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STATUS REPORT ON THE
CALUMET AREA POST ACTION SURVEILLANCE PROJECT
DEPARTMENT OF THE INTERIOR

FOR THE PERIOD
JANUARY THROUGH JUNE 1967

ILLINOIS-INDIANA

U. S. Department of the Interior
Federal Water Pollution Control Administration
Great Lakes Region
Chicago Program Office

August 1967

TABLE OF CONTENTS

	<u>Page No.</u>
TABLE OF CONTENTS	I
LIST OF FIGURES, MAPS & TABLES	II & III
INTRODUCTION	1
BACKGROUND	2
Authority and Organization	2
Purpose and Scope	2
Criteria	3
DESCRIPTION OF AREA	4
DESCRIPTION OF PROGRAMS	5
Stream and Harbor Sampling Program	5
Beach Sampling Program	5
Automatic Monitoring Program	5
Biological Sampling Program	5
CONCLUSIONS	9
Recommendations to the Conferees	9
WATER QUALITY	11
Beach Sampling Program	11
Stream, Harbor and Water Intake Sampling Program	16
Station 1 - Grand Calumet River at Pennsylvania R.R. Bridge	18
Station 2 - Indiana Harbor Canal at 151st St.	23
Station 3 - Indiana Harbor Canal at Dickey Road	28
Stations 4, 5 & 6 - Indiana Harbor	35
Station 7 - Grand Calumet River at Indiana Harbor Belt R.R. Br.	44
Station 8 - Little Calumet River at Wentworth Ave.	49
Stations 9 & 10 - Wolf Lake and Outlet	55
Stations 11, 12 & 13 - Calumet Harbor	63
Station 14 - Gary West Water Intake	73
Station 15 - East Chicago Water Intake	75
Station 16 - Hammond Water Intake	75
Station 17 - Dunne Crib Water Intake	79
BIOLOGICAL SAMPLING PROGRAM	82
UNITED STATES STEEL LANDFILL SURVEILLANCE	86

LIST OF FIGURES, MAPS AND TABLES

	<u>Page No.</u>
LOCATION MAP - CALUMET AREA	6
LOCATION MAP - BEACH SAMPLING PROGRAM	10
Table B-1 - Beach Sampling Results	12
Figure B-1 - Total Coliforms 1966 and 1967	13
B-2 - Fecal Coliforms 1966 and 1967	14
B-3 - Fecal Streptococci 1966 and 1967	15
LOCATION MAP - Stations 1, 2 and 3	17
Figure 1 - Bacterial Results - Station 1	19
Figure 2 - Chemical Results (total iron, phenol)-Station 1	20
Figure 3 - Chemical Results (cyanides, sulphates)-Station 1	21
Table 1 - Chemical Quality of Water - Station 1	22
Figure 4 - Bacterial Results - Station 2	25
Figure 5 - Chemical Results (total iron,phenol)-Station 2	26
Table 2 - Chemical Quality of Water - Station 2	27
Figure 6 - Bacterial Results - Station 3	30
Figure 7 - Chemical Results (iron,phenol) - Station 3	31
Figure 8 - Chemical Results (cyanide, D.O.)-Station 3	32
Table 3 - Chemical Quality of Water - Station 3	33
LOCATION MAP - Stations 4, 5 and 6	34
Figure 9 - Bacterial Results - Station 4	36
Figure 10-Bacterial Results - Station 5	37
Figure 11-Bacterial Results - Station 6	38
Figure 12-Chemical Results (iron, phenol)-Station 6	39
Table 4 - Chemical Quality of Water - Station 4	40
Table 5 - Chemical Quality of Water - Station 5	41
Table 6 - Chemical Quality of Water - Station 6	42
LOCATION MAP - Stations 7 and 8	43
Figure 13-Bacterial Results - Station 7	45
Figure 14-Chemical Results (D.O.,total PO ₄) - Station 7	46
Figure 15-Chemical Results (NH ₃ , Dis.Solids)- Station 7	47
Table 7 - Chemical Quality of Water - Station 7	48
Figure 16-Bacterial Results - Station 8	50
Figure 17-Chemical Results(NH ₃ , Dis. Solids)- Station 8	51
Figure 18-Chemical Results (DO, tot. PO ₄) - Station 8	52
Table 8 - Chemical Quality of Water - Station 8	53

	<u>Page No.</u>
LOCATION MAP - Stations 9 and 10	54
Figure 19-Bacterial Results - Station 9	56
Figure 20-Bacterial Results - Station 10	57
Figure 21-Chemical Results (MBAS, tot. PO ₄) - Station 9	58
Figure 22-Chemical Results (MBAS, tot. PO ₄) - Station 10	59
Table 9 - Chemical Quality of Water - Station 9	60
Table 10- Chemical Quality of Water - Station 10	61
LOCATION MAP - Stations 11, 12 and 13	62
Figure 23-Bacterial Results - Station 11	64
Figure 24-Bacterial Results - Station 12	65
Figure 25-Bacterial Results - Station 13	66
Figure 26-Chemical Results (iron, dis.solids) - Station 11	67
Figure 27-Chemical Results (NH ₃ , tot. PO ₄) - Station 13	68
Table 11 - Chemical Quality of Water - Station 11	69
Table 12 - Chemical Quality of Water - Station 12	70
Table 13 - Chemical Quality of Water - Station 13	71
LOCATION MAP - Stations 14, 15, 16 & 17	72
Table 14 - Chemical Quality of Water - Station 14	74
Table 15 - Chemical Quality of Water - Station 15	77
Table 16 - Chemical Quality of Water - Station 16	78
Table 17 - Chemical Quality of Water - Station 17	80
LOCATION MAP - Biological Survey	81
Table 18 - Comparison of Dendy Samplers with Standard Dredges	84
Table 19 - Phytoplankton Results	85
TABLE LF-1 - U.S. STEEL LANDFILL SURVEILLANCE RESULTS	86

INTRODUCTION

This report on the changes in water quality in the Calumet Area is the fourth in a series of semi-annual reports made by the Calumet Area Surveillance Project of the Federal Water Pollution Control Administration (FWPCA). Previous reports covered the periods July to December 1965, January to June 1966 and July to December 1966. This report covers January to June 1967 and includes a section on the beach surveillance program which covers data collected during July 1967.

The waters reported on include the Grand Calumet River, the Indiana Harbor Canal, Indiana Harbor, the Little Calumet River, Wolf Lake, Wolf Lake Outlet, Calumet Harbor and the lower end of Lake Michigan. Beaches include Rainbow Beach, two Calumet Park Beaches, Hammond Beach, Whiting Beach, East Chicago Beach and the Hammond Beach on Wolf Lake.

The cooperation provided by the Indiana Stream Pollution Control Board, the Illinois Sanitary Water Board, the Metropolitan Sanitary District of Greater Chicago, the United States Coast Guard, U. S. Army Corps of Engineers and others in supplying valuable information and facilities is gratefully acknowledged.

FWPCA personnel who participated include:

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BACKGROUND

Authority and Organization

A conference on pollution of the interstate waters of the Grand Calumet River, Little Calumet River, Calumet River, Wolf Lake, Lake Michigan and their tributaries, called by the Secretary of Health, Education and Welfare under the provisions of Section 8 of the Federal Water Pollution Control Act (33 USC 466 et. seq.) was held in Chicago, Illinois March 2-9, 1965.

Paragraph No. 14 of the Conclusions and Recommendations of the Conferees for this conference provided that "Surveillance will be the primary responsibility of the Indiana Stream Pollution Control Board, the Illinois Sanitary Water Board and the Metropolitan Sanitary District of Greater Chicago. The Department of Health, Education and Welfare will make available a resident technical group and visiting groups of experts which will assist the State agencies and the Metropolitan Sanitary District of Greater Chicago at such time as requested by them."

The State of Indiana, on April 6, 1965, and the State of Illinois, on April 16, 1965, requested an extensive sampling program by the Federal government to monitor the water quality in the Calumet Area. The Metropolitan Sanitary District has not formally requested a sampling program, but has requested laboratory assistance in the analysis of samples they have collected and in special studies they have conducted on chlorination of the effluent from their sewage treatment plant. The Calumet Area Surveillance Project was organized in the latter part of June 1965 to fulfill the requirements of paragraph No. 14 and the requests of the states.

On January 1, 1966 the Federal Water Pollution Control Administration was created within the Department of Health, Education and Welfare and incorporated the surveillance project.

On May 10, 1966 the Federal Water Pollution Control Administration was transferred from the Department of Health, Education and Welfare to the U. S. Department of the Interior.

Purpose and Scope

The purpose of the Calumet Area Surveillance Project is to assess the progress in the abatement of pollution in the conference area in cooperation with appropriate state and local agencies. This is being accomplished through a sampling program to monitor the water quality at various locations within the conference area and a series of electronic water quality monitors to continuously monitor the water quality at selected key points in the basin. Streamflow measurements are being made so that laboratory analyses in milligrams per liter can be converted to pounds per day. The information obtained

through federal, state and local sampling programs and the information furnished by the industries to the state or other responsible agencies on the quality and quantity of their waste flows are evaluated.

Reports are prepared and presented to the Conferees and reconvened conferences on the current water quality and the progress toward abatement of the pollution.

Criteria

The conclusions drawn in this report regarding water quality conditions in the Calumet Area are made relative to certain specific water quality standards. These standards, which are referred to throughout the report, are those proposed by the State of Indiana and approved by the Secretary of the Interior on July 18, 1967.

DESCRIPTION OF AREA

The Calumet area is a flat plain located at the southern end of Lake Michigan and includes the Calumet-Little Calumet River system, the Grand Calumet-Indiana Harbor Canal system, Wolf Lake and its outlet. It includes approximately 742 sq. miles and forms a part of the continental divide between the Mississippi River Basin and the Great Lakes-St. Lawrence River Basin. Approximately 60% of the area drains to Lake Michigan and the remaining 40% drains to the Mississippi River by way of the Illinois River system. Despite this fact the area is not well drained. There are large, marshy, low-lying areas which are subject to flooding during and after heavy rainfalls. The streams are sluggish and meandering except where they have been artificially maintained and/or supplemented by industrial or municipal waste flows.

The Grand Calumet and the Little Calumet Rivers both traverse the divide. On the Grand Calumet the divide is normally located at the Hammond, Indiana Sewage Treatment Plant outfall. Approximately two thirds of the effluent flows west into the Calumet River in Illinois and one third flows east to the Indiana Harbor Canal and Lake Michigan. Rainfall and lake level conditions can cause the divide to shift to either the east or the west.

The location of the divide on the Little Calumet River is not definite and varies over a distance of several miles in the vicinity of Highland, Indiana. The western portion flows to the Cal-Sag Channel in Illinois which connects the system to the Illinois River. The eastern portion flows to Lake Michigan by way of Burns Ditch which discharges to the lake near Ogden Dunes, Indiana.

Flow in the Calumet River is controlled by the O'Brien Lock and is directed from Lake Michigan to the Cal-Sag Channel except during periods of heavy flooding or unusually low lake levels.

The Indiana Harbor Canal connects the Grand Calumet River to Lake Michigan. The Grand Calumet River east of the Hammond Sewage Treatment Plant outfall is tributary to Lake Michigan through the canal.

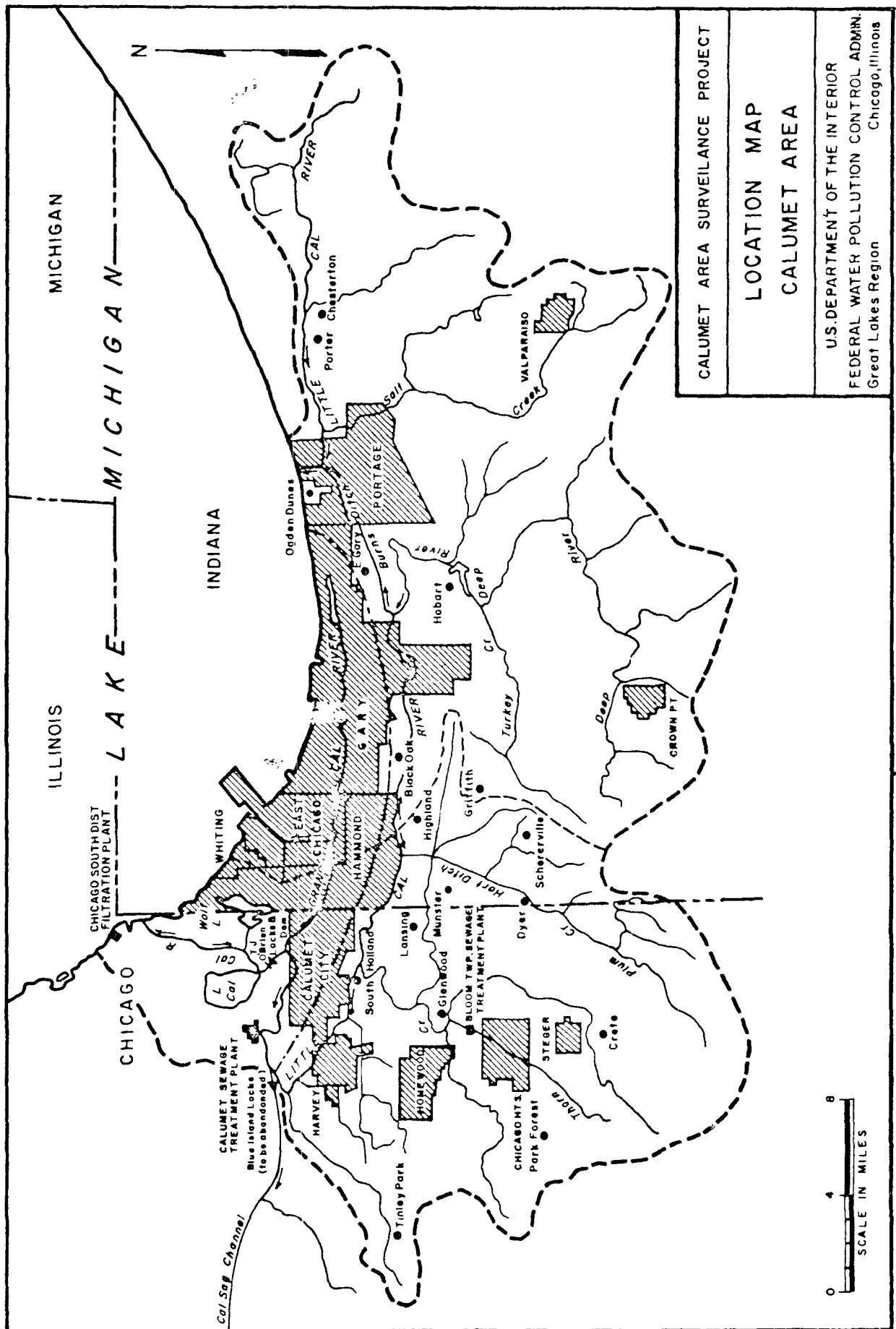
Wolf Lake is located on the Illinois-Indiana state line between Chicago, Illinois and Hammond, Indiana. The original outlet from Wolf Lake to Lake Michigan has been blocked and an outlet to the Calumet River in Chicago has been constructed. The city of Hammond maintains a park which occupies most of the Indiana shoreline of the lake. This park and the lake are extensively used for recreation. The Illinois portion of the lake is a part of the Wolf Lake Conservation Area.

Cities and Industries

The major population centers in the area are East Chicago, Gary, Hammond and Whiting in Indiana; and Calumet City, Chicago Heights and a part of the south side of Chicago in Illinois. The area is highly industrialized.

There are ten major steel mills including the United States Steel Corporation's Gary Works, Gary Sheet and Tin Mill, Youngstown Sheet and Tube Company, and Inland Steel Company in Indiana; and United States Steel's South Works, the Wisconsin Steel Company, the Interlake Iron Corporation, the Republic Steel Corporation and the Acme Steel Company in Illinois. There are five petroleum refineries including the American Oil Company, the Cities Service Petroleum Company, the Mobil Oil Company, and the Sinclair Refining Company in Indiana; and the Clark Oil and Refining Co. in Illinois. Other industries include Lever Brothers, Union Carbide Chemical, E. I. Du Pont, M & T. Chemicals, American Maize and a large number of smaller concerns.

These industries are located in three major groups. One group is concentrated along the Calumet River in Illinois. Another is along the Indiana Harbor Canal; and the third is in Gary, Indiana and discharges to the headwaters of the Grand Calumet River. These three groups make the Calumet Area one of the most important industrial centers in the nation and also one of the most significant from the standpoint of water pollution.



CALUMET AREA SURVEILLANCE PROJECT

LOCATION MAP
CALUMET AREA

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

DESCRIPTION OF PROGRAMS

Stream and Harbor Sampling Programs

Seventeen stream, harbor and water intake stations were scheduled to be sampled on a weekly basis to determine chemical and microbiological quality during the period January to June 1967. Thirteen of these were sampled during the entire period. The remaining four are lake stations that required a boat for sampling, and were not sampled before May 5, 1967 due to ice and inclement weather on the lake. The results of this sampling program are the basis for this report. The sampling locations are indicated on maps dispersed throughout this report, preceding the discussion of the results for each station.

Beach Sampling Program

Sampling on seven beaches in the area was initiated on May 16, 1967 and will continue on a twice weekly basis until September 15, 1967. Six of these beaches are located on Lake Michigan and one on Wolf Lake. A map showing the location of these beaches is on page 10. Five of the beaches were sampled at their mid-points in water approximately three feet deep. Rainbow Beach and Calumet Inner Beach were each sampled at two locations. Samples were collected on Tuesday and Thursday of each week and analyzed for total coliforms, fecal coliforms and fecal streptococci. This program was coordinated with the beach sampling programs of the Chicago Park District and the Indiana State Board of Health and data was distributed freely among the agencies.

Automatic Monitoring Program

Many operations of the industries in the basin result in discharge of wastes on a batch basis. This may occur at various times, depending on the operations of the industry. These discharges and accidental spills of oil or other pollutants could pass into Lake Michigan or down the Illinois River unobserved by a once-a-week sampling program. As the general quality of the waters in the area improve these spills will become more significant. Such spills will be detrimental to water uses which otherwise would be supported by the improved water quality.

A system of 24-hour automatic water quality monitors is being established in the area to detect such spills. Two of these instruments are in place and four more will be installed before the spring of 1968. A centralized computer station for the efficient handling of data from these instruments has been proposed to make the system an on-time system with a short reaction time. An on-time system is a system capable of detecting and reacting to pollution as soon as it occurs.

Biological Sampling Program

The kinds and number of aquatic plants and animals inhabiting a particular body of water reflect the quality of the water that prevails in the area.

Those that inhabit the bottom reflect the quality that existed in the past. Some organisms are capable of withstanding polluted conditions and will multiply rapidly when competition from other less tolerant organisms is eliminated. These pollution tolerant organisms include sludgeworms, bloodworms, leaches, blue green algae and pulmonate snails. In an unpolluted environment the number of these organisms is restricted by competition from other species but when the other species are killed off by pollution they multiply rapidly. Therefore, the continuous or sudden introduction of toxic wastes, settleable solids or oxygen consuming materials alters the composition of the benthic population. A balanced benthic population is not restored immediately upon the return of optimum water quality because the lengths of the life cycles of these organisms vary from weeks to years. This fact makes it possible to detect slugs of pollution that have passed through a sampling station.

In order to develop a more uniform and reliable biological sampling technique an experimental program using artificial substrates has been established. During April 1967 five Dendy type samplers were placed in streams of various quality in the Calumet Area. Regular bottom samples using a Peterson dredge were collected when the Dendy samplers were retrieved. A report on the results of this program is included in this report.

CONCLUSIONS

1. Industrial pollution in the Grand Calumet River-Indiana Harbor Canal System has become more severe since 1965. The findings indicate that concentrations of iron, cyanide and phenolic compounds were all higher than in 1965.

2. Bacterial quality in the Grand Calumet River-Indiana Harbor Canal System is still unsatisfactory.

3. Floating oil was consistently reported at all stations on the Grand Calumet River Indiana Harbor Canal System.

4. The water quality in the western portion of the Grand Calumet River at the state line improved slightly during the summer of 1966 but deteriorated during the winter due to an increased amount of raw or inadequately treated sewage reaching the stream. The stream did not meet the standards at any time.

5. Overflow from combined sewers associated with heavy rainfalls during April and May of 1967 caused a significant increase in bacterial counts at all stations.

6. The water quality in the Little Calumet River has improved since 1965, but the stream is still subject to severe pollution from combined sewer overflows and does not meet the standards.

7. Wolf Lake is a high quality body of water, suitable for all water uses but is threatened by high nutrient concentrations. Except for nutrients there was substantial compliance with the standards.

8. The water quality at the East Chicago and Hammond water intakes meets some of the standards but is affected by wastes from Indiana Harbor and direct discharges to the lake causing violation of the standards for ammonia, total phosphates, iron, phenol and threshold odors.

9. The water quality at Chicago's Dunne Crib and the Gary water intake did not meet the standards for chlorides, ammonia, total phosphate, iron, phenol and threshold odor.

10. The water quality at Chicago beaches was satisfactory except during early July and during periods of easterly winds when such winds locked in the contamination that might otherwise have been carried away.

11. Oil and grease was consistently found in samples from all of the water intakes.

12. The large number of alewives that died and were washed onto the beaches caused a severe odor and aesthetic problem but did not cause immediate

increases in the bacterial counts. Decaying fish may have caused the increased counts during July.

13. The water quality at Indiana beaches was not satisfactory, due to wastes from Indiana Harbor and direct discharges to Lake Michigan.

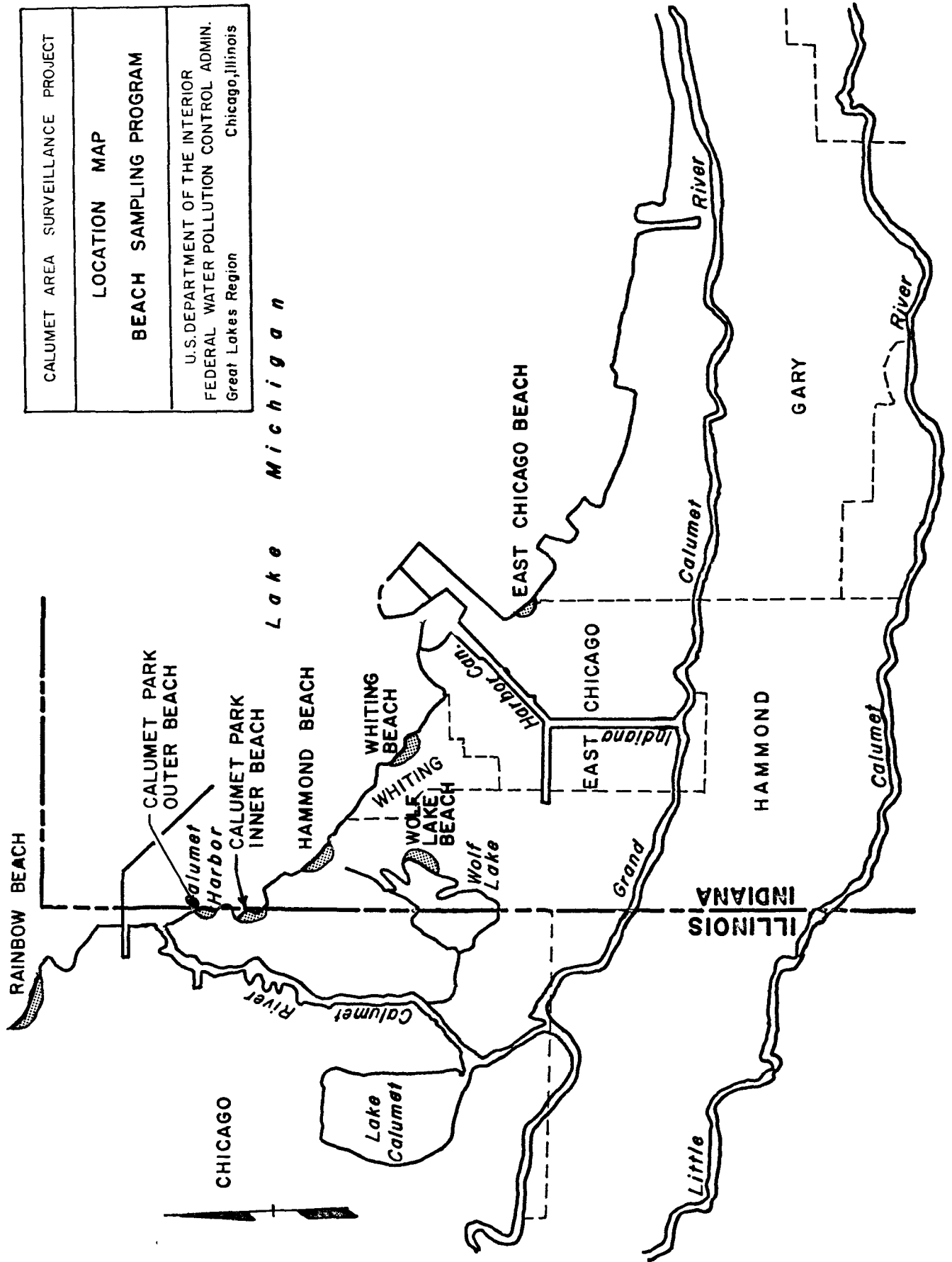
Recommendations to the Conferees

1. That numerical criteria for total iron, cyanide, sulphate and oil be included in the standards adopted for the Grand Calumet River.

2. That the criteria for ammonia in open Lake Michigan waters be reviewed in light of the high levels routinely found in the lake and the recommendations in the Laboratory Committee's report on ammonia.

3. That the criteria for MBAS be reviewed in light of the limitations of the laboratory analytical procedure reported in Standard Methods.

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
BEACH SAMPLING PROGRAM
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



WATER QUALITY

Beach Sampling Program

Six Lake Michigan beaches in the Calumet Area are being sampled twice each week for bacterial quality during the 1967 bathing season. This program, which started on May 18, 1967 and will continue until September 15, 1967, includes Rainbow Beach, Calumet Park Inner Beach, Calumet Park Outer Beach, Hammond Beach, Whiting Beach and East Chicago Beach. Rainbow Beach and Calumet Park Inner Beach are each sampled at two points. In addition, the Hammond Beach on Wolf Lake is being sampled.

Samples are obtained in four feet of water at elbow depth by samplers who wade into the lake wearing rubber waders. The purpose of the rubber waders is to prevent contamination of the sample by the sampler. The samples are immediately stored on ice and are processed by the laboratory within a few hours of collection. Samplers record the following information at the time of collecting the sample: number of bathers within 100 feet, air temperature, water temperature, wind speed and direction, height of waves, cloud and weather conditions and any other factors that may affect water quality.

Samples collected by the Surveillance Project are processed in the Chicago Program Office by means of the membrane filter (MF) method to determine total coliform, fecal coliform and fecal streptococci.

The laboratory methods followed are in accordance with the procedure established in "Standard Methods for the Examination of Water and Wastewater" (12th ed). Fecal coliform determinations are made by the MF method, using M-FC broth base (Difco) with Rosolic acid as an indicator. This method was developed by ¹Geldreich et al at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio.

The criteria for determining satisfactory water quality for bathing at the Calumet Area beaches are the following:

- a. The water quality is satisfactory if MF coliforms are less than 1000 and MF fecal streptococci are less than 100 per 100 milliliter(ml) of sample.
- b. The water quality is satisfactory if MF coliforms are between 1000 and 5000 and MF fecal streptococci are less than 20 per 100 ml of sample.

An average of the five most recent counts is used to determine if the water quality is satisfactory.

Results

This report considers the results of the beach sampling program up to the end of July 1967. The next semi-annual report will consider the entire

¹Geldreich et al '65, J.A.W.W.A., 57:2:208-214, Feb.

1967 swimming season.

Table B-1 and Figures B-1, B-2 and B-3 on pages 12 through 15 compare the beaches during the period May 18, 1967 to July 27, 1967 with a similar period in 1966. Table B-1 indicates no significant change in water quality at the beaches. There are two exceptions; the Calumet Park Outer Beach met the criteria more often in 1967, On the other hand, East Chicago Beach did not meet the criteria as often as in 1966. Rainbow Beach and the two Calumet Park Beaches met the criteria until the beginning of July when several very high counts were made. During this period there were a large number of partially decomposed alewives on the beaches and in the water. It has been considered a possibility that the high coliform counts during July may have been related to the decomposing fish; however, studies directed at confirming this fact have thus far been inconclusive. During the last week of July the alewives disappeared. At this time the coliform counts returned to a level which meets the criteria.

The correlation between winds with an easterly component and the high counts which was noted in 1966 continued in 1967. In addition, the easterly winds lock in contamination that might otherwise be carried away from the beaches.

Hammond Beach, Whiting Beach and East Chicago Beach are still heavily polluted. This is due to the combined sewer overflows that discharge in the area and the beaches' proximity to the mouth of the heavily polluted Indiana Harbor. Wolf Lake continued to meet the criteria during the first half of the 1967 bathing season.

TABLE B-1
BEACH SAMPLING RESULTS

	1966 May 31-July 28			1967 May 18-July 27		
	No.of Samples	No.of Failures	% of Failures	No.of Samples	No.of Failures	% of Failures
Rainbow-75th	18	7	39	20	7	35
Rainbow-77th	18	8	44	20	8	40
Calumet Outer	18	14	78	20	5	25
Calumet Inner- 99th	18	10	56	20	9	45
Calumet Inner- 100th	18	12	67	20	10	50
Hammond	18	17	94	20	18	90
Whiting	18	18	100	20	14	70
E. Chicago	18	10	56	20	16	80
Wolf Lake	18	0	0	20	0	0

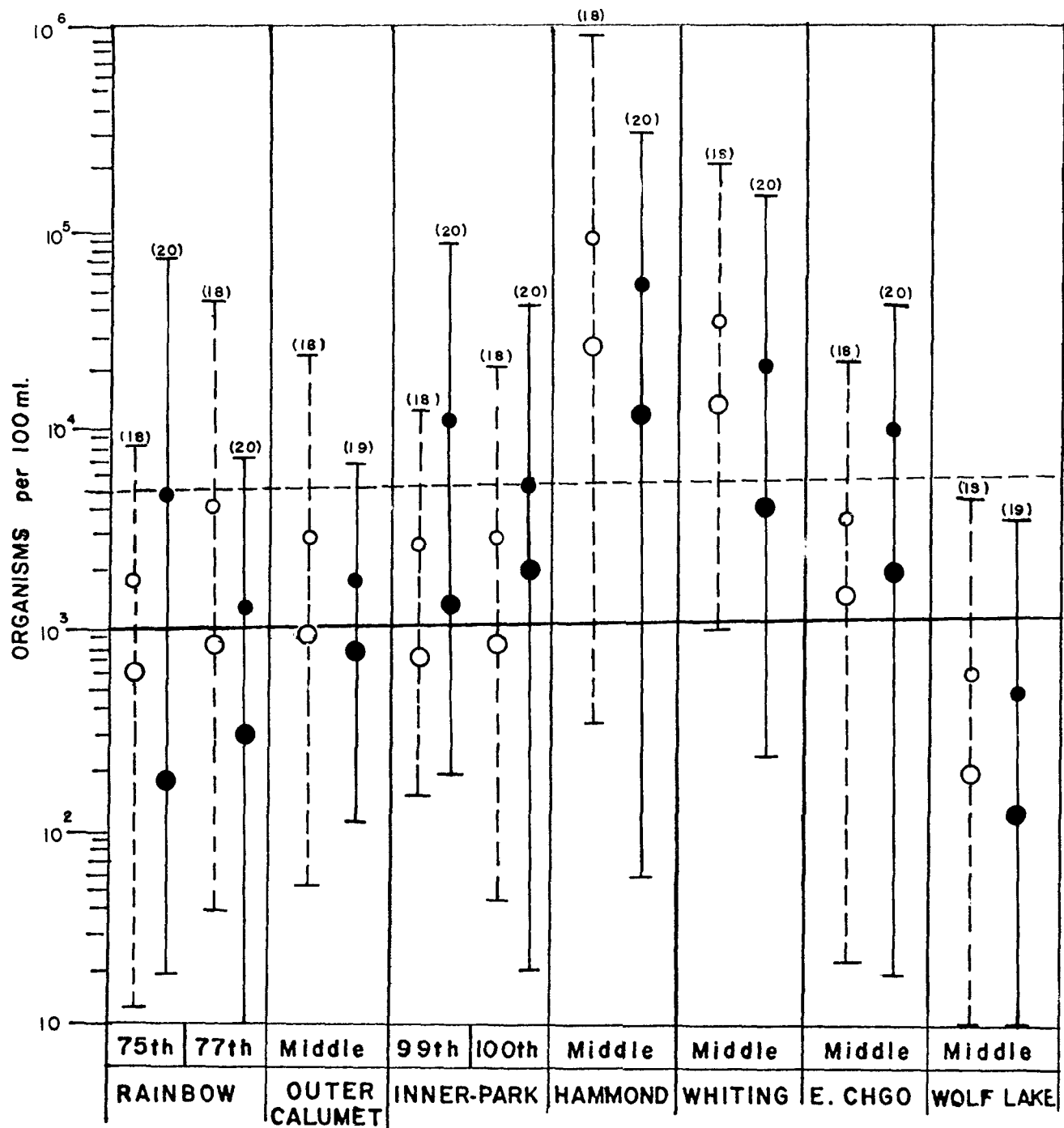
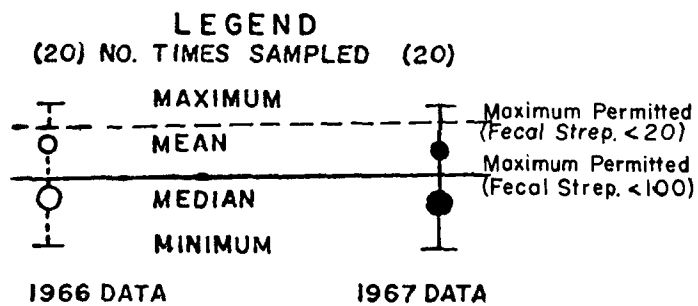


FIGURE B-1



CALUMET AREA SURVEILLANCE PROJECT	
BEACH SAMPLING RESULTS	
Total Coliforms	
1966 and 1967	
U.S. DEPARTMENT OF THE INTERIOR	
FEDERAL WATER POLLUTION CONTROL ADMIN	
Great Lakes Region	Chicago, Illinois

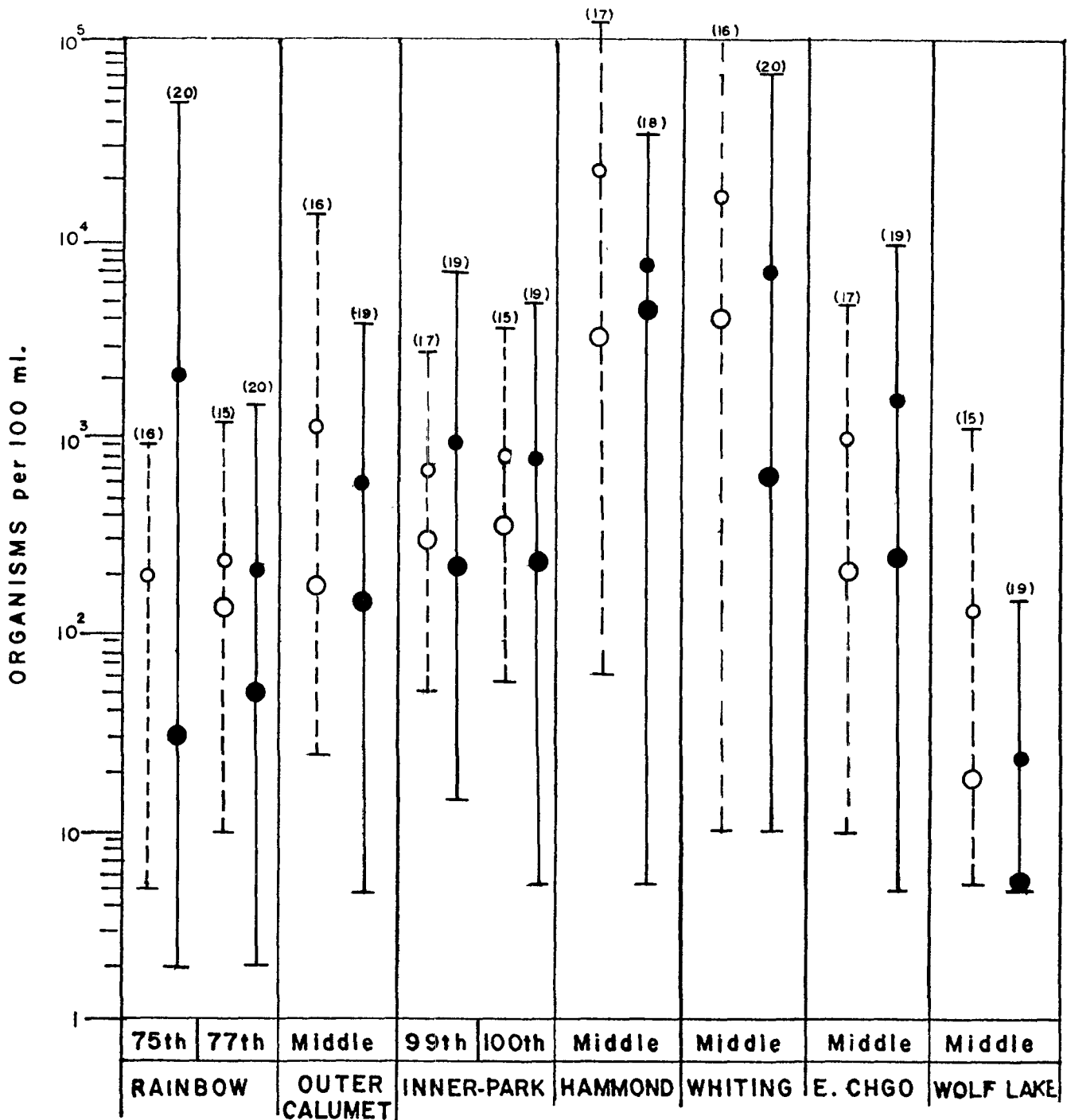


FIGURE B-2

LEGEND

(20) NO. TIMES SAMPLED (20)

MAXIMUM
 MEAN
 MEDIAN
 MINIMUM

1966 DATA 1967 DATA

CALUMET AREA SURVEILLANCE PROJECT
BEACH SAMPLING RESULTS Fecal Coliforms 1966 and 1967
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois

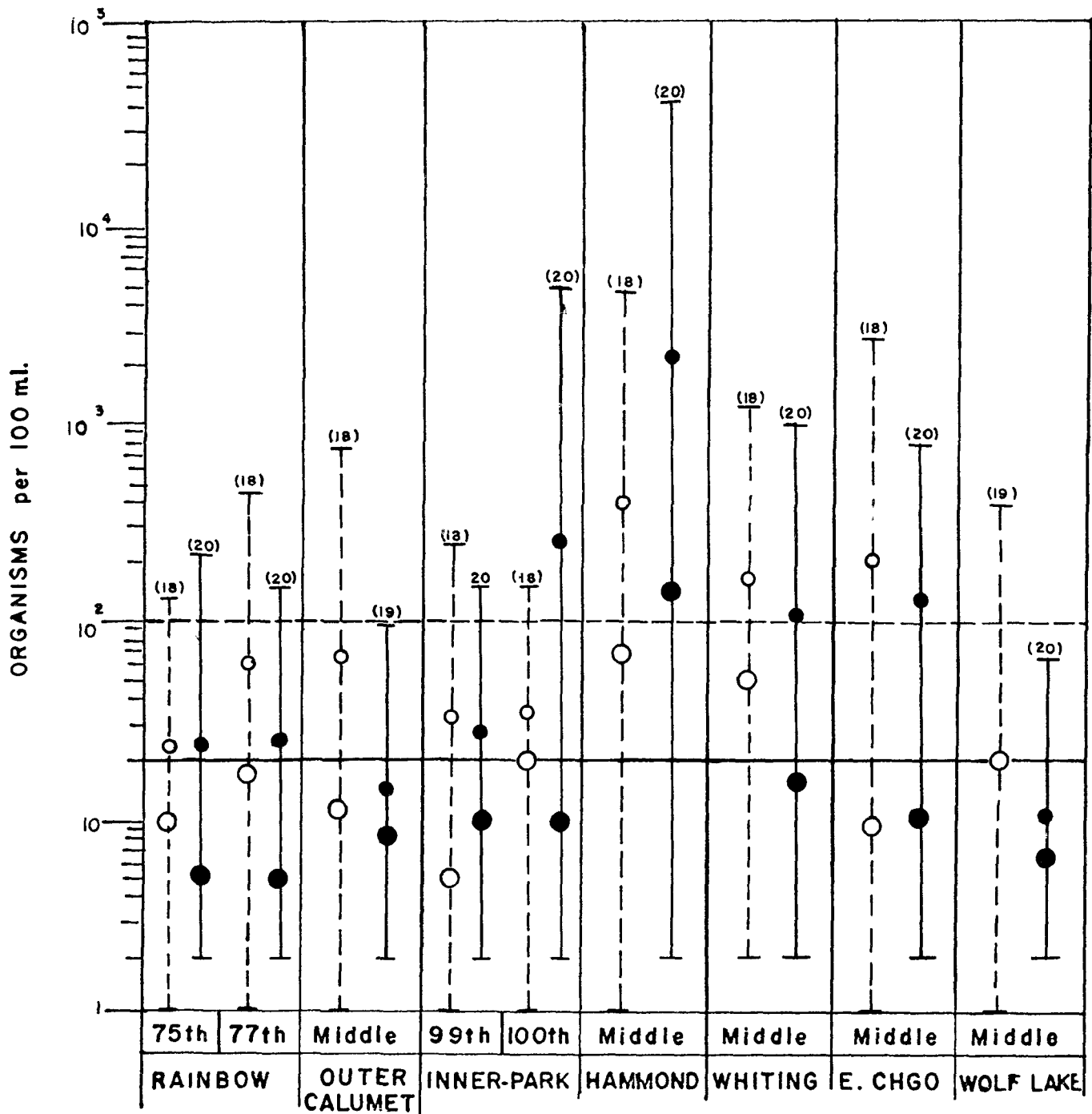
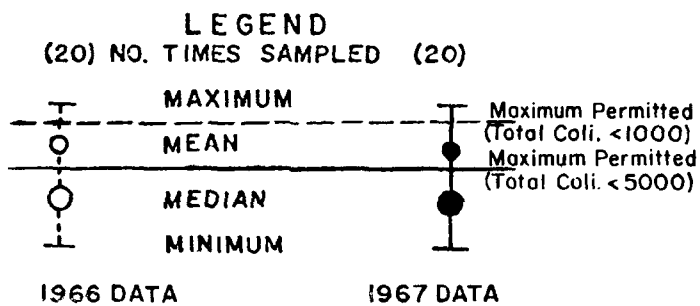


FIGURE B-3



CALUMET AREA SURVEILLANCE PROJECT
BEACH SAMPLING RESULTS
Fecal Streptococci 1966 and 1967
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region
Chicago, Illinois

Stream, Harbor and Water Intake Sampling

Thirteen stream and harbor stations and four Lake Michigan water intakes were scheduled to be sampled for bacterial and chemical quality during the first six months of 1967. Samples were collected once each week except that stations requiring a boat could not be sampled during severe weather. All stream stations were sampled at midstream except for the monitor stations, Numbers 6 and 11, which were sampled at the water quality monitor intake. The samples for bacterial analyses were taken at a depth of one foot. The samples for chemical analyses were taken at mid-depth or 10 feet in the case of navigable channels. All water intake samples were taken from the raw water tap at each of the water filtration plants.

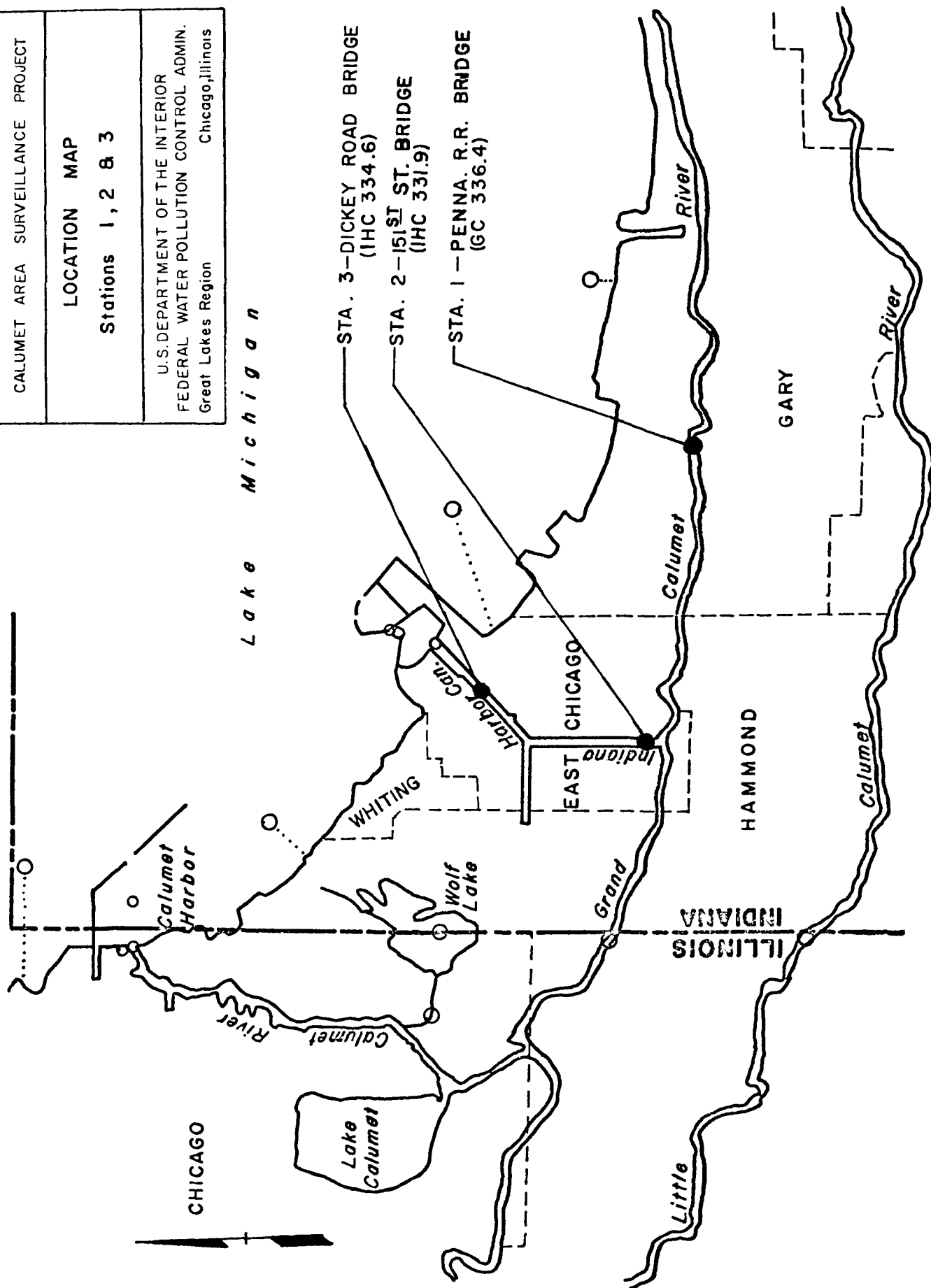
All samples were immediately preserved and/or iced where required in accordance with procedures established in "Standard Methods for Examination of Water and Wastewater, 12th Edition, 1965." Laboratory analyses on samples subject to deterioration were initiated on the day they were collected.

Bacterial analyses were performed as described on page 11.

Chemical analyses were performed in accordance with methods agreed upon by the Calumet Area Enforcement Laboratory Directors Committee.

In the following discussion criteria have been applied to some stations for which they were not specifically designated in the Water Quality Standards previously referred to. This was done for data evaluation purposes only. Where stations were not designated as control points and had no specific criteria established the most applicable and reasonable criteria were used.

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 1, 2 & 3
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Station 1 - Grand Calumet River at the Pennsylvania R.R. Bridge

This station is located approximately two miles downstream from the United States Steel Company's complex at Gary, Indiana. The bulk of the flow is industrial waste from this complex with some combined sewer overflows from the city of Gary, Indiana.

Figure 1 on page 19 shows that the improvement in the bacterial quality of the stream still does not meet the criteria. April and May of 1967 were unusually wet months in the Calumet Area and caused increased discharges of stormwater overflows from the city of Gary which resulted in higher counts during these months. It appears that the goals set by the State of Indiana cannot be reached until a solution is found for the problem of combined sewer overflows.

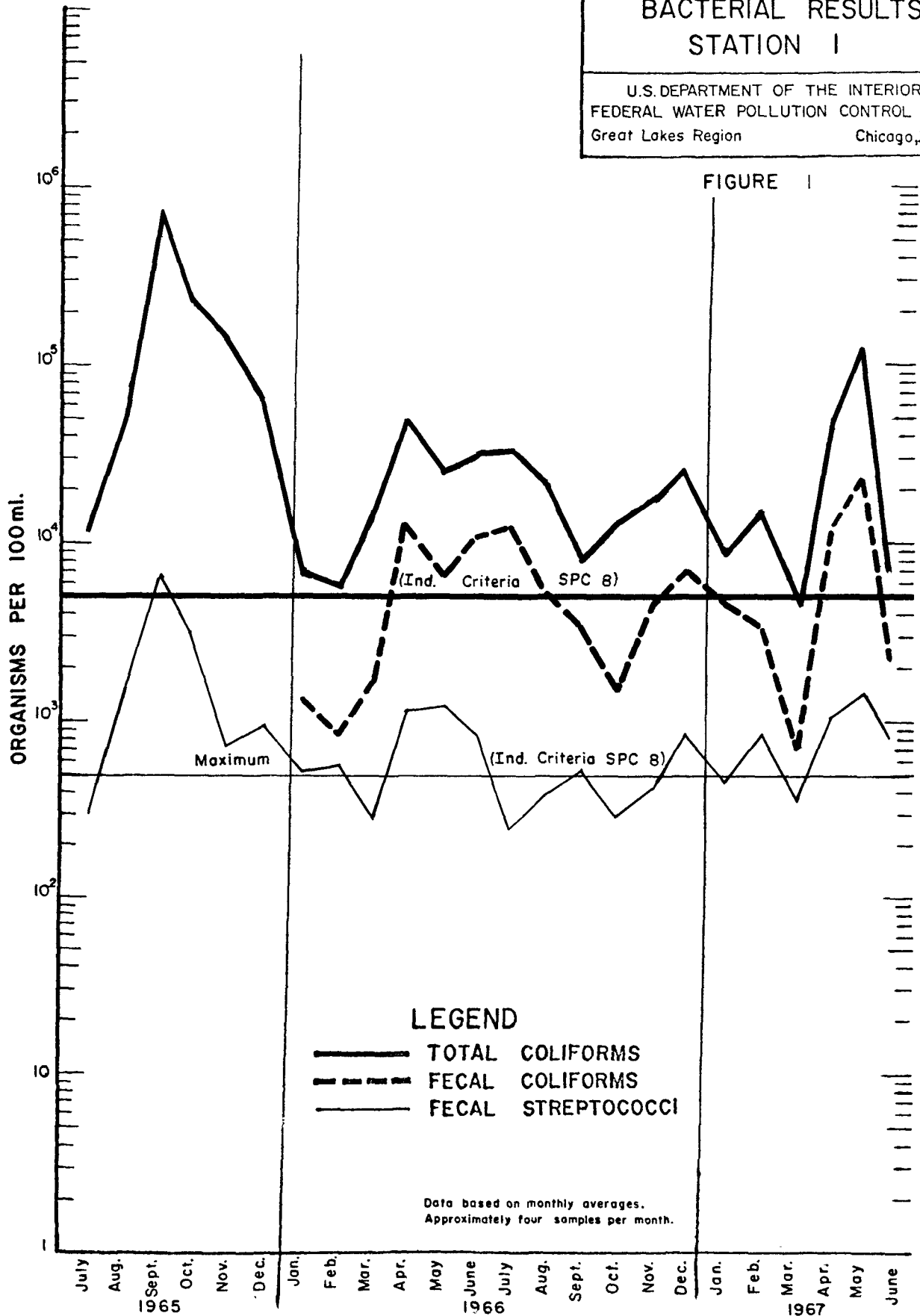
The industrial waste problem at this station continued to grow more severe. Figures 2 and 3 on pages 20 and 21 and Table 1 on page 22 show increased amounts of iron, phenols and cyanide in the stream. All of these are constituents of steel mill wastes. Sulphates have not decreased since the beginning of the surveillance in 1965. Occasional high concentrations of sulphate accompanied by a low pH indicate the presence of spent pickling liquor. The latest detected incident of this occurred on March 5, 1967. This indicated that the deep well was not in satisfactory operation at that time.

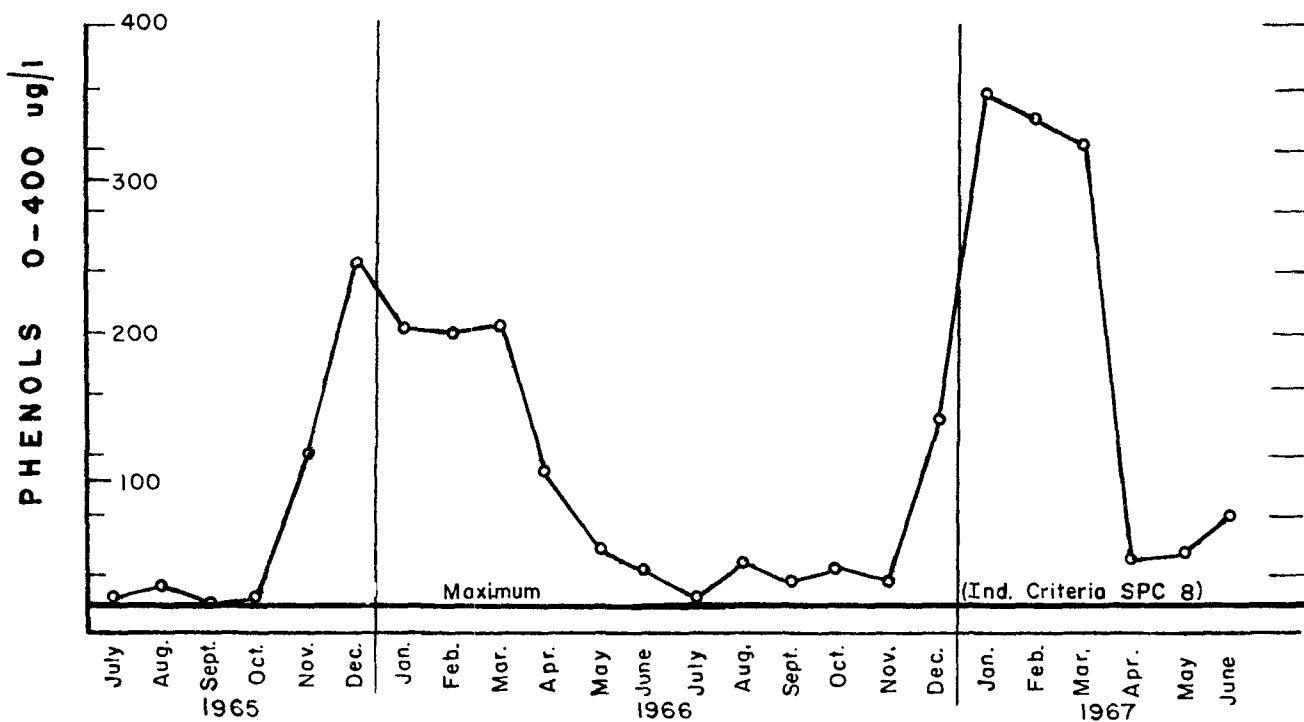
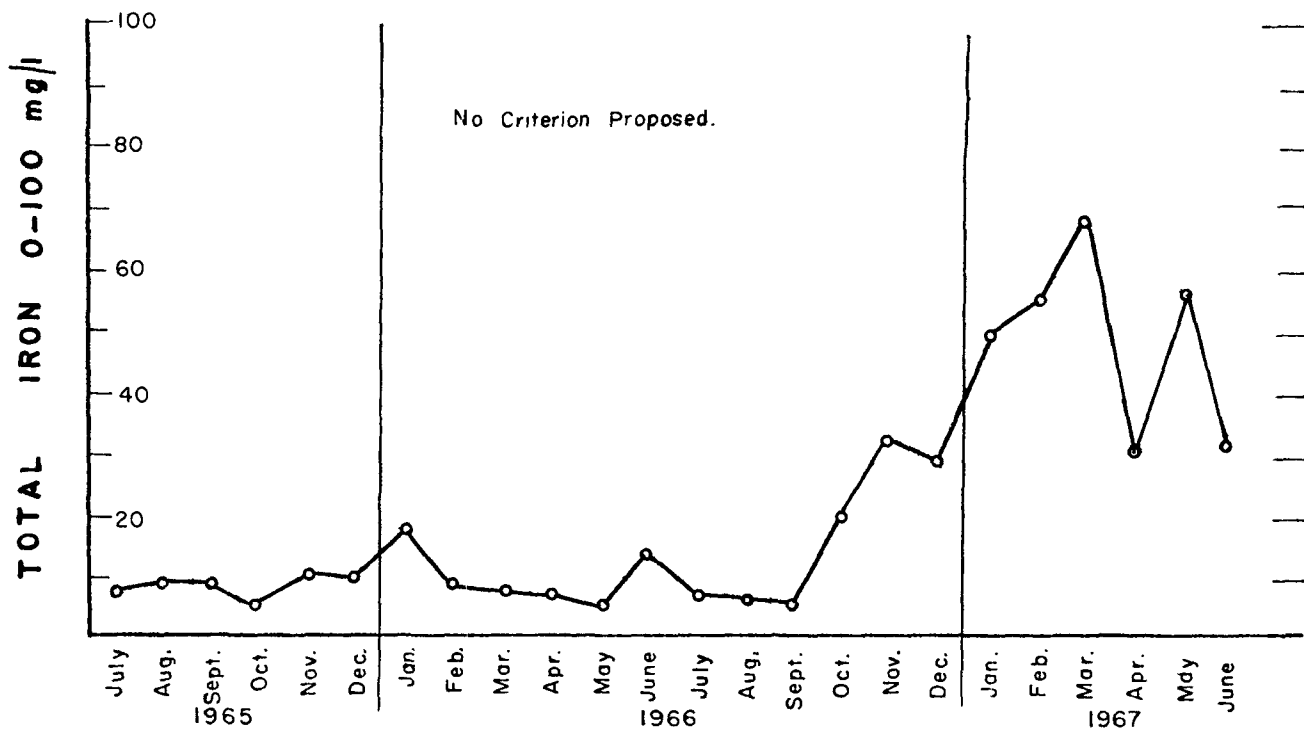
The continued discharge of industrial wastes to the stream caused a considerable amount of sedimentation. During May and June of 1967 this sedimentation raised the level of the river to a point where it reportedly overtopped the outer weirs of the bypass structures on the Gary's combined interceptor sewers. This reportedly resulted in excessive pumping by the city of Gary and threatened to cause serious flooding at the sewage treatment plant and in the city. The steel company subsequently dredged a large amount of material from the river and pumped it to storage lagoons, lowering the river by six inches to one foot, thereby temporarily relieving the problem.

BACTERIAL RESULTS STATION I

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois

FIGURE 1

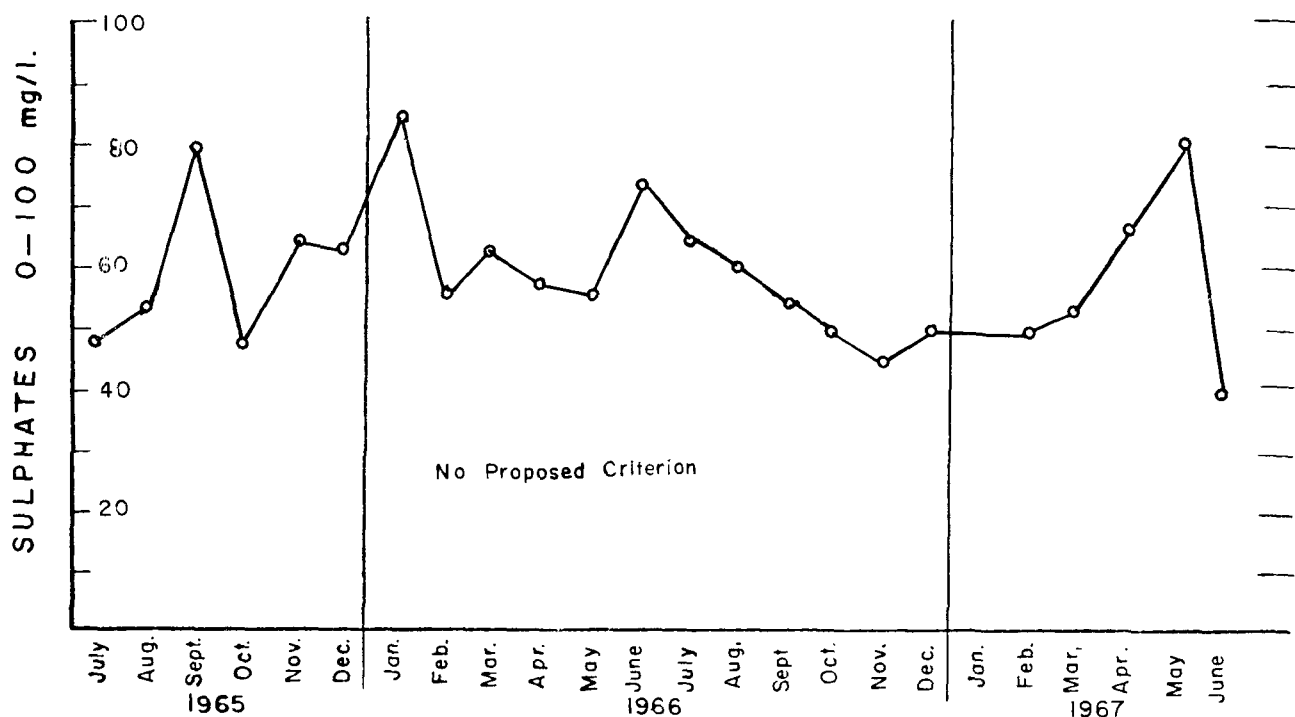
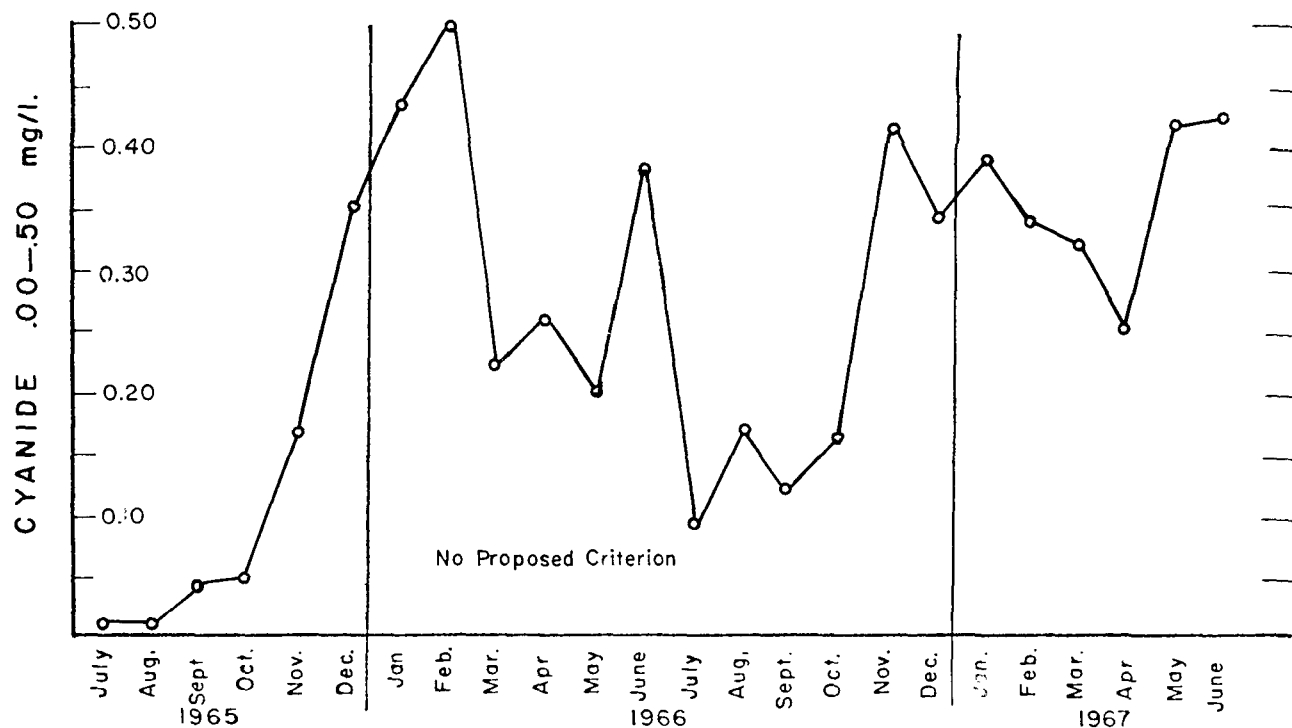




Data based on monthly averages.
Approximately four samples per month.

FIGURE 2

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION I	
Grand Calumet River at Pennsylvania R.R. Bridge	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month

FIGURE 3

CALUMET AREA SURVEILLANCE PROJECT
CHEMICAL RESULTS STATION 1 Grand Calumet River at Pennsylvania R.R. Bridge
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region
Chicago, Illinois

TABLE 1

CHEMICAL QUALITY OF WATER

STATION 1 - GRAND CALUMET RIVER AT PENNSYLVANIA R.R. BRIDGE-GC 336.6

Parameter	July 65 - June 66				July 66 - June 67				Standards Adopted by Ind. for Grand Calumet R. (Spc 8)	
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min. Ave.
Water Temp. °C	29	10	19	18	32	9	19	19	32.3	- -
pH	8.0	3.6	-	6.9	7.2	6.1	-	6.8	(med.)	6.5-9.0
Conductivity umho/cm	765	308	399	380	580	330	391	385		
Alkalinity mg/l	-	-	-	-	127	36	97	100		
DO	9.00	1.10	5.22	5.0	8.85	1.40	5.24	5.45	-	1.0 3.0 (May-Sept)
BOD	17.0	2.4	9.3	8.5	15.0	3.0	8.4	8.8	10	-
COD	152	8	35	29	114	14	42	39		
N Sulphates	200	32	63	53	170	28	54	50		
Chlorides	40	14	20	18	41	10	19	19	125	- 75
MBAS	0.28	0.07	0.14	0.12	0.34	0.08	0.15	0.15	0.5	
NH ₃ -N	4.40	0.87	1.97	1.7	4.20	0.09	1.89	1.7	5.0	-
NO ₂ +NO ₃ -N	11.30	0.18	0.89	0.60	12.00	0.09	0.47	0.43		
Org.N	3.71	0.0	0.94	0.50	1.4	0.0	0.06	0.05		
Sol PO ₄	0.41	0.00	0.15	0.12	0.40	0.01	0.04	0.03		
Total PO ₄	1.20	0.10	0.31	0.25	4.40	0.09	0.54	0.40		
Iron	48.0	2.2	9.2	5.9	109.0	2.6	33.3	27.0		
Cyanide	0.80	0.00	0.22	0.19	0.61	0.01	0.29	0.30		
Susp. Solids	130	26	57	54	842	29	113	92		
Dis. Solids	380	170	237	230	385	109	234	231	500	-
Phenol ug/l	392	10	103	63	601	8	129	66	20	-
Data based on 51 samples					Data based on 52 samples					

Station 2 - Indiana Harbor Canal at 151st St.

This station is located immediately downstream of the point where the eastern and western portions of the Grand Calumet River converge to form the Indiana Harbor Canal. The quality of the water entering the canal which eventually reaches Lake Michigan is measured at this point. Effluents from the Gary, Hammond and East Chicago sewage treatment plants as well as effluents from several industries on the Grand Calumet River affect this point. All of the sewage treatment plants are chlorinating their effluents at present.

Figure 4 on page 25 shows that the bacterial quality still did not meet the criteria. Figure 4 also shows an increase in bacterial counts during April, May and June of 1967. This increase may be explained by three factors: the heavy rainfall during April and May which increased the flow from combined sewer overflows, the increased temperature of the water and an experiment which was conducted at the Gary sewage treatment plant to determine if coke mill wastes from the U. S. Steel complex could be treated at the plant. The treatment of these wastes by the activated sludge process resulted in a great reduction in cyanide and phenol content but produced a very high concentration of ammonia in the plant's effluent. This ammonia combined with the chlorine to form chloramines, thereby greatly reducing the effect of the chlorination process. The plant did not have sufficient chlorination capacity to produce a free residual, therefore the bacterial counts in the effluent were high.

The increase in industrial wastes noted at Station 1 is also evident at Station 2. Figure 5 on page 26 and Table 2 on page 27 show the increased concentrations of iron and phenol. During January and February of 1967 phenol concentrations were 100 micrograms per liter (ug/l) higher than during January and February of 1966 in spite of slightly higher water temperatures. On March 1, 1967 a heavy slug of phenolic materials was found at this station. The concentration was 16,750 ug/l and the sample had a strong odor. The Hammond and East Chicago water treatment plant operators were notified and a special sampling run was made on March 2, 1967 but the estuarial effect of Lake Michigan on the canal dispersed the slug and made it impossible to trace. Phenol concentrations at the downstream stations were only slightly higher than normal for that time of the year. Moderately high threshold odors were reported by the East Chicago and Hammond water filtration plants during the following week. An investigation by the Indiana Stream Pollution Control Board revealed that the slug originated at the United States Steel Company in Gary when an employee "mistakenly discharged the wrong vat to the river."

Low pH values accompanied by high concentrations of sulphates indicate that this station is still affected by discharges of pickling liquor wastes.

Samples from this station were composited on a monthly basis and analyzed for heavy metals. The following table compares the average values for July to December 1966 and January to June 1967:

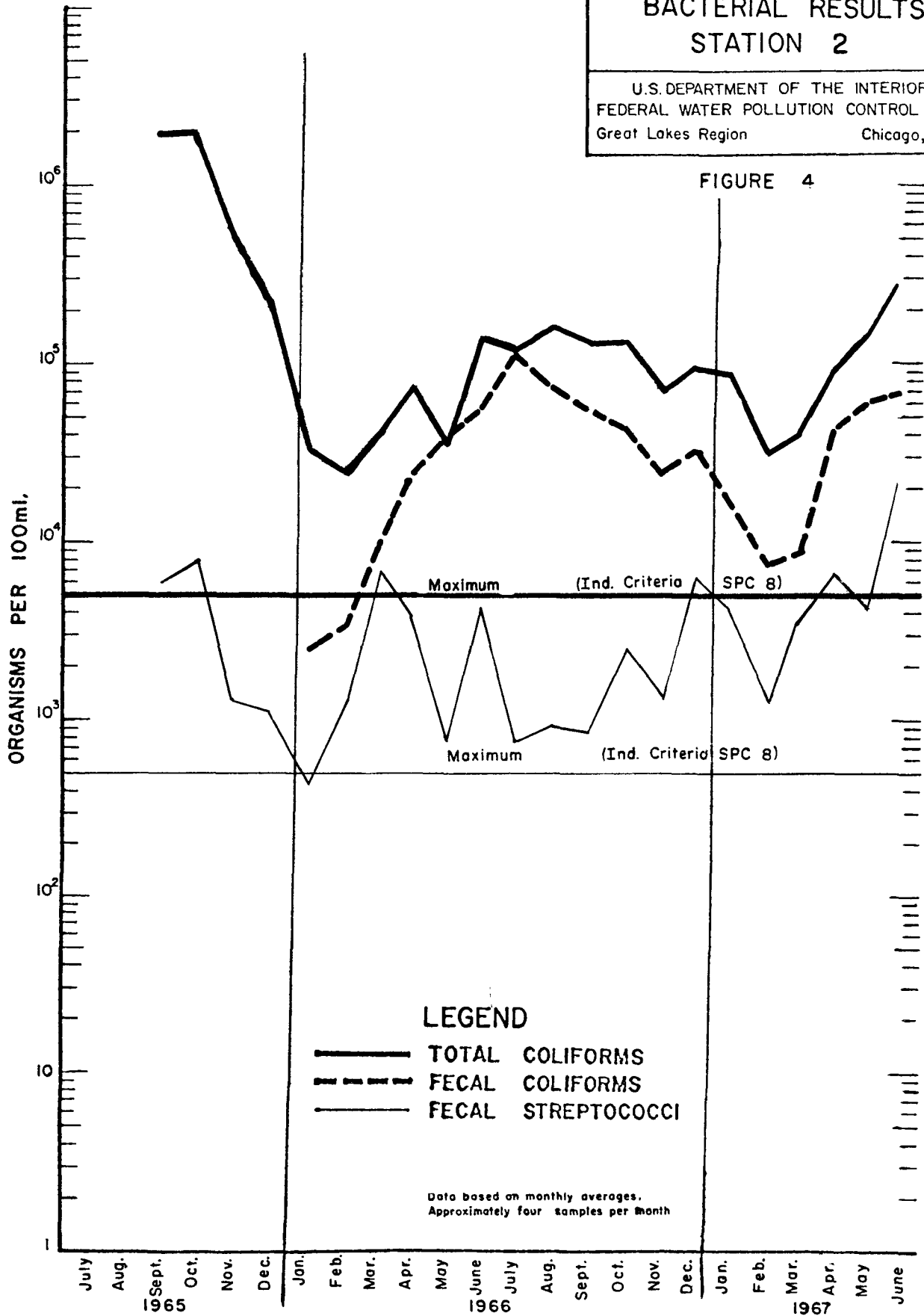
	<u>July-Dec 1966</u>	<u>Jan-June 1967</u>
Cadmium	less than 0.005 mg/l	less than 0.005 mg/l
Copper	0.07 "	0.03 "
Chromium	0.07 "	0.05 "
Potassium	4.6 "	4.6 "
Manganese	0.24 "	0.47 "
Lead	0.14 "	0.16 "
Nickel	0.03 "	0.03 "
Zinc	1.17 "	1.20 "
Sodium	18 "	20 "
Arsenic	less than 1 ug/l	30 ug/l

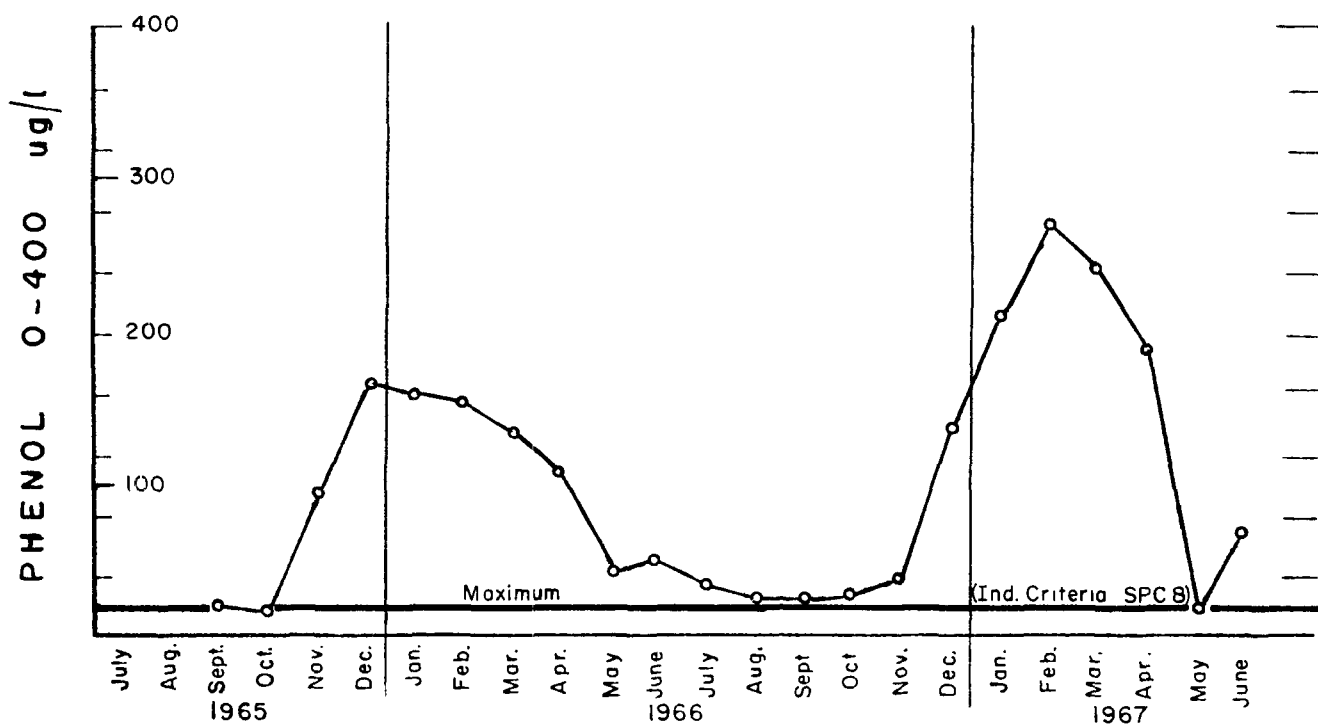
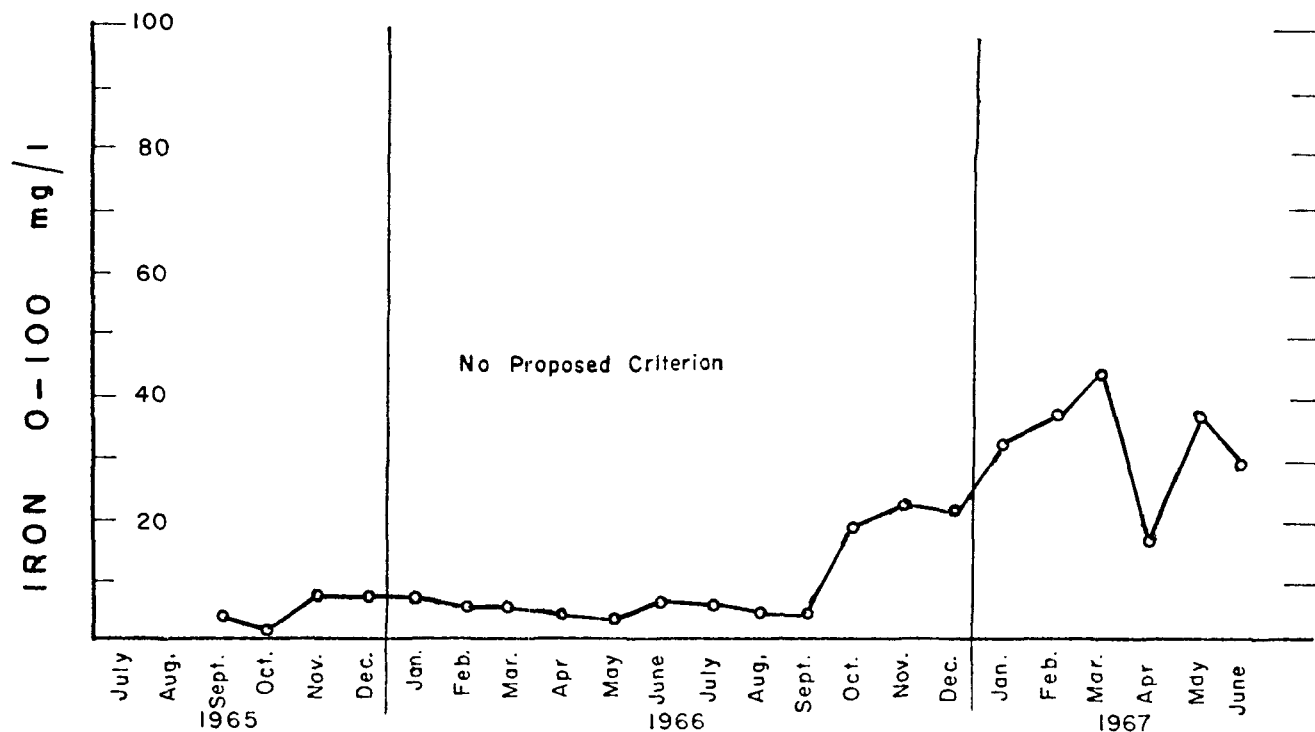
Except for arsenic the data does not indicate any increase or decrease in the concentrations of these elements. During 1967 arsenic was detected in March, April and May. None was found during January, February or June. It is probable that these results represent slugs that were caught by the samplers. It is possible for such slugs to be missed by a weekly sampling program; therefore this arsenic is probably not a new contaminant but one that was periodically present but not detected during 1966.

BACTERIAL RESULTS STATION 2

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 4





Data based on monthly averages.
Approximately four samples per month.

FIGURE 5

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS	
STATION 2	
Indiana Harbor Canal	
at 151st Street	
U.S. DEPARTMENT OF THE INTERIOR	
FEDERAL WATER POLLUTION CONTROL ADMIN.	
Great Lakes Region	Chicago, Illinois

TABLE 2

CHEMICAL QUALITY OF WATER

STATION 2 - INDIANA HARBOR CANAL - 151ST STREET-IHC 331.9

Parameter	Sept. 65 - June 66				July 66 - June 67				Standards Adopted Indiana for Grand Calumet River *	
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Ave.
Water Temp. °C	27	5	16	16	31	8	19	16	32.3	-
pH	7.9	6.3	-	7.0	7.5	6.3	-	6.9	-	Med. 6.5-9.0
Conductivity umho/cm	530	430	473	480	590	330	477	464	-	-
Alkalinity mg/l	-	-	-	-	174	51	110	107	-	-
DO	8.10	0.20	4.80	4.60	7.40	0.85	4.33	4.45	-	1.0 3.0 (May-Sept)
BOD	22.0	4.4	8.9	8.1	14.0	4.8	9.7	9.4	10	-
COD	148	50	34	30	179	17	40	39	-	-
Sulphates	138	50	76	74	125	36	73	73	-	-
Chlorides	44	22	29	29	50	16	28	27	125	75
MBAS	0.35	0.17	0.24	0.24	0.42	0.10	0.23	0.23	0.5	-
NH ₃ -N	4.70	0.77	3.01	3.00	5.9	1.6	3.8	3.3	5.0	-
NO ₂ +NO ₃ -N	2.20	0.21	0.94	0.85	1.70	0.08	0.62	0.58	-	-
Org. N	4.30	0.00	0.83	0.80	5.0	0.1	0.9	0.9	-	-
Sol. PO ₄	1.32	0.11	0.54	0.49	1.00	0.05	0.37	0.32	-	-
Total PO ₄	4.60	0.32	1.00	0.96	4.30	0.56	1.67	1.70	-	-
Iron	17.00	0.78	5.11	3.50	69.0	2.8	21.2	19.0	-	-
Cyanide	0.53	0.00	0.16	0.13	0.61	0.04	0.21	0.15	-	-
Susp. Solids	136	10	53	51	239	7	79	70	-	-
Dis. Solids	640	240	296	290	345	160	275	275	500	-
Phenol ug/l	308	9	92	93	16,757	15	100	48	20	-
Data based on 44 samples					Data based on 52 samples					

*Due to the size of the stream at this point and its proximity to the Grand Calumet River, SPC 8 is more applicable than SPC 7 which applies to the lower end of the Indiana Harbor Canal.

Station 3 - Indiana Harbor Canal at Dickey Road

Station 3 is located at Dickey Road Bridge on the Indiana Harbor Canal. This station is downstream from the St. George Branch of the Indiana Harbor Canal and receives the wastes from all of the refineries which discharge to the canal system.

Fluctuating lake levels cause the canal to act as an estuary in this area. The water level in the canal fluctuates two to three feet every six hours. Flow is often upstream at Dickey Road. The net discharge is estimated to be 1100 to 1200 cubic feet per second (cfs) toward Lake Michigan.

Figure 6 on page 30 indicates declining bacterial counts until April 1967 when they rose sharply. This rise was due to the combined sewer overflows caused by heavy rainfalls that occurred during these months and to the higher summer temperatures.

The recently approved water quality standards permit a maximum total coliform count of 5000 per 100 ml and an annual average of not more than 2000 per 100 ml. During January to June 1967 the maximum coliform count was 1,500,000 per 100 ml with an average of 325,880 per 100 ml. It is evident that a great deal must be done to meet these goals, particularly in respect to combined sewer overflows.

The extent of the industrial pollution problem is indicated by comparing the standards for iron, cyanide, dissolved solids and phenolic compounds with the existing levels in the stream. Table 3 on page 33 indicates that the existing levels for each of these parameters were many times higher than the standards. Figures 7 and 8 on pages 31 and 32 indicate that concentrations of these pollutants have increased during the past two years.

Low dissolved oxygen was an increasing problem at this point. During June 1967 zero dissolved oxygen was found in two of four samples. The dissolved oxygen was less than 1.0 milligrams per liter (mg/l) after the beginning of May. During 1966 dissolved oxygen contents less than 1.0 mg/l were not found until June 3.

Samples from this station were composited on a monthly basis and analyzed for heavy metals. The following table compares the average values for July to December 1966 and January to June 1967.

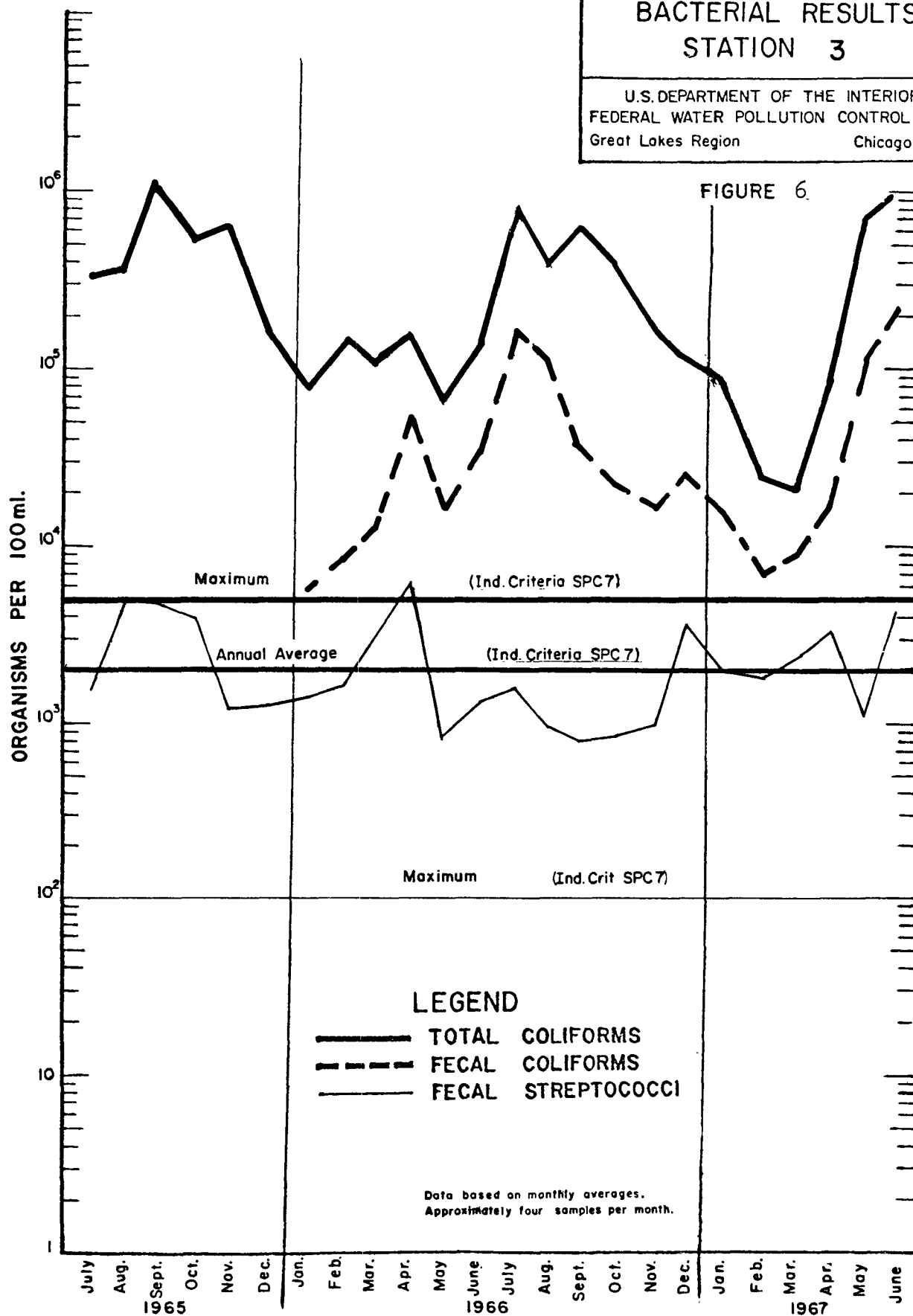
	<u>July-Dec 1966</u>	<u>Jan-June 1967</u>
Cadmium	less than 0.005 mg/l	less than 0.005 mg/l
Copper	0.08 "	0.05 "
Chromium	0.04 "	0.01 "
Potassium	4.5 "	4.8 "
Manganese	0.22 "	0.32 "
Lead	0.06 "	0.07 "
Nickel	0.03 "	0.04 "
Zinc	0.63 "	0.52 "
Sodium	21 "	24 "
Arsenic	less than 1 ug/l	6 ug/l

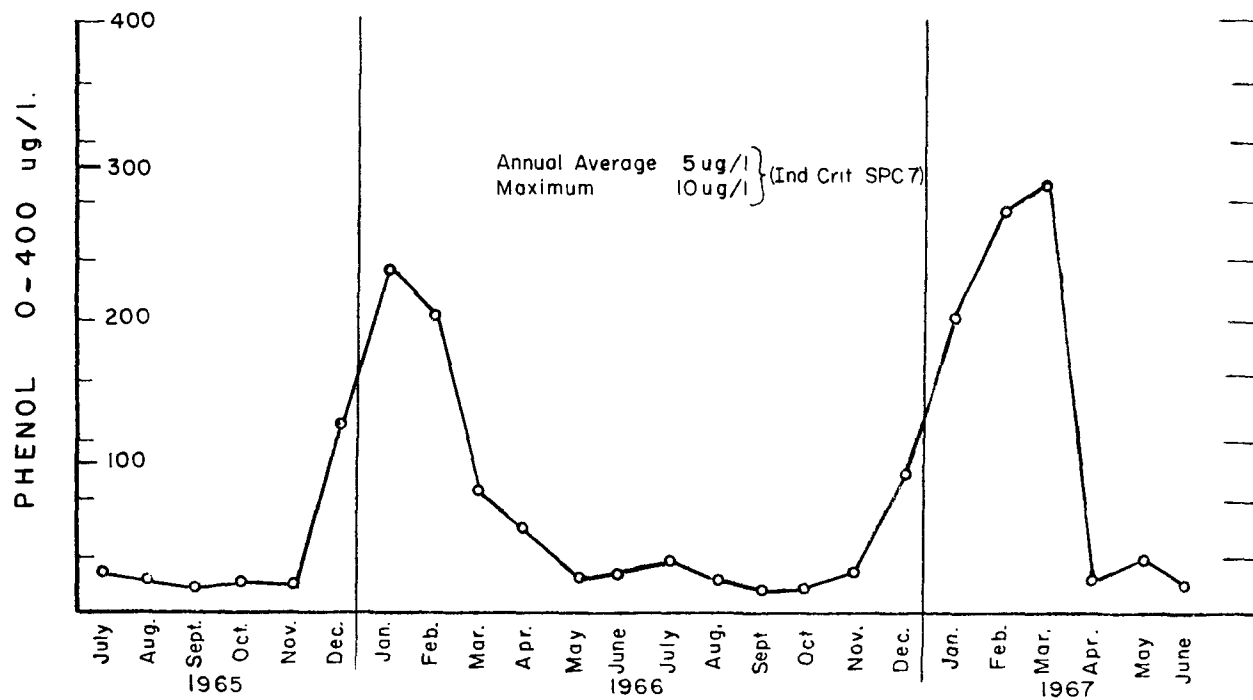
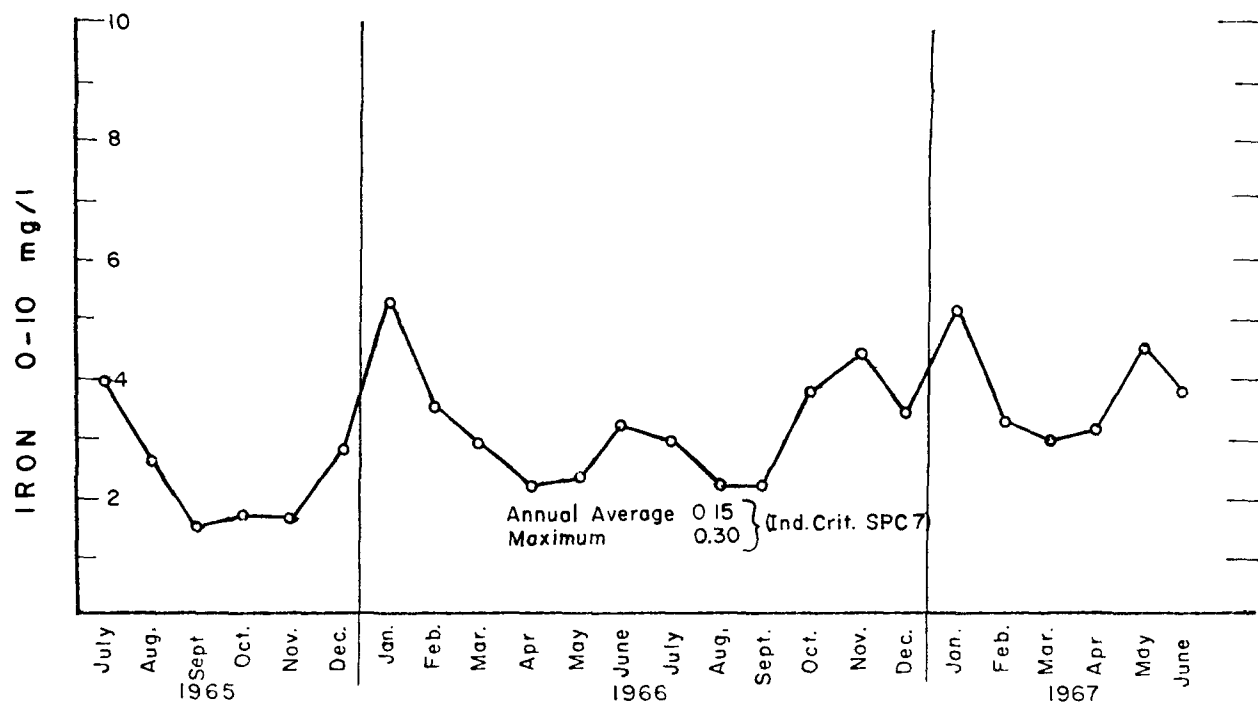
As at Station 2, the data does not indicate a definite trend. Significant arsenic was found in only the March 1967 composite, indicating that a slug was detected. It is probable that such slugs existed but were missed during 1966.

BACTERIAL RESULTS STATION 3

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 6.

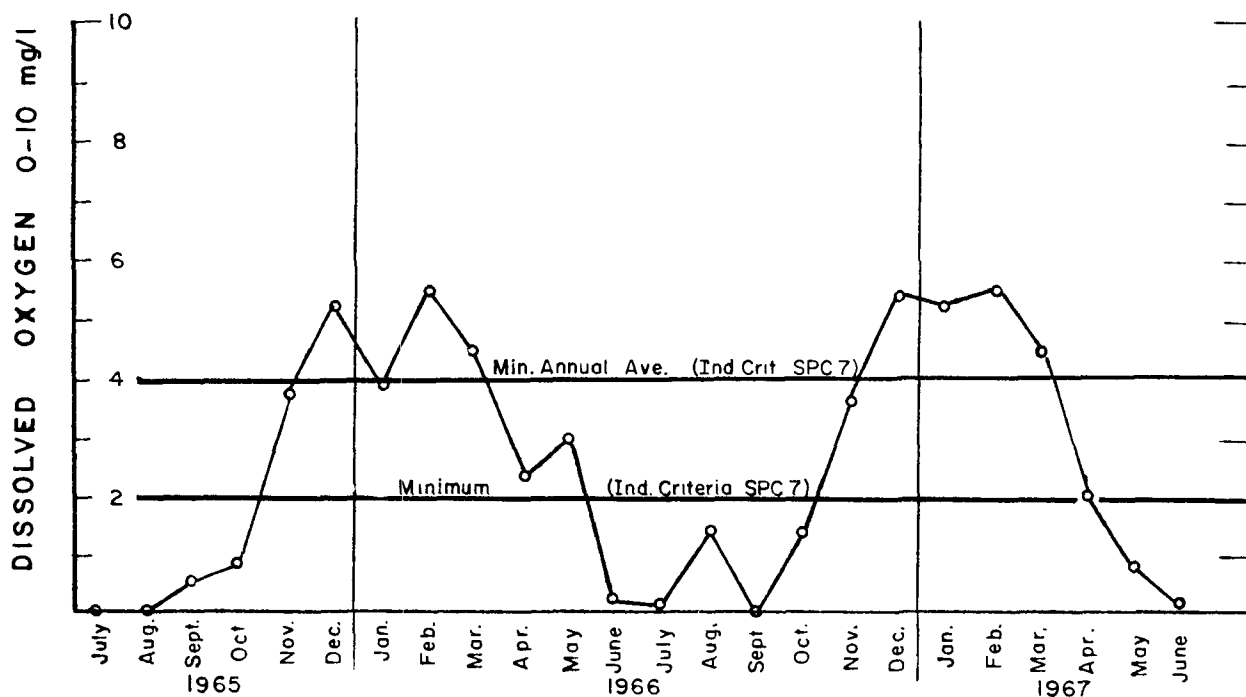
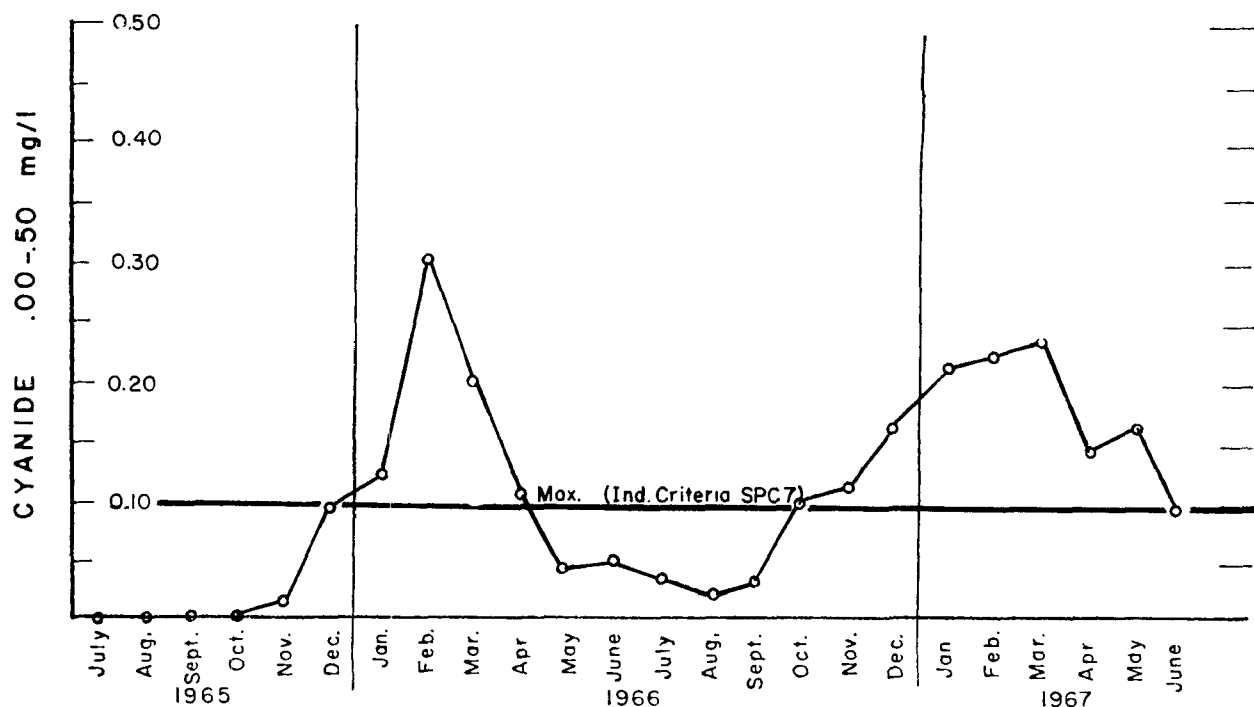




Data based on monthly averages.
Approximately four samples per month.

FIGURE 7

CALUMET AREA SURVEILLANCE PROJECT
CHEMICAL RESULTS STATION 3 Indiana Harbor Canal at Dickey Road Bridge
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month.

FIGURE 8

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 3 Indiana Harbor Canal at Dickey Road Bridge	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois

TABLE 3

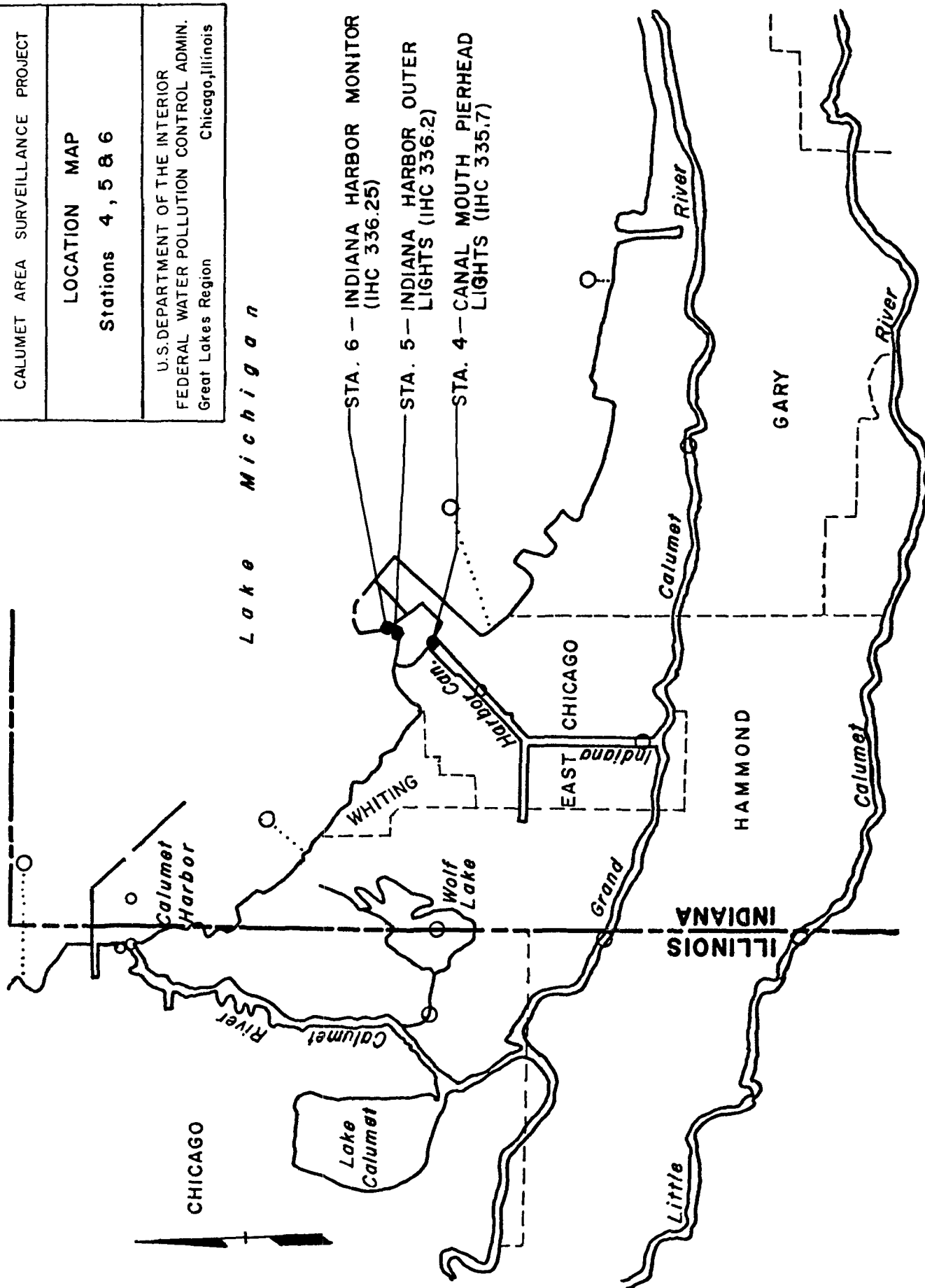
CHEMICAL QUALITY OF WATER
STATION 3 - INDIANA HARBOR CANAL AT DICKEY ROAD-IHC 334.6

Parameter	July 65 - June 66				July 66 - June 67				Standards Adopted by Indiana (Spec 7)	
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min. Ave.
Water Temp. °C	29	9	18	18	31	7	18	16	32.3	-
pH	8.0	6.3	-	7.0	7.6	6.4	7.0	6.9	9.0	7.0 Med. 7.5-8.5
Conductivity umho/cm	615	400	501	505	800	410	507	495		
Alkalinity mg/l	-	-	-	-	139	56	105	111		
DO	6.70	0.00	2.46	1.80	7.2	0.0	2.5	2.4	-	2.0 4.0
POD	11.0	2.2	5.7	5.4	18.0	2.5	6.0	5.2		
COD	147	0	28	22	53	12	27	24		
Sulphates	138	45.6	79	80	155	42	80	80	75	60
Chlorides	70	29	36	32	59	22	36	33	35	25
MBAS	0.61	0.16	0.29	0.29	0.59	0.17	0.35	0.31	0.5	0.3
NH ₃ -N	6.7	1.1	3.1	3.1	5.8	1.5	3.9	3.8	1.5	1.0
NO ₂ +NO ₃ -N	3.50	0.15	1.00	0.85	2.40	0.03	0.70	0.58		
Org. N	5.40	0.08	1.19	0.80	4.5	0.2	1.1	0.8		
Sol PO ₄	0.86	0.04	0.31	0.29	0.51	0.08	0.24	0.22		
Total PO ₄	1.10	0.24	0.53	0.48	1.30	0.05	0.76	0.73	.10	.05
Iron	9.00	0.88	2.75	2.20	10.0	1.6	3.4	3.1	.30	.15
Cyanide	0.56	0.00	0.08	0.02	0.43	0.01	0.12	0.11	0.1	-
Susp. Solids	84	6	20	17	64	4	22	20		
Dis. Solids	385	220	303	305	360	141	295	291	275	
Phenol ug/l	483	1	71	30	635	5	93	32	10	5

Data based on 52 samples

Data based on 52 samples

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 4, 5 & 6
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Stations 4, 5 and 6 - Indiana Harbor

Indiana Harbor was sampled at three points. Station 4 is located at the mouth of Indiana Harbor Canal, upstream of the Inland Steel and Youngstown Sheet and Tube ship turning basins. Station 5 is located immediately downstream of the ship turning basins and downstream of all industrial discharges to the harbor. The average dry weather flow to Lake Michigan past this station is 2700 cfs, but under certain wind and lake level conditions lake water is backed up into the harbor creating the effect of an estuary. Station 6 is located at the east breakwall inner light which is about 150 feet from Station 5 and contains a water quality monitoring station.

Stations 4 and 5 are boat stations and cannot be sampled in rough weather. During 1967 they were not sampled until May 5 and were missed several times thereafter. A comparison of the monthly data from Station 5 and 6 reveals that there is no essential difference in water quality between the two points. Therefore sampling of Station 5 was discontinued as of July 1967.

Figures 9, 10 and 11 on pages 36, 37 and 38 indicate that bacterial counts at these three stations did not meet the standards. The high counts during May and June were probably due to overflows from combined sewers resulting from the heavy rainfalls.

Tables 4 and 5 on pages 40 and 41 show high iron, cyanide and phenol concentrations at each of these points which indicate the continued presence of heavy industrial pollution.

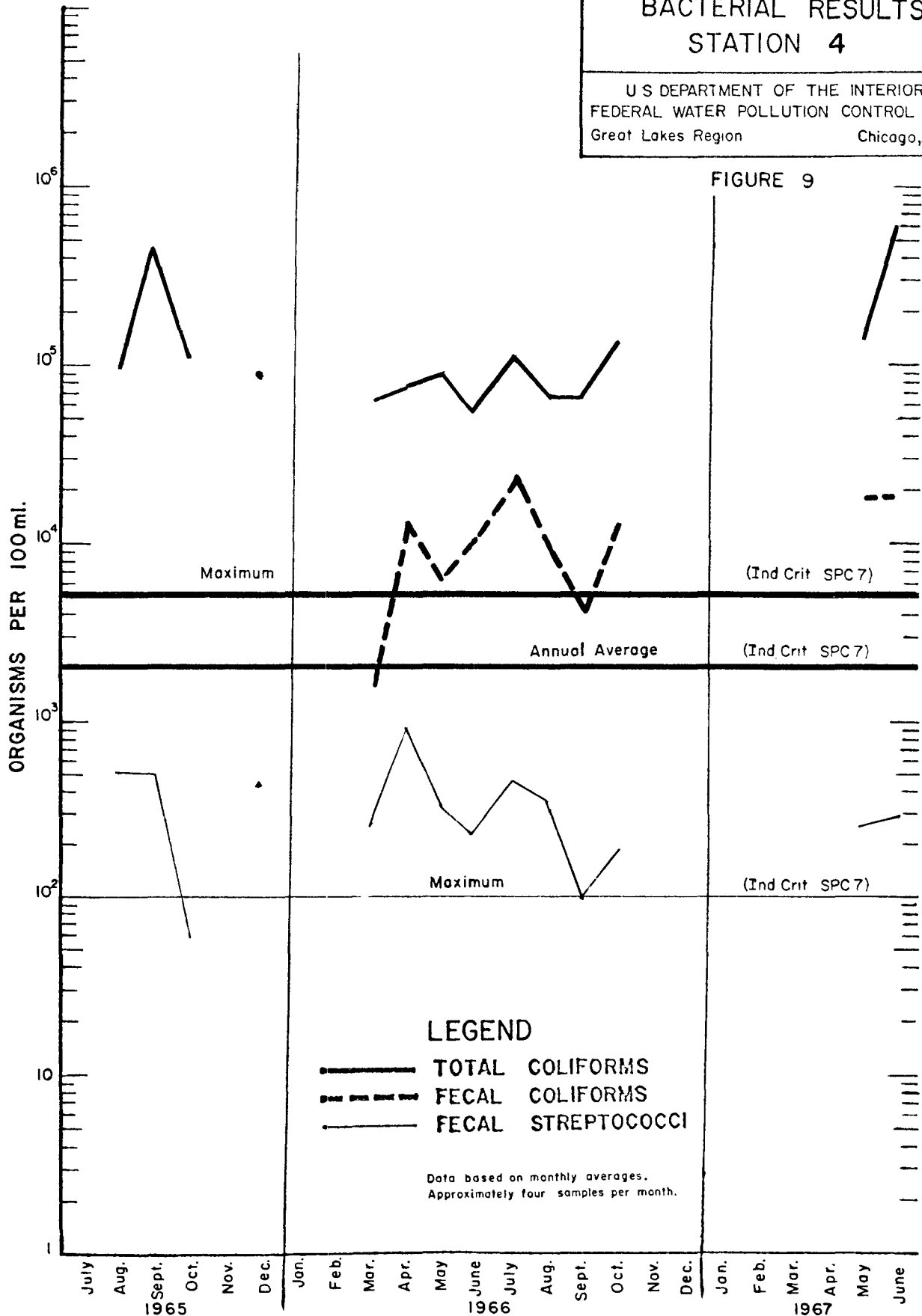
Station 6 is the control point designated by the Indiana Stream Pollution Control Board for the Indiana Harbor Canal. Table 6 on page 42 and Figure 12 on page 39 compare the proposed criteria with the actual water quality for the past two twelve-month periods. The criteria for temperature is being met. The median pH is below the range required by the criteria. In general the criteria for dissolved oxygen is met. This is because most of the oxygen demand is satisfied before the wastes reach this point and higher quality water from Lake Michigan often intrudes into the harbor. The criteria for sulphates, chlorides, ammonia and phosphate were not met. The most serious problems are iron, cyanides and phenols. The criterion for iron has often been violated and the criteria for phenols and cyanides were extensively violated during the colder months.

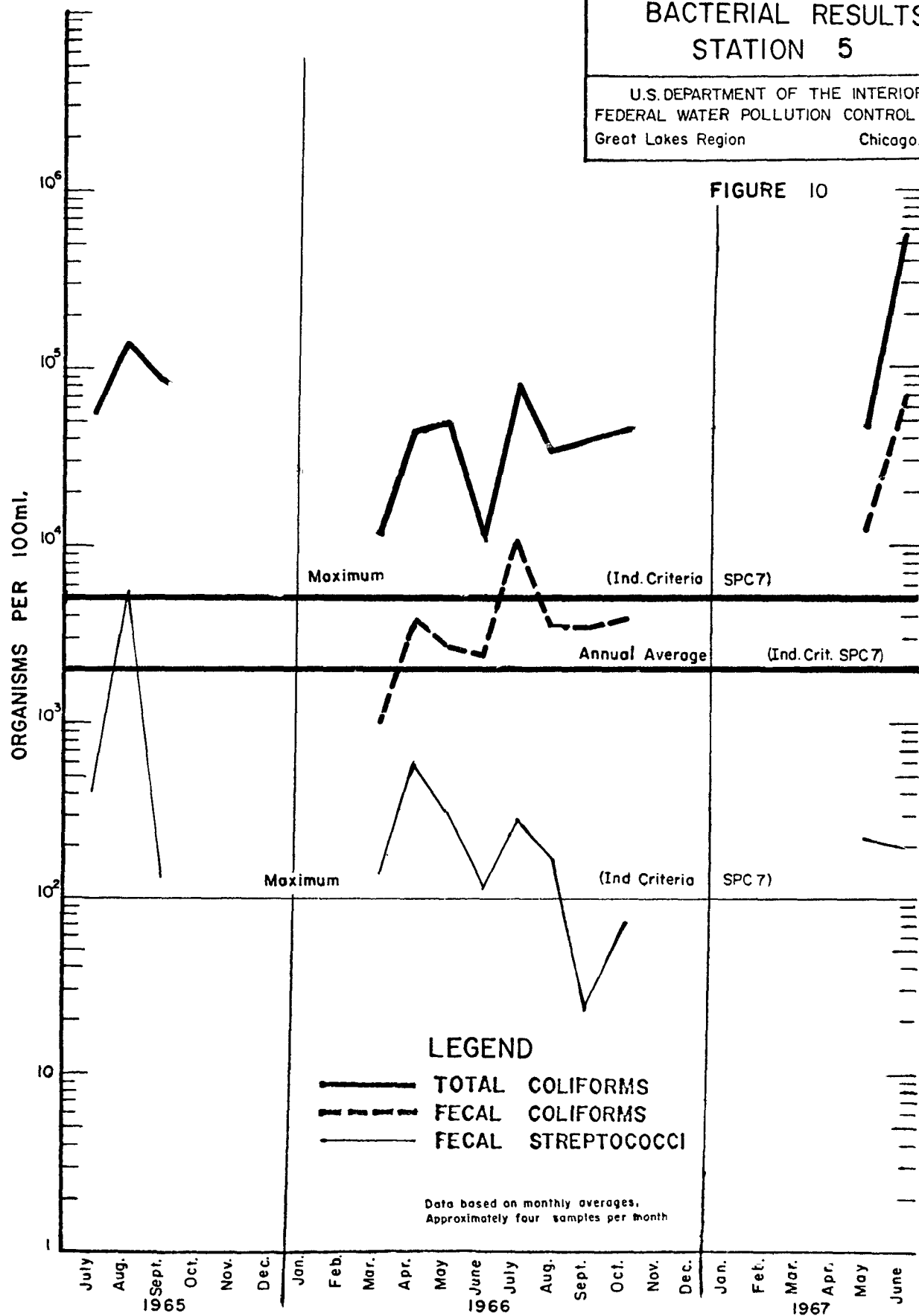
The bacterial criteria were violated in more than 95% of the samples. Many of the subjective criteria such as those calling for freedom from floating oil, floating solids and debris, odor and turbidity were also violated. The samplers reported floating oil on almost every sampling run and the waters often are turbid and have an unpleasant odor.

BACTERIAL RESULTS STATION 4

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 9

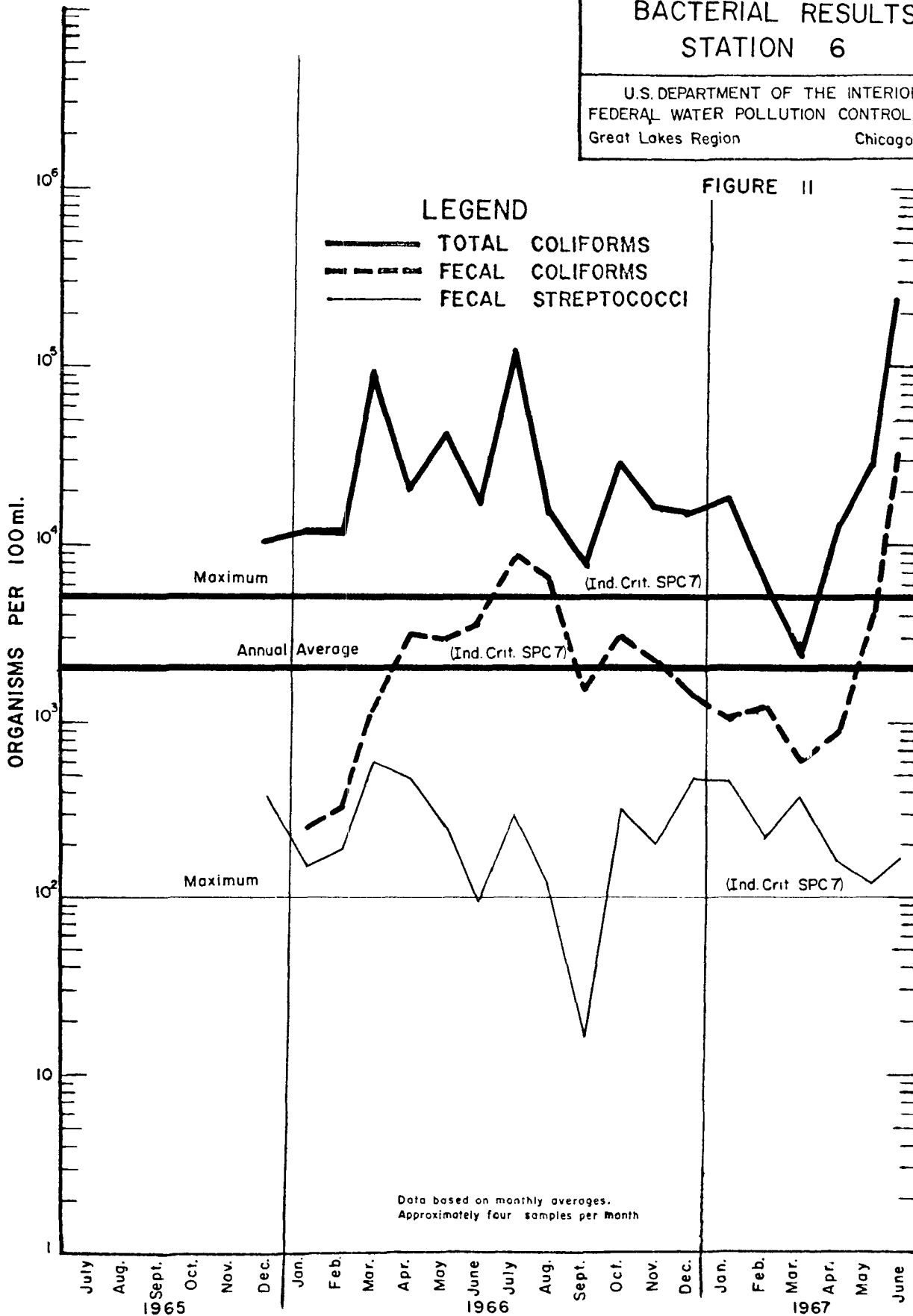


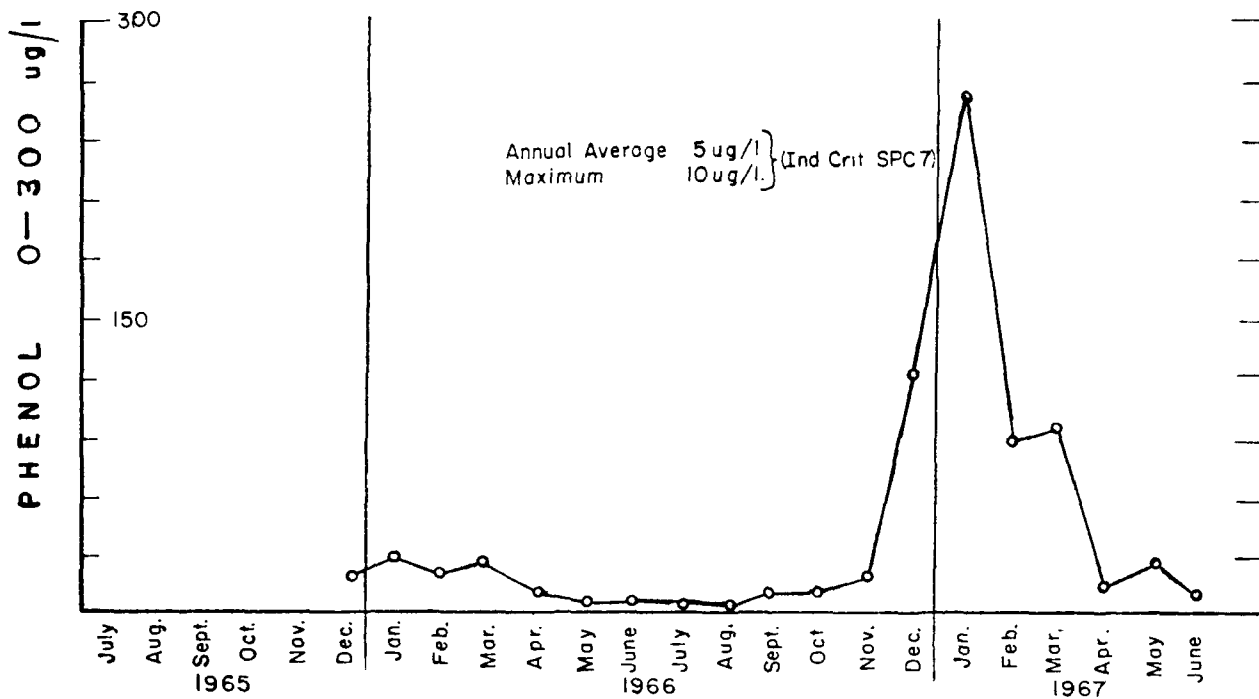
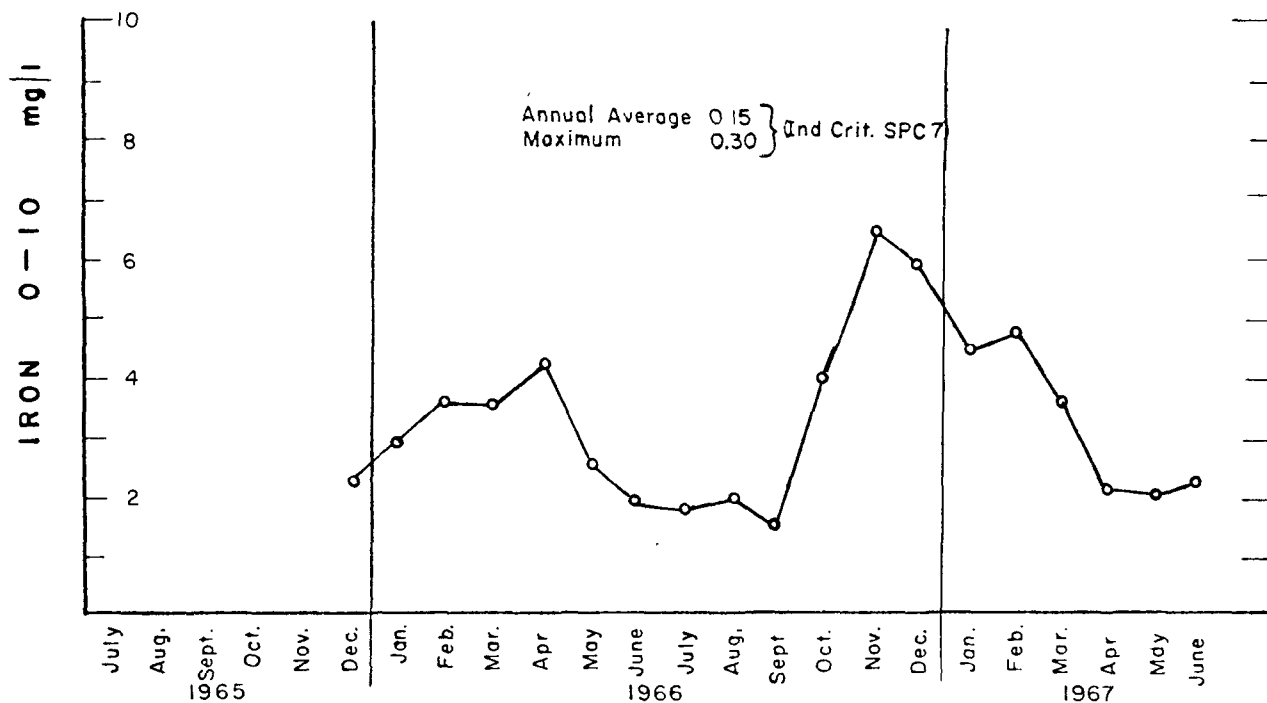
BACTERIAL RESULTS
STATION 5U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

BACTERIAL RESULTS STATION 6

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE II





Data based on monthly averages.
Approximately four samples per month.

FIGURE 12

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 6	
Indiana Harbor East Breakwall Inner Light	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	
Chicago, Illinois	

TABLE 4

CHEMICAL QUALITY OF WATER
STATION 4 - INDIANA HARBOR CANAL AT PIERHEAD LIGHTS-IHC 335.7

Parameter	August 65 - June 66				July 66 - June 67				Standards Adopted by Indiana (Spc 7)		
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.	Ave.
Water Temp. °C	26	11	19	19	29	14	23	25	32.3	-	-
pH	8.0	6.8	-	7.0	8.0	6.8	-	7.1	9.0	7.0	Med. 7.5-8.5
Conductivity umho/cm	460	385	419	420	485	301	385	395			
Alkalinity mg/l	-	-	-	-	109	51	87	91			
DO	6.60	2.05	3.77	3.50	7.20	0.90	3.42	3.10		2.0	4.0
BOD	9.1	2.4	4.1	3.9	7.0	2.8	4.2	3.9			
COD	126	0	22	14	58	6	9	19			
Sulphates	84	23	60	59	90	36	57	59	75		60
Chlorides	30	21	25	25	35	10	23	22	35		25
MBAS	0.25	0.07	0.17	0.17	0.93	0.10	0.22	0.18	0.5		0.3
NH ₃ -N	5.60	0.75	2.47	2.50	4.7	0.8	2.5	2.4	1.5		1.0
NO ₂ +NO ₃ -N	0.74	0.11	0.35	0.36	0.80	0.10	0.40	0.37			
Org. N	1.74	0.00	0.60	0.60	1.8	0.0	0.7	0.5			
Sol PO ₄	0.19	0.03	0.11	0.10	0.14	0.03	0.06	0.07			
Total PO ₄	0.29	0.08	0.18	0.19	0.44	0.09	0.20	0.24	.10		.05
Iron	5.0	1.5	3.0	2.9	44.0	1.2	5.0	2.6	.30		.15
Cyanide	0.25	0.00	0.04	0.06	0.09	0.02	0.04	0.03	0.1		-
Susp. Solids	107	11	25	14	73	7	20	20			
Dis. Solids	305	215	254	260	295	130	221	224	275		
Phenol ug/l	42	6	17	16	84	5	20	9	10		5
Turbidity units	-	-	-	-	3.4	2.5	-	-			
	Data based on 19 samples				Data based on 20 samples						

NOTE: This station was not sampled during winter months.

TABLE 5

CHEMICAL QUALITY OF WATER
STATION 5 - INDIANA HARBOR AT INNER BREAKWALL LIGHTS-IHC 336.2

Parameter	August 65 - June 66				July 66 - June 67				Standards Adopted by Indiana (Spc 7)	
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.
Water Temp. °C	26	10	18	19	29	12	22	24	32.3	-
pH	7.9	6.8	-	7.0	8.0	6.6	-	7.1	9.0	7.0
Conductivity umho/cm	420	350	384	385	435	330	368	370	-	Med. 7.5-8.5
Alkalinity mg/l	-	-	-	-	94	72	87	89	-	-
DO	6.80	1.85	4.61	3.75	6.40	0.60	3.38	3.35	-	-
BOD	13.0	2.0	3.7	3.1	4.4	2.2	3.1	3.1	-	-
COD	121	8	22	12	31	6	16	17	-	-
Sulphates	81	32	56	54	76	35	50	49	75	60
Chlorides	26	16	22	23	30	16	23	23	35	25
MBAS	0.21	0.10	0.14	0.014	0.32	0.09	0.16	0.14	0.5	0.3
NH ₃ -N	4.40	0.38	1.90	1.90	3.5	1.1	2.0	2.1	1.5	1.0
NO ₂ +NO ₃ -N	0.59	0.12	0.34	0.35	5.00	0.09	0.57	0.31	-	-
Org. N	1.38	0.00	0.38	0.30	1.5	0.0	0.5	0.5	-	-
Sol PO ₄	0.12	0.00	0.07	0.07	0.12	0.03	0.06	0.06	-	-
Total PO ₄	0.31	0.06	0.14	0.14	0.37	0.09	0.19	0.20	.10	.05
Iron	5.60	1.25	2.61	2.55	3.8	1.3	2.5	2.6	.30	.15
Cyanide	0.19	0.00	0.04	0.01	0.14	0.01	0.04	0.03	0.1	-
Susp. Solids	37	3	12	12	210	1	36	13	-	-
Dis. Solids	280	205	239	235	379	175	229	220	275	-
Phenol ug/l	23	0	9	7	41	3	12	11	10	5
Turbidity units	11.2	1.8	6.3	6.2	13.0	1.6	5.1	4.2	-	-
Data based on 19 samples					Data based on 20 samples					

NOTE: This station was not sampled during winter months.

TABLE 6

CHEMICAL QUALITY OF WATER
STATION 6 - INDIANA HARBOR AT EAST BREAKWALL INNER LIGHT
(WATER QUALITY MONITOR STATION)-IHC 336.25

Parameter	January 66 - June 66				July 66 - June 67				Standards Adopted by Indiana (Spc 7)		
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.	Ave.
Water Temp. °C	19	6	12	12	29	3	16	14	32.3	-	-
pH	8.0	6.6	-	7.0	8.0	6.7	-	7.1	9.0	7.0	Med.
Conductivity umho/cm	460	320	372	385	500	280	384	370			7.5-8.5
Alkalinity mg/l	-	-	-	-	115	79	98	99			
DO	8.00	2.80	6.50	7.10	9.10	1.15	6.62	7.00	-	2.0	4.0
BOD	5.6	1.7	3.4	3.6	13.0	1.2	3.9	3.7			
COD	37	4	12	11	72	5	17	14			
Sulphates	77	34	59	66	70	19	46	45	75		60
Chlorides	32	10	21	22	40	9	24	23	35		25
MBAS	0.35	0.08	0.15	0.15	0.30	0.05	0.17	0.15	0.5		0.3
NH ₃ -N	2.80	0.19	1.90	1.90	4.10	0.56	1.85	1.7	1.5		1.0
NO ₂ +NO ₃ -N	0.79	0.12	0.42	0.40	0.80	0.10	0.41	0.41			
Org. N	2.1	0.2	0.6	0.5	2.7	0.0	0.5	0.4			
Sol PO ₄	0.30	0.03	0.09	0.08	0.91	0.01	0.07	0.06			
Total PO ₄	0.34	0.08	0.14	0.13	1.40	0.08	0.23	0.18	.10		.05
Iron	8.1	1.3	3.1	3.0	15.0	0.8	3.3	2.7	.30		.15
Cyanide	0.20	0.00	0.08	0.07	0.36	0.00	0.17	0.03	0.1		-
Susp. Solids	46	8	17	15	119	1	20	13			
Dis. Solids	265	200	239	240	270	128	224	221	275		
Phenol ug/l	45	1	16	14	675	2	34	13	10		5
Turbidity units	-	-	-	-	55.0	1.6	13.8	17.0			
Data based on 26 samples					Data based on 49 samples						

Station 7 - Grand Calumet River at the Indiana Harbor Belt R.R. Bridge

This station is located on the Grand Calumet River in Illinois within a few hundred yards of the Illinois-Indiana state line and reflects the amount of pollution crossing the state line. It is one of the water quality control points established by the Calumet Area Technical Committee.

The dry weather flow in this portion of the stream consists of effluent from the Hammond sewage treatment plant and industrial effluent from a steel mill and several smaller industries.

Figure 13 on page 45 indicates that the December 1966 increase in bacterial levels reported in the previous report continued into the first week of 1967 after which the counts dropped one order of magnitude to the levels achieved between July and November of 1966. The higher counts noted in June 1967 once again reflected the results of combined sewer overflows. Figure 13 also shows that at no time did the counts meet the standards.

Figures 14 and 15 on pages 46 and 47 indicate the concentrations of dissolved oxygen, total phosphate, ammonia and dissolved solids at Station 7. The dissolved oxygen, normally high in winter in an unfrozen stream, dropped sharply during December and January. It is evident that there was heavy sewage pollution during December 1966. The reported bypassing by the Hammond sewage treatment plant is the most likely cause.

Table 7 on page 48 compares the actual water quality with the criteria established by the Calumet Area Conferees and proposed by both the states of Indiana and Illinois. The criteria for water temperature and pH were met. Dissolved oxygen increased during the last twelve months so that the criteria were met except on one occasion when the minimum value of 0.50 mg/l was recorded. The mean for the period May 1966 to September 1966 was 3.03 mg/l, which just meets the criterion of 3.0 mg/l. The criteria for BOD, chlorides, MBAS, ammonia, dissolved solids and phenols were violated many times.

The subjective criteria requiring freedom from floating oil, floating solids and debris, sludge banks and obnoxious odors were often violated. Samplers reported these conditions on many occasions.

Samples from this station were composited on a monthly basis and analyzed for heavy metals. The following table compares the average values for July to December 1966 and January to June 1967.

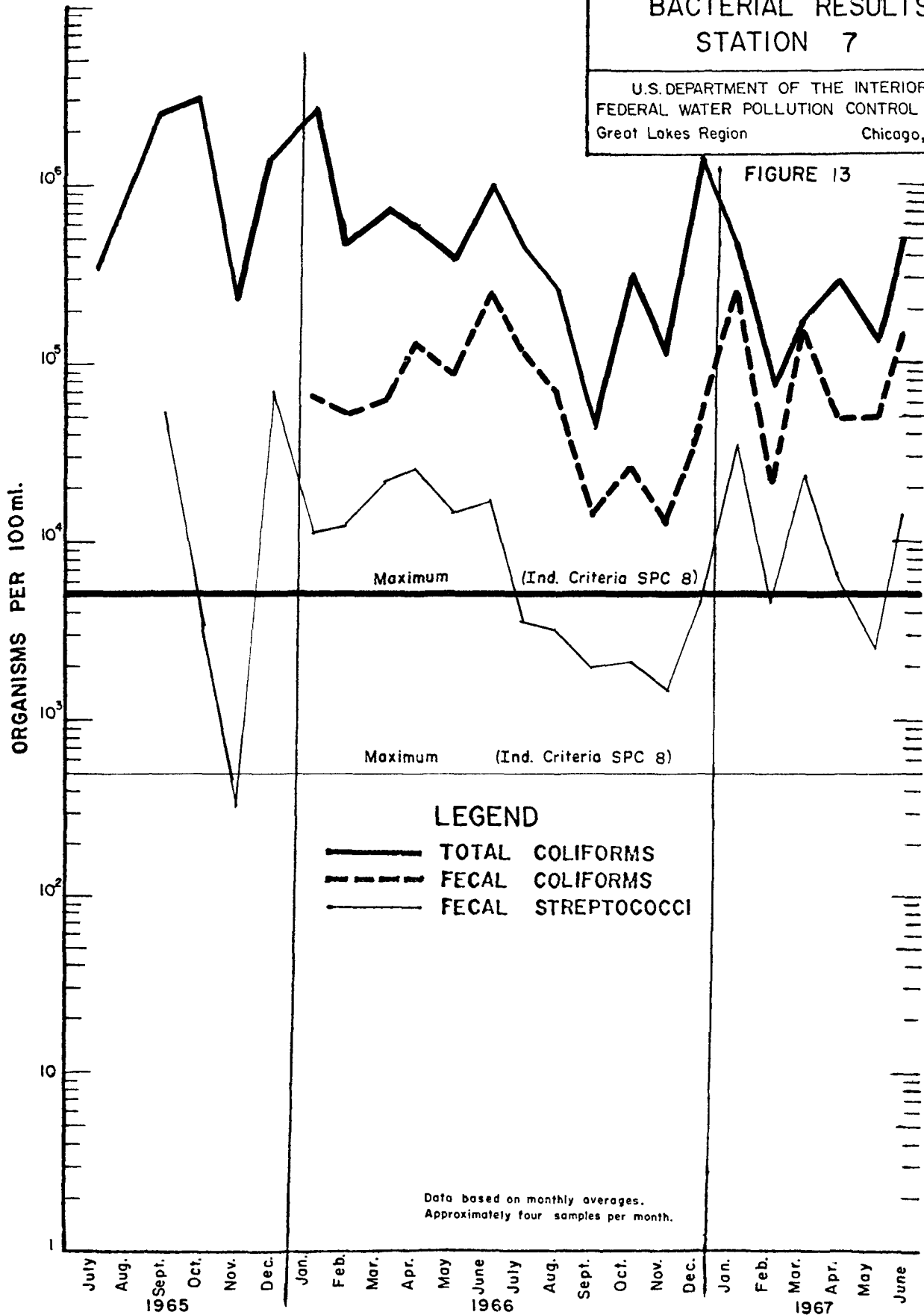
	<u>July-Dec 1966</u>	<u>Jan-June 1967</u>
Cadmium	less than 0.005 mg/l	less than 0.005 mg/l
Copper	0.03 "	0.02 "
Chromium (total)	9.3 "	8.6 "
Potassium	less than 0.005 "	less than 0.005 "
Manganese	0.09 "	0.22 "
Lead	less than 0.005 "	0.04 "
Nickel	0.01 "	0.02 "
Zinc	less than 0.04 "	0.10 "
Sodium	79	88
Arsenic	less than 1 ug/l	8 ug/l

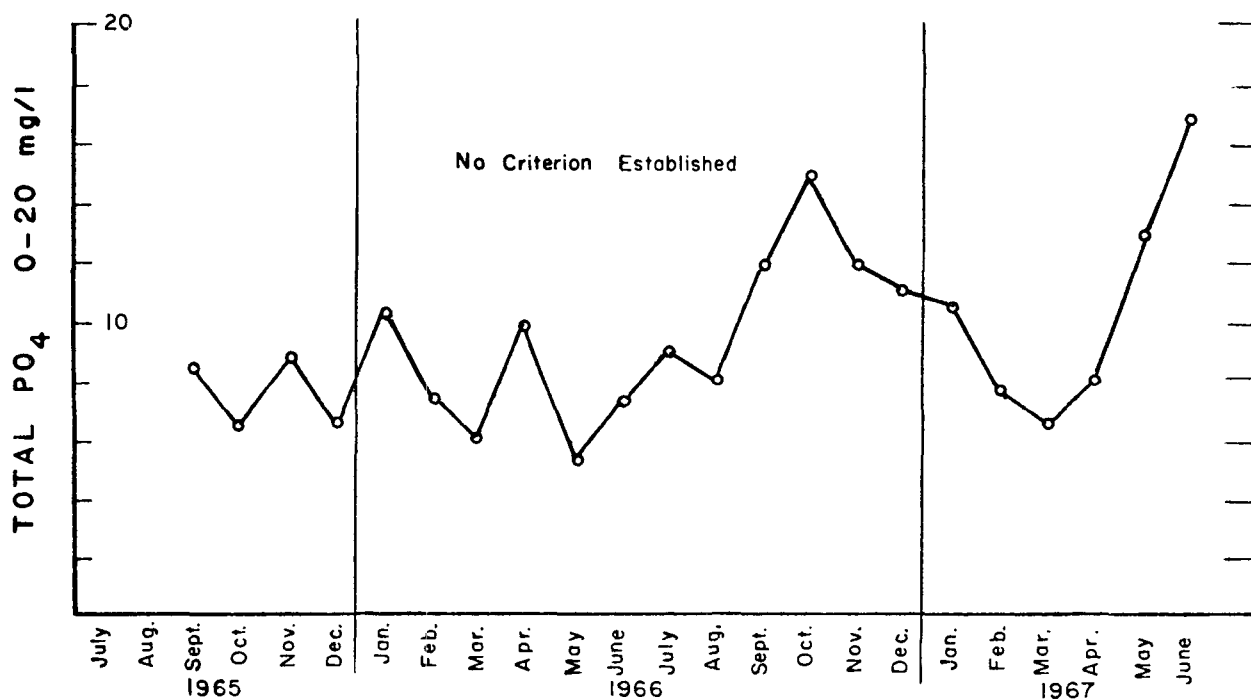
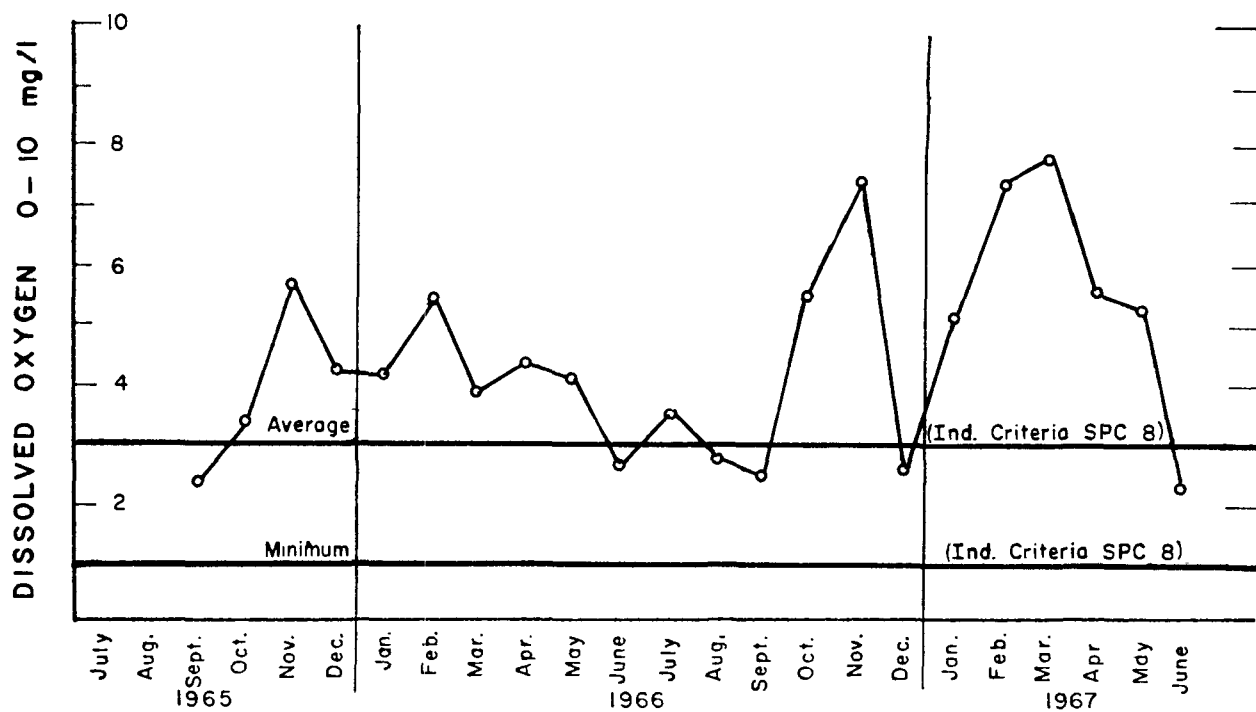
CALUMET AREA SURVEILLANCE PROJECT

BACTERIAL RESULTS
STATION 7

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 13

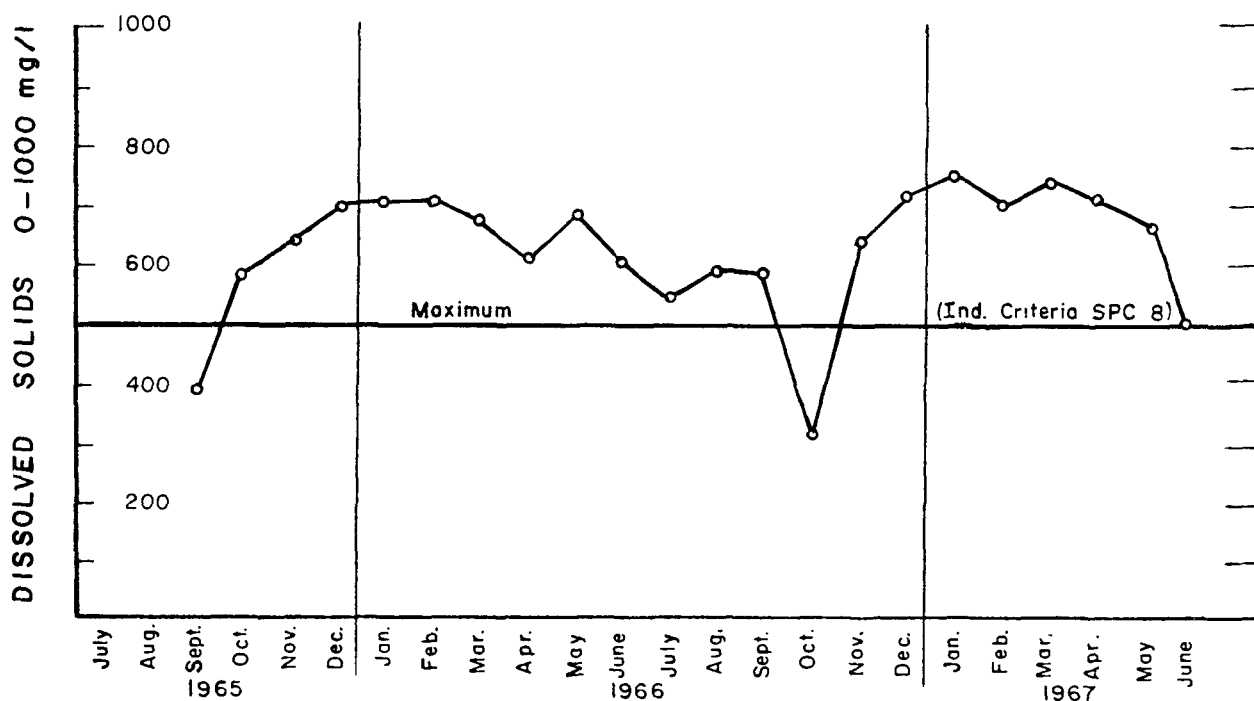
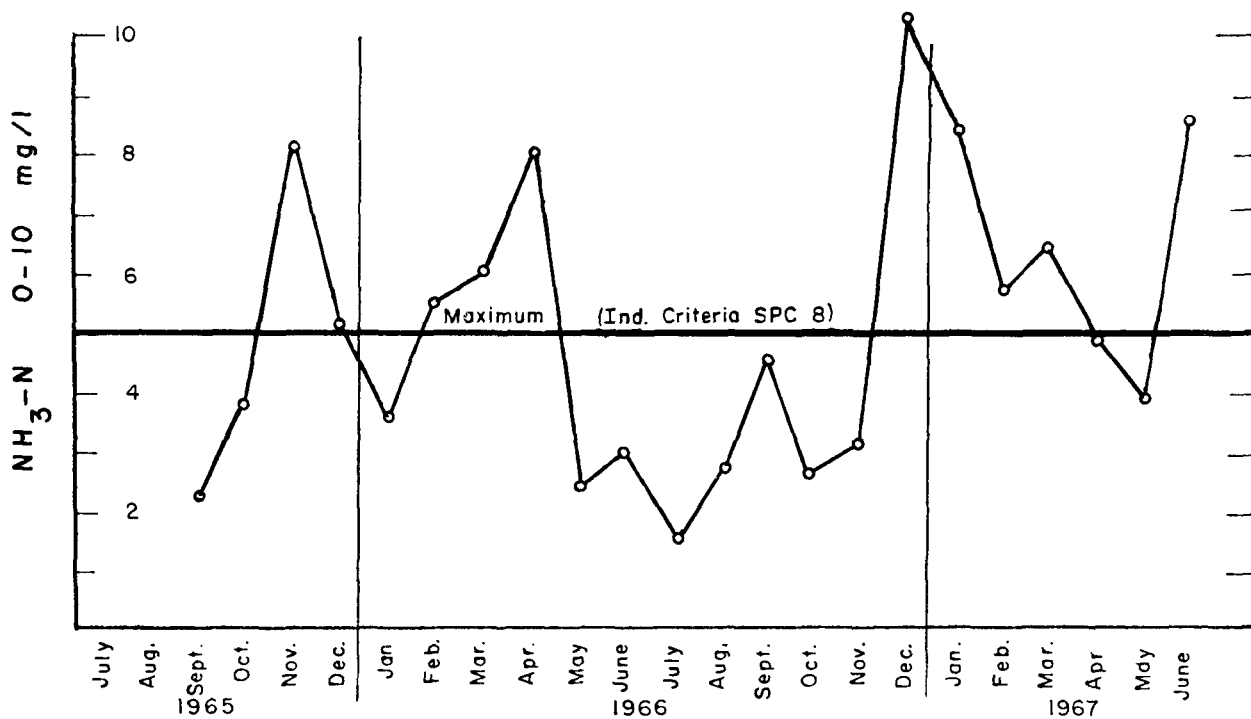




Data based on monthly averages.
Approximately four samples per month.

FIGURE 14

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 7 Grand Calumet River at Indiana Harbor Belt R.R. Bridge	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month.

FIGURE 15

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 7	
Grand Calumet River at Indiana Harbor Belt R.R. Bridge	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois

TABLE 7

CHEMICAL QUALITY OF WATER

STATION 7 - GRAND CALUMET RIVER AT INDIANA HARBOR BELT R.R. BRIDGE-GC 328.5

Parameter	Sept. 65 - June 66				July 66 - June 67				Standards Adopted by Conferees and by Indiana (Spc 8)		
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.	Ave.
Water Temp. °C	23	3	12	11	28	0	14	14	32.3	-	-
pH	8.2	6.5	-	7.2	7.3	6.5	-	7.1			Med. 6.5-9.C
Conductivity umho/cm	1150	410	922	1020	1500	365	1004	1000			
Alkalinity mg/l	-	-	-	-	253	84	181	177			
DO	8.00	0.00	4.05	4.20	11.60	0.50	4.87	5.05		1.0	3.0 (May-Sept)
BOD	104.0	3.2	19.0	16.0	89.0	2.6	16.4	10.0	10	-	-
COD	224	15	63	52	160	13	59	53			
Sulphates	282	52	182	190	430	95	184	180			
Chlorides	180	22	87	85	212	29	90	87	125	-	75
MBAS	1.80	0.15	0.70	0.63	2.80	0.37	0.71	0.66	0.5		
NH ₃ -N	12.00	0.55	4.67	3.60	14.0	0.3	4.9	4.7	5.0	-	-
NO ₂ +NO ₃ -N	15.0	1.1	5.8	4.9	14.0	0.2	4.9	4.6			
Org. N	6.6	0.05	2.11	1.80	11.9	0.5	2.4	1.9			
Sol PO ₄	11.0	0.3	4.1	5.3	22.0	0.7	8.2	8.2			
Total PO ₄	16.0	0.9	7.9	7.3	22.0	4.3	10.7	10.0			
Iron	17.00	0.27	2.08	1.30	8.10	0.21	1.23	0.77			
Cyanide	0.12	0.00	0.01	0.00	0.05	0.00	0.01	0.01			
Susp. Solids	155	5	34	27	102	4	22	18			
Dis. Solids	770	185	643	680	925	90	620	610	500		
Phenol ug/l	90	3	21	15	66	3	15	11			
Turbidity units	19.5	1.8	6.2	5.1	30.0	1.0	8.5	8.0			
Data based on 44 samples					Data based on 50 samples						

Station 8 - Little Calumet River at Wentworth Ave.

The Wentworth Avenue Station monitors the wastes in the Little Calumet River flowing from Indiana to Illinois. The station is located approximately one-half mile downstream from the state line and is one of the control points established by the Calumet Area Technical Committee.

Figure 16, page 50 indicates that the bacterial counts at Station 8 did not meet the water quality standards. The primary problem on the Little Calumet River is combined sewer overflows; therefore, the heavy rainfall during April and May caused the bacterial counts to rise sharply. The completion of the south side interceptor sewer which will direct much of the sewage to the Hammond Sewage Treatment Plant should improve the condition of the river.

Figures 17 and 18 and Table 8 on pages 51, 52 and 53 show that there has been little significant variation in the remaining parameters. Dissolved oxygen is slightly higher in 1967 but the minimum of 2.0 mg/l was violated three times during June. BOD, MBAS, ammonia, cyanide and phenols are often higher than the maximum permitted by the criteria.

Suspended material in the stream varies widely with flow. During high flow periods suspended material can be over 800 mg/l and when the stream is low, less than 10 mg/l. The average, however, has not changed significantly since 1965.

The criteria call for the stream to be substantially free of floating oil, floating solids and sludge banks. Floating oil and solids have frequently been observed during 1967 and gas bubbles indicate the presence of sludge banks.

Biological sampling of the river bottom at this station revealed a very large population of sludgeworms but little else which indicates extensive organic pollution.

Samples from this station were composited on a monthly basis and analyzed for heavy metals. The following table compares the average values for July to December 1966 and January to June 1967.

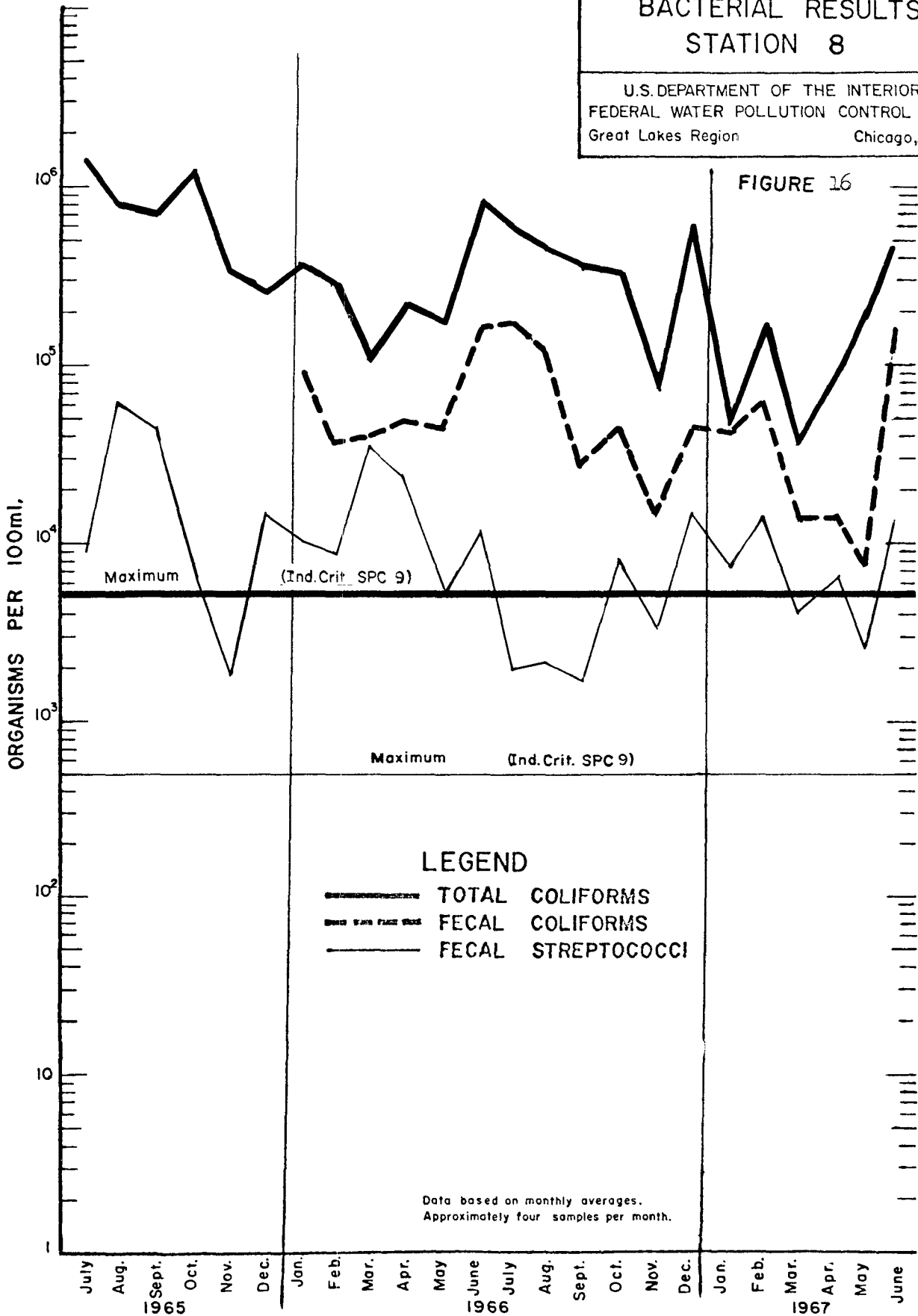
	<u>July-Dec 1966</u>	<u>Jan-June 1967</u>
Cadmium	less than 0.005 mg/l	less than 0.005 mg/l
Copper	0.07 "	0.03 "
Potassium	6.8 "	5.3 "
Chromium (total)	0.06 "	0.02 "
Manganese	0.23 "	0.23 "
Lead	0.02 "	0.04 "
Nickel	0.20 "	0.08 "
Zinc	0.03 "	0.09 "
Sodium	68 "	40 "
Arsenic	less than 1 ug/l	8 ug/l

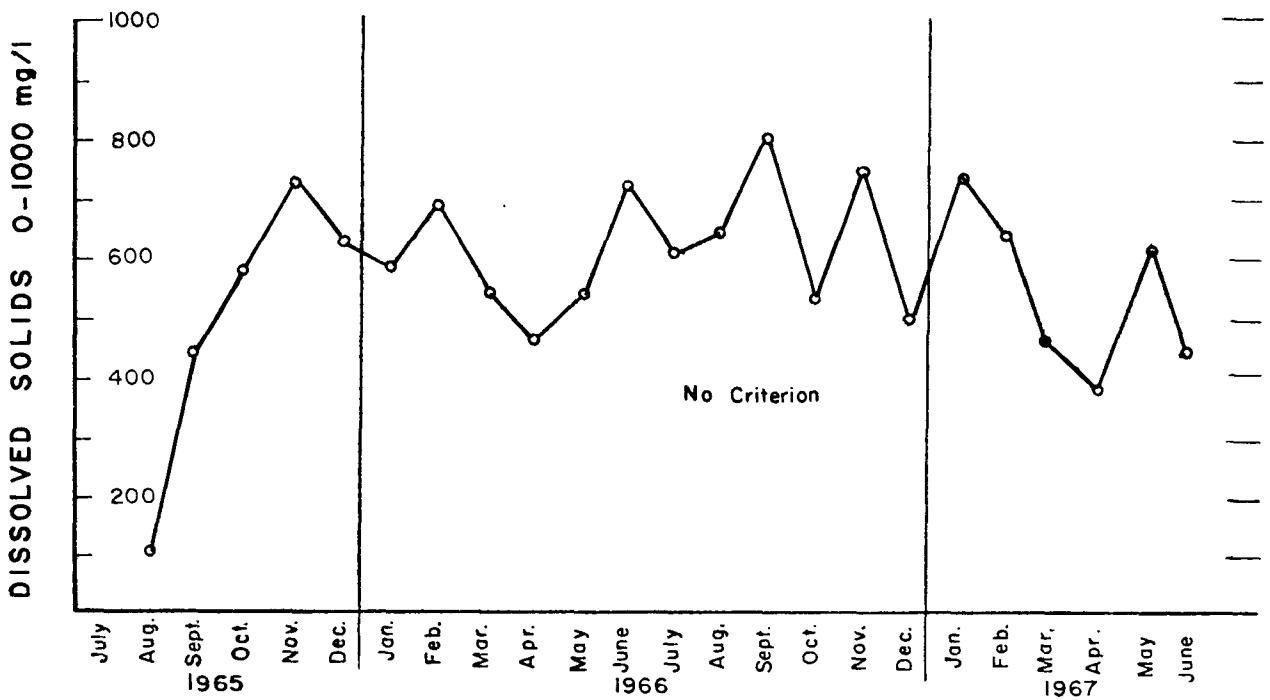
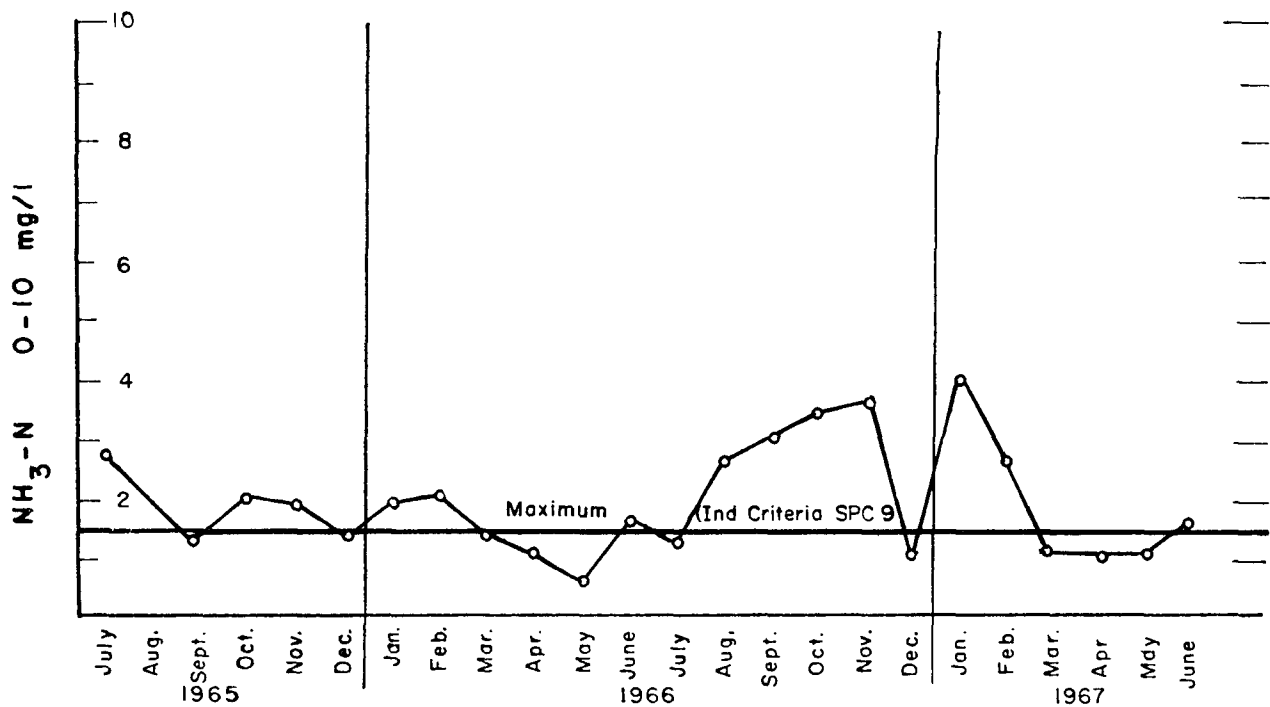
Most of these changes are not significant but the one for total chromium is interesting because Simmons Co., the only industry upstream of this sampling station, discharges chromium as part of their wastes.

BACTERIAL RESULTS STATION 8

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois

FIGURE 16

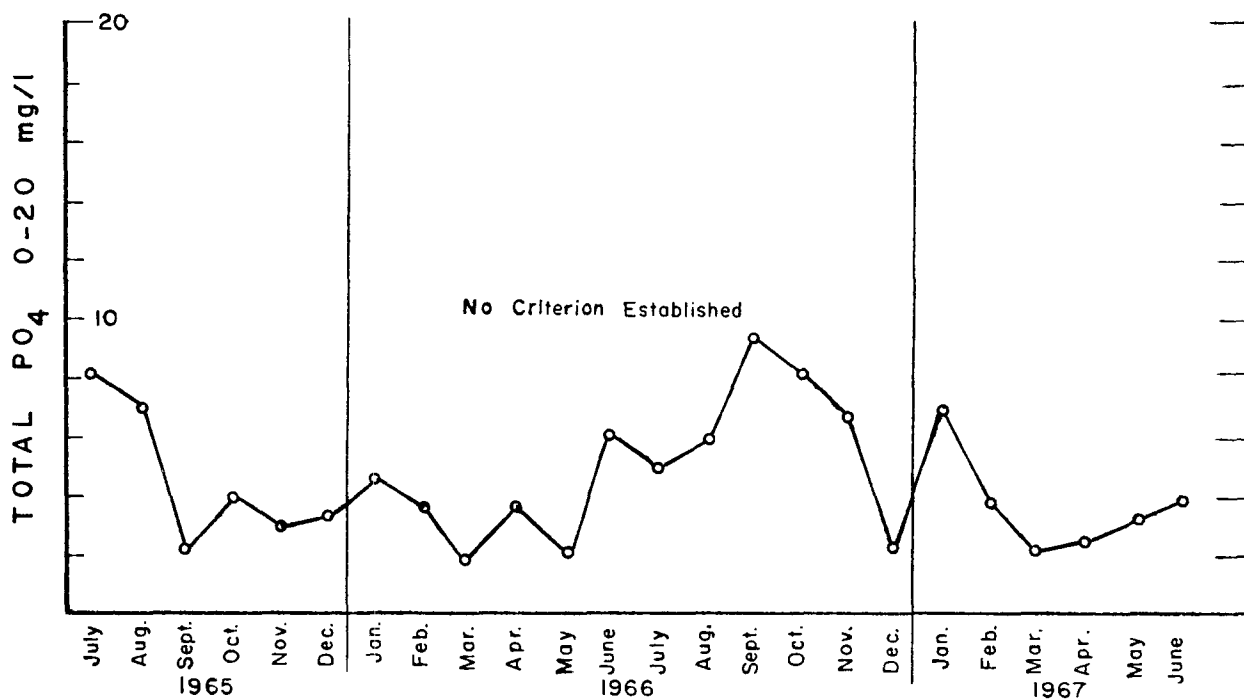
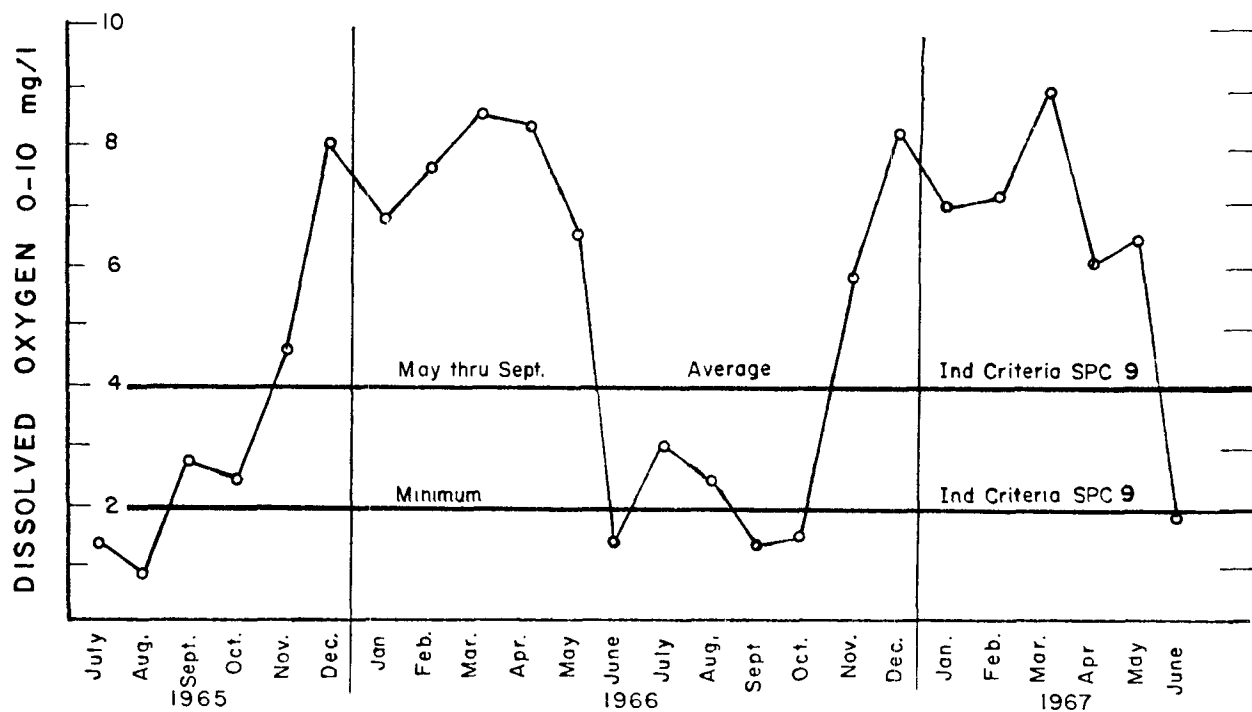




Data based on monthly averages.
Approximately four samples per month

FIGURE 17

CALUMET AREA SURVEILLANCE PROJECT
CHEMICAL RESULTS STATION 8 Little Calumet River at Wentworth Avenue Bridge
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month.

FIGURE 18

CALUMET AREA SURVEILLANCE PROJECT
CHEMICAL RESULTS STATION 8 Little Calumet River at Wentworth Avenue Bridge
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois

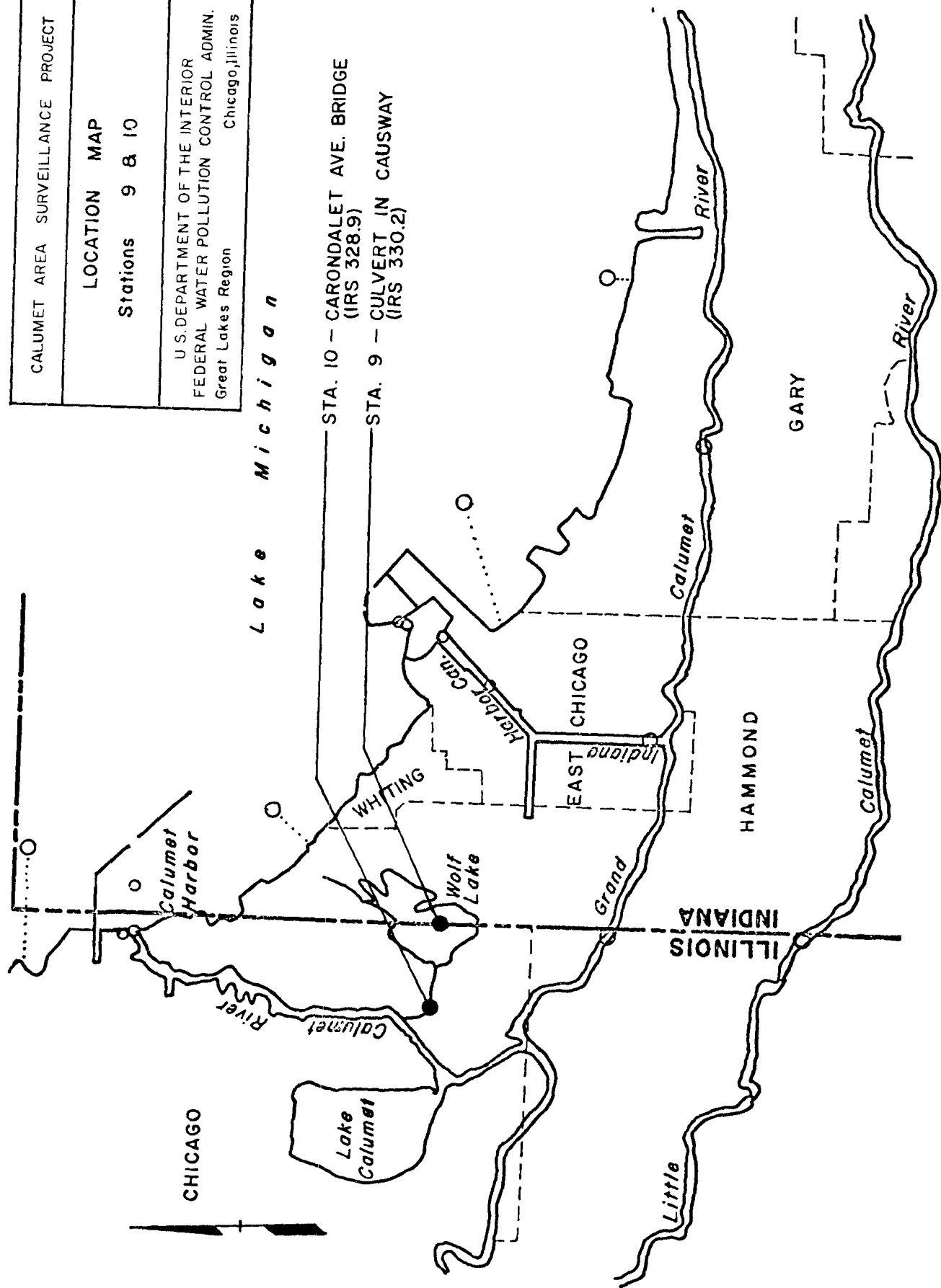
TABLE 8

CHEMICAL QUALITY OF WATER

STATION 8 - LITTLE CALUMET RIVER AT WENTWORTH AVENUE- LC 332.3

Parameter		July 65 - June 66			July 66 - June 67			Standards Adopted by Conferees (Spc 9)	
		Max.	Min.	Mean	Median	Max.	Min.	Mean	Median
Water Temp.	°C	24	0	11	10	30	0	11	9
pH		8.8	7.0	-	7.4	8.1	6.7	-	7.2
Conductivity	umho/cm	1220	425	808	765	1360	345	925	960
Alkalinity	mg/l	-	-	-	-	307	65	203	211
DO	"	11.00	0.00	4.86	4.70	11.85	0.10	4.90	4.60
BOD	"	35.0	3.9	9.6	7.8	17.0	4.3	9.1	9.0
COD	"	151	6	48	41	76	19	46	47
Sulphates	"	310	57	181	178	480	30	204	202
Chlorides	"	55	17	41	44	80	18	51	50
MBAS	"	0.76	0.15	0.28	0.25	1.10	0.19	0.44	0.40
NH ₃ -N	"	3.70	0.30	1.68	1.60	7.30	0.30	2.21	1.80
NO ₂ +NO ₃ -N	"	5.40	0.04	1.69	1.50	9.30	0.10	1.85	1.30
Org. N	"	6.23	0.13	2.14	1.50	7.2	0.3	1.74	1.6
Sol PO ₄	"	9.71	0.00	2.24	1.90	13.0	0.46	41	4.1
Total PO ₄	"	14.28	0.22	4.05	3.40	14.0	1.2	5.0	4.8
Iron	"	3.80	0.44	1.13	0.91	32.00	0.28	2.11	0.95
Cyanide	"	0.18	0.00	0.01	0.00	0.66	0.00	0.15	0.00
Susp. Solids	"	980	10	97	31	856	5	65	28
Dis. Solids	"	860	109	580	610	907	194	602	600
Phenol	ug/l	59.0	0.0	11.7	9.0	65.0	0.3	10.3	7.0
Turbidity	units	103.0	1.2	15.6	9.0	470.0	1.0	23.0	10.0
		Data based on 50 samples			Data based on 51 samples				

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 9 & 10
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Stations 9 and 10 - Wolf Lake and Outlet

Wolf Lake, which is located on the Indiana-Illinois state line, has been sampled at two points. Station 9 is directly on the state line which runs along a causeway that bisects the lake. This station monitors the quality of the water crossing the state line and has been established as a control point by the Calumet Area Technical Committee. Station 10 is located on the Wolf Lake outlet at Carondolet Avenue about 3000 feet downstream from Wolf Lake and monitors the quality of the water leaving the lake.

The bacterial quality of Wolf Lake and its outlet was good. At the state line bacterial counts met the criteria on all occasions during the first six months of 1967. This is shown on Figure 19, page 56. The outlet met the criteria on all but one occasion in June when there was a heavy rainfall on the sampling day. This is shown on Figure 20, page 57. The beach at 121st Street in Hammond has been sampled twice each week since May 18, 1967 for bacterial quality, as was indicated on Table B-1 on page 12. It met the criteria on all occasions.

The dissolved oxygen concentration in the lake and its outlet was adequate for all uses. The minimum, as Tables 9 and 10, pages 60 and 61 indicate, found in the lake over the past two years was 7.1 mg/l and 5.9 mg/l in the outlet.

Foam was observed on the lake on several occasions. Analyses of this foam revealed that the MBAS concentration was no more than that of the surrounding water and was far below the amount to cause foaming. It was concluded, therefore, that the foam was due to natural causes. Figures 21 and 22 show the concentrations of MBAS and phosphates.

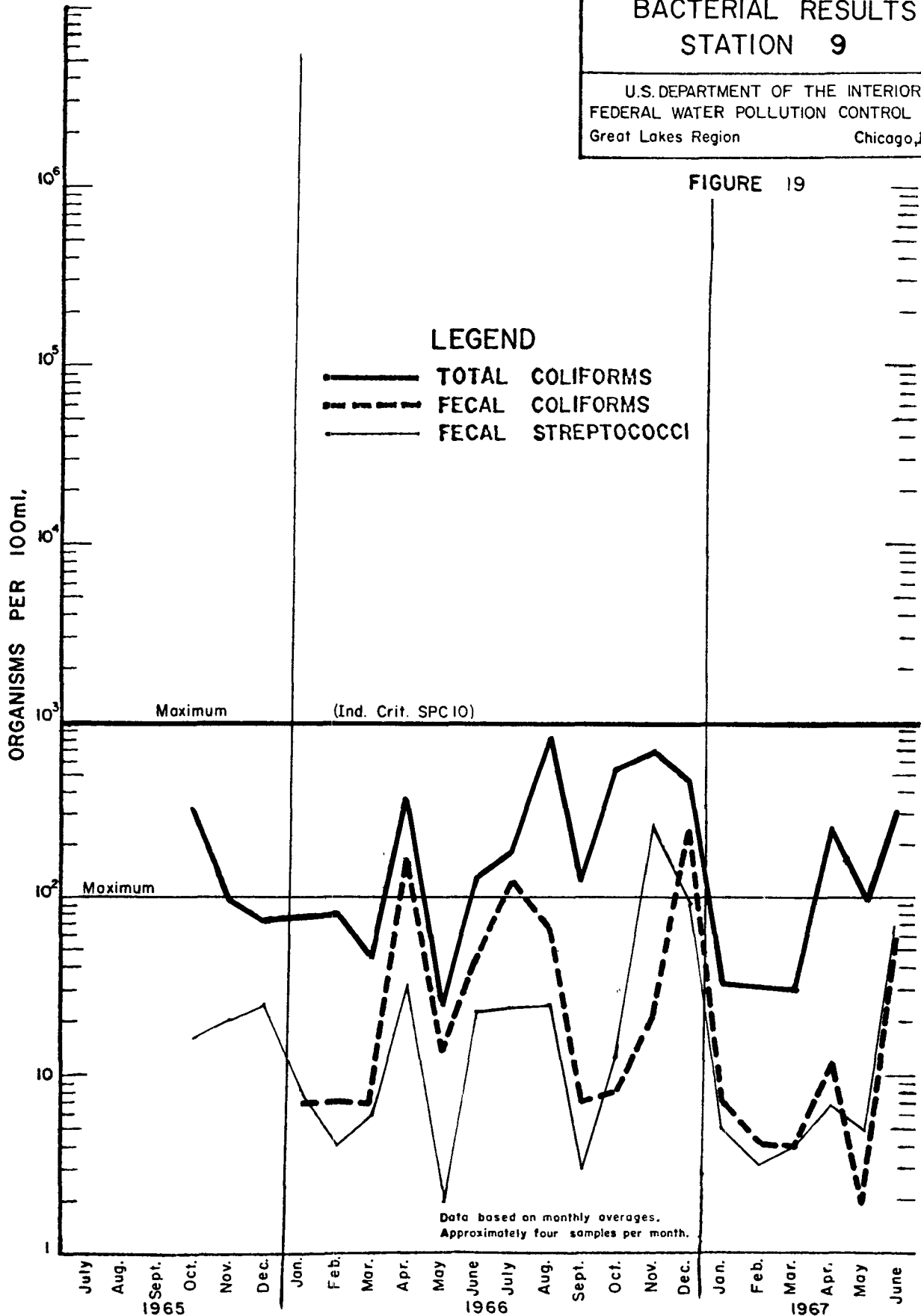
The concentrations of ammonia and phosphates in the lake were above the standards.

On May 16, 1967 the concentration of phenolic compounds in the lake increased from its normal level of less than 5 ug/l to 57 ug/l and did not subside until June. On May 31, 1967 a discharge of dark brown material was observed coming from an outfall just south of the Indianapolis Boulevard bridge over Wolf Lake. The outfall was sampled and 74 ug/l of phenol compounds were found. The source of this discharge is being investigated.

BACTERIAL RESULTS STATION 9

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

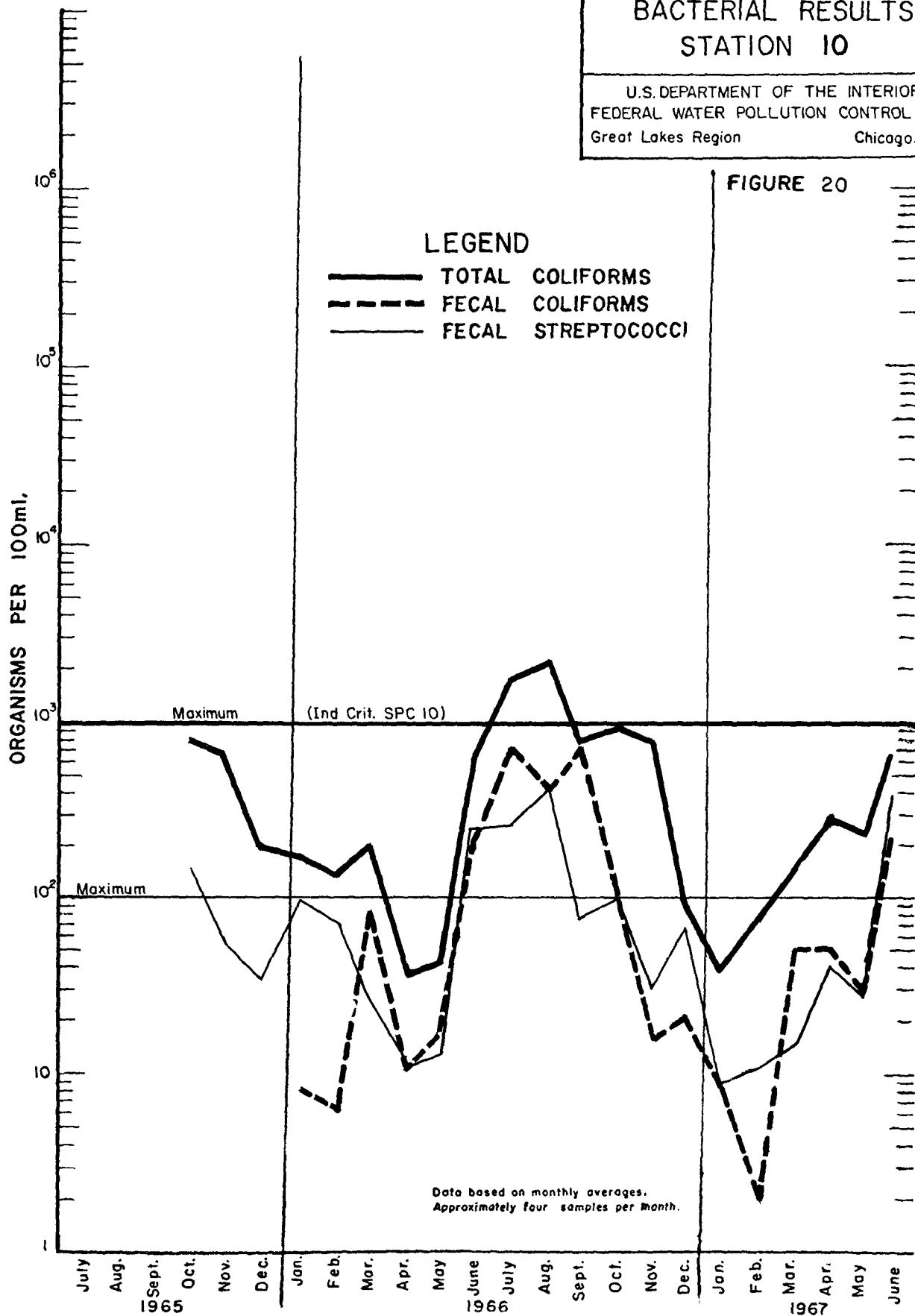
FIGURE 19

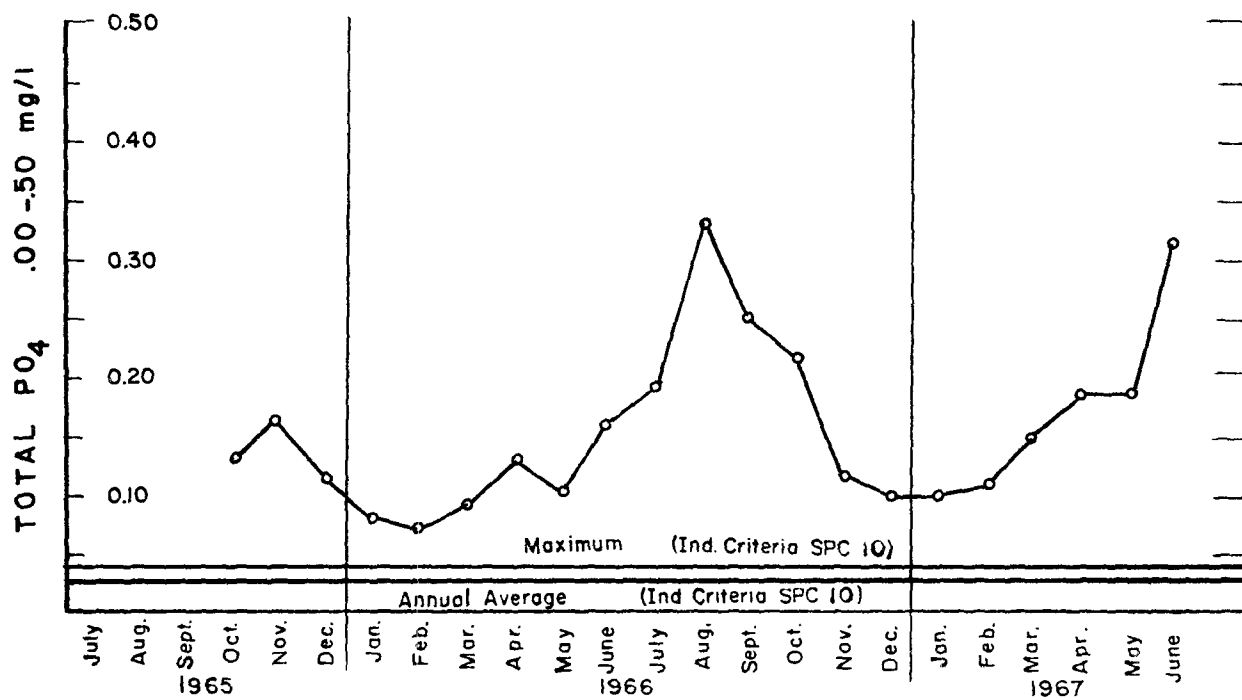
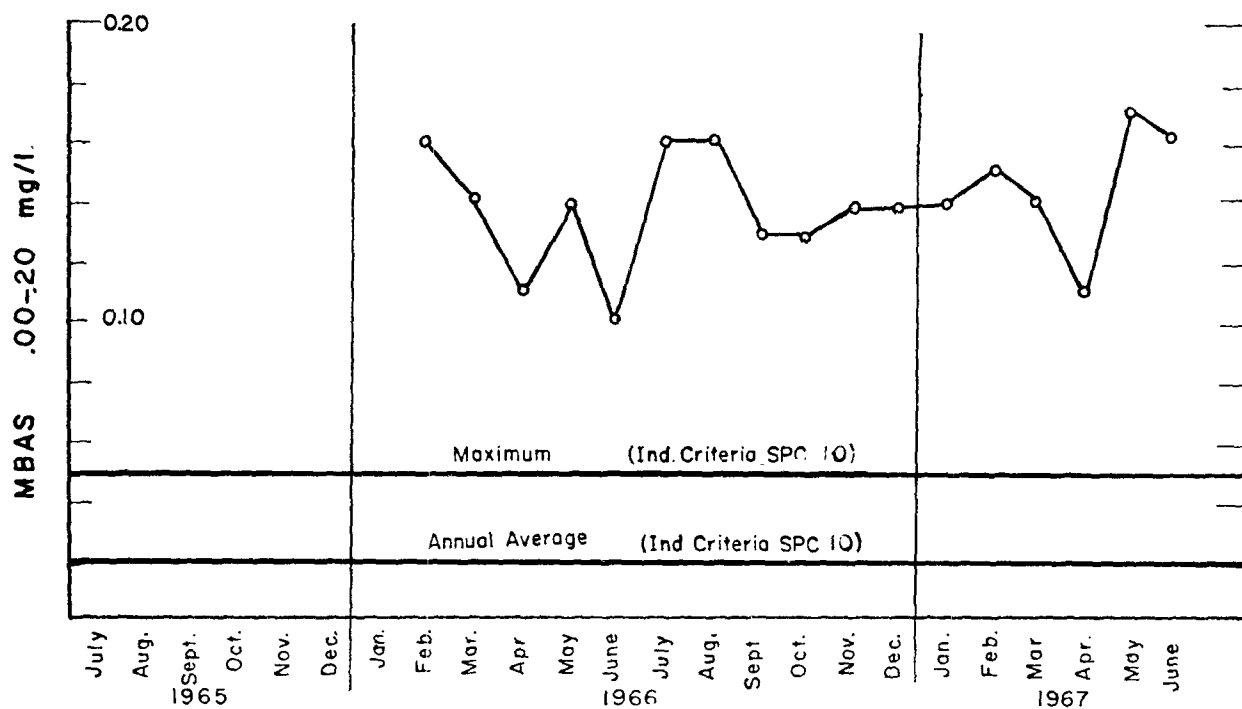


BACTERIAL RESULTS STATION 10

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 20

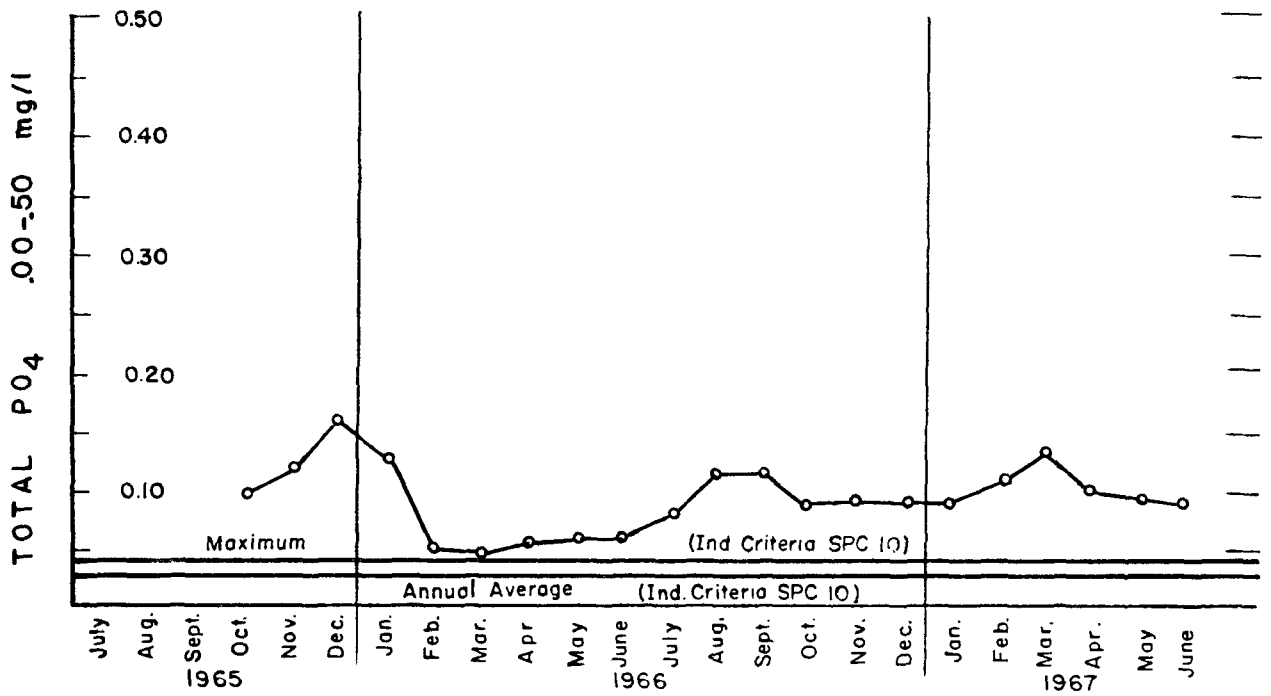
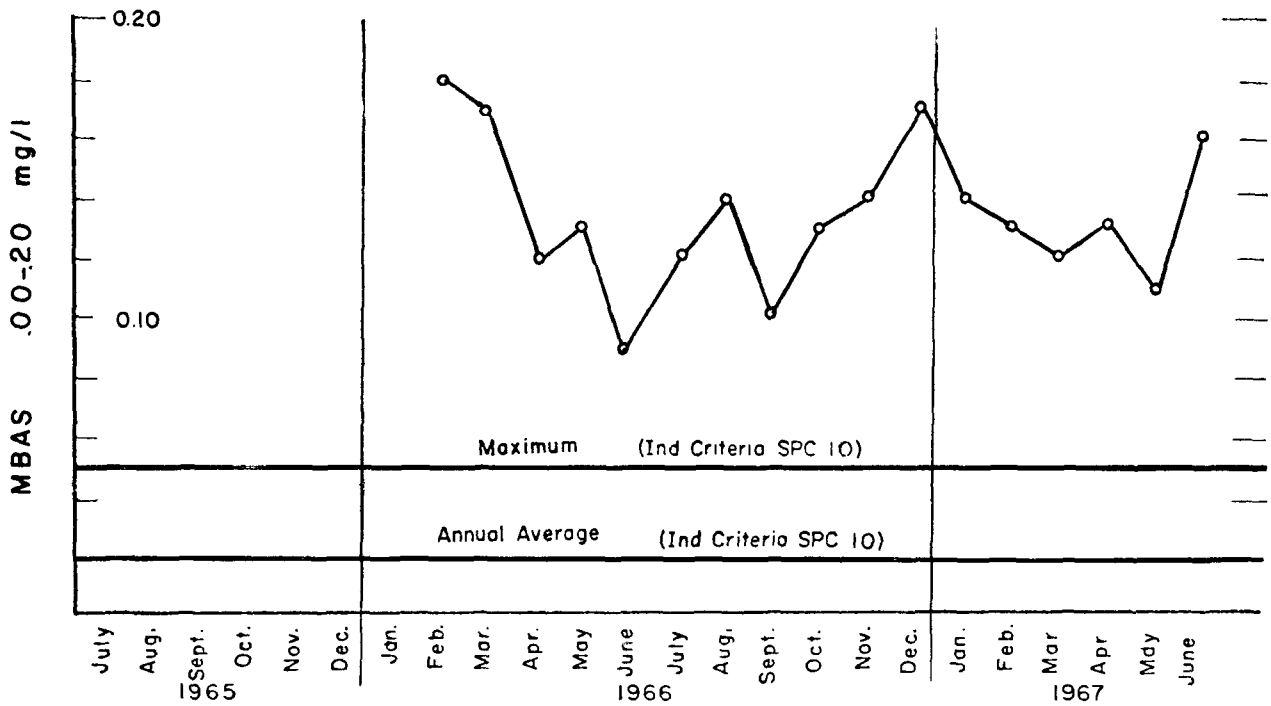




Data based on monthly averages.
Approximately four samples per month.

FIGURE 21

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 9	
Wolf Lake at State Line	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month.

FIGURE 22

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 10 Wolf Lake Outlet at Carondelet Avenue	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN Great Lakes Region Chicago, Illinois	

TABLE 9

CHEMICAL QUALITY OF WATER
STATION 9 - WOLF LAKE AT CULVERT ON INDIANA-ILLINOIS STATE LINE-IRS 330.2

Parameter		October 65 - June 66				July 66 - June 67				Standards Adopted by Indiana (Spc 10)	
		Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min. Ave.
Water Temp.	°C	24	0	7	4	29	0	10	9	29.4	- -
pH		9.8	7.5	-	8.0	9.6	6.9	-	7.8		Med. 7.0-9.0
Conductivity	umho/cm	460	350	414	400	510	335	406	395		
Alkalinity	mg/l	-	-	-	-	450	69	128	116		
DO	"	15.0	7.7	11.5	11.8	14.20	7.10	10.45	10.52		80% Sat. 90% Sat.
BOD	"	7.8	1.2	3.7	3.5	11.0	1.6	4.9	4.5		
COD	"	134.0	6.4	25.1	19.0	55	15	29	26		
Sulphates	"	69	45	54	54	70	22	48.8	48		
Chlorides	"	38	27	31	30	38	20	28.9	28		
MBAS	"	0.19	0.10	0.12	0.11	0.30	0.07	0.14	0.12	0.05	0.02
NH ₃ -N	"	0.56	0.02	0.27	0.26	0.73	0.03	0.25	0.25	0.12	0.05
NO ₂ +NO ₃ -N	"	1.20	0.03	0.44	0.39	0.99	0.02	0.31	0.29		
Org. N	"	1.19	0.45	0.74	0.70	2.0	0.55	1.1	1.0		
Sol PO ₄	"	0.29	0.00	0.04	0.03	0.36	0.05	0.12	0.10		
Total PO ₄	"	0.34	0.04	0.12	0.11	0.48	0.07	0.18	0.17	0.04	0.03
Iron	"	0.97	0.04	0.25	0.22	1.6	0.05	0.33	0.25		
Cyanide	"	0.35	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.025	
Susp. Solids	"	51	2	12	9	65	2	15	14		
Dis. Solids	"	320	180	267	265	342	184	246	244		
Phenol	ug/l	20	0	3	3	57	0	5.7	3		
Turbidity	units	4.2	0.5	2.3	2.1	16	1.3	5.5	5.5		
Data based on 37 samples						Data based on 51 samples					

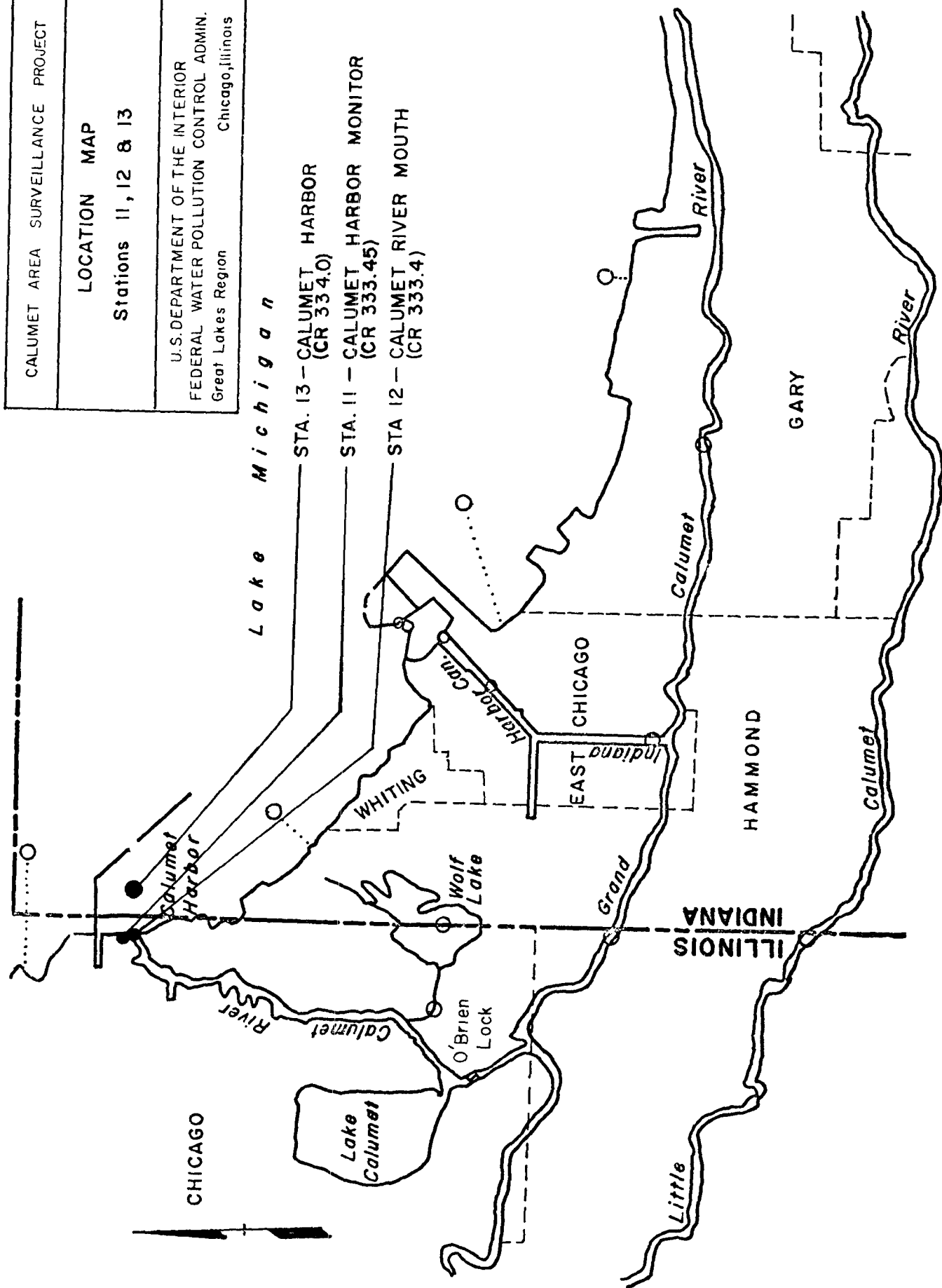
TABLE 10

CHEMICAL QUALITY OF WATER

STATION 10 - WOLF LAKE CHANNEL AT CARONDOLET AVE.-IRS 328.9

Parameter		October 65 - June 66				July 66 - June 67				Standards Adopted by Indiana for Wolf L. Ave.	
		Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.
Water Temp.	°C	25	0	7	4	28	0	11	10	29.4	-
pH		8.8	7.9	-	8.4	8.8	7.7	-	8.3		
Conductivity	umho/cm	545	370	463	460	550	340	437	425		
Alkalinity	mg/l	-	-	-	-	138	79	107	105		
DO	"	14.0	5.9	10.8	11.4	13.95	5.95	10.02	10.00		
BOD	"	5.0	1.7	2.8	2.6	7.6	1.9	3.3	3.2		
COD	"	138.0	0.8	22.0	18.0	38	11	24.8	25		
Sulphates	"	92	45	73	74	82	32	66.2	68		
Chlorides	"	37	30	34	35	42	21	33.8	34		
MBaS	"	0.24	0.09	0.13	0.12	.35	.08	.13	.12	0.05	0.02
NH ₃ -N	"	0.67	0.06	0.25	0.25	.78	.01	.22	.19	0.12	0.05
NO ₂ +HNO ₃ -N	"	0.67	0.10	0.35	0.32	.97	.01	.28	.26		
Org. N	"	1.11	0.35	0.66	0.61	1.05	0.28	0.70	0.70		
Sol PO ₄	"	0.24	0.00	0.05	0.03	0.15	0.02	0.07	0.07		
Total PO ₄	"	0.49	0.03	0.09	0.06	0.29	0.06	0.09	0.09	0.04	0.03
Iron	"	0.77	0.04	0.22	0.22	.54	.04	.32	.20		
Cyanide	"	0.02	0.00	0.00	0.00	.01	.00	.00	.00	0.025	
Susp. Solids	"	65	2	21	19	58	2	16.6	15		
Dis. Solids	"	315	245	287	290	343	172	268	270		
Phenol	ug/l	15	0	6	7	30	1	8.7	8		
Data based on 37 samples						Data based on 51 samples					

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 11, 12 & 13
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois



Stations 11, 12 and 13 - Calumet Harbor

Calumet Harbor was sampled at three points. Station 11 is located at the mouth of the Calumet River immediately adjacent to the north pierhead light. Station 12 is located at the mouth of the Calumet River at midstream. The purpose of these stations is to monitor the quality of the water entering the river from the harbor. Station 13 is located in mid-harbor approximately 3500 feet from the mouth of the river. This station monitors the quality of the water flowing from Lake Michigan to the river. Stations 12 and 13 require a boat for sampling and therefore can be sampled only when weather permits. A comparison of the data from Stations 11 and 12 revealed that they are essentially the same in terms of water quality. Sampling at Station 12 has, therefore, been discontinued as of July 1967.

Operation of the O'Brien Lock shown on the location map for Stations 11, 12 and 13, page 62 tends to isolate the lower end of the Calumet River by reversing the natural flow of the river. Under these conditions water flows from the lake to the river most of the time. For this reason it can be stated that most of the pollution in the harbor and at the river mouth originates in the immediate area.

Figures 23, 24 and 25, on pages 64, 65 and 66 show that the bacterial quality in this area is generally satisfactory. No criteria have been established specifically for the harbor but the criteria for Lake Michigan Inner Harbor Basins can reasonably be applied and are used for comparison purposes. At Stations 11 and 12 the maximum of 5000 total coliforms per 100 ml was exceeded on only one occasion during the first six months of 1967 and the arithmetic average of 1500 per 100 ml is within the allowable limit. The criteria for fecal streptococci (100 per 100 ml) was violated approximately 25% of the time. This indicates that whatever pollution is present is fresh in nature. The only known sources of human wastes are ships using the harbor.

The major industrial pollution problem in the area is iron discharged by the U.S. Steel Corporation's South Works, which often discolors the entire area. Phenols were generally within the limit set by the criteria (50 ug/l) except for a period in January and February when they were high for a two-week period. Except for ammonia nitrogen, all of the other criteria were met. Concentrations of these and other parameters measured at Stations 11, 12 and 13 are shown on Figures 26 and 27 and Tables 11, 12 and 13 on pages 69 through 71.

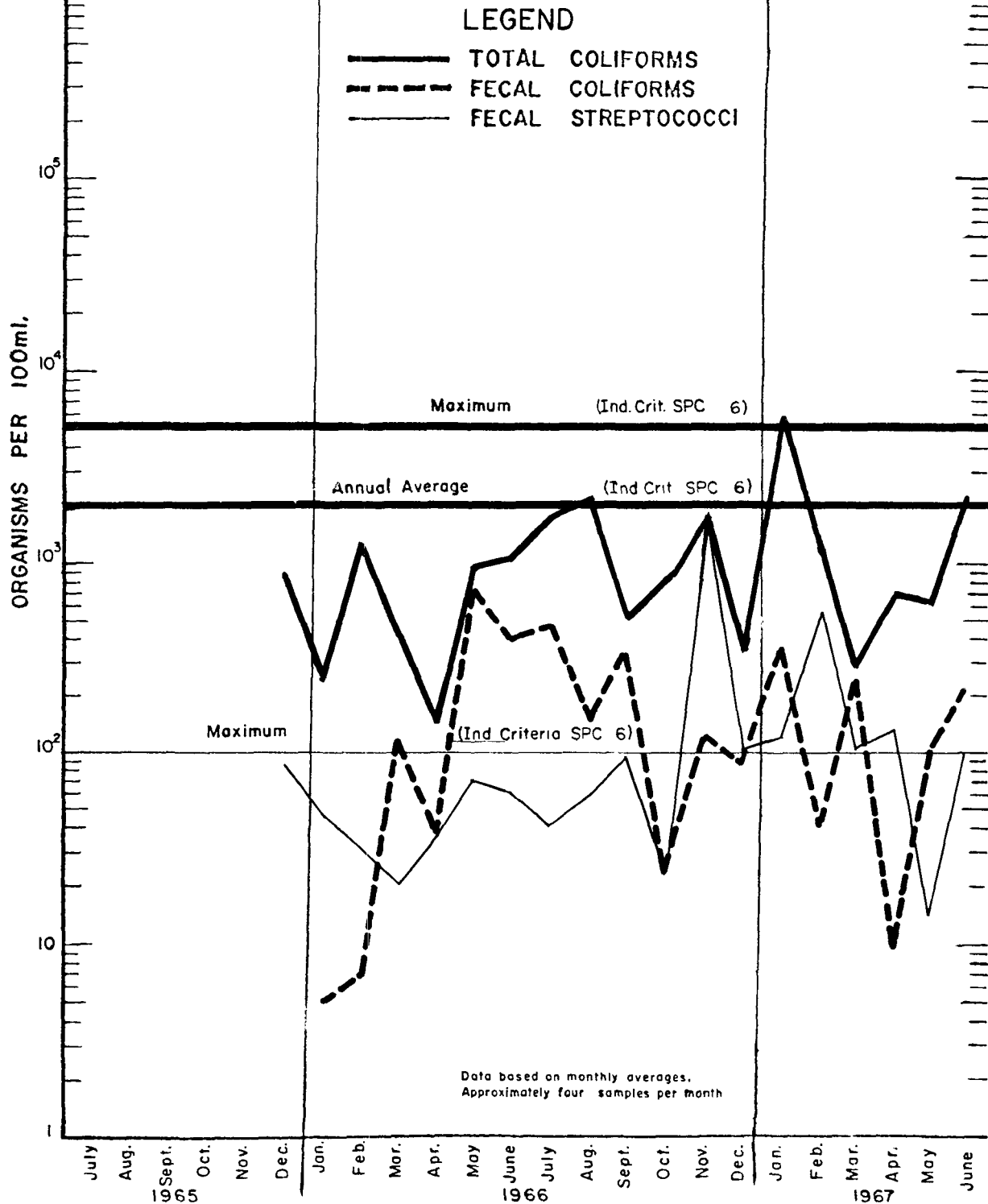
Samples from Station 11 were composited on a monthly basis and analyzed for heavy metals. The following table gives the average values for the first six months of 1967.

Cadmium	less than 0.005 mg/l
Copper	0.04 "
Potassium	3.9 "
Chrome	less than 0.005 "
Manganese	0.22 "
Lead	0.04 "
Nickel	0.03 "
Zinc	0.09 "
Sodium	8 "
Arsenic	6 ug/l

BACTERIAL RESULTS STATION II

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois

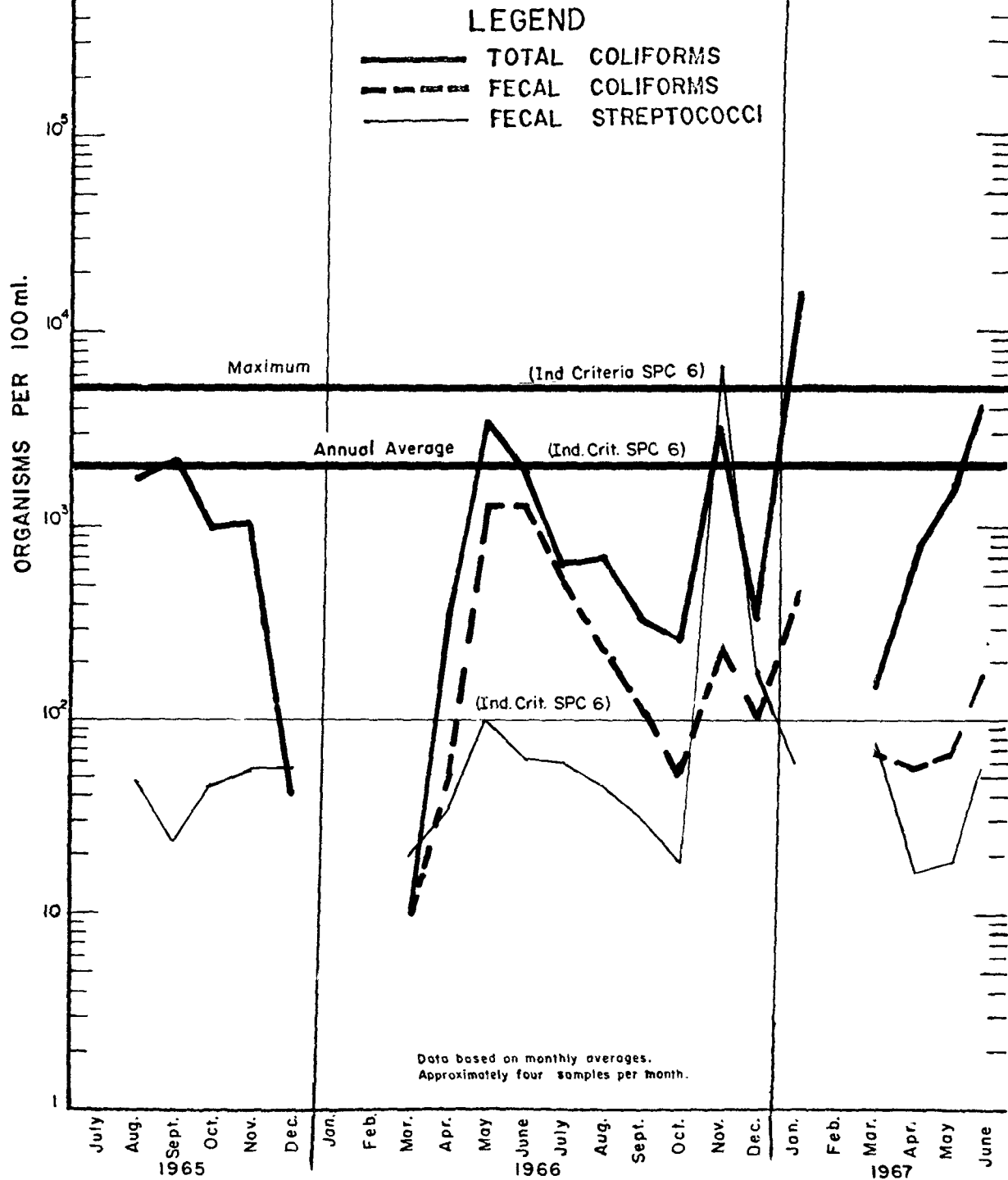
FIGURE 23



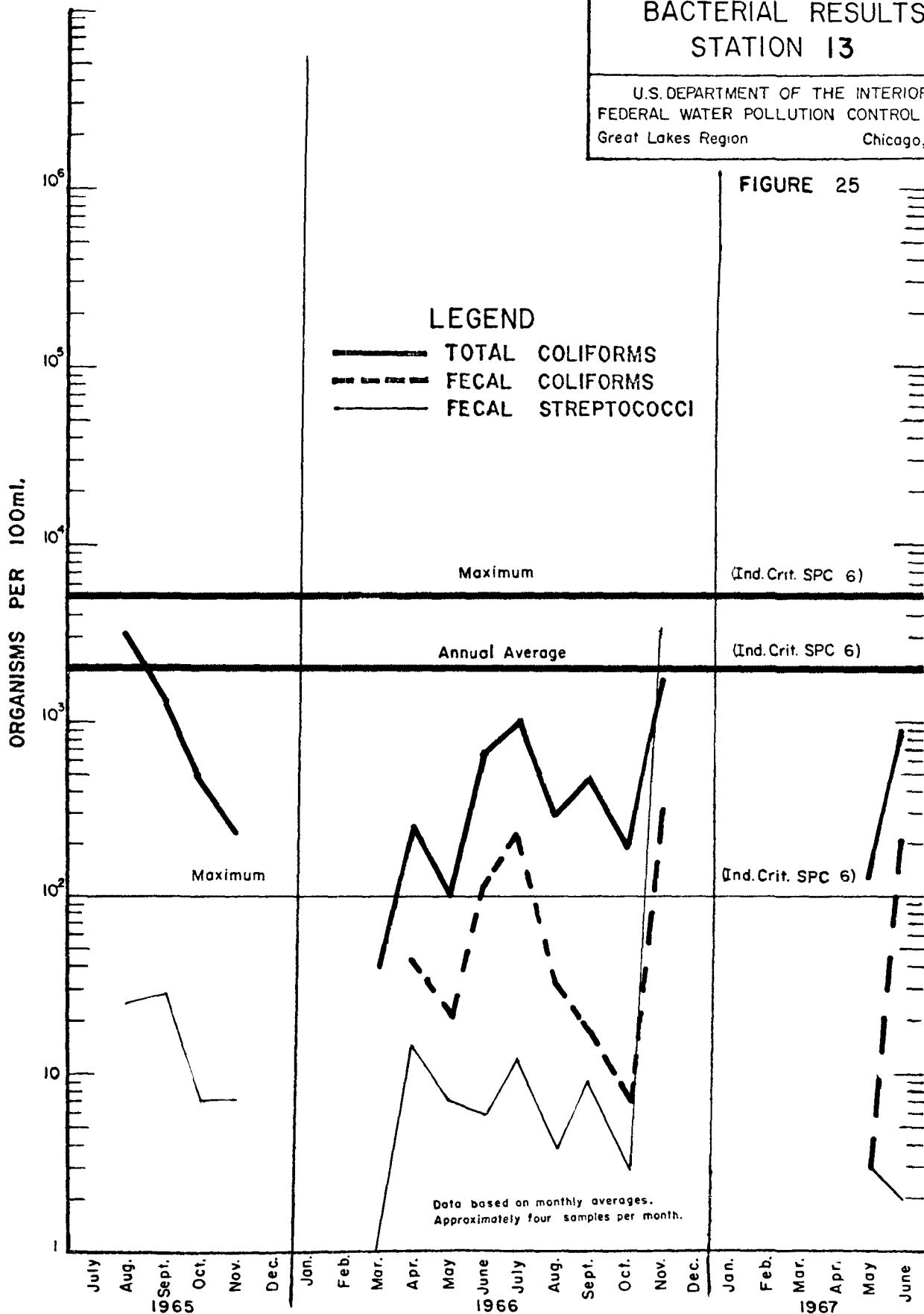
BACTERIAL RESULTS STATION 12

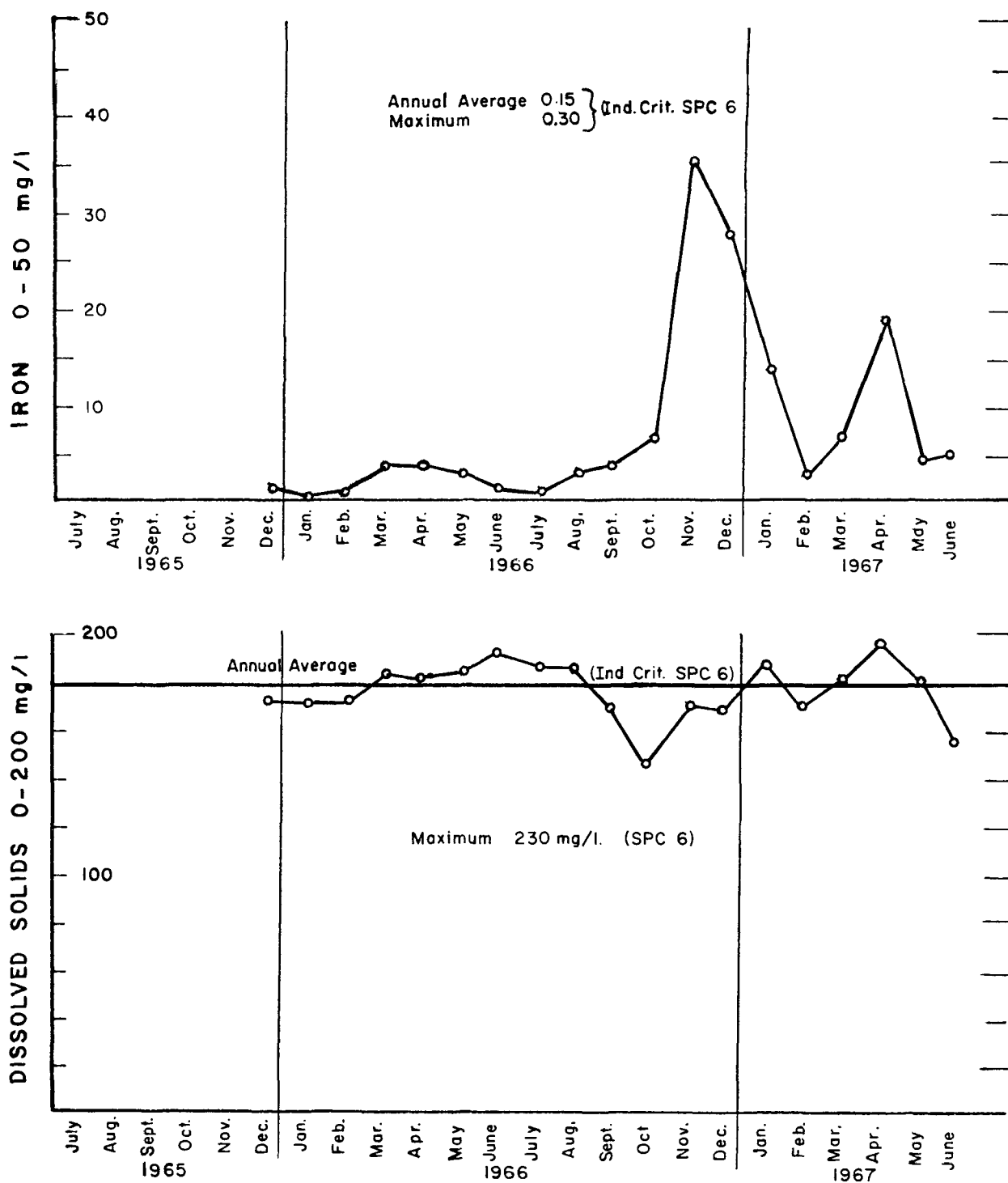
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 24



U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois

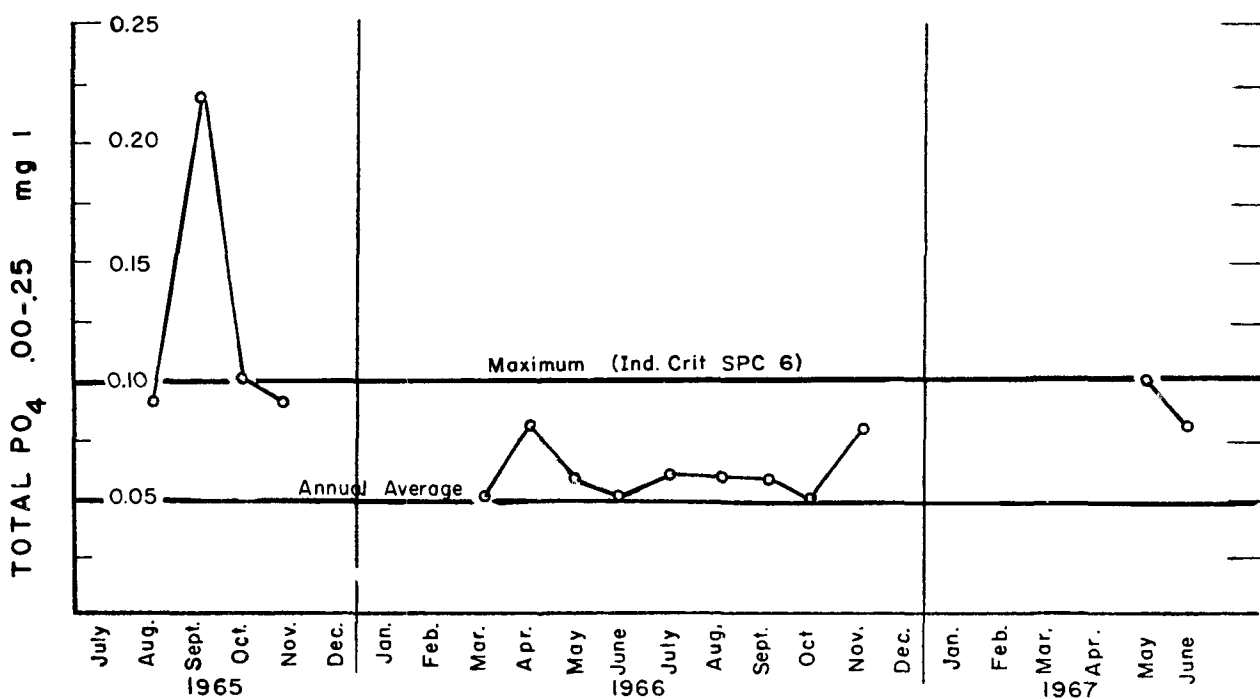
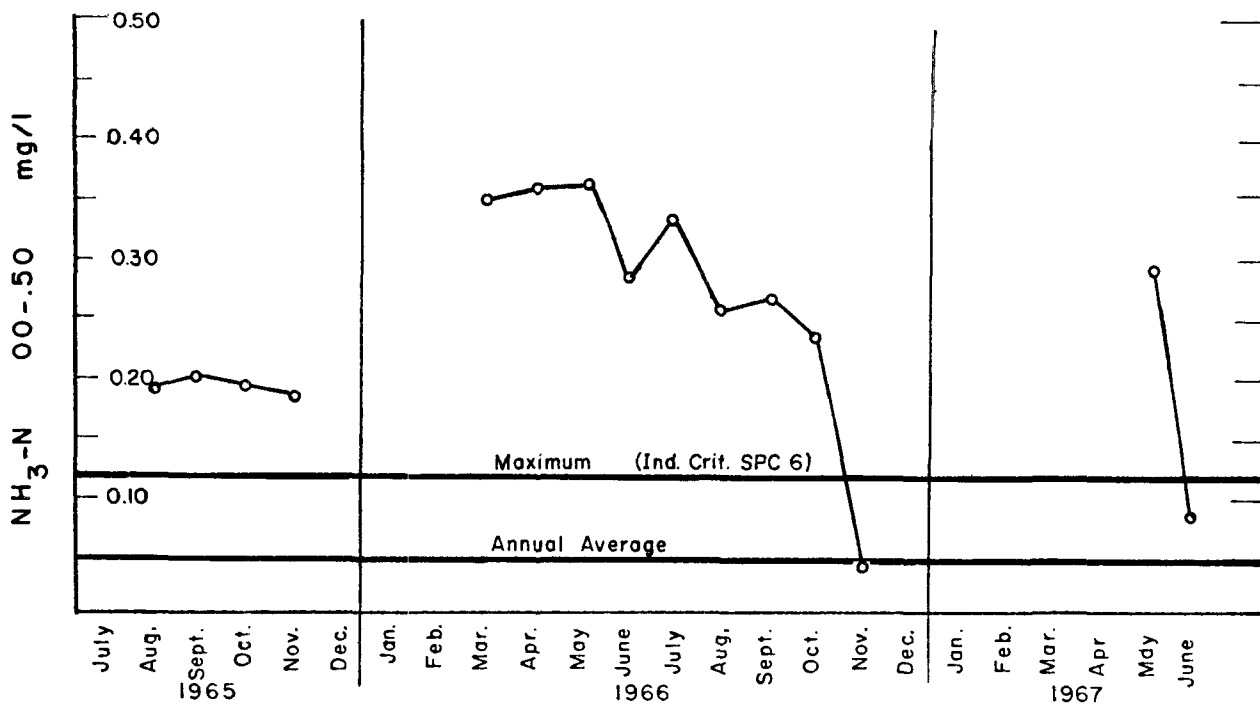




Data based on monthly averages.
Approximately four samples per month.

FIGURE 26

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS	
STATION II	
Calumet Harbor	
North Pierhead Light	
U.S. DEPARTMENT OF THE INTERIOR	
FEDERAL WATER POLLUTION CONTROL ADMIN.	
Great Lakes Region	Chicago, Illinois



Data based on monthly averages.
Approximately four samples per month.

FIGURE 27

CALUMET AREA SURVEILLANCE PROJECT	
CHEMICAL RESULTS STATION 13 Calumet Harbor	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region	Chicago, Illinois

TABLE 11

CHEMICAL QUALITY OF WATER
STATION 11 - CALUMET RIVER AT NORTH PIERHEAD LIGHT-CR 333.45
(WATER QUALITY MONITORING STATION)

Parameter	January 66 - June 66				July 66 - June 67				Standards Adopted by Indiana for L. Mich. Shore Waters		
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.	Ave.
Water Temp. °C	19	0	7	6	26	0	11.7	9	29.4	-	-
pH	8.3	7.4	-	7.8	8.3	7.1	-	7.9			Med. 7.0-9.0
Conductivity umho/cm	330	203	298	300	440	250	317	310			
Alkalinity mg/l	-	-	-	-	133	88	108	106			
DO "	14.1	4.2	10.1	10.4	13.40	2.75	8.37	8.70			
BOD "	4.9	0.9	2.5	2.2	5.60	1.1	3.8	2.5			
COD "	36	0.7	9.5	8.8	42	5	16	13			
Sulphates "	35	21	27	27	58	9	28.7	29			
Chlorides "	16	10	12	12	33	7	14.4	12			
MBAS "	.22	.03	.07	.05	.32	.02	0.08	0.08	0.05		0.02
NH ₃ -N "	0.72	0.21	0.49	0.46	4.4	.12	0.60	0.37	0.12		0.05
NO ₂ +NO ₃ -N "	0.32	0.09	0.20	0.22	0.78	0.03	0.28	0.24			
Org. N "	0.70	0.05	0.34	0.31	1.00	0.03	0.37	0.35			
Sol PO ₄ "	0.78	0.00	0.11	0.04	0.79	0.01	0.06	0.04			
Total PO ₄ "	0.90	0.04	0.17	0.09	1.10	0.03	0.16	0.16	0.04		0.03
Iron "	8.6	0.1	2.1	1.1	97.0	0.69	10.7	3.1			
Cyanide "	0.13	0.00	0.02	0.01	0.08	0.00	0.005	0.2	0.025		
Susp. Solids "	85	8	29	23	239	3	40	22			
Dis. Solids "	210	160	182	185	252	80	180	180			
Phenol ug/l	15	0.6	2.9	2.7	131	0.0	10.0	5.0			50
Turbidity units	-	-	-	-	90.0	0.6	25.0	12.5			
Data based on 25 samples					Data based on 52 samples						

TABLE 12

CHEMICAL QUALITY OF WATER

STATION 12 - CALUMET RIVER AT MOUTH - PIERHEAD LIGHTS-CR 333.4

Parameter	August 65 - June 66				July 66 - June 67				Standards Adopted by Indiana for L. Mich. Shore Waters	
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min. Ave.
Water Temp. °C	22	3	12	13	24	1	15.4	15.0	29.4	
pH	8.1	7.5	-	7.9	8.05	7.2	7.9	7.9		Med. 7.0-9.0
Conductivity umho/cm	330	285	300	295	400	255	307	305		
Alkalinity mg/l	117	110	113	113	211	90	112	109		
DO	13.00	5.40	8.64	8.50	12.40	1.60	7.80	7.95		80% Sat 90% Sat.
BOD	5.5	1.0	2.3	2.2	28	0.4	3.17	2.0		
COD	120.0	0.9	20.2	11.0	39	7	11.6	12.0		
Sulphates	30	17	24	24	47	16	26.8	26.0		
Chlorides	16	9	12	12	28	9	13.1	12.		
MBAS	0.10	0.03	0.06	0.05	0.16	0.03	0.08	0.08	0.05	0.02
NH ₃ -N	0.68	0.15	0.34	0.35	1.4	0.08	0.42	0.33	0.12	0.05
NO ₂ +NO ₃ -N	0.41	0.09	0.22	0.23	0.96	0.09	0.33	0.28		
Org. N	3.23	0.04	0.39	0.29	0.52	0.01	0.30	0.30		
Sol PO ₄	0.23	0.01	0.06	0.04	0.11	0.01	0.05	0.04		
Total PO ₄	0.25	0.02	0.10	0.08	0.23	0.04	0.11	0.09	0.04	0.03
Iron	2.30	0.24	0.96	0.86	11.0	0.44	2.35	2.0		
Cyanide	0.12	0.00	0.00	0.00	0.01	0.0	0.0	0.0	0.025	
Susp. Solids	76	2	20	18	88	6	21.9	14.0		
Dis. Solids	280	140	186	185	241	155	180	173		
Phenol ug/l	12.0	0.0	2.1	1.0	12.0	0	3.1	3.0	50	
Data based on 28 samples					Data based on 27 samples					

NOTE: This station was not sampled during the winter of 1965-66.

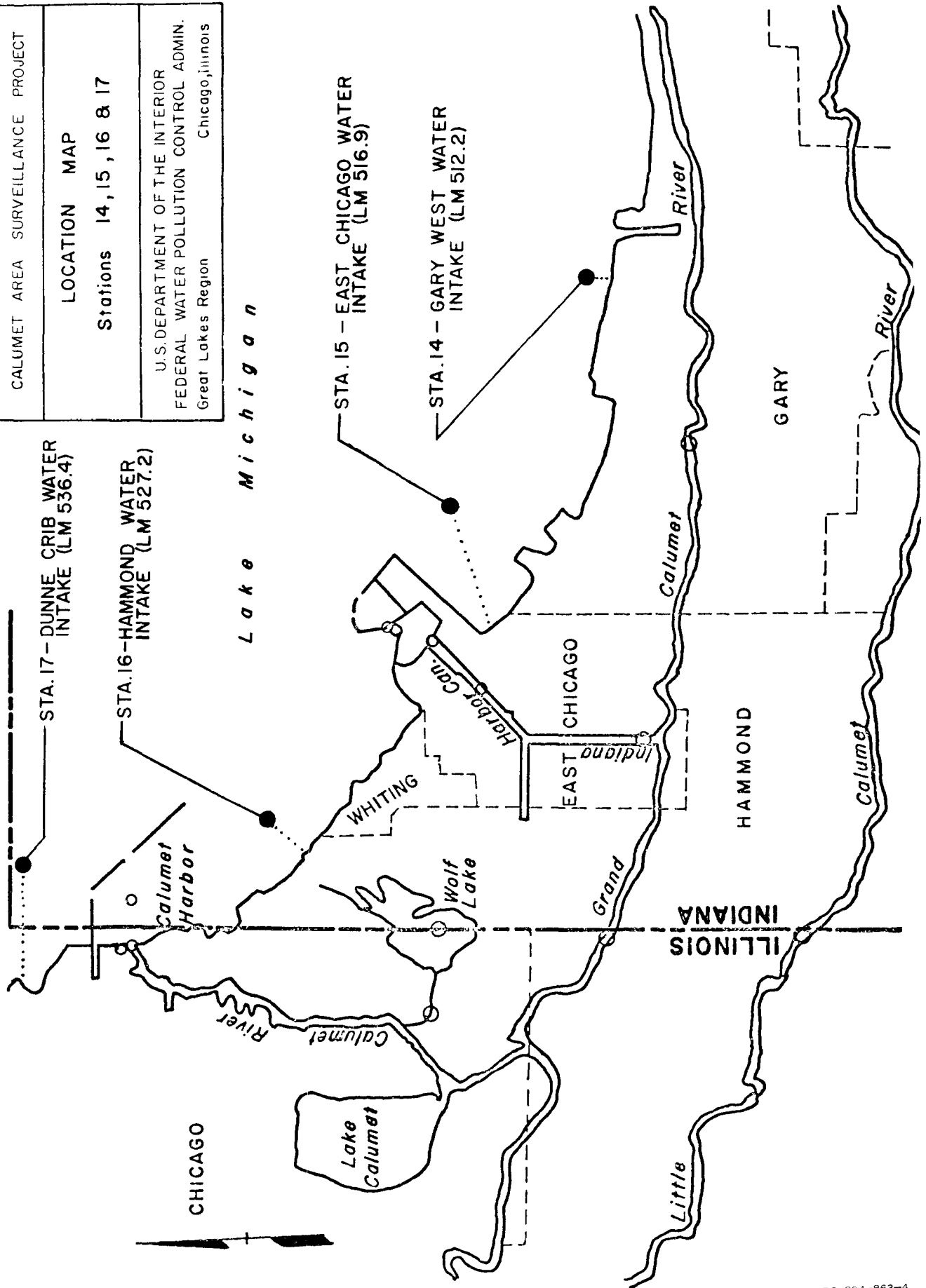
TABLE 13

CHEMICAL QUALITY OF WATER
STATION 13 - CALUMET HARBOR AT MID-CHANNEL-CR 334.0

Parameter	July 65 0 June 66				July 66 - June 67				Standards Adopted by Indiana for Inner Harbor Basin		
	Max.	Min.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.	Ave.
Water Temp. °C	22	5	14	15	24	7	15.5	19	29.4	-	-
pH	8.1	7.4	-	7.9	8.15	7.45	7.9	7.8	9.0	7.5	Med. 8.0-8.5
Conductivity umho/cm	310	270	293	300	315	260	294.5	300			
Alkalinity mg/l	121	107	113	111	212	96	111.5	109			
DO	12.20	6.95	9.02	9.00	11.4	6.2	8.75	8.5	-	65% Sat.	80% Sat.
BOD	4.8	1.0	2.1	1.8	3.4	0.6	1.9	2.0			
COD	120.0	0.0	13.9	9.0	120	0.0	12.4	13			
Sulphates	37	18	24	24	37.0	16	25.3	25	75		35
Chlorides	14	8	11	11	15	9	11	10	30		16
MBAS	0.09	0.03	0.05	0.04	0.13	0.02	0.08	0.07	0.10		0.10
NH ₃ -N	0.48	0.10	0.26	0.25	0.47	0.04	0.25	0.25	0.12		0.05
NO ₂ +NO ₃ -N	0.53	0.08	0.22	0.21	0.40	0.04	0.24	0.19			
Org. N	0.56	0.03	0.31	0.36	0.52	0.06	0.31	0.26			
Sol PO ₄	0.29	0.00	0.05	0.05	0.08	0.01	0.04	0.04			
Total PO ₄	0.78	0.02	0.10	0.06	0.11	0.04	0.08	0.06	0.10		0.05
Iron	2.10	0.09	0.55	0.37	1.80	0.12	0.46	0.46	0.30		0.15
Cyanide	0.01	0.00	0.00	0.00	0.01	0.00	0.0	0.0	0.01		
Susp. Solids	46	1	11	8	23	2	8	7			
Dis. Solids	210	150	180	180	200	126	171	174	230		187
Phenol ug/l	8.0	0.0	1.2	0.0	11	0	3.6	3.0	5		2
Turbidity units	8.8	1.3	2.6	3.4	19.9	0.6	3.4	1.6			

NOTE: This station was not sampled during winter months. Data based on 22 samples

CALUMET AREA SURVEILLANCE PROJECT	LOCATION MAP
Stations 14, 15, 16 & 17	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois	



Station 14 - Gary West Water Intake

The Gary West water intake is one of the control points designated by the Calumet Area Technical Committee for Lake Michigan open waters. The intake is located at a point remote from major sources of pollution and is exposed to the predominate clockwise current in the southern end of the lake. The water is of a high quality and should reflect the characteristics of the open waters of Lake Michigan.

The bacterial quality of the water was good during the first six months of 1967. The water quality standards for total coliforms (maximum 2500 per 100 ml; average 200 per 100 ml) was met on every occasion. The standards for fecal streptococci (maximum 25 per 100 ml) was met on all but four occasions.

As indicated on Table 14 on page 74 chemical quality of the water was also good although several criteria were not met. The criteria for ammonia and phosphates tentatively established by the Technical Committee were adopted as Water Quality Standards by the State of Indiana. The concentrations found in the lake at Station 14 exceed these standards.

The maximum sulphate and dissolved solids were within the range permitted by the standards but the averages were slightly above those required by the standards. The standards for iron and chloride were not met which may indicate that surface drainage from the U.S. Steel complex in Gary affected the lake during the period of heavy runoff.

In the previous report it was stated that the pH was consistently below the range required by the criteria. At that time samples were being taken into the laboratory to be tested for pH. It was believed that because the samples were iced and tested within a few hours of collection there would be no change in pH. Comparisons of laboratory results with field measurements on the same sample revealed that the pH measured in the field was 0.3 to 0.6 units higher than the laboratory pH. All pH values are now being measured in the field when the sample is collected.

TABLE 14
CHEMICAL QUALITY OF WATER
STATION 14 - GARY WEST WATER FILTRATION INTAKE-LM 512.2

Parameter		Recommended Criteria				Aug. 1966-June 1967			
		Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	29.4				22	1	9	10
pH		9.0	7.7		8.1-8.4	8.5	7.1	-	7.9
Conductivity	umho/cm	-	-	-	-	335	240	287	290
Alkalinity	mg/l	-	-	-	-	120	90	106	107
DO	"	-	80% sat.	90% sat.	-	14.80	4.90	11.00	11.25
BOD	"	-	-	-	-	2.9	0.1	1.5	1.5
COD	"	-	-	-	-	22.0	2.0	10.7	10.0
Sulphates	"	50		23		37	16	24	23
Chlorides	"	15		8		26	7	11	10
MBAS	"	0.20		0.05		0.14	0.02	0.05	0.05
NH ₃ -N)	"	0.05*		0.02*		0.28	0.01	0.08	0.06
NO ₂ +NO ₃ -N) tot.N	"	0.04*				0.54	0.05	0.27	0.27
Org.N)	"					0.50	0.01	0.23	0.24
Sol PO ₄	"	-	-	-	-	0.18	0.01	0.04	0.04
Total PO ₄	"	0.04*		0.03*		0.24	0.02	0.08	0.06
Iron	"	0.30		0.15		3.9	0.05	0.57	0.35
Cyanide	"	0.025				0.01	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	149	3	18	10
Dis. Solids	"	200		162		215	112	175	172
Fluorides	"	1.3		1.0		0.40	0.12	0.29	0.32
Oil & Grease	"	Free from floating oil				4.8	0.0	0.8	0.5
Phenol	ug/l	3.0*		1.0*		5.0	0.0	1.4	1.0
Turbidity	units	No contrast with natural appearance				49.0	0.6	11.0	9.0
Color	"	15		5		20.0	0.0	3.5	3.5
Threshold Odor	"	8		4		60.0	1.5	6.1	315
*tentative						Data based on 48 samples			

Stations 15 and 16 - East Chicago Water Intake and Hammond Water Intake

The East Chicago and the Hammond water intakes are the two control points designated by the Calumet Area Technical Committee for inner harbor basins. These control points have been adopted for the Indiana Water Quality Standards.

The East Chicago water intake (Station 15) is located east of the mouth of Indiana Harbor. It is often affected by wastes discharged from Indiana Harbor despite the prevailing northwesterly current. North and west winds often cause adverse currents which carry wastes to the intake.

Table 15 on page 77 compares the results for the period August 1966 thru June 1967 with the Standards. The bacterial quality of the water is fairly good although the standard for fecal streptococci was violated 24% of the time.

The dissolved oxygen concentration was sufficient for all water uses. Nitrogens and phosphates are far above levels designated by the Standards. Standards for parameters indicating domestic pollution (BOD, coliforms, MBAS, dissolved solids) were all met, but the criteria for parameters indicating industrial pollution (iron, phenol, ammonia) were not. This was consistent with the conditions found in Indiana Harbor and the Indiana Harbor Canal.

The Hammond water intake (Station 16) is located west of Indiana Harbor in the path of the prevailing current from the harbor. It is therefore much more seriously affected by wastes from the harbor. In addition it can be affected by combined sewer overflows which discharge to Lake Michigan in the vicinity.

During the last week of January and the entire month of February bacterial counts, turbidity and suspended solids were very high at Station 16. This indicates that combined sewer overflows to the lake resulted from the heavy snows during that period. The bacterial counts also rose sharply in June after a period of heavy rains.

Except for these higher bacterial counts the pattern was the same as at the East Chicago Water Intake (Station 15). As Table 16 on page 78 indicates the nutrients and industrial parameters (except cyanide) all violated the standards. Standards for MBAS, dissolved solids and dissolved oxygen were met.

The standard for cyanide (an industrial waste) was met at both stations 15 and 16 because, given time, cyanide breaks down in water and the time it takes for an individual slug of pollution to reach the intakes is considerable. This time is lengthened by the estuarial nature of the harbor and canal which causes considerable mixing, particularly during periods of northerly winds. At both stations the standards for threshold odor and turbidity were often violated while those for fluoride and true color were met.

The superintendents of both the East Chicago and the Hammond water filtration plants were informed of the heavy slug of phenol detected in the Indiana Harbor Canal on March 1, 1967. (see previous discussion on page 23).

A special sampling run on March 2 failed to detect the slug but the threshold odor records of the plants reveal both had periods of higher than normal odors during the next few weeks. It is not possible to say whether or not the slug caused these odors but it must certainly have been a contributing factor.

TABLE 15
CHEMICAL QUALITY OF WATER
STATION 15 - EAST CHICAGO WATER FILTRATION INTAKE-LM 516.9

Parameter		Recommended Criteria				Aug. 1966-June 1967			
		Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	29.4				21	0	9	8
pH		9.0	7.5		8.0-8.5	8.4	7.4	-	7.8
Conductivity	umho/cm	-	-	-	-	360	245	296	300
Alkalinity	mg/l	-	-	-	-	132	86	105	106
DO	"	-	65% sat.	80% sat.	-	17.05	8.30	14.29	13.90
BOD	"	-	-	-	-	6.0	0.2	1.8	1.7
COD	"	-	-	-	-	68	3	15	10
Sulphates	"	75		35		36	16	26	25
Chlorides	"	30		16		19	7	11	10
MBAS	"	0.30		0.10		0.16	0.01	0.06	0.06
NH ₃ -N	"	0.12*		0.05*		0.80	0.02	0.18	0.15
NO ₂ +NO ₃ -N	"	-	-	-	-	0.60	0.00	0.27	0.26
Org. N	"	-	-	-	-	1.19	0.05	0.32	0.29
Sol PO ₄	"	-	-	-	-	0.07	0.01	0.05	0.04
Total PO ₄	"	0.10*		0.05*		1.00	0.03	0.12	0.08
Iron	"	0.30		0.15		22.00	0.05	1.12	0.37
Cyanide	"	0.1				0.02	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	464	1	33	12
Dis. Solids	"	230		187		211	77	171	174
Fluorides	"	1.3		1.0		.50	.14	.29	.28
Oil & Grease	"	Free from floating oil				4.8	0.0	1.0	0.6
Phenol	ug/l	5.0*		2.0*		16	0	3	1
Turbidity	units	No contrast with natural appearance				160.0	0.6	13.0	8.0
Color	"	15		5		50	0	5	4
Threshold Odor	"	20*		8*		175.0	1.5	46.9	9.0

*tentative

Data based on 48 samples

TABLE 16
CHEMICAL QUALITY OF WATER
STATION 16 - HAMMOND WATER FILTRATION INTAKE-LM 527.2

Parameter		Recommended Criteria				Aug. 1966-June 1967			
		Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	29.4				22	0	9	7
pH		9.0	7.5		8.0-8.5	8.1	7.2	-	7.8
Conductivity	umho/cm	-	-	-	-	345	245	296	300
Alkalinity	mg/l	-	-	-	-	119	80	106	107
DO	"	-	65% sat.	80% sat.	-	14.35	5.70	10.63	10.60
BOD	"	-	-	-	-	5.5	0.9	1.7	1.9
COD	"	-	-	-	-	32	2	13	13
Sulphates	"	75		35		38	13	25	26
Chlorides	"	30		16		20	8	11	10
MBAS	"	0.30		0.10		0.20	0.02	0.07	0.07
NH ₃ -N	"	0.12*		0.05*		0.38	0.03	0.17	0.16
NO ₂ +NO ₃ -N	"	-	-	-	-	0.76	0.05	0.31	0.26
Org. N	"	-	-	-	-	0.73	0.05	0.33	0.32
Sol PO ₄	"	-	-	-	-	0.07	0.01	0.05	0.04
Total PO ₄	"	0.10*		0.05*		0.32	0.03	0.10	0.09
Iron	"	0.30		0.15		5.90	0.04	0.78	0.52
Cyanide	"	0.1				0.02	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	202	2	24	13
Dis. Solids	"	230		187		275	87	174	173
Fluorides	"	1.3		1.0	-	0.46	0.16	0.27	0.28
Oil & Grease	"	Free from floating oil				5.4	0.0	1.0	0.9
Phenol	ug/l	5.0*		2.0*		29	0	4	2
Turbidity	units	No contrast with natural appearance				180.0	0.6	15.4	8.0
Color	"	15		5		15	0	5	4
Threshold Odor	"	20*		8*		800	4	56	30
*tentative						Data based on 48 samples			

Station 17 - Dunne Crib Water Intake

The Dunne Crib water intake supplies water to the city of Chicago's South District Water Filtration Plant and is the second control point designated by the Calumet Area Technical Committee for open Lake Michigan water. The Calumet Harbor breakwater protects this intake from pollution originating in the Calumet Area so that the water quality at this point is better than at any of the other water intakes previously mentioned.

The bacterial quality of the water is good. The criterion for total coliforms and the criterion for fecal streptococci was violated only twice during the first six months of 1967.

The dissolved oxygen concentration was high and the oxygen demand was low. Table 17 on page 80 shows that several of the chemical criteria, especially the nutrients, were violated.

The criteria for chlorides, ammonia, total phosphates, iron, dissolved solids and phenol were also violated. This may have resulted from long periods of turbulent weather which is known to cause higher concentrations of many of the chemical constituents in the lake.

TABLE 17

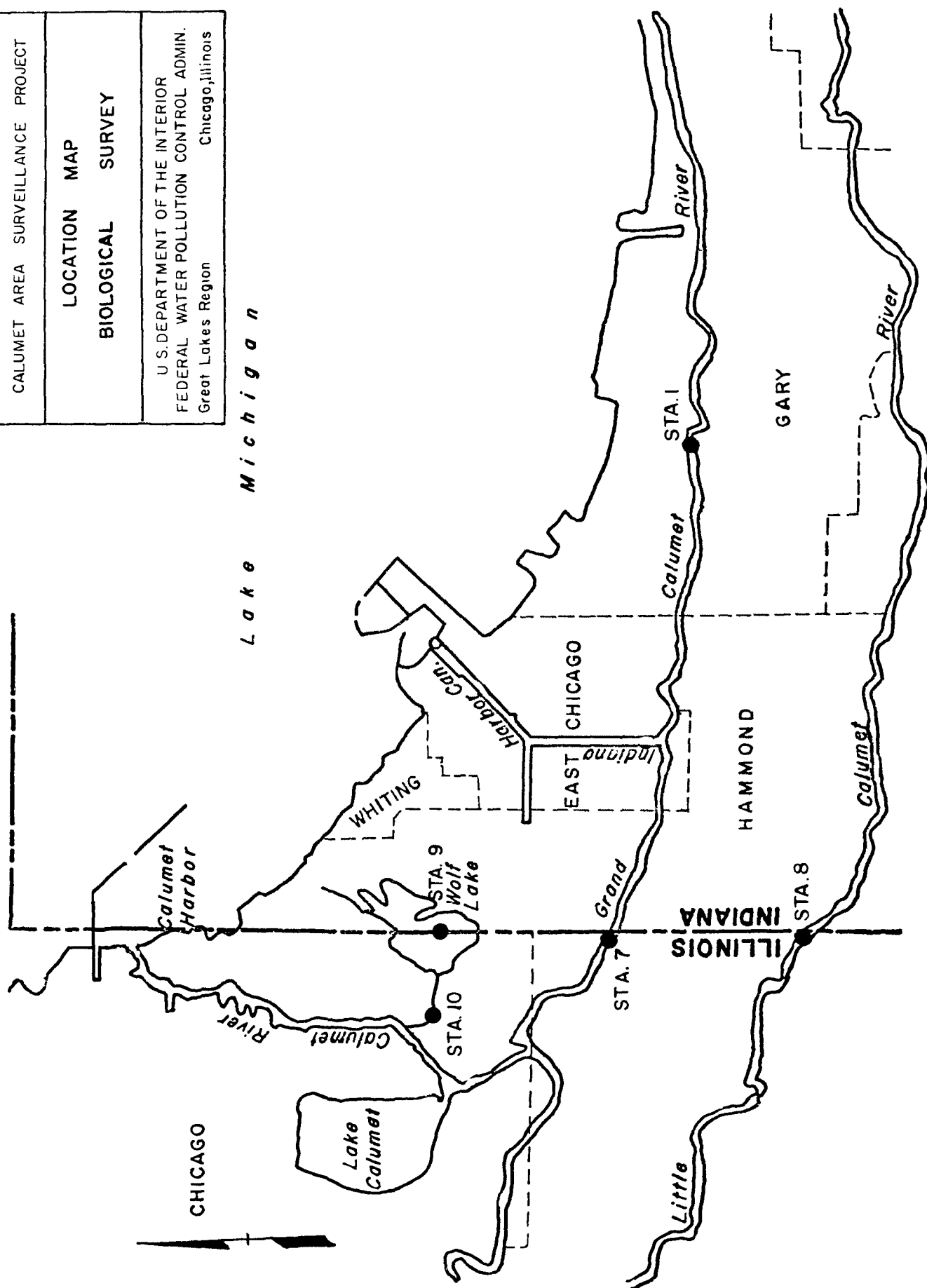
CHEMICAL QUALITY OF WATER
STATION 17 - SOUTH DISTRICT DUNNE CRIB WATER FILTRATION INTAKE-IM 536.4

Parameter	Recommended Criteria				Aug. 1966-June 1967			
	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp. °C	29.4				23	3	12	12
pH	9.0	7.7		8.1-8.4	8.5	7.2	-	7.9
Conductivity umho/cm	-	-	-	-	350	250	288	290
Alkalinity mg/l	-	-	-	-	120	88	106	108
DO	-	80% sat.	90% sat.	-	16.30	6.5	12.33	13.20
BOD	-	-	-	-	3.0	0.2	1.2	1.1
COD	-	-	-	-	18	2	10	8
Sulphates	50		23		32	13	23	23
Chlorides	15		8		17	8	10	9
MBAS	0.20		0.05		0.12	0.01	0.05	0.04
NH ₃ -N)	0.05*		0.02*		0.33	0.01	0.08	0.05
NO ₂ +NO ₃ -N) tot. N"	0.04*				0.92	0.05	0.25	0.22
Org. N					0.70	0.02	0.24	0.23
Sol PO ₄	-	-	-	-	0.25	0.01	0.04	0.04
Total PO ₄	0.04*		0.03*		0.21	0.02	0.07	0.05
Iron	0.30		0.15		3.90	0.01	0.41	0.23
Cyanide	0.025				0.01	0.00	0.00	0.00
Sus. Solids	-	-	-	-	135	1	17	7
Dis. Solids	200		162		205	37	165	168
Fluorides	1.3		1.0		.50	.16	.30	.26
Oil & Grease	Free from floating oil				6.7	0.0	0.9	0.9
Phenol ug/l	3.0*		1.0*		9	0	1	1
Turbidity units	No contrast with natural appearance				160.0	0.6	29.3	4.5
Color	15		5		10	0	3	3
Threshold Odor	8		4		50.0	1.5	7.8	5.0

*tentative

Data based on 48 samples

CALUMET AREA SURVEILLANCE PROJECT	LOCATION MAP	
	BIOLOGICAL SURVEY	
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois		



BIOLOGICAL SAMPLING PROGRAM

For the purpose of the biological sampling program five stations were selected from the seventeen regular sampling stations utilized by the Calumet Area Surveillance Project. The five selected represent a wide variety of water quality conditions.

Station 1 (Grand Calumet River-east) represents a stream highly polluted by industrial wastes.

Station 7 (Grand Calumet River-west) represents a stream highly polluted by industrial and municipal wastes.

Station 8 (Little Calumet River) represents a stream heavily polluted by combined sewer overflows.

Station 9 (Wolf Lake) represents a relatively pollution-free lake.

Station 10 (Wolf Lake Outlet) represents a relatively pollution-free stream.

On April 13, 1967, Dendy-type samplers containing sand, shell and sawdust substrates were set on the bottom at each of the five stations. This permitted the gathering of information on biological conditions at various locations in the Calumet Surveillance Area during the spring of 1967. The effectiveness of sampling benthic organisms by the Dendy sampler was compared with that of two conventional bottom sampling devices, the Eckman dredge and the Petersen dredge. A previous study during October 1966 indicated that the Dendy sampler did not quantitatively sample the benthic organisms as well as the other two samplers. The samplers were set for a period of 14 days after which time they were retrieved and examined for various organisms that had been attracted to the various substrates. At the time (April 27, 1967) each of the Dendy samplers was retrieved, a bottom sample was collected in the vicinity with either an Eckman dredge or a Petersen dredge. A surface water sample also was collected at each of the sites for phytoplankton analysis. The Dendy sampler at Wolf Lake (Station 9) was destroyed by fishermen or vandals.

All samples were analyzed by personnel of the Biology Laboratory, Chicago Program Office during the period May-June, 1967. Results are shown in Tables 18 and 19 on pages 84 and 85.

Benthos

Table 18 indicates that pollution tolerant organisms, especially the Tubificidae (sludgeworms) were taken at all stations except the Wolf Lake Outlet (Station 10) by both sampling devices. At Station 10, both the Dendy sampler and the Petersen dredge took species less pollution-tolerant than sludgeworms.

The numbers of sludgeworms taken at the Indiana Harbor Belt Railroad Bridge (Station 7) by Dendy and Eckman samplers were quite similar. An oil film was noted on the surface of the water at this station. The number of sludgeworms taken by Eckman Dredge at the Pennsylvania Railroad (Station 1) and at the Wentworth Avenue Bridge (Station 8) far exceeded the number of

these organisms collected by the Dendy sampler at the same sites.

Table 18 indicates that materials used as substrates on the Dendy sampler vary considerably in their effectiveness in luring benthic organisms. In the present study, sawdust was most effective for collecting sludgeworms, followed by shells and then by sand. The kinds of organisms collected on the three substrates were quite similar.

In conclusion, it was noted that pollution-tolerant organisms, especially sludgeworms, were taken by both samplers at all stations except the Wolf Lake outlet. These worms indicate pollution in the streams at these sites.

In comparing the effectiveness of the Dendy samplers with the other two samplers, it was noted that the numbers of the organisms taken by either the Eckman dredge or the Petersen dredge far exceeded those taken by the Dendy sampler at the same sites. This difference in numbers of organisms collected by the samplers was noted in the previous study. Therefore, it has been concluded that, although the Dendy sampler may qualitatively sample a stream fairly well, it is not as effective in quantitatively sampling a body of water for benthic organisms as is either the Eckman dredge or the Petersen dredge.

Phytoplankton

Table 19 shows the presence of all algal groups except green filamentous algae in Wolf Lake. Fewer groups were represented in the samples collected from the Little Calumet River (Station 8) and Grand Calumet River (Station 1). However, considerable numbers of green flagellates, mainly *Euglena* were recorded in Little Calumet River at the Wentworth Avenue Bridge. This indicates that some organic enrichment such as sewage is entering the stream above this station. Fewer numbers of algae were found in the Grand Calumet River. A heavy film of oil was noted on the surface of the stream at the Indiana Harbor Belt Railroad Bridge (Station 7). The water in the stream at the Pennsylvania Railroad Bridge (Station 1) was turbid with some reddish colored material and an oil film was noted on the surface.

TABLE 18
COMPARISON OF KINDS AND NUMBERS OF BENTHIC ORGANISMS COLLECTED IN A
DENDY SAMPLER WITH OTHER BOTTOM SAMPLERS

STATION	TYPE OF SAMPLERS COMPARED	DEPTH OF SAMPLE (M)	SUBSTRATE	SPECIES AND NUMBER OF ORGANISMS TAKEN BY DENDY SAMPLER	SPECIES AND NUMBER OF ORGANISMS TAKEN BY BOTTOM DREDGES
1. Grand Calumet River at Pennsylvania R.R. Bridge	Dendy and Eckman	0.6	Sand Shell Sawdust	Sludgeworm 31 Sludgeworm 23 Sludgeworm 45	Sludgeworm 437
7. Grand Calumet River at Indiana Harbor Belt R.R. Bridge	Dendy and Eckman	0.2	Sand Shell Sawdust	Sludgeworm 8 Sludgeworm 34 Sludgeworm 42	Sludgeworm 51 Flowerfly larva 2 Tricoptera larva 1
8. Little Calumet River at Wentworth Ave.	Dendy and Eckman	1	Sand Shell Sawdust	Bloodworm 1 Sludgeworm 1 Sludgeworm 3 Bloodworm 1 Sludgeworm 1 Sludgeworm 13 Diptera Blood- worm 2 Sludgeworm 18 Biting midge 1 Crane Fly 1	Sludgeworm 274
10. Wolf Lake Channel at Coronadolet Ave.	Dendy and Petersen	0.3	Sand Shell	Nymph 1 " 1 Snail 1 Damselfly Nymph 1 Biting midge 1 Snail 1	Sludgeworm 6 Sludgeworm 4 Midge 1 Leach 1

TABLE 19
PHYTOPLANKTON, CALUMET SURVEILLANCE AREA

Station	Number of Organisms per Milliliter									
	Centric Diatoms	Pennate Diatoms	Green Coccolids	Green Fila- mentous	Blue- Green Coccolids	Blue-Green Fila- mentous	Green Flag- ellates	Brown Flag- ellates	Total	
1. Grand Calumet River at Pennsylvania R.R. Bridge	572	616					132		1,320	
7. Grand Calumet River at Indiana Harbor Belt R.R. Bridge	44	44	110			44	88		330	
8. Little Calumet River at Wentworth Ave. Bridge	374	198				220	3718		4,180	
9. Wolf Lake at Ill.-Ind.132 State Line		1694	1716		198	1430	44	66	5,280	
10. Wolf Lake Channel at Corondolet Ave.	88	726	3256			44	66		4,180	

United States Steel Landfill Surveillance

During March 1967 the United States Steel Company at Gary, Indiana began work on a 330 acre landfill in Lake Michigan. Shortly thereafter the mayor of Gary expressed concern about the possibility of excessive turbidity or other adverse effects on the municipal beach at Gary being caused by the landfill operation. A weekly surveillance of the beach and landfill area has been established with the concurrence of the State of Indiana.

Samples from a series of ten points were analyzed for turbidity and pH. As of July 20, 1967 no adverse effects on the Gary beaches, attributable to the landfill operation, have been observed. The following table presents the results of this program. Turbidity is in Standard Jackson turbidity units.

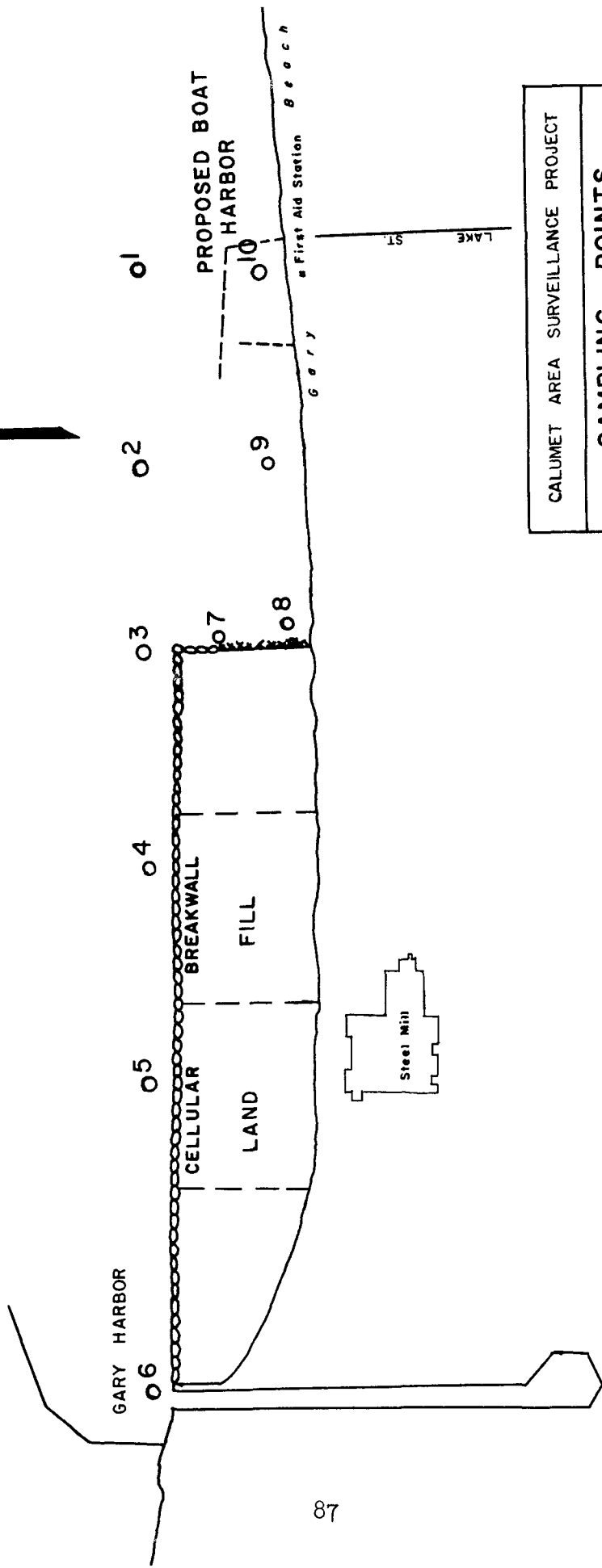
U. S. STEEL LANDFILL
20 April - 20 July, 1967

Station	Turbidity			pH		
	Max	Min	Mean	Max	Min	Median
1	33.0	1.2	6.8	8.1	7.7	8.0
2	11.0	0.7	3.0	8.3	7.3	8.0
3	11.0	0.7	3.3	8.3	7.5	7.9
4	9.0	1.2	3.0	8.2	7.5	7.8
5	9.0	1.3	2.8	8.2	7.5	7.8
6	22.0	1.3	7.3	8.5	7.5	7.9
7	27.5	1.2	5.6	8.3	7.7	8.1
8	37.0	1.2	8.0	8.2	7.1	7.8
9	32.5	1.2	8.5	8.0	7.3	7.9
10	45.0	1.0	9.5	8.1	7.6	7.9

Data based on 10 samples



L a k e M i c h i g a n



CALUMET AREA SURVEILLANCE PROJECT
SAMPLING POINTS U.S. STEEL LANDFILL SURVEILLANCE
U.S. DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois

FIGURE 28

