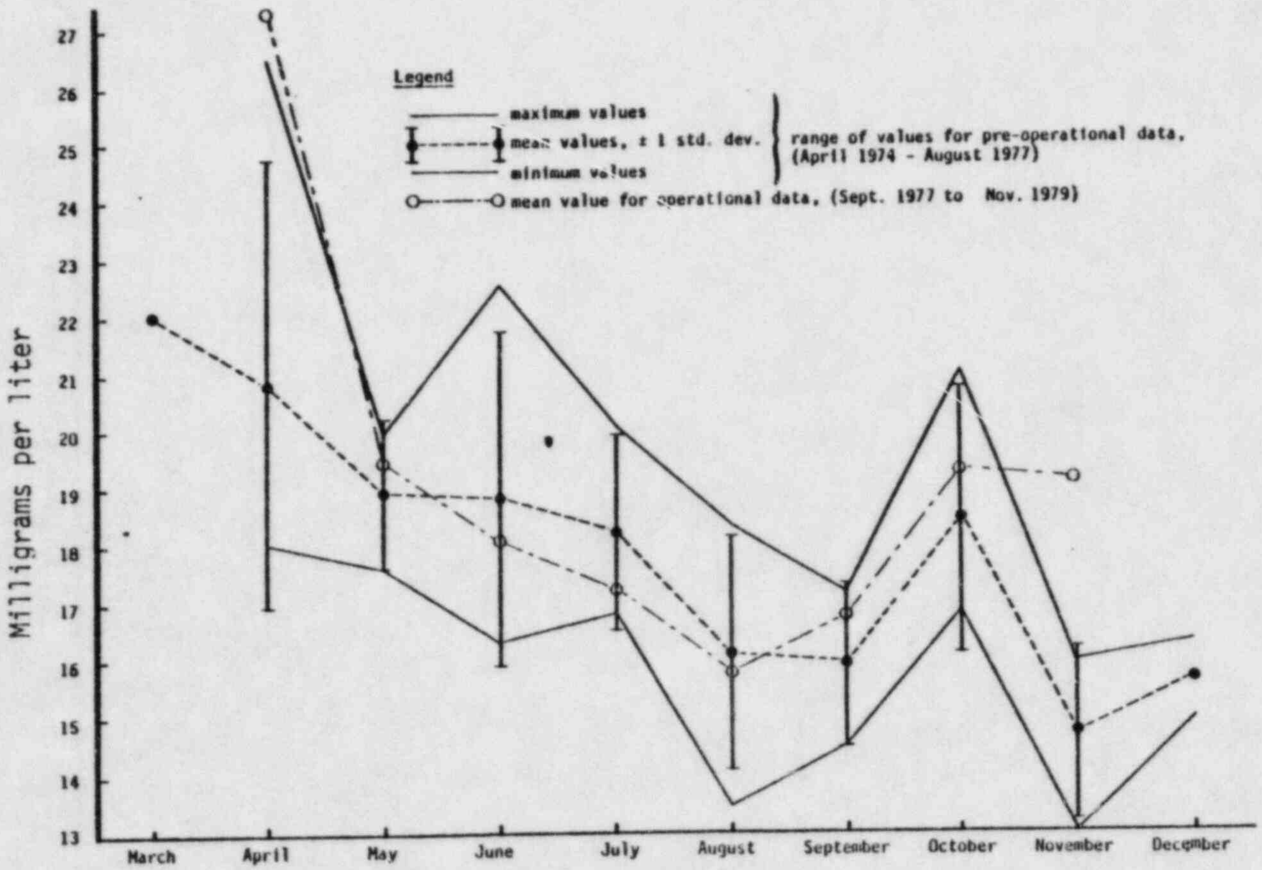


FIGURE 30. Comparison of Pre-operational and Operational Data of Sulfate in Bottom Water at Station Discharge (Station No. 13).

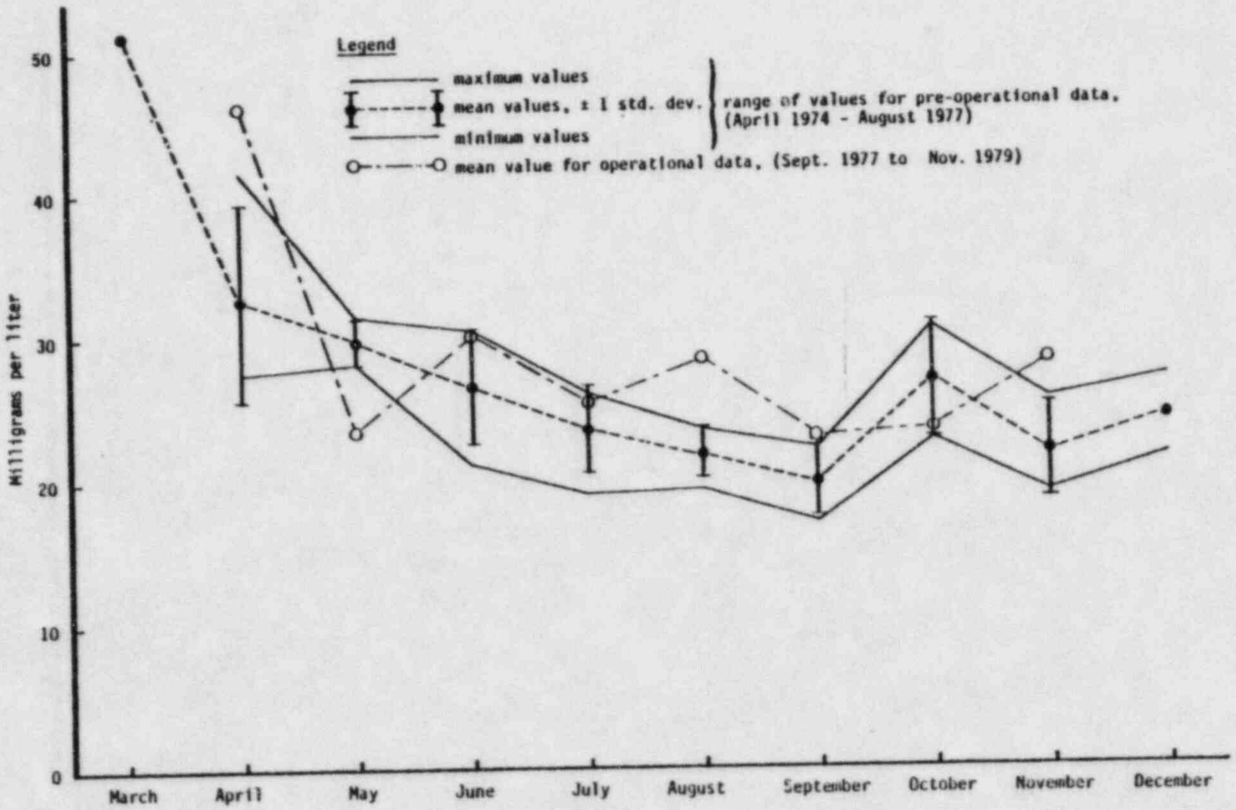


FIGURE 31. Comparison of Pre-operational and Operational Data for Sodium in Bottom Water at Station Discharge (Station No. 13).

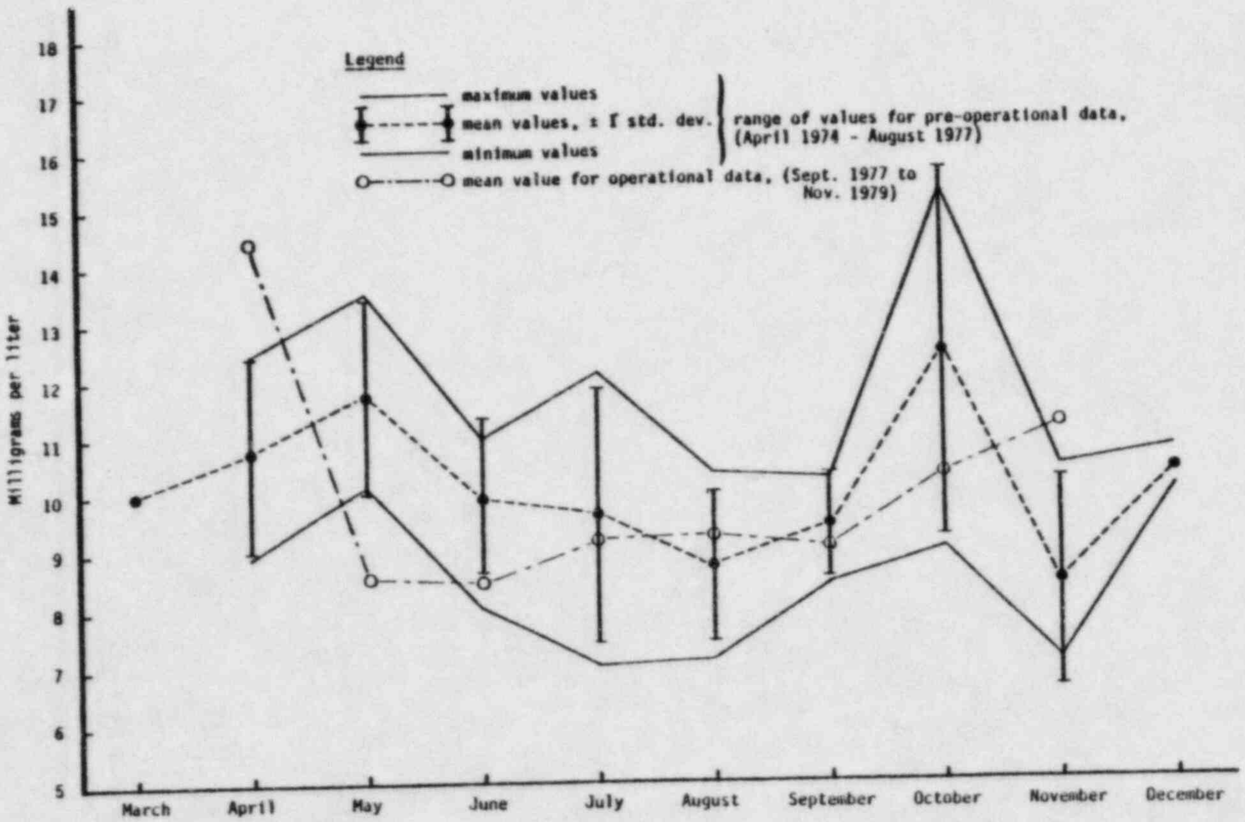


FIGURE 32 Comparison of Pre-operational and Operational Data for Magnesium in Bottom Water at Station Discharge (Station No. 13).

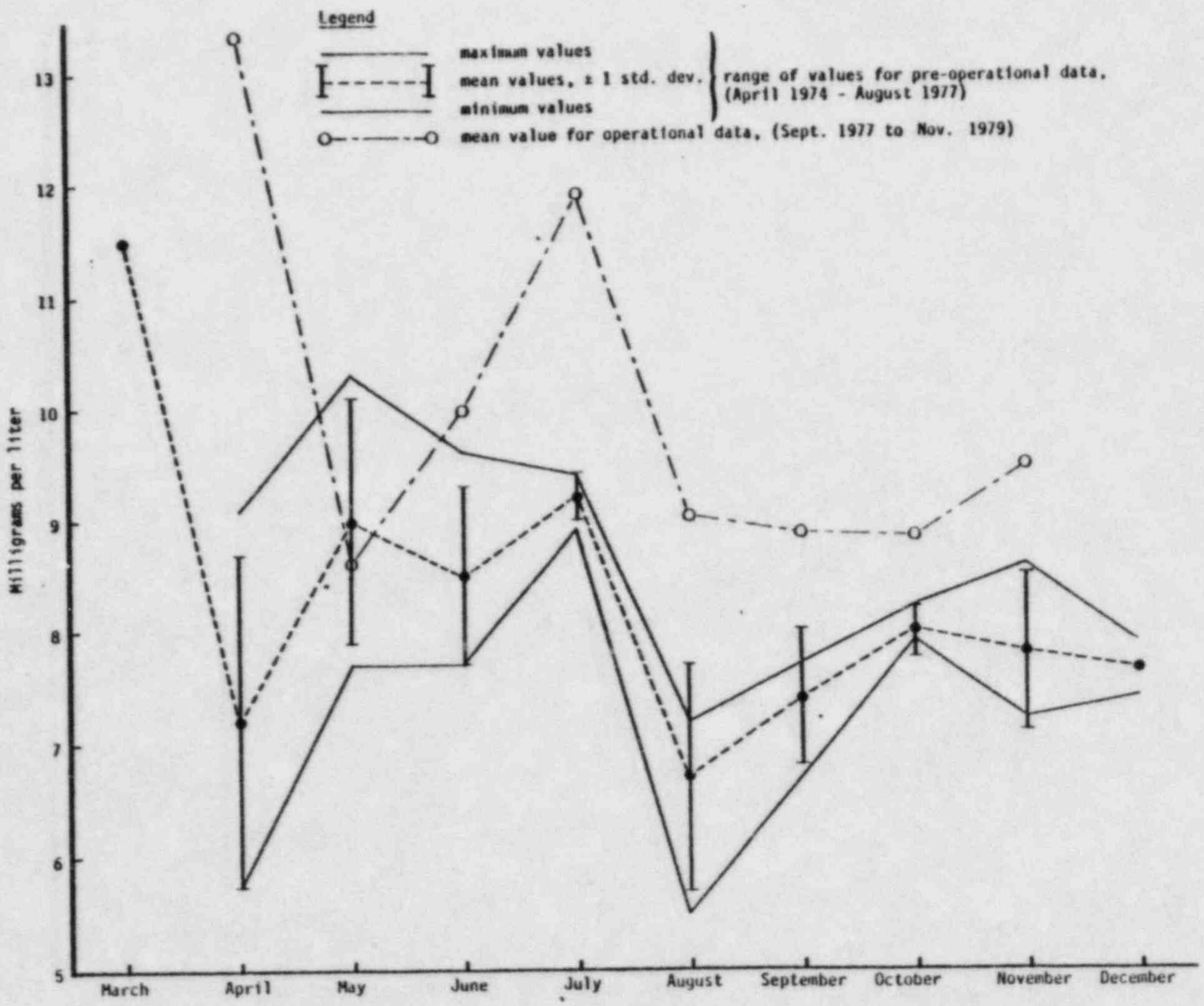


FIGURE 33. Comparison of Pre-operational and Operational Data for Total Alkalinity of Bottom Water at Station Discharge (Station No. 13).

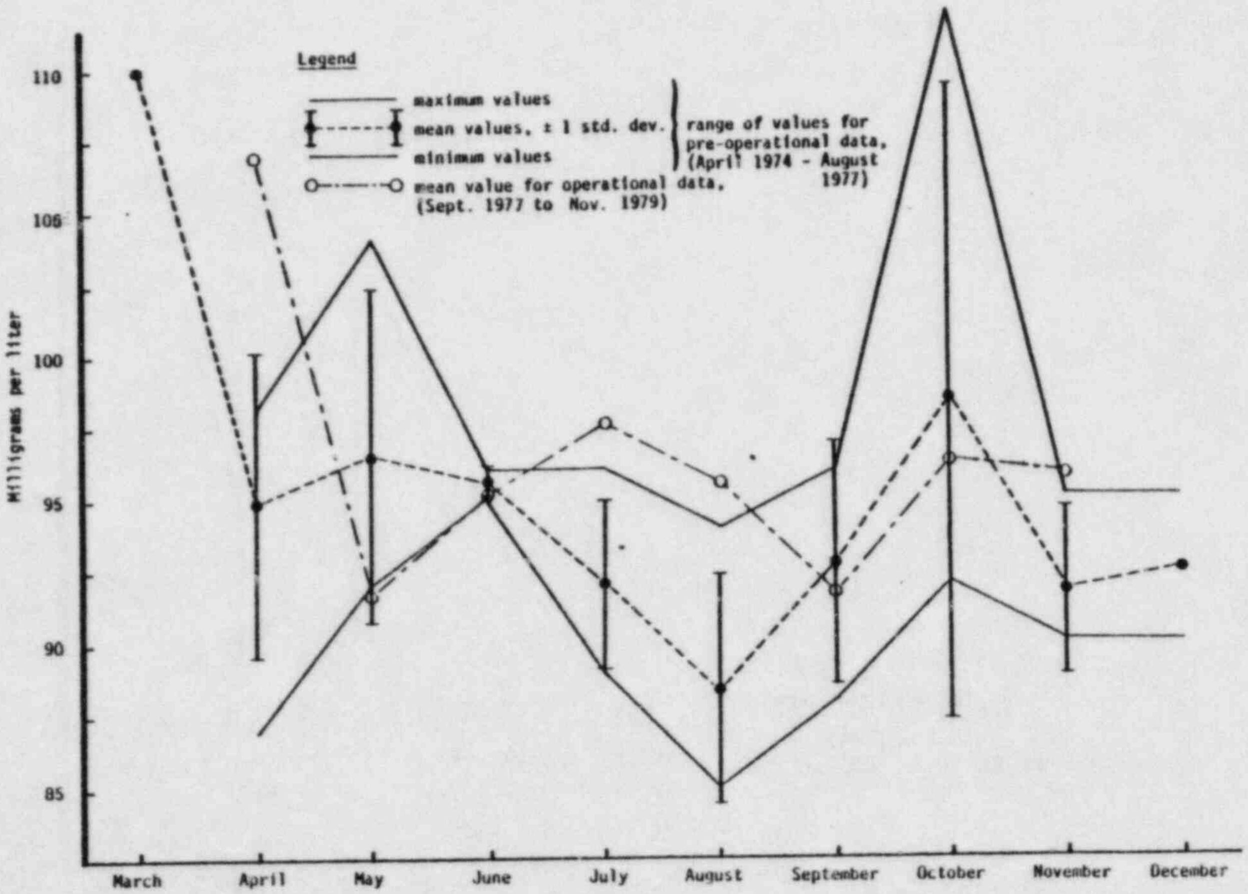


FIGURE 34. Comparison of Pre-operational and Operational Data for Nitrate in Bottom Water at Station Discharge (Station No. 13).

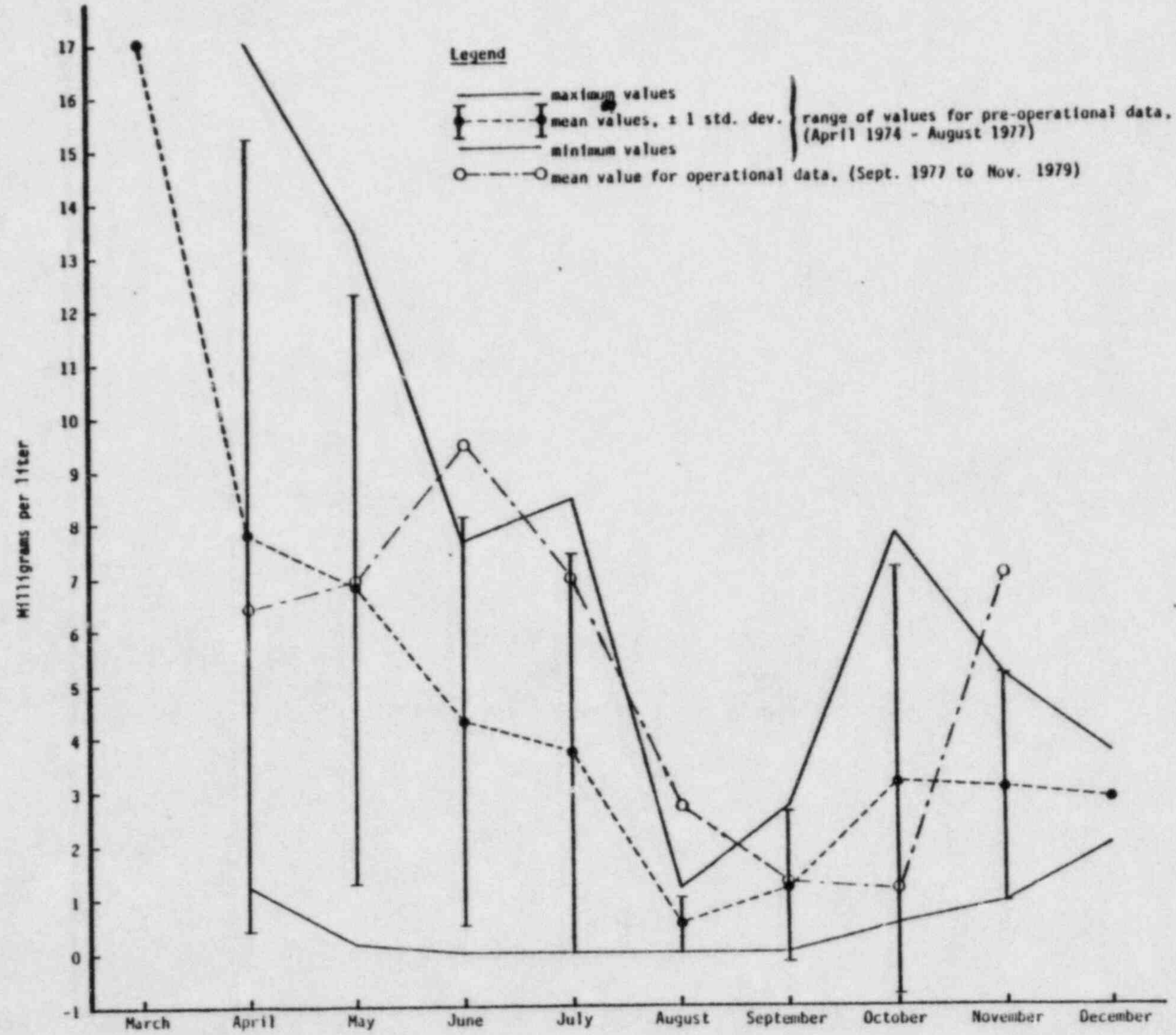


FIGURE 35. Comparison of Pre-operational and Operational Data for Phosphorus in Bottom Water at Station Discharge (Station No. 13).

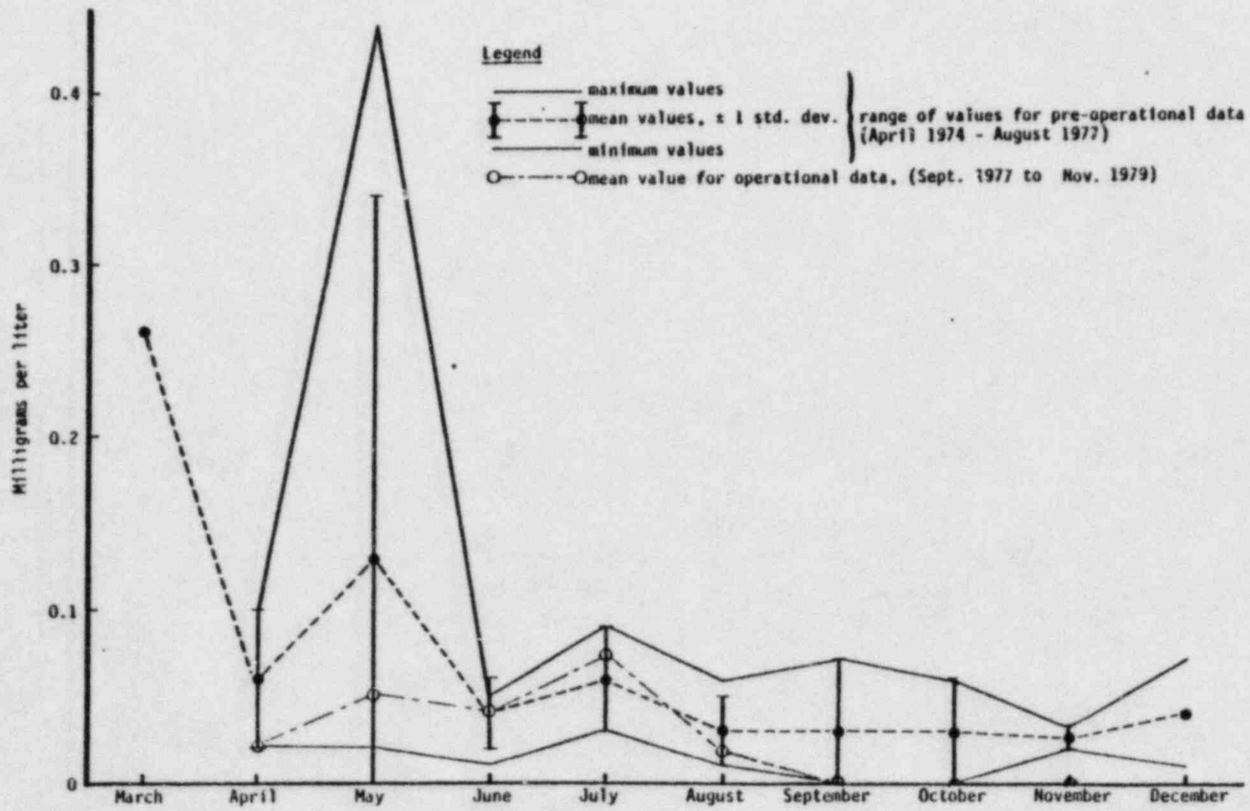


FIGURE 36. Comparison of Pre-operational and Operational Data for Silica in Bottom Water at Station Discharge (Station No. 13).

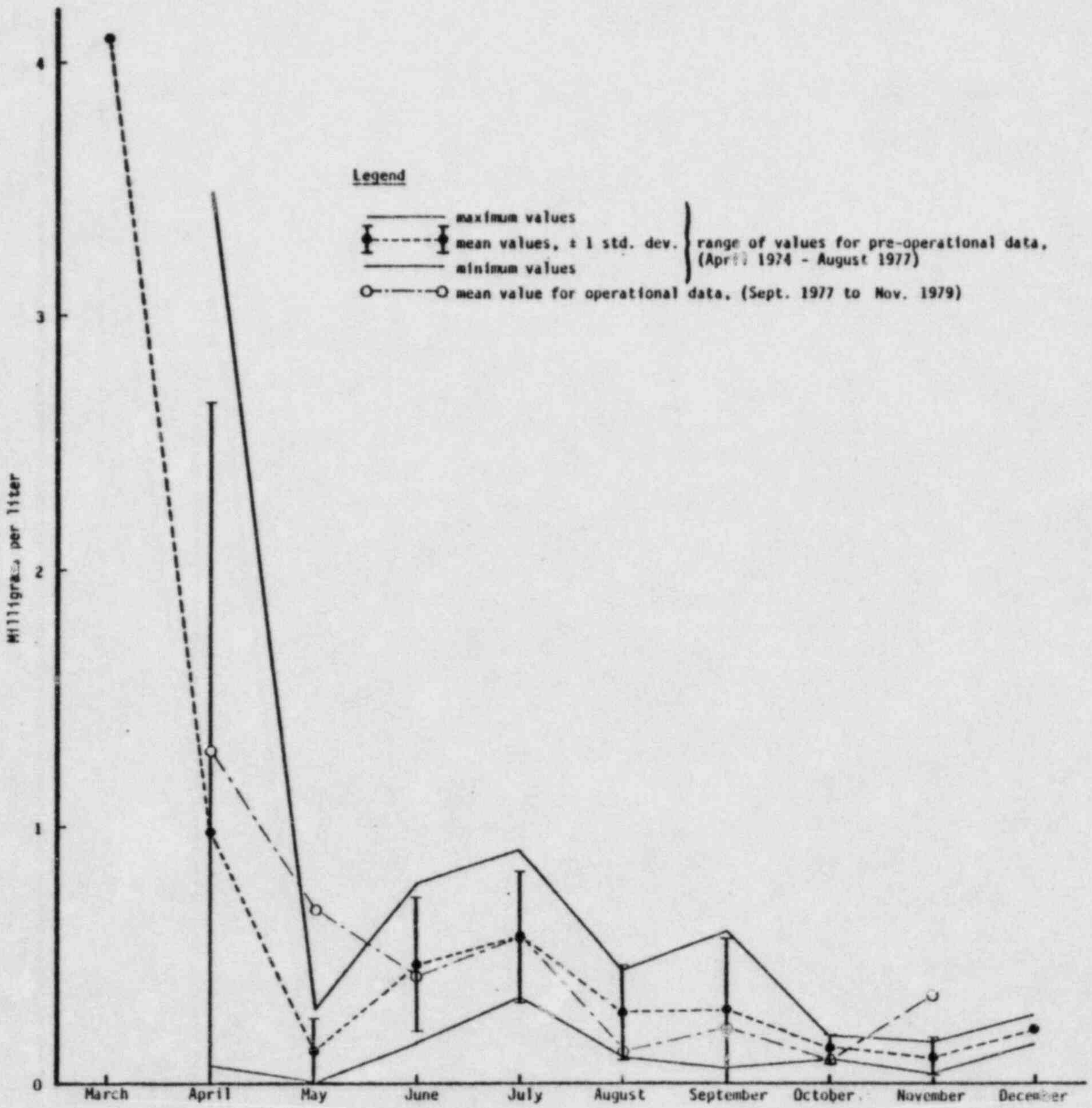


FIGURE 37. Comparison of Pre-operational and Operational Data of Biochemical Oxygen Demand of Bottom Water at Station Discharge (Station No. 13).

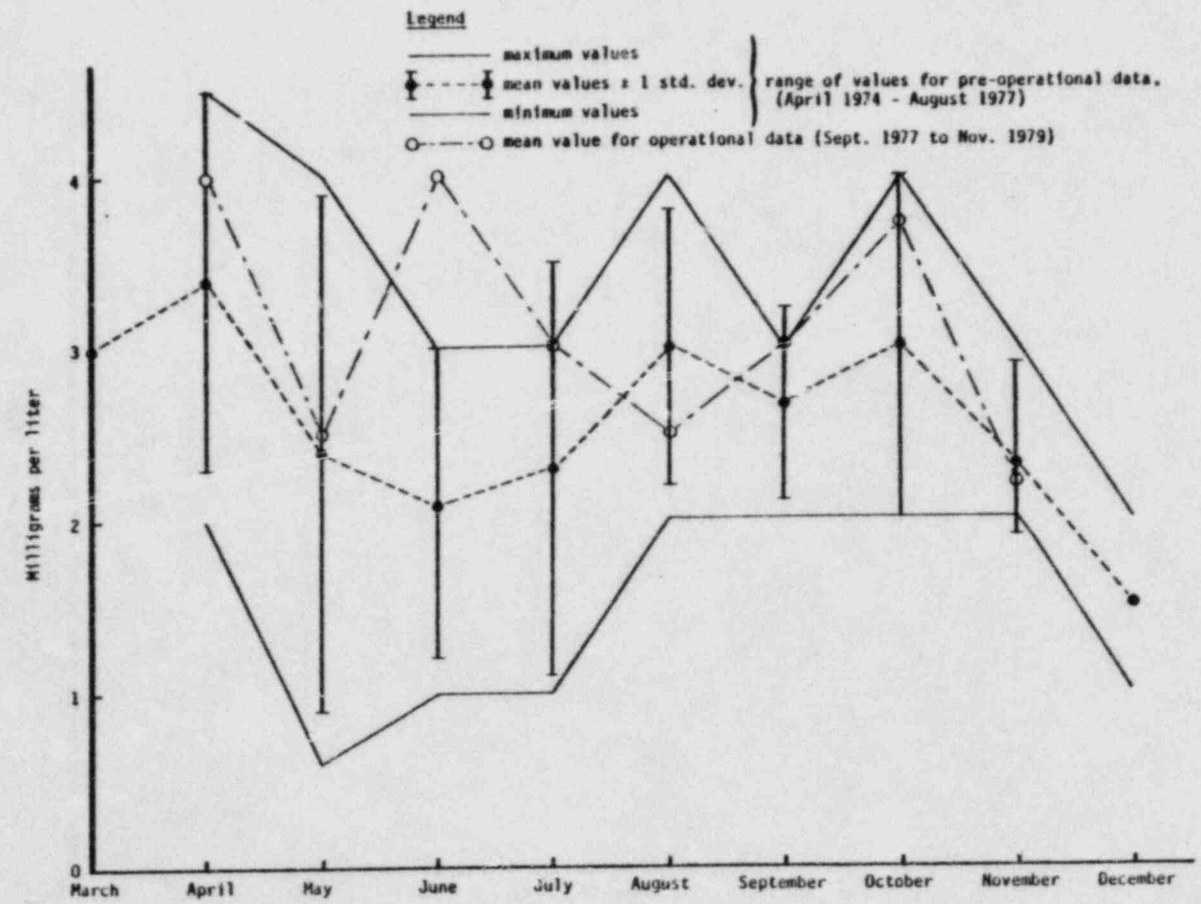


FIGURE 38. Comparison of Pre-operational and Operational Data for Temperature of Bottom Water at Station Discharge (Station No. 13).

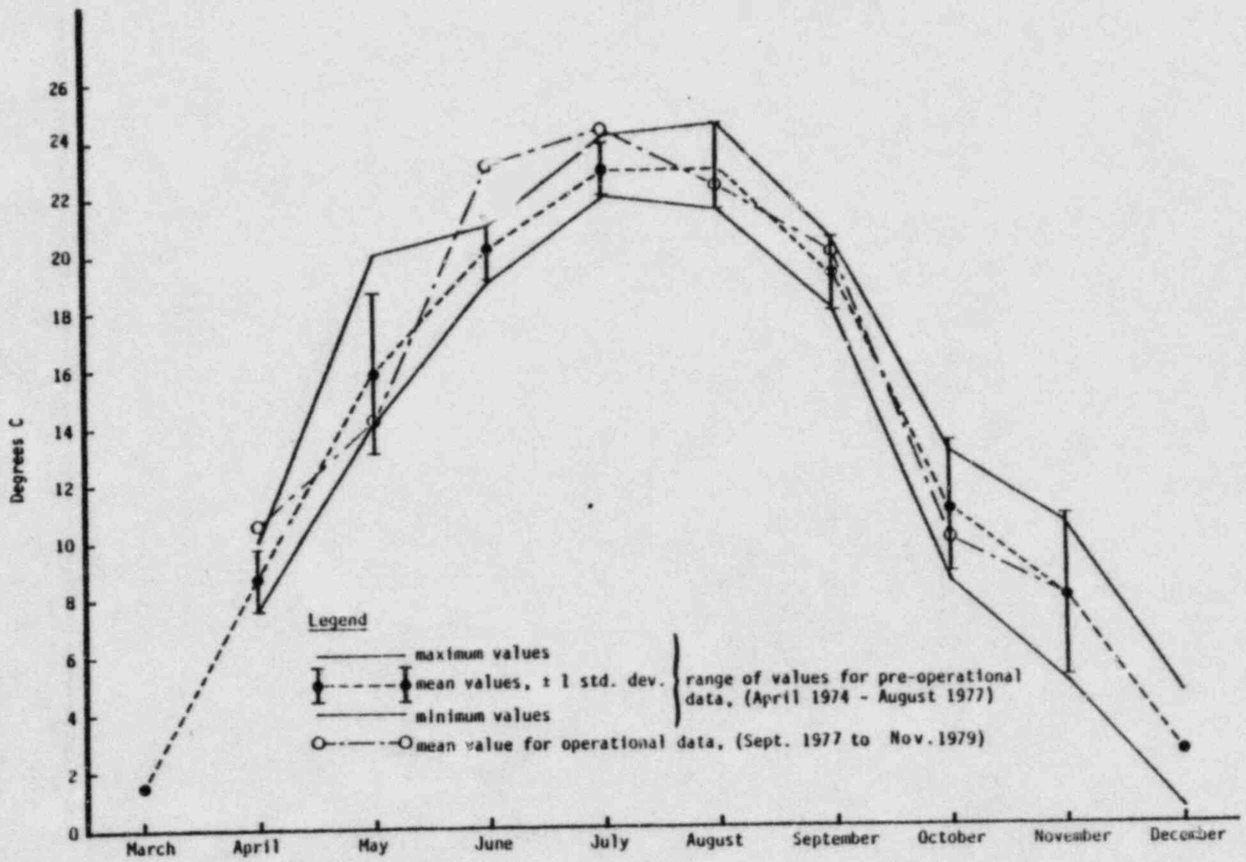
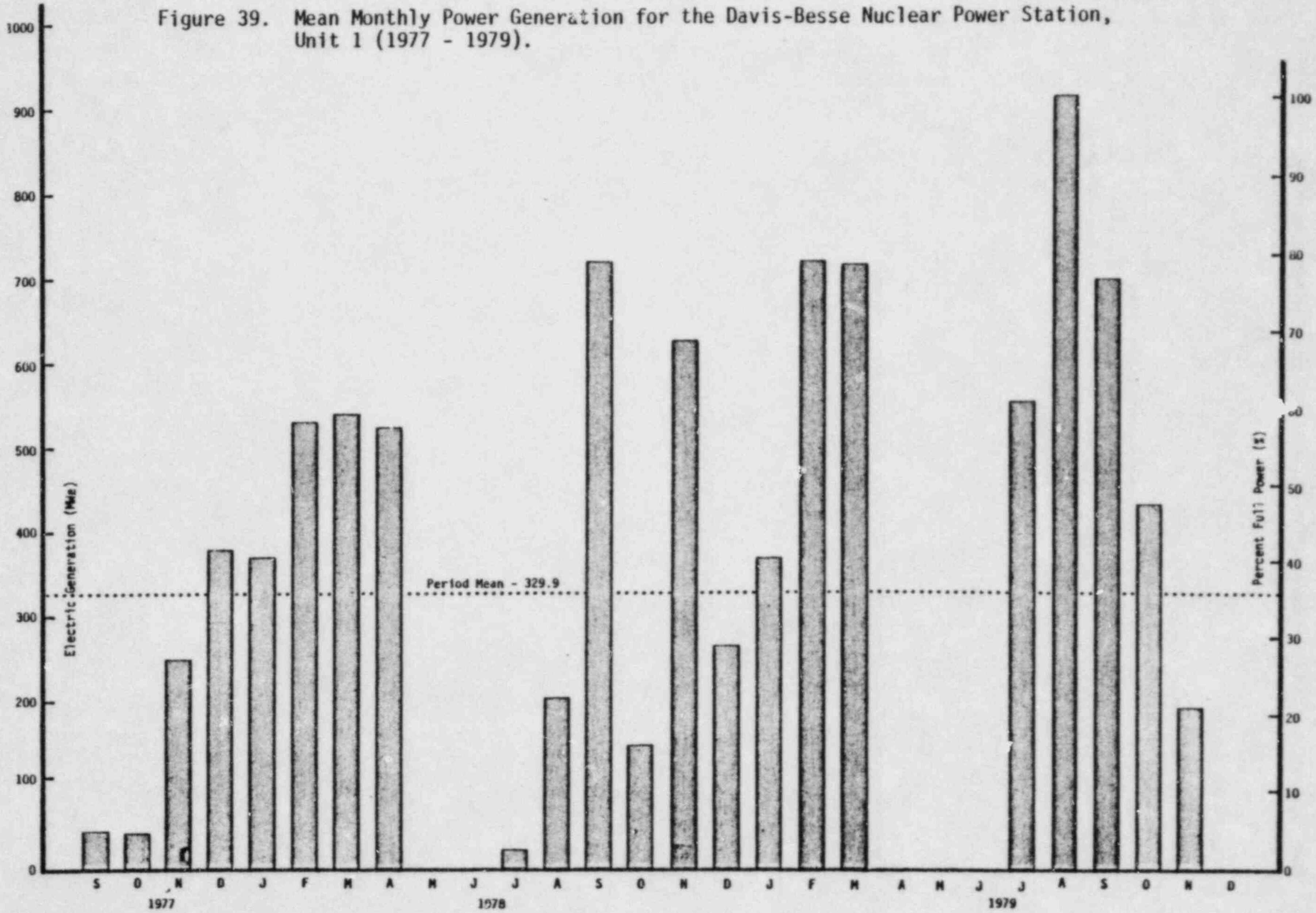


Figure 39. Mean Monthly Power Generation for the Davis-Besse Nuclear Power Station, Unit 1 (1977 - 1979).



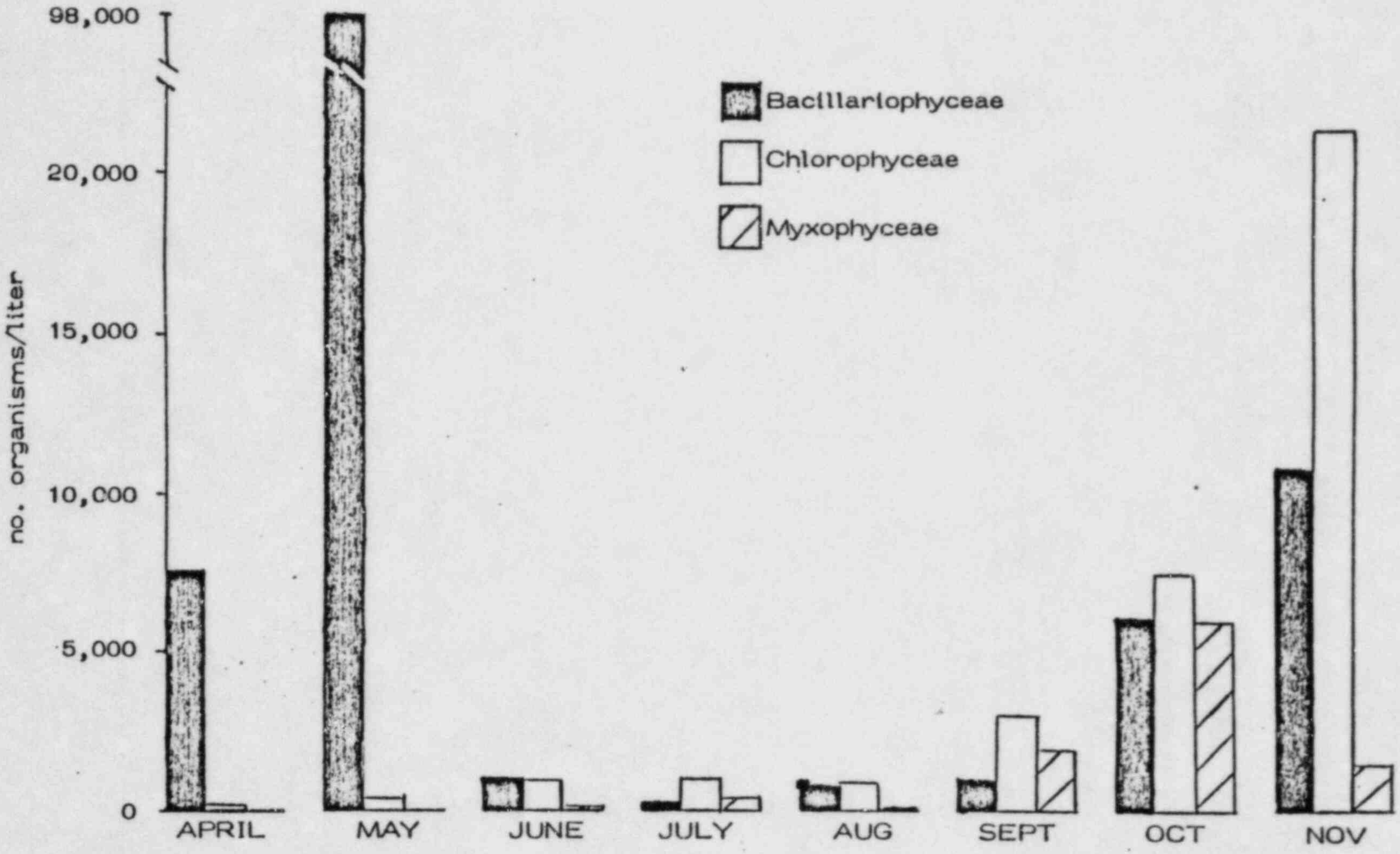


FIGURE 40. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1974.

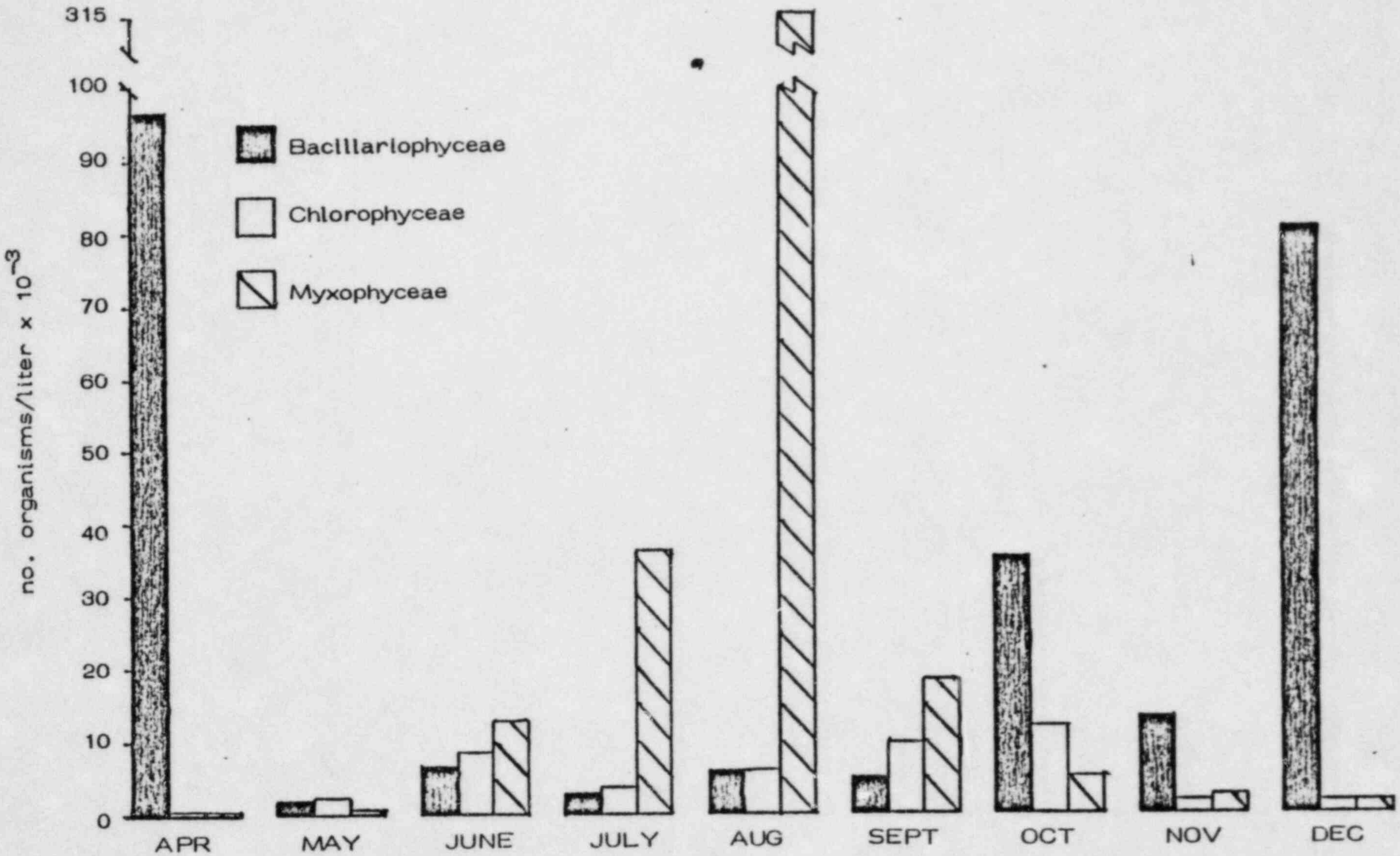


FIGURE 41. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1975.

FIGURE 42. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1976.

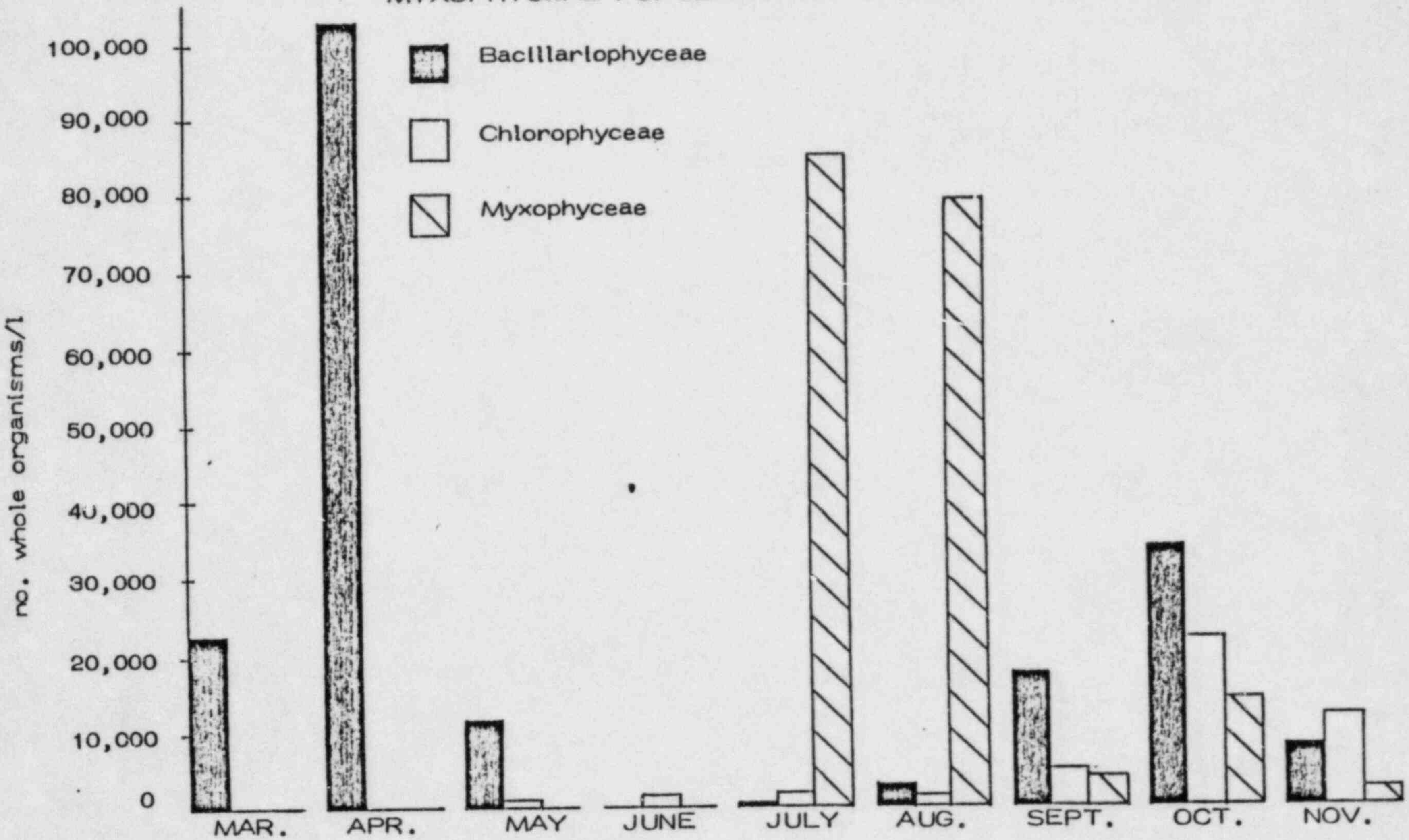


FIGURE 43

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1977.

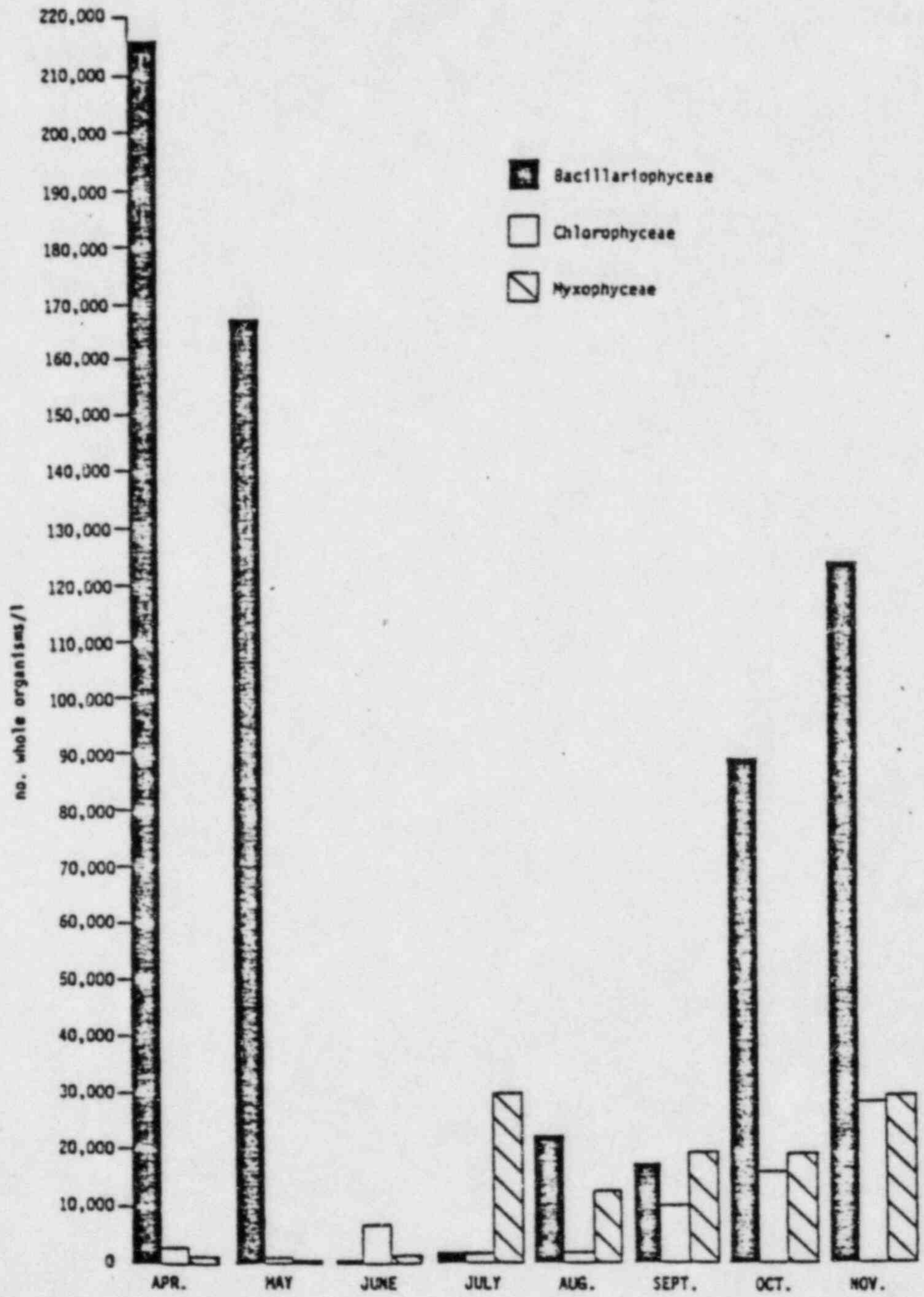


FIGURE 44

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1978.

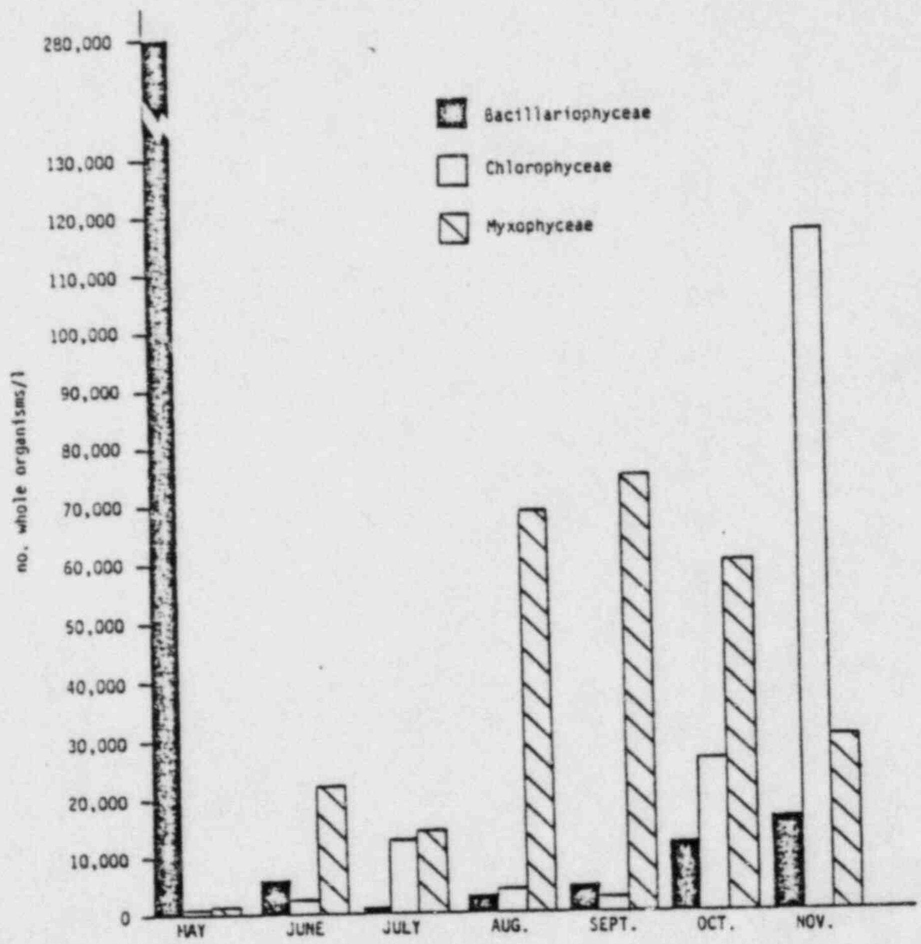


FIGURE 45 MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1979.

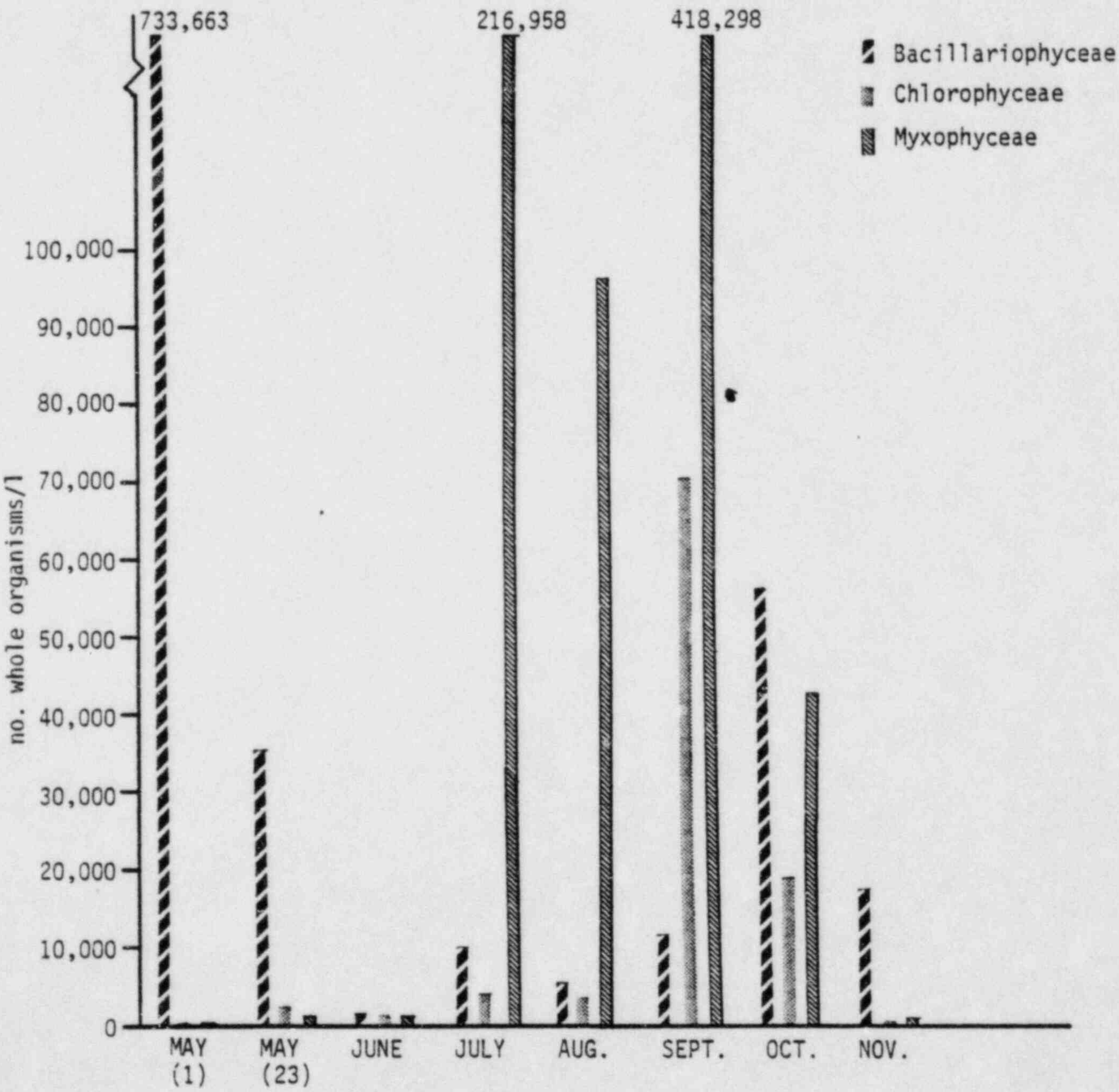
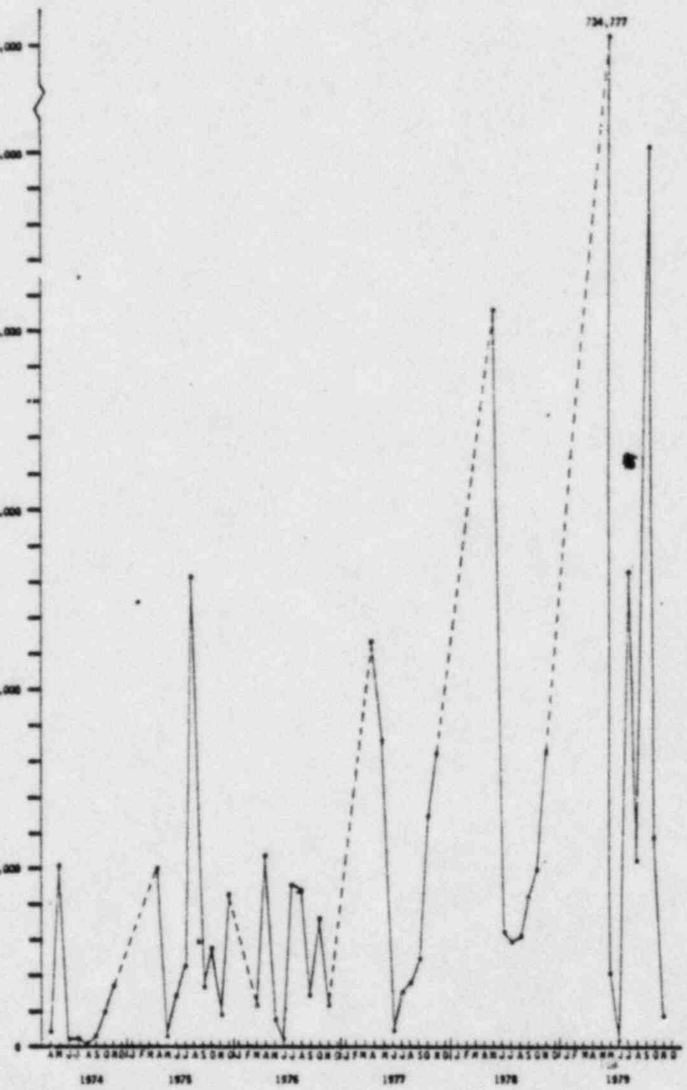


FIGURE 46.MONTHLY MEAN PHYTOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1974 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 47. Comparison of Pre-operational and Operational Data for Diatom Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

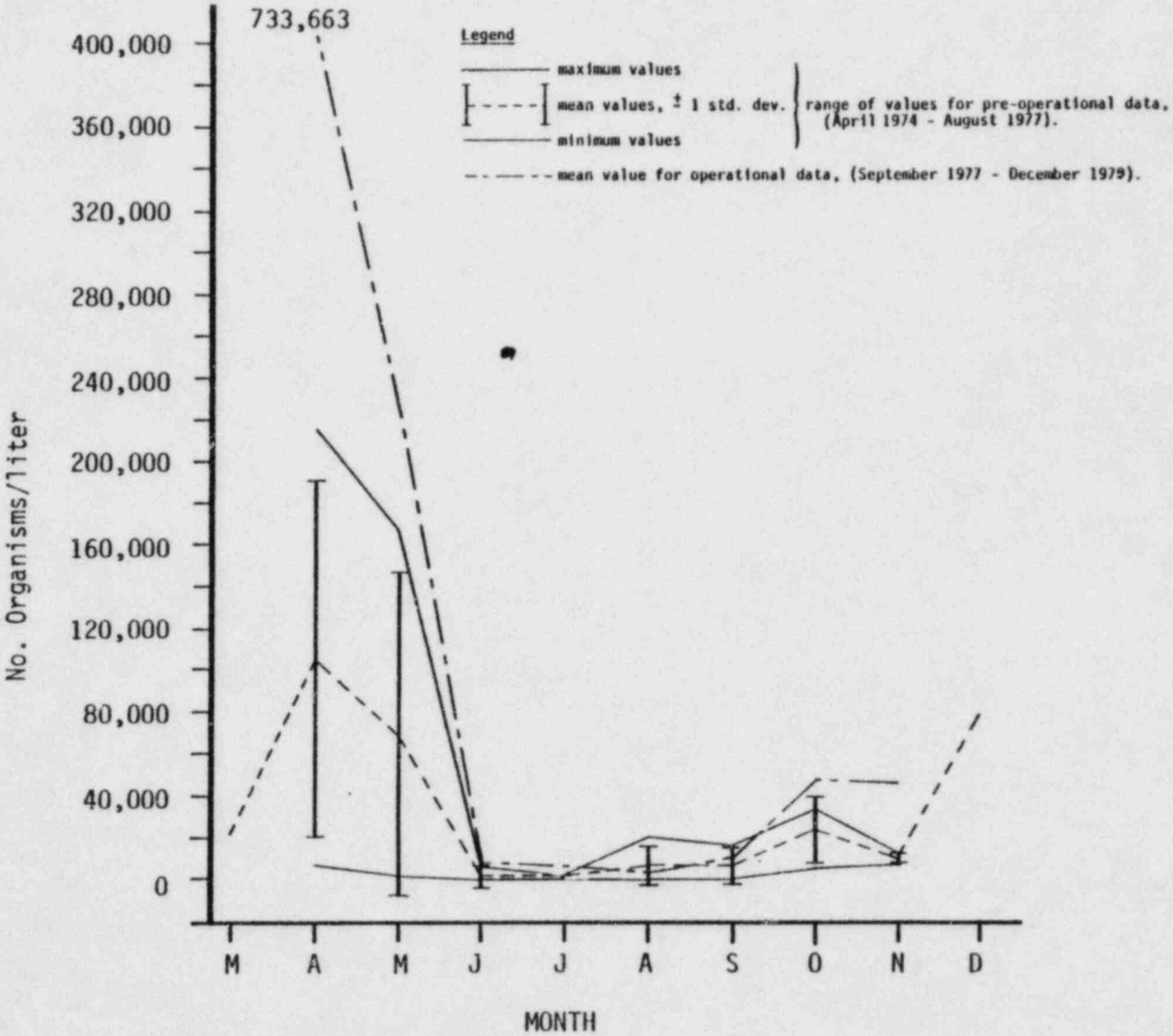


Figure 48. Comparison of Pre-operational and Operational Data for Green Algae Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

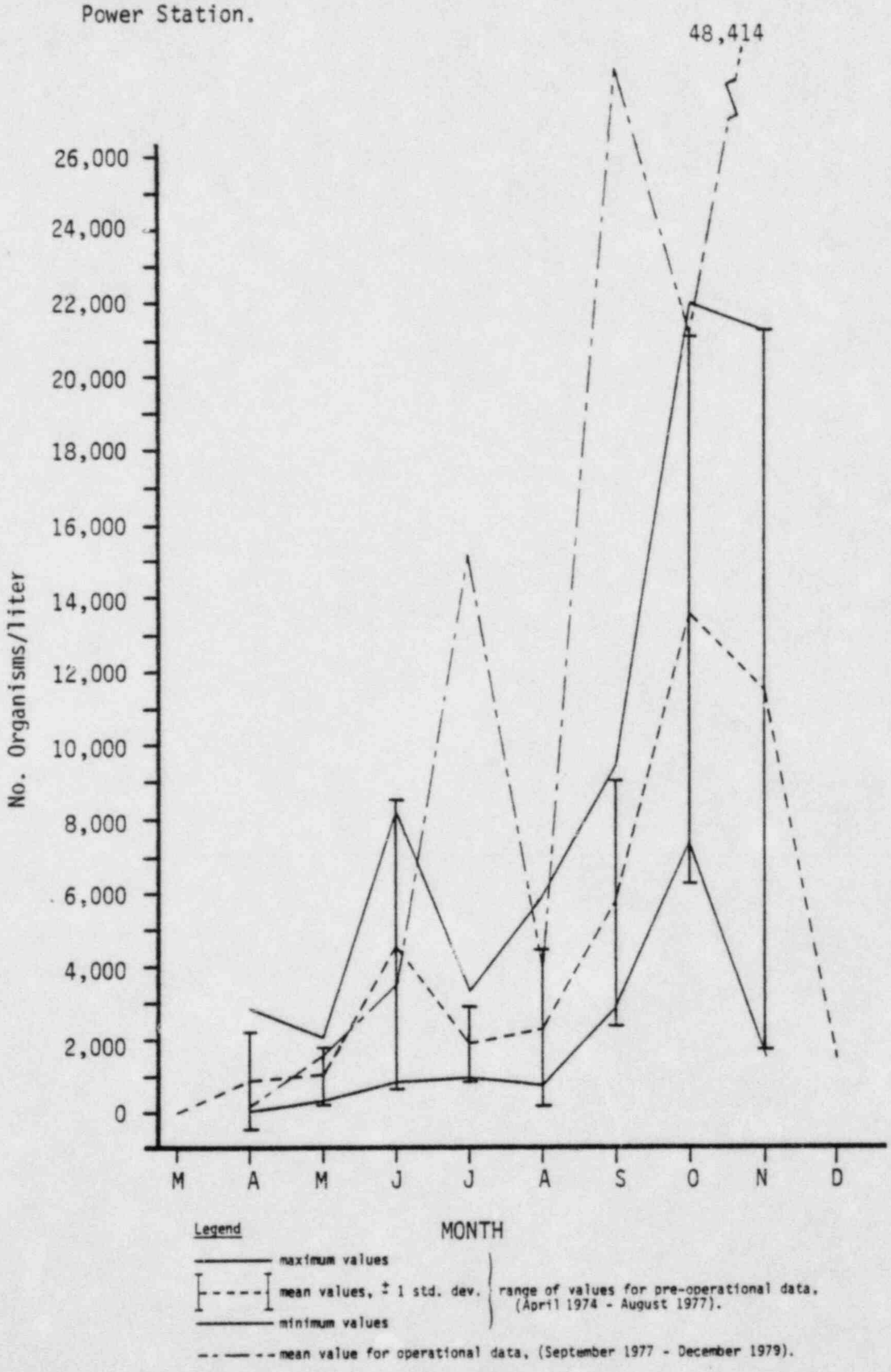


Figure 49. Comparison of Pre-operational and Operational Data for Blue-green Algae Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

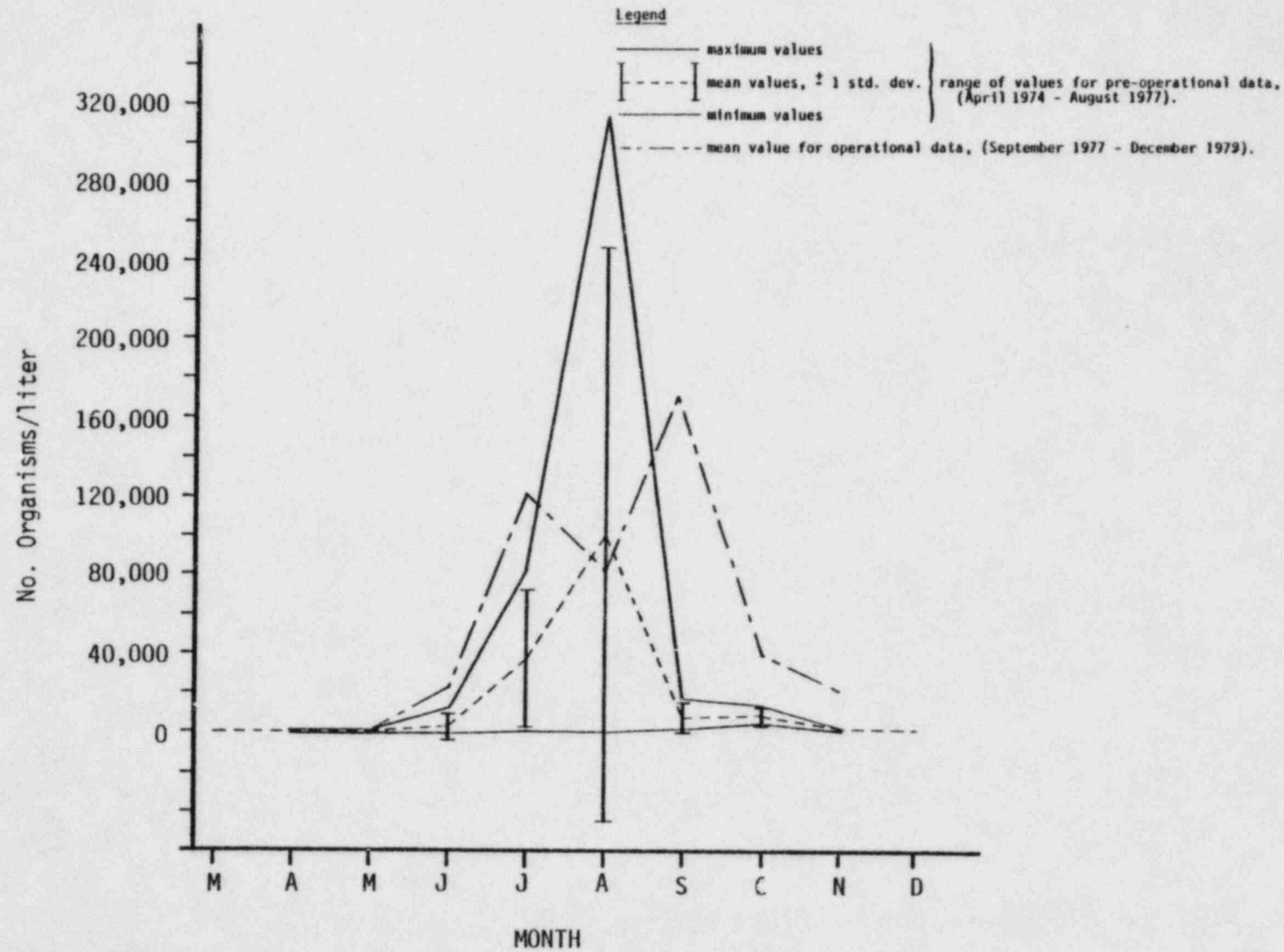


Figure 50. Comparison of Pre-operational and Operational Data for Phytoplankton Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

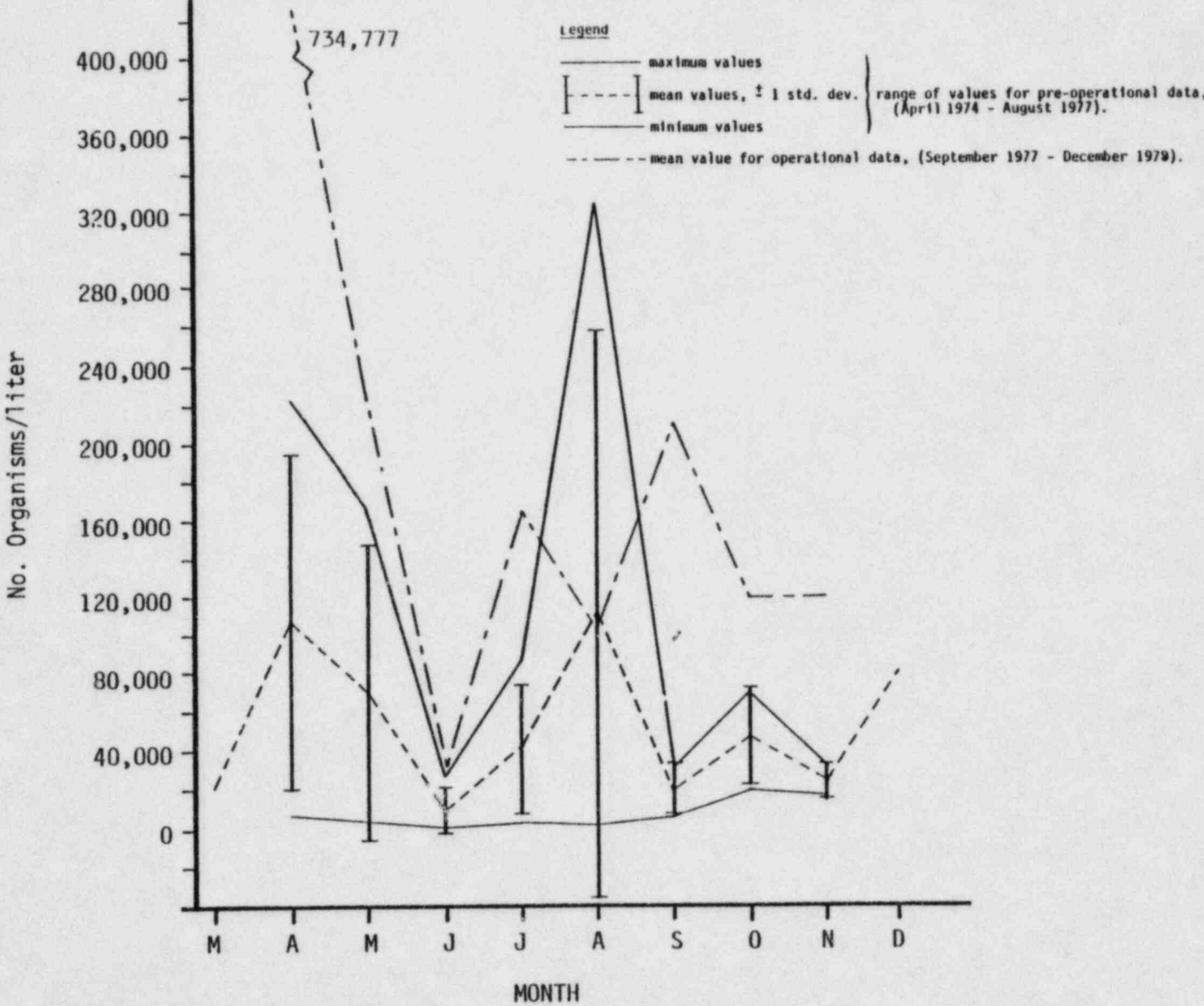


Figure 51 Comparison of Pre-operational and Operational Data for Phytoplankton Densities at the Station Intake (Sta. No. 8).

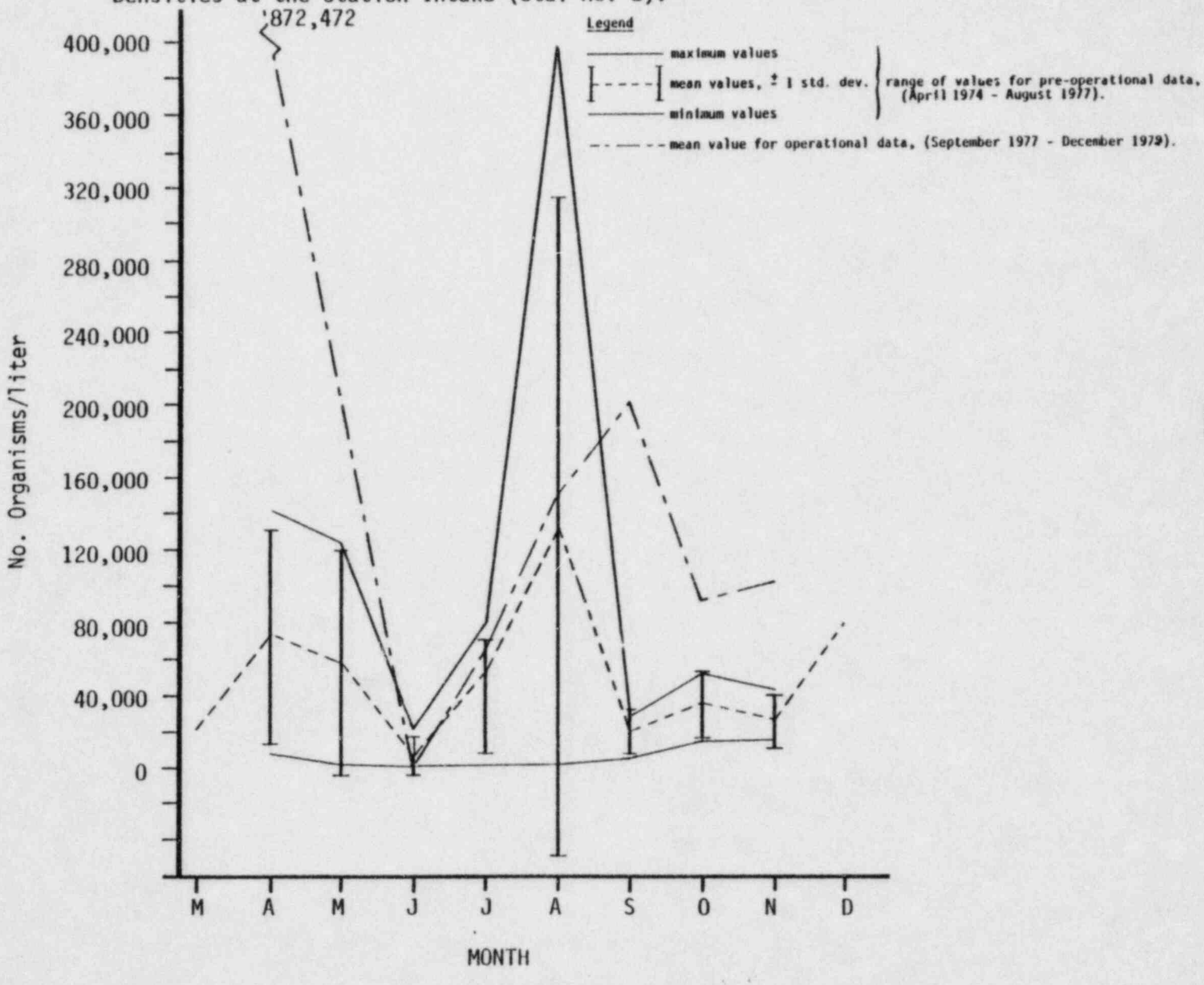


Figure 52. Comparison of Pre-operational and Operational Data for Phytoplankton Densities at the Station Discharge (Sta. No. 13).

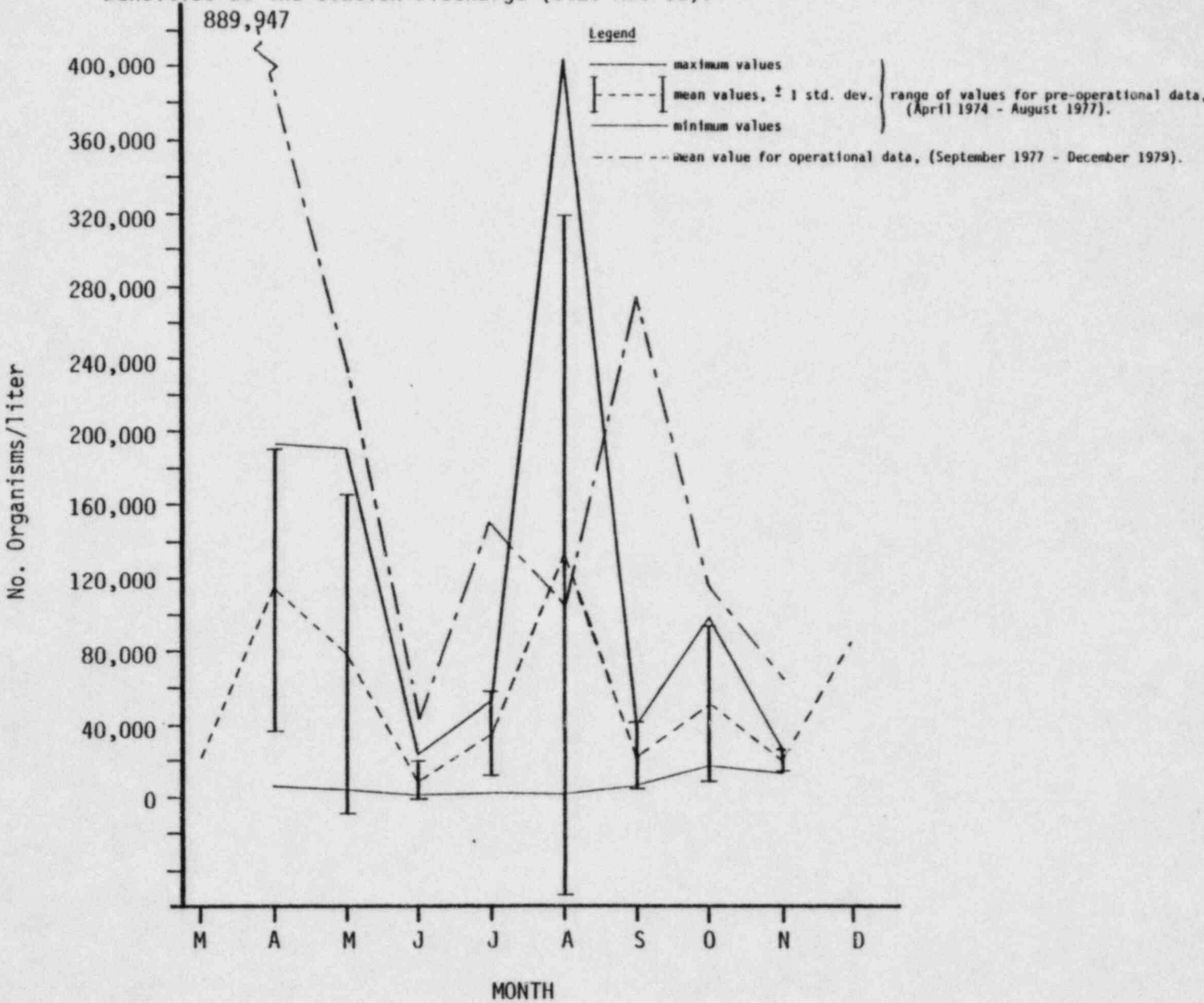


Figure 53. Comparison of Pre-operational and Operational Data for Phytoplankton Densities at a Control Station (Sta. No. 3).

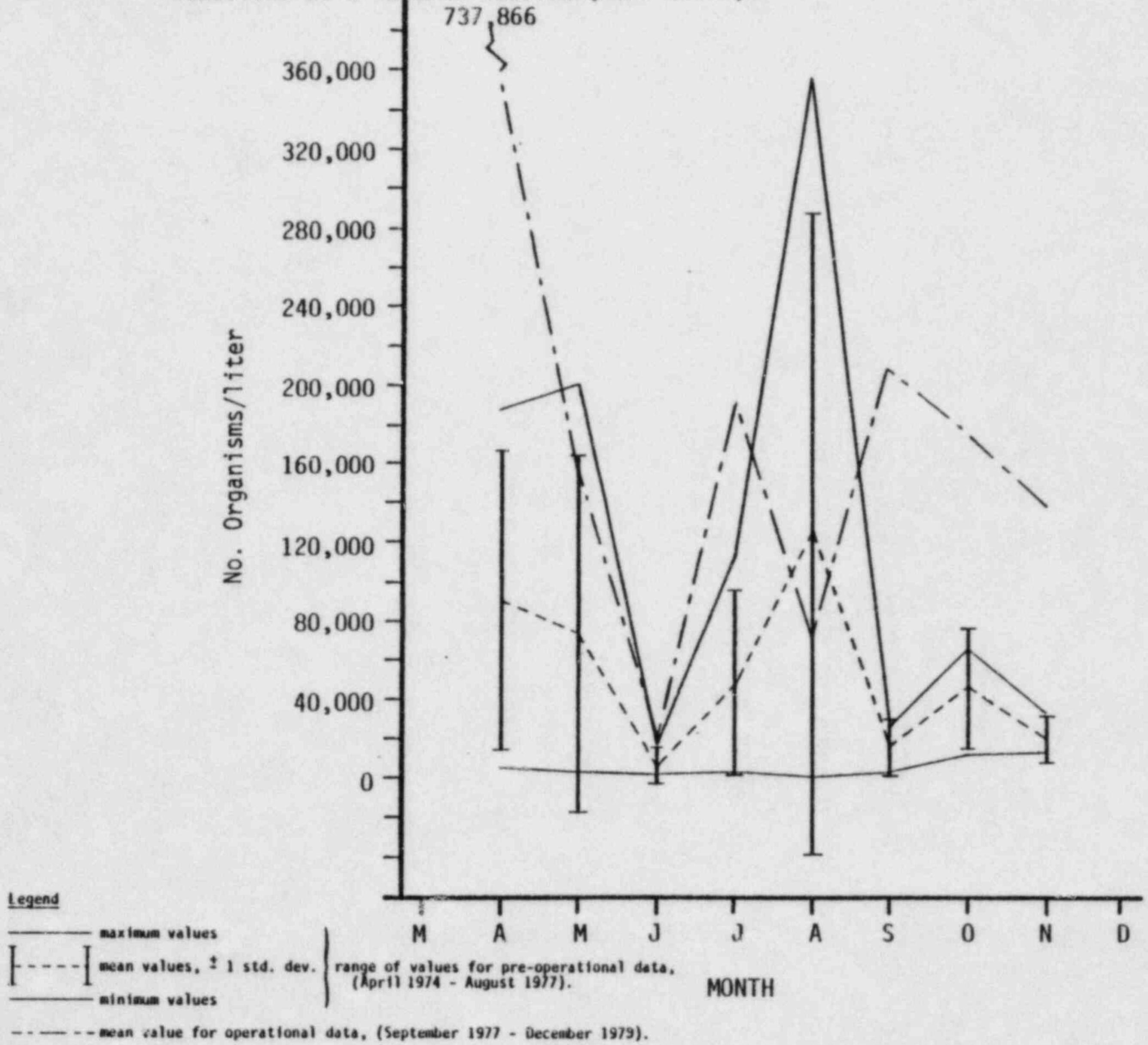
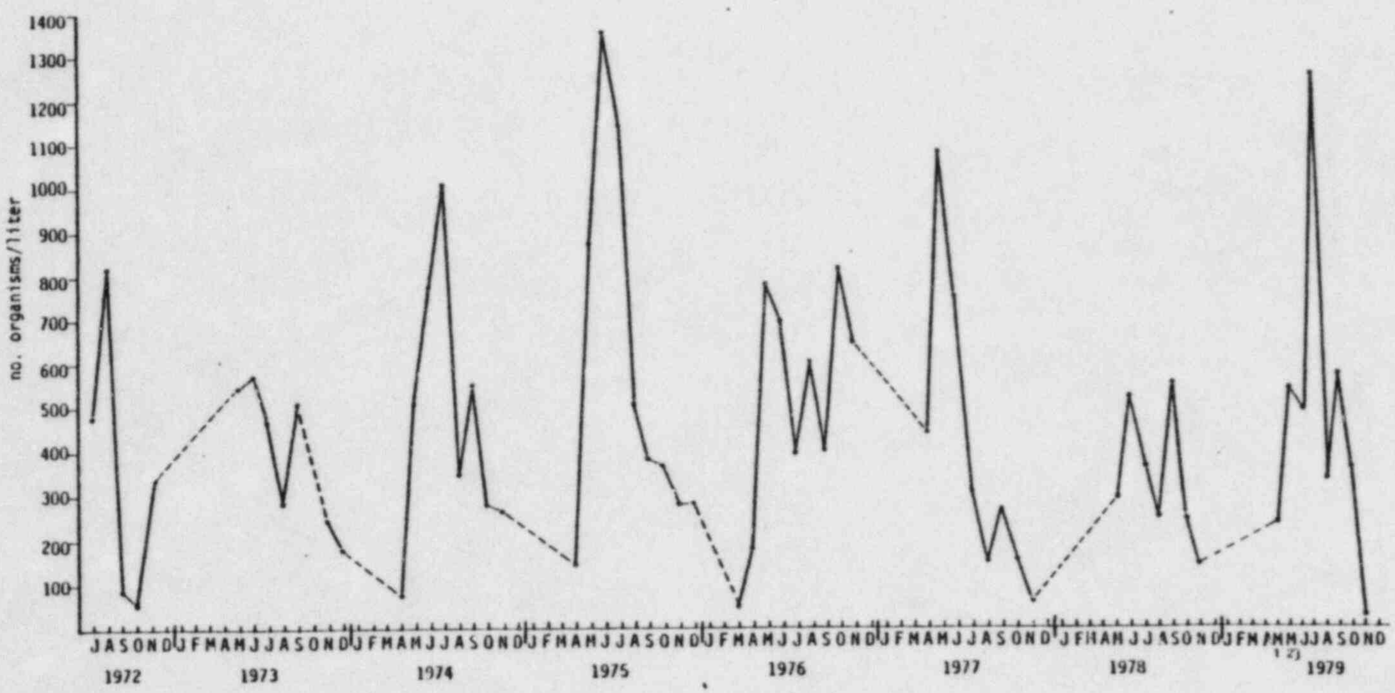
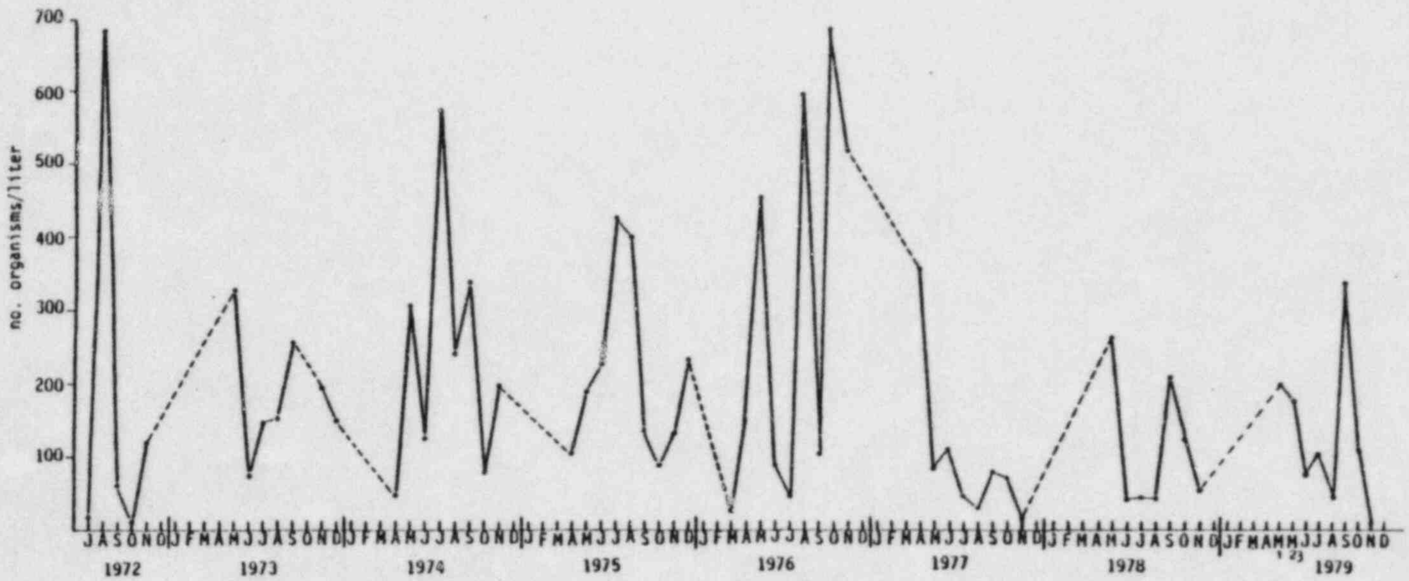


FIGURE 54 MONTHLY MEAN ZOOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



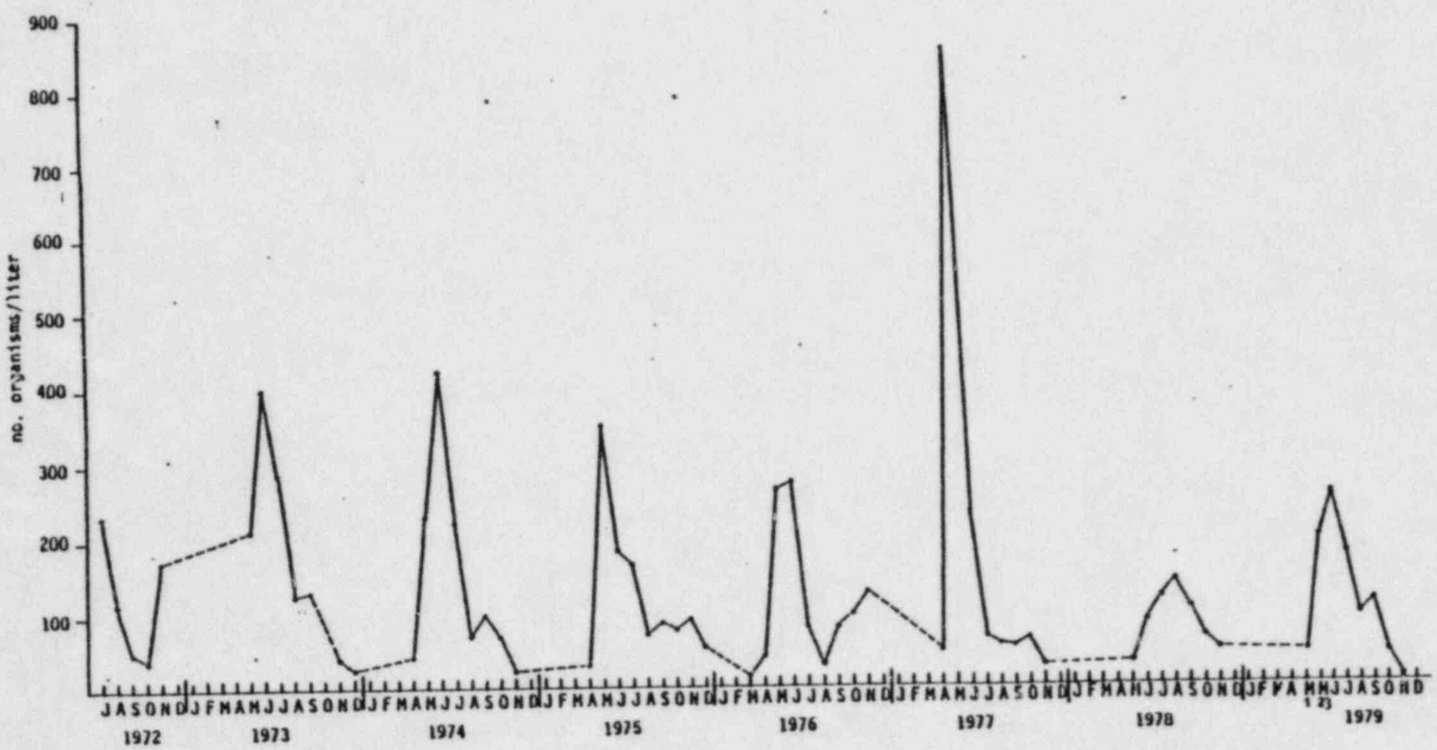
*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 55. MONTHLY MEAN ROTIFER POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



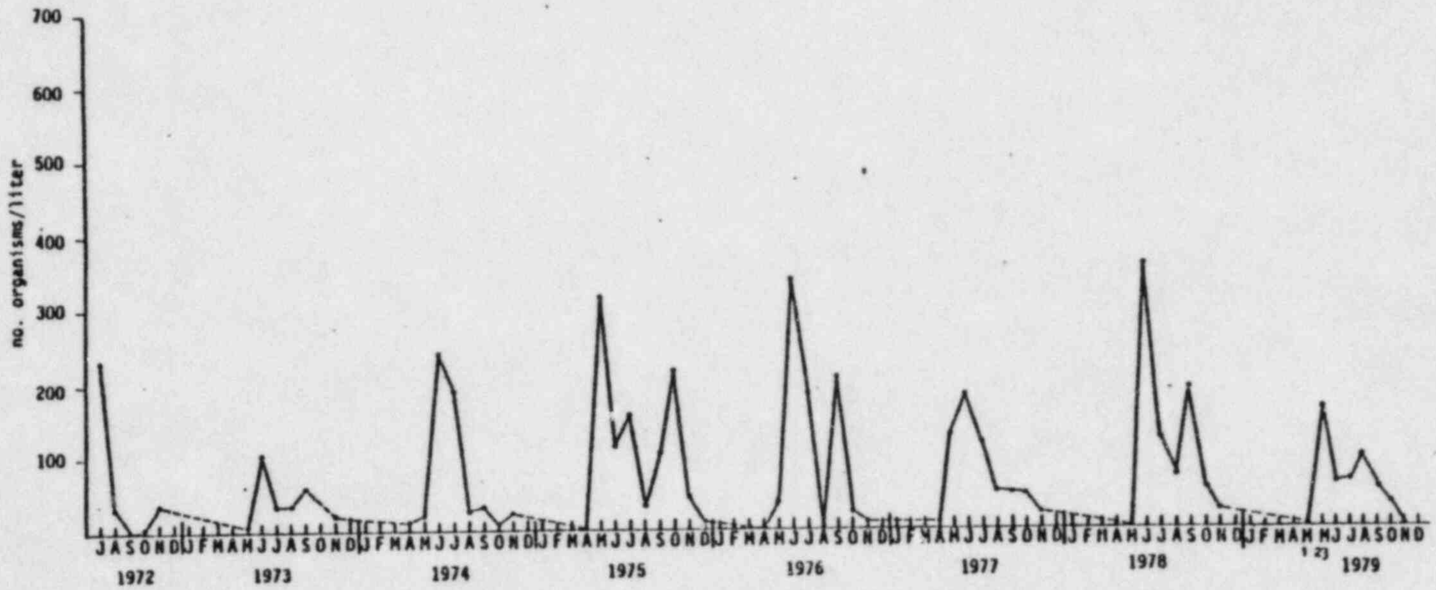
*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 56. MONTHLY MEAN COPEPOD POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 57. MONTHLY MEAN CLADOCERAN POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 68. Comparison of Pre-operational and Operational Data for Zooplankton Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

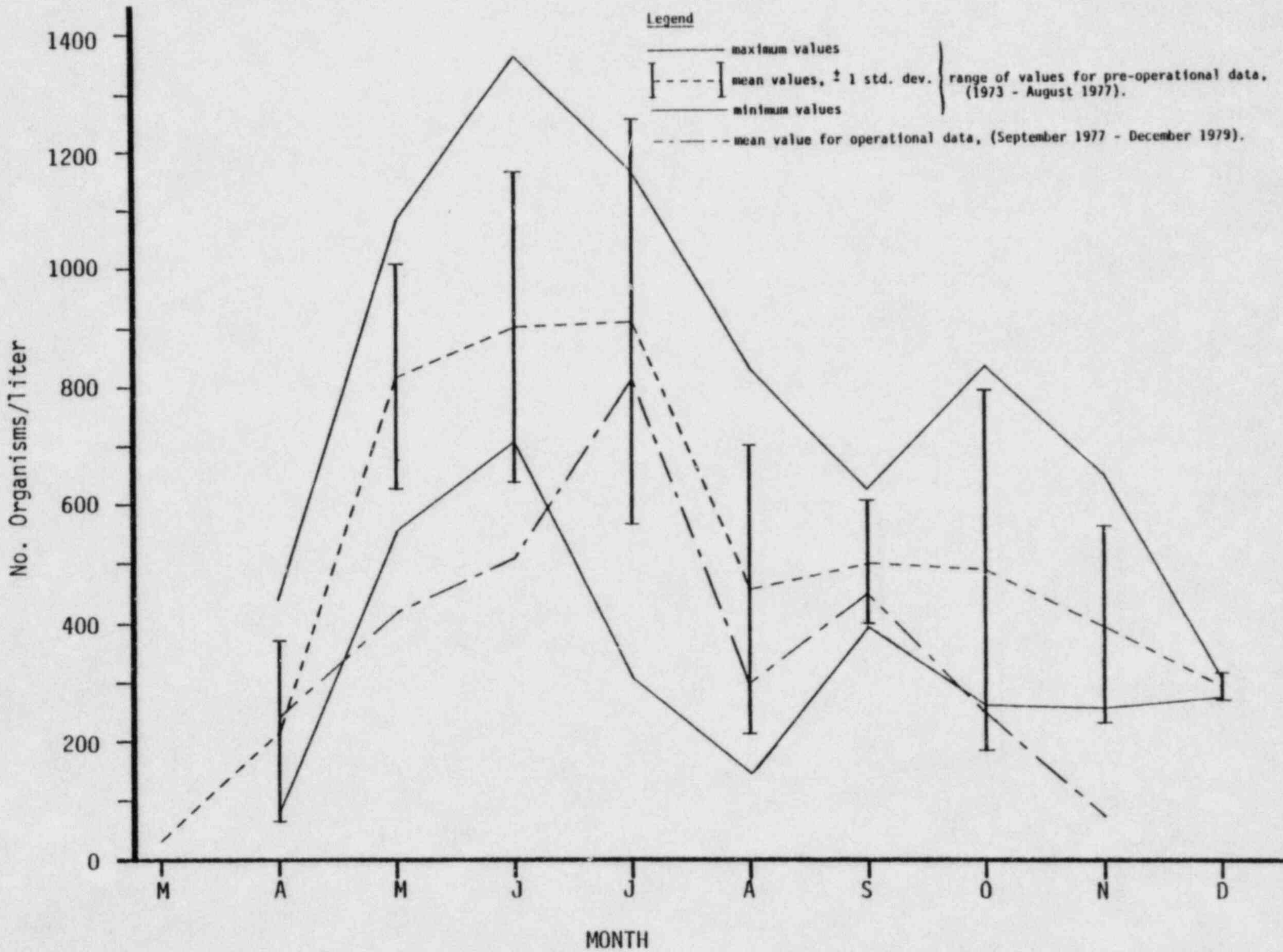


Figure 59. Comparison of Pre-operational and Operational Data for Zooplankton Rotifer Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

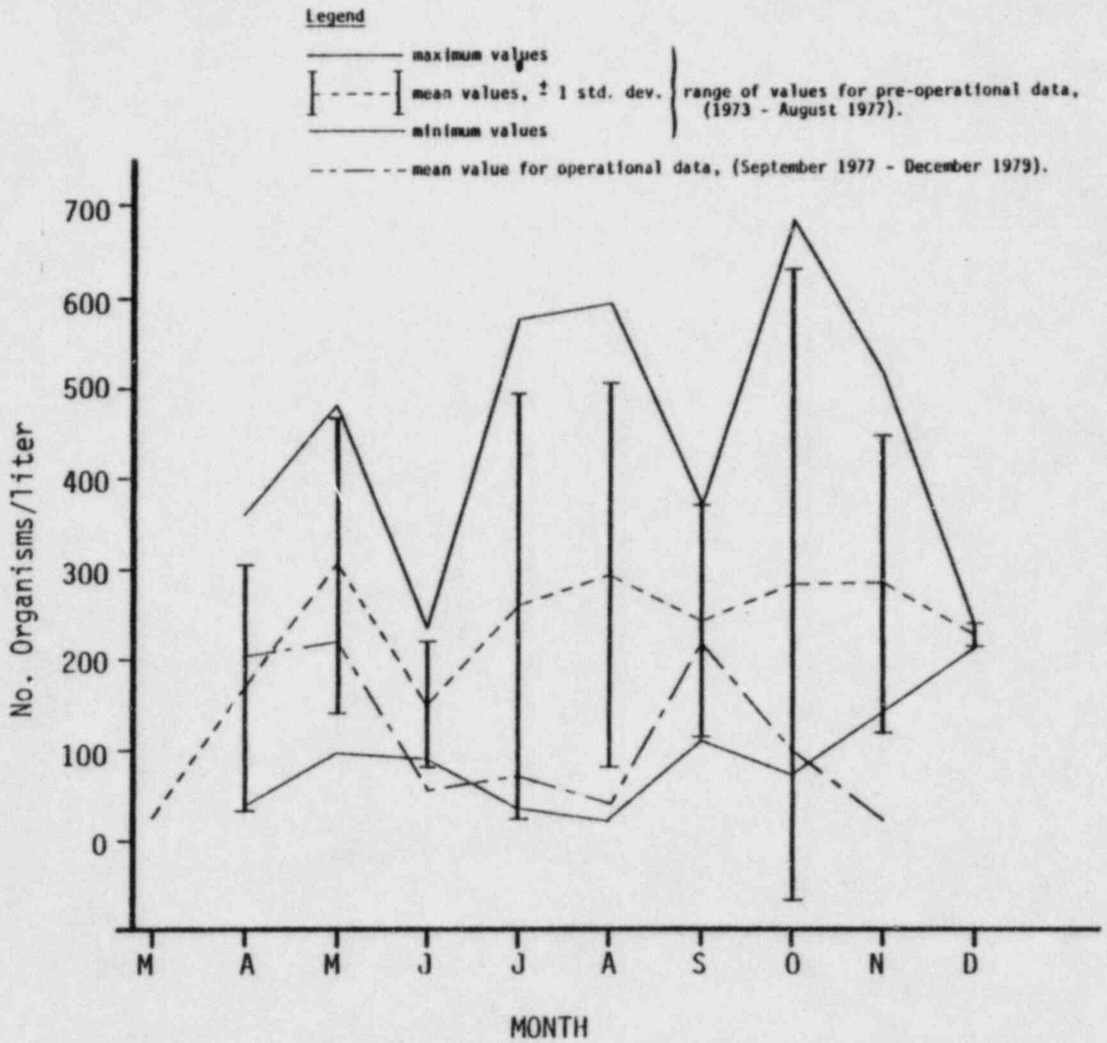


Figure 60. Comparison of Pre-operational and Operational Data for Zooplankton Copepod Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

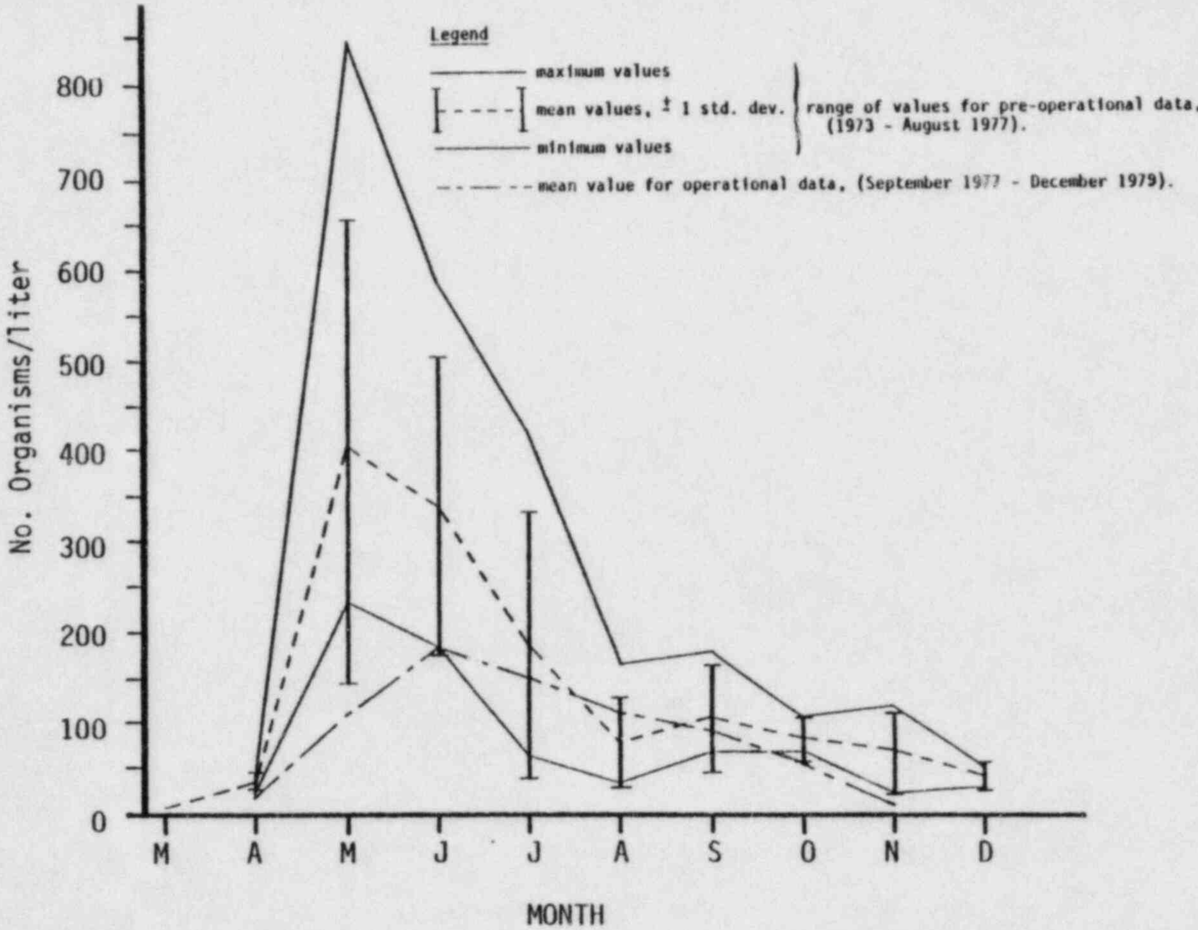


Figure 61. Comparison of Pre-operational and Operational Data for Zooplankton Cladoceran Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

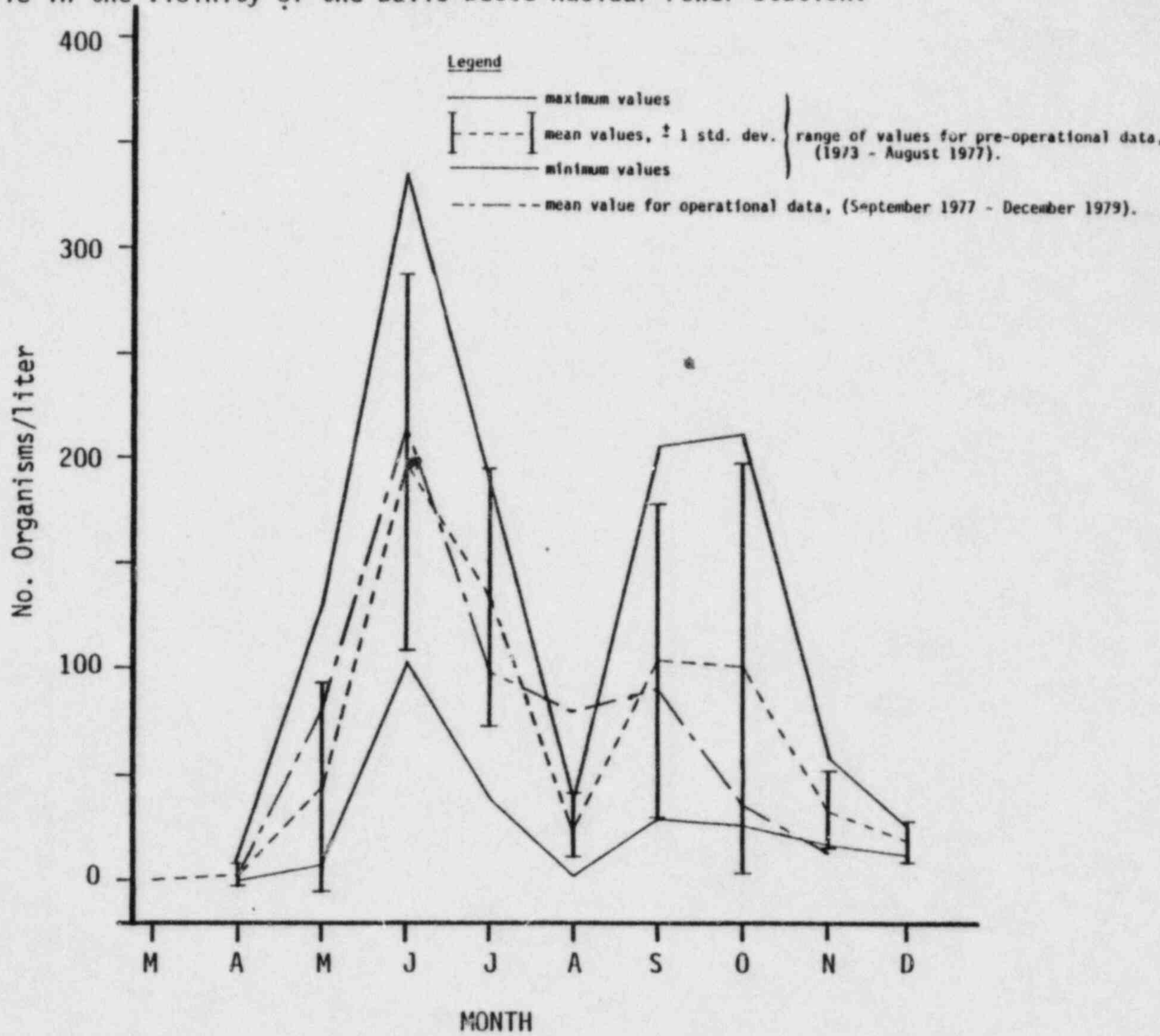


Figure 62. Comparison of Pre-operational and Operational Data for Zooplankton Densities at the Station Intake (Sta. No. 8).

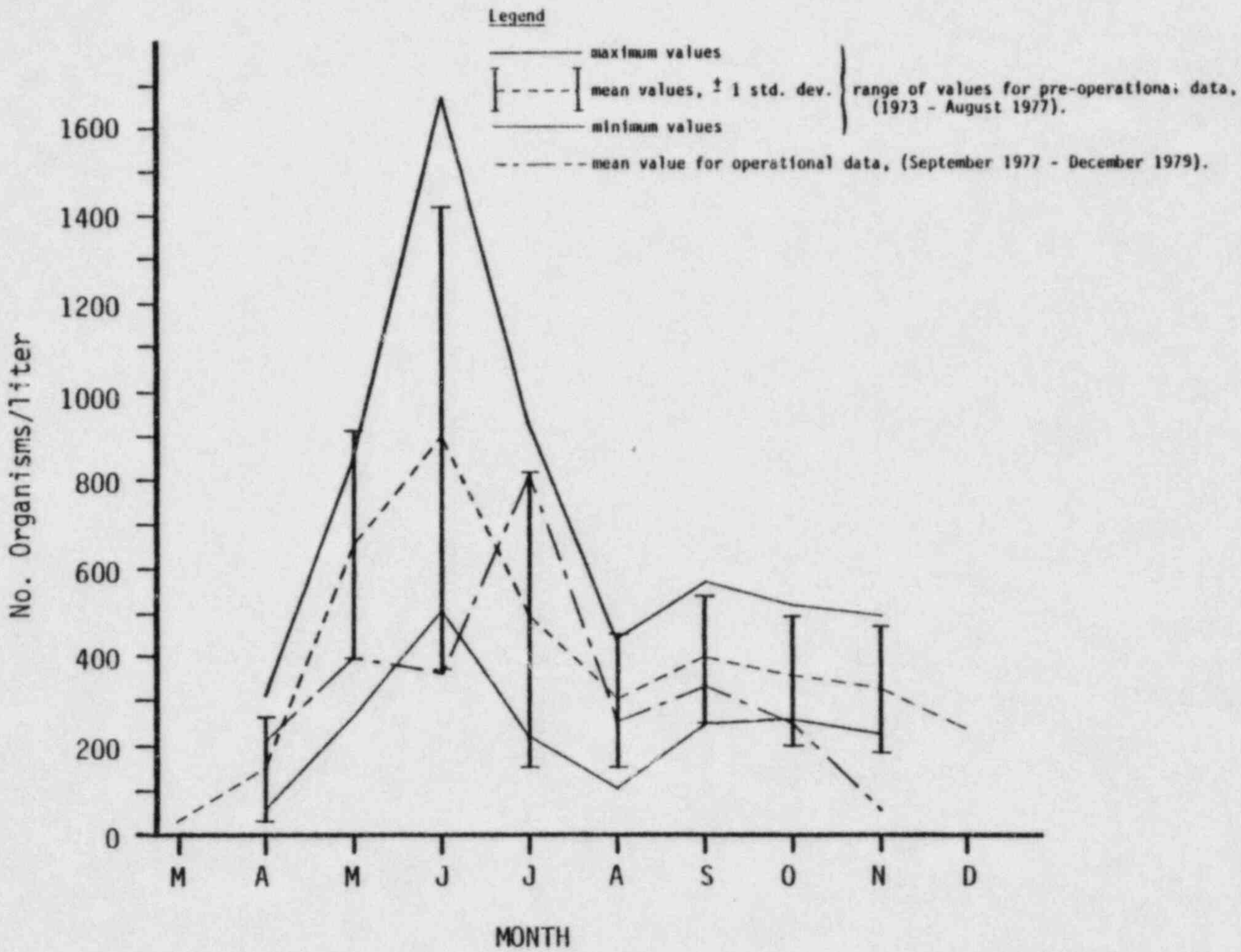


Figure 63. Comparison of Pre-operational and Operational Data for Zooplankton Densities at the Station Discharge (Sta. No. 13).

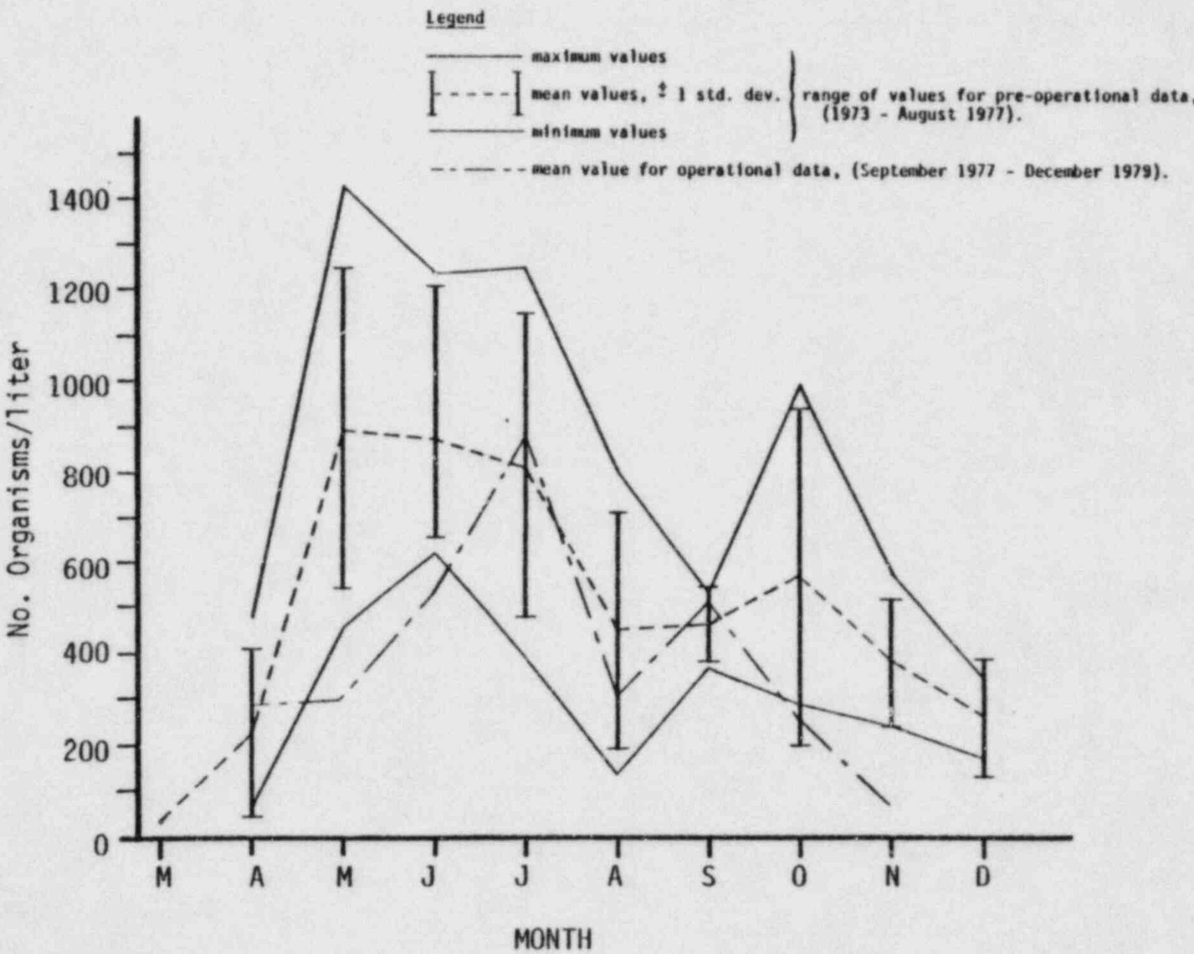


Figure 64. Comparison of Pre-operational and Operational Data for Zooplankton Densities at a Control Station (Sta. No. 3).

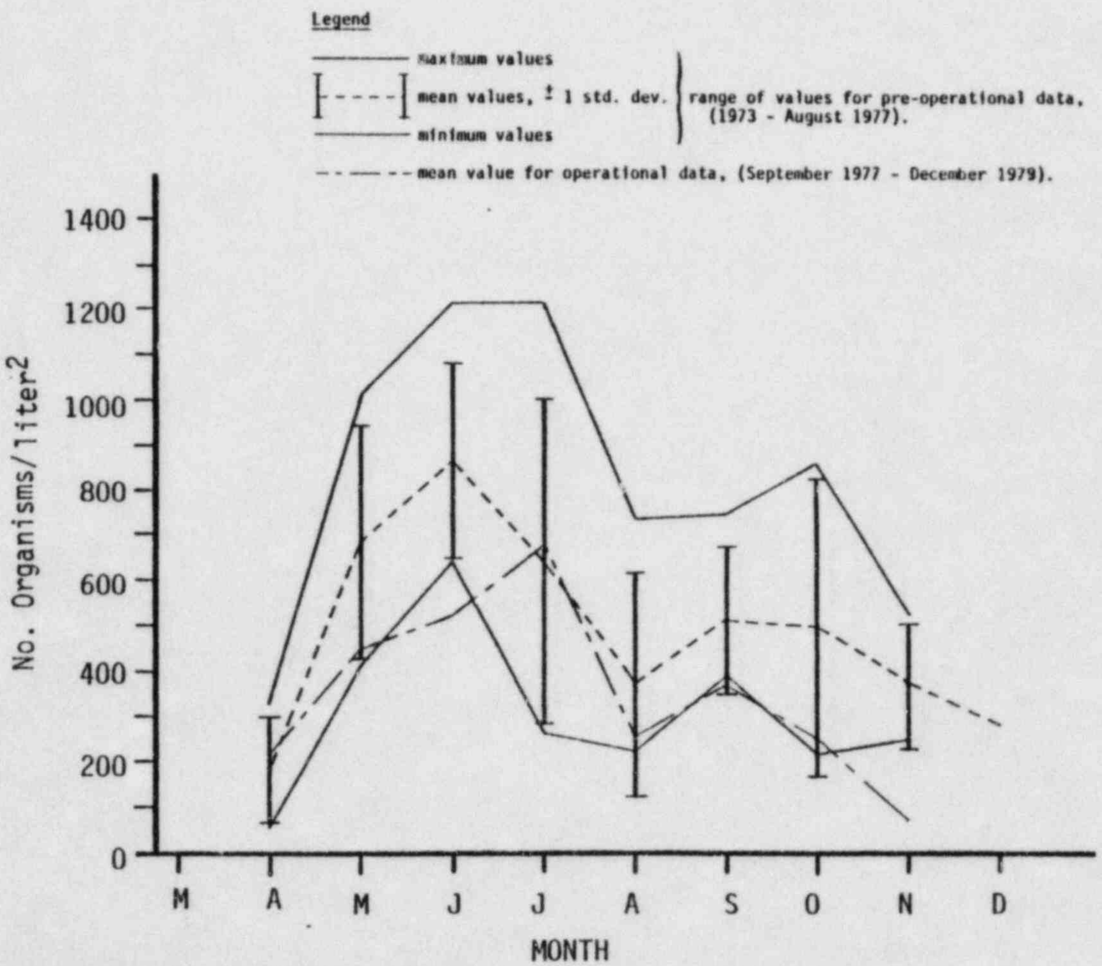
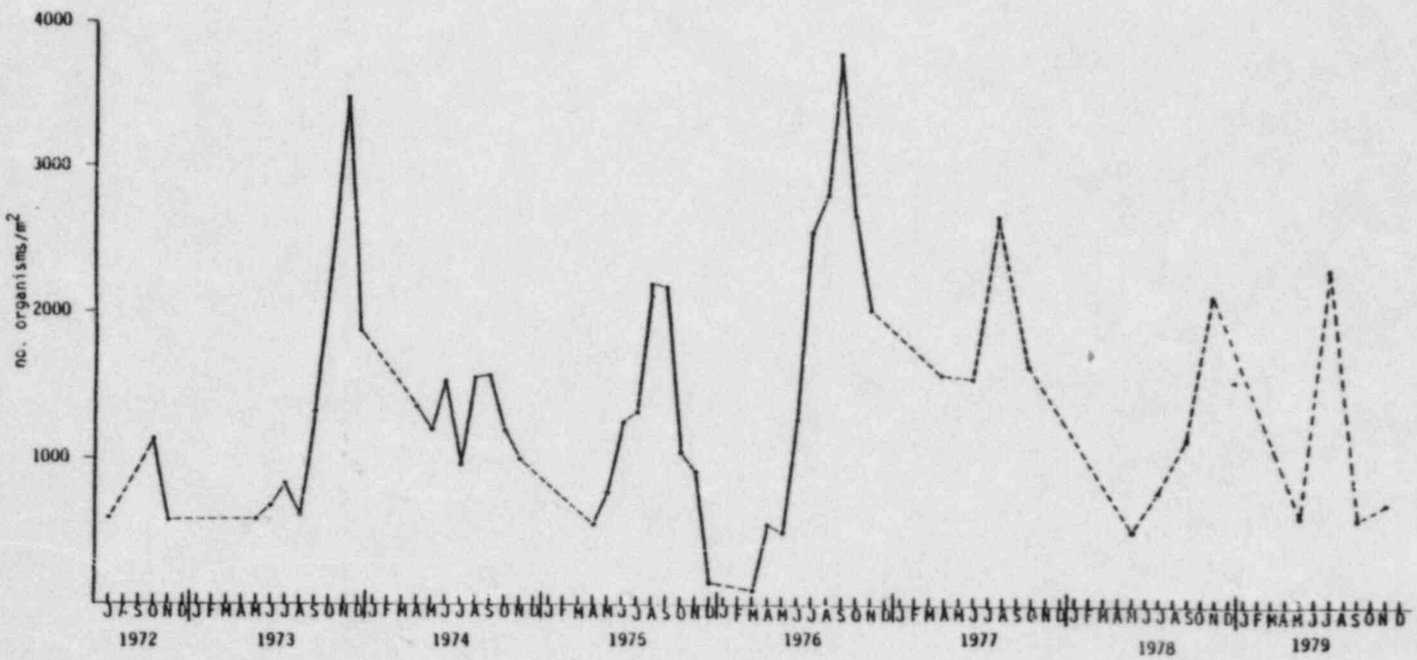


FIGURE 65 MONTHLY MEAN BENTHIC MACROINVERTEBRATE POPULATIONS
FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

Figure 66. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

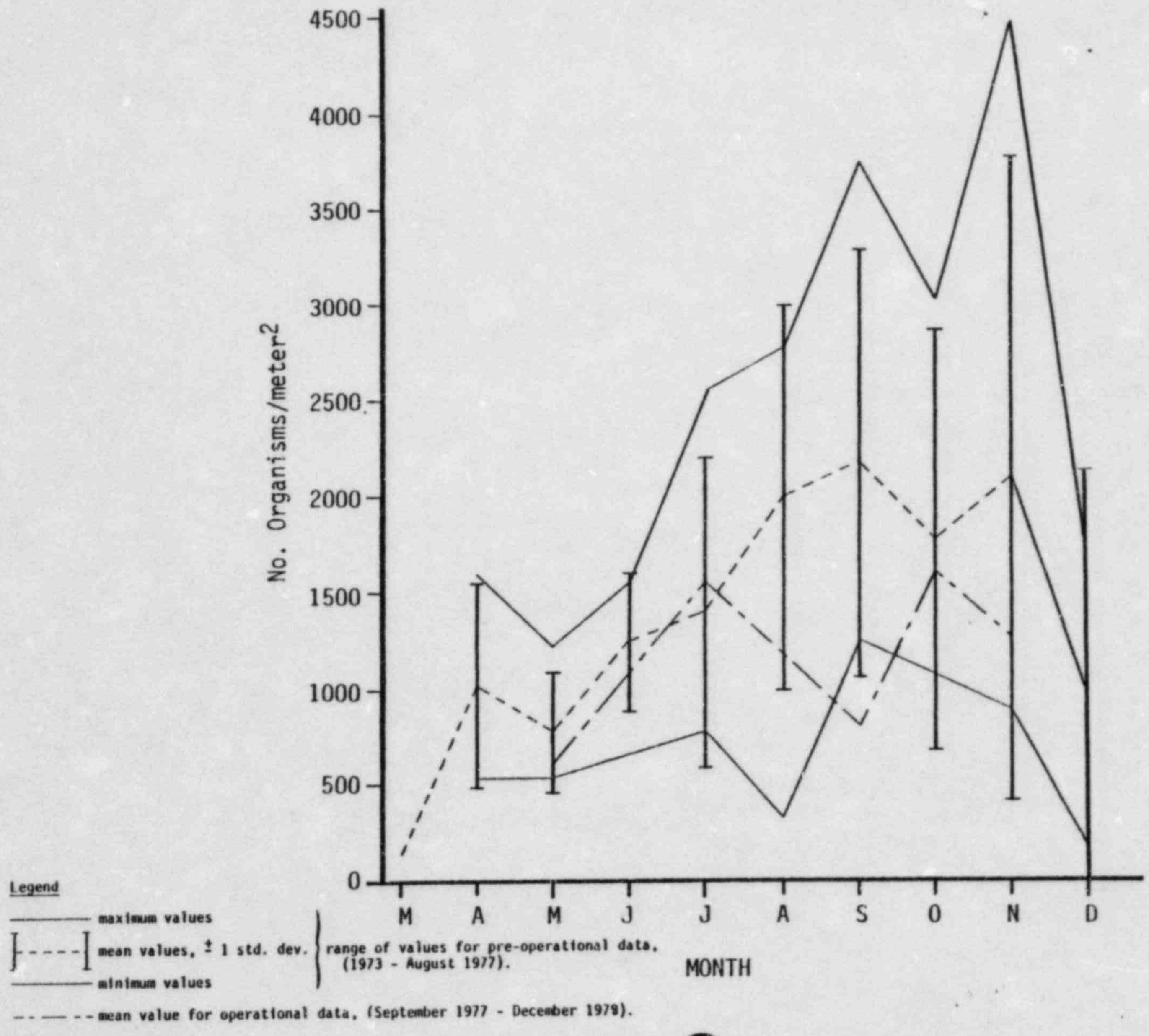


Figure 67. Comparison of Pre-operational and Operational Data for Benthic Coelenterate Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

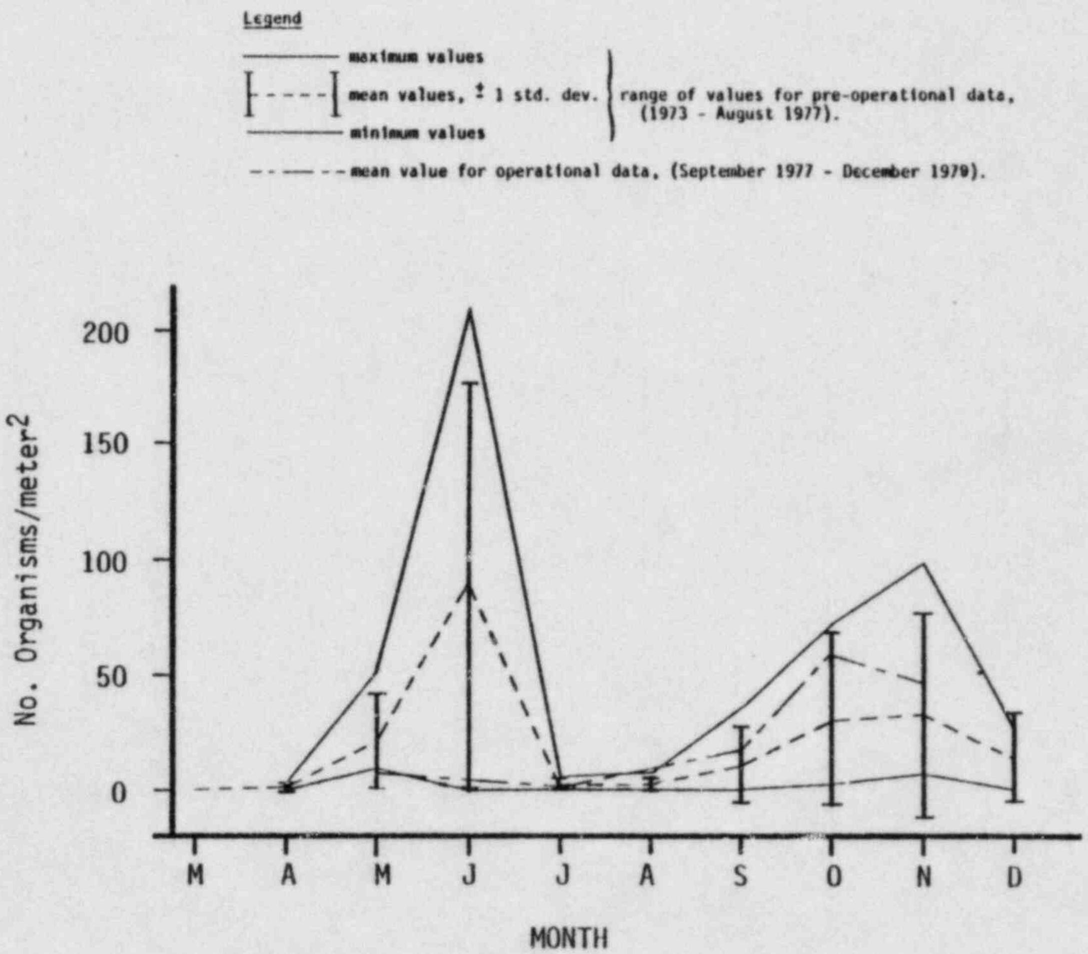


Figure 68. Comparison of Pre-operational and Operational Data for Benthic Annelid Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

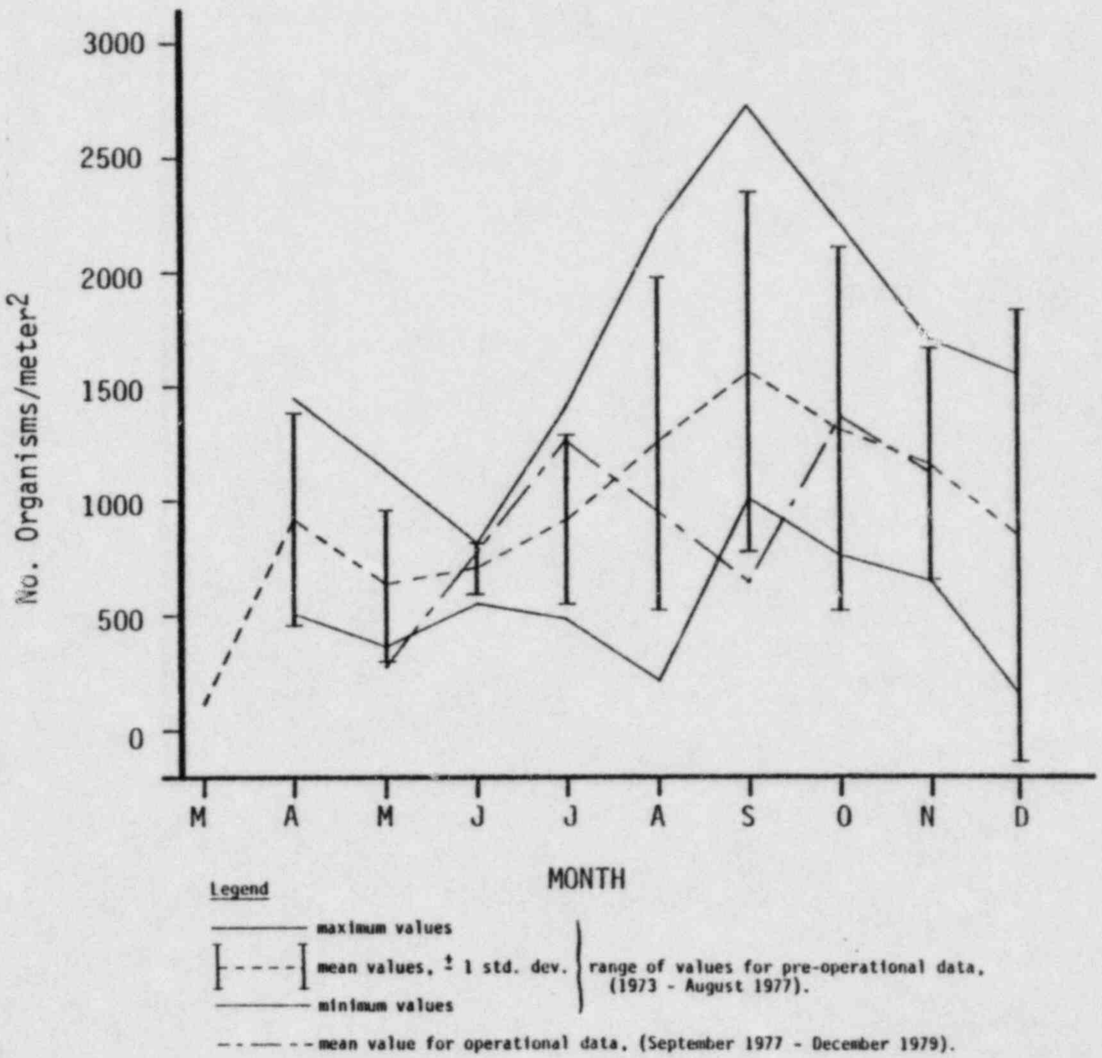


Figure 69. Comparison of Pre-operational and Operational Data for Benthic Arthropod Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

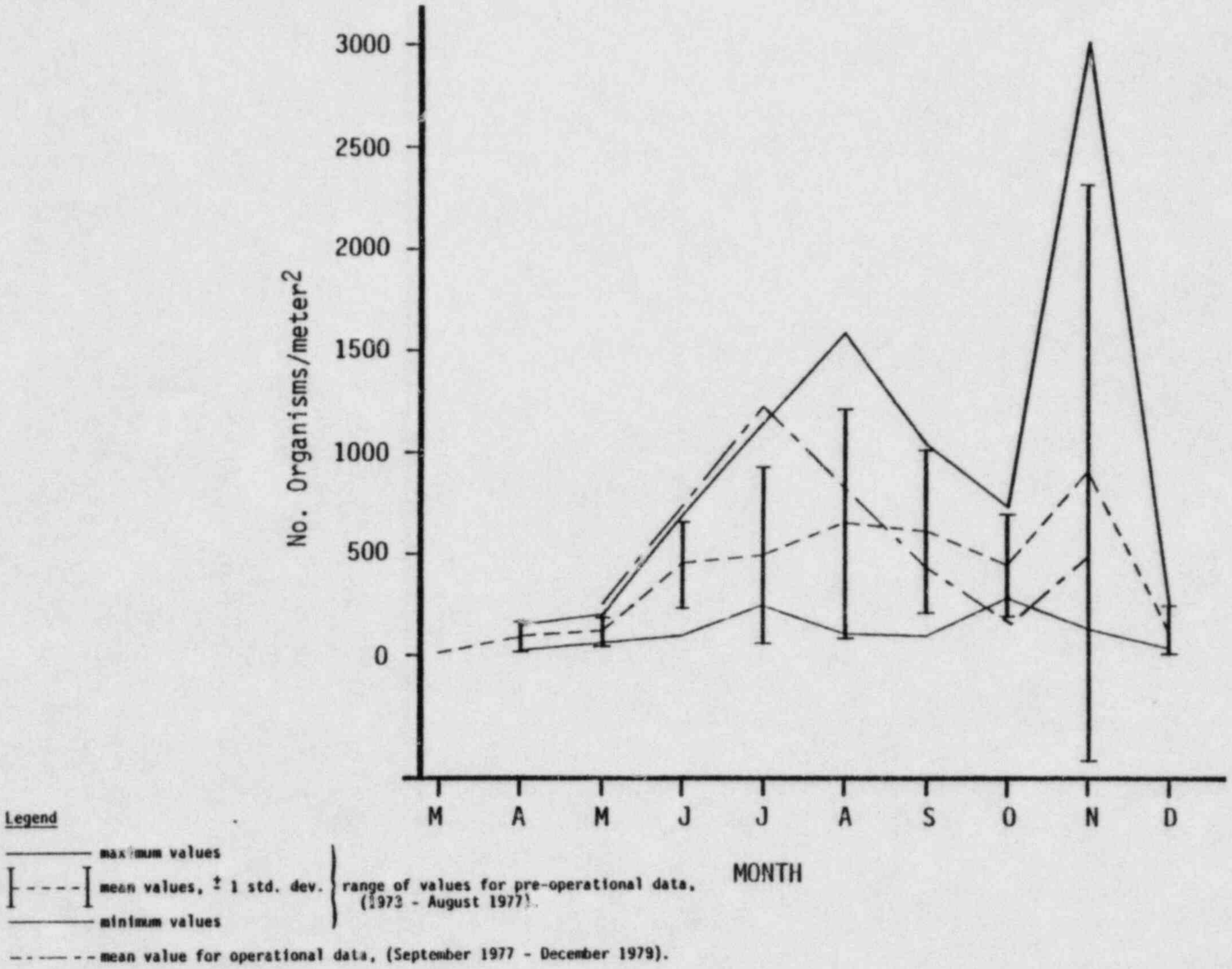


Figure 70. Comparison of Pre-operational and Operational Data for Benthic Mollusc Densities in Lake Erie in the Vicinity of the Davis-Besse Nuclear Power Station.

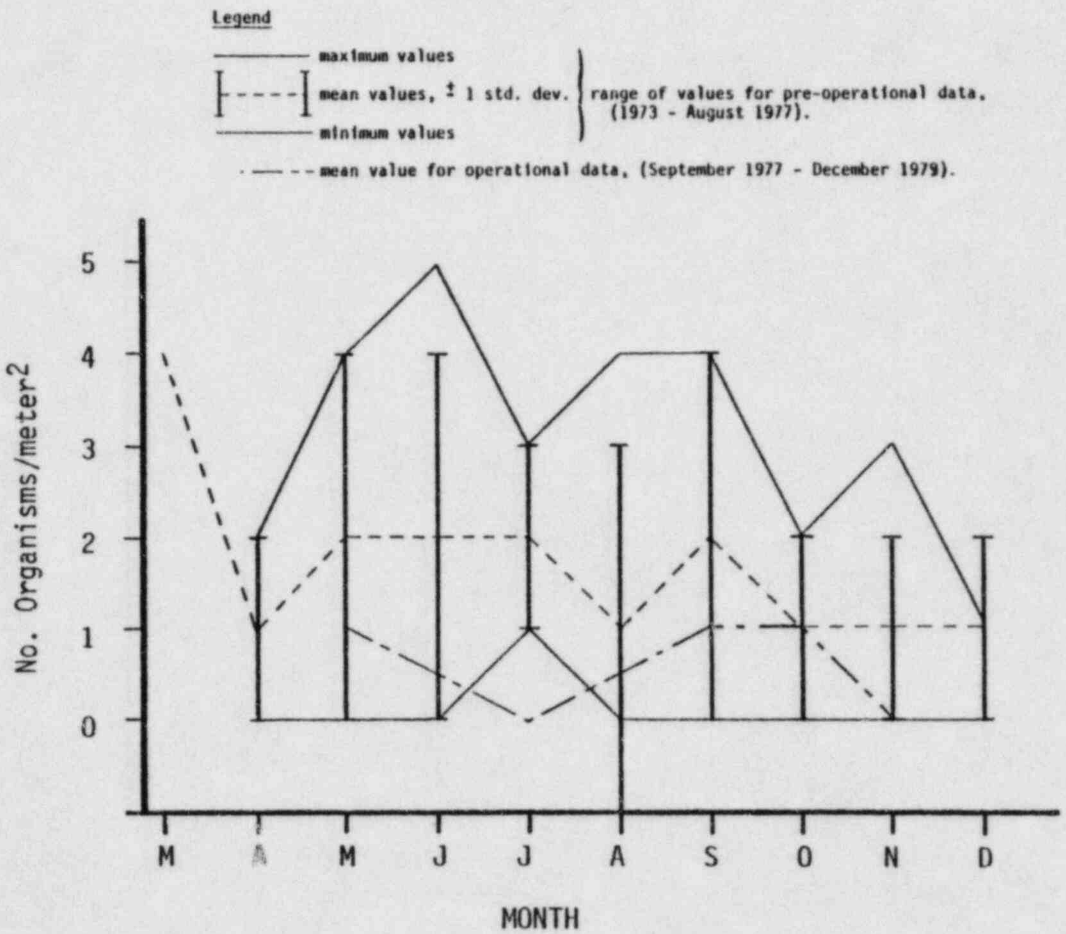


Figure 71. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at the Station Intake (Sta. No. 8).

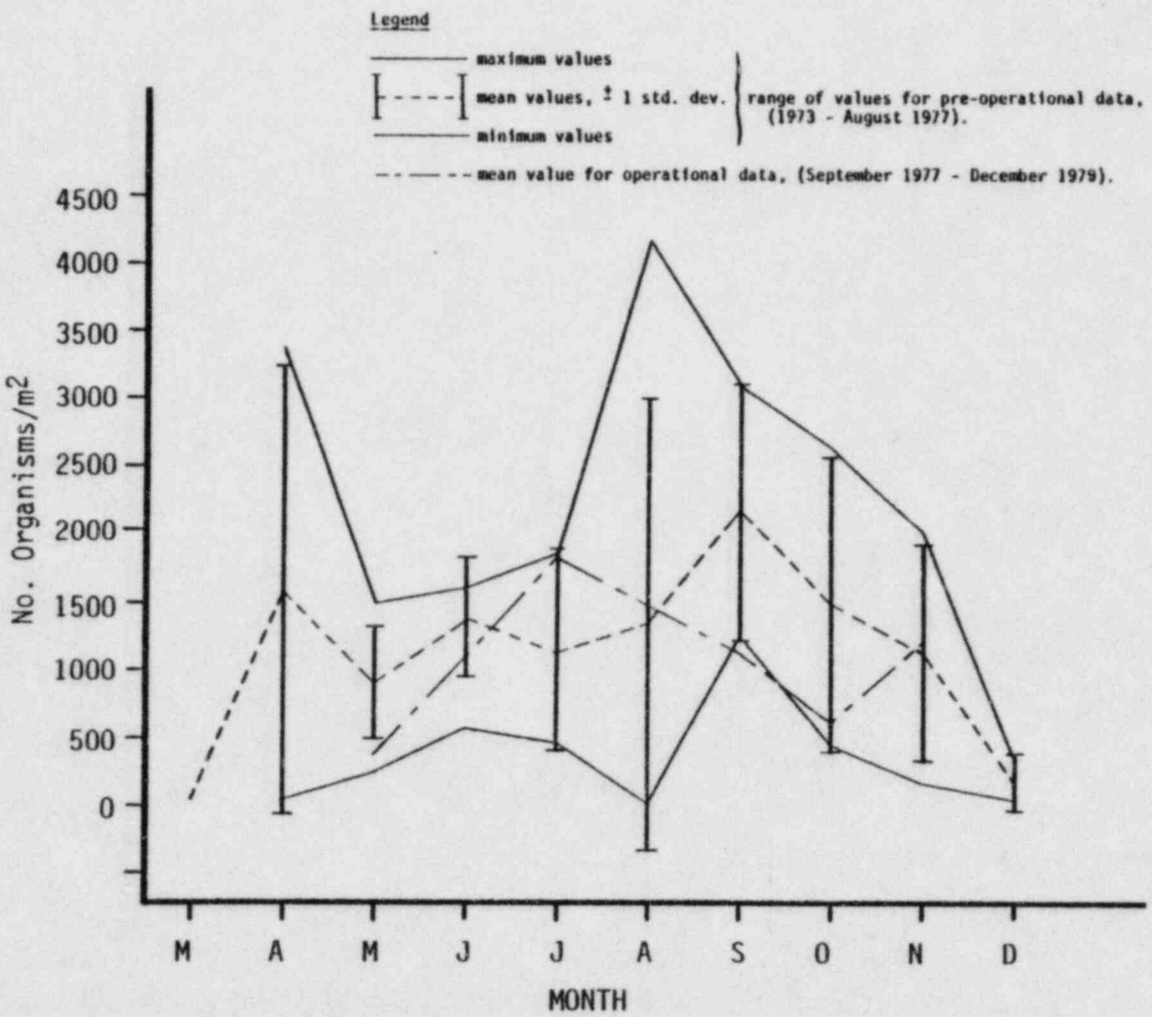


Figure 72. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at the Station Discharge (Sta. No. 13).

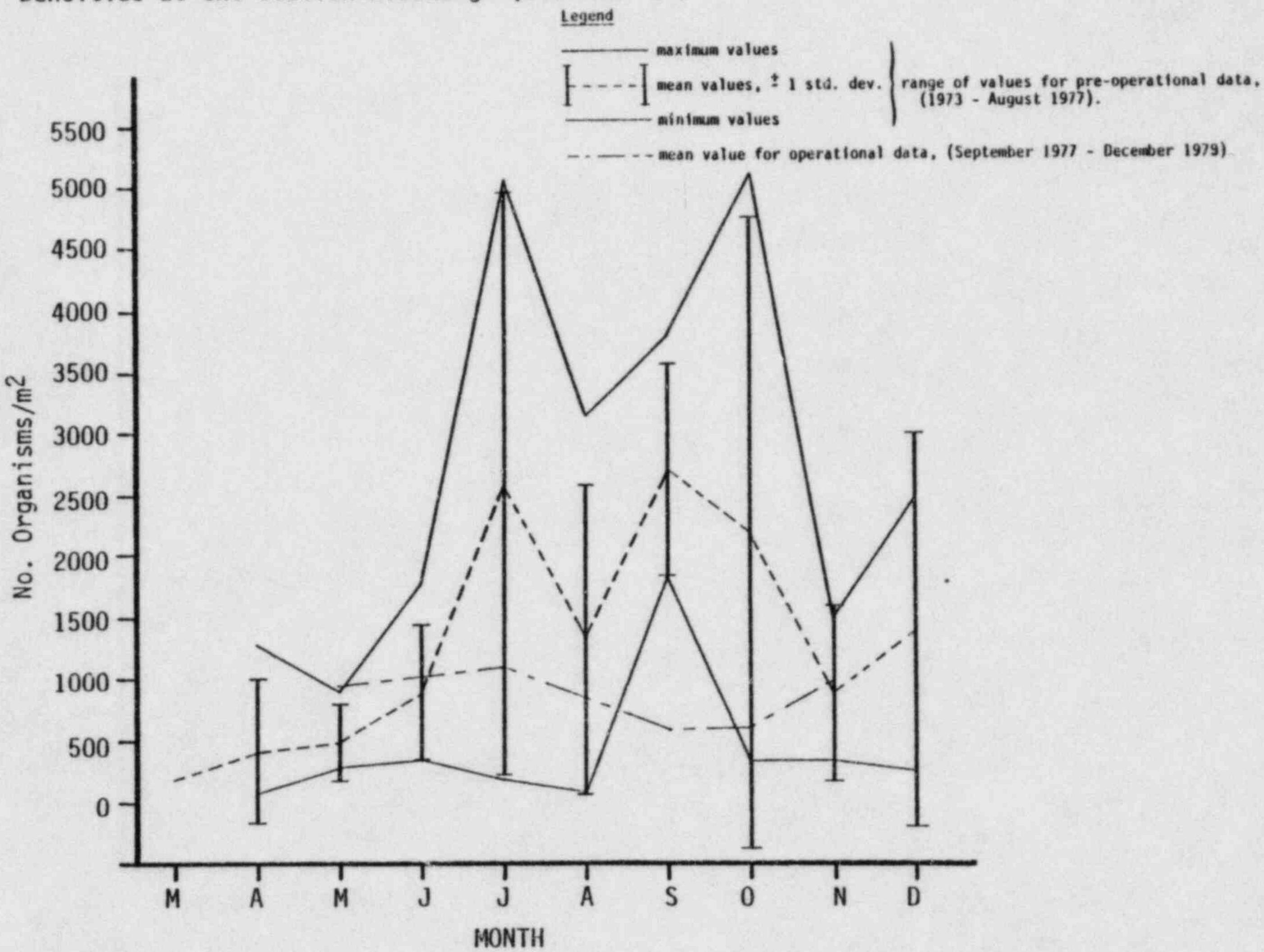


Figure 73. Comparison of Pre-operational and Operational Data for Benthic Macroinvertebrate Densities at a Control Station (Sta. No. 3).

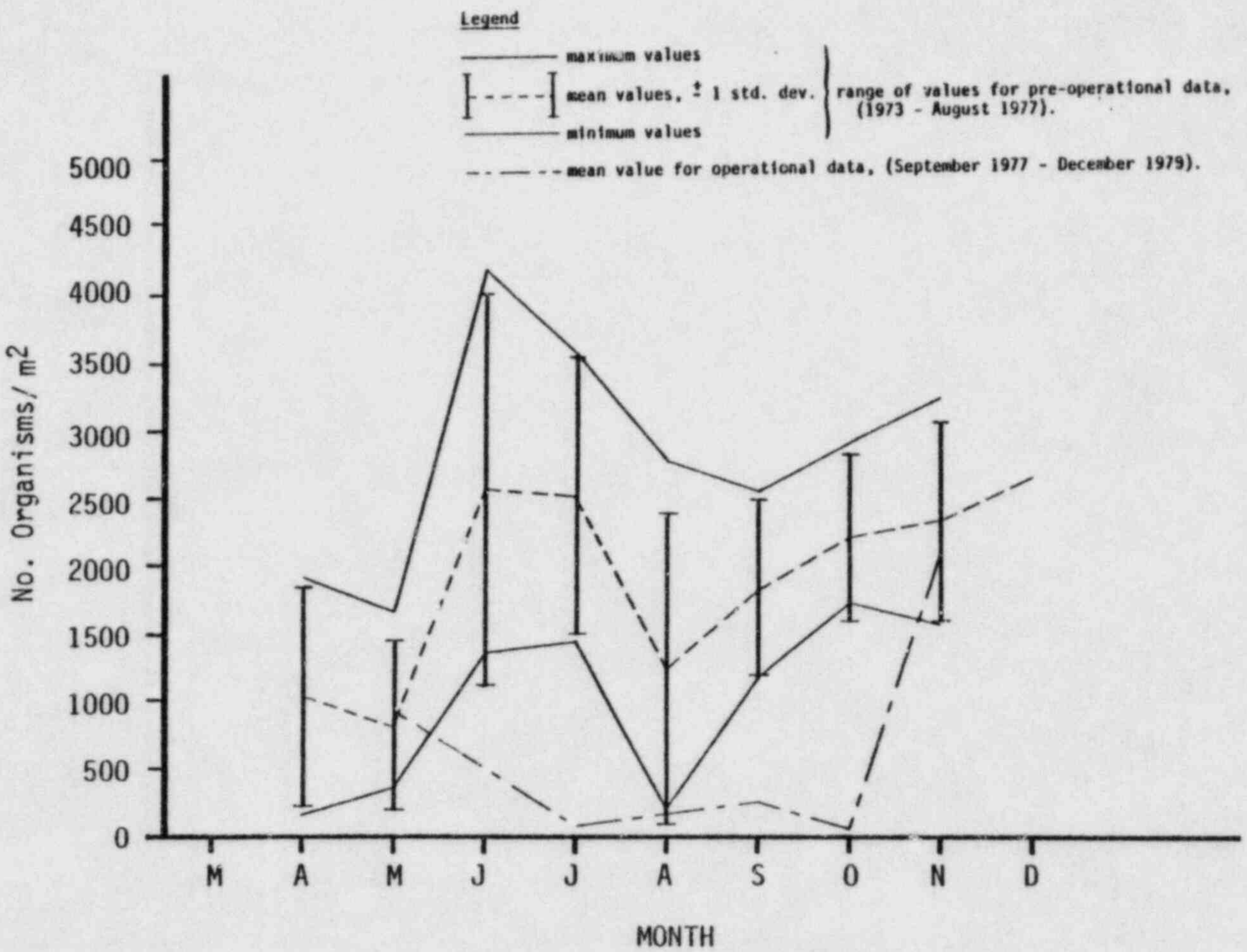


Figure 74. Comparison of Pre-operational and Operational Alewife Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

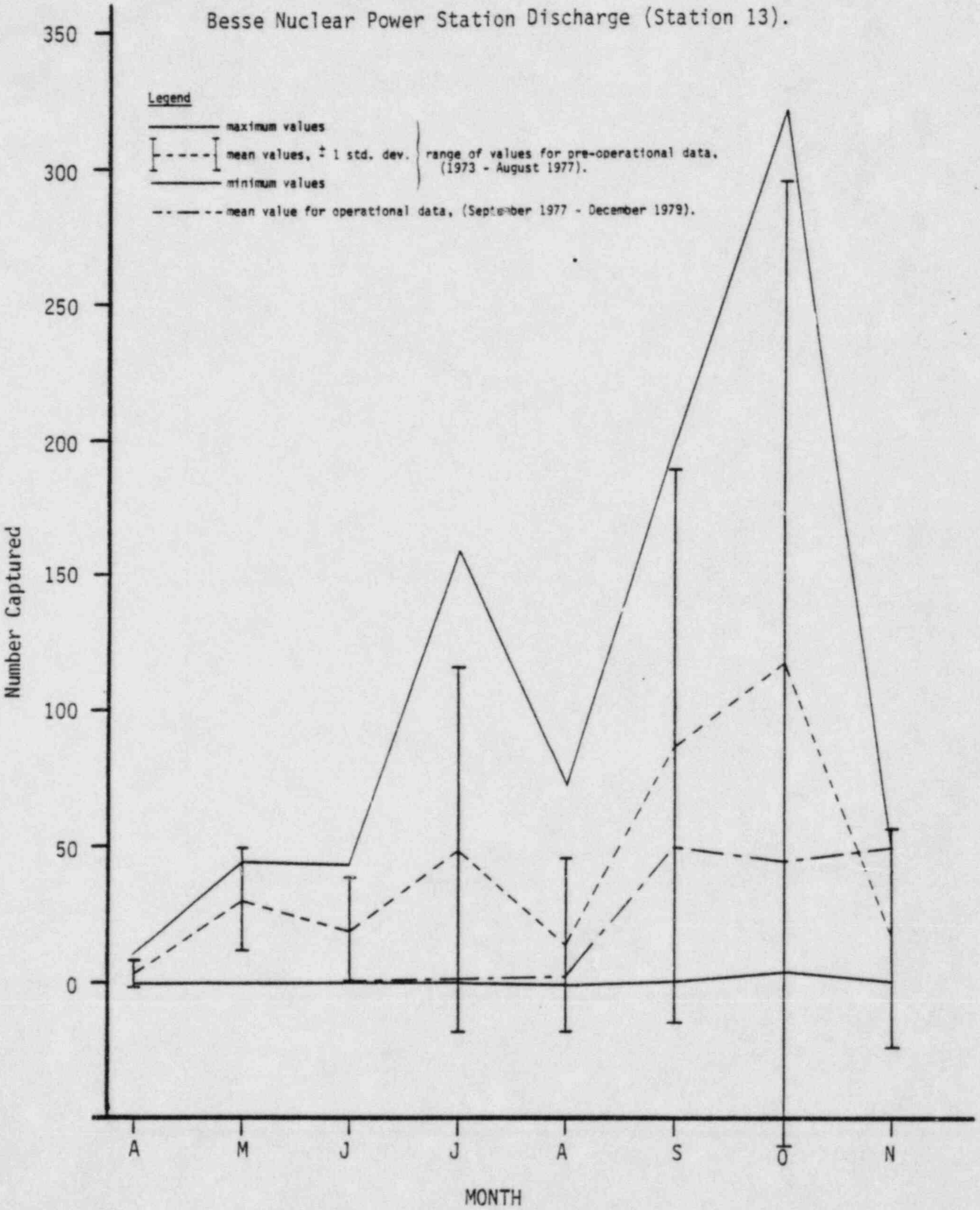


Figure 75. Comparison of Pre-operational and Operational Channel Catfish Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

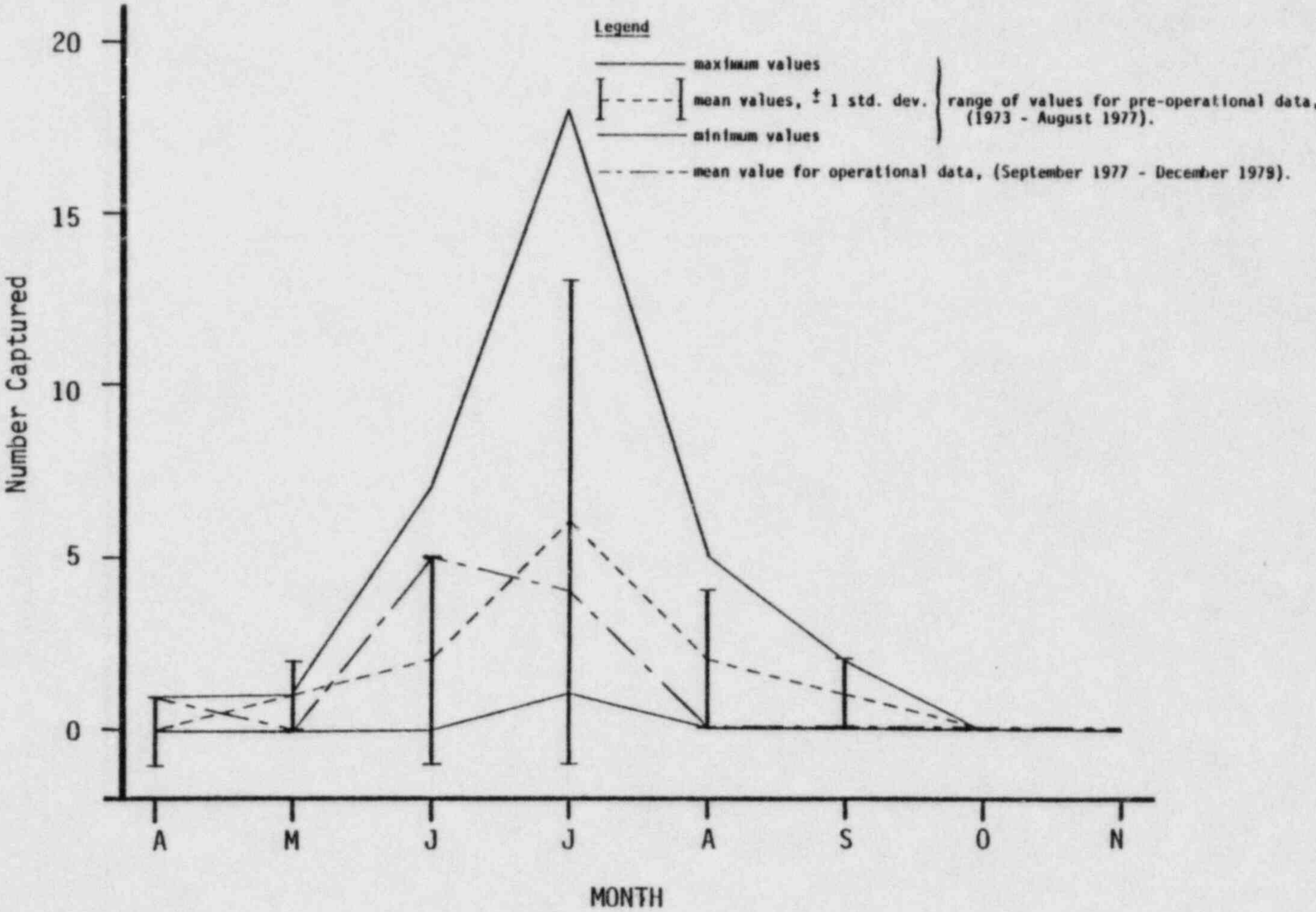


Figure 76. Comparison of Pre-operational and Operational Freshwater Drum Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

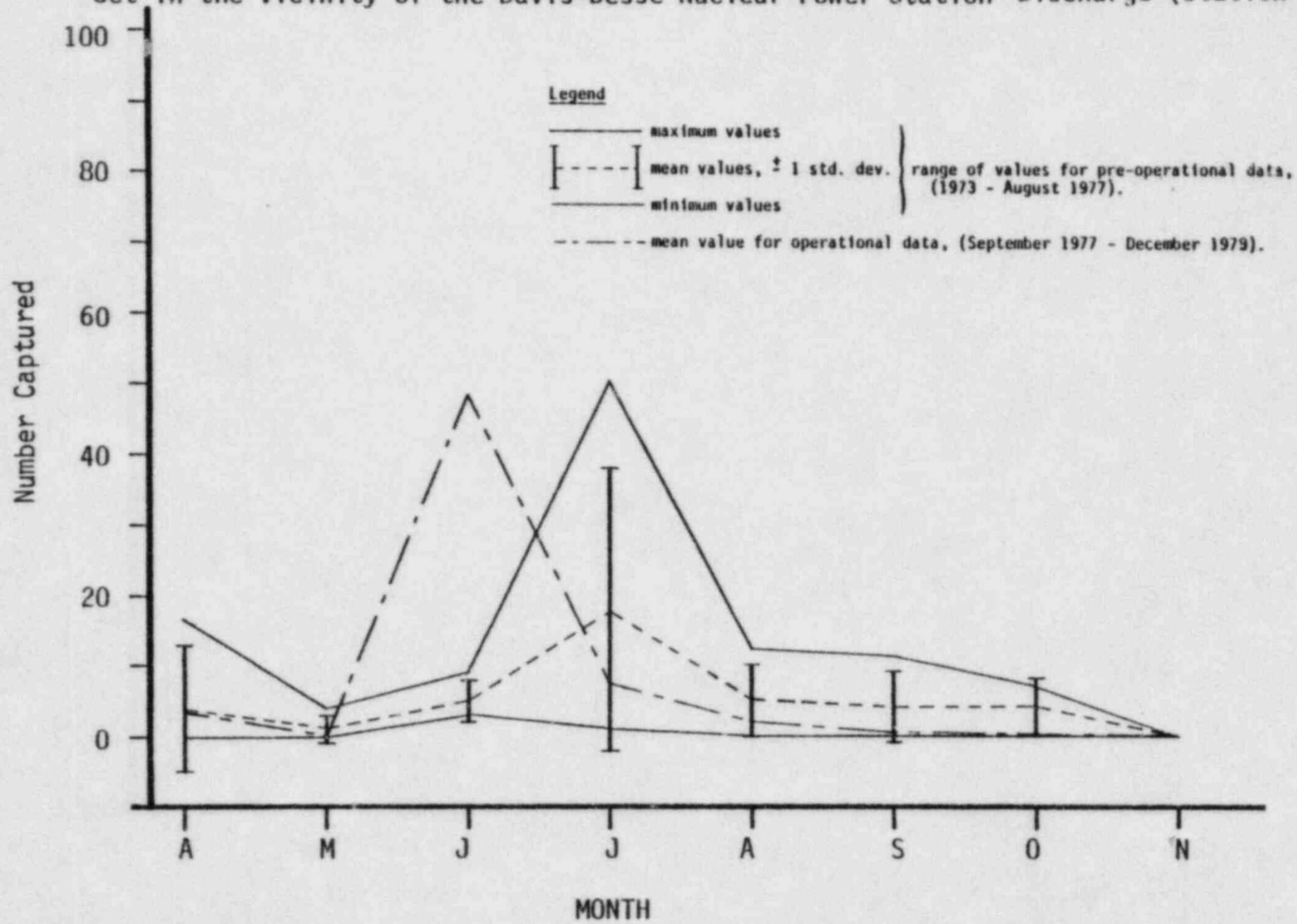


Figure 77. Comparison of Pre-operational and Operational Gizzard Shad Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

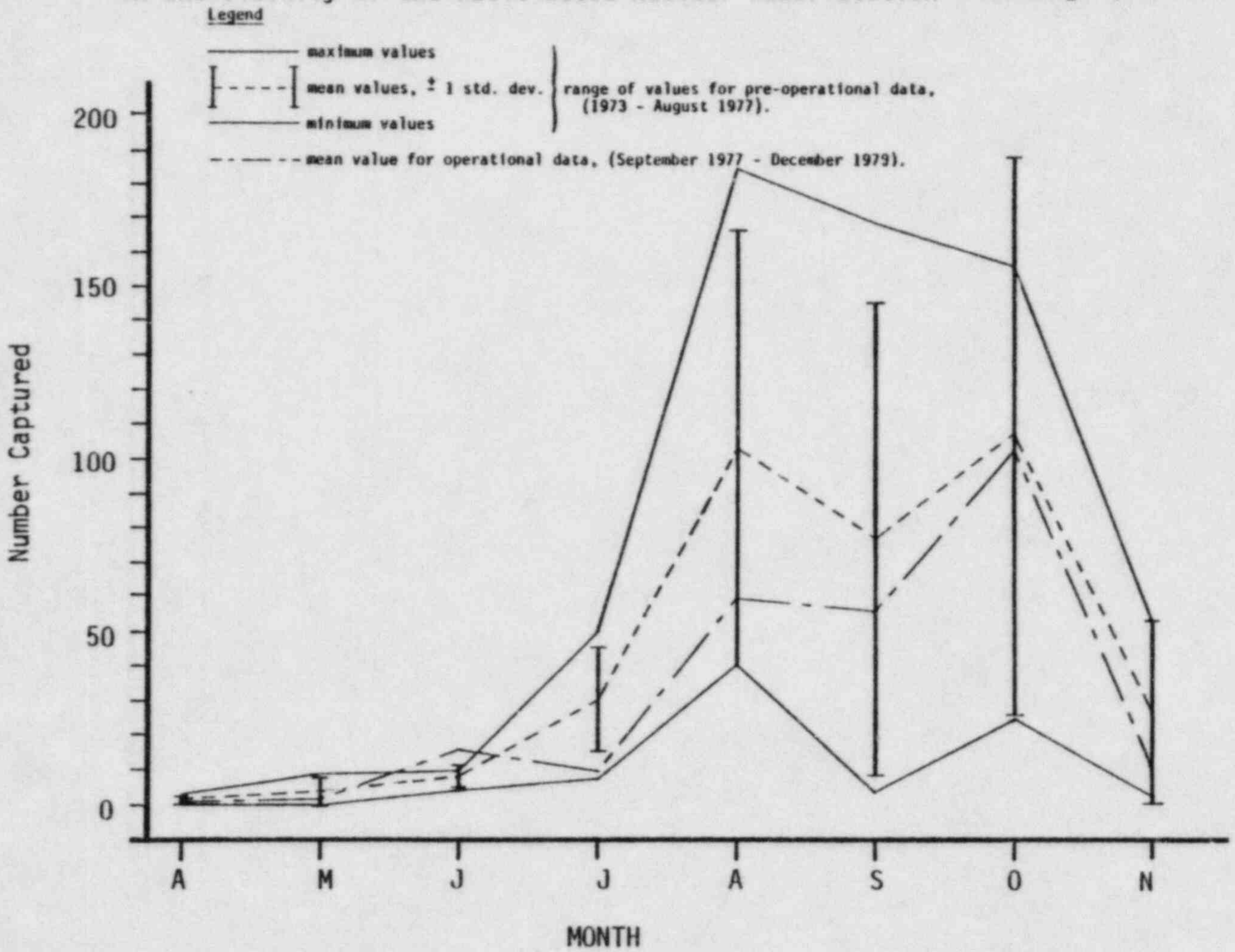


Figure 78. Comparison of Pre-operational and Operational Spottail Shiner Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

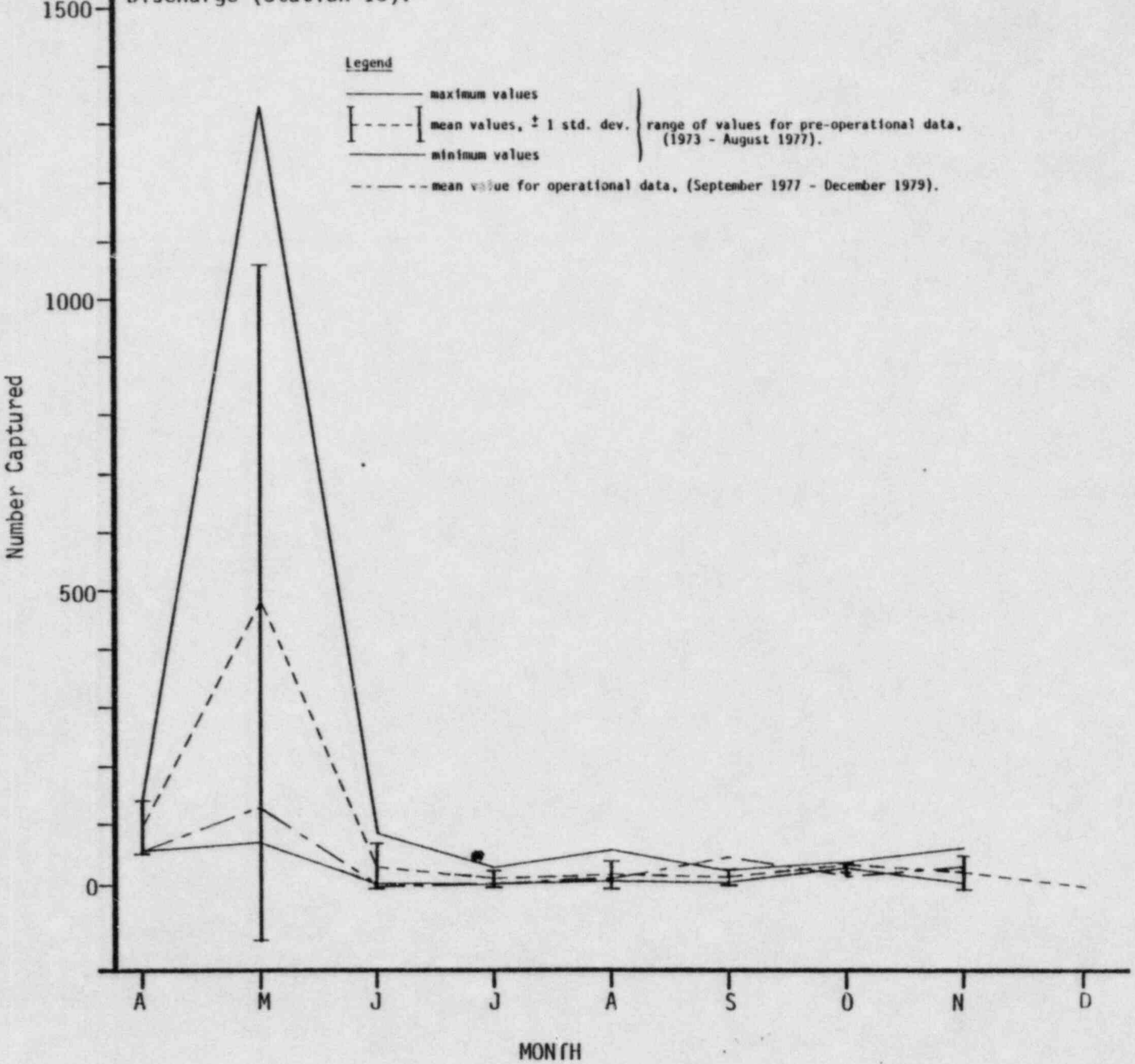


Figure 79. Comparison of Pre-operational and Operational Walleye Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

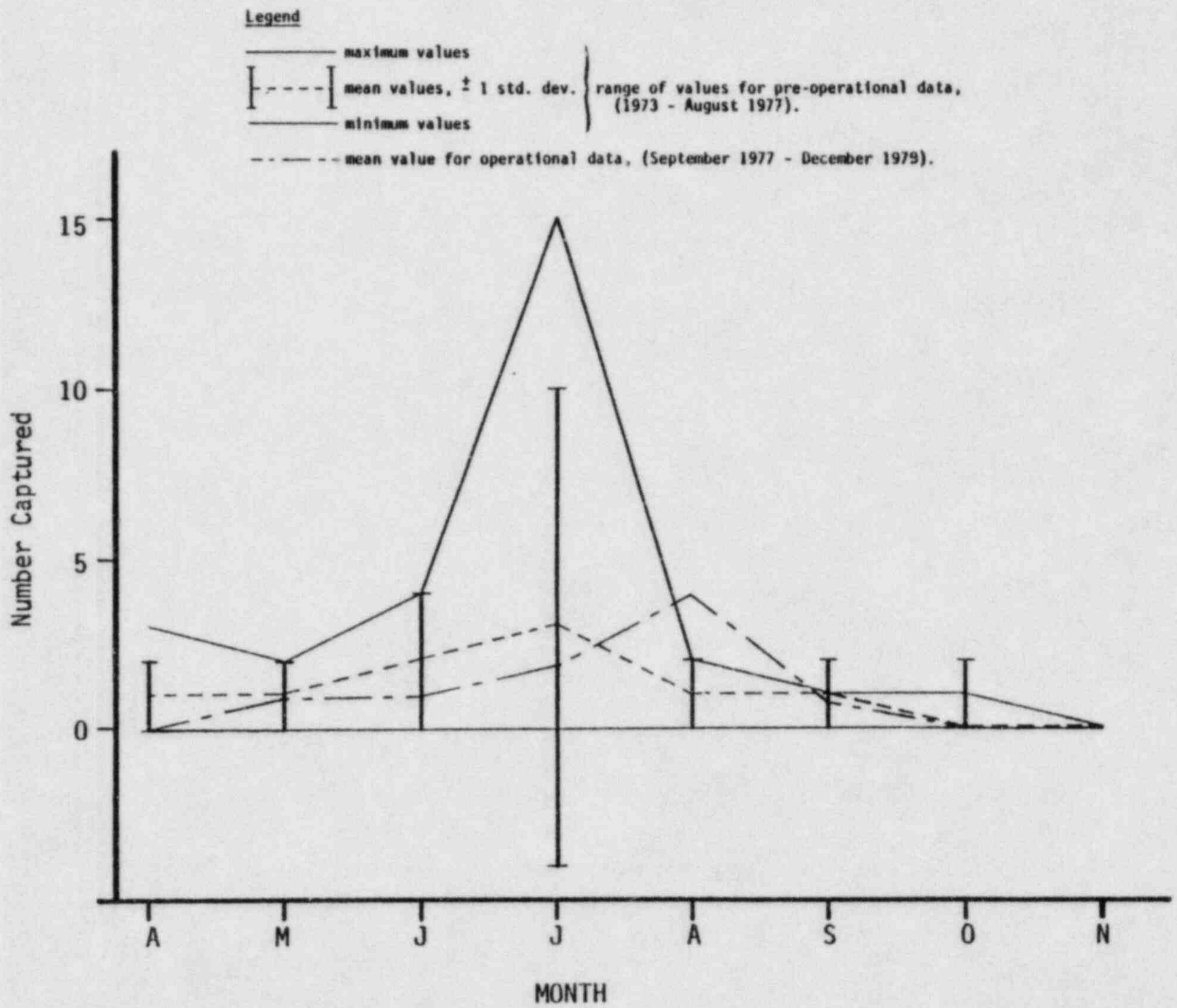


Figure 80. Comparison of Pre-operational and Operational White Bass Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

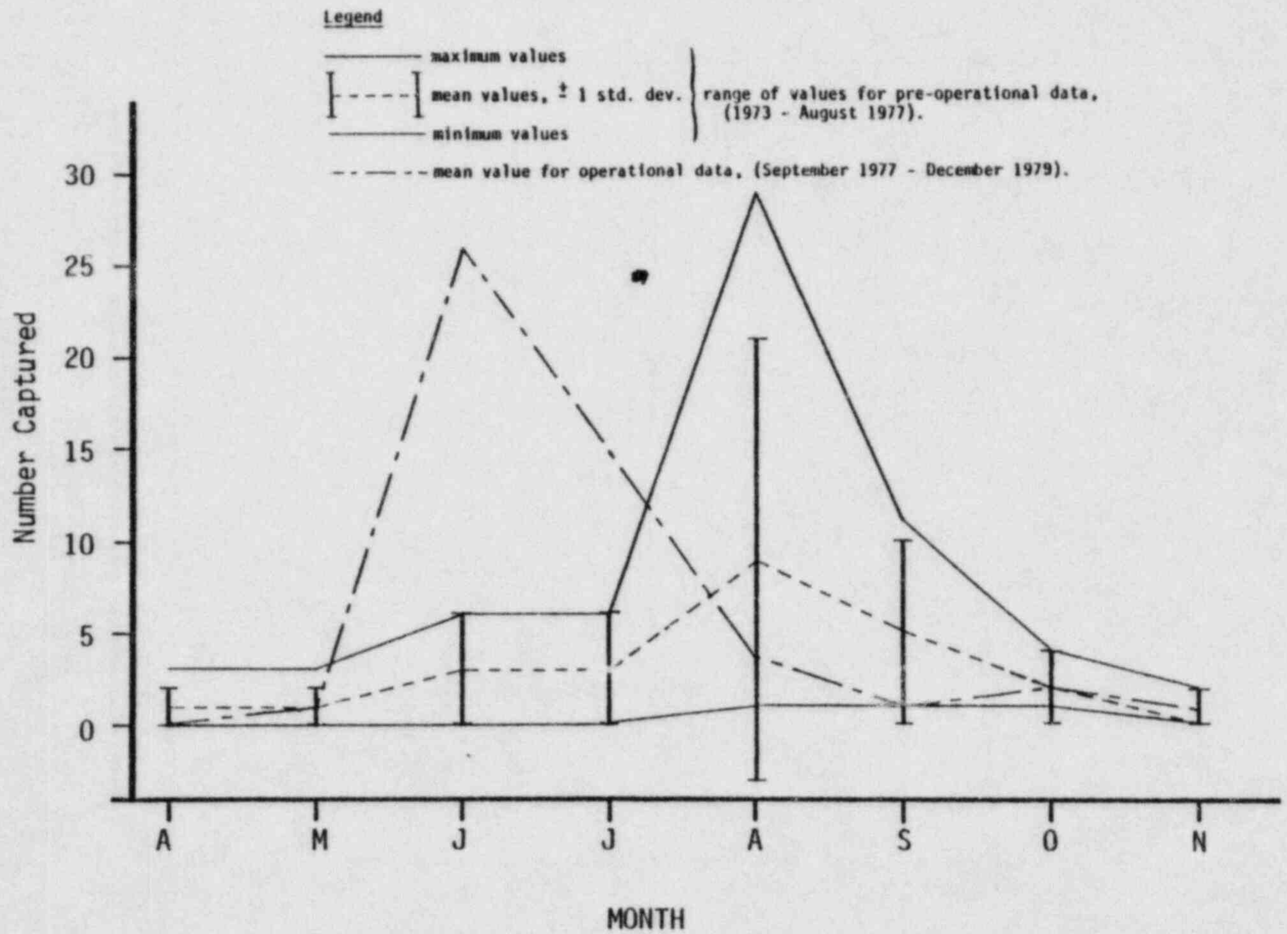


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Figure 81. Comparison of Pre-operational and Operational Yellow Perch Catches in Gill Nets Set in the Vicinity of the Davis-Besse Nuclear Power Station Discharge (Station 13).

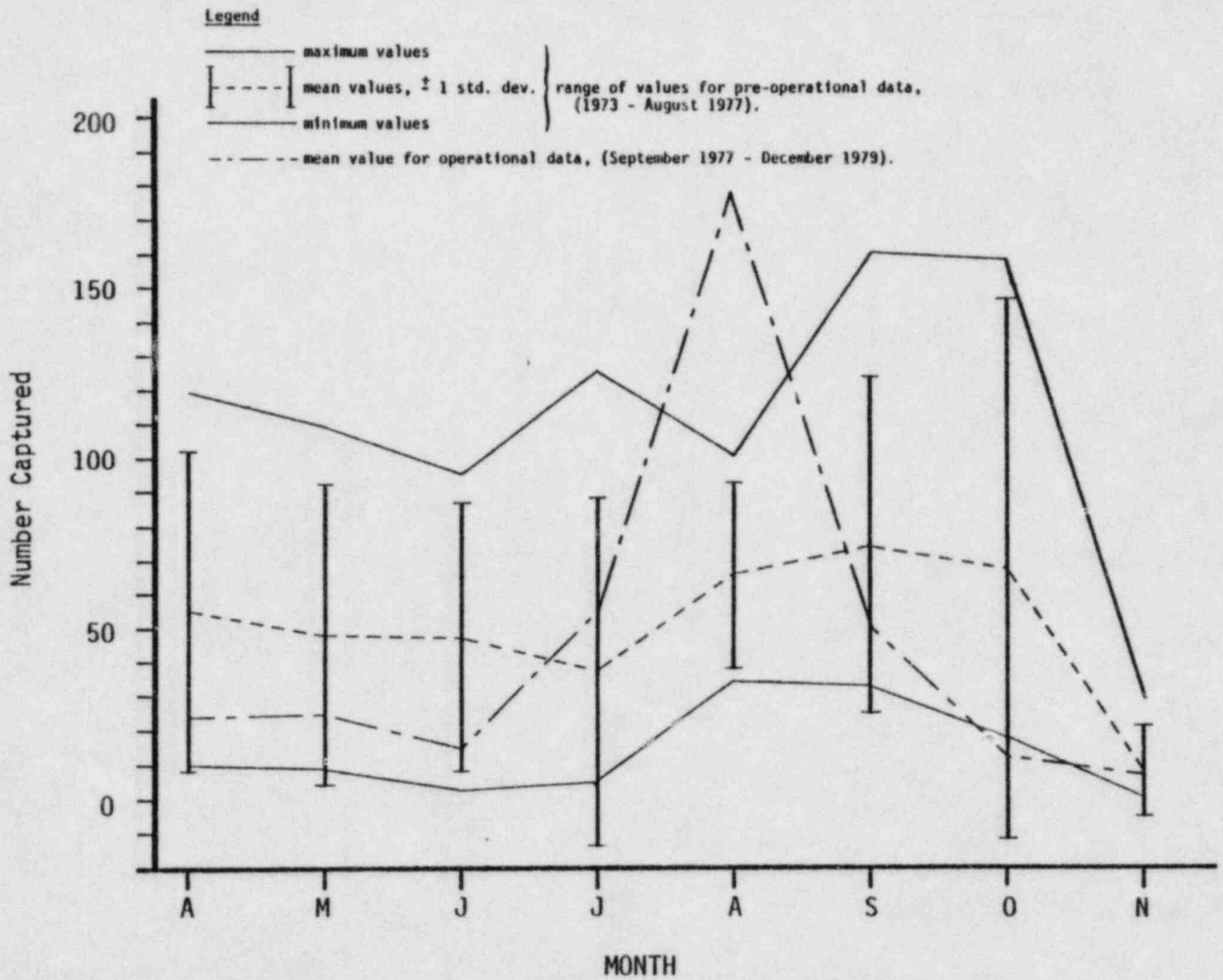


Figure 82. Comparison of Pre-operational and Operational Gill Net Results at the Station Intake (Sta. No. 8).

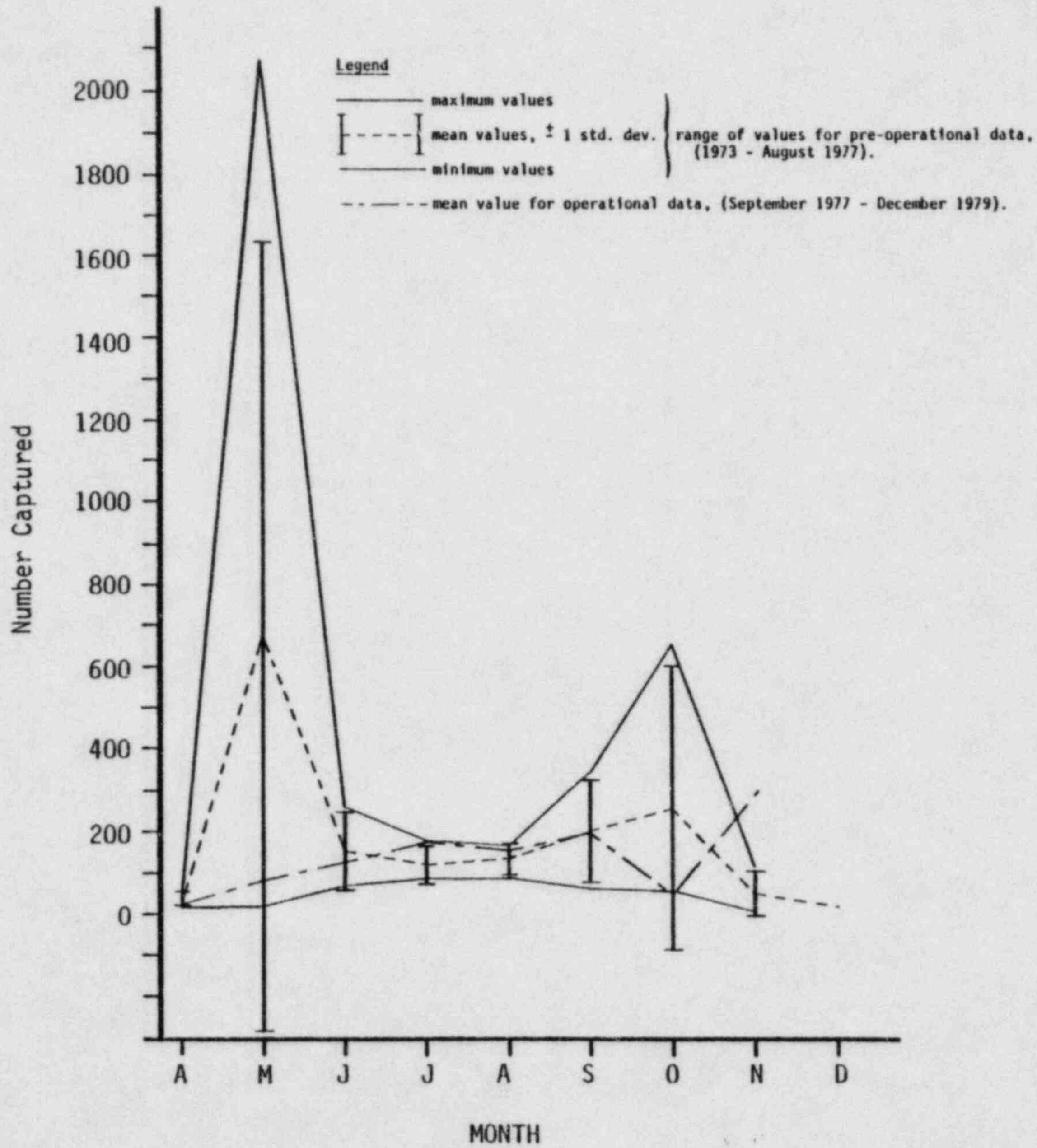


Figure 83. Comparison of Pre-operational and Operational Gill Net Results at the Station Discharge (Sta. No. 13).

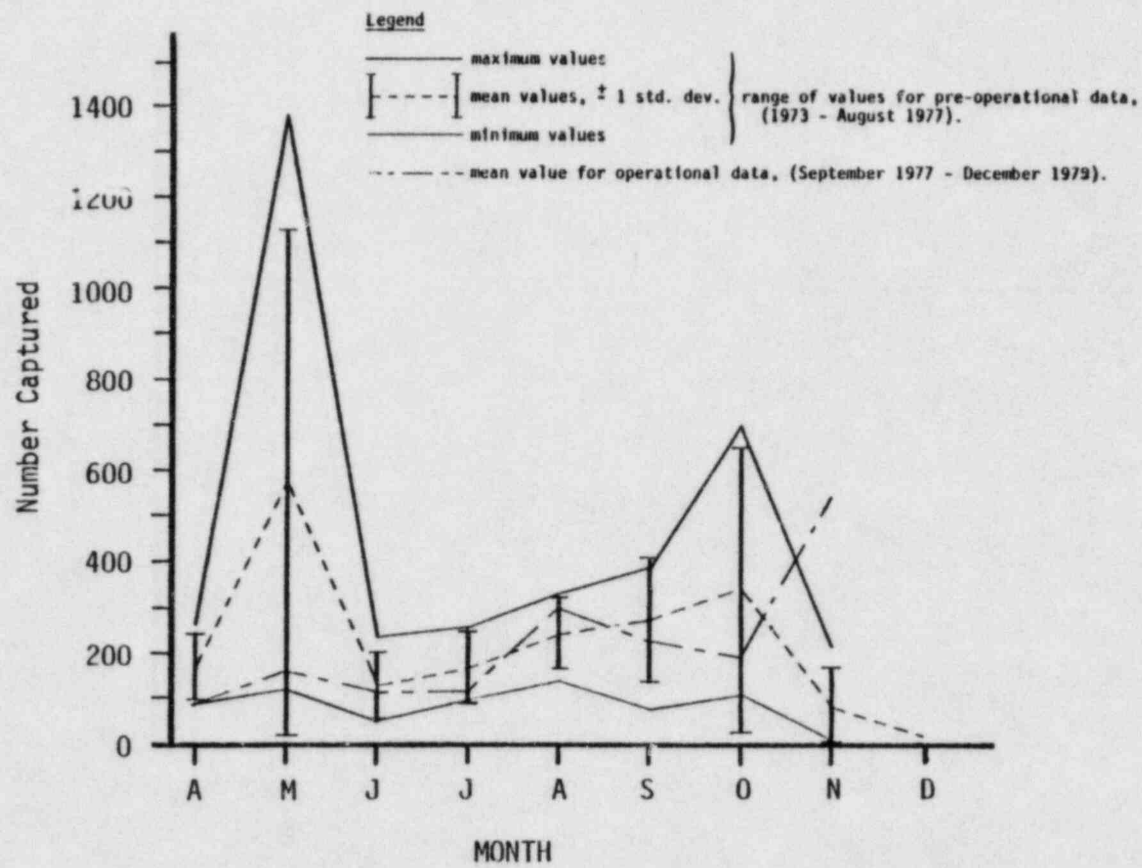


Figure 84. Comparison of Pre-operational and Operational Gill Net Results at an In-shore Control Station (Sta. No. 3).

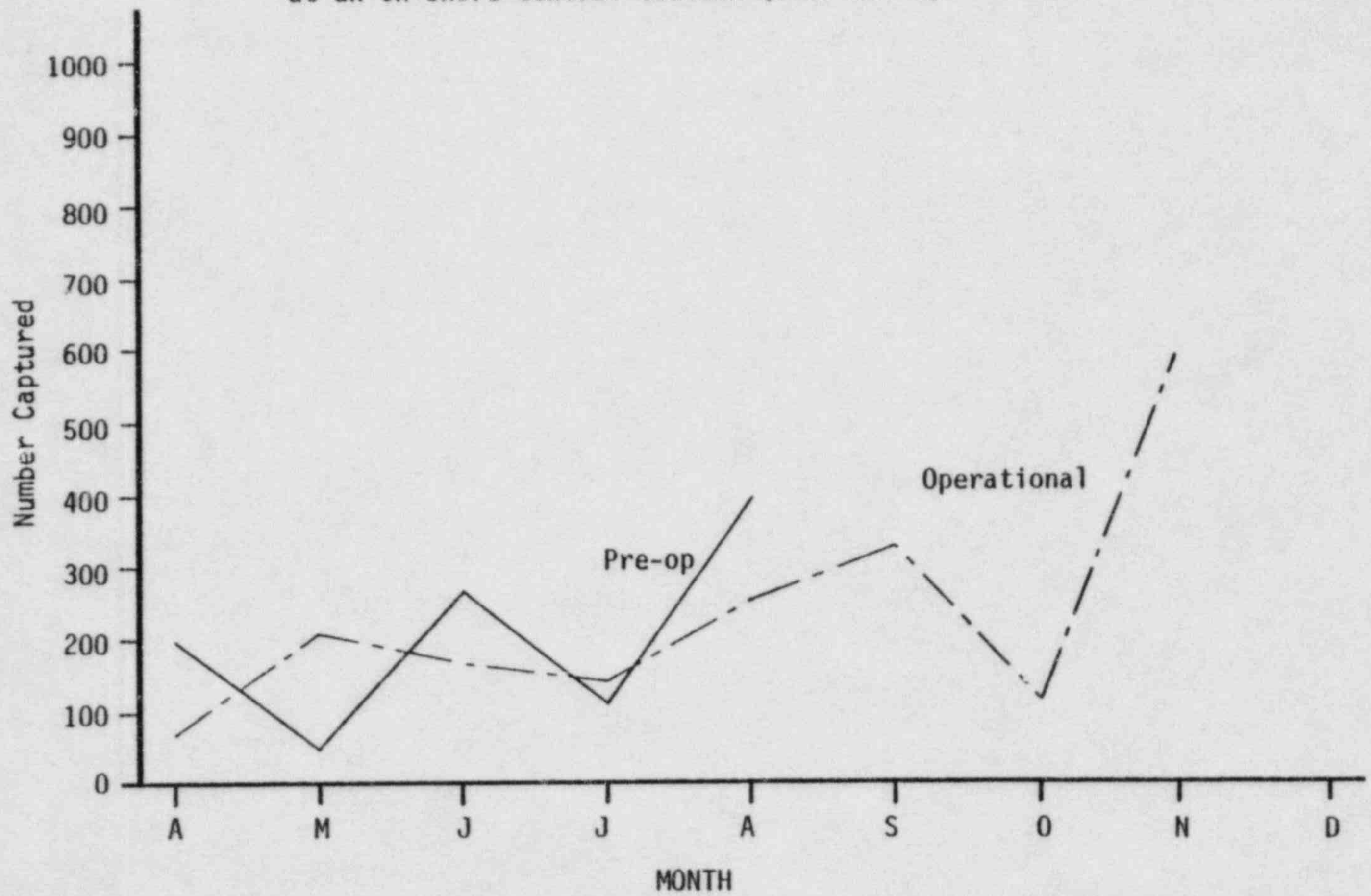
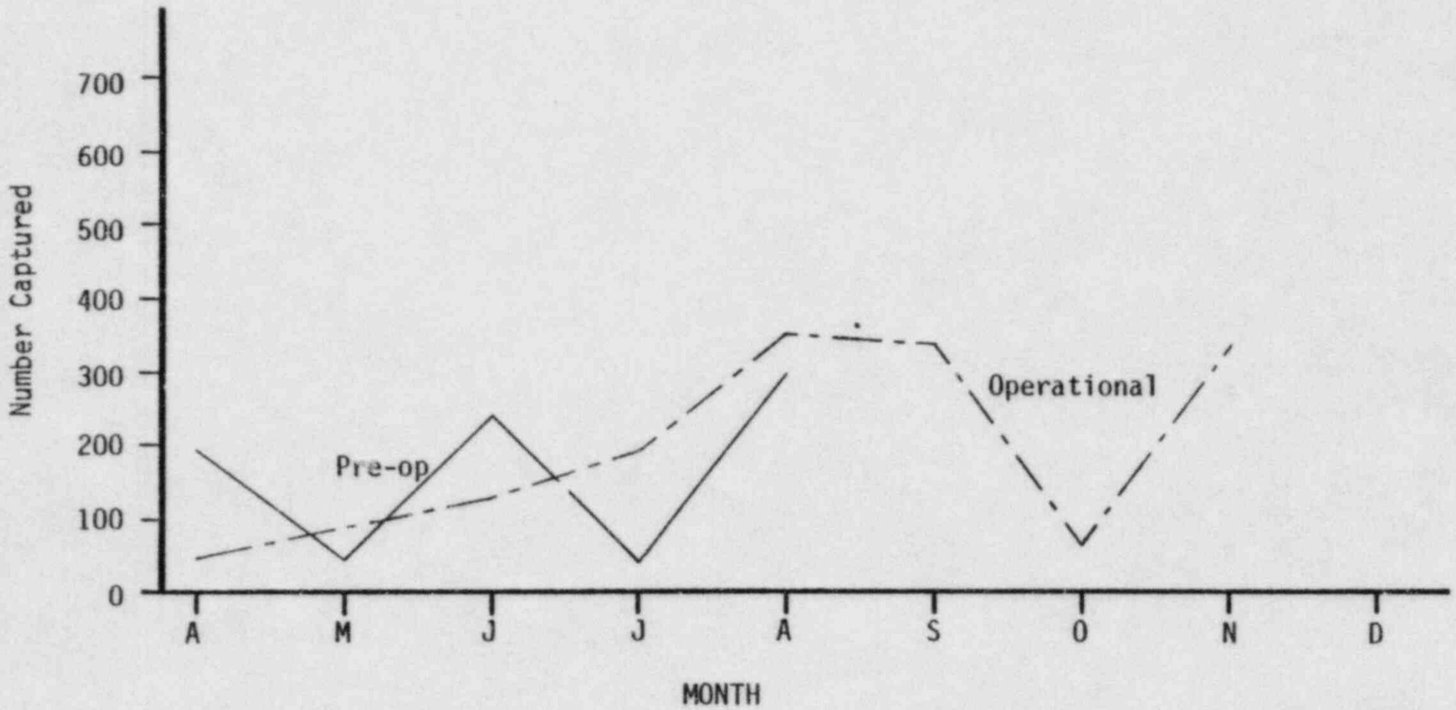


Figure 85. Comparison of Pre-operational and Operational Gill Net Results at an Off-shore Control Station (Sta. No. 26).



METEOROLOGICAL MONITORING

ANALYSIS OF THERMAL INTERNAL BOUNDARY LAYER CONDITIONS FOR A COASTAL NUCLEAR POWER PLANT

1982 METEOROLOGICAL DATA FOR THE DAVIS-BESSE NUCLEAR POWER STATION MONTHLY AVERAGES AND WINDROSES

PRECIPITATION STUDY OF THE DAVIS-BESSE NUCLEAR POWER STATION

A PRELIMINARY ANALYSIS OF THERMAL INTERNAL BOUNDARY LAYER CONDITIONS FOR A COASTAL NUCLEAR POWER PLANT

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January 1983

The purpose of the Thermal Internal Boundary Layer (TIBL) investigation was to provide site specific background information on the formation of the TIBL at Davis-Besse Nuclear Power Station. Davis-Besse is located on the shoreline adjacent to Lake Erie near Locust Point.

The Thermal Internal Boundary Layer is a meteorological phenomenon and can be described as an atmospheric boundary layer that forms when air flows across the surface discontinuity between land and water. Because the two air layers many times do not have either the same temperature or roughness, an interface is created. The air above the TIBL is stable and the air below the TIBL is unstable. The interface which is formed usually starts at the point where the shore and water meet. The height of the TIBL is determined by temperature difference, how much greater the land temperature is than the water temperature, surface roughness, wind speed, and insolation.

This TIBL formation is important in atmospheric dispersion estimates. For instance, if the release height of the air pollutants (radionuclides, in this case) is within the boundary layer, the air pollutants will diffuse until they reach the top of the boundary layer, and will then be reflected back down to the ground. Fumigation occurs and results in higher pollutant ground-level concentrations than would be predicted by a simple Gaussian dispersion model. A similar problem exists when the pollutants are released above the TIBL.

Hourly averages of the meteorological data obtained from the meteorological monitoring system, located at the Davis-Besse Nuclear Power Station, were examined for a period between January 1, 1982 and December 31, 1982. During this study the following meteorological conditions were used to characterize the TIBL formation: wind direction between 337.5° and 112.5°, land temperature greater than water temperature, and wind speed greater than 0.5 mph, and occurrence one hour after sunrise to one hour before sunset (daylight hours).

Using these criteria, the meteorological data were reviewed to determine when such conditions existed. The data were compiled and tabulated. The data were broken down into two onshore categories, possible TIBL cases and non-TIBL cases. From within these two categories, the data were further examined to determine site specific characteristics of possible TIBL formation. Refer to Tables A-1 through A-5.

The investigation showed that TIBL conditions do exist at the Davis-Besse Nuclear Power Station. Visual examination of velocity, temperature and stability data indicates that in most cases the possible TIBL height at the tower was below 100m. The difference between land temperature and lake temperature rarely exceeded 10°F.

TABLE A-1
Frequency of Occurrence of Onshore Flow

Month	A Hours in Month	B Obser- vations (Hours)	C Onshore Flow (Hours)	D Onshore Flow %	E TIBL (Hours)	F TIBL %	G Onshore Flow (No TIBL) (Hours)	H Onshore Flow (No TIBL) %
Jan 81	744	456	39	8.6	0	0.0	39	8.6
Feb 81	672	391	65	16.6	10	2.5	55	14.1
Mar 81	744	506	107	21.1	28	5.5	79	15.6
Apr 81	720	561	148	26.4	25	4.4	123	21.9
May 81	744	595	277	46.5	26	4.4	251	42.2
Jun 81	720	698	159	22.8	25	3.6	134	19.2
Jul 81	744	701	322	46.0	34	4.9	288	41.1
Aug 81	744	732	58	7.9	51	7.0	7	0.9
Sep 81	720	548	153	27.9	5	0.9	148	27.0
Oct 81	744	744	300	40.3	60	8.1	240	32.2
Nov 81	720	712	224	31.5	32	4.5	192	27.0
Dec 81	744	581	52	9.0	1	0.2	51	8.8

A. Total hours in a month.
B. Hours of data analyzed or available.
C. Hours of wind direction from 337.5° to 112.5°.
D. Percent of data hours that on-shore flow occurred = (C/B) (100).
E. Hours of wind direction from 337.5° to 112.50, wind speed greater than 0.5 mph, and TL>TW.
F. Percent of available data hours that wind direction was from 337.5° to 112.50, wind speed greater than 0.5 mph, and TL>TW = (E/B) (100).
G. Hours of wind direction from 337.5° to 112.5° and TW>TL=C-E.
H. Percent of available data hours of wind direction from 337.5° to 112.5° and TW>TL= (G/B) (100)

TL = Temperature of Land
TW = Temperature of Water

TABLE A-2
Classification of Onshore Flow Based on
Lake Temperature (TW) and Land Temperature (TL)

Month	A Hours in Month	B Data Available (Hours)	C Onshore Flow (Hours)	D Onshore Flow (No TIBL) %	E TIBL (Hours)	F Onshore Flow Occurrences with TIBL %
Jan 81	744	456	39	100.0	0	0.0
Feb 81	672	391	65	84.6	10	15.4
Mar 81	744	506	107	73.8	28	26.2
Apr 81	720	561	52	51.9	25	48.1
May 81	744	595	277	90.6	26	9.4
Jun 81	720	698	159	84.3	25	15.7
Jul 81	744	701	322	89.4	34	10.6
Aug 81	744	732	58	12.1	51	87.9
Sep 81	720	548	153	96.7	5	3.3
Oct 81	744	744	300	80.0	60	20.0
Nov 81	720	712	224	85.7	32	14.3
Dec 81	744	581	52	98.1	1	1.9

A. Total hours in a month.
B. Hours of data analyzed.
C. Hours of wind direction from 337.5° to 112.5°
D. Percent of time onshore flow (no TIBL) = (C-E) (100)/C.
E. Hours of wind direction from 337.5° to 112.5°, wind speed greater than 0.5 mph, and TL>TW.
F. Percent of time TL>TW (TIBL) of the hours of on-shore flow. F = (E/C) (100).

TL = Temperature of Land.
TW = Temperature of Water.

TABLE A-3
Duration of Possible Thermal Internal Boundary Layer Formation
using TL > TW
Wind Direction 337.5°-112.5°
Wind Speed > 0.5 mph

MONTH	DAY	DURATION HOURS	TIME PERIOD
January 81		No Cases of T.I.B.L.	
	Total	0	
February 81	20	1	1400
	22	1	0400
	22	1	0700
	22	5	1000-1400
	25	1	1800
	27	1	1400
	Total	10	
March 81	22	3	1600-1800
	23	7	1200-1800
	24	7	1200-1800
	25	1	1100
	25	3	1400-1600
	26	2	1600-1700
	27	5	1400-1800
	Total	28	
April 81	06	1	1600
	09	2	1700-1800
	22	1	1200
	27	7	1200-1800
	28	1	0200
	28	5	0800-1200
	28	4	1500-1800
	30	4	1500-1800
	Total	25	
May 81	03	4	1500-1800
	08	2	1300-1400
	12	2	1600-1700
	13	2	1300-1400
	16	1	1300
	19	4	1500-1800
	20	7	1200-1800
	22	2	1300-1400

Table A-3 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
	23	1	1800
	27	1	1000
	Total	26	
June 81	02	8	1200-1900
	04	5	1200-1700
	05	2	1100-1200
	12	1	1900
	19	1	1500
	21	6	1300-1800
	30	2	1100-1200
	Total	25	
July 81	02	1	1400
	05	9	1100-1900
	06	2	1800-1900
	07	8	1200-1900
	18	6	1300-1800
	25	8	1100-1900
	Total	34	
August 81	02	5	1300-1700
	21	6	1200-1700
	22	6	1300-1800
	23	3	1400-1600
	24	9	1100-1900
	25	5	1400-1800
	26	8	1100-1900
	27	8	1200-1900
	Total	51	
September 81	24	3	1600-1800
	25	1	1300
	25	1	1900
	Total	5	
October 81	05	2	1800-1900
	11	2	1500-1600
	12	4	1400-1700
	13	6	1400-1900
	26	12	0800-1900
	27	8	0900-1600
	28	1	1200
	28	6	1400-1900
	29	9	1000-1800
	30	10	1100-1900
	Total	60	

TL>TW - Wind Direction 337.5° - 112.5° - Wind Speed > 0.5 mph

Table A-3 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
November 81	01	4	1300-1600
	02	5	1200-1600
	03	7	1000-1600
	04	5	1200-1600
	13	2	1500-1600
	14	7	1000-1600
	16	2	1400-1500
	Total	32	
December 81	22	1	1600
	Total	1	

TL>TW - Wind Direction 337.5° - 112.5° - Wind Speed > 0.5 mph

TABLE A-4
Duration of On-Shore Flow (Non-TIBL Conditions)
Using TW > TL
Wind Direction 337.5° - 112.5°

MONTH	DAY	DURATION HOURS	TIME PERIOD
January 81	02	2	1400-1500
	03	4	0600-0900
	14	8	1500-2200
	15	1	0100
	16	2	2000-2100
	20	14	1100-2400
	21	8	0100-0800
	Total	39	
February 81	14	3	1900-2100
	20	1	0400
	21	12	1300-2400
	22	5	0100-0500
	22	1	0700
	22	5	1000-1400
	25	1	1800
	25	4	2100-2300
	26	20	0100-2000
	26	2	2300-2400
	27	5	0100-0500
	27	6	1400-1900
	Total	65	
March 81	13	2	1200-1300
	16	15	0100-1500
	18	1	2100
	19	2	0100-0200
	21	12	1200-2400
	22	2	0100-0200
	22	20	0500-2400
	23	18	0100-1800
	24	13	1200-2400
	25	6	0100-0600
	25	4	1100-1600
	26	2	1600-1700
	27	1	0800
	27	9	1000-1800
	Total	107	
April 81	09	2	1700-1800
	12	22	0300-2400
	13	12	0100-1200
	14	4	2100-2400
	15	18	0100-1800
	20	14	1100-2400

Table A-4 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
	21	14	0100-1400
	22	8	1100-1800
	26	6	1900-2400
	27	21	0100-2100
	28	2	0200-0300
	28	5	0800-1200
	28	4	1500-1800
	29	4	0600-0900
	30	12	1000-2100
	Total	148	
May 81	01	23	0200-2400
	02	17	0100-1700
	03	8	1500-2200
	05	3	2200-2400
	06	17	0100-1700
	06	5	2000-2400
	07	24	0100-2400
	08	6	0100-0600
	08	6	0800-1400
	12	2	1600-1700
	13	3	1200-1400
	14	4	0300-0600
	14	15	0800-2400
	15	1	0900
	16	1	1300
	16	1	1900
	17	23	0200-2400
	18	24	0100-2400
	19	20	0100-2000
	19	2	2200-2400
	20	18	0100-1800
	22	2	1300-1400
	23	6	1800-2300
	27	12	0900-2400
	28	3	0500-0700
	30	11	1400-2400
	31	20	0100-2000
	Total	277	
June 81	01	16	0900-2400
	02	1	0100
	02	11	1200-2200
	04	5	1200-1700
	05	2	1100-1200
	07	12	0800-1900
	12	3	1900-2100
	13	3	0200-0400
	13	5	0700-1100
	17	5	1400-1800
	19	10	1500-2400
	20	23	0100-2300

TW > TL - Wind Direction 337.5° - 112.5°

Table A-4 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
	21	8	1300-2000
	23	15	0500-1900
	25	3	2200-2400
	26	1	0100
	26	10	1000-1900
	27	12	1100-2200
	30	14	1100-240C
	Total	159	
July 81	01	7	0100-0700
	01	2	0900-1000
	01	12	1300-2400
	02	12	1000-2100
	04	4	1600-1900
	05	14	1100-2400
	06	19	0100-1900
	07	9	1200-2000
	09	1	2400
	10	14	0100-1400
	14	24	0100-2400
	15	24	0100-2400
	16	1	0200
	16	17	0500-2100
	17	8	1200-1900
	18	6	1300-1800
	2[illegible]	5	0500-0900
	21	12	1300-2400
	22	17	0100-1700
	22	6	1900-2400
	23	4	0100-0400
	23	13	1200-2400
	24	13	1000-2200
	25	9	1100-1900
	26	1	0500
	26	3	2000-2200
	27	24	0100-2400
	28	2	0100-0200
	29	11	0800-1800
	30	11	1000-2000
	31	17	0800-2400
	Total	322	
August 81	02	5	1300-1700
	21	6	1200-1700
	22	6	1300-1800
	23	3	1400-1600
	24	11	1100-2100
	25	5	1400-1800
	26	12	1100-2200
	27	10	1200-2100
	Total	58	

TW > TL - Wind Direction 337.5° - 112.5°

Table A-4 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
September 81	02	14	1100-2400
	03	1	0100
	03	14	0700-2000
	08	2	2300-2400
	17	7	1800-2400
	18	18	0100-1800
	20	7	1500-2100
	21	17	0800-2400
	22	24	0100-2400
	23	16	0100-1600
	23	3	2200-2400
	24	6	1300-1800
	25	1	1000
	25	1	1300
	25	2	1900-2000
	29	4	0200-0500
	29	5	1900-2300
	30	3	1100-1300
	30	6	1500-2000
	30	2	2200-2300
	Total	153	
October 81	01	2	0200-0300
	03	3	1500-1700
	05	5	1800-2200
	07	2	2100-2200
	08	5	0100-0500
	08	1	1100
	08	5	1300-1700
	09	15	1000-2400
	10	1	0300
	10	1	0500
	10	18	0700-2400
	11	24	0100-2400
	12	24	0100-2400
	13	2	0100-0200
	13	8	1200-1900
	15	2	2300-2400
	16	17	0100-1700
	16	1	2300
	21	20	0500-2400
	22	17	0100-1700
	22	2	1900-2000
	25	11	1400-2400
	26	24	0100-2400
	27	16	0100-1600
	28	2	0800-0900
	28	13	1200-2400
	29	24	0100-2400
	30	24	0100-2400
	31	11	1200-2200
	Total	300	

TW > TL - Wind Direction 337.5° - 112.5°

Table A-4 Cont.

MONTH	DAY	DURATION HOURS	TIME PERIOD
November 81	01	6	1300-1800
	02	1	0300
	02	7	1200-1800
	02	5	2000-2400
	03	19	0100-1900
	04	1	0300
	04	13	1200-2400
	09	24	0100-2400
	10	7	0100-0700
	11	7	1200-1800
	11	5	2000-2400
	12	8	0100-0800
	12	11	1200-2200
	13	14	1100-2400
	14	2	0700-0800
	14	15	1000-2400
	15	2	0100-0200
	15	10	0800-1700
	16	1	0100
	16	2	0500-0600
	16	8	1200-1900
	19	5	0400-0800
	19	12	1300-2400
	20	1	0100
	23	4	1900-2200
	24	23	0200-2400
	25	1	0100
	25	4	0300-0600
	25	1	1300
	25	1	1600
	30	4	2100-2400
	Total	224	
December 81	04	13	0500-1700
	08	2	2300-2400
	09	1	1100
	09	1	2300
	10	2	0500-0600
	12	3	1200-1400
	14	3	0700-0900
	17	13	1200-2400
	18	5	0100-0500
	22	9	1600-2400
	Total	52	

TW > TL - Wind Direction 337.5° - 112.5°

TABLE A-5
Number of Days for Possible Occurrence of
Thermal Internal Boundary Layer (TL>TW)

Month	Days in Month	Days TL>TW Occurred	% of Month TL>TW Occurred
Jan	31	0	0
Feb	28	4	17.8
Mar	31	7	22.5
Apr	30	6	20
May	31	10	35.4
Jun	30	7	23.3
Jul	31	6	19.3
Aug	31	8	25.8
Sep	30	2	6.6
Oct	31	10	32.2
Nov	30	8	26.6
Dec	31	1	3.2

TL = Temperature of the land
TW = Temperature of the water

1982 Meteorological Data for the
Davis-Besse Nuclear Power Station
Windroses, Precipitation, and Daily
Meteorological Averages

Prepared by

Kelly L. Clayton

This report summarizes meteorological data collected onsite at the Davis-Besse Nuclear Power Station during 1982. Onsite weather data were collected from one 100m (340') freestanding meteorological tower, one 10m (35') satellite tower, and a ground-level precipitation monitor. Meteorological sensors are located at 10m (35'), 75m (250') and 100m (340') above ground level. The main meteorological tower supports meteorological sensors at all three levels, while the satellite tower houses wind speed and wind direction sensors at 10 meters. The meteorological data gathered from the main tower are: wind direction and wind speed from the 75m and 100m levels; ambient air temperature at all three levels; dewpoint at the 10m and 100m levels, and differential temperatures (ΔT) between the 10m and 75m sensors and the 10m and 100m sensors. Precipitation is measured by a ground level tipping bucket system located at the base of the satellite tower.

The sensors send signals which are recorded on a Meteorological Data Processing System (MDPS) designed, installed, and maintained by an independent consultant. The analog signals are then converted to digital signals by a microprocessor and sent to a DEC PDP 11/34 computer located in the Davis-Besse Administration Building. Software within the DEC PDP 11/34 computer system average and store the meteorological data each hour.

The wind direction and wind speed data for 1982 were graphed onto windrose charts. Windroses were graphed with the wind direction being the percentage of hours recorded for each of the 16 cardinal compass directions and wind speed in miles per hour (mph) averaged for the hours of each wind direction (Figures 1-36).

The daily averages of all meteorological parameters were calculated and are included in the following data tables (Tables 1 - 12). Similarly, daily precipitation data were averaged and tabulated in Tables 13 - 26.

Results

From the meteorological data collected onsite at the Davis-Besse Nuclear Power Station, the following trends were identified. The predominant wind direction was from the west-southwest (WSW) during 1982 at all three sensor levels. The only variance from this occurred during May when the major wind direction was from the East (E).

The average wind speeds for all three sensor levels were: 9.2 mph at the 10m level, 13.7 mph at the 75m level, and 15.42 mph at the 100m level. The highest average wind speed at all three levels occurred during January from the west-southwest (WSW) direction with an average wind speed of 27.4 mph.

The precipitation data showed the greatest rainfall occurred during the month of November with 6.3 inches total. The average precipitation during 1982 at the Davis-Besse site was 2.5 inches per month.

TABLES 1-12

MONTHLY DAVIS-BESSE SITE AVERAGE WEATHER DATA

Table 1

DAVIS BESSE SITE AVERAGE WEATHER DATA

JANUARY 1, 1982 THROUGH JANUARY 28, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
1/ 1	22.1 D F	27.6 D F	15.7 MPH	250.8 DEG	20.5 MPH	261.9 DEG	21.7 MPH	254.9 DEG	-1.0 D F
1/ 2	18.0 D F	28.6 D F	12.1 MPH	105.3 DEG	18.5 MPH	111.1 DEG	19.5 MPH	105.6 DEG	-0.7 D F
1/ 3	35.4 D F	36.6 D F	10.0 MPH	133.4 DEG	18.0 MPH	148.1 DEG	19.7 MPH	142.8 DEG	0.3 D F
1/ 4	29.7 D F	33.6 D F	26.7 MPH	215.8 DEG	36.4 MPH	225.3 DEG	43.2 MPH	218.1 DEG	-0.2 D F
1/ 5	20.5 D F	28.9 D F	14.9 MPH	218.1 DEG	21.5 MPH	225.7 DEG	25.4 MPH	220.9 DEG	-0.9 D F
1/ 6	23.0 D F	27.0 D F	10.4 MPH	349.0 DEG	15.6 MPH	358.6 DEG	18.2 MPH	350.6 DEG	-0.8 D F
1/ 7	9.0 D F	16.7 D F	11.3 MPH	296.7 DEG	16.3 MPH	306.2 DEG	18.9 MPH	290.9 DEG	-0.8 D F
1/ 8	7.8 D F	14.4 D F	16.1 MPH	242.8 DEG	21.7 MPH	251.9 DEG	25.3 MPH	246.7 DEG	-0.9 D F
1/ 9	1.3 D F	6.9 D F	17.2 MPH	296.6 DEG	22.2 MPH	306.2 DEG	25.1 MPH	299.3 DEG	-1.0 D F
1/10	-9.6 D F	-5.8 D F	27.6 MPH	258.6 DEG	34.0 MPH	266.9 DEG	39.6 MPH	262.7 DEG	-1.1 D F
1/11	-0.4 D F	2.5 D F	27.1 MPH	245.2 DEG	32.9 MPH	253.6 DEG	38.0 MPH	248.9 DEG	-1.2 D F
1/12	7.9 D F	12.1 D F	9.3 MPH	201.3 DEG	11.3 MPH	208.6 DEG	13.3 MPH	204.9 DEG	-1.2 D F
1/13	15.1 D F	20.8 D F	5.5 MPH	106.9 DEG	8.5 MPH	68.2 DEG	10.0 MPH	62.6 DEG	0.5 D F
1/14	11.9 D F	13.9 D F	6.4 MPH	231.0 DEG	10.5 MPH	272.7 DEG	13.0 MPH	273.8 DEG	0.2 D F
1/15	3.6 D F	7.5 D F	10.8 MPH	211.8 DEG	14.8 MPH	220.1 DEG	17.7 MPH	216.0 DEG	-1.0 D F
1/16	1.9 D F	6.2 D F	22.3 MPH	258.3 DEG	28.3 MPH	267.8 DEG	33.5 MPH	262.2 DEG	-0.9 D F
1/17	-14.7 D F	-9.6 D F	17.4 MPH	224.6 DEG	21.7 MPH	232.2 DEG	25.0 MPH	227.5 DEG	-1.1 D F
1/18	3.0 D F	9.0 D F	7.4 MPH	187.6 DEG	10.3 MPH	201.7 DEG	12.4 MPH	203.8 DEG	-0.8 D F
1/19	15.0 D F	20.1 D F	6.9 MPH	76.4 DEG	10.6 MPH	91.4 DEG	12.8 MPH	88.2 DEG	-0.1 D F
1/20	17.4 D F	21.3 D F	10.3 MPH	49.1 DEG	15.4 MPH	41.6 DEG	18.6 MPH	36.5 DEG	0.4 D F
1/21	12.8 D F	17.4 D F	17.3 MPH	51.4 DEG	22.8 MPH	60.3 DEG	25.4 MPH	52.7 DEG	-1.1 D F
1/22	12.8 D F	16.7 D F	20.0 MPH	82.6 DEG	27.6 MPH	87.9 DEG	28.7 MPH	76.0 DEG	-1.0 D F
1/23	21.2 D F	28.5 D F	27.2 MPH	226.9 DEG	36.9 MPH	235.5 DEG	999.9 MPH	999.9 DEG	-0.6 D F
1/24	1.4 D F	7.8 D F	24.0 MPH	253.8 DEG	30.0 MPH	263.0 DEG	999.9 MPH	999.9 DEG	-1.2 D F
1/25	3.7 D F	8.3 D F	6.1 MPH	251.8 DEG	9.0 MPH	276.3 DEG	4.2 MPH	190.0 DEG	-0.3 D F
1/26	5.3 D F	10.6 D F	9.1 MPH	244.7 DEG	15.2 MPH	266.8 DEG	999.9 MPH	999.9 DEG	0.5 D F
1/27	7.7 D F	19.5 D F	11.2 MPH	183.2 DEG	20.3 MPH	194.8 DEG	18.5 MPH	200.5 DEG	0.0 D F
1/28	19.6 D F	32.2 D F	18.0 MPH	246.4 DEG	25.8 MPH	257.2 DEG	26.8 MPH	269.7 DEG	-0.4 D F

Table 2

DAVIS BESSE SITE AVERAGE WEATHER DATA

FEBRUARY 1, 1982 THROUGH FEBRUARY 28, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT	100M DELT
2/ 1	11.7 D F	16.3 D F	9.2 MPH	243.0 DEG	13.3 MPH	253.9 DEG	15.4 MPH	250.8 DEG	0.3 D F	0.1 D F
2/ 2	19.7 D F	23.6 D F	5.8 MPH	88.9 DEG	10.6 MPH	113.7 DEG	12.2 MPH	117.4 DEG	1.2 D F	1.3 D F
2/ 3	22.3 D F	25.4 D F	15.7 MPH	10.4 DEG	20.1 MPH	19.4 DEG	22.8 MPH	12.2 DEG	-0.8 D F	-1.0 D F
2/ 4	5.7 D F	10.5 D F	6.3 MPH	354.6 DEG	10.8 MPH	17.7 DEG	11.8 MPH	13.6 DEG	0.6 D F	0.5 D F
2/ 5	12.9 D F	13.7 D F	7.7 MPH	35.1 DEG	11.0 MPH	61.6 DEG	12.8 MPH	64.8 DEG	0.8 D F	0.5 D F
2/ 6	0.3 D F	2.7 D F	13.6 MPH	235.5 DEG	20.6 MPH	248.7 DEG	26.0 MPH	246.3 DEG	0.3 D F	0.5 D F
2/ 7	2.8 D F	9.9 D F	17.3 MPH	223.1 DEG	26.4 MPH	233.2 DEG	33.2 MPH	229.8 DEG	0.1 D F	0.1 D F
2/ 8	11.0 D F	17.4 D F	7.8 MPH	230.3 DEG	12.0 MPH	243.3 DEG	15.3 MPH	242.1 DEG	0.0 D F	0.2 D F
2/ 9	10.3 D F	15.9 D F	10.0 MPH	305.6 DEG	14.3 MPH	317.8 DEG	16.2 MPH	309.0 DEG	-0.4 D F	-0.6 D F
2/10	-8.3 D F	-3.7 D F	11.8 MPH	230.2 DEG	18.1 MPH	243.1 DEG	20.3 MPH	239.3 DEG	-0.1 D F	-0.0 D F
2/11	-1.0 D F	6.7 D F	9.7 MPH	218.8 DEG	17.5 MPH	236.6 DEG	20.0 MPH	234.4 DEG	0.7 D F	1.1 D F
2/12	9.1 D F	13.8 D F	3.8 MPH	65.6 DEG	6.2 MPH	45.9 DEG	6.9 MPH	49.0 DEG	0.8 D F	1.0 D F
2/13	13.8 D F	16.0 D F	8.2 MPH	230.5 DEG	13.3 MPH	246.5 DEG	15.5 MPH	248.9 DEG	0.8 D F	0.5 D F
2/14	21.6 D F	29.4 D F	10.7 MPH	196.9 DEG	17.6 MPH	206.1 DEG	19.6 MPH	201.0 DEG	-0.6 D F	-0.7 D F
2/15	35.5 D F	40.6 D F	13.2 MPH	211.5 DEG	22.8 MPH	224.9 DEG	28.4 MPH	218.9 DEG	0.8 D F	1.0 D F
2/16	32.7 D F	34.3 D F	11.2 MPH	54.3 DEG	18.2 MPH	45.4 DEG	20.1 MPH	37.3 DEG	-0.1 D F	-0.0 D F
2/17	23.3 D F	28.5 D F	21.0 MPH	65.6 DEG	29.2 MPH	72.5 DEG	30.5 MPH	64.4 DEG	-1.0 D F	-1.4 D F
2/18	32.5 D F	33.1 D F	7.9 MPH	113.2 DEG	12.8 MPH	134.9 DEG	13.6 MPH	134.5 DEG	-0.5 D F	-0.3 D F
2/19	31.3 D F	32.4 D F	9.8 MPH	262.5 DEG	14.0 MPH	278.6 DEG	15.0 MPH	268.8 DEG	-0.2 D F	-1.0 D F
2/20	33.0 D F	35.5 D F	10.3 MPH	231.6 DEG	17.1 MPH	246.9 DEG	18.7 MPH	237.6 DEG	-0.2 D F	-1.0 D F
2/21	30.6 D F	33.9 D F	9.5 MPH	307.0 DEG	15.8 MPH	333.6 DEG	17.4 MPH	325.0 DEG	-0.3 D F	-0.5 D F
2/22	26.8 D F	33.8 D F	8.6 MPH	272.0 DEG	14.4 MPH	292.0 DEG	16.0 MPH	281.0 DEG	-0.5 D F	-0.6 D F
2/23	27.8 D F	33.7 D F	11.8 MPH	348.1 DEG	18.5 MPH	348.3 DEG	20.6 MPH	338.9 DEG	-0.2 D F	-0.2 D F
2/24	18.1 D F	22.7 D F	17.1 MPH	37.3 DEG	20.7 MPH	46.6 DEG	20.9 MPH	37.7 DEG	-1.1 D F	-1.6 D F
2/25	6.4 D F	16.9 D F	6.2 MPH	40.8 DEG	8.1 MPH	32.7 DEG	8.1 MPH	24.0 DEG	-0.4 D F	-0.6 D F
2/26	7.6 D F	17.7 D F	4.5 MPH	211.7 DEG	9.1 MPH	256.1 DEG	9.0 MPH	248.1 DEG	2.1 D F	2.3 D F
2/27	13.7 D F	21.3 D F	5.0 MPH	55.4 DEG	8.4 MPH	60.2 DEG	9.2 MPH	54.4 DEG	2.2 D F	2.4 D F
2/28	16.7 D F	21.3 D F	10.0 MPH	62.9 DEG	15.9 MPH	81.5 DEG	17.7 MPH	74.5 DEG	2.6 D F	2.7 D F

Table 3

DAVIS BESSE SITE AVERAGE WEATHER DATA

MARCH 1, 1982 THROUGH MARCH 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
3/ 1	25.8 D F	33.2 D F	13.2 MPH	233.5 DEG	21.5 MPH	246.7 DEG	24.4 MPH	237.1 DEG	0.7 D F
3/ 2	22.8 D F	26.6 D F	9.4 MPH	20.0 DEG	12.6 MPH	6.6 DEG	14.0 MPH	357.6 DEG	-0.7 D F
3/ 3	5.3 D F	10.9 D F	13.1 MPH	47.5 DEG	19.9 MPH	61.0 DEG	20.6 MPH	54.4 DEG	2.0 D F
3/ 4	25.3 D F	28.1 D F	14.9 MPH	133.8 DEG	21.2 MPH	145.8 DEG	22.6 MPH	137.7 DEG	-0.3 D F
3/ 5	15.0 D F	24.8 D F	8.6 MPH	252.4 DEG	12.4 MPH	267.1 DEG	13.0 MPH	257.7 DEG	-0.7 D F
3/ 6	19.7 D F	25.8 D F	3.5 MPH	290.7 DEG	5.5 MPH	322.6 DEG	5.5 MPH	281.4 DEG	-0.1 D F
3/ 7	14.3 D F	23.6 D F	9.1 MPH	303.0 DEG	13.6 MPH	320.6 DEG	14.7 MPH	312.7 DEG	-0.7 D F
3/ 8	10.4 D F	21.0 D F	9.6 MPH	186.7 DEG	13.6 MPH	197.3 DEG	14.4 MPH	176.6 DEG	-0.9 D F
3/ 9	12.6 D F	20.7 D F	13.6 MPH	226.9 DEG	19.6 MPH	243.0 DEG	21.1 MPH	234.7 DEG	-0.3 D F
3/10	26.2 D F	30.9 D F	8.5 MPH	165.1 DEG	17.3 MPH	182.2 DEG	20.1 MPH	175.0 DEG	0.7 D F
3/11	39.5 D F	41.4 D F	8.4 MPH	220.5 DEG	18.9 MPH	235.7 DEG	21.6 MPH	224.1 DEG	0.9 D F
3/12	35.1 D F	37.9 D F	6.9 MPH	118.0 DEG	10.3 MPH	126.2 DEG	15.1 MPH	139.3 DEG	1.2 D F
3/13	36.0 D F	46.0 D F	22.5 MPH	231.8 DEG	33.9 MPH	230.0 DEG	36.3 MPH	238.6 DEG	0.3 D F
3/14	30.1 D F	38.1 D F	8.6 MPH	295.0 DEG	13.7 MPH	346.7 DEG	14.7 MPH	304.8 DEG	0.5 D F
3/15	27.2 D F	34.2 D F	15.8 MPH	73.4 DEG	27.2 MPH	82.7 DEG	29.8 MPH	81.7 DEG	0.0 D F
3/16	42.8 D F	44.6 D F	9.7 MPH	140.8 DEG	19.7 MPH	159.3 DEG	21.8 MPH	160.6 DEG	1.2 D F
3/17	32.5 D F	37.4 D F	10.2 MPH	281.5 DEG	14.1 MPH	293.0 DEG	14.9 MPH	288.0 DEG	-1.0 D F
3/18	35.6 D F	38.5 D F	6.3 MPH	238.9 DEG	9.9 MPH	255.0 DEG	10.2 MPH	251.1 DEG	-0.2 D F
3/19	31.4 D F	34.4 D F	8.9 MPH	51.6 DEG	15.1 MPH	60.4 DEG	16.2 MPH	57.7 DEG	-0.5 D F
3/20	32.4 D F	33.9 D F	11.0 MPH	65.3 DEG	17.1 MPH	79.1 DEG	15.8 MPH	80.0 DEG	-0.7 D F
3/21	31.3 D F	36.7 D F	14.7 MPH	265.4 DEG	20.4 MPH	277.1 DEG	21.0 MPH	274.4 DEG	-0.8 D F
3/22	29.6 D F	37.8 D F	11.1 MPH	256.4 DEG	16.5 MPH	269.2 DEG	17.6 MPH	268.0 DEG	-0.7 D F
3/23	30.4 D F	38.4 D F	7.0 MPH	209.3 DEG	12.7 MPH	230.0 DEG	13.2 MPH	230.4 DEG	0.3 D F
3/24	33.8 D F	42.5 D F	7.7 MPH	190.4 DEG	15.9 MPH	212.7 DEG	17.9 MPH	212.0 DEG	1.2 D F
3/25	32.7 D F	35.6 D F	9.6 MPH	350.0 DEG	13.8 MPH	5.5 DEG	15.7 MPH	3.0 DEG	0.7 D F
3/26	19.1 D F	28.4 D F	16.4 MPH	292.0 DEG	22.4 MPH	302.4 DEG	23.6 MPH	299.0 DEG	-1.2 D F
3/27	8.0 D F	23.8 D F	11.7 MPH	328.3 DEG	15.3 MPH	334.6 DEG	15.4 MPH	330.2 DEG	-1.4 D F
3/28	16.9 D F	30.6 D F	6.4 MPH	212.8 DEG	10.5 MPH	232.5 DEG	10.9 MPH	230.7 DEG	0.2 D F
3/29	21.4 D F	38.3 D F	6.9 MPH	142.2 DEG	14.0 MPH	168.9 DEG	14.7 MPH	172.6 DEG	1.8 D F
3/30	42.4 D F	55.3 D F	15.5 MPH	180.3 DEG	28.8 MPH	191.9 DEG	31.5 MPH	191.1 DEG	0.8 D F
3/31	40.2 D F	53.1 D F	17.9 MPH	229.2 DEG	27.7 MPH	240.0 DEG	30.4 MPH	238.1 DEG	-0.1 D F

Table 4

DAVIS BESSE SITE AVERAGE WEATHER DATA

APRIL 1, 1982 THROUGH APRIL 30, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
4/ 1	26.0 D F	48.9 D F	17.2 MPH	272.8 DEG	25.1 MPH	284.0 DEG	26.7 MPH	281.2 DEG	-0.3 D F
4/ 2	30.1 D F	40.4 D F	15.3 MPH	89.4 DEG	22.9 MPH	98.2 DEG	24.5 MPH	97.7 DEG	-0.6 D F
4/ 3	36.5 D F	43.7 D F	28.9 MPH	220.2 DEG	39.1 MPH	228.2 DEG	41.6 MPH	225.7 DEG	-1.1 D F
4/ 4	12.7 D F	25.5 D F	23.5 MPH	286.8 DEG	29.7 MPH	297.0 DEG	31.4 MPH	293.2 DEG	-1.4 D F
4/ 5	18.4 D F	27.0 D F	18.9 MPH	52.2 DEG	24.4 MPH	57.2 DEG	25.8 MPH	54.4 DEG	-1.5 D F
4/ 6	12.2 D F	23.8 D F	23.7 MPH	333.7 DEG	13.2 MPH	341.4 DEG	31.7 MPH	336.7 DEG	-1.4 D F
4/ 7	9.2 D F	23.1 D F	10.9 MPH	308.7 DEG	3.5 MPH	317.4 DEG	14.3 MPH	312.8 DEG	-1.1 D F
4/ 8	13.4 D F	26.1 D F	8.0 MPH	113.9 DEG	11.1 MPH	62.7 DEG	11.2 MPH	59.6 DEG	0.9 D F
4/ 9	20.6 D F	33.4 D F	11.9 MPH	352.9 DEG	12.5 MPH	354.9 DEG	16.4 MPH	351.1 DEG	-0.9 D F
4/10	25.3 D F	31.5 D F	13.2 MPH	221.0 DEG	9.2 MPH	232.2 DEG	20.3 MPH	231.3 DEG	-1.2 D F
4/11	26.3 D F	34.6 D F	11.4 MPH	245.0 DEG	6.4 MPH	257.4 DEG	16.3 MPH	255.9 DEG	-1.1 D F
4/12	30.2 D F	42.6 D F	9.6 MPH	165.4 DEG	7.2 MPH	178.3 DEG	16.5 MPH	176.0 DEG	0.4 D F
4/13	38.9 D F	50.1 D F	16.0 MPH	271.7 DEG	18.0 MPH	281.1 DEG	26.7 MPH	277.6 DEG	-0.4 D F
4/14	30.6 D F	37.8 D F	7.7 MPH	53.8 DEG	9.5 MPH	63.4 DEG	10.1 MPH	61.9 DEG	-1.1 D F
4/15	35.7 D F	41.7 D F	8.9 MPH	83.4 DEG	14.0 MPH	101.2 DEG	15.7 MPH	105.8 DEG	1.3 D F
4/16	53.8 D F	63.6 D F	10.5 MPH	184.2 DEG	20.9 MPH	194.8 DEG	23.4 MPH	193.5 DEG	1.0 D F
4/17	49.5 D F	56.1 D F	17.5 MPH	231.3 DEG	26.2 MPH	240.4 DEG	28.3 MPH	237.7 DEG	-0.9 D F
4/18	32.2 D F	48.8 D F	9.5 MPH	239.5 DEG	14.6 MPH	253.1 DEG	15.6 MPH	251.0 DEG	-0.2 D F
4/19	35.4 D F	57.3 D F	10.3 MPH	195.4 DEG	18.9 MPH	204.9 DEG	21.5 MPH	202.3 DEG	-0.0 D F
4/20	41.6 D F	53.9 D F	14.7 MPH	227.4 DEG	21.7 MPH	236.6 DEG	23.2 MPH	234.4 DEG	-0.9 D F
4/21	17.0 D F	42.1 D F	15.2 MPH	280.8 DEG	20.4 MPH	292.7 DEG	21.0 MPH	288.6 DEG	-1.1 D F
4/22	16.2 D F	43.3 D F	7.8 MPH	313.3 DEG	11.1 MPH	324.1 DEG	11.6 MPH	320.4 DEG	-0.4 D F
4/23	28.3 D F	52.4 D F	14.8 MPH	243.7 DEG	22.2 MPH	257.9 DEG	24.6 MPH	256.5 DEG	-0.1 D F
4/24	32.6 D F	58.0 D F	13.1 MPH	224.6 DEG	20.7 MPH	237.6 DEG	22.7 MPH	236.5 DEG	0.2 D F
4/25	34.9 D F	59.9 D F	8.6 MPH	205.1 DEG	16.9 MPH	219.6 DEG	18.5 MPH	220.9 DEG	1.2 D F
4/26	50.3 D F	57.1 D F	6.6 MPH	153.5 DEG	10.4 MPH	178.4 DEG	11.0 MPH	184.7 DEG	-0.1 D F
4/27	32.0 D F	44.3 D F	16.6 MPH	20.5 DEG	18.2 MPH	25.7 DEG	20.0 MPH	21.3 DEG	-1.6 D F
4/28	26.8 D F	44.9 D F	12.7 MPH	62.1 DEG	15.1 MPH	68.4 DEG	15.4 MPH	65.9 DEG	-1.6 D F
4/29	32.4 D F	48.3 D F	12.2 MPH	68.4 DEG	16.7 MPH	77.2 DEG	18.3 MPH	76.9 DEG	-1.3 D F
4/30	38.0 D F	52.4 D F	6.8 MPH	72.8 DEG	10.1 MPH	85.5 DEG	10.8 MPH	88.1 DEG	0.7 D F

Table 5

DAVIS BESSE SITE AVERAGE WEATHER DATA

MAY 1, 1982 THROUGH MAY 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
5/ 1	40.2 D F	59.3 D F	4.9 MPH	15.5 DEG	6.9 MPH	13.7 DEG	7.3 MPH	1.9 DEG	0.0 D F
5/ 2	36.5 D F	60.7 D F	6.4 MPH	11.1 DEG	9.3 MPH	359.7 DEG	9.9 MPH	350.2 DEG	0.1 D F
5/ 3	38.4 D F	57.0 D F	7.6 MPH	71.8 DEG	10.9 MPH	83.8 DEG	11.6 MPH	85.6 DEG	-0.7 D F
5/ 4	38.2 D F	57.7 D F	9.3 MPH	99.8 DEG	15.7 MPH	117.7 DEG	17.4 MPH	120.4 DEG	0.1 D F
5/ 5	40.6 D F	68.0 D F	7.9 MPH	164.3 DEG	15.1 MPH	181.8 DEG	17.4 MPH	183.8 DEG	1.3 D F
5/ 6	43.1 D F	74.0 D F	11.2 MPH	198.0 DEG	19.3 MPH	205.0 DEG	24.1 MPH	203.8 DEG	0.5 D F
5/ 7	54.2 D F	62.5 D F	8.1 MPH	233.9 DEG	14.0 MPH	245.2 DEG	15.4 MPH	243.4 DEG	-0.6 D F
5/ 8	44.4 D F	60.1 D F	8.7 MPH	328.6 DEG	11.9 MPH	340.6 DEG	12.9 MPH	338.5 DEG	-0.9 D F
5/ 9	36.2 D F	57.5 D F	7.8 MPH	69.2 DEG	9.3 MPH	76.7 DEG	9.5 MPH	73.9 DEG	-1.0 D F
5/10	42.3 D F	57.5 D F	8.2 MPH	86.0 DEG	11.0 MPH	93.8 DEG	11.7 MPH	95.6 DEG	-1.1 D F
5/11	44.7 D F	70.4 D F	8.9 MPH	203.1 DEG	16.9 MPH	214.8 DEG	19.8 MPH	214.3 DEG	0.5 D F
5/12	51.4 D F	69.7 D F	7.9 MPH	117.6 DEG	13.2 MPH	30.1 DEG	14.2 MPH	3.6 DEG	0.8 D F
5/13	56.6 D F	65.8 D F	6.5 MPH	83.9 DEG	9.8 MPH	93.1 DEG	11.1 MPH	91.3 DEG	0.4 D F
5/14	54.2 D F	65.2 D F	9.9 MPH	85.6 DEG	15.8 MPH	101.5 DEG	17.5 MPH	105.5 DEG	0.6 D F
5/15	49.0 D F	63.1 D F	10.2 MPH	85.4 DEG	15.7 MPH	99.4 DEG	17.6 MPH	101.4 DEG	-0.4 D F
5/16	47.4 D F	64.4 D F	8.0 MPH	80.2 DEG	11.8 MPH	88.4 DEG	13.5 MPH	86.5 DEG	-0.8 D F
5/17	55.6 D F	65.8 D F	7.7 MPH	74.5 DEG	11.4 MPH	94.5 DEG	13.2 MPH	94.9 DEG	-0.5 D F
5/18	55.0 D F	70.5 D F	6.7 MPH	121.1 DEG	12.2 MPH	150.9 DEG	13.7 MPH	155.9 DEG	1.3 D F
5/19	53.1 D F	69.4 D F	9.5 MPH	225.2 DEG	14.7 MPH	241.3 DEG	16.1 MPH	240.5 DEG	-0.4 D F
5/20	55.0 D F	67.8 D F	10.0 MPH	346.1 DEG	14.7 MPH	334.8 DEG	16.4 MPH	324.4 DEG	-0.7 D F
5/21	51.6 D F	58.8 D F	14.1 MPH	69.9 DEG	20.4 MPH	76.9 DEG	21.1 MPH	74.1 DEG	-1.2 D F
5/22	54.6 D F	59.5 D F	11.4 MPH	83.1 DEG	15.8 MPH	93.8 DEG	16.2 MPH	94.6 DEG	-1.2 D F
5/23	54.3 D F	63.2 D F	6.9 MPH	228.7 DEG	9.1 MPH	241.1 DEG	9.6 MPH	236.1 DEG	-1.2 D F
5/24	51.9 D F	60.0 D F	6.1 MPH	286.7 DEG	8.0 MPH	299.6 DEG	8.2 MPH	296.1 DEG	-1.2 D F
5/25	49.9 D F	59.9 D F	7.5 MPH	41.1 DEG	8.0 MPH	47.9 DEG	8.2 MPH	43.6 DEG	-1.4 D F
5/26	54.7 D F	61.2 D F	7.9 MPH	95.1 DEG	11.5 MPH	95.7 DEG	12.3 MPH	92.6 DEG	-0.9 D F
5/27	59.7 D F	66.0 D F	8.0 MPH	106.4 DEG	12.5 MPH	121.3 DEG	13.7 MPH	124.6 DEG	-0.8 D F
5/28	58.3 D F	68.1 D F	9.8 MPH	209.9 DEG	14.5 MPH	225.6 DEG	15.4 MPH	224.2 DEG	-0.8 D F
5/29	60.5 D F	70.1 D F	6.9 MPH	184.2 DEG	11.9 MPH	199.4 DEG	12.3 MPH	196.7 DEG	0.1 D F
5/30	61.5 D F	69.3 D F	5.5 MPH	282.5 DEG	7.7 MPH	298.9 DEG	8.3 MPH	292.6 DEG	-0.8 D F
5/31	62.5 D F	73.5 D F	6.3 MPH	192.0 DEG	10.9 MPH	209.0 DEG	11.6 MPH	207.8 DEG	-0.3 D F

Table 6

DAVIS BESSE SITE AVERAGE WEATHER DATA

JUNE 1, 1982 THROUGH JUNE 30, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
6/ 1	53.1 D F	65.0 D F	11.9 MPH	266.8 DEG	17.4 MPH	279.3 DEG	18.5 MPH	275.9 DEG	-1.0 D F
6/ 2	46.0 D F	63.1 D F	8.8 MPH	248.0 DEG	12.0 MPH	287.8 DEG	12.1 MPH	285.4 DEG	0.1 D F
6/ 3	43.9 D F	56.2 D F	17.4 MPH	45.0 DEG	21.0 MPH	52.5 DEG	21.5 MPH	49.0 DEG	-1.6 D F
6/ 4	50.5 D F	58.6 D F	12.0 MPH	56.0 DEG	15.7 MPH	62.9 DEG	16.2 MPH	59.7 DEG	-1.4 D F
6/ 5	52.2 D F	59.2 D F	15.7 MPH	4.4 DEG	19.5 MPH	10.8 DEG	21.3 MPH	6.9 DEG	-1.3 D F
6/ 6	51.3 D F	62.7 D F	10.9 MPH	29.8 DEG	14.7 MPH	35.9 DEG	15.5 MPH	31.3 DEG	-1.3 D F
6/ 7	54.4 D F	62.4 D F	7.6 MPH	124.6 DEG	11.7 MPH	133.2 DEG	12.5 MPH	130.4 DEG	-0.9 D F
6/ 8	61.2 D F	69.9 D F	6.0 MPH	106.9 DEG	11.1 MPH	115.7 DEG	12.1 MPH	106.1 DEG	0.2 D F
6/ 9	60.9 D F	68.2 D F	8.0 MPH	101.6 DEG	13.6 MPH	116.4 DEG	15.5 MPH	118.3 DEG	-0.7 D F
6/10	54.7 D F	67.7 D F	10.9 MPH	278.8 DEG	15.1 MPH	287.5 DEG	16.1 MPH	283.0 DEG	-1.2 D F
6/11	46.2 D F	64.2 D F	7.9 MPH	62.8 DEG	10.9 MPH	58.6 DEG	11.5 MPH	55.8 DEG	-0.7 D F
6/12	47.8 D F	67.5 D F	5.8 MPH	205.6 DEG	10.6 MPH	215.4 DEG	12.1 MPH	214.2 DEG	-0.3 D F
6/13	47.4 D F	66.6 D F	9.8 MPH	265.9 DEG	14.7 MPH	287.6 DEG	15.4 MPH	287.0 DEG	0.2 D F
6/14	48.2 D F	68.5 D F	6.8 MPH	177.2 DEG	11.3 MPH	245.1 DEG	12.6 MPH	252.1 DEG	0.1 D F
6/15	55.0 D F	70.4 D F	13.1 MPH	201.3 DEG	22.8 MPH	209.5 DEG	25.5 MPH	208.0 DEG	-0.6 D F
6/16	55.1 D F	61.3 D F	10.4 MPH	27.1 DEG	12.9 MPH	32.9 DEG	13.9 MPH	29.2 DEG	-1.2 D F
6/17	51.0 D F	62.5 D F	7.5 MPH	236.9 DEG	10.6 MPH	253.0 DEG	10.9 MPH	251.2 DEG	-0.8 D F
6/18	53.3 D F	67.5 D F	5.1 MPH	193.3 DEG	9.7 MPH	214.6 DEG	10.2 MPH	214.5 DEG	0.4 D F
6/19	52.7 D F	63.2 D F	9.8 MPH	271.7 DEG	15.4 MPH	286.6 DEG	16.6 MPH	283.7 DEG	-0.6 D F
6/20	49.0 D F	61.7 D F	11.3 MPH	224.0 DEG	18.7 MPH	238.8 DEG	20.8 MPH	237.4 DEG	-0.3 D F
6/21	49.0 D F	62.1 D F	9.1 MPH	263.9 DEG	13.4 MPH	275.3 DEG	14.3 MPH	271.6 DEG	-0.9 D F
6/22	50.1 D F	63.4 D F	9.2 MPH	298.6 DEG	13.3 MPH	305.3 DEG	13.8 MPH	299.1 DEG	-1.1 D F
6/23	45.8 D F	61.7 D F	6.4 MPH	321.5 DEG	7.6 MPH	340.1 DEG	7.1 MPH	334.3 DEG	-0.6 D F
6/24	50.4 D F	69.9 D F	5.8 MPH	128.5 DEG	7.8 MPH	143.1 DEG	9.0 MPH	128.7 DEG	0.2 D F
6/25	51.6 D F	70.6 D F	7.9 MPH	215.6 DEG	14.6 MPH	228.5 DEG	16.7 MPH	227.7 DEG	0.4 D F
6/26	59.3 D F	65.6 D F	8.7 MPH	57.0 DEG	10.6 MPH	61.4 DEG	11.0 MPH	57.6 DEG	-1.4 D F
6/27	61.2 D F	66.9 D F	7.8 MPH	81.0 DEG	10.4 MPH	90.7 DEG	10.8 MPH	90.1 DEG	-1.3 D F
6/28	64.4 D F	70.6 D F	5.9 MPH	184.9 DEG	10.0 MPH	200.8 DEG	10.8 MPH	202.8 DEG	0.5 D F
6/29	62.4 D F	71.3 D F	7.3 MPH	4.0 DEG	8.8 MPH	15.5 DEG	9.2 MPH	12.1 DEG	-1.3 D F
6/30	46.3 D F	67.1 D F	11.3 MPH	351.5 DEG	14.3 MPH	358.5 DEG	15.0 MPH	353.6 DEG	-1.4 D F

Table 7

DAVIS BESSE SITE AVERAGE WEATHER DATA

JULY 1, 1982 THROUGH JULY 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
7/ 1	47.3 D F	67.8 D F	7.3 MPH	358.7 DEG	10.1 MPH	6.1 DEG	10.7 MPH	0.8 DEG	-1.1 D F
7/ 2	51.6 D F	68.4 D F	7.0 MPH	208.3 DEG	12.8 MPH	216.7 DEG	14.4 MPH	214.4 DEG	-0.1 D F
7/ 3	61.7 D F	67.1 D F	5.8 MPH	126.0 DEG	8.1 MPH	136.8 DEG	8.9 MPH	137.4 DEG	-1.2 D F
7/ 4	61.4 D F	67.9 D F	7.3 MPH	31.4 DEG	10.2 MPH	4.6 DEG	10.7 MPH	1.7 DEG	-0.6 D F
7/ 5	59.2 D F	69.5 D F	4.5 MPH	68.6 DEG	6.7 MPH	73.1 DEG	6.9 MPH	71.9 DEG	-0.9 D F
7/ 6	66.9 D F	78.2 D F	6.8 MPH	183.1 DEG	15.2 MPH	189.9 DEG	17.3 MPH	188.7 DEG	-0.2 D F
7/ 7	68.8 D F	70.1 D F	9.6 MPH	223.4 DEG	17.3 MPH	233.1 DEG	19.4 MPH	247.0 DEG	-0.3 D F
7/ 8	61.6 D F	72.3 D F	5.9 MPH	260.7 DEG	9.6 MPH	280.5 DEG	9.9 MPH	280.6 DEG	2.8 D F
7/ 9	54.7 D F	60.2 D F	9.8 MPH	52.4 DEG	11.6 MPH	56.9 DEG	16.8 MPH	57.0 DEG	-1.3 D F
7/10	66.1 D F	75.3 D F	7.2 MPH	164.6 DEG	14.0 MPH	171.1 DEG	15.9 MPH	173.2 DEG	-0.6 D F
7/11	64.5 D F	74.3 D F	14.8 MPH	231.4 DEG	21.9 MPH	236.8 DEG	23.6 MPH	234.6 DEG	-1.0 D F
7/12	59.6 D F	72.4 D F	9.9 MPH	243.0 DEG	14.9 MPH	254.6 DEG	16.3 MPH	255.1 DEG	-0.6 D F
7/13	61.2 D F	72.0 D F	6.1 MPH	36.6 DEG	8.9 MPH	26.4 DEG	9.1 MPH	26.4 DEG	0.0 D F
7/14	62.1 D F	75.3 D F	4.8 MPH	150.2 DEG	9.2 MPH	153.2 DEG	10.3 MPH	153.2 DEG	-0.2 D F
7/15	64.5 D F	77.4 D F	4.9 MPH	93.9 DEG	7.3 MPH	89.5 DEG	8.1 MPH	82.6 DEG	0.3 D F
7/16	64.0 D F	79.7 D F	5.3 MPH	199.4 DEG	11.3 MPH	208.4 DEG	12.7 MPH	209.0 DEG	0.7 D F
7/17	67.8 D F	80.3 D F	10.1 MPH	214.5 DEG	17.1 MPH	219.7 DEG	19.4 MPH	219.3 DEG	-0.7 D F
7/18	68.5 D F	78.6 D F	9.2 MPH	218.9 DEG	15.1 MPH	226.0 DEG	17.1 MPH	225.9 DEG	-0.8 D F
7/19	66.4 D F	74.1 D F	7.1 MPH	230.7 DEG	9.9 MPH	252.4 DEG	11.0 MPH	253.4 DEG	-0.9 D F
7/20	57.2 D F	72.9 D F	9.7 MPH	34.4 DEG	10.9 MPH	37.4 DEG	11.5 MPH	37.2 DEG	-1.4 D F
7/21	56.9 D F	73.7 D F	6.2 MPH	93.5 DEG	9.0 MPH	92.5 DEG	9.2 MPH	90.7 DEG	-0.9 D F
7/22	60.1 D F	73.7 D F	6.9 MPH	88.6 DEG	10.1 MPH	87.7 DEG	10.6 MPH	84.5 DEG	-0.8 D F
7/23	60.4 D F	74.5 D F	9.4 MPH	51.4 DEG	11.6 MPH	55.0 DEG	12.1 MPH	53.1 DEG	-1.2 D F
7/24	56.5 D F	74.7 D F	6.9 MPH	91.0 DEG	10.2 MPH	92.3 DEG	10.6 MPH	90.3 DEG	-0.8 D F
7/25	60.3 D F	76.5 D F	7.2 MPH	236.3 DEG	12.0 MPH	242.0 DEG	12.5 MPH	244.3 DEG	1.8 D F
7/26	66.9 D F	77.9 D F	7.1 MPH	247.1 DEG	10.9 MPH	273.1 DEG	11.7 MPH	278.8 DEG	-0.2 D F
7/27	68.4 D F	78.1 D F	7.0 MPH	119.0 DEG	9.9 MPH	127.3 DEG	10.4 MPH	131.7 DEG	-0.9 D F
7/28	59.2 D F	73.3 D F	10.8 MPH	358.3 DEG	14.0 MPH	2.2 DEG	14.8 MPH	2.4 DEG	-1.1 D F
7/29	56.2 D F	71.7 D F	6.2 MPH	222.0 DEG	9.4 MPH	216.3 DEG	9.5 MPH	219.9 DEG	0.2 D F
7/30	56.9 D F	73.4 D F	6.8 MPH	220.7 DEG	11.1 MPH	238.1 DEG	11.5 MPH	240.5 DEG	0.7 D F
7/31	58.0 D F	70.7 D F	7.1 MPH	288.0 DEG	9.9 MPH	316.4 DEG	10.3 MPH	320.6 DEG	0.2 D F

Table 8

DAVIS BESSE SITE AVERAGE WEATHER DATA

AUGUST 1, 1982 THROUGH AUGUST 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
8/ 1	59.9 D F	73.0 D F	8.0 MPH	237.8 DEG	12.9 MPH	253.4 DEG	13.6 MPH	255.7 DEG	0.7 D F
8/ 2	62.9 D F	71.9 D F	6.5 MPH	199.3 DEG	10.5 MPH	215.2 DEG	11.7 MPH	219.3 DEG	-0.4 D F
8/ 3	67.2 D F	77.0 D F	6.4 MPH	173.0 DEG	10.3 MPH	178.1 DEG	11.3 MPH	177.5 DEG	-0.7 D F
8/ 4	70.4 D F	78.9 D F	6.4 MPH	246.0 DEG	10.8 MPH	263.8 DEG	12.1 MPH	265.1 DEG	-0.2 D F
8/ 5	64.7 D F	73.0 D F	9.7 MPH	47.8 DEG	11.1 MPH	50.7 DEG	11.4 MPH	48.4 DEG	-1.2 D F
8/ 6	64.0 D F	74.0 D F	9.5 MPH	76.6 DEG	13.2 MPH	79.3 DEG	13.5 MPH	76.9 DEG	-1.1 D F
8/ 7	65.3 D F	75.0 D F	6.2 MPH	102.7 DEG	9.9 MPH	99.1 DEG	10.5 MPH	97.1 DEG	-0.4 D F
8/ 8	66.9 D F	74.6 D F	8.0 MPH	223.2 DEG	13.7 MPH	233.0 DEG	15.2 MPH	234.2 DEG	-0.4 D F
8/ 9	57.2 D F	71.7 D F	8.8 MPH	273.7 DEG	13.6 MPH	291.0 DEG	14.6 MPH	292.5 DEG	-0.1 D F
8/10	49.8 D F	63.1 D F	7.4 MPH	281.4 DEG	11.2 MPH	297.9 DEG	11.5 MPH	299.6 DEG	-0.3 D F
8/11	47.5 D F	64.2 D F	6.1 MPH	354.8 DEG	8.3 MPH	21.8 DEG	8.4 MPH	23.6 DEG	0.3 D F
8/12	46.8 D F	65.4 D F	4.7 MPH	304.7 DEG	7.4 MPH	331.7 DEG	7.2 MPH	336.7 DEG	1.1 D F
8/13	48.5 D F	66.1 D F	5.4 MPH	171.8 DEG	10.5 MPH	159.0 DEG	10.9 MPH	153.5 DEG	1.5 D F
8/14	52.9 D F	69.6 D F	5.2 MPH	189.9 DEG	10.2 MPH	172.2 DEG	10.7 MPH	179.3 DEG	1.4 D F
8/15	57.6 D F	71.9 D F	5.0 MPH	130.7 DEG	8.4 MPH	132.2 DEG	8.6 MPH	123.0 DEG	1.0 D F
8/16	59.7 D F	73.6 D F	4.0 MPH	151.3 DEG	8.0 MPH	155.3 DEG	8.2 MPH	150.7 DEG	1.1 D F
8/17	57.0 D F	72.2 D F	8.5 MPH	22.2 DEG	11.8 MPH	27.1 DEG	12.3 MPH	26.0 DEG	0.2 D F
8/18	52.0 D F	69.7 D F	4.5 MPH	318.9 DEG	7.4 MPH	8.5 DEG	7.2 MPH	7.1 DEG	1.3 D F
8/19	53.4 D F	72.7 D F	10.4 MPH	228.0 DEG	18.1 MPH	233.5 DEG	20.4 MPH	232.1 DEG	0.3 D F
8/20	61.2 D F	73.0 D F	9.9 MPH	282.4 DEG	14.6 MPH	292.4 DEG	16.0 MPH	291.9 DEG	-0.7 D F
8/21	49.9 D F	64.7 D F	10.4 MPH	23.4 DEG	13.9 MPH	32.0 DEG	14.3 MPH	32.4 DEG	-0.7 D F
8/22	49.0 D F	62.1 D F	7.4 MPH	197.6 DEG	15.7 MPH	199.4 DEG	18.4 MPH	197.4 DEG	-0.0 D F
8/23	59.8 D F	68.4 D F	5.8 MPH	217.2 DEG	10.2 MPH	239.6 DEG	11.6 MPH	239.3 DEG	-0.4 D F
8/24	58.4 D F	69.6 D F	5.7 MPH	213.5 DEG	10.5 MPH	233.1 DEG	11.4 MPH	231.8 DEG	1.0 D F
8/25	53.1 D F	67.6 D F	11.5 MPH	290.3 DEG	17.1 MPH	303.3 DEG	18.0 MPH	302.8 DEG	-0.3 D F
8/26	52.7 D F	66.5 D F	7.0 MPH	220.5 DEG	12.7 MPH	242.6 DEG	13.8 MPH	245.2 DEG	1.5 D F
8/27	55.8 D F	66.4 D F	8.2 MPH	301.4 DEG	12.3 MPH	317.5 DEG	13.5 MPH	318.5 DEG	-0.4 D F
8/28	41.6 D F	61.5 D F	7.8 MPH	36.8 DEG	9.6 MPH	40.7 DEG	9.7 MPH	39.9 DEG	-0.8 D F
8/29	40.6 D F	59.6 D F	5.0 MPH	165.7 DEG	10.7 MPH	167.6 DEG	11.9 MPH	164.1 DEG	0.7 D F
8/30	54.8 D F	69.6 D F	7.0 MPH	201.5 DEG	13.5 MPH	204.5 DEG	15.7 MPH	203.6 DEG	-0.5 D F
8/31	63.3 D F	67.8 D F	7.9 MPH	85.3 DEG	11.7 MPH	83.3 DEG	12.5 MPH	79.7 DEG	-0.8 D F

Table 9

DAVIS BESSE SITE AVERAGE WEATHER DATA

SEPTEMBER 1, 1982 THROUGH SEPTEMBER 30, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
9/ 1	66.3 D F	73.2 D F	9.1 MPH	206.0 DEG	15.0 MPH	212.6 DEG	16.3 MPH	212.9 DEG	-0.7 D F
9/ 2	58.2 D F	70.0 D F	9.2 MPH	258.6 DEG	14.9 MPH	275.2 DEG	16.1 MPH	275.7 DEG	0.1 D F
9/ 3	47.2 D F	62.4 D F	12.3 MPH	283.0 DEG	19.3 MPH	293.2 DEG	20.7 MPH	293.7 DEG	-0.4 D F
9/ 4	47.2 D F	60.0 D F	6.3 MPH	71.6 DEG	11.1 MPH	21.6 DEG	11.9 MPH	23.2 DEG	1.0 D F
9/ 5	48.0 D F	66.1 D F	6.9 MPH	207.8 DEG	14.7 MPH	215.6 DEG	17.3 MPH	215.6 DEG	1.1 D F
9/ 6	54.4 D F	63.0 D F	9.5 MPH	311.3 DEG	14.0 MPH	319.2 DEG	15.1 MPH	323.1 DEG	1.0 D F
9/ 7	54.2 D F	62.2 D F	11.3 MPH	69.2 DEG	16.2 MPH	71.5 DEG	16.8 MPH	69.3 DEG	-1.0 D F
9/ 8	49.3 D F	60.3 D F	4.6 MPH	128.3 DEG	6.7 MPH	99.3 DEG	6.9 MPH	93.6 DEG	0.7 D F
9/ 9	52.3 D F	62.8 D F	5.4 MPH	148.0 DEG	10.1 MPH	145.3 DEG	9.9 MPH	143.6 DEG	2.3 D F
9/10	59.7 D F	68.5 D F	5.4 MPH	161.2 DEG	11.9 MPH	177.0 DEG	12.3 MPH	179.6 DEG	2.5 D F
9/11	61.5 D F	73.1 D F	6.0 MPH	181.5 DEG	13.8 MPH	196.9 DEG	15.4 MPH	201.1 DEG	1.7 D F
9/12	62.1 D F	73.1 D F	6.6 MPH	144.9 DEG	15.5 MPH	156.8 DEG	18.0 MPH	158.9 DEG	1.5 D F
9/13	64.4 D F	77.3 D F	5.8 MPH	176.1 DEG	14.3 MPH	187.7 DEG	16.0 MPH	189.7 DEG	0.4 D F
9/14	67.1 D F	73.1 D F	5.4 MPH	241.4 DEG	8.8 MPH	268.8 DEG	9.9 MPH	275.7 DEG	-0.7 D F
9/15	62.1 D F	66.8 D F	6.2 MPH	13.8 DEG	7.0 MPH	16.5 DEG	7.3 MPH	11.0 DEG	-1.1 D F
9/16	48.3 D F	58.8 D F	10.1 MPH	322.7 DEG	14.4 MPH	331.7 DEG	15.2 MPH	331.8 DEG	-0.9 D F
9/17	45.0 D F	53.2 D F	4.3 MPH	191.0 DEG	6.2 MPH	152.5 DEG	6.3 MPH	130.2 DEG	1.7 D F
9/18	40.7 D F	62.3 D F	8.7 MPH	334.0 DEG	12.0 MPH	341.5 DEG	12.3 MPH	339.7 DEG	-0.8 D F
9/19	42.9 D F	58.1 D F	6.5 MPH	230.8 DEG	9.4 MPH	242.1 DEG	10.2 MPH	235.4 DEG	2.2 D F
9/20	43.8 D F	56.8 D F	10.1 MPH	281.7 DEG	16.7 MPH	288.9 DEG	18.0 MPH	287.9 DEG	0.3 D F
9/21	40.1 D F	49.7 D F	6.7 MPH	278.5 DEG	10.0 MPH	298.0 DEG	10.1 MPH	300.6 DEG	0.0 D F
9/22	46.8 D F	52.5 D F	8.4 MPH	299.8 DEG	11.6 MPH	319.8 DEG	12.2 MPH	321.9 DEG	-0.2 D F
9/23	47.9 D F	57.0 D F	8.0 MPH	239.9 DEG	13.8 MPH	251.7 DEG	15.4 MPH	252.2 DEG	-0.4 D F
9/24	51.0 D F	56.4 D F	7.4 MPH	190.2 DEG	15.7 MPH	192.2 DEG	17.9 MPH	191.4 DEG	-0.8 D F
9/25	55.0 D F	59.5 D F	5.1 MPH	146.3 DEG	9.7 MPH	152.5 DEG	10.9 MPH	152.9 DEG	-0.7 D F
9/26	55.4 D F	59.5 D F	4.2 MPH	111.8 DEG	7.6 MPH	127.1 DEG	7.8 MPH	121.8 DEG	0.3 D F
9/27	53.4 D F	58.1 D F	7.5 MPH	302.9 DEG	11.7 MPH	314.8 DEG	12.5 MPH	316.2 DEG	-0.9 D F
9/28	53.6 D F	58.7 D F	5.4 MPH	159.9 DEG	9.2 MPH	46.7 DEG	9.8 MPH	46.6 DEG	1.0 D F
9/29	54.6 D F	61.1 D F	7.2 MPH	118.6 DEG	13.2 MPH	129.7 DEG	15.2 MPH	131.2 DEG	-0.0 D F
9/30	54.8 D F	63.0 D F	4.8 MPH	135.0 DEG	9.6 MPH	154.6 DEG	10.2 MPH	156.7 DEG	1.4 D F

Table 10

DAVIS BESSE SITE AVERAGE WEATHER DATA

OCTOBER 1, 1982 THROUGH OCTOBER 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
10/ 1	53.9 D F	66.1 D F	9.1 MPH	230.1 DEG	15.4 MPH	271.8 DEG	16.4 MPH	281.2 DEG	1.4 D F
10/ 2	52.9 D F	60.9 D F	9.8 MPH	92.3 DEG	14.7 MPH	96.2 DEG	15.5 MPH	94.1 DEG	-0.9 D F
10/ 3	55.1 D F	67.4 D F	7.2 MPH	262.8 DEG	14.3 MPH	273.9 DEG	16.3 MPH	275.7 DEG	0.7 D F
10/ 4	51.0 D F	61.9 D F	9.1 MPH	77.8 DEG	13.1 MPH	81.3 DEG	13.4 MPH	78.9 DEG	-1.0 D F
10/ 5	57.4 D F	62.7 D F	4.7 MPH	107.1 DEG	9.3 MPH	116.4 DEG	9.4 MPH	123.2 DEG	1.3 D F
10/ 6	59.7 D F	69.1 D F	5.8 MPH	165.1 DEG	14.9 MPH	181.4 DEG	16.9 MPH	184.8 DEG	2.8 D F
10/ 7	56.3 D F	66.8 D F	8.2 MPH	212.8 DEG	16.0 MPH	224.1 DEG	17.8 MPH	223.2 DEG	0.8 D F
10/ 8	49.4 D F	61.5 D F	5.8 MPH	212.0 DEG	10.9 MPH	253.9 DEG	11.9 MPH	253.5 DEG	2.4 D F
10/ 9	52.9 D F	61.0 D F	14.1 MPH	81.8 DEG	21.5 MPH	85.5 DEG	22.2 MPH	82.4 DEG	-1.1 D F
10/10	56.6 D F	68.1 D F	8.7 MPH	168.9 DEG	14.7 MPH	175.7 DEG	15.6 MPH	174.2 DEG	-0.3 D F
10/11	45.3 D F	57.0 D F	9.7 MPH	249.5 DEG	14.2 MPH	265.0 DEG	14.8 MPH	264.0 DEG	-0.1 D F
10/12	41.3 D F	54.3 D F	7.7 MPH	233.8 DEG	12.0 MPH	244.6 DEG	13.1 MPH	242.9 DEG	-0.7 D F
10/13	43.4 D F	53.2 D F	6.7 MPH	251.7 DEG	12.4 MPH	271.6 DEG	14.0 MPH	273.0 DEG	0.2 D F
10/14	42.3 D F	52.9 D F	15.1 MPH	252.2 DEG	21.5 MPH	261.7 DEG	23.1 MPH	260.7 DEG	-0.8 D F
10/15	38.7 D F	51.3 D F	15.1 MPH	277.7 DEG	22.2 MPH	285.4 DEG	23.8 MPH	283.5 DEG	-0.8 D F
10/16	30.2 D F	43.4 D F	14.1 MPH	303.9 DEG	21.6 MPH	312.8 DEG	22.6 MPH	311.5 DEG	-0.8 D F
10/17	33.1 D F	42.7 D F	7.4 MPH	354.1 DEG	11.7 MPH	14.6 DEG	12.4 MPH	12.2 DEG	-0.2 D F
10/18	31.9 D F	52.8 D F	6.7 MPH	189.4 DEG	15.9 MPH	198.1 DEG	19.0 MPH	197.6 DEG	0.7 D F
10/19	41.8 D F	60.1 D F	9.2 MPH	192.1 DEG	19.1 MPH	198.8 DEG	22.1 MPH	197.4 DEG	0.3 D F
10/20	38.9 D F	50.5 D F	19.7 MPH	222.9 DEG	30.4 MPH	228.2 DEG	32.4 MPH	225.2 DEG	-0.9 D F
10/21	29.0 D F	42.0 D F	8.7 MPH	292.2 DEG	12.4 MPH	302.2 DEG	13.0 MPH	300.6 DEG	-1.0 D F
10/22	25.5 D F	41.9 D F	6.9 MPH	308.8 DEG	9.5 MPH	322.8 DEG	9.6 MPH	322.2 DEG	-0.8 D F
10/23	28.3 D F	41.9 D F	5.8 MPH	26.5 DEG	7.8 MPH	54.7 DEG	8.2 MPH	52.0 DEG	-0.4 D F
10/24	36.1 D F	44.5 D F	5.2 MPH	75.8 DEG	8.5 MPH	80.8 DEG	9.0 MPH	78.8 DEG	1.3 D F
10/25	40.0 D F	46.7 D F	6.1 MPH	329.0 DEG	7.8 MPH	18.8 DEG	8.0 MPH	29.5 DEG	1.6 D F
10/26	36.1 D F	47.8 D F	4.4 MPH	225.3 DEG	8.2 MPH	283.6 DEG	7.9 MPH	292.2 DEG	4.2 D F
10/27	36.0 D F	50.6 D F	5.1 MPH	149.3 DEG	11.9 MPH	176.0 DEG	12.5 MPH	175.4 DEG	3.7 D F
10/28	34.9 D F	58.6 D F	6.9 MPH	183.3 DEG	18.4 MPH	192.7 DEG	22.1 MPH	192.3 DEG	1.6 D F
10/29	40.4 D F	55.0 D F	11.4 MPH	202.6 DEG	22.2 MPH	211.3 DEG	25.1 MPH	210.0 DEG	0.6 D F
10/30	44.2 D F	53.2 D F	6.9 MPH	195.9 DEG	15.4 MPH	208.6 DEG	18.0 MPH	210.5 DEG	0.7 D F
10/31	57.5 D F	60.6 D F	7.1 MPH	209.5 DEG	15.0 MPH	219.7 DEG	17.4 MPH	219.6 DEG	-0.0 D F

Table 11

DAVIS BESSE SITE AVERAGE WEATHER DATA

NOVEMBER 1, 1982 THROUGH NOVEMBER 30, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
11/ 1	59.4 D F	64.1 D F	8.6 MPH	200.5 DEG	15.0 MPH	221.4 DEG	16.7 MPH	224.1 DEG	-0.2 D F
11/ 2	57.3 D F	61.0 D F	10.9 MPH	209.7 DEG	17.1 MPH	218.6 DEG	19.0 MPH	220.9 DEG	-0.4 D F
11/ 3	44.6 D F	57.9 D F	9.0 MPH	285.0 DEG	12.3 MPH	293.0 DEG	12.8 MPH	292.4 DEG	-0.7 D F
11/ 4	33.1 D F	28.0 D F	19.9 MPH	261.2 DEG	22.1 MPH	269.3 DEG	36.9 MPH	268.8 DEG	-1.7 D F
11/ 5	22.6 D F	31.7 D F	18.7 MPH	235.4 DEG	24.1 MPH	242.5 DEG	25.6 MPH	241.6 DEG	-1.2 D F
11/ 6	22.2 D F	31.8 D F	13.0 MPH	225.9 DEG	18.6 MPH	237.0 DEG	20.2 MPH	237.4 DEG	-0.6 D F
11/ 7	27.9 D F	44.3 D F	11.4 MPH	202.1 DEG	21.2 MPH	209.2 DEG	24.7 MPH	211.4 DEG	0.2 D F
11/ 8	37.2 D F	50.8 D F	10.2 MPH	238.9 DEG	17.2 MPH	252.5 DEG	19.3 MPH	253.2 DEG	0.0 D F
11/ 9	38.5 D F	44.9 D F	12.8 MPH	63.4 DEG	19.2 MPH	68.1 DEG	20.0 MPH	68.6 DEG	-0.9 D F
11/10	39.7 D F	49.9 D F	10.5 MPH	118.8 DEG	18.6 MPH	131.1 DEG	20.1 MPH	134.5 DEG	0.3 D F
11/11	48.7 D F	57.2 D F	12.4 MPH	199.7 DEG	22.6 MPH	206.8 DEG	25.7 MPH	207.8 DEG	-0.3 D F
11/12	41.5 D F	50.3 D F	21.5 MPH	224.7 DEG	32.0 MPH	232.2 DEG	34.7 MPH	231.2 DEG	-0.6 D F
11/13	21.7 D F	32.7 D F	12.9 MPH	237.4 DEG	16.9 MPH	269.7 DEG	17.7 MPH	268.7 DEG	-1.2 D F
11/14	21.3 D F	31.8 D F	9.4 MPH	179.7 DEG	12.7 MPH	224.3 DEG	13.6 MPH	222.9 DEG	-1.3 D F
11/15	17.9 D F	30.1 D F	9.8 MPH	225.4 DEG	14.8 MPH	256.9 DEG	16.2 MPH	257.4 DEG	-0.7 D F
11/16	21.3 D F	33.9 D F	7.3 MPH	195.1 DEG	14.9 MPH	211.9 DEG	17.4 MPH	214.0 DEG	0.2 D F
11/17	30.9 D F	39.9 D F	4.6 MPH	142.7 DEG	10.6 MPH	167.4 DEG	10.4 MPH	175.5 DEG	2.7 D F
11/18	38.9 D F	45.7 D F	4.5 MPH	110.5 DEG	10.1 MPH	140.8 DEG	10.7 MPH	151.2 DEG	2.8 D F
11/19	45.1 D F	53.5 D F	8.6 MPH	141.3 DEG	16.5 MPH	154.7 DEG	18.6 MPH	158.7 DEG	1.3 D F
11/20	50.5 D F	55.9 D F	12.8 MPH	181.2 DEG	22.6 MPH	184.1 DEG	25.1 MPH	184.6 DEG	-0.9 D F
11/21	45.7 D F	51.0 D F	8.8 MPH	191.5 DEG	15.1 MPH	336.8 DEG	17.0 MPH	338.2 DEG	-0.6 D F
11/22	41.3 D F	46.3 D F	10.2 MPH	133.2 DEG	14.5 MPH	67.6 DEG	16.0 MPH	69.7 DEG	-1.0 D F
11/23	45.8 D F	46.0 D F	9.4 MPH	258.2 DEG	14.2 MPH	306.2 DEG	15.5 MPH	304.3 DEG	-0.8 D F
11/24	23.6 D F	33.0 D F	14.9 MPH	286.0 DEG	19.7 MPH	296.7 DEG	20.6 MPH	295.6 DEG	-1.3 D F
11/25	17.4 D F	29.4 D F	12.1 MPH	203.4 DEG	16.7 MPH	227.6 DEG	18.3 MPH	227.5 DEG	-1.1 D F
11/26	28.3 D F	33.7 D F	9.9 MPH	75.4 DEG	15.3 MPH	248.1 DEG	16.6 MPH	249.4 DEG	-0.7 D F
11/27	17.6 D F	31.5 D F	8.8 MPH	37.7 DEG	11.5 MPH	58.7 DEG	12.0 MPH	58.6 DEG	-1.2 D F
11/28	35.4 D F	40.6 D F	10.6 MPH	123.5 DEG	17.9 MPH	158.7 DEG	20.1 MPH	160.0 DEG	-0.2 D F
11/29	36.5 D F	42.4 D F	13.6 MPH	136.8 DEG	19.5 MPH	238.2 DEG	21.2 MPH	238.5 DEG	-0.8 D F
11/30	43.7 D F	48.0 D F	6.3 MPH	79.4 DEG	14.3 MPH	190.0 DEG	16.1 MPH	193.9 DEG	0.5 D F

Table 12

DAVIS BESSE SITE AVERAGE WEATHER DATA

DECEMBER 1, 1982 THROUGH DECEMBER 31, 1982

DAILY AVERAGES

DAY	10M DEW PT	10M A TEMP	10M W SPD	10M W DIR	75M W SPD	75M W DIR	100M W SPD	100M W DIR	75M DELT
12/ 1	49.2 D F	56.4 D F	6.5 MPH	114.0 DEG	14.1 MPH	196.4 DEG	16.7 MPH	198.3 DEG	0.3 D F
12/ 2	55.5 D F	62.1 D F	8.9 MPH	151.7 DEG	18.4 MPH	178.5 DEG	21.4 MPH	181.6 DEG	0.7 D F
12/ 3	56.6 D F	66.8 D F	12.8 MPH	203.3 DEG	22.6 MPH	207.1 DEG	25.3 MPH	206.9 DEG	-0.3 D F
12/ 4	46.4 D F	50.7 D F	7.8 MPH	25.1 DEG	13.9 MPH	38.3 DEG	14.9 MPH	31.9 DEG	0.2 D F
12/ 5	48.3 D F	54.7 D F	12.5 MPH	150.7 DEG	21.9 MPH	165.8 DEG	25.0 MPH	168.9 DEG	0.7 D F
12/ 6	32.8 D F	43.5 D F	14.4 MPH	252.1 DEG	21.1 MPH	261.9 DEG	23.2 MPH	261.7 DEG	-0.6 D F
12/ 7	30.3 D F	38.4 D F	9.7 MPH	255.5 DEG	13.3 MPH	265.4 DEG	14.9 MPH	266.1 DEG	-0.9 D F
12/ 8	30.5 D F	38.1 D F	8.9 MPH	50.0 DEG	12.2 MPH	12.1 DEG	12.8 MPH	7.5 DEG	-1.0 D F
12/ 9	11.4 D F	23.5 D F	11.2 MPH	355.6 DEG	14.5 MPH	10.4 DEG	15.1 MPH	12.0 DEG	-1.2 D F
12/10	24.1 D F	29.0 D F	11.9 MPH	220.4 DEG	17.6 MPH	226.4 DEG	19.6 MPH	226.2 DEG	-1.0 D F
12/11	14.6 D F	26.8 D F	11.0 MPH	313.8 DEG	16.3 MPH	323.4 DEG	17.3 MPH	323.7 DEG	-0.6 D F
12/12	9.1 D F	21.4 D F	10.7 MPH	296.4 DEG	15.6 MPH	313.2 DEG	16.1 MPH	315.1 DEG	0.1 D F
12/13	9.6 D F	20.9 D F	10.8 MPH	205.9 DEG	18.0 MPH	213.9 DEG	20.1 MPH	216.0 DEG	-0.1 D F
12/14	23.5 D F	33.8 D F	10.8 MPH	188.5 DEG	19.8 MPH	197.1 DEG	22.8 MPH	198.4 DEG	0.0 D F
12/15	38.5 D F	41.9 D F	7.8 MPH	169.1 DEG	14.7 MPH	180.2 DEG	16.8 MPH	183.6 DEG	0.4 D F
12/16	27.9 D F	33.5 D F	12.7 MPH	322.1 DEG	17.5 MPH	330.6 DEG	18.6 MPH	331.1 DEG	-1.0 D F
12/17	17.8 D F	27.5 D F	6.9 MPH	62.8 DEG	8.6 MPH	69.3 DEG	9.3 MPH	70.2 DEG	-1.0 D F
12/18	23.9 D F	32.8 D F	11.7 MPH	179.3 DEG	20.8 MPH	183.1 DEG	23.0 MPH	183.5 DEG	-0.9 D F
12/19	35.5 D F	36.5 D F	8.7 MPH	227.1 DEG	14.5 MPH	238.4 DEG	16.4 MPH	240.3 DEG	-0.9 D F
12/20	26.2 D F	32.2 D F	14.5 MPH	273.5 DEG	19.5 MPH	281.8 DEG	20.9 MPH	281.4 DEG	-1.1 D F
12/21	22.5 D F	31.8 D F	10.2 MPH	270.1 DEG	14.5 MPH	279.0 DEG	15.5 MPH	278.7 DEG	-0.9 D F
12/22	24.5 D F	31.7 D F	7.1 MPH	158.9 DEG	13.3 MPH	174.4 DEG	15.5 MPH	179.0 DEG	-0.1 D F
12/23	41.2 D F	45.7 D F	9.3 MPH	174.7 DEG	18.8 MPH	189.1 DEG	21.7 MPH	192.8 DEG	0.3 D F
12/24	41.6 D F	54.1 D F	9.9 MPH	187.9 DEG	21.2 MPH	193.1 DEG	24.5 MPH	193.3 DEG	0.3 D F
12/25	51.0 D F	58.9 D F	16.7 MPH	209.6 DEG	27.7 MPH	213.7 DEG	30.9 MPH	213.3 DEG	-0.5 D F
12/26	32.7 D F	40.4 D F	11.8 MPH	9.2 DEG	16.2 MPH	15.5 DEG	17.2 MPH	15.5 DEG	-1.0 D F
12/27	38.1 D F	41.5 D F	6.8 MPH	104.2 DEG	12.5 MPH	134.4 DEG	14.3 MPH	144.7 DEG	1.5 D F
12/28	39.5 D F	50.6 D F	25.4 MPH	219.2 DEG	35.8 MPH	224.2 DEG	39.1 MPH	222.8 DEG	-0.6 D F
12/29	16.5 D F	28.0 D F	16.9 MPH	260.1 DEG	20.7 MPH	265.9 DEG	21.7 MPH	264.2 DEG	-1.3 D F
12/30	14.4 D F	24.0 D F	8.6 MPH	227.6 DEG	10.7 MPH	237.5 DEG	11.2 MPH	237.0 DEG	-1.1 D F
12/31	17.8 D F	27.4 D F	7.1 MPH	200.2 DEG	11.7 MPH	205.2 DEG	13.2 MPH	204.4 DEG	-0.6 D F

TABLES 13-26

MONTHLY DAVIS-BESSE SITE PRECIPITATION DATA

Table 13

DAVIS BESSE SITE PRECIPITATION DATA

JANUARY 1, 1982 THROUGH JANUARY 31, 1982

DAILY TOTALS

DAY	RAIN FALL
1/ 1	0.00 IN.
1/ 2	0.00 IN.
1/ 3	0.28 IN.
1/ 4	0.22 IN.
1/ 5	0.02 IN.
1/ 6	0.20 IN.
1/ 7	0.00 IN.
1/ 8	0.00 IN.
1/ 9	0.00 IN.
1/10	0.00 IN.
1/11	0.00 IN.
1/12	0.01 IN.
1/13	0.05 IN.
1/14	0.00 IN.
1/15	0.00 IN.
1/16	0.00 IN.
1/17	0.00 IN.
1/18	0.00 IN.
1/19	0.00 IN.
1/20	0.00 IN.
1/21	0.00 IN.
1/22	0.18 IN.
1/23	1.19 IN.
1/24	0.05 IN.
1/25	0.04 IN.
1/26	0.00 IN.
1/27	0.00 IN.
1/28	0.00 IN.
1/29	0.05 IN.
1/30	0.76 IN.
1/31	0.24 IN.

Table 14

DAVIS BESSE SITE PRECIPITATION DATA

FEBRUARY 1, 1982 THROUGH FEBRUARY 28, 1982

DAILY TOTALS

DAY	RAIN FALL
2/ 1	0.09 IN.
2/ 2	0.00 IN.
2/ 3	0.14 IN.
2/ 4	0.00 IN.
2/ 5	0.19 IN.
2/ 6	0.00 IN.
2/ 7	0.00 IN.
2/ 8	0.02 IN.
2/ 9	0.14 IN.
2/10	0.00 IN.
2/11	0.00 IN.
2/12	0.00 IN.
2/13	0.00 IN.
2/14	0.00 IN.
2/15	0.00 IN.
2/16	0.00 IN.
2/17	0.02 IN.
2/18	0.09 IN.
2/19	0.01 IN.
2/20	0.00 IN.
2/21	0.01 IN.
2/22	0.00 IN.
2/23	0.00 IN.
2/24	0.08 IN.
2/25	0.00 IN.
2/26	0.00 IN.
2/27	0.00 IN.
2/28	0.00 IN.

Table 15

DAVIS BESSE SITE PRECIPITATION DATA

MARCH 1, 1982 THROUGH MARCH 31, 1982

DAILY TOTALS

DAY	RAIN FALL
3/ 1	0.00 IN.
3/ 2	0.34 IN.
3/ 3	0.00 IN.
3/ 4	0.69 IN.
3/ 5	0.00 IN.
3/ 6	0.00 IN.
3/ 7	0.00 IN.
3/ 8	0.02 IN.
3/ 9	0.01 IN.
3/10	0.00 IN.
3/11	0.17 IN.
3/12	0.10 IN.
3/13	0.21 IN.
3/14	0.00 IN.
3/15	0.00 IN.
3/16	0.37 IN.
3/17	0.00 IN.
3/18	0.00 IN.
3/19	0.04 IN.
3/20	0.20 IN.
3/21	0.00 IN.
3/22	0.00 IN.
3/23	0.00 IN.
3/24	0.00 IN.
3/25	0.29 IN.
3/26	0.00 IN.
3/27	0.00 IN.
3/28	0.00 IN.
3/29	0.00 IN.
3/30	0.38 IN.
3/31	0.01 IN.

Table 16

DAVIS BESSE SITE PRECIPITATION DATA

APRIL 1, 1982 THROUGH APRIL 30, 1982

DAILY TOTALS

DAY	RAIN FALL
4/ 1	0.00 IN.
4/ 2	0.00 IN.
4/ 3	0.50 IN.
4/ 4	0.10 IN.
4/ 5	0.07 IN.
4/ 6	0.00 IN.
4/ 7	0.00 IN.
4/ 8	0.00 IN.
4/ 9	0.00 IN.
4/10	0.07 IN.
4/11	0.00 IN.
4/12	0.00 IN.
4/13	0.00 IN.
4/14	0.00 IN.
4/15	0.00 IN.
4/16	0.56 IN.
4/17	0.08 IN.
4/18	0.00 IN.
4/19	0.01 IN.
4/20	0.08 IN.
4/21	0.00 IN.
4/22	0.00 IN.
4/23	0.00 IN.
4/24	0.00 IN.
4/25	0.06 IN.
4/26	0.03 IN.
4/27	0.00 IN.
4/28	0.00 IN.
4/29	0.00 IN.
4/30	0.00 IN.

Table 17

DAVIS BESSE SITE PRECIPITATION DATA

MAY 1, 1982 THROUGH MAY 31, 1982

DAILY TOTALS

DAY	RAIN FALL
5/ 1	0.00 IN.
5/ 2	0.00 IN.
5/ 3	0.00 IN.
5/ 4	0.00 IN.
5/ 5	0.00 IN.
5/ 6	0.00 IN.
5/ 7	0.25 IN.
5/ 8	0.04 IN.
5/ 9	0.00 IN.
5/10	0.00 IN.
5/11	0.00 IN.
5/12	0.00 IN.
5/13	0.00 IN.
5/14	0.00 IN.
5/15	0.00 IN.
5/16	0.00 IN.
5/17	0.00 IN.
5/18	0.01 IN.
5/19	0.02 IN.
5/20	0.18 IN.
5/21	0.20 IN.
5/22	0.53 IN.
5/23	0.00 IN.
5/24	0.00 IN.
5/25	0.00 IN.
5/26	0.09 IN.
5/27	0.68 IN.
5/28	0.00 IN.
5/29	0.00 IN.
5/30	0.04 IN.
5/31	0.00 IN.

Table 18

DAVIS BESSE SITE PRECIPITATION DATA

JUNE 1, 1982 THROUGH JUNE 30, 1982

DAILY TOTALS

DAY	RAIN FALL
6/ 1	0.00 IN.
6/ 2	0.00 IN.
6/ 3	0.01 IN.
6/ 4	0.00 IN.
6/ 5	0.14 IN.
6/ 6	0.14 IN.
6/ 7	0.00 IN.
6/ 8	0.00 IN.
6/ 9	0.03 IN.
6/10	0.00 IN.
6/11	0.00 IN.
6/12	0.00 IN.
6/13	0.00 IN.
6/14	0.00 IN.
6/15	0.31 IN.
6/16	0.40 IN.
6/17	0.00 IN.
6/18	0.00 IN.
6/19	0.21 IN.
6/20	0.13 IN.
6/21	0.00 IN.
6/22	0.00 IN.
6/23	0.00 IN.
6/24	0.00 IN.
6/25	0.00 IN.
6/26	0.00 IN.
6/27	0.00 IN.
6/28	1.08 IN.
6/29	0.11 IN.
6/30	0.00 IN.

Table 19

DAVIS BESSE SITE PRECIPITATION DATA

JULY 1, 1982 THROUGH JULY 31, 1982

DAILY TOTALS

DAY	RAIN FALL
7/ 1	0.00 IN.
7/ 2	0.00 IN.
7/ 3	0.98 IN.
7/ 4	0.00 IN.
7/ 5	0.00 IN.
7/ 6	0.00 IN.
7/ 7	0.09 IN.
7/ 8	0.01 IN.
7/ 9	0.00 IN.
7/10	0.39 IN.
7/11	0.00 IN.
7/12	0.00 IN.
7/13	0.00 IN.
7/14	0.00 IN.
7/15	0.00 IN.
7/16	0.00 IN.
7/17	0.00 IN.
7/18	0.00 IN.
7/19	0.05 IN.
7/20	0.02 IN.
7/21	0.00 IN.
7/22	0.00 IN.
7/23	0.00 IN.
7/24	0.00 IN.
7/25	0.00 IN.
7/26	0.00 IN.
7/27	0.00 IN.
7/28	0.00 IN.
7/29	0.00 IN.
7/30	0.04 IN.
7/31	0.00 IN.

Table 20

DAVIS BESSE SITE PRECIPITATION DATA

AUGUST 1, 1982 THROUGH AUGUST 31, 1982

DAILY TOTALS

DAY	RAIN FALL
8/ 1	0.00 IN.
8/ 2	0.05 IN.
8/ 3	0.00 IN.
8/ 4	0.00 IN.
8/ 5	0.00 IN.
8/ 6	0.00 IN.
8/ 7	0.00 IN.
8/ 8	0.12 IN.
8/ 9	0.03 IN.
8/10	0.00 IN.
8/11	0.00 IN.
8/12	0.00 IN.
8/13	0.00 IN.
8/14	0.00 IN.
8/15	0.00 IN.
8/16	0.00 IN.
8/17	0.00 IN.
8/18	0.00 IN.
8/19	0.00 IN.
8/20	0.59 IN.
8/21	0.00 IN.
8/22	0.00 IN.
8/23	0.22 IN.
8/24	0.01 IN.
8/25	0.00 IN.
8/26	0.00 IN.
8/27	0.00 IN.
8/28	0.00 IN.
8/29	0.00 IN.
8/30	0.00 IN.
8/31	0.00 IN.

Table 21

DAVIS BESSE SITE PRECIPITATION DATA

SEPTEMBER 1, 1982 THROUGH SEPTEMBER 30, 1982

DAILY TOTALS

DAY	RAIN FALL
9/ 1	0.00 IN.
9/ 2	0.12 IN.
9/ 3	0.00 IN.
9/ 4	0.00 IN.
9/ 5	0.00 IN.
9/ 6	0.09 IN.
9/ 7	0.07 IN.
9/ 8	0.00 IN.
9/ 9	0.00 IN.
9/10	0.00 IN.
9/11	0.00 IN.
9/12	0.00 IN.
9/13	0.00 IN.
9/14	0.60 IN.
9/15	0.12 IN.
9/16	0.00 IN.
9/17	0.00 IN.
9/18	0.00 IN.
9/19	0.00 IN.
9/20	0.00 IN.
9/21	0.02 IN.
9/22	0.41 IN.
9/23	0.00 IN.
9/24	0.04 IN.
9/25	0.02 IN.
9/26	0.14 IN.
9/27	0.97 IN.
9/28	0.00 IN.
9/29	0.00 IN.
9/30	0.00 IN.

Table 22

DAVIS BESSE SITE PRECIPITATION DATA

OCTOBER 1, 1982 THROUGH OCTOBER 31, 1982

DAILY TOTALS

DAY	RAIN FALL
10/ 1	0.00 IN.
10/ 2	0.00 IN.
10/ 3	0.00 IN.
10/ 4	0.00 IN.
10/ 5	0.17 IN.
10/ 6	0.00 IN.
10/ 7	0.07 IN.
10/ 8	0.00 IN.
10/ 9	0.00 IN.
10/10	0.02 IN.
10/11	0.00 IN.
10/12	0.00 IN.
10/13	0.10 IN.
10/14	0.00 IN.
10/15	0.08 IN.
10/16	0.00 IN.
10/17	0.00 IN.
10/18	0.00 IN.
10/19	0.00 IN.
10/20	0.11 IN.
10/21	0.00 IN.
10/22	0.06 IN.
10/23	0.00 IN.
10/24	0.00 IN.
10/25	0.00 IN.
10/26	0.00 IN.
10/27	0.00 IN.
10/28	0.00 IN.
10/29	0.01 IN.
10/30	0.00 IN.
10/31	1.02 IN.

Table 23

DAVIS BESSE SITE PRECIPITATION DATA

NOVEMBER 1, 1982 THROUGH NOVEMBER 30, 1982

DAILY TOTALS

DAY	RAIN FALL
11/ 1	2.27 IN.
11/ 2	0.46 IN.
11/ 3	0.00 IN.
11/ 4	0.00 IN.
11/ 5	0.03 IN.
11/ 6	0.00 IN.
11/ 7	0.00 IN.
11/ 8	0.00 IN.
11/ 9	0.05 IN.
11/10	0.03 IN.
11/11	0.15 IN.
11/12	0.44 IN.
11/13	0.00 IN.
11/14	0.00 IN.
11/15	0.00 IN.
11/16	0.00 IN.
11/17	0.00 IN.
11/18	0.00 IN.
11/19	0.00 IN.
11/20	0.81 IN.
11/21	0.73 IN.
11/22	0.00 IN.
11/23	0.47 IN.
11/24	0.10 IN.
11/25	0.00 IN.
11/26	0.17 IN.
11/27	0.00 IN.
11/28	0.55 IN.
11/29	0.02 IN.
11/30	0.00 IN.

Table 24

DAVIS BESSE SITE PRECIPITATION DATA

DECEMBER 1, 1982 THROUGH DECEMBER 31, 1982

DAILY TOTALS

DAY	RAIN FALL
12/ 1	0.20 IN.
12/ 2	0.00 IN.
12/ 3	0.03 IN.
12/ 4	0.17 IN.
12/ 5	0.10 IN.
12/ 6	0.01 IN.
12/ 7	0.00 IN.
12/ 8	0.03 IN.
12/ 9	0.00 IN.
12/10	0.01 IN.
12/11	0.00 IN.
12/12	0.00 IN.
12/13	0.00 IN.
12/14	0.00 IN.
12/15	0.68 IN.
12/16	0.17 IN.
12/17	0.13 IN.
12/18	0.00 IN.
12/19	0.41 IN.
12/20	0.00 IN.
12/21	0.00 IN.
12/22	0.10 IN.
12/23	0.09 IN.
12/24	0.09 IN.
12/25	0.75 IN.
12/26	0.00 IN.
12/27	0.38 IN.
12/28	0.51 IN.
12/29	0.00 IN.
12/30	0.00 IN.
12/31	0.00 IN.

Table 25

DAVIS BESSE SITE PRECIPITATION DATA

JANUARY 1, 1982 THROUGH DECEMBER 31, 1982

MONTHLY TOTALS

MONTH	RAIN FALL
1/82	3.29 IN.
2/82	0.79 IN.
3/82	2.83 IN.
4/82	1.56 IN.
5/82	2.04 IN.
6/82	2.56 IN.
7/82	1.58 IN.
8/82	1.02 IN.
9/82	2.60 IN.
10/82	1.64 IN.
11/82	6.28 IN.
12/82	3.86 IN.

TABLE 26

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
JANUARY 1, 1982 THROUGH JANUARY 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	11	0.06 *
NNE	8	0.04 *
NE	50	0.24 *
ENE	44	0.03 *
E	38	0.29 *
ESE	28	0.21 *
SE	20	0.28 *
SSE	19	0.11 *
S	57	0.35 *
SSW	57	0.25 *
SW	90	0.35 *
WSW	179	0.87 *
W	67	0.02 *
WNW	25	0.04 *
NW	23	0.01 *
NNW	27	0.14 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
FEBRUARY 1, 1982 THROUGH FEBRUARY 28, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	40	0.17 *
NNE	35	0.09 *
NE	61	0.09 *
ENE	76	0.13 *
E	23	0.05 *
ESE	10	0.00 *
SE	12	0.00 *
SSE	14	0.00 *
S	20	0.00 *
SSW	66	0.05 *
SW	139	0.01 *
WSW	72	0.11 *
W	24	0.01 *
WNW	27	0.03 *
NW	20	0.01 *
NNW	33	0.04 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
MARCH 1, 1982 THROUGH MARCH 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	20	0.12 *
NNE	16	0.12 *
NE	45	0.07 *
ENE	56	0.18 *
E	37	0.31 *
ESE	34	0.64 *
SE	16	0.13 *
SSE	37	0.07 *
S	75	0.14 *
SSW	63	0.39 *
SW	54	0.02 *
WSW	102	0.36 *
W	63	0.00 *
WNW	46	0.00 *
NW	44	0.24 *
NNW	30	0.04 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
APRIL 1, 1982 THROUGH APRIL 30, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	20	0.00 *
NNE	30	0.00 *
NE	45	0.00 *
ENE	76	0.07 *
E	56	0.00 *
ESE	10	0.00 *
SE	13	0.00 *
SSE	31	1.01 *
S	43	0.12 *
SSW	53	0.14 *
SW	86	0.07 *
WSW	103	0.05 *
W	55	0.10 *
WNW	43	0.00 *
NW	24	0.00 *
NNW	32	0.00 *

0 HOURS OF CALM

TABLE 27

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
MAY 1, 1982 THROUGH MAY 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	22	0.05 *
NNE	25	0.00 *
NE	58	0.15 *
ENE	92	0.32 *
E	135	0.50 *
ESE	62	0.19 *
SE	36	0.22 *
SSE	24	0.16 *
S	44	0.01 *
SSW	66	0.03 *
SW	68	0.02 *
WSW	35	0.10 *
W	20	0.08 *
WNW	14	0.06 *
NW	24	0.13 *
NNW	19	0.02 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
JUNE 1, 1982 THROUGH JUNE 30, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	30	0.12 *
NNE	45	0.18 *
NE	63	0.24 *
ENE	54	0.29 *
E	67	0.00 *
ESE	24	0.01 *
SE	20	0.03 *
SSE	17	0.00 *
S	29	0.30 *
SSW	83	0.12 *
SW	79	0.51 *
WSW	48	0.21 *
W	39	0.03 *
WNW	21	0.00 *
NW	49	0.40 *
NNW	52	0.12 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
JULY 1, 1982 THROUGH JULY 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	32	0.00 *
NNE	37	0.08 *
NE	53	0.00 *
ENE	55	0.00 *
E	50	0.00 *
ESE	32	0.00 *
SE	44	0.24 *
SSE	30	0.49 *
S	45	0.18 *
SSW	91	0.04 *
SW	110	0.37 *
WSW	90	0.03 *
W	25	0.09 *
WNW	11	0.00 *
NW	13	0.06 *
NNW	23	0.00 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
AUGUST 1, 1982 THROUGH AUGUST 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	30	0.00 *
NNE	32	0.00 *
NE	47	0.00 *
ENE	60	0.00 *
E	51	0.01 *
ESE	22	0.00 *
SE	20	0.00 *
SSE	24	0.00 *
S	40	0.01 *
SSW	96	0.03 *
SW	124	0.21 *
WSW	79	0.48 *
W	43	0.27 *
WNW	30	0.01 *
NW	23	0.00 *
NNW	22	0.00 *

0 HOURS OF CALM

TABLE 28

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
SEPTEMBER 1, 1982 THROUGH SEPTEMBER 30, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	17	0.00 *
NNE	25	0.18 *
NE	29	0.20 *
ENE	46	0.03 *
E	35	0.00 *
ESE	32	0.17 *
SE	34	0.06 *
SSE	39	0.05 *
S	72	0.03 *
SSW	97	0.01 *
SW	56	0.24 *
WSW	41	0.31 *
W	60	0.39 *
WNW	38	0.36 *
NW	46	0.55 *
NNW	21	0.00 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
OCTOBER 1, 1982 THROUGH OCTOBER 31, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	7	0.00 *
NNE	14	0.00 *
NE	23	0.14 *
ENE	35	0.00 *
E	59	0.00 *
ESE	32	0.00 *
SE	21	0.02 *
SSE	30	0.20 *
S	74	0.02 *
SSW	127	0.27 *
SW	70	0.27 *
WSW	97	0.08 *
W	46	0.62 *
WNW	34	0.00 *
NW	45	0.02 *
NNW	29	0.00 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
NOVEMBER 1, 1982 THROUGH NOVEMBER 30, 1982

WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	6	0.00 *
NNE	7	0.01 *
NE	27	0.12 *
ENE	44	0.43 *
E	41	0.18 *
ESE	57	0.41 *
SE	47	0.01 *
SSE	49	0.53 *
S	78	0.86 *
SSW	119	0.88 *
SW	86	0.39 *
WSW	61	0.61 *
W	45	0.24 *
WNW	27	0.76 *
NW	12	0.00 *
NNW	14	0.85 *

0 HOURS OF CALM

DAVIS BESSE SITE WIND DISTRIBUTION
10 M WIND DIRECTION VS PRECIPITATION
DECEMBER 1, 1982 THROUGH DECEMBER 31, 1982

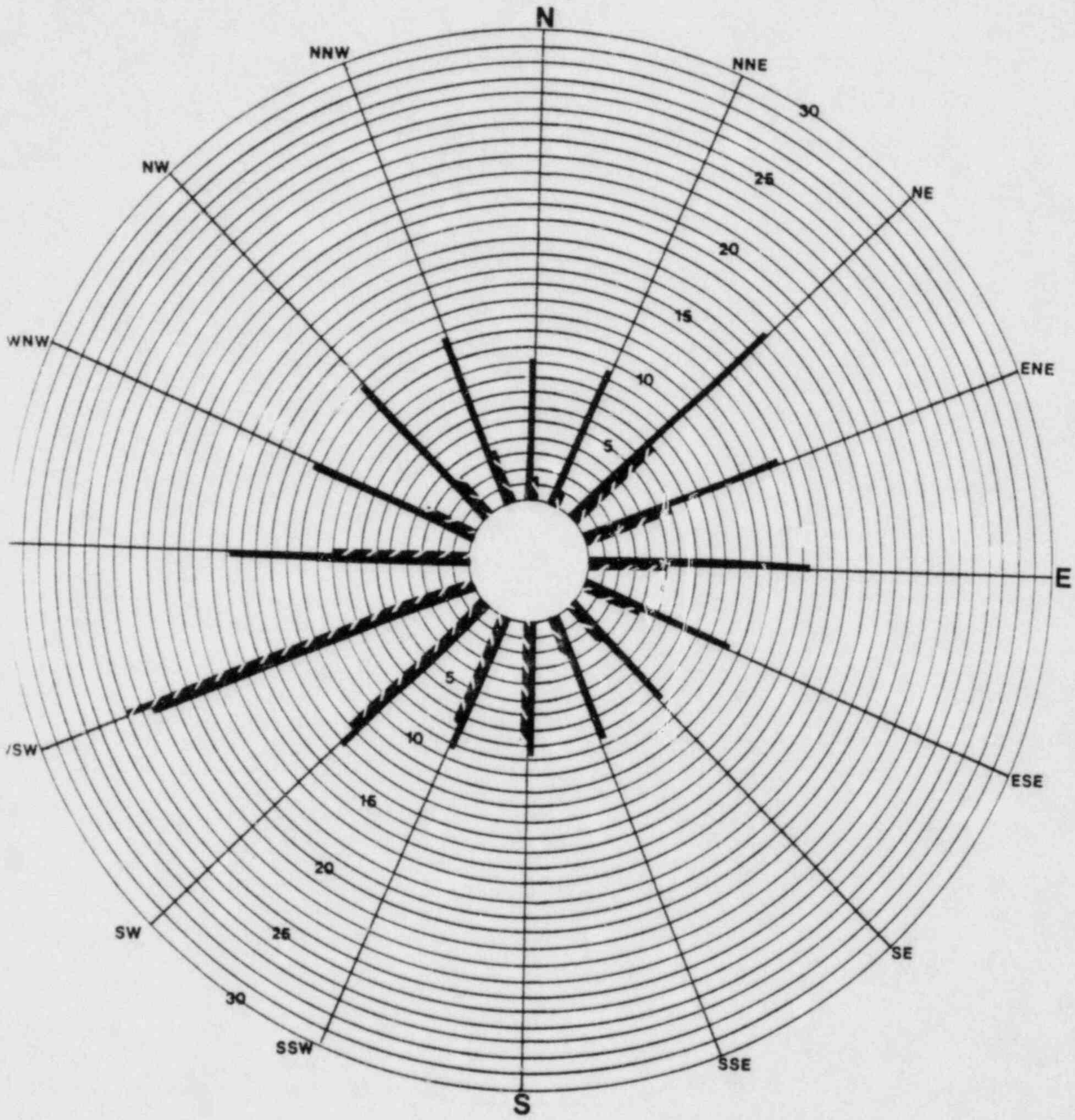
WIND DIRECTION	HOURS AT EACH WIND DIRECTION	TOTAL AMOUNT OF PRECIPITATION
N	15	0.08 *
NNE	10	0.10 *
NE	13	0.13 *
ENE	27	0.14 *
E	43	0.29 *
ESE	27	0.54 *
SE	28	0.23 *
SSE	35	0.12 *
S	97	0.39 *
SSW	136	0.75 *
SW	56	0.43 *
WSW	80	0.34 *
W	67	0.00 *
WNW	41	0.08 *
NW	27	0.06 *
NNW	41	0.14 *

0 HOURS OF CALM

1982 WINDROSE CHARTS

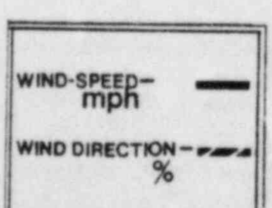
FIGURES 1-12 = 10 METER SENSOR LEVEL
FIGURES 13-24 = 75 METER SENSOR LEVEL
FIGURES 25-36 = 100 METER SENSOR LEVEL

10 METER JANUARY 82

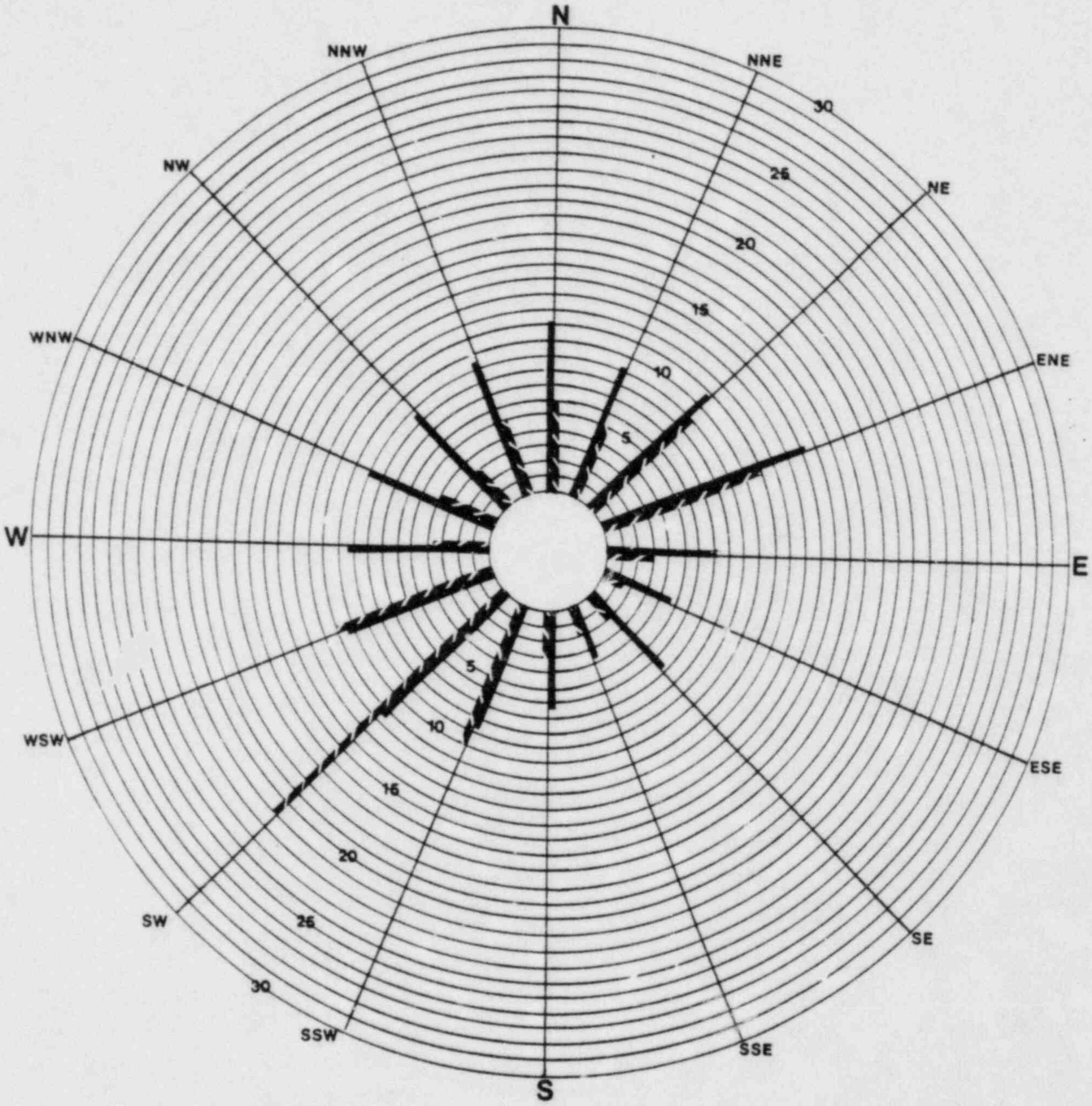


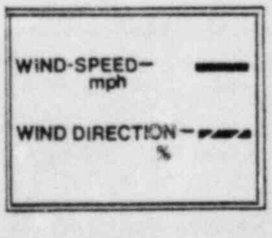
DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 1



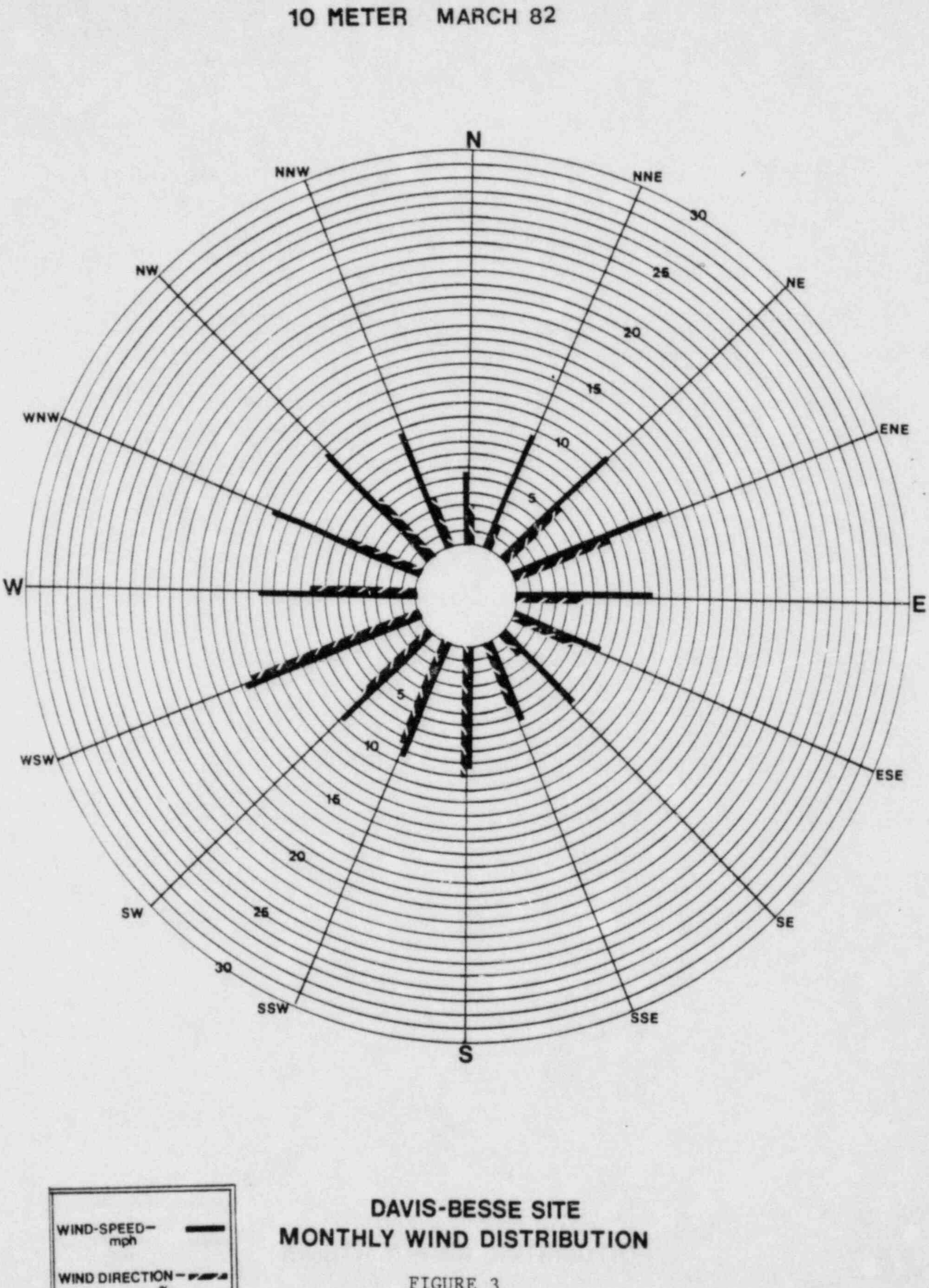
10 METER FEBRUARY 82





DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

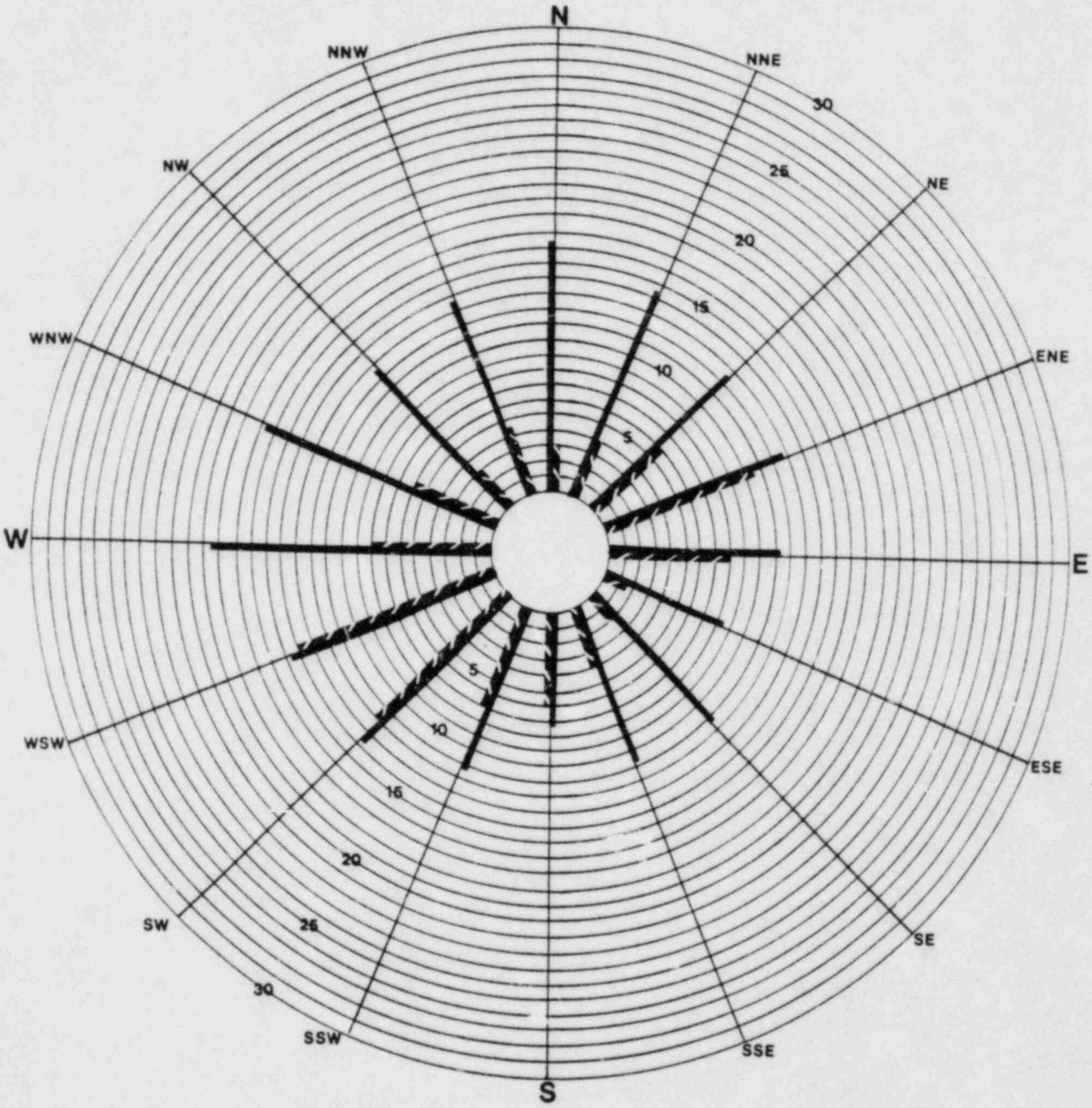
FIGURE 2

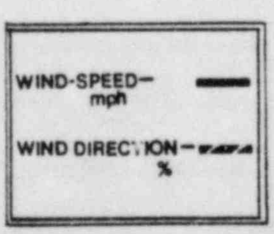


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 3

10 METER APRIL 82

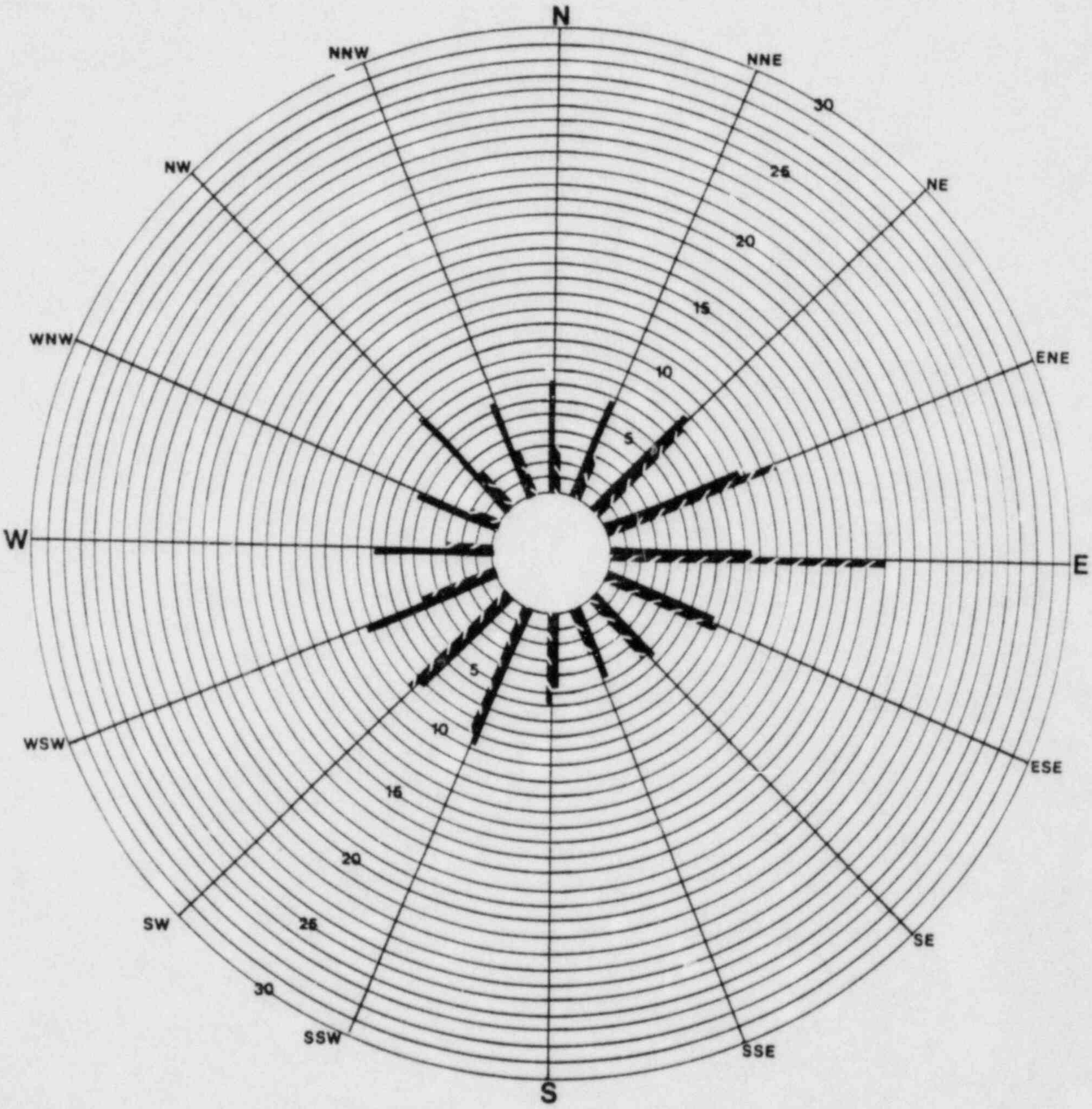




DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 4

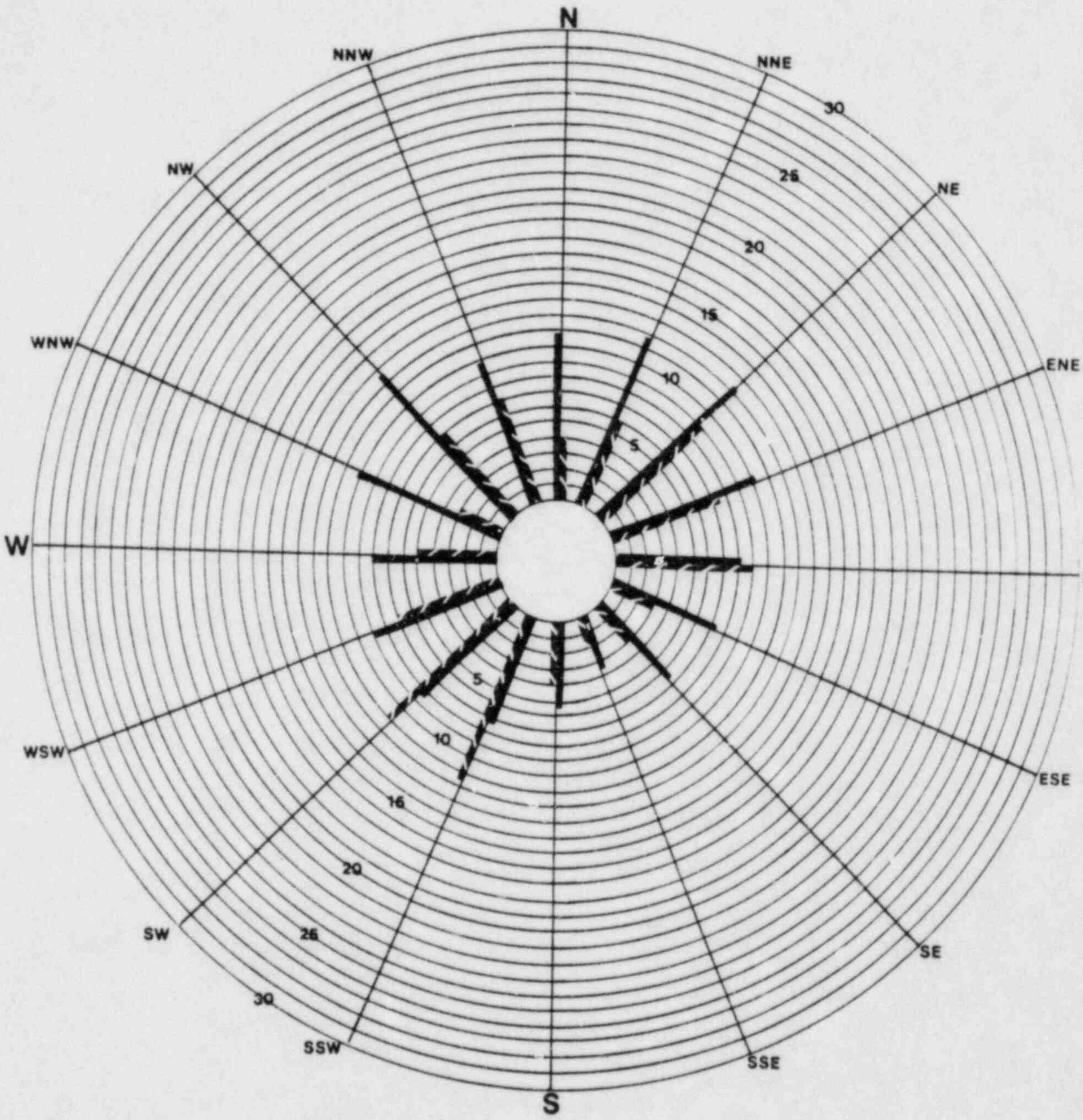
10 METER MAY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 5

10 METER JUNE 82

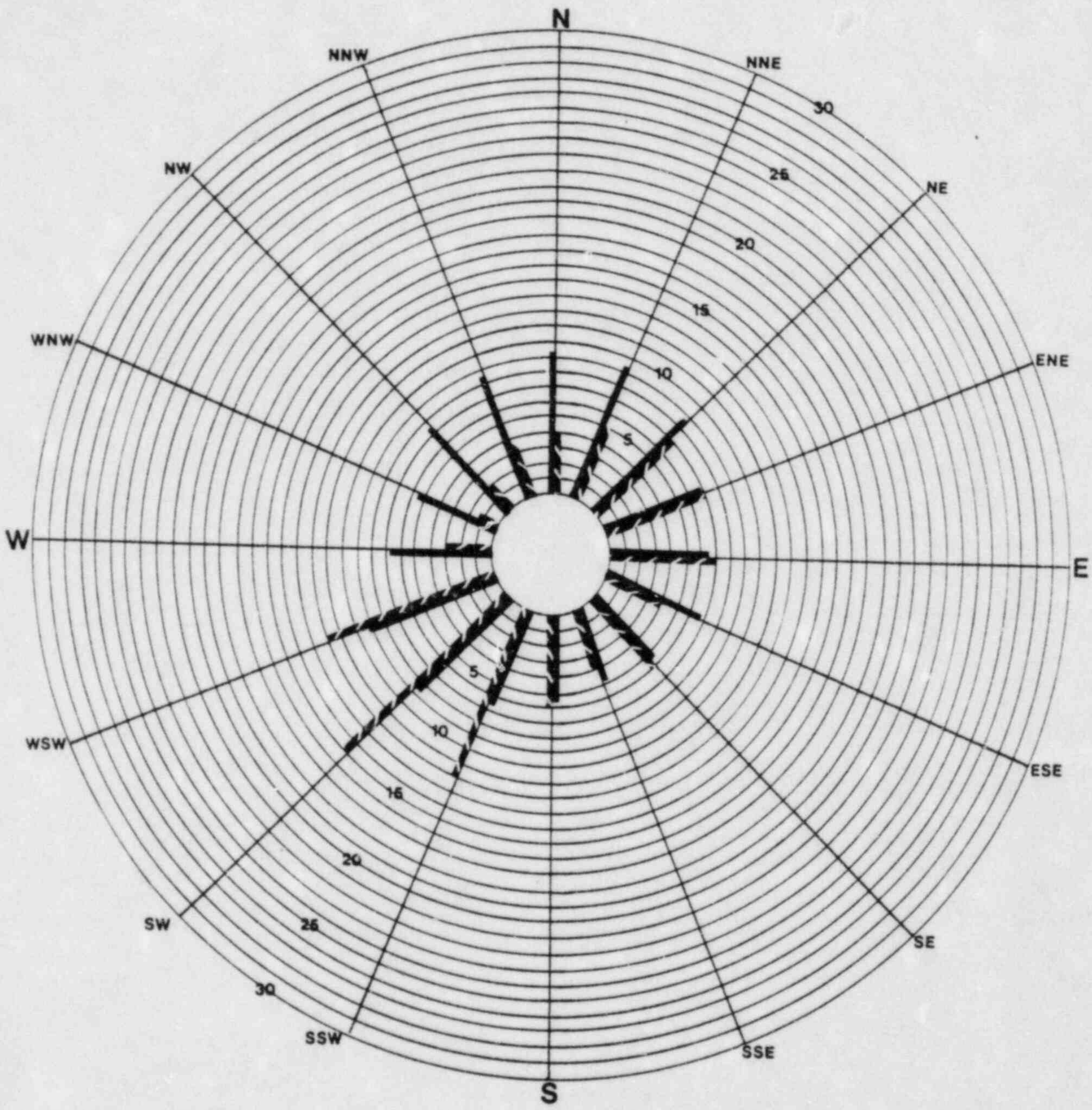


WIND-SPEED—mph
WIND DIRECTION—%

DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 6

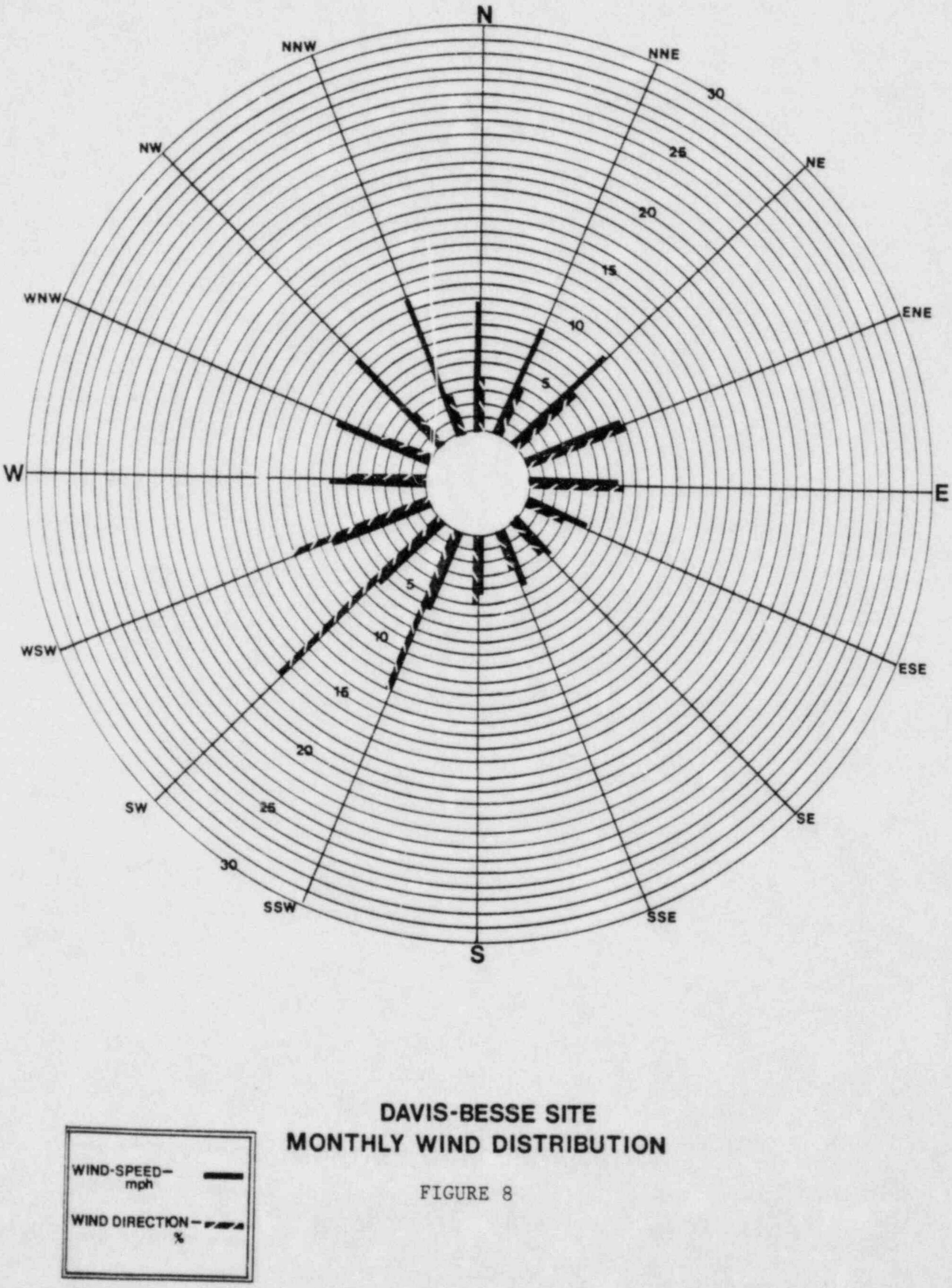
10 METER JULY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 7

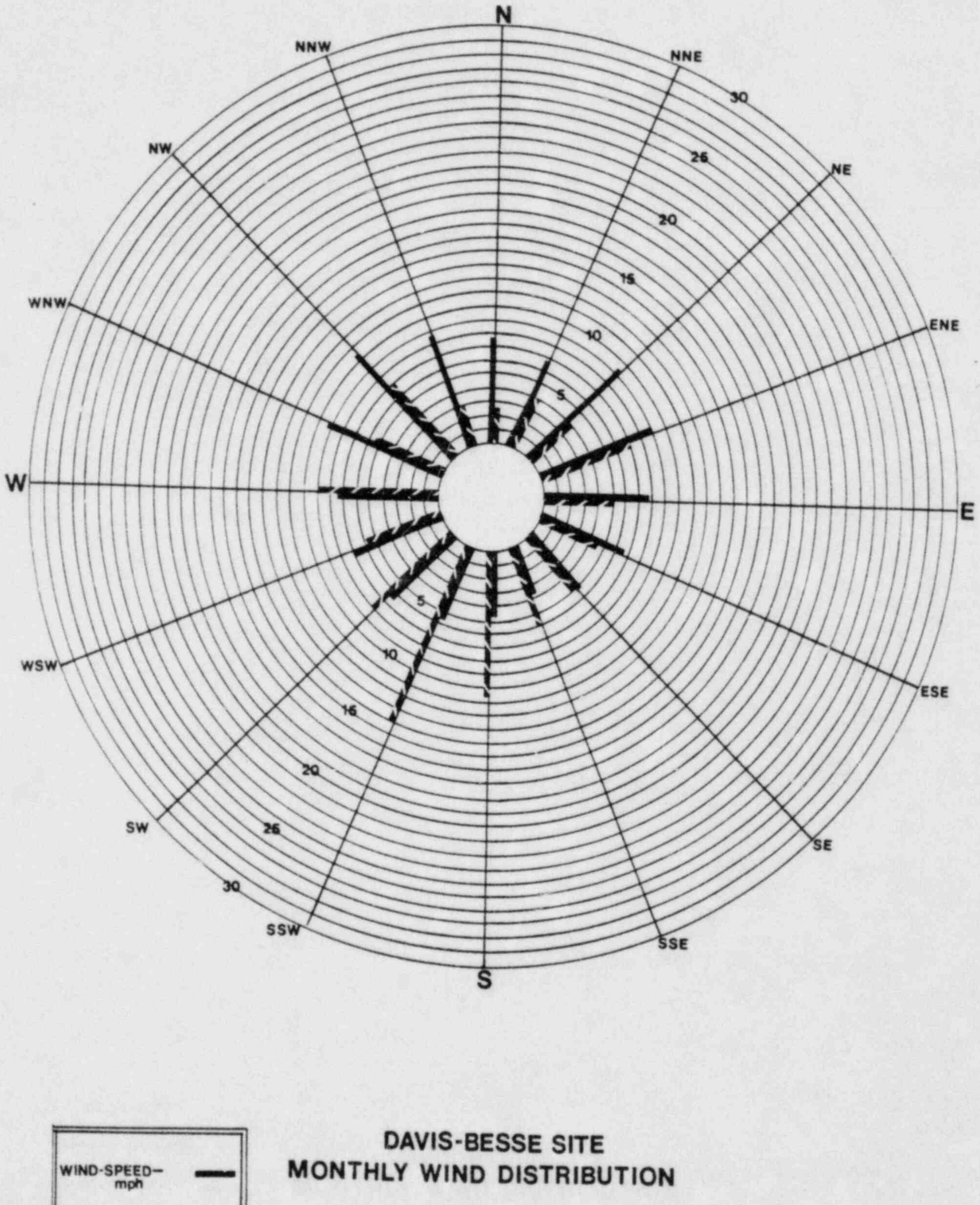
10 METER AUGUST 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 8

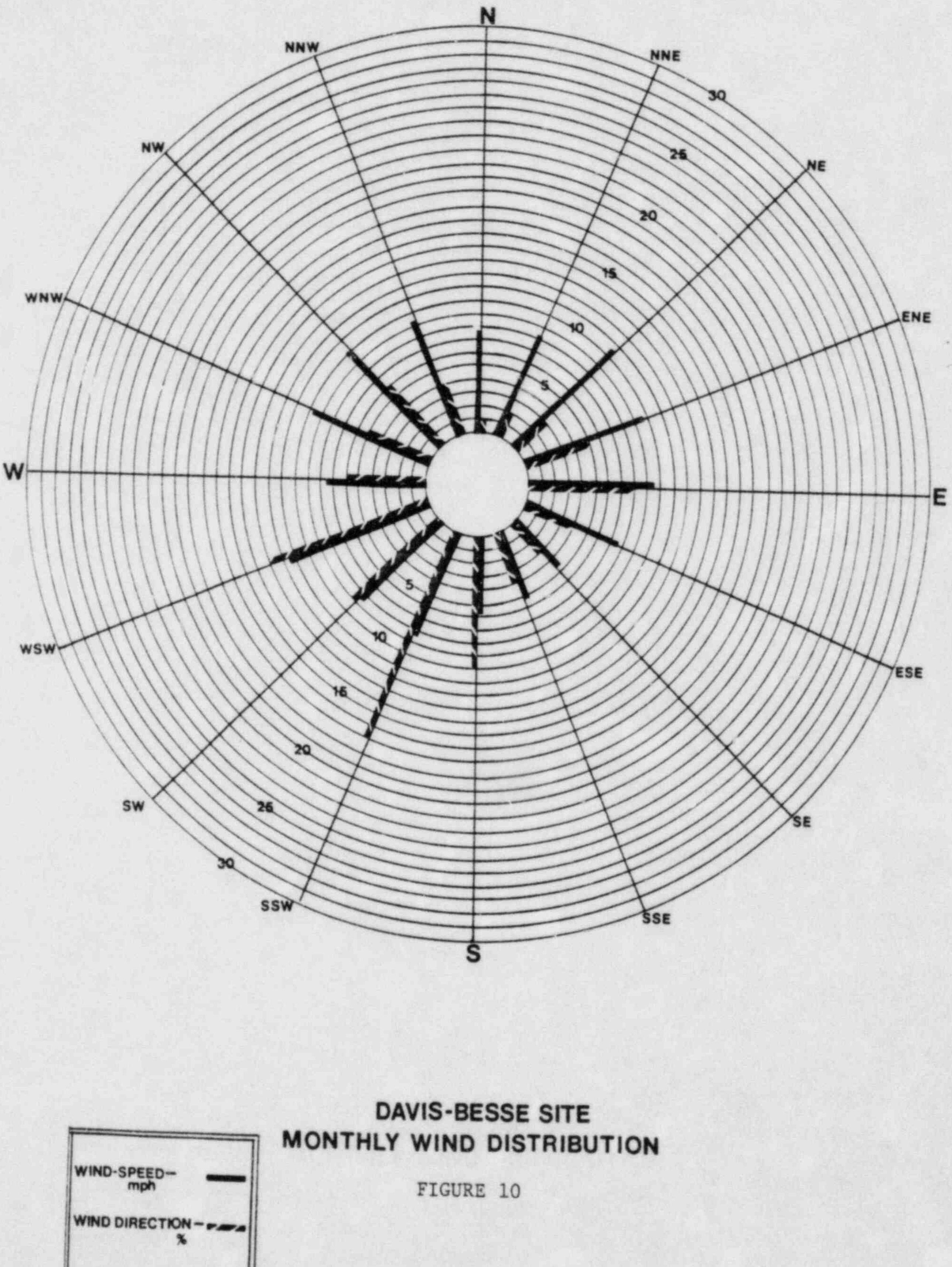
10 METER SEPTEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 9

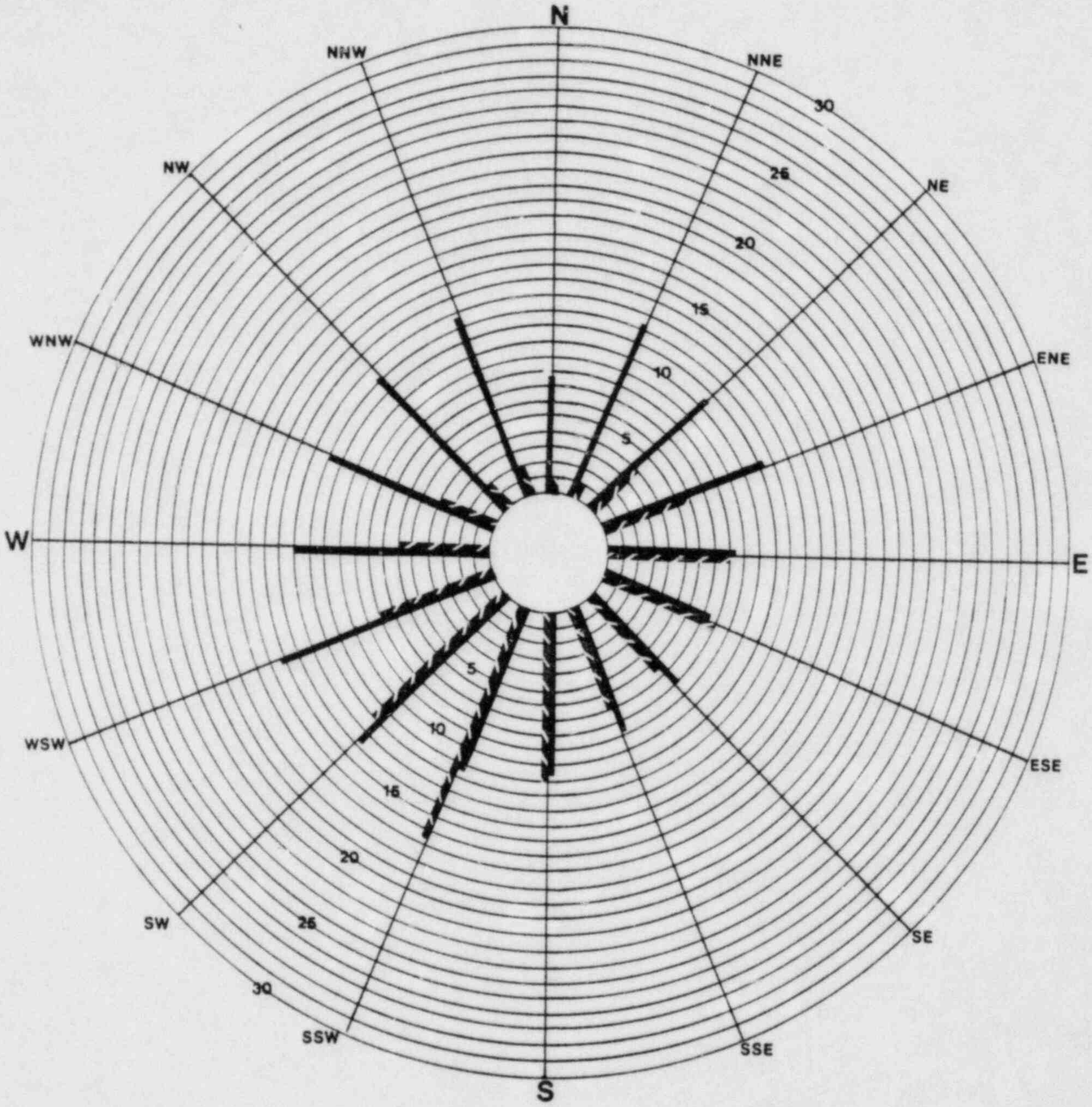
10 METER OCTOBER 82

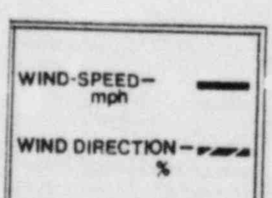


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 10

10 METER NOVEMBER 82

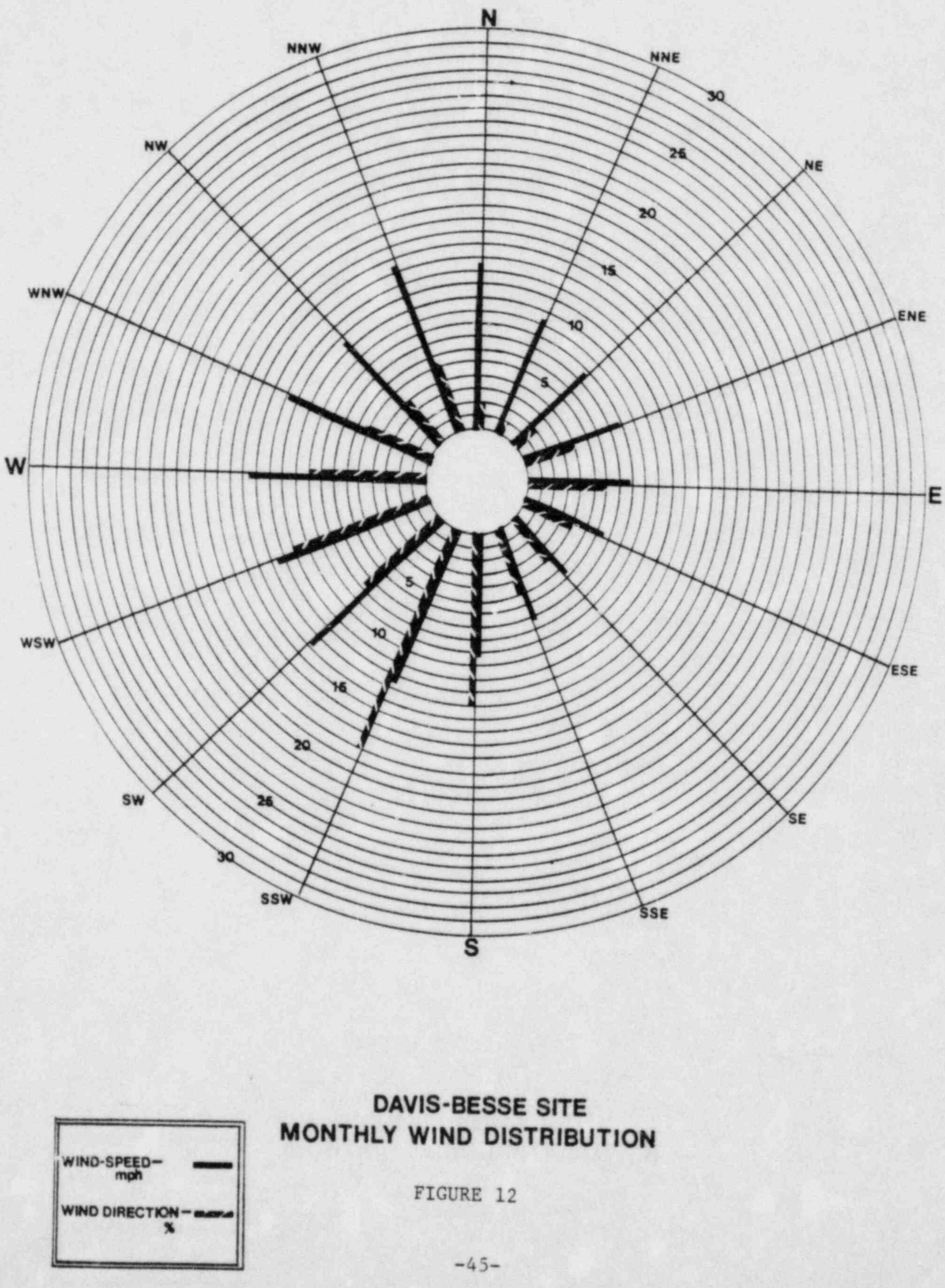




DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 11

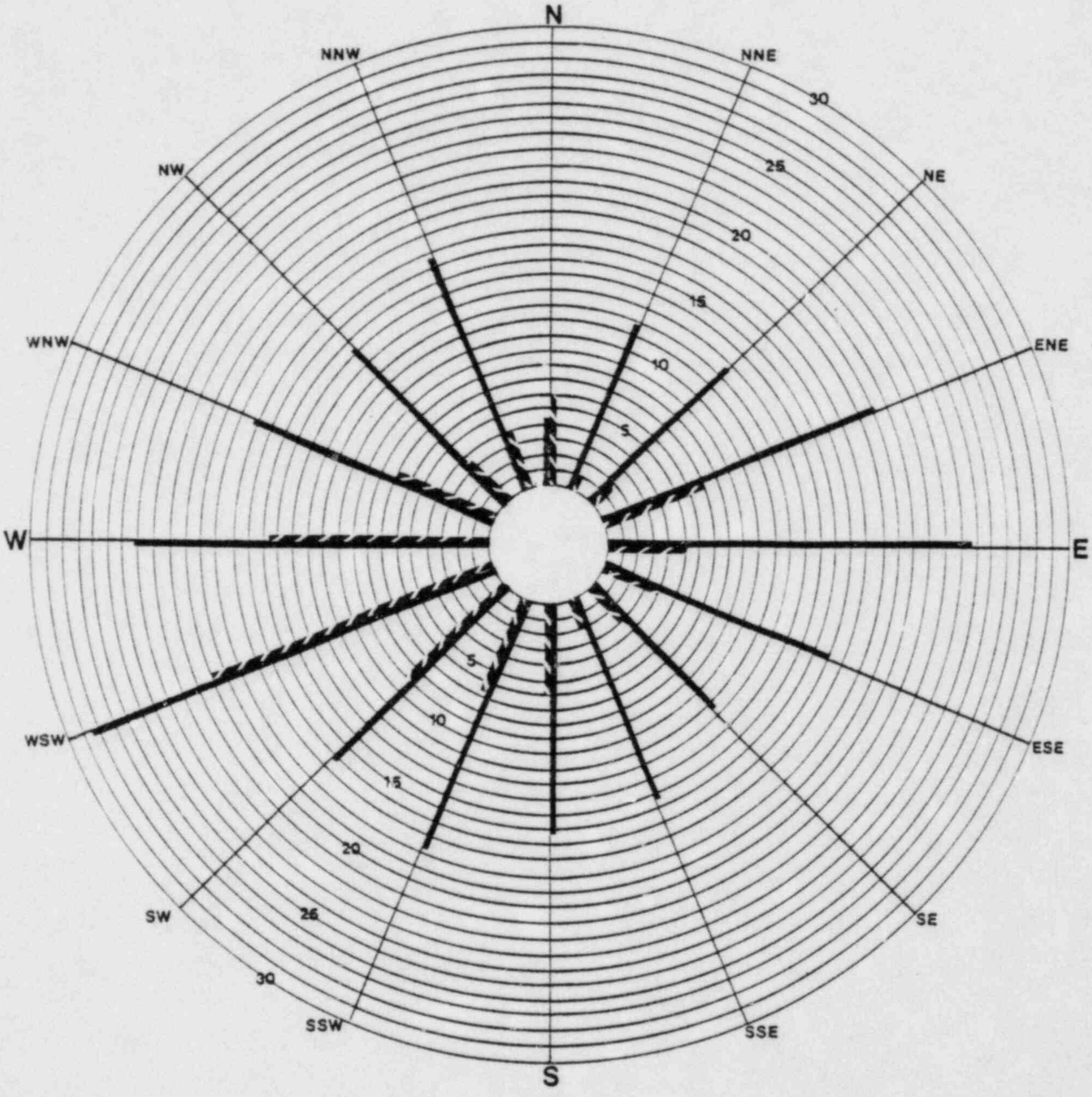
10 METER DECEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 12

75 meter JANUARY 82



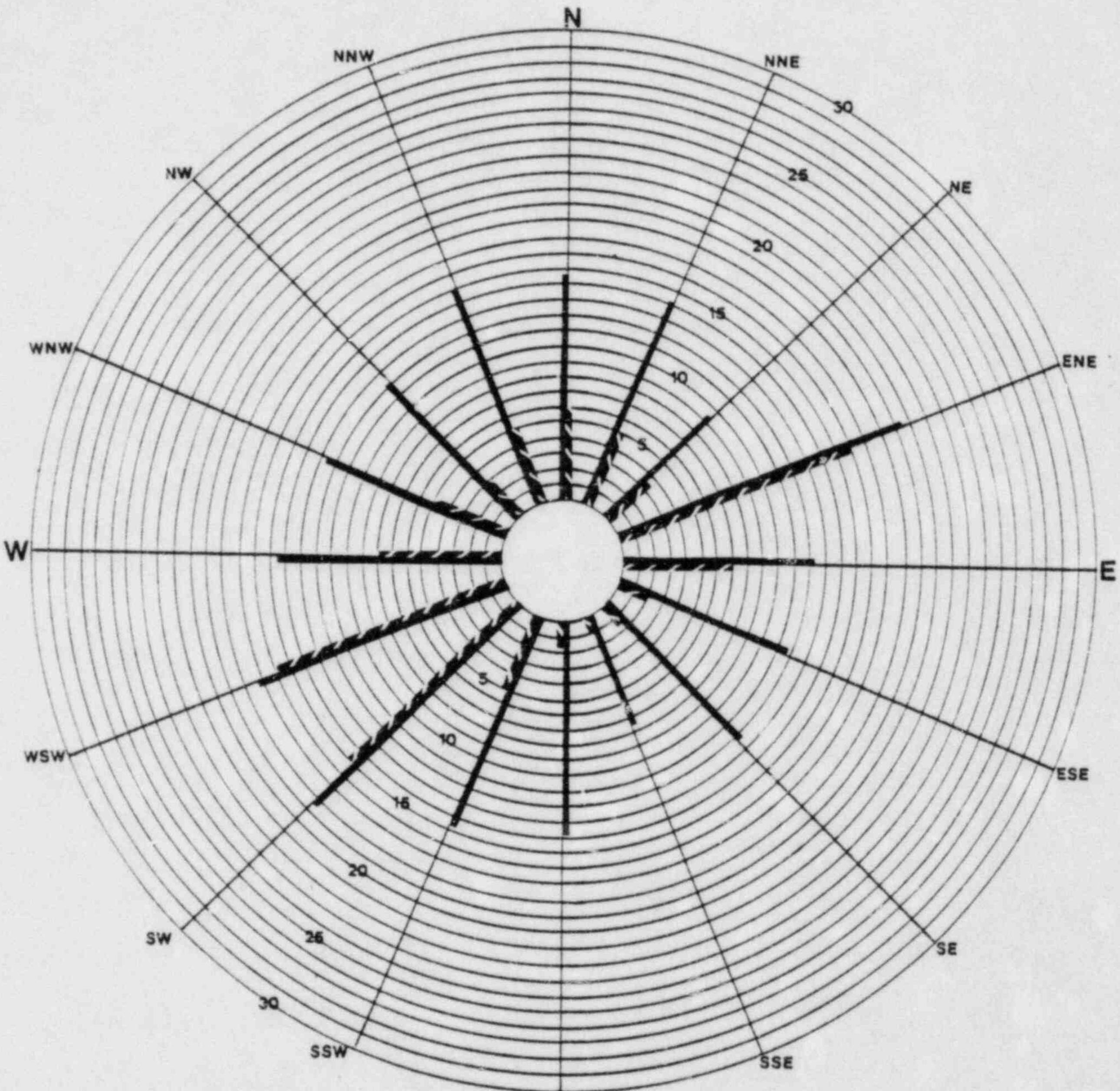
DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 13

WIND-SPEED- mph

WIND DIRECTION-%

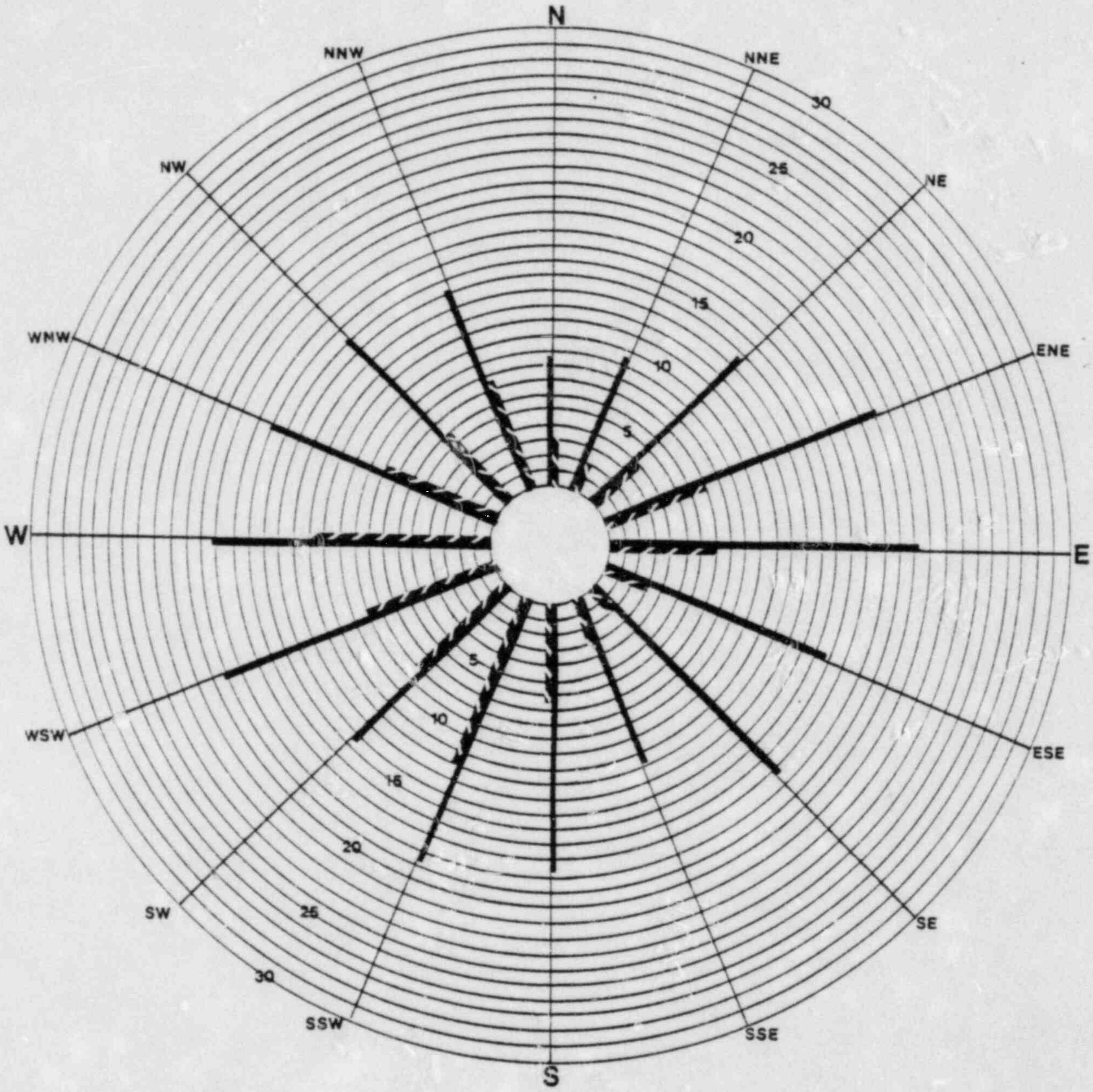
75 meter FEBRUARY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 14

75 meter MARCH 82



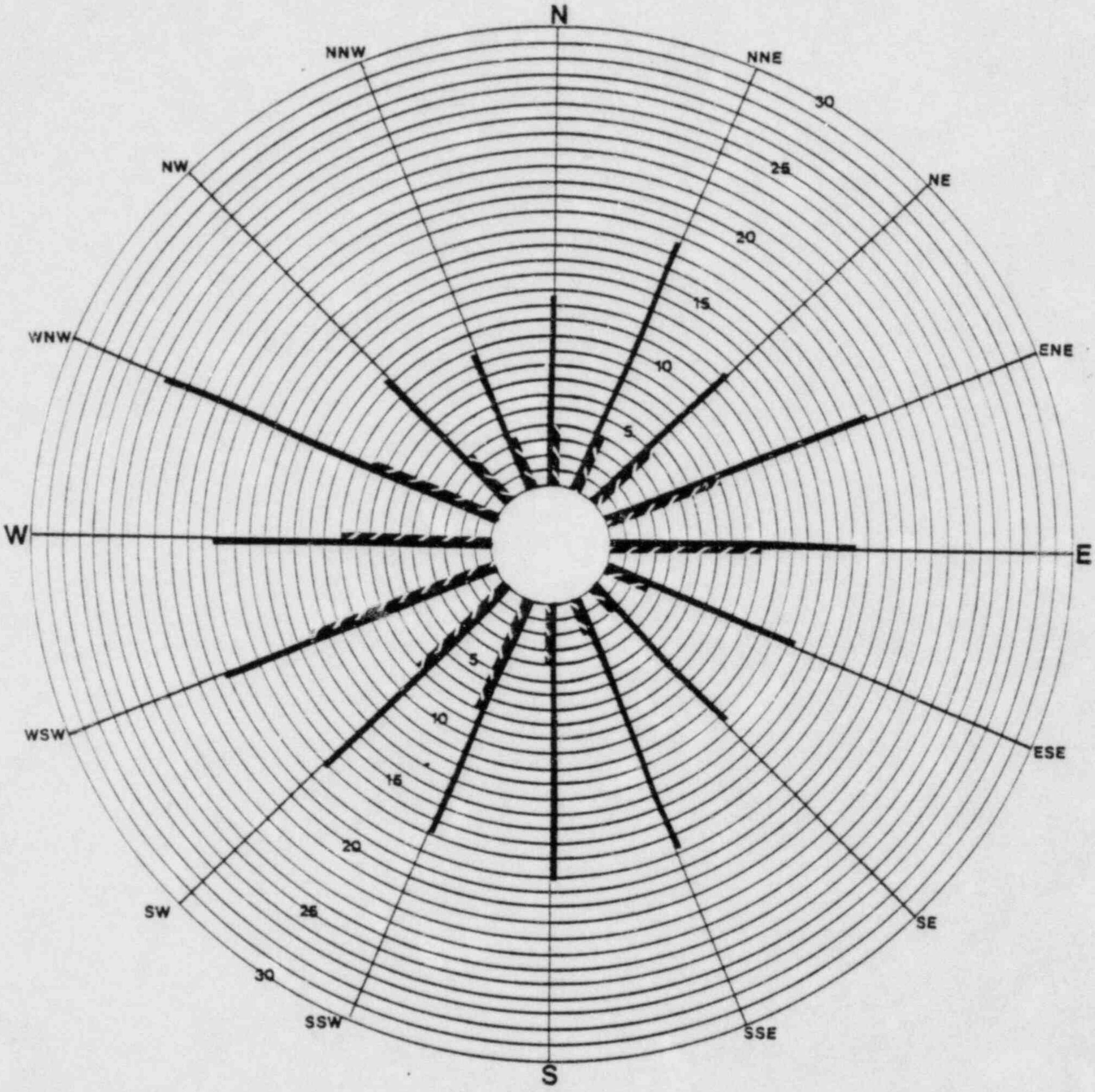
DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 15

WIND-SPEED- mph

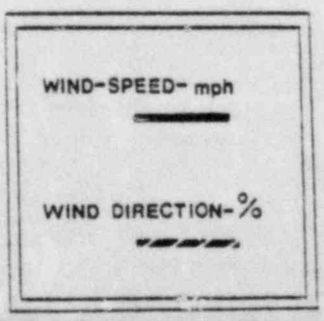
WIND DIRECTION-%

75 meter APRIL 82

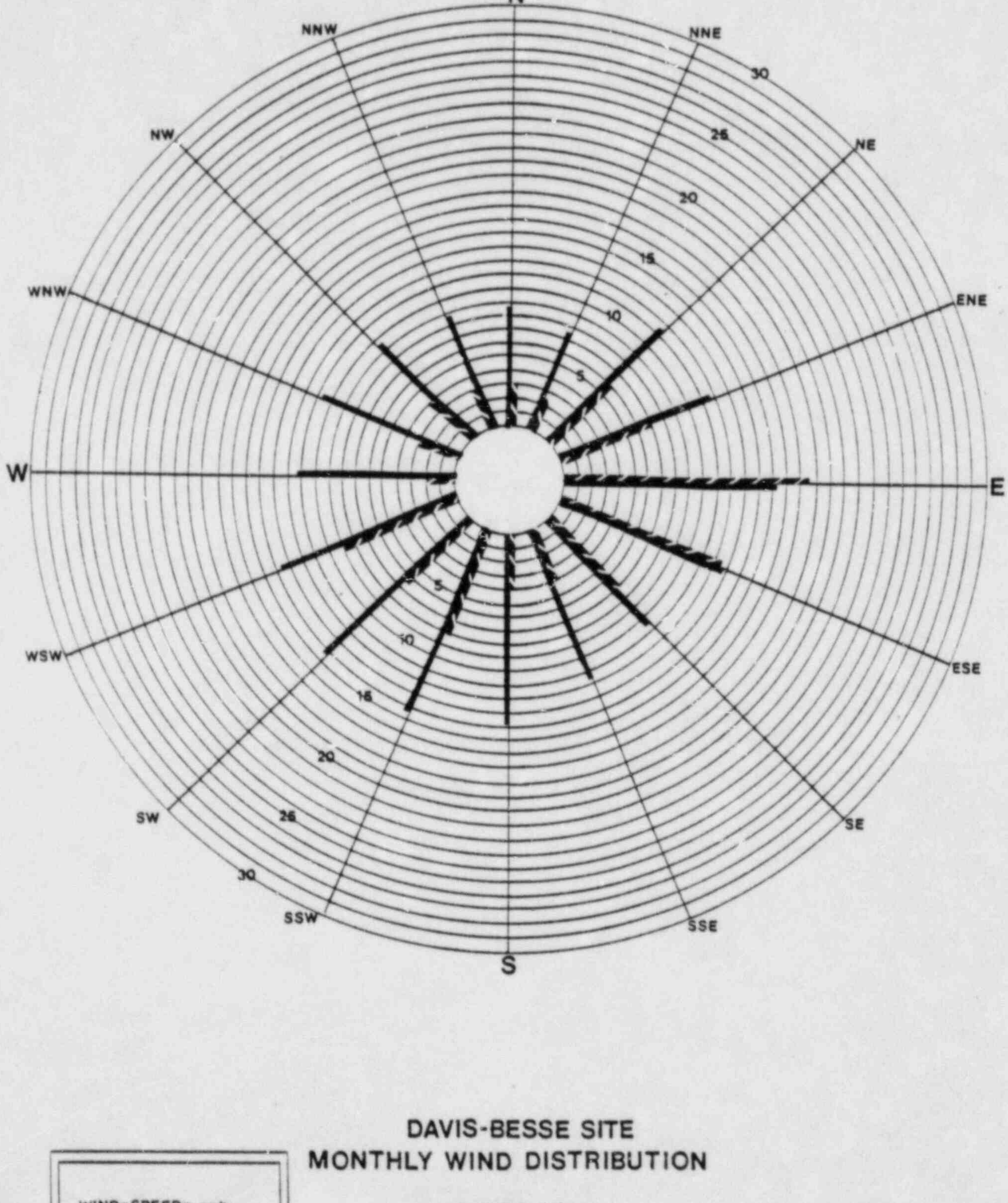


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 16



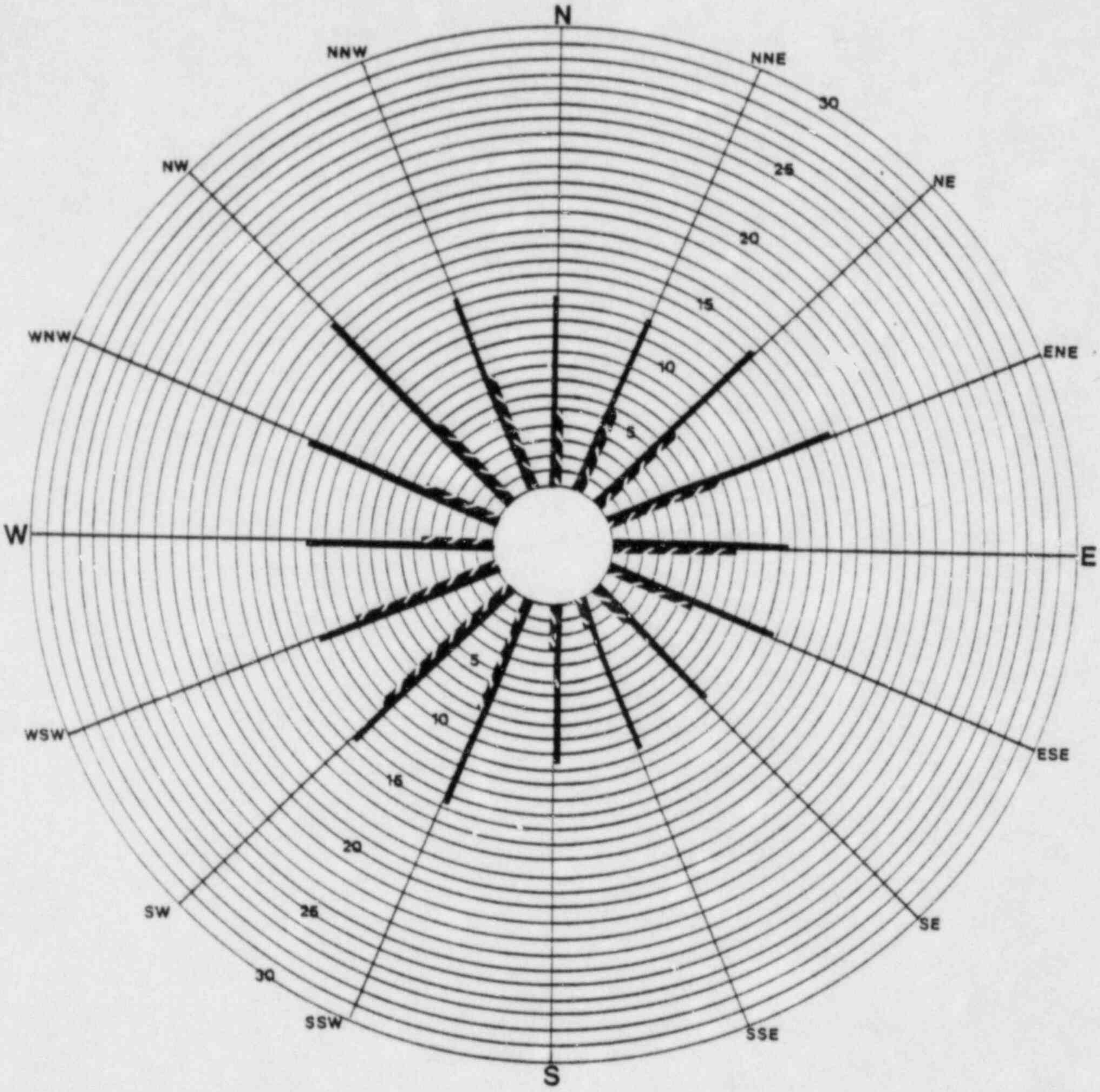
75 meter MAY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 17

75 meter JUNE 82

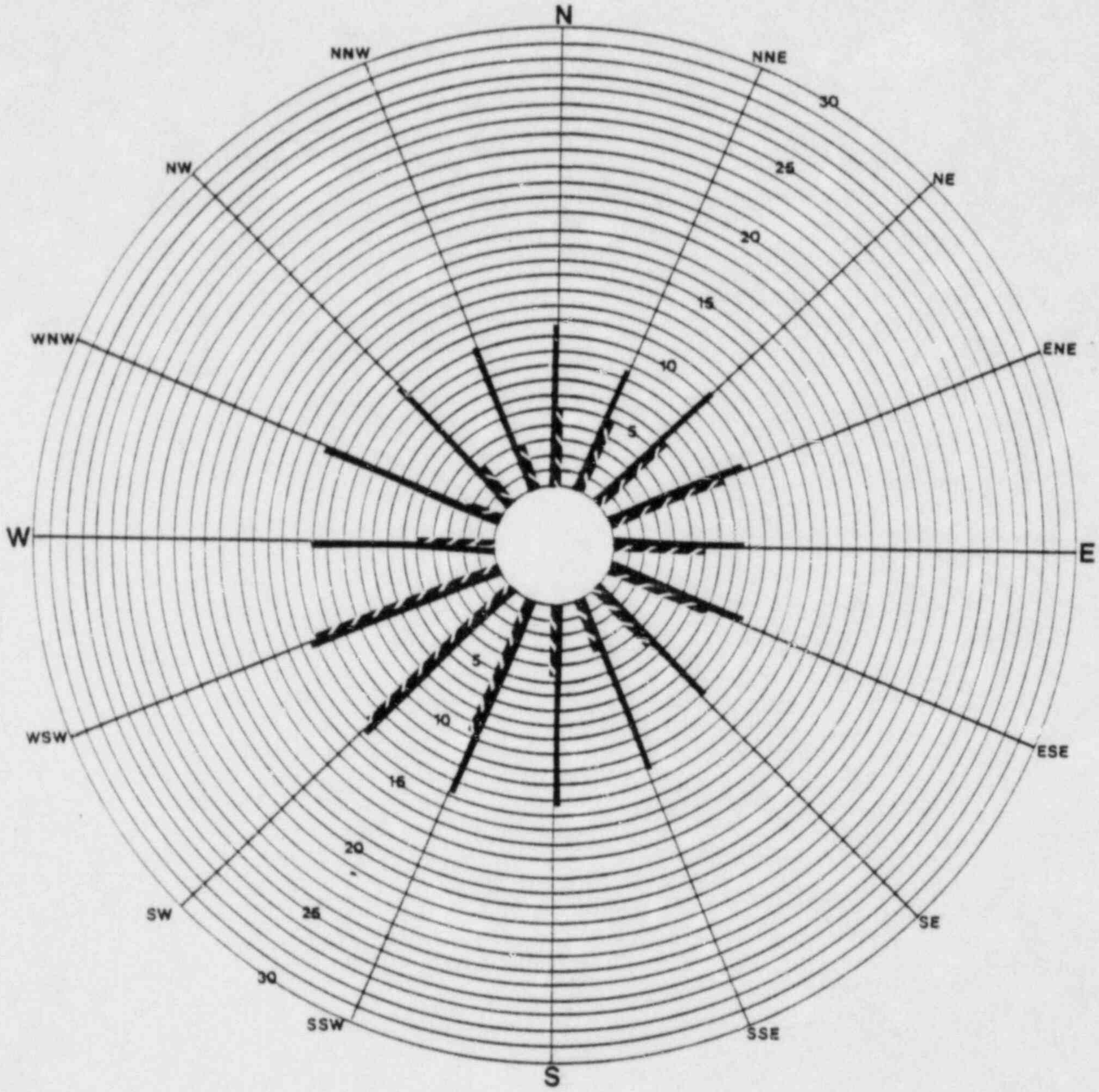


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 18

WIND-SPEED- mph
WIND DIRECTION-%

75 meter JULY 82



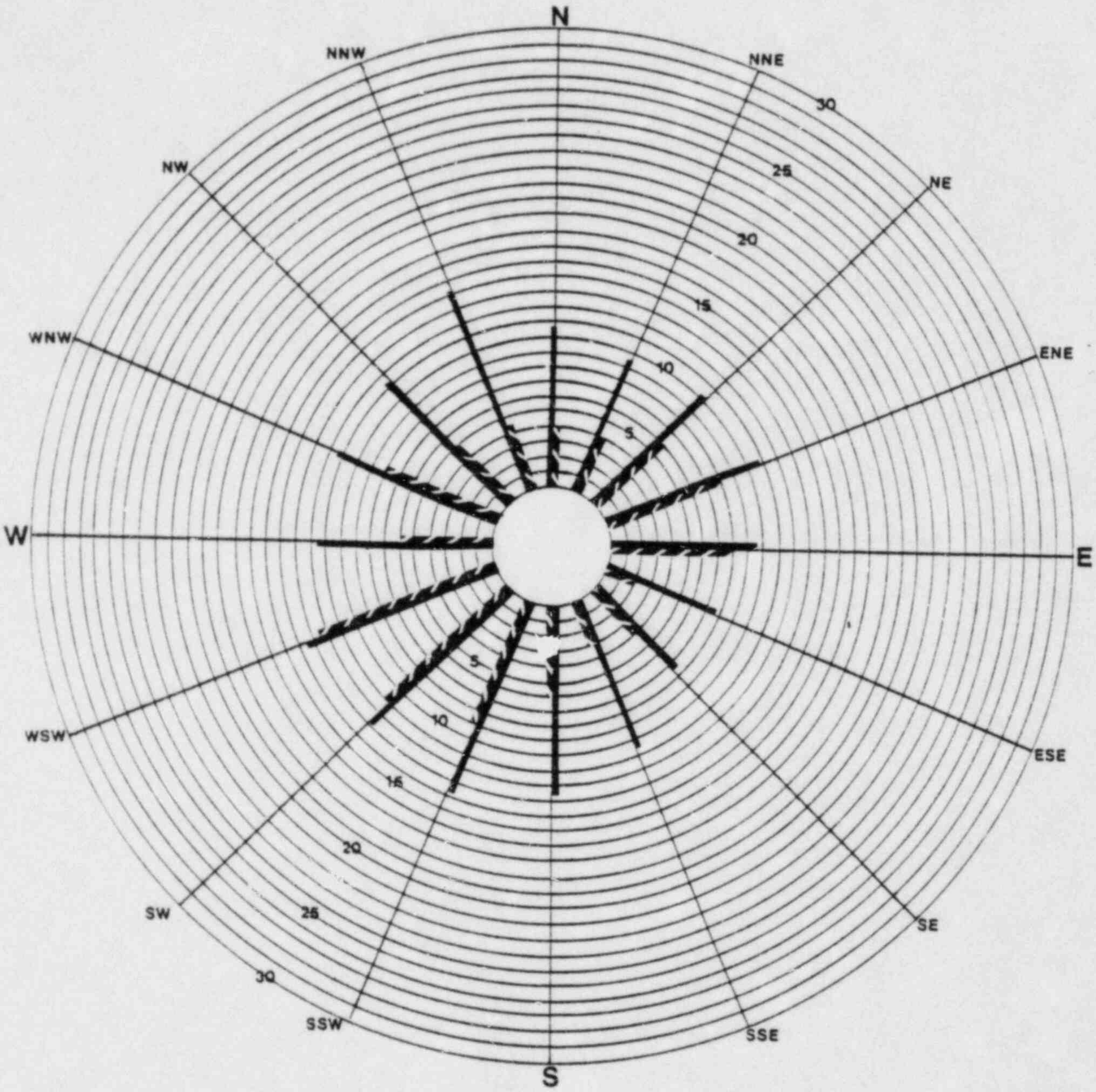
DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 19

WIND-SPEED- mph

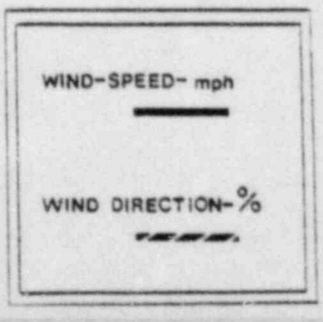
WIND DIRECTION-%

75 meter AUGUST 82

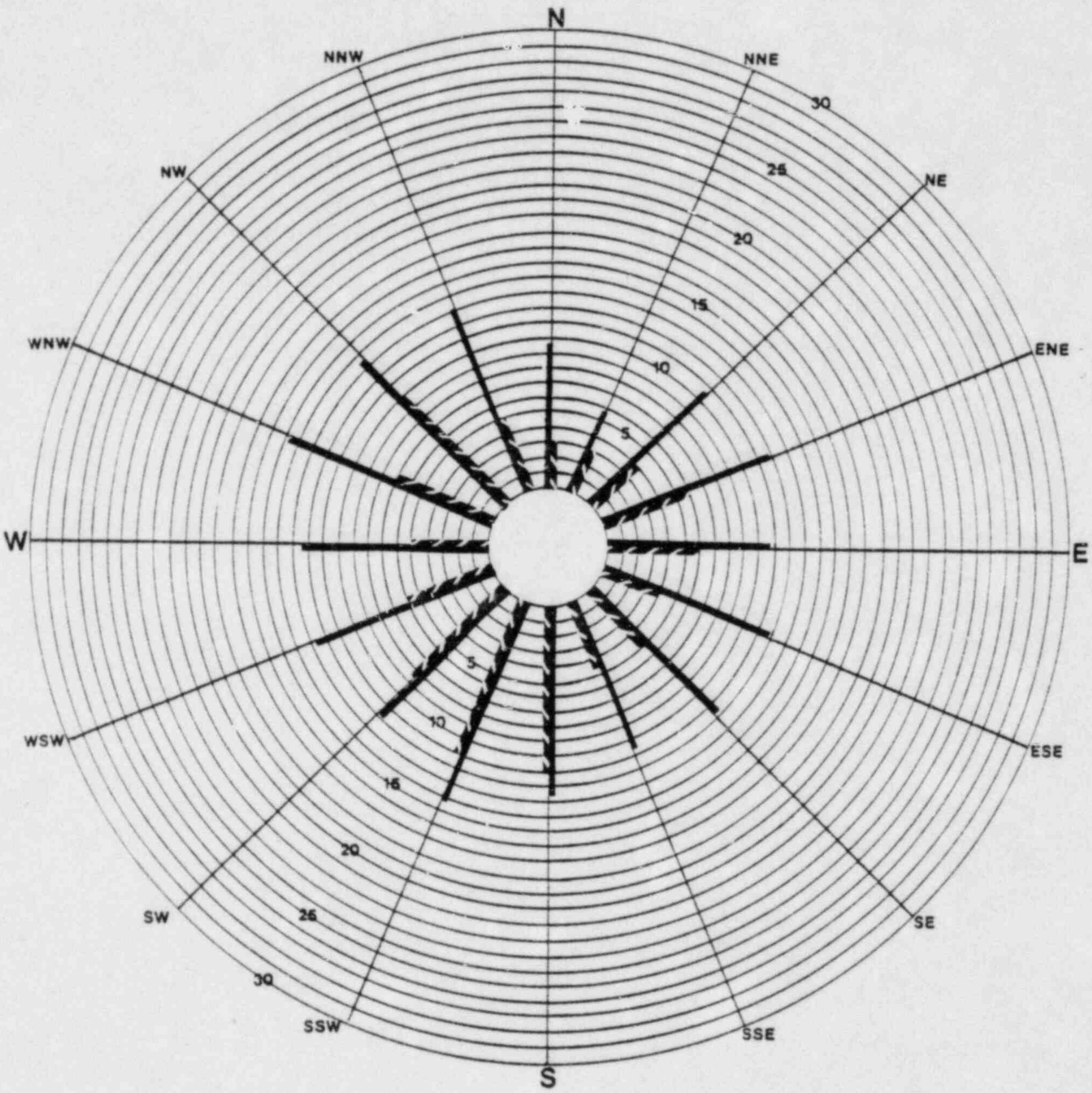


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 20

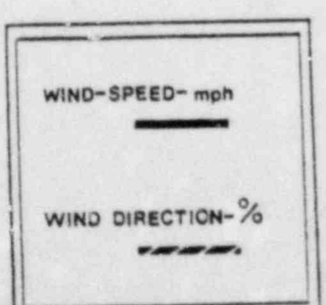


75 meter SEPTEMBER 82

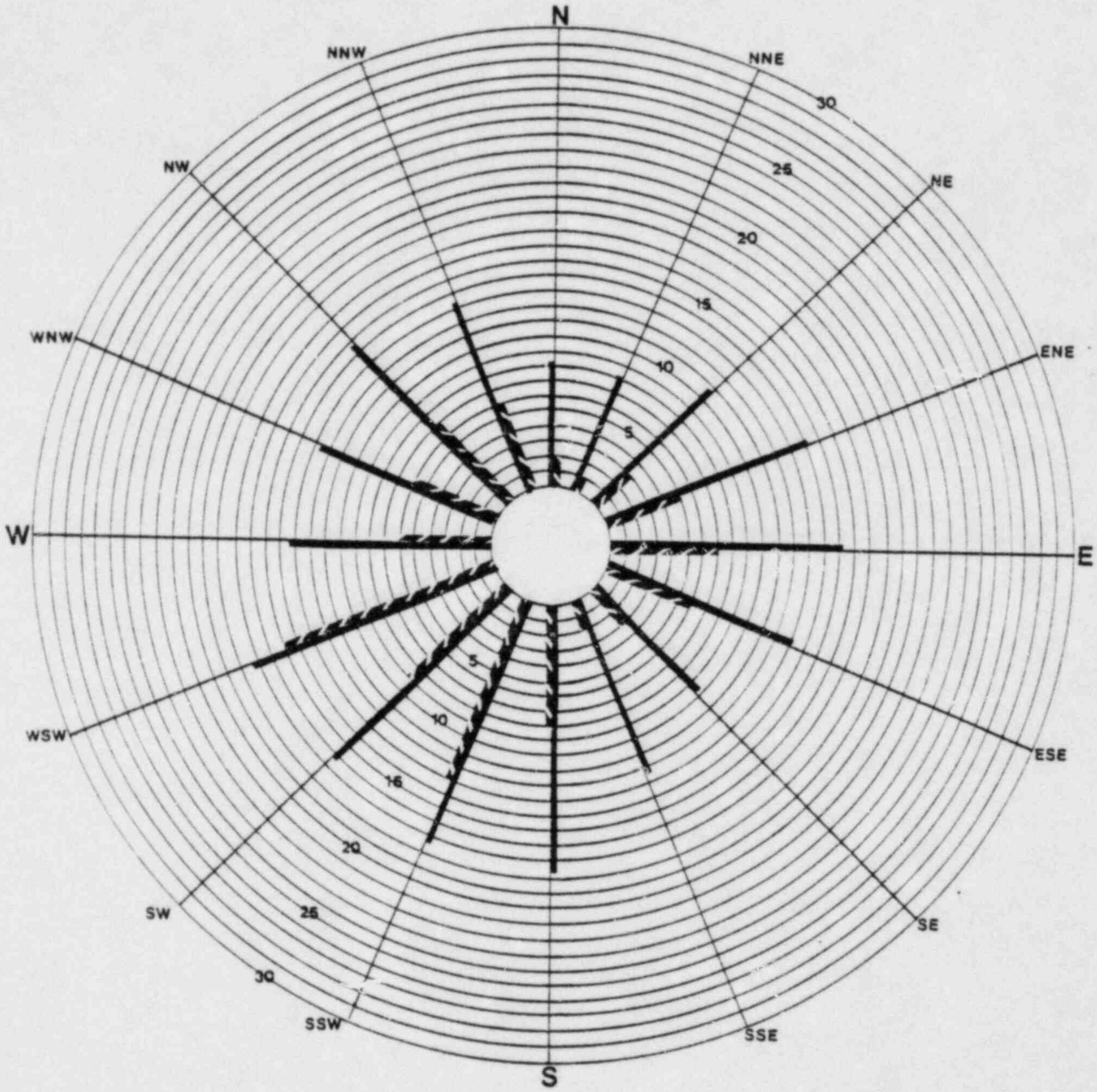


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 21



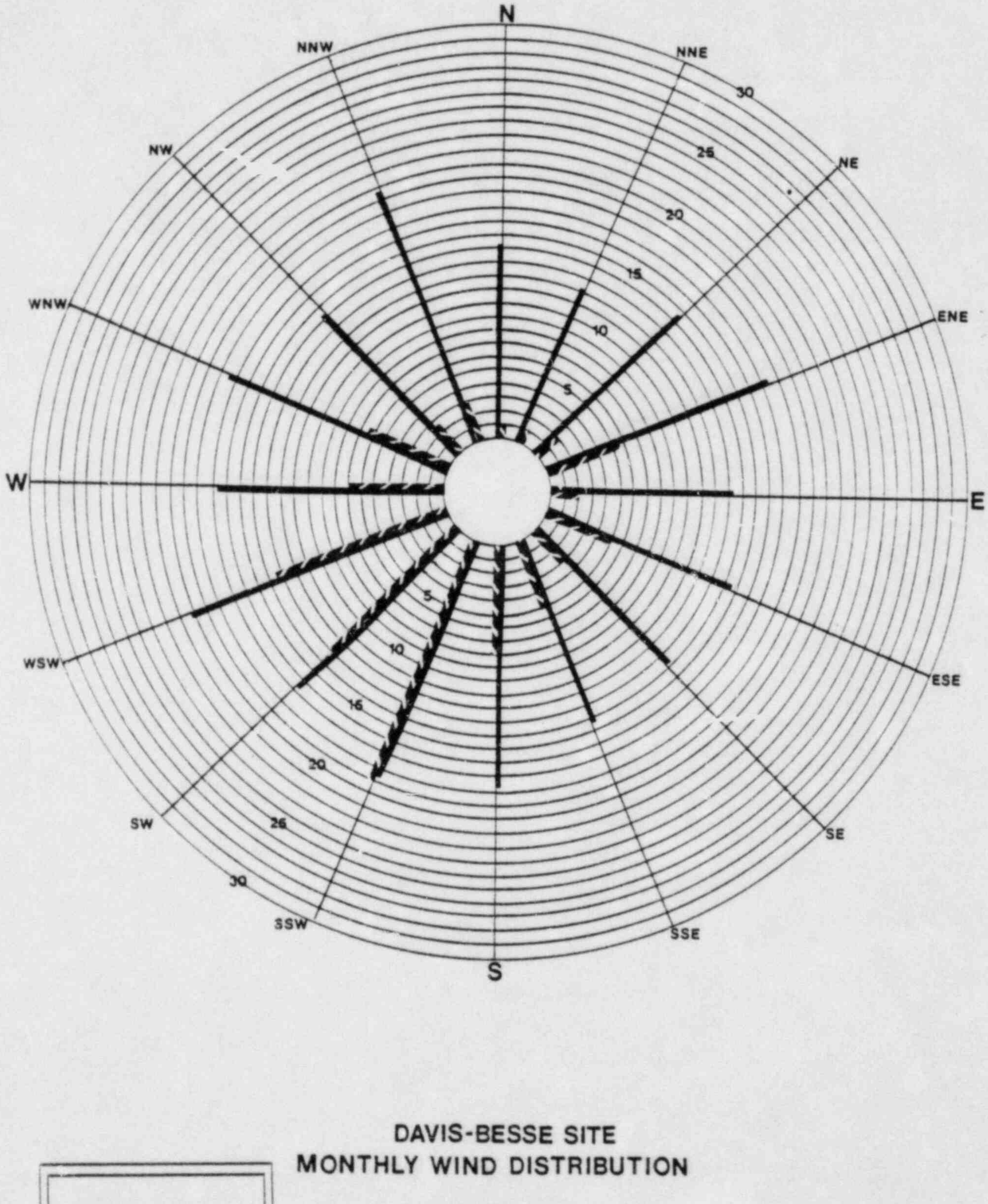
75 meter OCTOBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 22

75 meter NOVEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

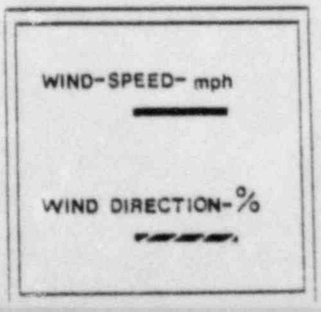
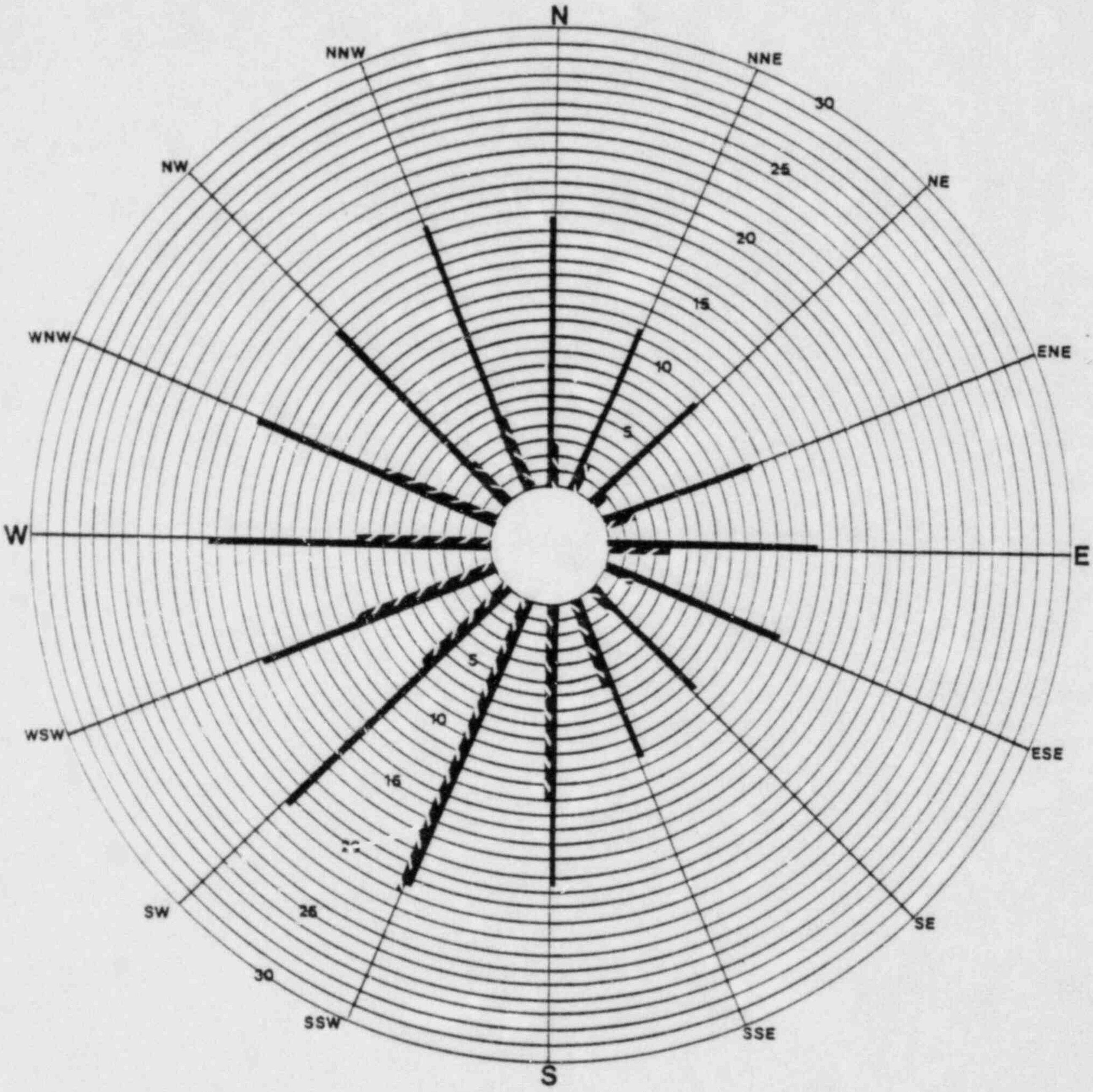


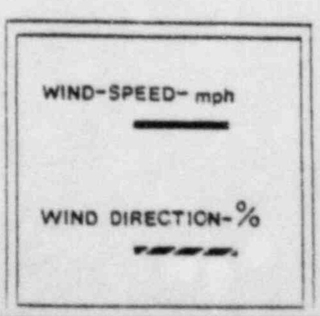
FIGURE 23

75 meter DECEMBER 82

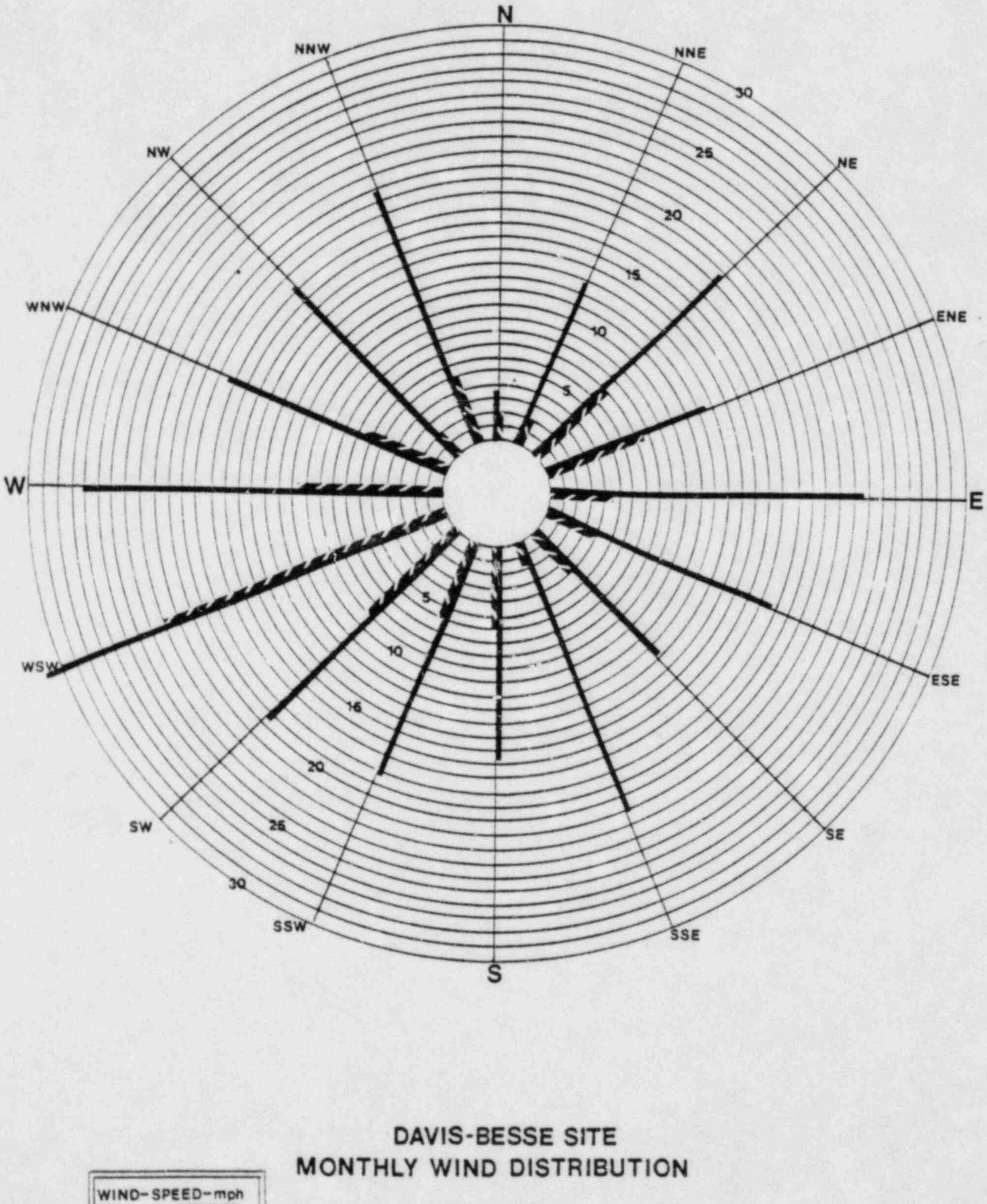


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 24



100 meter JANUARY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

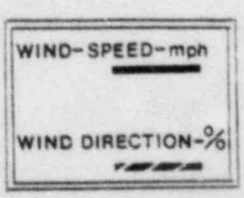
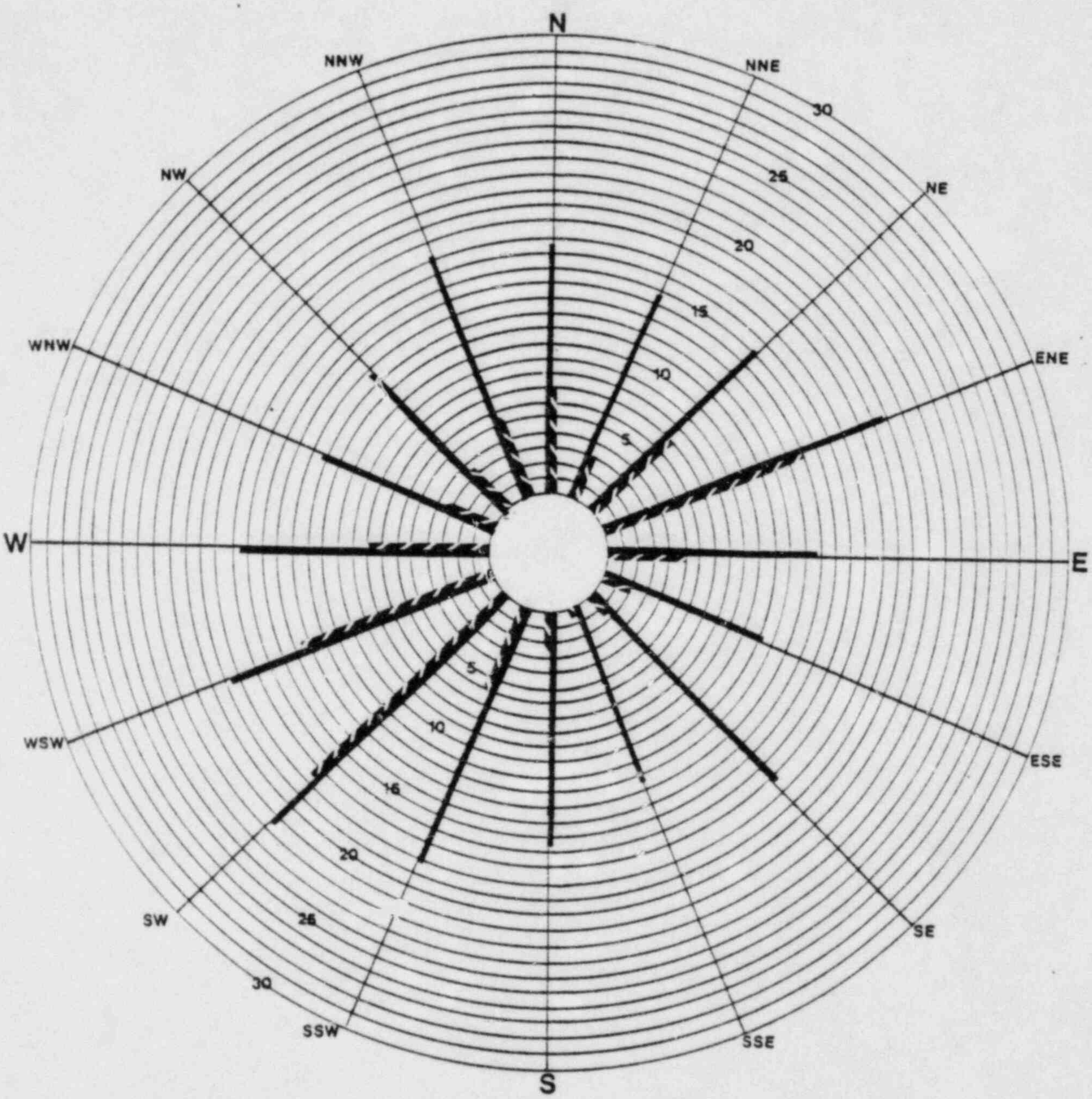


FIGURE 25

100 meter FEBRUARY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

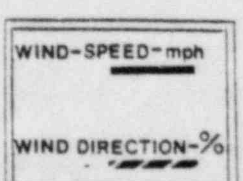
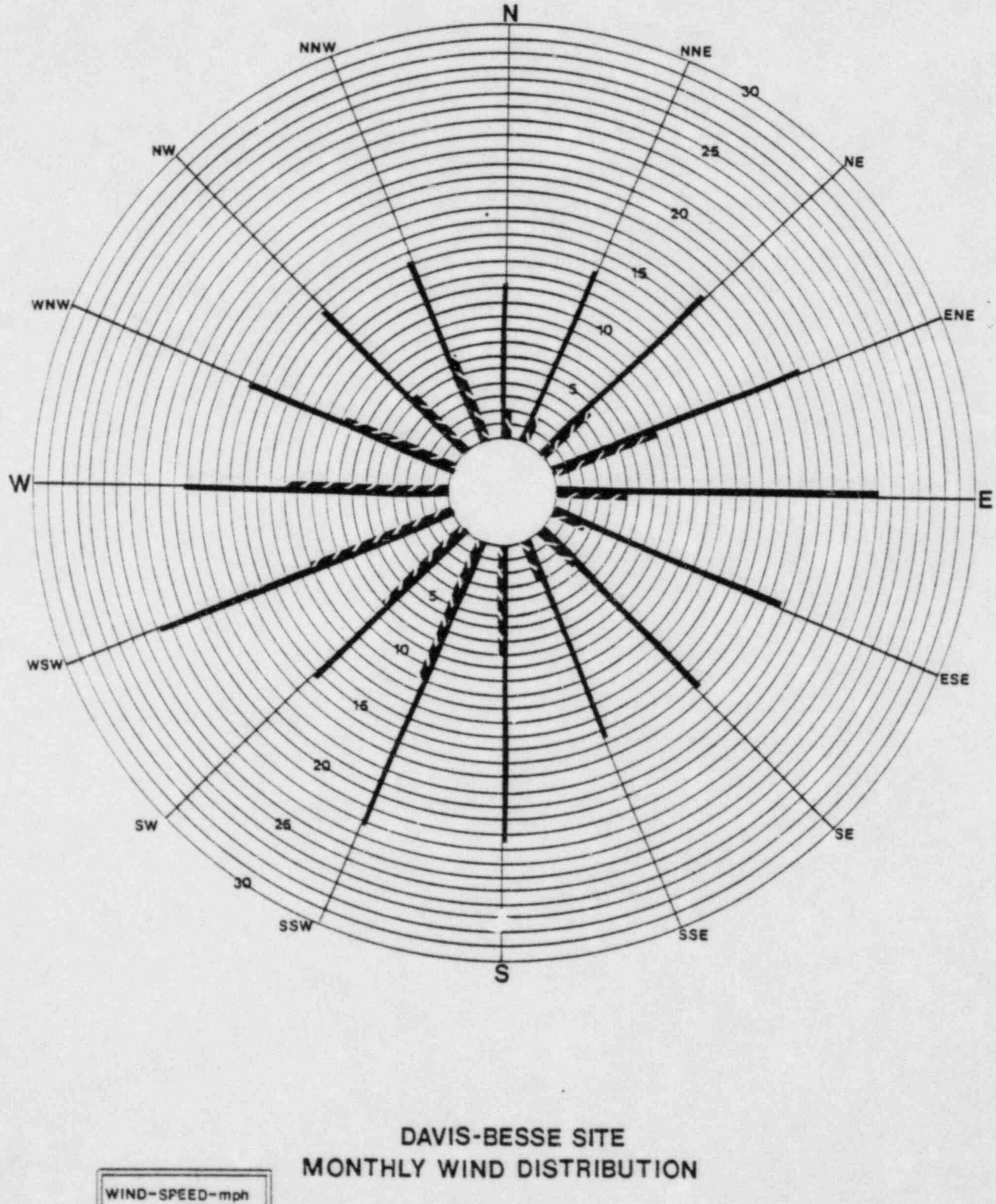


FIGURE 26

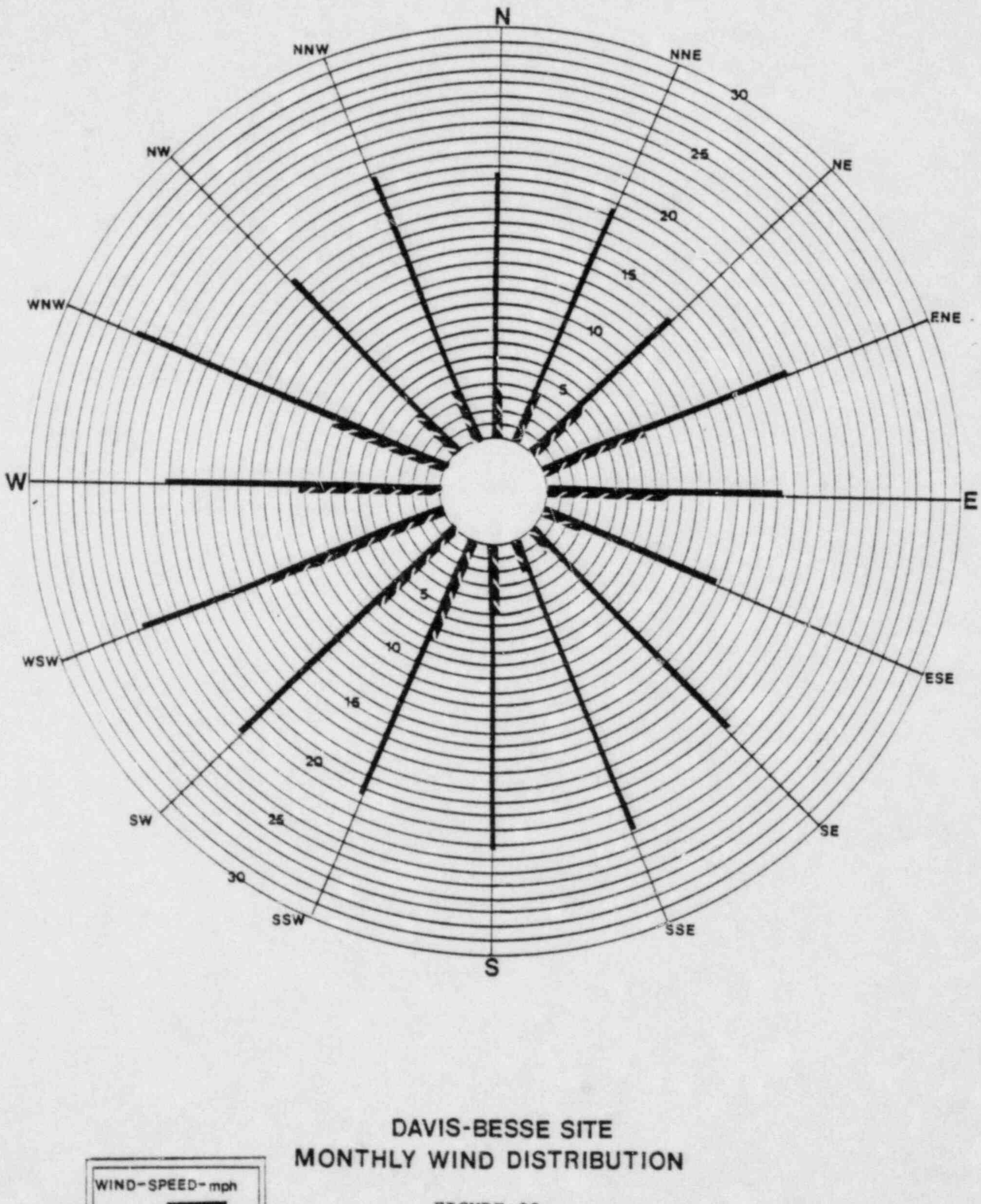
100 meter MARCH 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 27

100 meter APRIL 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

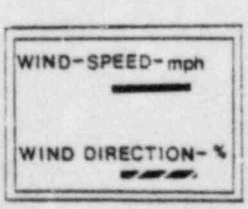
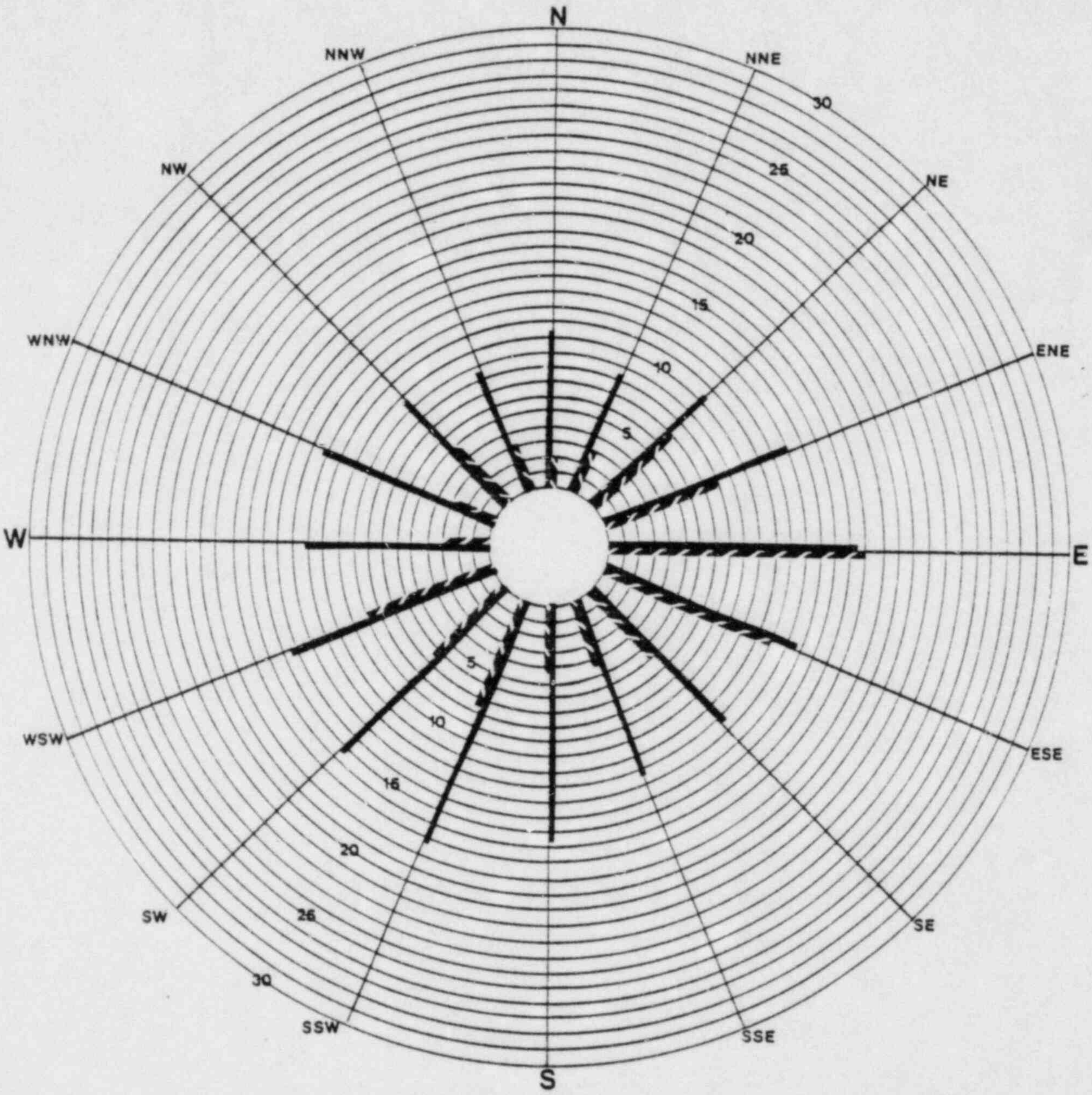


FIGURE 28

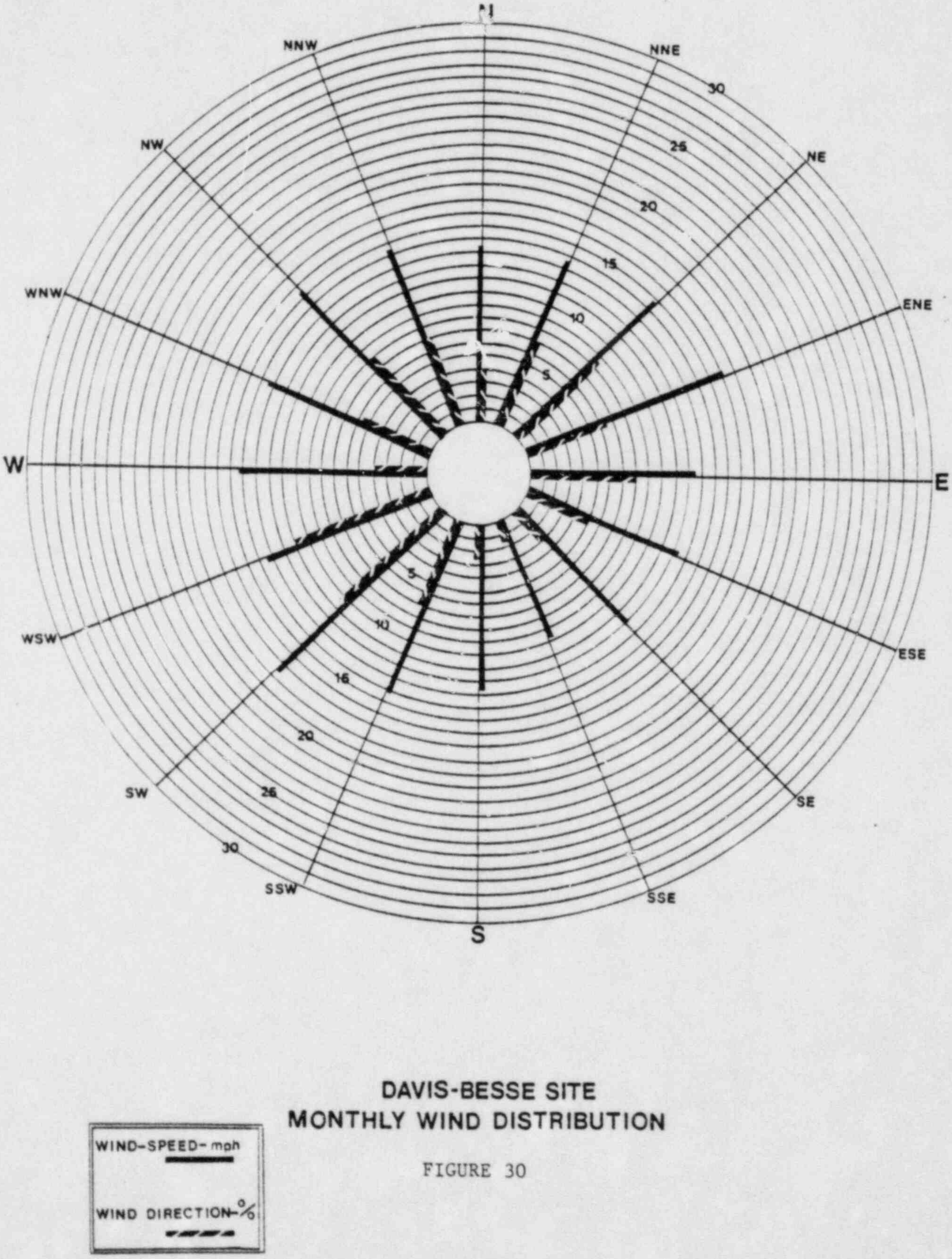
100 meter MAY 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 29

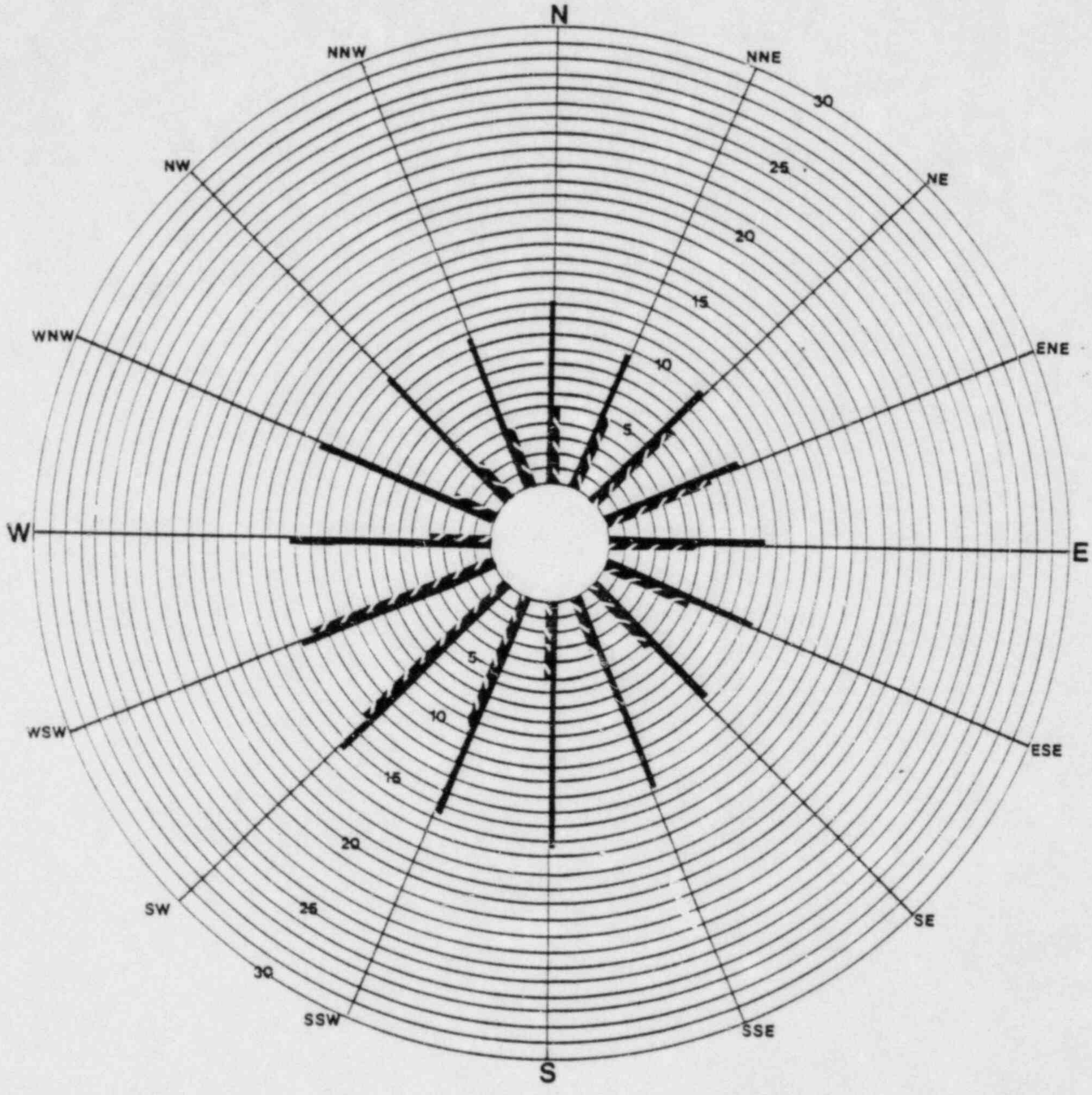
100 meter JUNE 82

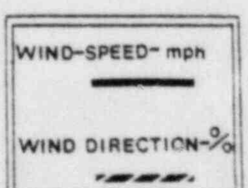


DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 30

100 meter JULY 82

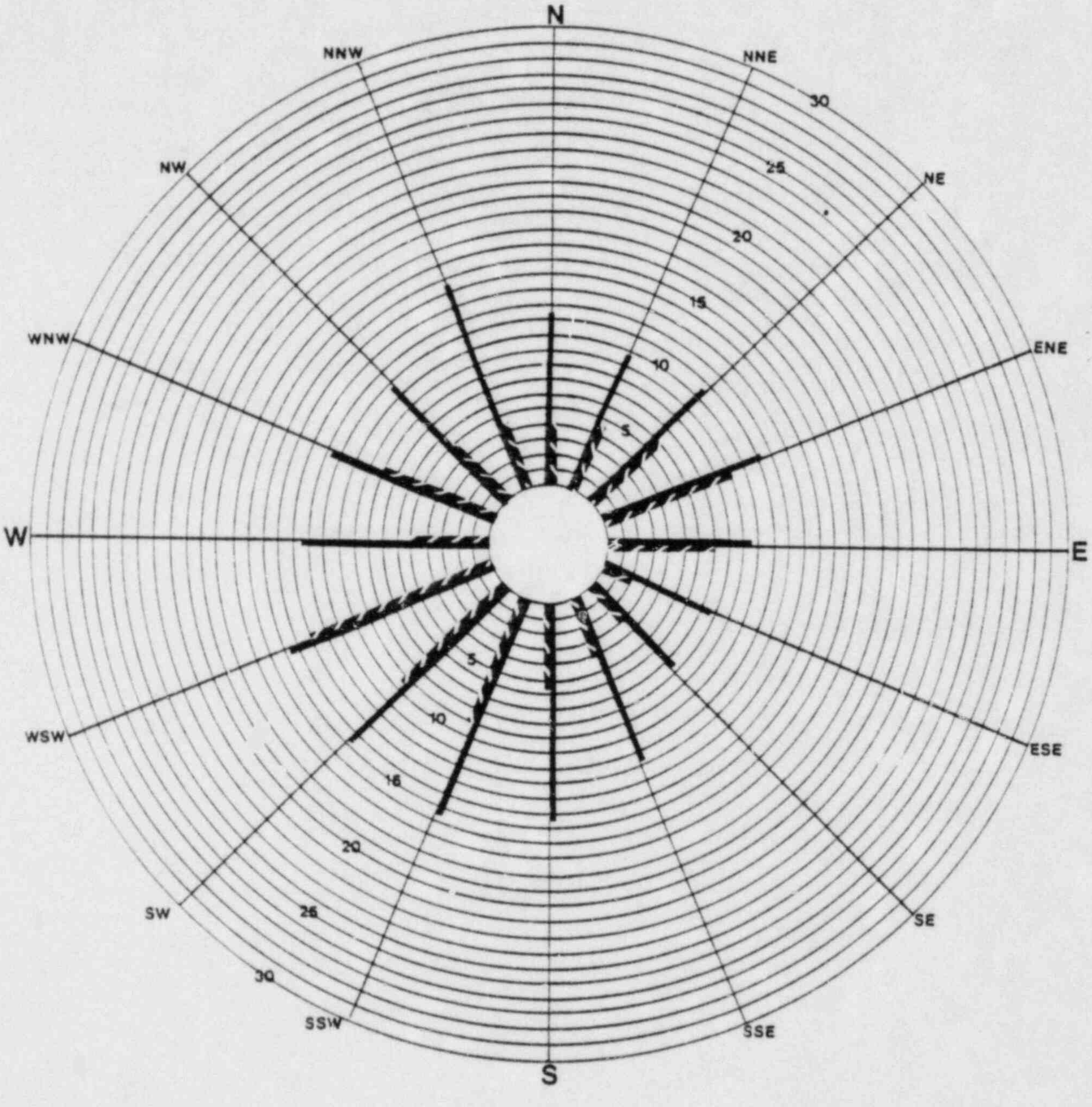




DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 31

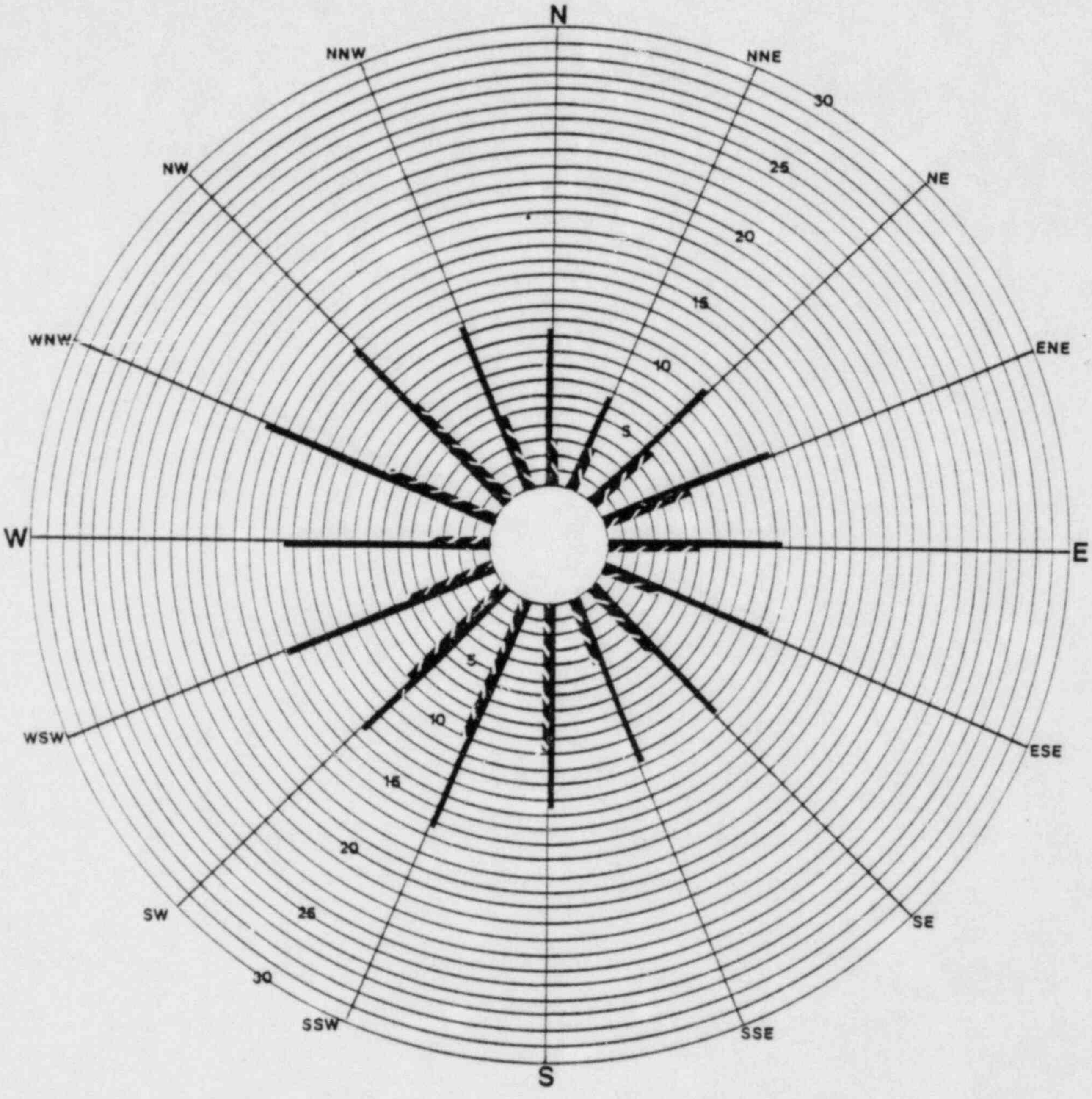
100 meter AUGUST 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 32

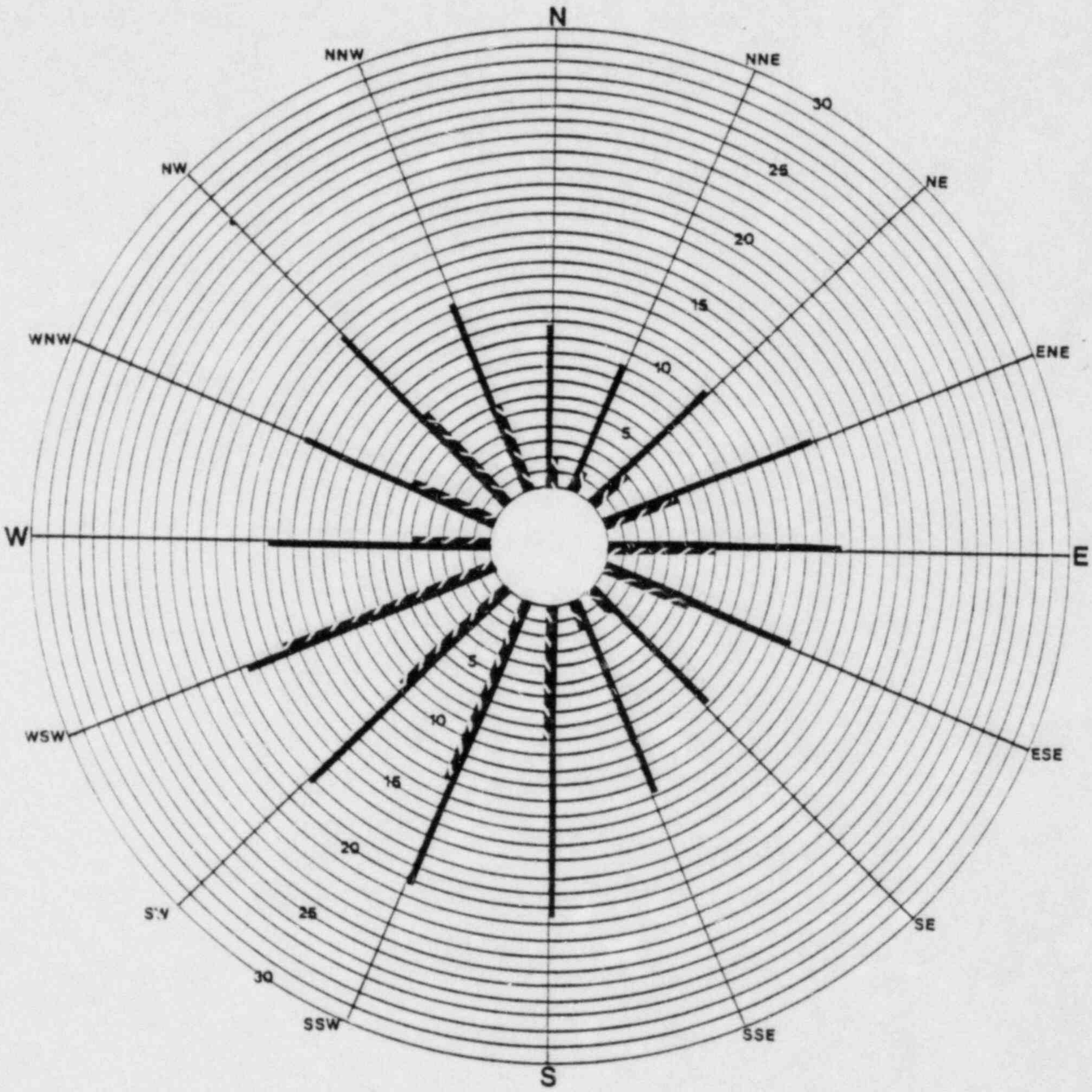
100 meter SEPTEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 33

100 meter OCTOBER 82



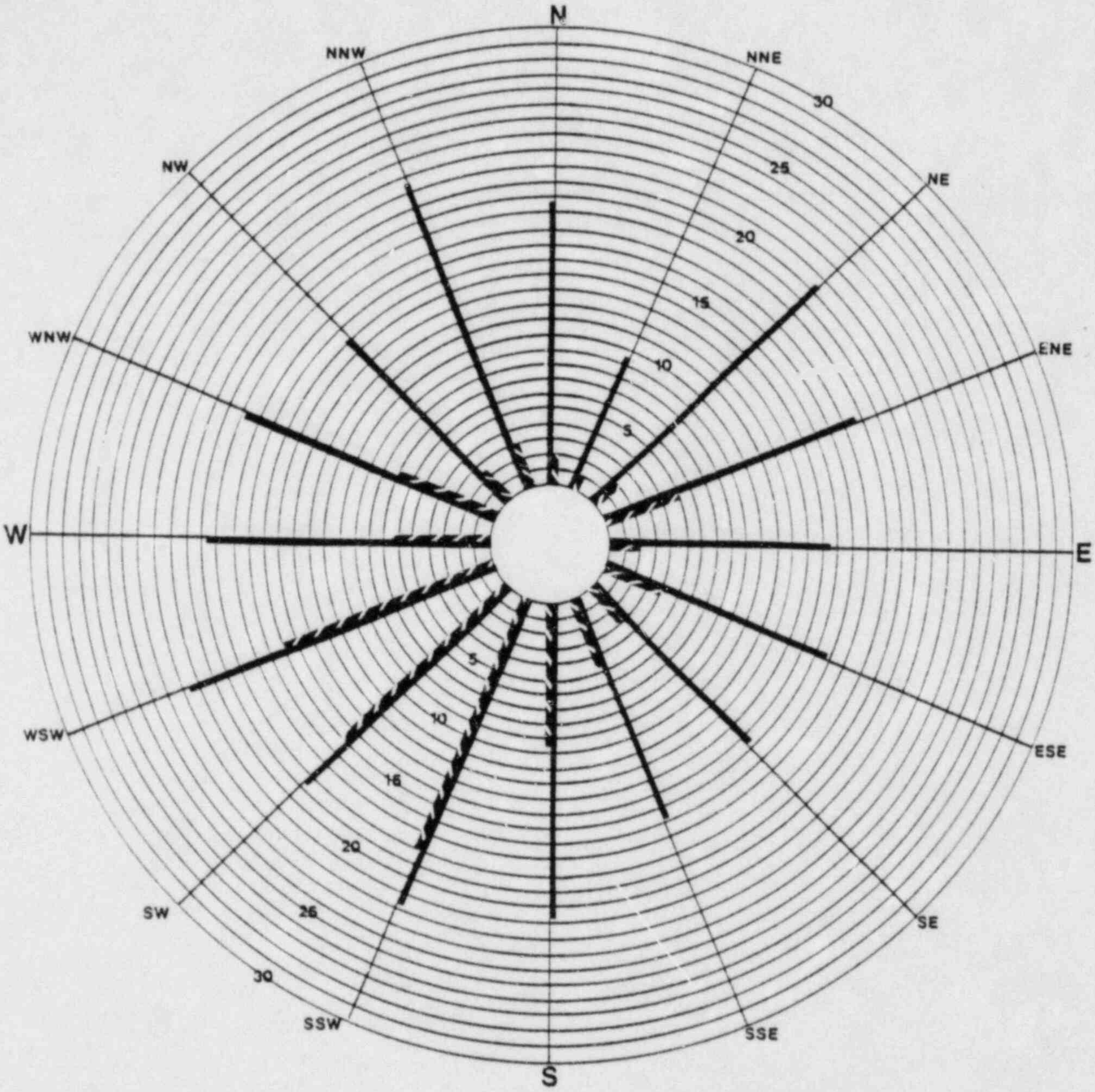
DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 34

WIND-SPEED-mph

WIND DIRECTION-%

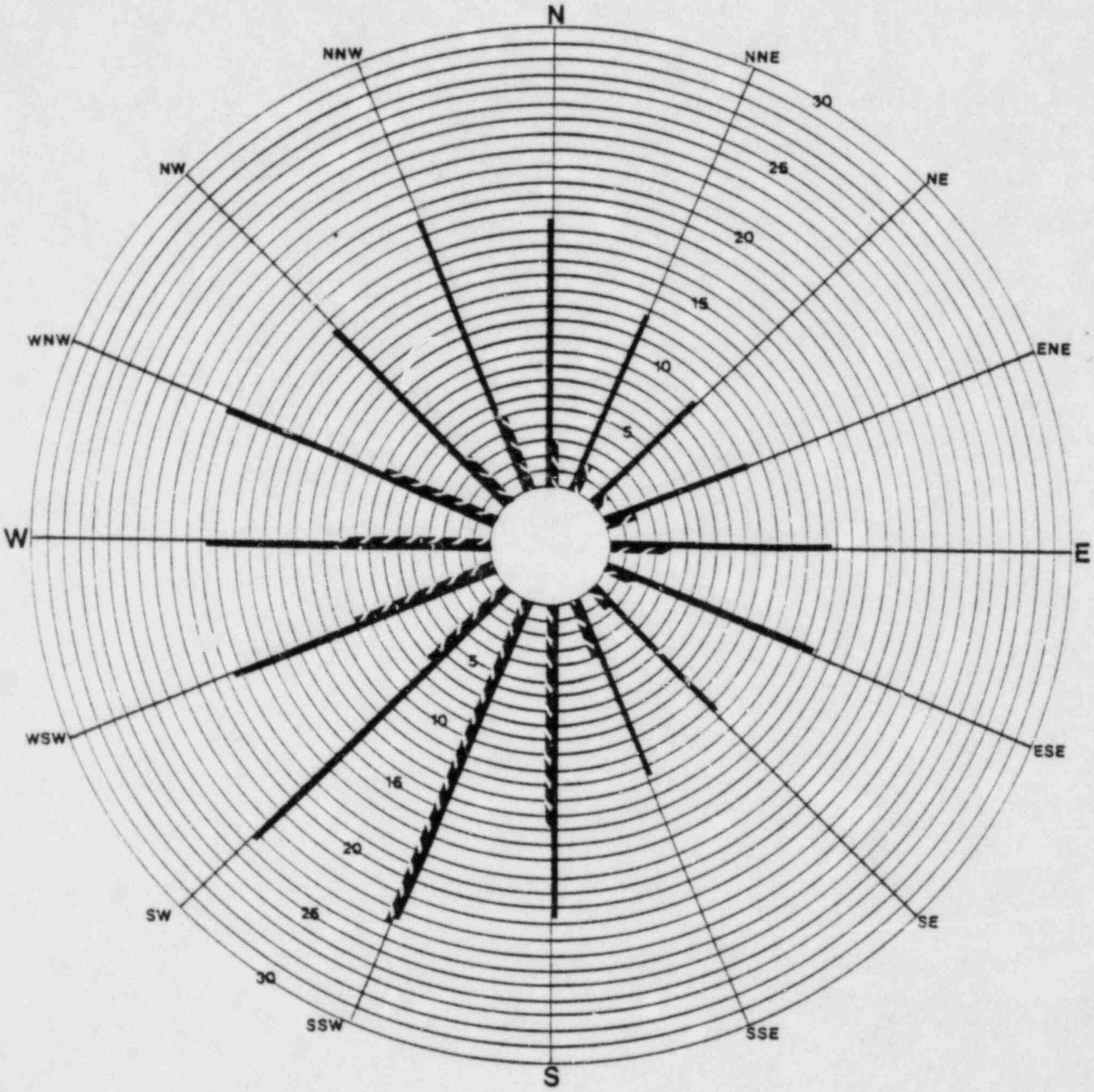
100 meter NOVEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

FIGURE 35

100 meter DECEMBER 82



DAVIS-BESSE SITE
MONTHLY WIND DISTRIBUTION

WIND-SPEED- mph

WIND DIRECTION-%

FIGURE 36

PRECIPITATION STUDY

OF

DAVIS-BESSE NUCLEAR POWER STATION UNIT 1

BY

MATT LEWCZYNSKI

JULY 1982

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APPENDIX B: TABLES

Hourly Records by Month

Total Daily Data by Month (Using Available Data)

PRECIPITATION STUDY
April 1981 - March 1982
DAVIS-BESSE NUCLEAR POWER STATION

SUMMARY

The purpose of this study was to evaluate the relationship between amount, duration and rate of precipitation, and wind direction at the Davis-Besse Nuclear Power Station.

The meteorological data used in this study were taken from the Davis-Besse meteorological monitoring system and the precipitation recorder at the Crane Creek Wildlife Refuge. Data from Crane Creek were used only when Davis-Besse data were unavailable. The Davis-Besse meteorological monitoring system consists of two towers - a 100m freestanding tower and a 10m satellite tower, and recording equipment in a shelter at the base of the 100m tower. Wind speed and direction data used in this report were taken from a sensor on the 10m level of the satellite tower, and the rainfall was measured at 1m near the base of that tower. Using this information, a precipitation wind rose for each month was developed.

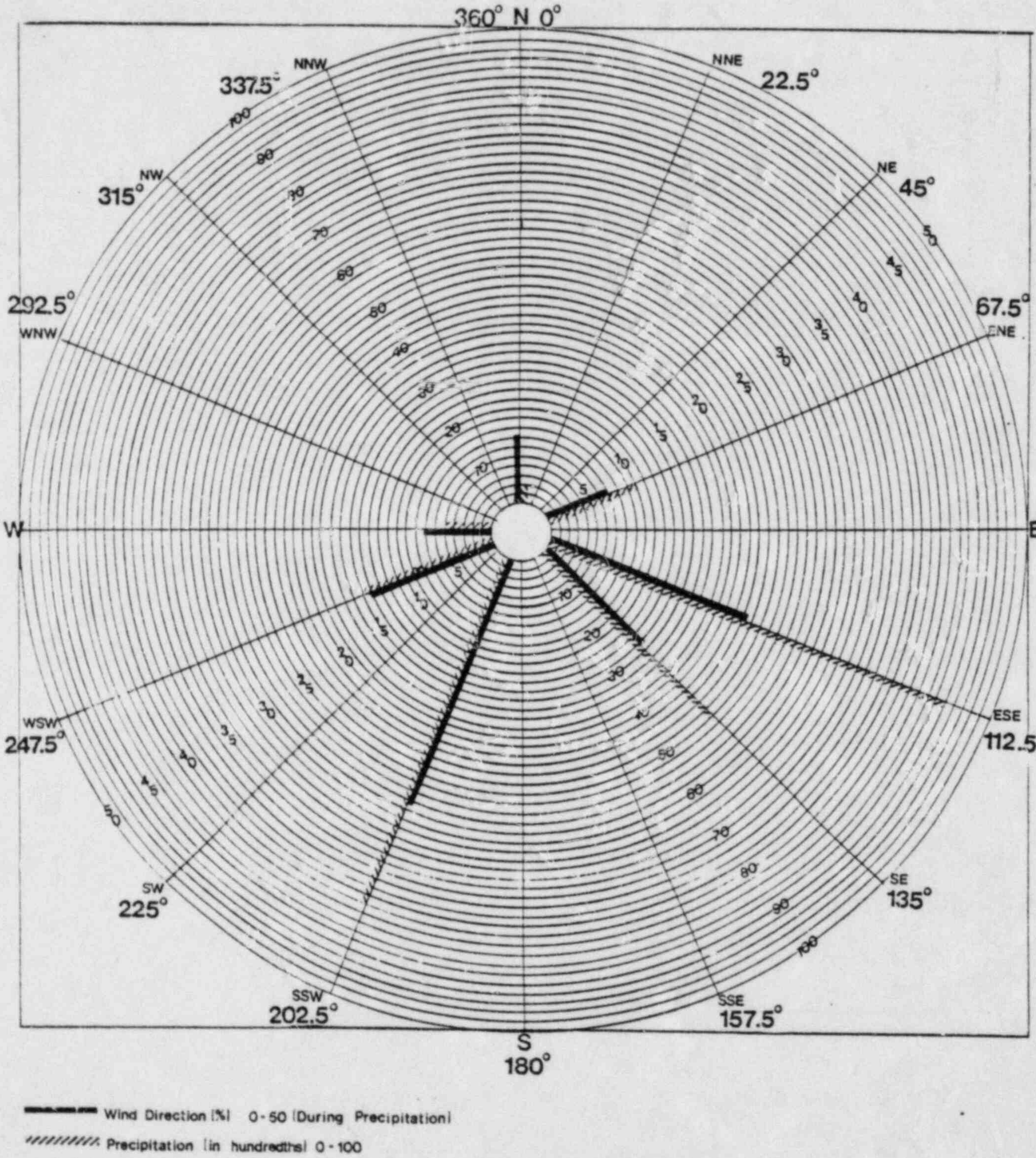
From this study it was found that (i) in summer 64% of the time precipitation fell when the wind was blowing from the land toward the lake, (ii) in the fall 56% of the time the precipitation fell when the wind was blowing from the lake to the land, (iii) in winter and in spring, the percent of time precipitation fell during off-shore flows and on-shore flows was roughly equal.

During the time periods over the course of the year that precipitation was actually falling, the rate was 0.06 inches per hour.

APPENDIX A

DAVIS-BESSE PRECIPITATION WINDROSES

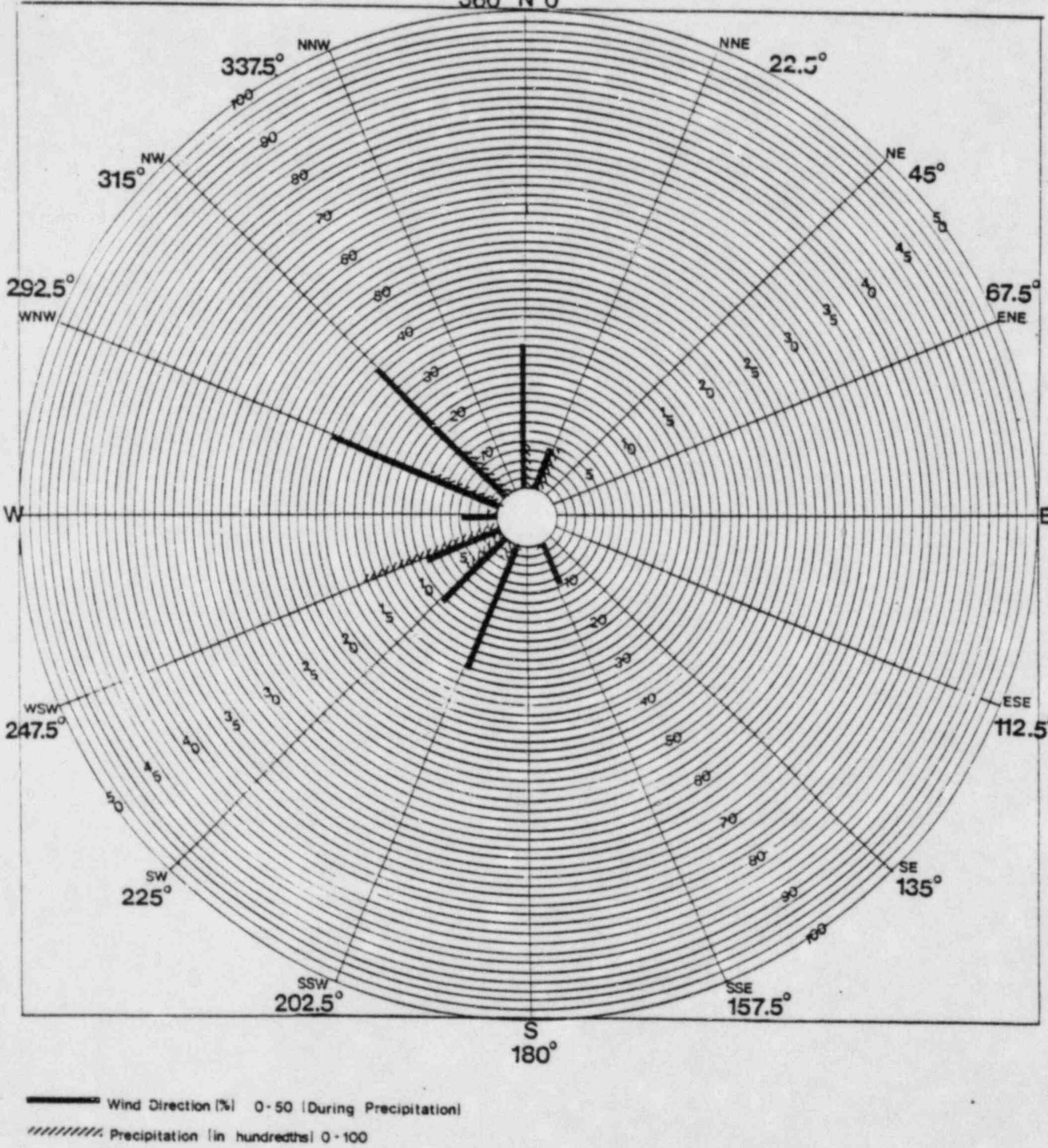
FIGURE 1



DAVIS-BESSE
PRECIPITATION WINDROSE

APRIL 1981

FIGURE 2

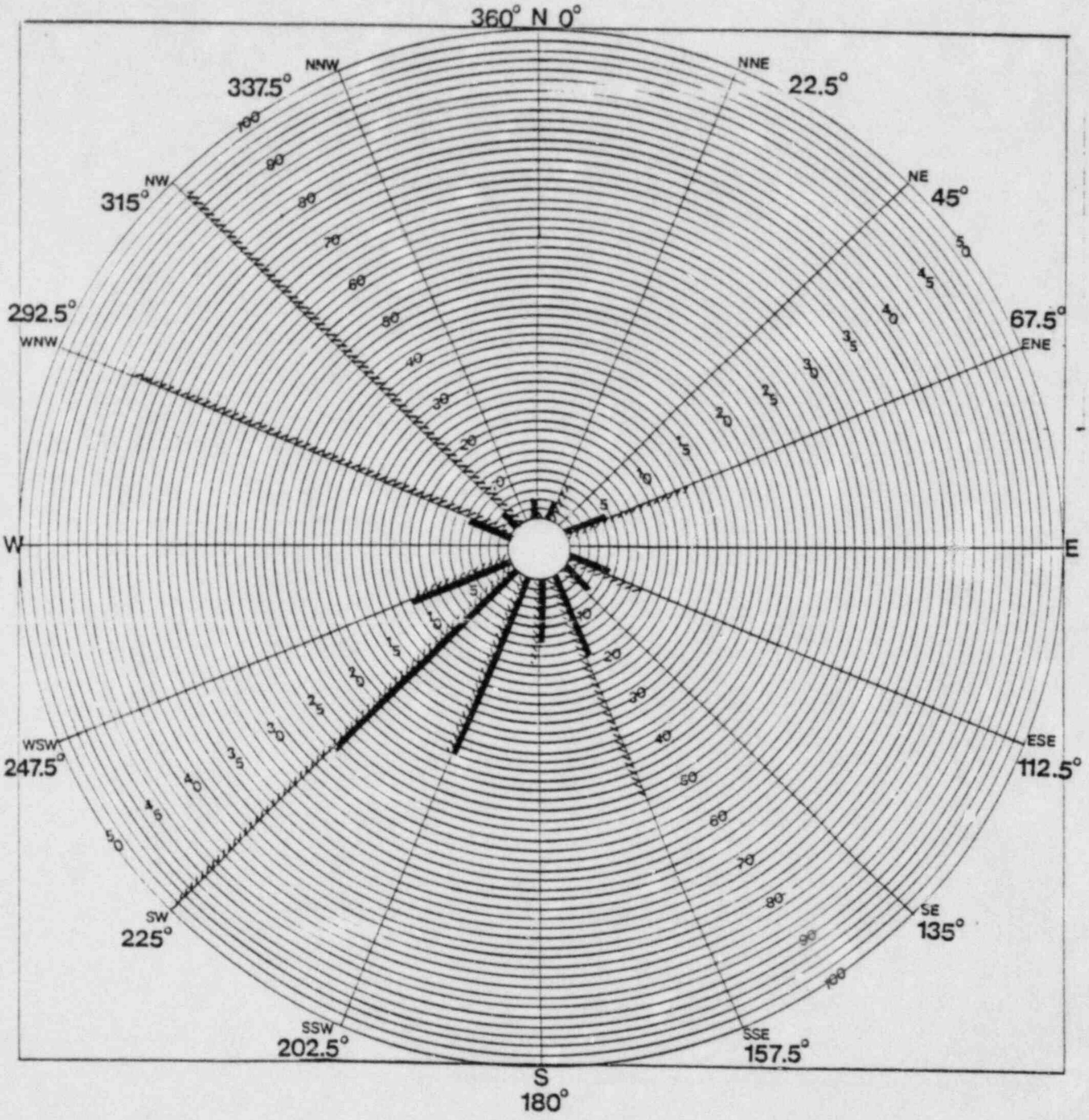


DAVIS-BESSE

PRECIPITATION WINDROSE

MAY 1981

FIGURE 3



Wind Direction (%) 0-50 (During Precipitation)

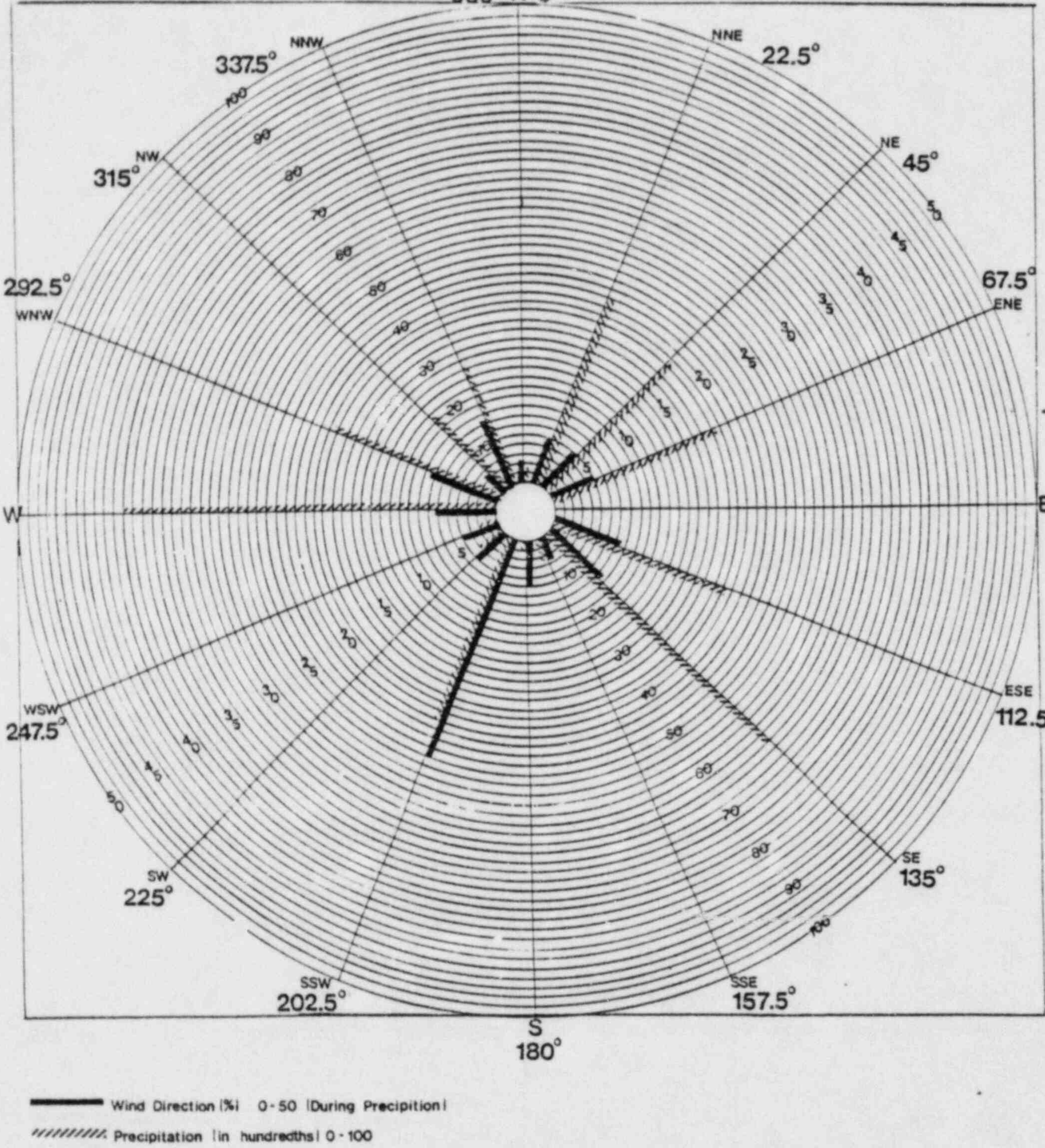
Precipitation (in hundredths) 0-100

DAVIS-BESSE

PRECIPITATION WINDROSE

JUNE 1981

FIGURE 4

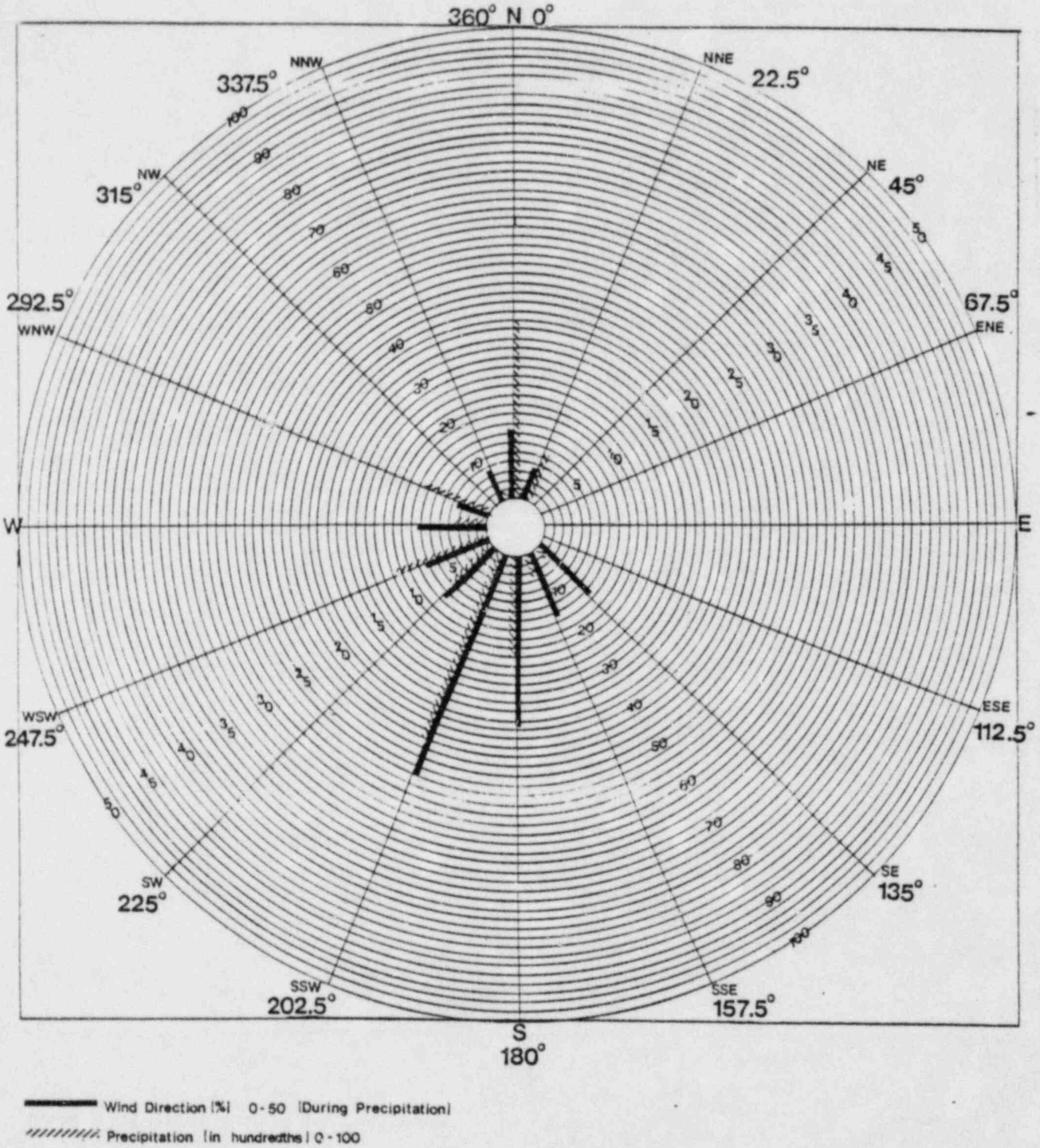


DAVIS-BESSE

PRECIPITATION WINDROSE

JULY 1981

FIGURE 5

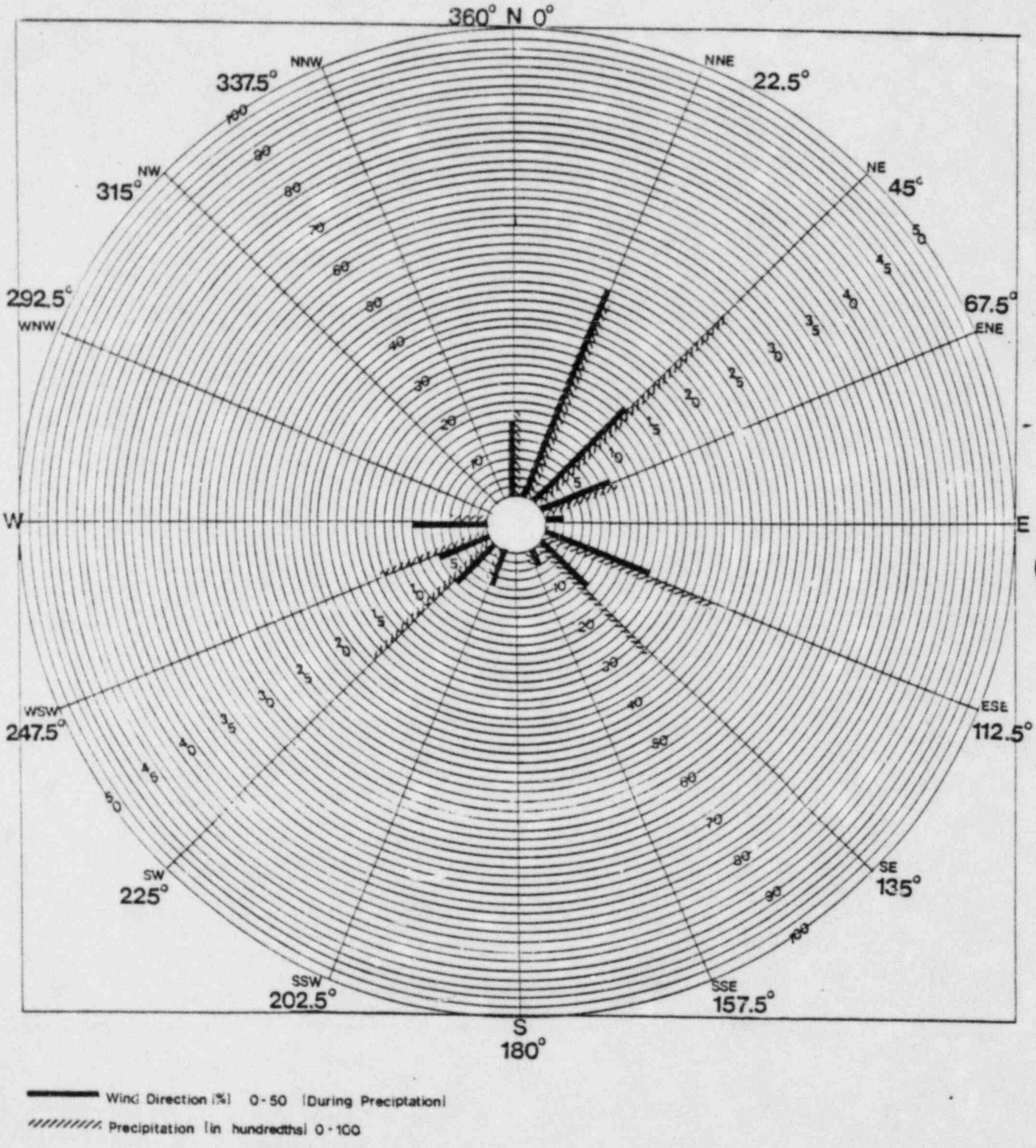


DAVIS-BESSE

PRECIPITATION WINDROSE

AUGUST 1981

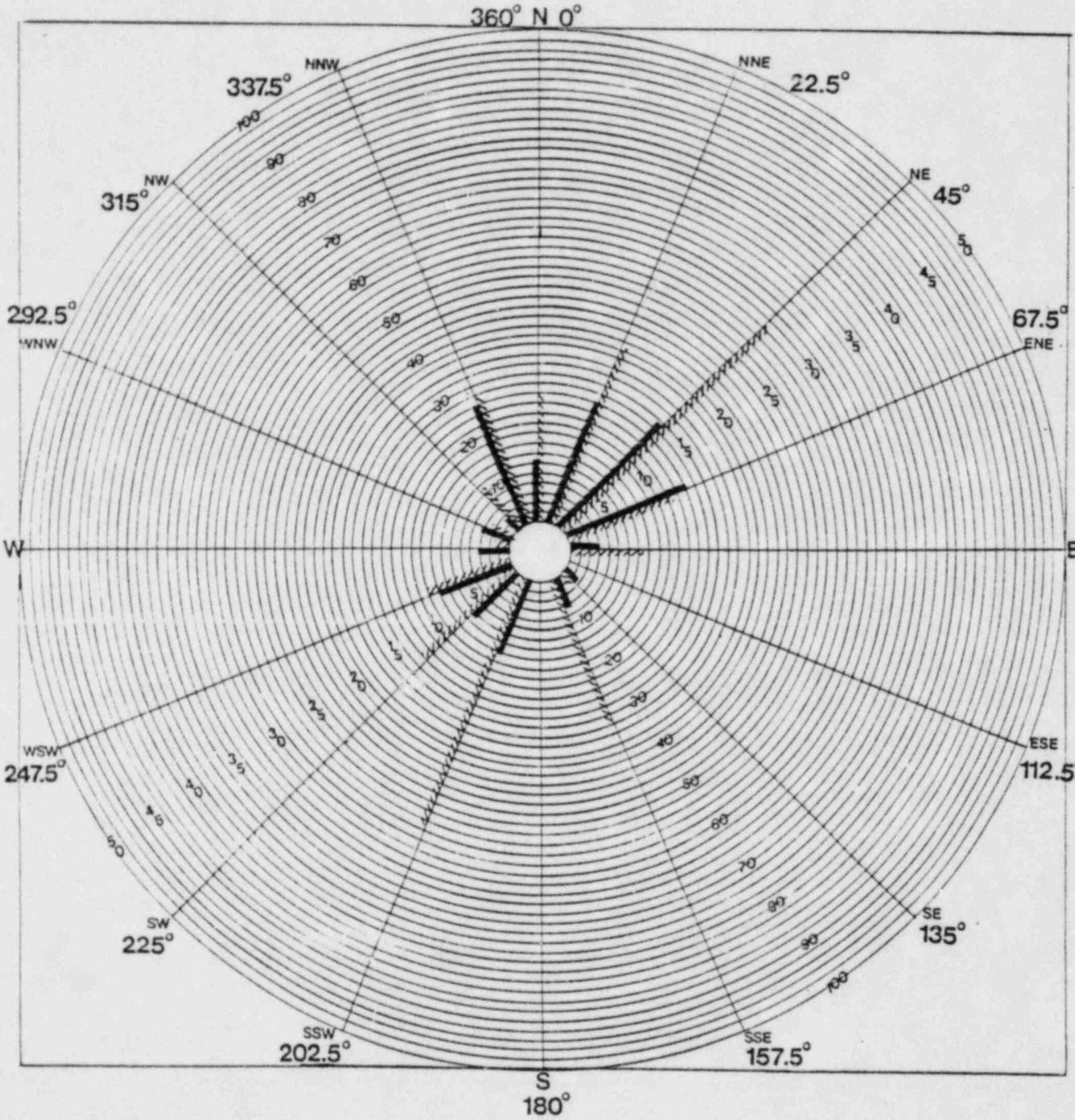
FIGURE 6



DAVIS-BESSE
PRECIPITATION WINDROSE

SEPTEMBER 1981

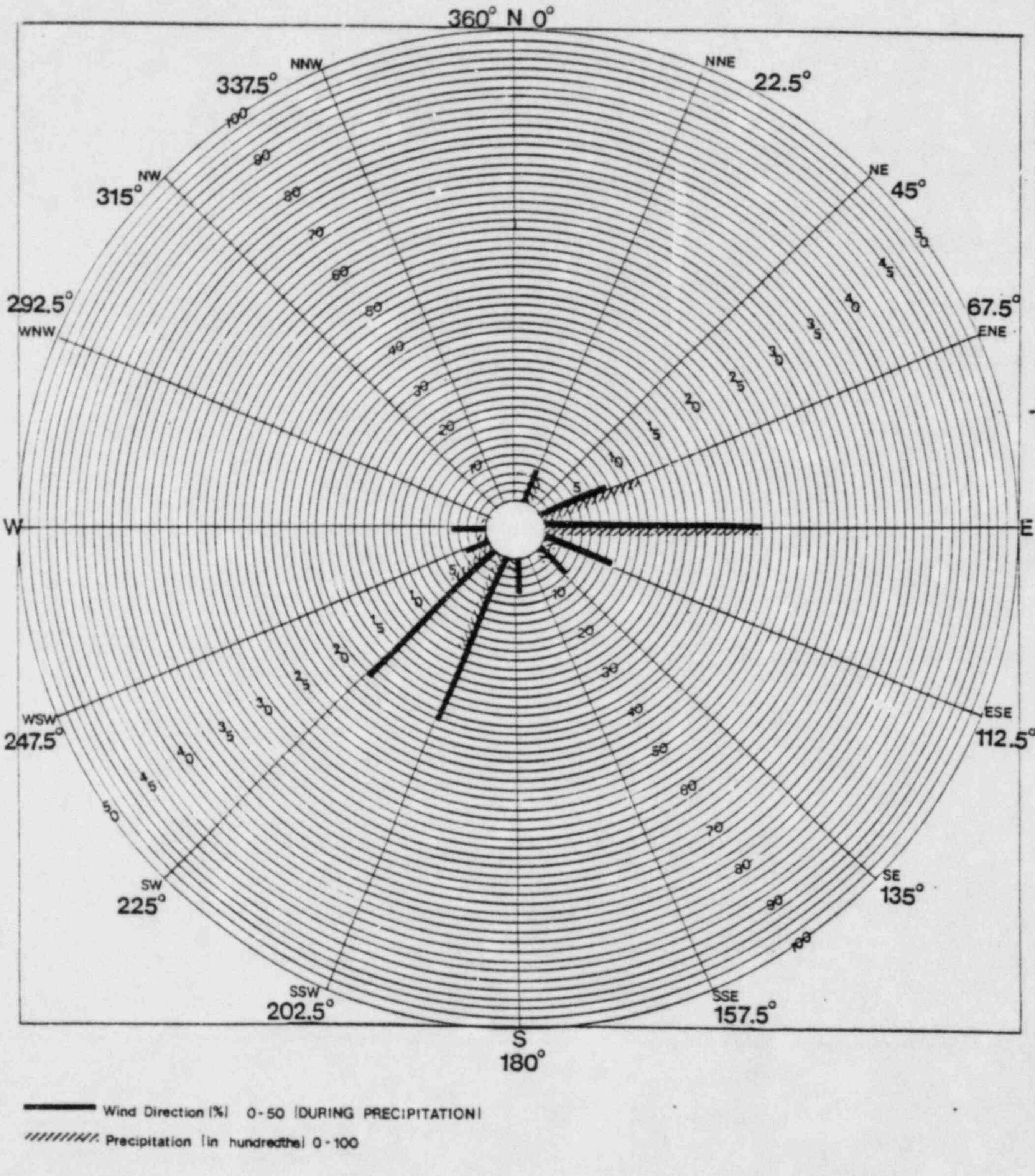
FIGURE 7



DAVIS-BESSE
PRECIPITATION WINDROSE

OCTOBER 1981

FIGURE 8

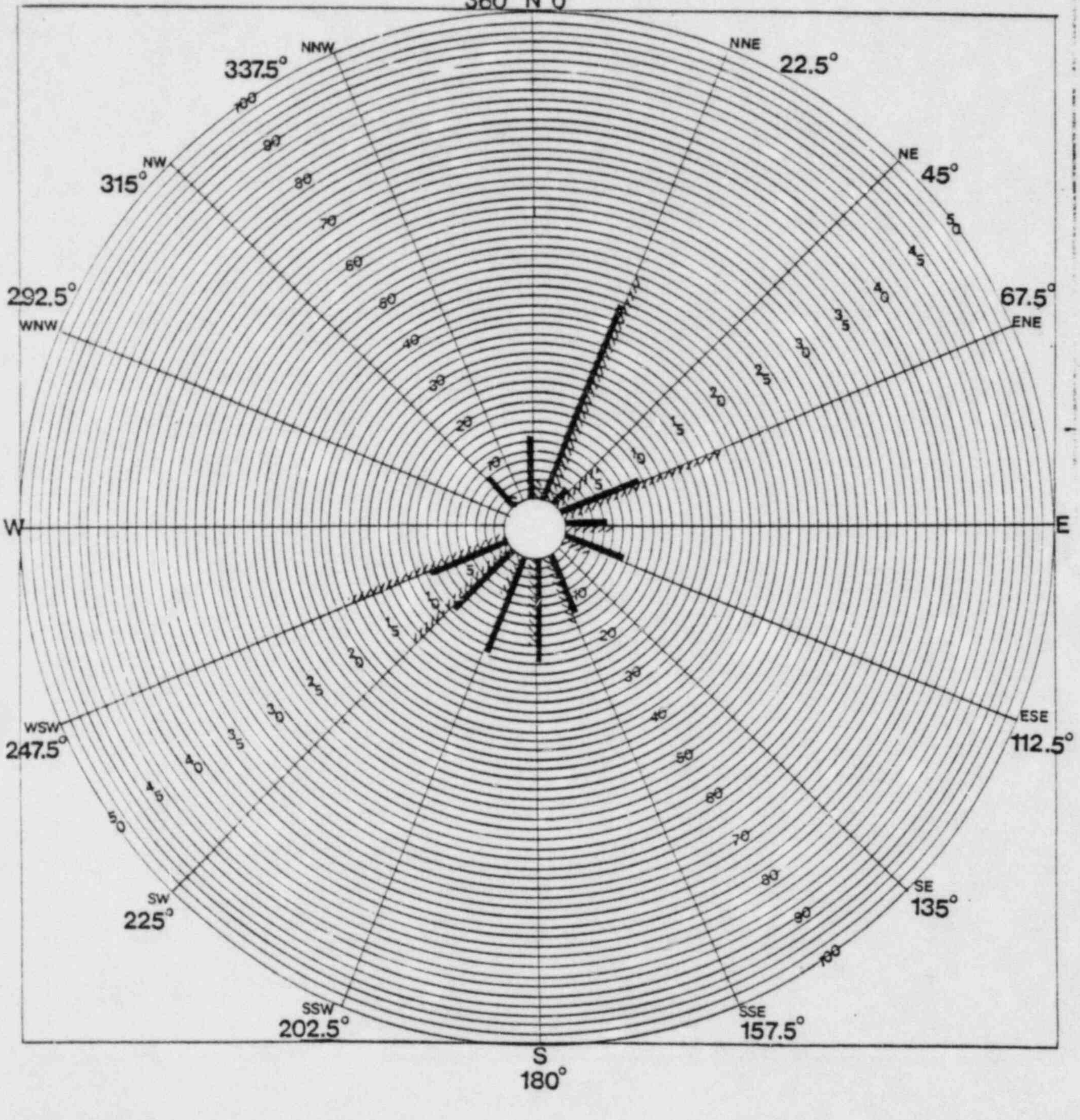


DAVIS-BESSE

PRECIPITATION WINDROSE

NOVEMBER 1981

FIGURE 9

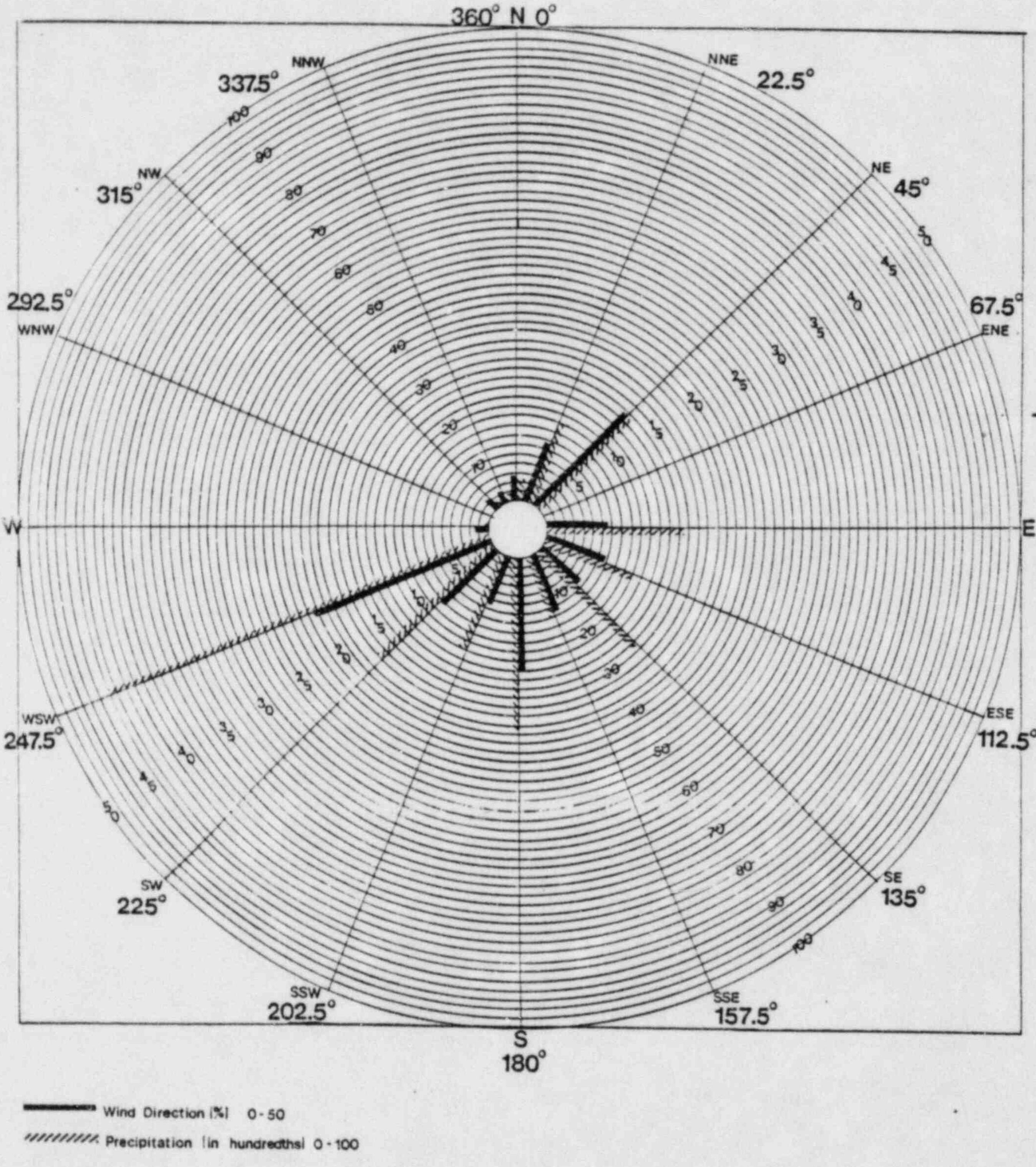


DAVIS-BESSE

PRECIPITATION WINDROSE

DECEMBER 1981

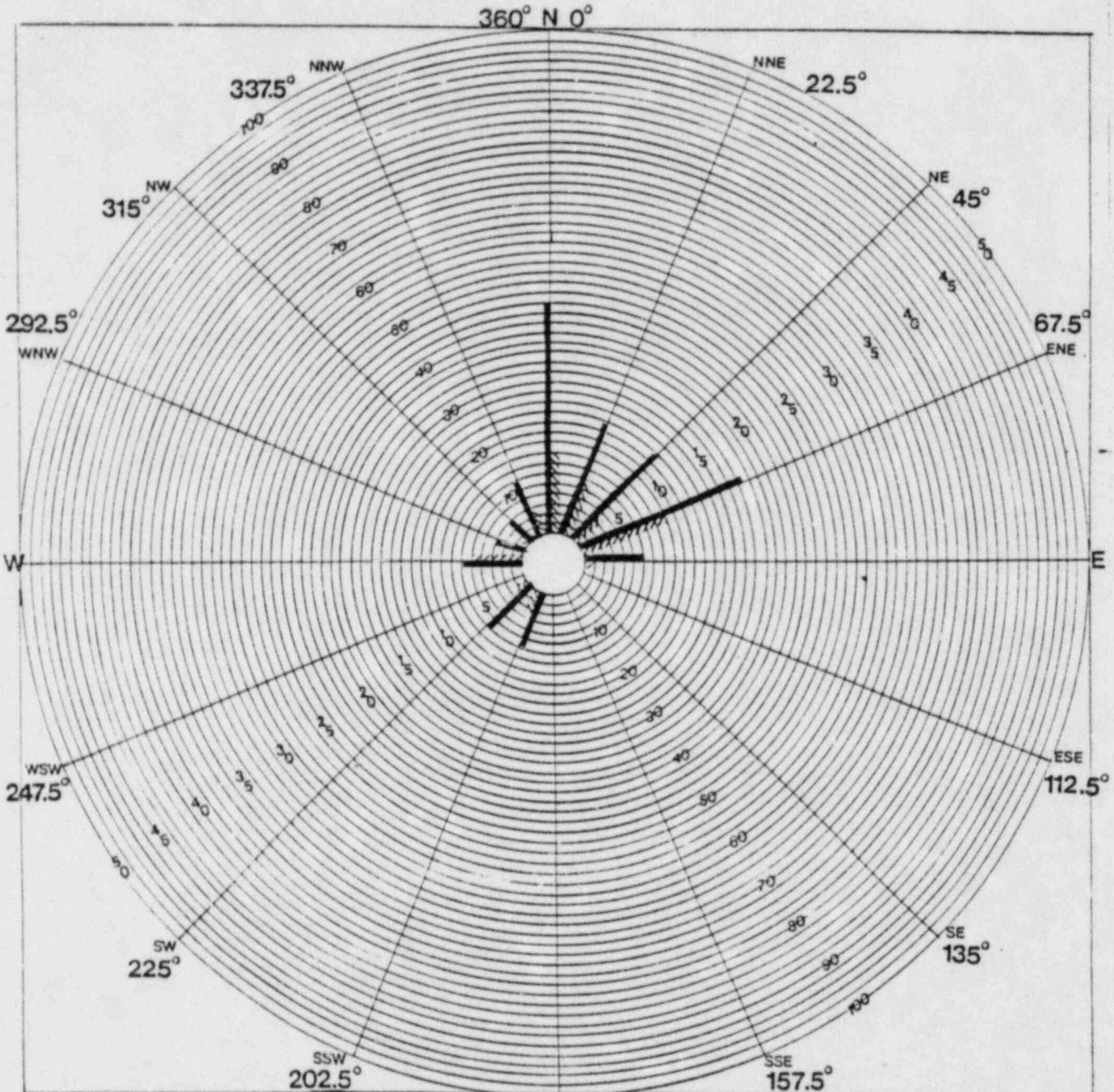
FIGURE 10



DAVIS-BESSE
PRECIPITATION WINDROSE

JANUARY 1982

FIGURE 11



Wind Direction (%) 0 - 50

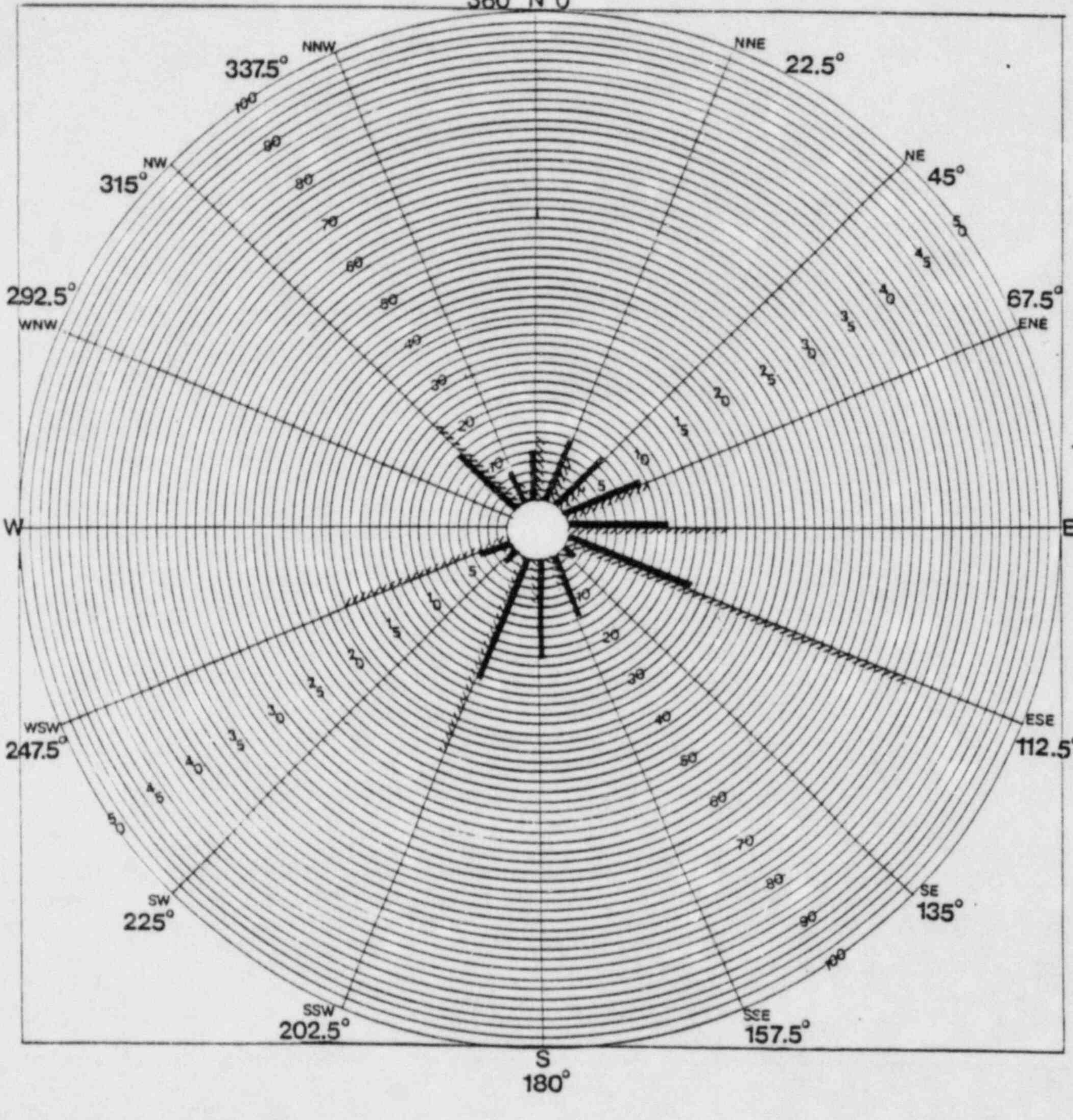
Precipitation (in hundredths) 0 - 100

DAVIS-BESSE

PRECIPITATION WINDROSE

FEBRUARY 1982

FIGURE 12



DAVIS-BESSE
PRECIPITATION WINDROSE

MARCH 1982

APPENDIX B

TABLES

TABLE 1

MONTH - APRIL, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
01	13	0.1	241	WSW	L-W
01	19	0.1	279	W	L-W
03	16	0.1	210	SSW	L-W
09	05	0.2	240	WSW	L-W
11	19	0.4	135	SE	L-L
11	24	0.2	202	SSW	L-W
13	16	0.1	124	ESE	L-L
13	18	0.1	67	ENE	W-L
14	03	0.3	197	SSW	L-W
14	05	0.2	200	ESE	L-W
22	11	0.2	102	ESE	W-L
22	19	0.1	140	SE	L-L
28	13	0.6	119	ESE	W-L
28	18	0.4	2	N	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 2

MONTH - MAY, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
05	21	0.1	312	NW	L-L
12	*	0.02	-	-	
14	*	0.48	-	-	
15	*	0.18	-	-	
16	*	0.01	-	-	
20	10	0.1	23	NNE	W-L
22	07	0.1	230	SW	L-W
22	08	0.3	240	WSW	L-W
24	21	0.01	247	WSW	L-W
25	07	0.01	201	SSW	L-W
27	04	0.01	191	SSW	L-W
27	05	0.02	268	W	L-W
27	06	0.03	300	WNW	L-L
27	07	0.01	311	NW	L-L
27	08	0.01	324	NW	L-L
27	09	0.02	351	N	W-L
27	10	0.04	352	N	W-L
27	11	0.03	353	N	W-L
27	18	0.01	315	NW	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 2

MONTH - MAY, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
28	01	0.04	286	WNW	L-W
28	02	0.04	286	WNW	L-W
28	03	0.05	290	WNW	L-W
28	*	0.02	-	-	-
30	05	0.02	198	SSW	L-W
30	06	0.01	156	SSE	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 3

MONTH - JUNE, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
03	20	0.01	229	SW	L-W
03	21	0.06	227	SW	L-W
05	08	0.10	190	S	L-W
05	15	0.01	232	SW	L-W
05	16	0.03	198	SSW	L-W
05	19	0.01	208	SSW	L-W
08	18	0.18	227	SW	L-W
08	19	0.01	179	S	L-W
08	20	0.03	202	SSW	L-W
08	21	0.24	195	SSW	L-W
08	22	0.12	215	SW	L-W
08	23	0.61	297	WNW	L-L
08	24	0.22	296	WNW	L-L
09	01	0.14	250	WSW	L-W
09	17	0.02	245	WSW	L-W
09	19	0.01	255	WSW	L-W
09	21	0.02	237	WSW	L-W
09	22	0.01	219	SW	L-W
09	23	0.02	214	SW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 3

MONTH - JUNE, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
13	08	0.06	111	ESE	W-L
13	09	0.08	32	NNE	W-L
13	10	0.13	56	ENE	W-L
13	11	0.14	66	ENE	W-L
13	12	0.10	114	ESE	L-L
13	13	0.22	153	SSE	L-L
13	14	0.09	157	SSE	L-L
13	15	0.03	166	SSE	L-W
13	16	0.08	182	S	L-W
13	17	0.01	195	SSW	L-W
13	18	0.01	183	S	L-W
13	23	0.01	201	SSW	L-W
14	07	0.01	218	SW	L-W
14	08	0.01	218	SW	L-W
14	09	0.04	217	SW	L-W
16	14	0.02	248	WSW	L-W
19	07	0.16	214	SW	L-W
20	24	0.01	146	SE	L-L
21	01	0.04	132	SE	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 3

MONTH - JUNE, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
22	01	0.01	205	SSW	L-W
22	02	0.03	200	SSW	L-W
22	03	0.36	214	SW	L-W
22	04	0.97	308	NW	L-L
22	05	0.01	198	SSW	L-W
24	07	0.15	161	SSE	L-W
25	*	0.61	-	-	
30	23	0.01	9	N	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 4

MONTH - JULY, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
01	07	0.03	6	N	W-L
04	15	0.01	330	NNW	L-L
04	21	0.01	186	S	L-W
09	17	0.42	272	W	L-W
09	18	0.01	117	ESE	L-L
09	19	0.06	340	NNW	W-L
09	20	0.21	322	NW	L-L
15	08	0.04	77	ENE	W-L
17	07	0.02	224	SW	L-W
19	15	0.01	205	SSW	L-W
19	16	0.01	177	S	L-W
20	04	0.03	200	SSW	L-W
20	05	0.01	194	SSW	L-W
20	06	0.01	209	SSW	L-W
20	07	0.12	202	SSW	L-W
20	09	0.06	206	SSW	L-W
20	11	0.03	198	SSW	L-W
20	12	0.04	219	SW	L-W
20	14	0.01	269	W	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 4

MONTH - JULY, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
20	16	0.33	296	WNW	L-L
20	17	0.02	292	WNW	L-W
21	01	0.13	211	SSW	L-W
21	16	0.38	25	ENE	W-L
21	17	0.01	114	ESE	L-L
21	18	0.36	45	NE	W-L
22	08	0.04	33	NNE	W-L
24	08	0.05	153	SSE	L-L
26	03	0.35	263	W	L-W
26	04	0.12	125	SE	L-L
26	05	0.01	54	NE	W-L
26	06	0.12	134	SE	L-L
26	07	0.01	204	SSW	L-W
27	08	0.33	57	ENE	W-L
28	03	0.40	126	SE	L-L
28	09	0.01	212	SSW	L-W
28	13	0.02	237	WSW	L-W
28	14	0.02	247	WSW	L-W
28	17	0.02	289	WNW	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 4

MONTH - JULY, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
29	08	0.20	348	NNW	W-L
31	08	0.37	109	ESE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 5

MONTH - AUGUST, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
03	07	0.04	174	S	L-W
03	09	0.07	258	WSW	L-W
03	10	0.02	334	NNW	L-L
03	13	0.02	143	SE	L-L
08	15	0.04	275	W	L-W
08	16	0.05	263	W	L-W
09	21	0.09	171	S	L-W
09	22	0.01	167	SSE	L-W
10	23	0.07	189	S	L-W
11	04	0.15	285	WNW	L-W
11	05	0.14	257	WSW	L-W
11	06	0.01	203	SSW	L-W
28	02	0.06	191	SSW	L-W
29	05	0.01	178	S	L-W
29	06	0.04	192	SSW	L-W
29	11	0.01	190	S	L-W
29	13	0.28	197	SSW	L-W
29	14	0.27	354	N	W-L
29	15	0.11	10	N	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 5

MONTH - AUGUST, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
29	16	0.04	152	SSE	L-L
29	17	0.11	30	NNE	W-L
29	18	0.01	146	SE	L-L
29	24	0.01	196	SSW	L-W
31	04	0.02	194	SSW	L-W
31	08	0.05	218	SW	L-W
31	09	0.07	219	SW	L-W
31	10	0.02	210	SSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 6

MONTH - SEPTEMBER, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
02	08	0.32	230	SW	L-W
02	14	0.12	44	SW	W-L
02	15	0.38	38	NE	W-L
02	16	0.01	45	NE	W-L
02	17	0.03	57	ENE	W-L
02	18	0.07	63	ENE	W-L
03	19	0.03	75	ENE	W-L
03	20	0.04	74	ENE	W-L
03	21	0.01	116	ESE	L-L
04	03	0.01	259	W	L-L
04	13	0.11	255	WSW	L-L
04	14	0.05	260	W	L-W
04	15	0.01	261	W	L-W
17	20	0.03	11	N	W-L
17	22	0.02	17	NNE	W-L
17	23	0.01	10	N	W-L
17	24	0.01	22	NNE	W-L
18	06	0.01	14	NNE	W-L
18	08	0.01	14	NNE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 6

MONTH - SEPTEMBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
18	09	0.07	17	NNE	W-L
18	10	0.03	26	NNE	W-L
18	11	0.01	14	NNE	W-L
18	12	0.01	14	NNE	W-L
18	13	0.12	9	N	W-L
18	14	0.20	21	NNE	W-L
18	15	0.01	21	NNE	W-L
18	16	0.01	25	NNE	W-L
19	03	0.01	229	SW	L-W
21	09	0.02	107	ESE	W-L
21	23	0.01	40	NE	W-L
21	24	0.11	36	NE	W-L
22	01	0.03	42	NE	W-L
22	03	0.01	28	NNE	W-L
23	07	0.02	1	N	W-L
25	07	0.02	200	SSW	L-W
26	19	0.05	209	SSW	L-W
27	01	0.01	237	WSW	L-W
27	02	0.13	243	WSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 6

MONTH - SEPTEMBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
27	03	0.03	236	SW	L-W
27	06	0.01	263	W	L-W
30	05	0.03	154	SSE	L-L
30	06	0.17	134	SE	L-L
30	07	0.15	118	ESE	L-L
30	08	0.12	124	SE	L-L
30	09	0.04	130	SE	L-L
30	10	0.01	119	ESE	L-L
30	14	0.07	118	ESE	L-L
30	15	0.13	111	ESE	W-L
30	17	0.01	80	E	W-L
30	22	0.01	54	NE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 7

MONTH - OCTOBER, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
01	09	0.03	236	SW	L-W
05	24	0.03	134	SE	L-L
06	01	0.29	155	SSE	L-L
06	02	0.03	168	SSE	L-W
06	06	0.01	209	SSW	L-W
06	23	0.02	297	WNW	L-L
18	01	0.19	193	SSW	L-W
18	02	0.08	192	SSW	L-W
18	03	0.09	206	SSW	L-W
18	04	0.18	204	SSW	L-W
18	05	0.20	232	SW	L-W
18	06	0.05	244	WSW	L-W
18	11	0.02	233	SW	L-W
18	14	0.03	242	WSW	L-W
18	15	0.04	239	WSW	L-W
18	16	0.05	254	WSW	L-W
18	18	0.02	280	W	L-W
18	19	0.01	258	WSW	L-W
19	07	0.01	280	W	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 7

MONTH - OCTOBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
19	09	0.03	287	WNW	L-W
21	08	0.03	51	NE	W-L
21	12	0.01	41	NE	W-L
22	06	0.01	40	NE	W-L
22	09	0.12	30	NNE	W-L
22	10	0.06	30	NNE	W-L
22	11	0.04	55	NE	W-L
22	12	0.06	56	NE	W-L
22	13	0.06	75	ENE	W-L
22	14	0.13	81	E	W-L
22	15	0.09	36	NE	W-L
22	16	0.06	68	ENE	W-L
22	17	0.07	8	N	W-L
22	18	0.05	333	NNW	L-L
22	19	0.05	338	NNW	W-L
22	20	0.02	345	NNW	W-L
22	21	0.01	334	NNW	W-L
23	09	0.01	233	SW	L-W
25	24	0.01	26	NNE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 7

MONTH - OCTOBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
26	01	0.03	30	NNE	W-L
26	02	0.03	58	ENE	W-L
26	03	0.01	61	ENE	W-L
26	04	0.03	58	ENE	W-L
26	05	0.02	88	E	W-L
26	21	0.01	58	ENE	W-L
26	22	0.02	69	ENE	W-L
27	02	0.01	68	ENE	W-L
27	03	0.01	55	NE	W-L
27	04	0.20	45	NE	W-L
27	05	0.14	36	NE	W-L
27	06	0.02	31	NNE	W-L
27	07	0.10	24	NNE	W-L
27	08	0.10	359	N	W-L
27	09	0.02	5	N	W-L
27	10	0.02	17	NNE	W-L
27	12	0.03	20	NNE	W-L
27	13	0.07	10	N	W-L
27	14	0.06	338	NNW	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 7

MONTH - OCTOBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
27	16	0.03	346	NNW	W-L
27	19	0.02	331	NNW	L-L
27	20	0.04	329	NNW	L-L
27	21	0.11	325	NW	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 8

MONTH - NOVEMBER, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
05	05	0.06	195	SSW	L-W
05	06	0.01	187	S	L-W
06	01	0.01	230	SW	L-W
06	02	0.03	229	SW	L-W
06	03	0.01	268	W	L-W
09	09	0.06	14	NNE	W-L
19	07	0.01	100	E	W-L
19	11	0.02	119	ESE	L-L
19	12	0.03	125	SE	L-L
19	13	0.03	101	E	W-L
19	14	0.01	103	ESE	W-L
19	20	0.13	75	ENE	W-L
19	21	0.02	79	E	W-L
19	22	0.09	67	[illegible]	W-L
19	23	0.09	80	E	W-L
19	24	0.26	91	E	W-L
20	01	0.04	94	E	W-L
20	02	0.02	169	S	L-W
20	06	0.04	213	SSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 8

MONTH - NOVEMBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
20	07	0.07	206	SSW	L-W
20	08	0.03	220	SW	L-W
20	10	0.01	236	SW	L-W
26	20	0.03	192	SSW	L-W
26	21	0.02	193	SSW	L-W
26	23	0.03	226	SW	L-W
26	24	0.02	241	WSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 9

MONTH - DECEMBER, 1981

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
01	18	0.01	183	S	L-W
01	19	0.06	227	SW	L-W
02	08	0.05	232	SW	L-W
04	03	0.02	121	ESE	L-L
04	04	0.01	113	ESE	L-L
04	06	0.03	103	ESE	W-L
04	07	0.02	94	E	W-L
04	08	0.06	90	E	W-L
04	11	0.02	25	NNE	W-L
04	12	0.02	20	NNE	W-L
04	13	0.03	16	NNE	W-L
04	15	0.01	5	N	W-L
04	21	0.01	352	N	W-L
07	18	0.01	250	WSW	L-W
07	19	0.01	206	SSW	L-W
07	20	0.02	227	SW	L-W
07	21	0.01	248	WSW	L-W
08	04	0.01	304	NW	L-L
19	01	0.01	24	NNE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 9

MONTH - DECEMBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
21	21	0.01	190	S	L-W
21	23	0.01	186	S	L-W
22	01	0.03	193	SSW	L-W
22	02	0.02	200	SSW	L-W
22	19	0.02	195	SSW	L-W
22	19	0.02	61	ENE	W-L
22	20	0.11	66	ENE	W-L
22	21	0.10	77	ENE	W-L
22	22	0.12	69	ENE	W-L
22	23	0.12	47	NE	W-L
22	24	0.19	32	NNE	W-L
23	01	0.12	22	NNE	W-L
23	02	0.05	18	NNE	W-L
23	03	0.02	344	N	W-L
23	01	0.01	321	NW	L-L
27	08	0.04	148	SSE	L-L
27	09	0.10	164	SSE	L-W
27	10	0.13	187	S	L-W
27	11	0.15	217	SW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 9

MONTH - DECEMBER, 1981

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
27	12	0.16	250	WSW	L-W
27	13	0.17	257	WSW	L-W
28	15	0.02	25	NNE	W-L
28	16	0.03	21	NNE	W-L
28	20	0.01	331	NNE	L-L
31	17	0.02	169	S	L-W
31	18	0.01	165	SSE	L-W
31	23	0.01	204	SSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 10

MONTH - JANUARY, 1982

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
03	01	0.06	141	SE	L-L
03	02	0.01	155	SSE	L-L
03	03	0.03	182	S	L-W
03	23	0.04	81	E	W-L
03	24	0.13	89	E	W-L
04	01	0.09	92	E	W-L
04	02	0.02	89	E	W-L
04	06	0.01	161	SSE	L-W
04	08	0.08	206	SSW	L-W
04	09	0.01	229	SW	L-W
04	11	0.01	228	SW	L-W
06	16	0.01	18	NNE	W-L
06	17	0.07	15	NNE	W-L
06	18	0.05	38	NE	W-L
06	19	0.01	37	NE	W-L
06	20	0.05	15	NNE	W-L
06	22	0.01	349	N	W-L
12	24	0.01	142	SE	L-L
13	07	0.01	129	SE	L-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 10

MONTH - JANUARY, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
13	08	0.01	112	ESE	L-L
13	09	0.01	106	ESE	W-L
13	10	0.01	120	ESE	L-L
13	12	0.01	338	NNW	W-L
22	22	0.01	94	E	W-L
22	23	0.07	104	ESE	W-L
22	24	0.10	116	ESE	L-L
23	01	0.21	141	SE	L-L
23	02	0.07	158	SSE	L-W
23	03	0.05	173	S	L-W
23	04	0.05	191	S	L-W
23	11	0.08	237	WSW	L-W
23	12	0.22	239	WSW	L-W
23	13	0.05	243	WSW	L-W
23	14	0.03	242	WSW	L-W
23	15	0.04	242	WSW	L-W
23	16	0.09	240	WSW	L-W
23	17	0.03	244	WSW	L-W
23	18	0.09	245	WSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 10

MONTH - JANUARY, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
23	19	0.09	247	WSW	L-W
23	20	0.02	256	WSW	L-W
23	23	0.02	256	WSW	L-W
23	24	0.05	252	WSW	L-W
24	01	0.04	256	WSW	L-W
24	02	0.01	254	WSW	L-W
25	10	0.02	191	S	L-W
25	11	0.01	174	S	L-W
25	13	0.01	53	NE	W-L
27	09	0.03	172	S	L-W
29	08	0.03	197	SSW	L-W
29	24	0.02	163	SSE	L-W
30	01	0.01	168	SSE	L-W
30	02	0.02	182	S	L-W
30	03	0.06	235	SW	L-W
30	04	0.05	221	SW	L-W
30	05	0.08	194	SSW	L-W
30	06	0.09	190	S	L-W
30	07	0.10	173	S	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 10

MONTH - JANUARY, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
30	08	0.18	227	SW	L-W
30	09	0.04	32	NNE	W-L
30	10	0.03	18	NNE	W-L
30	11	0.03	229	SW	L-W
30	12	0.03	207	SSW	L-W
30	13	0.02	237	WSW	L-W
30	17	0.01	266	W	L-W
30	20	0.01	316	NW	L-L
31	10	0.01	53	NE	W-L
31	12	0.01	47	NE	W-L
31	13	0.02	49	NE	W-L
31	14	0.01	49	NE	W-L
31	15	0.01	53	NE	W-L
31	16	0.01	55	NE	W-L
31	19	0.13	43	NE	W_L
31	20	0.04	359	N	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 11

MONTH - FEBRUARY, 1982

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
01	09	0.09	261	W	L-W
03	08	0.01	29	NNE	W-L
03	09	0.01	40	NE	W-L
03	10	0.01	42	NE	W-L
03	12	0.04	10	N	W-L
03	13	0.03	11	N	W-L
03	14	0.01	9	N	W-L
03	15	0.01	73	ENE	W-L
03	16	0.01	350	N	W-L
03	19	0.01	355	N	W-L
05	07	0.05	29	NNE	W-L
05	17	0.01	86	E	W-L
05	18	0.09	60	ENE	W-L
05	19	0.03	36	NE	W-L
05	20	0.01	318	NW	L-L
08	24	0.02	16	NNE	W-L
09	01	0.03	18	NNE	W-L
09	02	0.03	8	N	W-L
09	03	0.02	1	N	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 11

MONTH - FEBRUARY, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
09	04	0.03	335	NNW	L-L
09	05	0.01	349	N	W-L
09	06	0.02	348	NNW	W-L
17	12	0.02	62	ENE	W-L
18	11	0.01	98	E	W-L
18	19	0.03	292	SSW	L-W
18	20	0.02	210	SSW	L-W
18	21	0.01	229	SW	L-W
18	22	0.02	235	SW	L-W
19	05	0.01	281	W	L-W
21	12	0.01	302	WNW	L-L
24	02	0.02	63	ENE	W-L
24	03	0.02	55	NE	W-L
24	04	0.02	61	ENE	W-L
24	05	0.02	64	ENE	W-L

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 12

MONTH - MARCH, 1982

HOURLY RECORDS

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
02	07	0.04	306	NW	L-L
02	08	0.12	320	NW	L-L
02	09	0.07	222	SSW	L-W
02	10	0.03	168	SSE	L-W
02	11	0.03	27	NNE	W-L
02	12	0.03	15	NNW	W-L
02	16	0.01	35	NE	W-L
02	17	0.01	37	NE	W-L
04	06	0.02	84	E	W-L
04	07	0.06	81	E	W-L
04	08	0.04	84	E	W-L
04	09	0.04	94	E	W-L
04	10	0.15	95	E	W-L
04	11	0.13	104	ESE	W-L
04	12	0.08	107	ESE	W-L
04	13	0.10	115	ESE	L-L
04	14	0.02	159	SSE	L-W
04	15	0.02	195	SSW	L-W
04	16	0.03	196	SSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 12

MONTH - MARCH, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
08	22	0.01	162	SSE	L-W
08	24	0.01	172	S	L-W
09	02	0.01	208	SSW	L-W
11	09	0.10	192	SSW	L-W
11	10	0.04	185	S	L-W
11	11	0.01	180	S	L-W
11	13	0.02	201	SSW	L-W
12	20	0.08	112	ESE	W-L
12	21	0.02	110	ESE	W-L
13	02	0.01	186	S	L-W
13	04	0.18	196	SSW	L-W
13	05	0.02	215	SW	L-W
16	08	0.13	113	ESE	L-L
16	09	0.11	123	ESE	L-L
16	10	0.10	118	ESE	L-L
16	12	0.02	139	SE	L-L
16	18	0.01	157	SSE	L-L
19	23	0.01	56	NE	W-L
19	24	0.03	61	ENE	W-L

* <u>Only</u> the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 12

MONTH - MARCH, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
20	01	0.07	68	ENE	W-L
20	02	0.01	72	ENE	W-L
20	03	0.05	69	ENE	W-L
20	04	0.04	48	NE	W-L
20	05	0.02	58	ENE	W-L
20	08	0.01	79	E	W-L
25	10	0.01	350	N	W-L
25	11	0.01	17	NNE	W-L
25	12	0.03	13	NNE	W-L
25	13	0.05	11	N	W-L
25	14	0.07	7	N	W-L
25	15	0.03	338	NNW	W-L
25	16	0.05	321	NW	L-L
25	17	0.01	330	NNW	L-L
25	18	0.02	319	NW	L-L
25	19	0.01	310	NW	L-L
30	20	0.01	189	S	L-W
30	21	0.01	195	SSW	L-W
30	22	0.20	242	WSW	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 12

MONTH - MARCH, 1982

HOURLY RECORDS

(CONTINUED)

DAY	HOUR	INCHES THAT FELL IN HOUR	10 M WIND DIRECTION (IN DEGREES)	GENERAL WIND DIRECTION	WATER, LAND** RELATIONSHIP
30	23	0.16	237	WSW	L-W
31	08	0.01	188	S	L-W

* Only the total daily data are known for these days unless some specific hours have been documented.

**Indicates if wind was blowing from land to water (L-W), water to land (W-L), or land to land (L-L).

TABLE 13

TOTAL DAILY DATA (USING AVAILABLE DATA)
APRIL, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0.2	2	-	0.2
02	0	0	-	0
03	0.1	1	-	0.1
04	0	0	-	0
05	0	0	-	0
06	0	0	-	0
07	0	0	-	0
08	0	0	-	0
09	0.2	1	-	0.2
10	0	0	-	0
11	0.6	2	-	0.6
12	0	0	-	0
13	0.2	2	-	0.2
14	0.5	2	-	0.5
15	0	0	-	0
16	-	-	0.5	0.5
17	No Data			
18	No Data			
19	No Data			
20	No Data			

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 13

TOTAL DAILY DATA (USING AVAILABLE DATA)
APRIL, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	-	0
22	0.3	2	-	0.3
23	0	0	-	0
24	0	0	-	0
25	0	0	-	0
26	0	0	-	0
27	0	0	-	0
28	1.0	2	-	1.0
29	0	0	-	0
30	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 14

TOTAL DAILY DATA (USING AVAILABLE DATA)
MAY, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	-	0
02	0	0	-	0
03	0	0	-	0
04	0	0	-	0
05	0.1	1	-	0.1
06	0	0	-	0
07	No Data	-		
08	0	0	-	0
09	No Data	-		
10	No Data	-		
11	No Data	-		
12	-	-	0.02	0.02
13	0	0	-	0
14	-	-	0.48	0.48
15	-	-	0.18	0.18
16	-	-	0.01	0.01
17	0	0	-	0
18	0	0	-	0
19	0	0	-	0
20	0.1	1	-	0.1

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 14

TOTAL DAILY DATA (USING AVAILABLE DATA)
MAY, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	-	0
22	0.4	2	-	0.4
23	0	0	-	0
24	0.01	1	-	0.01
25	0.03	2	-	0.03
26	0	0	-	0
27	0.18	9	-	0.18
28	0.13	3	0.02	0.15
29	0	0	-	0
30	0.03	2	-	0.03
31	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 15

TOTAL DAILY DATA (USING AVAILABLE DATA)
JUNE, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	-	0
02	0	0	-	0
03	0.07	2	-	0.07
04	0	0	-	0
05	0.15	3	-	0.15
06	0	0	-	0
07	0	0	-	0
08	1.41	7	-	1.41
09	0	0	-	0
10	0	0	-	0
11	0	0	-	0
12	0	0	-	0
13	0.96	12	-	0.96
14	0.06	3	-	0.06
15	0	0	-	0
16	0.02	1	-	0.02
17	0	0	-	0
18	0	0	-	0
19	0.16	1	-	0.16
20	0.01	1	-	0.01
21	0.04	1	-	0.04

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 15

TOTAL DAILY DATA (USING AVAILABLE DATA)
JUNE, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
22	1.38	5	-	1.38
23	0	0	-	0
24	0.15	1	-	0.15
25	-	-	0.61	0.61
26	0	0	-	0
27	0	0	-	0
28	0	0	-	0
29	0	0	-	0
30	0.01	1	-	0.01

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 16

TOTAL DAILY DATA (USING AVAILABLE DATA)
JULY, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0.03	1	-	0.03
02	0	0	-	0
03	0	0	-	0
04	0.02	2	-	0.02
05	0	0	-	0
06	0	0	-	0
07	0	0	-	0
08	0	0	-	0
09	0.70	4	-	0.70
10	No Data	-		
11	No Data	-		
12	No Data	-		
13	0	0	-	0
14	0	0	-	0
15	0.04	1	-	0.04
16	0	0	-	0
17	0.02	1	-	0.02
18	0	0	-	0
19	0.02	2	-	0.02
20	0.66	10	-	0.66

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 16

TOTAL DAILY DATA (USING AVAILABLE DATA)
JULY, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0.88	4	-	0.88
22	0.04	1	-	0.04
23	0	0	-	0
24	0.05	1	-	0.05
25	0	0	-	0
26	0.61	4	-	0.61
27	0.31	1	-	0.31
28	0.47	4	-	0.47
29	0.20	1	-	0.20
30	0	0	-	0
31	0.37	1	-	0.37

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 17

TOTAL DAILY DATA (USING AVAILABLE DATA)
AUGUST, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	-	0
02	0	0	-	0
03	0.15	4	-	0.15
04	0	0	-	0
05	0	0	-	0
06	0	0	-	0
07	0	0	-	0
08	0.09	2	-	0.09
09	0.10	2	-	0.10
10	0.07	1	-	0.07
11	0.30	3	-	0.30
12	0	0	-	0
13	0	0	-	0
14	0	0	-	0
15	0	0	-	0
16	0	0	-	0
17	0	0	-	0
18	0	0	-	0
19	0	0	-	0
20	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 17

TOTAL DAILY DATA (USING AVAILABLE DATA)
AUGUST, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	-	0
22	0	0	-	0
23	0	0	-	0
24	0	0	-	0
25	0	0	-	0
26	0	0	-	0
27	0	0	-	0
28	0.06	1	-	0.06
29	0.89	10	-	0.89
30	0	0	-	0
31	0.16	4	-	0.16

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 18

TOTAL DAILY DATA (USING AVAILABLE DATA)
SEPTEMBER, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	-	-	0.43	0.43
02	0.93	5	0.07	1.00
03	0.08	3	-	0.08
04	0.18	4	-	0.18
05	-	-	0.02	0.02
06	No Data			
07	No Data			
08	0	0	-	0
09	0	0	-	0
10	0	0	-	0
11	0	0	-	0
12	0	0	-	0
13	0	0	-	0
14	0	0	-	0
15	0	0	-	0
16	0	0	-	0
17	0.07	4	-	0.07
18	0.53	10	-	0.53
19	0.01	1	-	0.01
20	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 18

TOTAL DAILY DATA (USING AVAILABLE DATA)
SEPTEMBER, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0.14	3	-	0.14
22	0.04	2	-	0.04
23	0.02	1	-	0.02
24	0	0	-	0
25	0.02	1	-	0.02
26	0.05	1	-	0.05
27	0.18	4	-	0.18
28	0	0	-	0
29	0	0	-	0
30	0.74	10	-	0.74

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 19

TOTAL DAILY DATA (USING AVAILABLE DATA)
OCTOBER, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0.03	1	-	0.03
02	0	0	-	0
03	0	0	-	0
04	0	0	-	0
05	0.03	1	-	0.03
06	0.35	4	-	0.35
07	0	0	-	0
08	0	0	-	0
09	0	0	-	0
10	0	0	-	0
11	0	0	-	0
12	0	0	-	0
13	0	0	-	0
14	0	0	-	0
15	0	00	-	0
16	0	0	-	0
17	0	0	-	0
18	0.96	12	-	0.96
19	0.04	2	-	0.04
20	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 19

TOTAL DAILY DATA (USING AVAILABLE DATA)
OCTOBER, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0.04	2	-	0.04
22	0.83	14	-	0.83
23	0.01	1	-	0.01
24	0	0	-	0
25	0.01	1	-	0.01
26	0.15	7	-	0.15
27	0.98	16	-	0.98
28	0	0	-	0
29	0	0	-	0
30	0	0	-	0
31	0	0	-	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 20

TOTAL DAILY DATA (USING AVAILABLE DATA)
NOVEMBER, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	-	0
02	0	0	-	0
03	0	0	-	0
04	0	0	-	0
05	0.07	2	-	0.07
06	0.05	3	-	0.05
07	0	0	-	0
08	0	0	-	0
09	0.06	1	-	0.06
10	0	0	-	0
11	0	0	-	0
12	0	0	-	0
13	0	0	-	0
14	0	0	-	0
15	0	0	-	0
16	0	0	-	0
17	0	0	-	0
18	0	0	-	0
19	0.69	10	-	0.69
20	0.21	6	-	0.21

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 20

TOTAL DAILY DATA (USING AVAILABLE DATA)
NOVEMBER, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0.10	4	0	0.10
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 21

TOTAL DAILY DATA (USING AVAILABLE DATA)
DECEMBER, 1981

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0.07	2	0	0.07
02	0.05	1	0	0.05
03	0	0	0	0
04	0.23	10	0	0.23
05	0	0	0	0
06	0	0	0	0
07	0.05	4	0	0.05
08	0.01	1	0	0.01
09	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	No Data			
18	0.01	1	0	0.01
19	0	0	0	0
20	0	0	0	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 21

TOTAL DAILY DATA (USING AVAILABLE DATA)
DECEMBER, 1981

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0.02	2	0	0.02
22	0.73	9	0	0.73
23	0.20	4	0	0.20
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0.75	6	0	0.75
28	0.06	3	0	0.06
29	0	0	0	0
30	0	0	0	0
31	0.04	3	0	0.04

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 22

TOTAL DAILY DATA (USING AVAILABLE DATA)
JANUARY, 1982

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	0	0
02	0	0	0	0
03	0.28	5	0	0.28
04	0.22	6	0	0.22
05	0.02	1	0	0.02
06	0.20	5	0	0.20
07	0	0	0	0
08	0	0	0	0
09	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0.01	1	0	0.01
13	0.05	5	0	0.05
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 22

TOTAL DAILY DATA (USING AVAILABLE DATA)
JANUARY, 1982

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	0	0
22	0.18	3	0	0.18
23	1.19	16	0	1.19
24	0.05	2	0	0.05
25	0.04	3	0	0.04
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0.05	2	9	0.05
30	0.76	15	0	0.76
31	0.24	8	0	0.24

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 23

TOTAL DAILY DATA (USING AVAILABLE DATA)
FEBRUARY, 1982

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0.09	1	0	0.09
02	0	0	0	0
03	0.14	9	0	0.14
04	0	0	0	0
05	0.19	5	0	0.19
06	0	0	0	0
07	0	0	0	0
08	0.02	2	0	0.02
09	0.14	6	0	0.14
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0.02	1	0	0.021
18	0.09	5	0	0.09
19	0.01	1	0	0.01
20	0	0	0	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 23

TOTAL DAILY DATA (USING AVAILABLE DATA)
FEBRUARY, 1982

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0.01	1	0	0.01
22	0	0	0	0
23	0	0	0	0
24	0.08	4	0	0.08
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 24

TOTAL DAILY DATA (USING AVAILABLE DATA)
MARCH, 1982

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
01	0	0	0	0
02	0.34	8	0	0.34
03	0	0	0	0
04	0.69	11	0	0.69
05	0	0	0	0
06	0	0	0	0
07	0	0	0	0
08	0.02	2	0	0.02
09	0.01	1	0	0.01
10	0	0	0	0
11	0.17	4	0	0.17
12	0.10	2	9	0.10
13	0.21	3	0	0.21
14	0	0	0	0
15	0	0	0	0
16	0.37	5	0	0.37
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0.23	6	0	0.23

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 24

TOTAL DAILY DATA (USING AVAILABLE DATA)
MARCH, 1982

(CONTINUED)

DAY	INCHES OF TOTAL PRECIPITATION USING KNOWN HOURS	NUMBER OF HOURS OF PRECIPITATION	PRECIPITATION OF UNKNOWN HOURS*	TOTAL INCHES OF PRECIPITATION
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0.30	10	0	0.30
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0.38	4	0	0.38
31	0.01	1	0	0.01

*Data were obtained from a source outside the Davis-Besse meteorological monitoring system. The number of hours of rainfall is also unknown.

TABLE 25

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: APRIL, 1981

TOTAL RAINFALL: 3.1 INCHES
TOTAL HOURS OF PRECIPITATION: 14
COMPUTER AVAILABILITY: 78%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.40	1	12.90	0.40	7.1
NNE	0.00	0	0.00	0.00	0.0
NE	0.00	0	0.00	0.00	0.0
ENE	0.10	1	3.03	0.10	7.1
E	0.00	0	0.00	0.00	0.0
ESE	0.90	3	29.03	0.30	21.4
SE	0.50	2	16.13	0.25	14.3
SSE	0.00	0	0.00	0.00	0.0
S	0.00	0	0.00	0.00	0.0
SSW	0.80	4	25.80	0.20	28.6
SW	0.00	0	0.00	0.00	0.0
WSW	0.30	2	3.03	0.15	14.3
W	0.10	1	3.03	0.10	7.1
WNW	0.00	0	0.00	0.00	0.0
NW	0.00	0	0.00	0.00	0.0
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 26

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: MAY, 1981

TOTAL RAINFALL: 0.98 INCHES
TOTAL HOURS OF PRECIPITATION: 21
COMPUTER AVAILABILITY: 80%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.09	3	9.20	0.03	14.3
NNE	0.10	1	10.2	0.10	4.8
NE	0.00	0	0.00	0.00	0.0
ENE	0.00	0	0.00	0.00	0.0
E	0.00	0	0.00	0.00	0.0
ESE	0.00	0	0.00	0.00	0.0
SE	0.00	0	0.00	0.00	0.0
SSE	0.01	1	1.02	0.01	4.8
S	0.00	0	0.00	0.00	0.0
SSW	0.04	3	4.08	0.01	14.3
SW	0.12	2	12.24	0.06	9.5
WSW	0.31	2	31.63	0.16	9.5
W	0.02	1	2.04	0.02	4.8
WNW	0.16	4	16.33	0.04	19.0
NW	0.13	4	13.27	0.03	19.0
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 27

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: JUNE, 1981

TOTAL RAINFALL: 4.64 INCHES
TOTAL HOURS OF PRECIPITATION: 45
COMPUTER AVAILABILITY: 96.9%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.01	1	0.22	0.01	2.2
NNE	0.08	1	1.72	0.08	2.2
NE	0.00	0	0.00	0.00	0.0
ENE	0.27	2	5.82	0.13	4.4
E	0.00	0	0.00	0.00	0.0
ESE	0.16	2	3.45	0.08	4.4
SE	0.05	2	1.08	0.02	4.4
SSE	0.49	4	10.56	0.12	8.9
S	0.20	4	10.56	0.12	8.9
SSW	0.38	9	8.20	0.04	20.0
SW	0.99	12	21.34	0.08	26.6
WSW	0.21	5	4.53	0.04	11.1
W	0.00	0	0.00	0.00	0.0
WNW	0.83	2	17.90	0.41	4.4
NW	0.97	1	20.91	0.97	2.2
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 28

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: JULY, 1981

TOTAL RAINFALL: 4.44 INCHES
TOTAL HOURS OF PRECIPITATION: 40
COMPUTER AVAILABILITY: 96.9%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.03	1	0.68	0.03	2.5
NNE	0.42	2	9.46	0.21	5.0
NE	0.37	2	8.33	0.18	5.0
ENE	0.37	2	8.33	0.18	5.0
E	0.00	0	0.00	0.00	0.0
ESE	0.39	3	8.78	0.13	7.5
SE	0.64	3	14.40	0.21	7.5
SSE	0.05	1	1.13	0.05	2.5
S	0.02	2	0.45	0.01	5.0
SSW	0.42	10	9.46	0.04	25.0
SW	0.06	2	1.35	0.03	5.0
WSW	0.04	2	0.90	0.02	5.0
W	0.78	3	17.60	0.26	7.5
WNW	0.37	3	8.33	0.12	7.5
NW	0.21	1	4.73	0.21	2.5
NNW	0.27	3	6.10	0.09	7.5

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 29

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: AUGUST, 1981

TOTAL RAINFALL: 1.82 INCHES
TOTAL HOURS OF PRECIPITATION: 27
COMPUTER AVAILABILITY: 98%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.38	2	20.88	0.19	7.4
NNE	0.11	1	6.04	0.11	3.7
NE	0.00	0	0.00	0.00	0.0
ENE	0.00	0	0.00	0.00	0.0
E	0.00	0	0.00	0.00	0.0
ESE	0.00	0	0.00	0.00	0.0
SE	0.03	2	1.65	0.01	7.4
SSE	0.05	2	2.77	0.02	7.4
S	0.22	5	12.09	0.04	18.5
SSW	0.44	7	24.18	0.06	26.0
SW	0.12	2	6.59	0.06	7.4
WSW	0.21	2	11.54	0.11	7.4
W	0.09	2	4.94	0.04	7.4
WNW	0.15	1	8.24	0.15	3.7
NW	0.00	0	0.00	0.00	0.0
NNW	0.02	1	1.10	0.02	3.7

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 30

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: SEPTEMBER, 1981

TOTAL RAINFALL: 2.99 INCHES
TOTAL HOURS OF PRECIPITATION: 50
COMPUTER AVAILABILITY: 76%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.18	4	6.02	0.04	8.0
NNE	0.45	12	15.05	0.04	24.0
NE	0.67	7	22.41	0.10	14.0
ENE	0.17	4	5.69	0.04	8.0
E	0.01	1	0.33	0.01	2.0
ESE	0.39	6	13.04	0.06	12.0
SE	0.33	3	11.04	0.11	6.0
SSE	0.03	1	1.00	0.03	2.0
S	0.00	0	0.00	0.00	0.0
SSW	0.07	2	2.34	0.03	4.0
SW	0.36	3	12.04	0.12	6.0
WSW	0.25	3	8.36	0.08	6.0
W	0.08	4	2.68	0.02	8.0
WNW	0.00	0	0.00	0.00	0.0
NW	0.00	0	0.00	0.00	0.0
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 31

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: OCTOBER, 1981

TOTAL RAINFALL: 3.43 INCHES
TOTAL HOURS OF PRECIPITATION: 61
COMPUTER AVAILABILITY: 100%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.26	4	7.58	0.07	6.6
NNE	0.39	8	11.37	0.10	13.1
NE	0.59	9	17.20	0.07	14.7
ENE	0.23	8	6.71	0.03	13.1
E	0.15	2	4.37	0.07	3.3
ESE	0.00	0	0.00	0.00	0.0
SE	0.03	1	0.87	0.03	1.6
SSE	0.32	2	9.34	0.16	3.3
S	0.00	0	0.00	0.00	0.0
SSW	0.55	5	16.03	0.11	8.2
SW	0.26	4	7.58	0.07	6.6
WSW	0.18	5	5.25	0.04	8.2
W	0.03	2	0.87	0.01	3.3
WNW	0.05	2	1.46	0.03	3.3
NW	0.11	1	3.21	0.11	1.6
NNW	0.28	8	8.16	0.03	13.1

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 32

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: NOVEMBER, 1981

TOTAL RAINFALL: 1.18 INCHES
TOTAL HOURS OF PRECIPITATION: 26
COMPUTER AVAILABILITY: 99%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.00	0	0.00	0.00	0.0
NNE	0.06	1	5.10	0.06	3.8
NE	0.00	0	0.00	0.00	0.0
ENE	0.22	2	18.60	0.11	7.7
E	0.45	6	38.10	0.07	23.1
ESE	0.03	2	2.50	0.01	7.7
SE	0.03	1	2.50	0.03	3.8
SSE	0.00	0	0.00	0.00	0.0
S	0.03	2	2.50	0.01	7.7
SSW	0.22	5	18.60	0.04	19.2
SW	0.11	5	9.30	0.02	19.2
WSW	0.02	1	1.70	0.02	3.8
W	0.01	1	0.80	0.01	3.8
WNW	0.00	0	0.00	0.00	0.0
NW	0.00	0	0.00	0.00	0.0
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 33

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: DECEMBER, 1981

TOTAL RAINFALL: 2.22 INCHES
TOTAL HOURS OF PRECIPITATION: 46
COMPUTER AVAILABILITY: 78%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.04	3	1.80	0.01	6.5
NNE	0.50	10	22.50	0.05	21.7
NE	0.12	1	5.40	0.12	2.2
ENE	0.35	4	15.80	0.09	8.7
E	0.08	2	3.60	0.04	4.3
ESE	0.06	3	2.70	0.02	6.5
SE	0.00	0	0.00	0.00	0.0
SSE	0.15	3	6.80	0.05	6.5
S	0.18	5	8.10	0.04	10.9
SSW	0.09	5	4.10	0.02	10.9
SW	0.28	4	12.60	0.07	8.7
WSW	0.35	4	15.80	0.09	8.7
W	0.00	0	0.00	0.00	0.0
WNW	0.00	0	0.00	0.00	0.0
NW	0.02	2	0.90	0.01	4.3
NNW	0.00	0	0.00	0.00	0.0

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 34

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: JANUARY, 1982

TOTAL RAINFALL: 3.29 INCHES
TOTAL HOURS OF PRECIPITATION: 73
COMPUTER AVAILABILITY: 93%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.05	2	1.50	0.02	2.7
NNE	0.20	5	6.10	0.04	6.8
NE	0.27	10	8.20	0.03	13.7
ENE	0.00	0	0.00	0.00	0.0
E	0.29	5	8.80	0.06	6.8
ESE	0.20	5	6.10	0.04	6.8
SE	0.29	4	8.80	0.07	5.5
SSE	0.12	5	3.60	0.02	6.8
S	0.40	9	12.10	0.04	12.3
SSW	0.22	4	6.70	0.05	5.5
SW	0.34	6	10.30	0.06	8.2
WSW	0.88	15	26.70	0.06	20.5
W	0.01	1	0.30	0.01	1.4
WNW	0.00	0	0.00	0.00	0.0
NW	0.01	1	0.30	0.01	1.4
NNW	0.01	1	0.30	0.01	1.4

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of <u>total monthly hours</u> of rainfall that fell from each direction.

TABLE 35

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: FEBRUARY, 1982

TOTAL RAINFALL: 0.79 INCHES
TOTAL HOURS OF PRECIPITATION: 34
COMPUTER AVAILABILITY: 100%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.16	8	20.20	0.02	23.5
NNE	0.11	5	14.00	0.03	11.7
NE	0.07	4	8.80	0.02	11.7
ENE	0.18	6	22.80	0.03	17.6
E	0.02	2	2.50	0.01	5.9
ESE	0.00	0	0.00	0.00	0.0
SE	0.00	0	0.00	0.00	0.0
SSE	0.00	0	0.00	0.00	0.0
S	0.00	0	0.00	0.00	0.0
SSW	0.05	2	6.30	0.02	5.9
SW	0.03	2	3.80	0.01	5.9
WSW	0.00	0	0.00	0.00	0.0
W	0.10	2	12.60	0.05	5.9
WNW	0.01	1	1.30	0.01	3.0
NW	0.01	1	1.30	0.01	3.0
NNW	0.05	2	6.30	0.02	5.9

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 36

MONTHLY DIRECTIONAL PRECIPITATION ANALYSIS

MONTH: MARCH, 1982

TOTAL RAINFALL: 2.83 INCHES
TOTAL HOURS OF PRECIPITATION: 59
COMPUTER AVAILABILITY: 100%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.13	3	4.59	0.04	5.1
NNE	0.10	4	3.53	0.02	6.8
NE	0.07	4	2.47	0.02	6.8
ENE	0.18	5	6.36	0.04	8.5
E	0.32	6	11.31	0.05	10.2
ESE	0.75	8	26.50	0.09	13.6
SE	0.02	1	0.71	0.02	1.7
SSE	0.07	4	2.47	0.02	6.8
S	0.09	6	3.18	0.01	10.2
SSW	0.44	8	15.55	0.05	13.6
SW	0.02	1	0.71	0.02	1.7
WSW	0.36	2	12.72	0.18	3.4
W	0.00	0	0.00	0.00	0.0
WNW	0.00	0	0.00	0.00	0.0
NW	0.24	5	8.72	0.05	8.5
NNW	0.04	2	1.41	0.02	3.4

*Percentage of the total monthly rainfall that fell from each direction.
**Percentage of total monthly hours of rainfall that fell from each direction.

TABLE 37

SUMMER DIRECTIONAL PRECIPTATION ANALYSIS

SEASON: SUMMER, 1981

TOTAL RAINFALL: 10.90 INCHES
TOTAL HOURS OF PRECIPITATION: 112
COMPUTER AVAILABILITY: 97.3%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.42	4	3.90	0.11	3.9
NNE	0.61	4	5.60	0.15	3.9
NE	0.37	2	3.40	0.18	2.0
ENE	0.64	4	5.90	0.16	3.9
E	0.00	0	0.00	0.00	0.0
ESE	0.55	5	5.00	0.11	4.5
SE	0.72	7	6.60	0.10	6.2
SSE	0.59	7	5.40	0.08	6.2
S	0.44	11	4.00	0.04	9.8
SSW	1.24	26	11.40	0.05	23.2
SW	1.17	16	10.70	0.07	14.3
WSW	0.46	9	4.20	0.05	8.0
W	0.87	5	8.00	0.17	4.5
WNW	1.35	6	12.40	0.17	5.4
NW	1.18	2	10.80	0.59	1.8
NNW	0.29	4	2.70	0.07	3.9

*Percentage of the total seasonal rainfall that fell from each direction.
**Percentage of total seasonal hours of rainfall that fell from each direction.

TABLE 38

FALL DIRECTIONAL PRECIPTATION ANALYSIS

SEASON: FALL, 1981

TOTAL RAINFALL: 7.60 INCHES
TOTAL HOURS OF PRECIPITATION: 137
% COMPUTER AVAILABILITY: 92%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.44	8	5.80	0.05	5.8
NNE	0.90	21	11.80	0.04	15.3
NE	1.26	16	16.60	0.08	11.7
ENE	0.62	14	8.20	0.04	10.2
E	0.61	9	8.00	0.08	6.6
ESE	0.42	8	5.50	0.05	5.8
SE	0.39	5	5.10	0.08	3.6
SSE	0.35	3	4.60	0.12	2.2
S	0.03	2	0.40	0.01	1.5
SSW	0.84	12	11.10	0.07	8.8
SW	0.73	12	9.60	0.06	8.8
WSW	0.45	9	5.90	0.05	6.6
W	0.12	7	1.60	0.02	5.1
WNW	0.05	2	0.70	0.02	1.5
NW	0.11	1	1.40	0.11	0.7
NNW	0.28	8	3.70	0.04	5.8

*Percentage of the total seasonal rainfall that fell from each direction.
**Percentage of total seasonal hours of rainfall that fell from each direction.

TABLE 39

WINTER DIRECTIONAL PRECIPTATION ANALYSIS

SEASON: WINTER, 1981-1982

TOTAL RAINFALL: 6.3[illegible] INCHES
TOTAL HOURS OF PRECIPITATION: 153
% COMPUTER AVAILABILITY: 90%

WIND DIRECTION	NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	% OF MONTH* RAINFALL	AVERAGE INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.25	13	4.00	0.02	8.5
NNE	0.31	19	[illegible]	0.04	12.4
NE	0.46	15	7.30	0.03	9.8
ENE	0.53	10	8.40	0.05	6.5
E	0.39	9	6.20	0.04	5.8
ESE	0.26	8	[illegible]	0.03	5.2
SE	0.29	4	4.60	0.07	2.6
SSE	0.27	8	4.30	0.03	5.2
S	0.58	14	9.20	0.04	9.1
SSW	0.36	11	5.70	0.03	7.2
SW	0.65	12	10.30	0.05	7.8
WSW	[illegible]	19	19.50	0.06	12.4
W	[illegible]	3	1.70	0.04	2.0
WNW	0.01	1	0.20	0.01	0.7
NW	0.04	4	0.60	0.01	2.6
NNW	0.06	3	1.00	0.03	2.0

*Percentage of the total seasonal rainfall that fell from each direction.
**Percentage of total seasonal hours of rainfall that fell from each [illegible]rec-tion.

TABLE 40

SPRING DIRECTIONAL PRECIPITATION ANALYSIS

SEASON: SPRING
APRIL, MAY 1981,
MARCH 1982

TOTAL RAINFALL: 6.91 INCHES
TOTAL HOURS OF PRECIPITATION: 94
COMPUTER AVAILABILITY: 86%

WIND DIRECTION	NUMBER OF NUMBER OF INCHES	NUMBER OF HOURS IT RAINED	AVERAGE % OF MONTH* RAINFALL	INCHES PER HOUR	% OF TOTAL** HOURLY RAINFALL
N	0.62	7	8.97	0.09	7.4
NNE	0.20	5	2.89	0.04	5.3
NE	0.07	4	1.08	0.02	4.3
ENE	0.28	6	4.05	0.05	6.4
E	0.32	6	4.95	0.05	6.4
ESE	1.65	11	23.89	0.15	11.7
SE	0.52	3	7.52	0.17	3.2
SSE	0.08	5	1.16	0.02	5.3
S	0.09	6	1.39	0.01	6.4
SSW	1.28	15	18.52	0.08	16.0
SW	0.14	3	2.03	0.05	3.2
WSW	0.97	6	14.04	0.16	6.4
W	0.12	2	1.74	0.06	2.1
WNW	0.16	4	2.48	0.04	4.3
NW	0.37	9	5.35	0.04	9.6
NNW	0.04	2	0.58	0.02	2.1

*Percentage of the total seasonal rainfall that fell from each direction.
**Percentage of total seasonal hours of rainfall that fell from each direction.

TABLE 41

DOMINANT RATES OF PRECIPITATION

MONTH	WIND DIRECTION WITH GREATEST RATE OF PRECIPITATION	RATE OF PRECIPITATION (INCHES PER HOUR)	TOTAL MONTHLY RATE OF PRECIPITATION
APRIL, 1981	N	0.40	0.22
MAY, 1981	WSW	0.16	0.05
JUNE, 1981	NW	0.97	0.10
JULY, 1981	W	0.26	0.11
AUGUST, 1981	N	0.19	0.07
SEPTEMBER, 1981	SW	0.12	0.06
OCTOBER, 1981	SSE	0.16	0.06
NOVEMBER, 1981	ENE	0.11	0.04
DECEMBER, 1981	NE	0.12	0.05
JANUARY, 1982	SE	0.07	0.04
FEBRUARY, 1982	W	0.05	0.02
MARCH, 1982	WSW	0.18	0.05

TOTAL

1-YEAR STUDY = 0.06 INCHES/HOUR

TABLE 42

WATER-LAND RELATIONSHIP (SUMMER)
JUNE 1, 1981 - AUGUST 31, 1981

MONTH	HOURS OF RAIN	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO WATER & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM WATER TO LAND & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO LAND & PRECIPITATION
JUNE	45	23 Hours = 71% Total Precip. 1.96 inches	5 Hours = 11% Total Precip. 0.42 inches	8 Hours = 18% Total Precip. 2.26 inches
JULY	40	20 Hours = 50% Total Precip. 1.34 inches	10 Hours = 25% Total Precip. 1.28 inches	10 Hours = 25% Total Precip. 1.82 inches
AUGUST	27	20 Hours = 74% Total Precip. 1.24 inches	2 Hours = 7% Total Precip. 0.38 inches	5 Hours = 19% Total Precip. 0.20 inches
TOTAL SUMMER	112	72 Hours = 64% Total Precip. 4.54 inches	17 Hours = 15% Total Precip. 2.08 inches	23 Hours = 21% Total Precip. 4.28 inches

TABLE 43

WATER-LAND RELATIONSHIP (FALL)
SEPTEMBER 1, 1981 - NOVEMBER 31, 1981

MONTH	HOURS OF RAIN	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO WATER & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM WATER TO LAND & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO LAND & PRECIPITATION
SEPTEMBER	50	10 hours = 20% Total Precip. 0.69 inches	30 hours = 60% Total Precip. 1.58 inches	10 hours = 20% Total Precip. 0.72 inches
OCTOBER	61	18 hours = 30% Total Precip. 1.08 inches	37 hours = 60% Total Precip. 1.79 inches	6 hours = 10% Total Precip. 0.56 inches
NOVEMBER	26	14 hours = 54% Total Precip. 0.39 inches	10 hours = 38% Total Precip. 0.74 inches	2 hours = 8% Total Precip. 0.05 inches
TOTAL FALL	137	42 hours = 31% Total Precip. 2.16 inches	77 hours = 56% Total Precip. 4.11 inches	18 hours = 13% Total Precip. 1.33 inches

TABLE 44

WATER-LAND RELATIONSHIP (WINTER)
DECEMBER 1, 1981 - FEBRUARY 28, 1982

MONTH	HOURS OF RAIN	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO WATER & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM WATER TO LAND & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO LAND & PRECIPITATION
DECEMBER	46	20 hours = 13.5% Total Precip. 1.02 inches	20 hours = 43.5% Total Precip. 1.11 inches	6 hours = 13% Total Precip. 0.09 inches
JANUARY	73	39 hours = 53.4% Total Precip. 1.97 inches	25 hours = 34.2% Total Precip. 0.09 inches	9 hours = 12.3% Total Precip. 0.42 inches
FEBRUARY	34	6 hours = 17.6 Total Precip. 0.18 inches	26 hours = 76.5% Total Precip. 0.57 inches	2 hours = 5.8% Total Precip. 0.04 inches
WINTER	153	65 hours = 42.5% Total Precip. 3.17 inches	71 hours = 46.4% Total Precip. 2.58 inches	17 hours = 11% Total Precip. 0.55 inches

TABLE 45

WATER-LAND RELATIONSHIP (SPRING)
MARCH 1982, APRIL 1981, MAY 1981

MONTH	HOURS OF RAIN	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO WATER & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM WATER TO LAND & PRECIPITATION	NUMBER OF HOURS THAT WIND DIRECTION WAS FROM LAND TO LAND & PRECIPITATION
MARCH	59	20 Hours = 34% Total Precip. 0.97 inches	27 Hours = 46% Total Precip. 1.14 inches	12 Hours = 20% Total Precip. 0.72 inches
APRIL	14	7 Hours = 50% Total Precip. 1.20 inches	4 Hours = 29% Total Precip. 1.30 inches	3 Hours = 21% Total Precip. 0.60 inches
MAY	21	11 Hours = 52% Total Precip. 0.06 inches	4 Hours = 19% Total Precip. 0.19 inches	6 Hours = 29% Total Precip. 0.17 inches
SPRING	94	38 Hours = 41% Total Precip. 2.77 inches	35 Hours = 37% Total Precip. 2.63 inches	21 Hours = 22% Total Precip. 1.49 inches

TABLE 46

DOMINANT WIND DIRECTIONS

MONTH	DOMINANT WIND DIRECTION IN WHICH MOST PRECIPITATION OCCURRED	DOMINANT WIND DIRECTION IN WHICH MOST HOURS OF PRECIPITATION OCCURRED
January, 1982	WSW	WSW
February, 1982	ENE	N
March, 1982	ESE	ESE/SSW
April, 1981	ESE	SSW
May, 1981	WSW	WNW/NW
June, 1981	SW	SW
July, 1981	W	SSW
August, 1981	SSW	SSW
September, 1981	NE	NNE
October, 1981	NE	NE
November, 1981	E	E
December, 1981	NNE	NNE

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