001R80100

BLACK RIVER
WASTE LOAD ALLOCATION REPORT

Volume II
Water Quality and Effluent Data

Attachment A

Ohio EPA

VOLUME II

WATER QUALITY AND EFFLUENT DATA

U.S. Environmental Protection Agency
Region 5, Library
230 South Dearborn Street
Chicago, Illinois 60604

U.S. Environmental Protection Agency

Station Code: 50152

Samples Collected by: Ohio E.P.A.

Water Year 1977

Station / Date	Flow/cfs	Water Temp. C°	pH Field S.U.	Dissolved Oxygen lbs./day	Conductivity-Field Micromhos	Suspended Solids lbs./day	Dissolved Solids lbs./day	TKN lbs./day	Ammonia Nitrogen lbs./day	Nitrite, N lbs./day	Nitrate, N lbs./day	Total Phosphorus lbs./day	Soluble Phosphate lbs./day	Sulfate lbs./day	Chloride lbs./day	BOD, 5 Day lbs./day
Black River at Cascade Park Elyria																
12-28-76	41	0.2	8.1				168000	800	594	4.4	263	102			28500	
1-26-77	30		8.2				134000	660	529		338	50			23800	
2-24-77	3488	0.4	7.2			063000	3870000	21600	10900		73300	2630			620000	
3-24-77	1750	3.0	7.4			377000	2560000	11600	3680		31900	849			226000	
4-13-77	167	14.5	7.8			83700	349000	4790	2060		1400	144				
5-25-77	27	23.0	7.8			1455	95500	764	350	70	170	29			19600	
6-21-77	58	20	7.15			27800	117000	734	397	106	863	190				
7-28-77																
8-25-77	105					29300	191000	804	153	51	657	323			19800	
9-15-77	164	17.8	7.7			56600	276000	1620	256	53	566	601			28300	
Avg.						1529000	862300	4819	5780			641			138000	

LOADINGS

Station Code: - 50152

Samples Collected by: Ohio E.P.A.

Water Year 1977

Station / Date	C.O.D. lbs./day	T.O.C.	MBAS lbs./day	Fecal Coliform 100 ml	Fecal Strep 100 ml	Dissolved Fluoride lbs./day	Hardness Total $CaCO_3$ lbs./day	Arsenic Total lbs./day	Barium lbs./day	Cadmium Total lbs./day	Chromium Total lbs./day	Copper Total lbs./day	Iron Total lbs./day	Lead lbs./day	Manganese lbs./day	Mercury Total lbs./day
Black River at Gascade Park Elyria																
12-28-76	1800	2650				69										
1-26-77		490	42			82						81	870			
2-24-77	1350000	395000	3400			3000					7500	18800	3610000	7500		
3-24-77	264000		1230			1410							453000	940		
4-13-77	12600	9900	81			180										
5-25-77	4660		28			107						44	610	29		
6-21-77	11800	6250	66			128							125	100		
7-28-77																
8-25-77	13600	5660	85			175								96		
9-15-77	24800		141			309								265		
Avg.	224580															

LOADINGS

Station Code: 50152

Samples Collected by: Ohio E.P.A.

Station Black River at Cascade Park Elyria Date	Nickel Total lbs./day	Zinc Total lbs./day	Oil-Grease lbs./day	Cyanide lbs./day	Phenols lbs./day	Pesticide (15) lbs./day	Radiological Beta Total pc/l	Radiological Alpha Total pc/l								
12-28-77					22											
1-26-77		49			29											
2-24-77		30000			2000											
3-24-77					1100											
4-13-77		1170			144											
5-25-77					8.7											
6-21-77		250			41											
7-28-77																
8-25-77					11											
9-15-77					88											
Avg.					383											

1976 Water Year

Station: Black River
Cascade Park Gauge

Station Code: 50152

Samples Collected By: Ohio E.P.A.

	Flow/CFS	Water Temp. C°	PH Field S. U.	D. O. mg/1	Conductivity Micromhos at temp	Residue Total mg/1	Residue Diss. mg/1	Nitrogen Ammonia mg/1	Nitrate mg/1	TKN mg/1	Phosphorus Total mg/1	BOD mg/1	COD mg/1	TOC mg/1	MBAS mg/1	Sulfate mg/1	Residue Sus. mg/1
10-29-75	41	11.0	-	6.8	-	578	-	2.95	1.1	3.2	0.2	-	-	12	0.19	165	<10
11-26-75	39	1.9	-	7.1	430	580	-	11.19	0.7	5.2	0.3	7	28	-	0.25	183	<10
2-25-76	562	5.5	8	10.2	305	401	274	0.89	1.50	0.9	0.1	-	-	8	0.09	-	38
3-11-76	261	4.0	-	-	305	348	338	1.51	1.13	1.8	0.1	1.9	16	6	0.06	-	18
4-14-76	68	10.0	-	9.2	550	442	446	2.25	0.67	3.1	0.1	3.7	12	8	0.13	139	<10
5-19-76	211	12.9	-	9.4	330	366	294	1.11	1.33	2.5	0.14	5.7	16.	20	0.12	-	73
7-1-76	30	21.2	7.39	4.1	810	584	544	2.03	1.81	3.1	0.2	4.1	20	9	4		15
7-29-76	24	24.8	6.5	4.4	620	-	-	0.59	1.84	0.8	0.17	-	-	8	0.12	81	-
9-1-76	199							0.91	0.99	1.9	0.2			20	0.1	-	
9-22-76	45	15.8	7.7	5.2	600	440	386	3.81	0.82	4.7	0.32	4.8	28	5	0.16	-	23

Station: Black River Cascade Park Gauge Station Code: 50152 Samples Collected By: Ohio E.P.A.

	Chloride mg/l	Fecal 100 ml Coliform	Fecal Strep 100 ml	Hardness Total $CaCO_3$ mg/l	Aluminum Total ug/l	Barium ug/l	Cadmium Total ug/l	Chromium Hex ug/l	Copper Total ug/l	Iron Total ug/l	Fluoride Diss. mg/l	Lead ug/l	Manganese ug/l	Strontium ug/l	Zinc ug/l
10-29-75	74	6300	480	270	-	<200	<10	<	<30		-	13			<30
11-26-75	66	-	-	328						660		16	80	400	
2-25-76	29	1700	1100	-											
3-11-76	36	3300	760												
4-14-76	60	660	460	-	-	<200	<10	<30	70	780	0.26	<10	60	-	<30
5-19-76	37	4900	11,000	-											
7-1-76	101	1400	230												
7-29-76	42	1800	140	238	-	<200	<5	<30	<30	-	0.35	<10	100	-	<30
9-1-76	74														
9-22-76	77	12,000	3,000	-											

Black River

Station: Cascade Park Gauge Station Code: 50152 Samples Collected By: Ohio E.P.A.

	Pesticide (15) ug/l	Radiological Beta Total pc/l	Beta Diss. pc/l	Alpha Total pc/l	Alpha Diss. pc/l	Oil - Grease, Tot. mg/l	Phenols ug/l	Cyanide mg/l	Turbidity F.T.U.	Chromium Tot. ug/l	Mercury Tot. ug/l	Sodium Tot. mg/l	Potassium Tot. mg/l	Calcium Tot. mg/l		
10-29-75						1	<2	<0.01	51	<30	<0.5					
11-26-75																
2-25-76							2		22.0							
3-11-76							3	<0.01	17.0							
4-14-76		1		1		<5	2	<0.01	5.2	<30	<0.5	42	3.2	20		
5-19-76		1		1		-	6	<0.01	36.0	-	-		-	-		
7-1-76		0	0	0	0		4	0.11	5.2							
7-29-76		9	9	0	0	<5	<2	<0.01	4.2	<30	<0.5	48	6.0	68		
9-1-76		8		0			8	<0.01	6.7							
9-22-76		8		0			4	<0.01	14.0							
10-6-76		14		0												

Station Code: 50151 Black R. below Elyria (Ford Rd.)

Samples Collected by: Ohio E.P.A.

Station Date	Flow/cfs	Water Temp. C°	pH Field S.U.	Dissolved Oxygen mg/l	Conductivity-Field Micromhos	Suspended Solids mg/l	Dissolved Solids mg/l	TKN mg/l	Ammonia Nitrogen mg/l	Nitrite, N mg/l	Nitrate, N mg/l	Total Phosphorus mg/l	Soluble Ortho Phosphate mg/l	Sulfate mg/l	Chloride mg/l	BOD, 5 Day mg/l
12-29-76	low	1.8	7.8	10.6	819	<10	772	6.82	4.94	0.02	1.03	1.58			148	—
1-26-77	low	-	7.9	-	-	20	928	10.9	8.14		1.26	1.35			223	15
2-24-77	high	1.5	7.1	13.4	420	681	266	2.91	0.68		3.7	0.53			112	1.2
3-21-77		4.0	7.4 8.9	13.0	204	110	248	1.79	.48		3.35	0.22			26	2.4
4-13-77		14.3	7.6 7.3	8.4	696	13	402	5.57	2.30		1.96	0.43				3.3
5-25-77		22.3	7.6	0.5	1438	<10	644	10.0	4.16		0.90	1.17			126	—
6-21-77		19.5	7.2	5.		92	391	3.13	1.40	0.25	2.22	0.98				
7-28-77	low	20.8	7.7 7.5	5.7	800	<10	428	10.3	10.1	0.16	0.70	1.17	0.86		66	8.0
8-15-77		19.1	8.0	6.2	637	34	331	3.22	1.42	0.15	0.91	1.06			45	2.1
9-15-77		15.1	7.9	6.0	650	26	480	3.95	3.12	0.15	0.61	1.29			88	7.2

Station Code: -50151 Black River Below Elyria (Ford Rd.)

Samples Collected by: Ohio E.P.A.

Station Date	C.O.D. mg/l	T.O.C.	MBAS mg/l	Fecal Coliform 100 ml	Fecal Strep 100 ml	Dissolved Fluoride mg/l	Hardness Total $CaCO_3$ mg/l	Arsenic Total ug/l	Barium ug/l	Cadmium Total ug/l	Chromium Total ug/l	Copper Total ug/l	Iron Total ug/l	Lead ug/l	Manganese ug/l	Mercury Total ug/l
12-28-76	16	13	0.416	<9	29	0.37	374					<30		<10		
1-26-77	–	14	0.8	2.9	14	0.69	374			<5	<30	30	410	<10		<0.5
2-24-77	76	28	0.18	7,800	5,100	0.17	146				50	110	22,500	42		<0.5
3-24-77	28	7	0.67	2,700	3,000	0.15	156				<30	<30	4450	5		<0.5
4-13-77	28	9	0.19	870	70	0.25	258					<30		<5		2.7
5-25-77	52		0.6	<9	21	0.80	296				<30		430	25		<.5
6-21-77	539	24	0.29	2800	730	0.50	202				<30	<30		23		
7-28-77	–	12	0.7	18	33	0.60	205					<30		5		<.5
8-25-77	24	10	0.19	2200	810	0.42	214					<30		10		
9-15-77	3	16	0.11	49	494	0.71	200					<30		17		

Station Code: 50151 Black River below Elyria (Ford Rd.)

Samples Collected by: Ohio E.P.A.

Station Date	Nickel Total ug/l	Zinc Total ug/l	Oil-Grease mg/l	Cyanide mg/l	Phenols ug/l	Pesticide (15) ug/l	Radiological Beta Total pc/l	Radiological Alpha Total pc/l	Selenium ug/l	Silica						
12-28-76		50		<0.01	18											
1-26-77		40		0.02	32											
2-24-77		21		<0.01	10				<5							
3-24-77				<0.01	13											
4-13-77		<30		0.01	20											
5-25-77		30		0.01	9					4.95						
6-21-77		80			16											
7-28-77		30			6											
8-25-77				<0.01	<2											
9-15-77				<0.01	5											

Station Code: 50152 - Black River @ Elyria (Cascade Park)

Samples Collected by: Ohio E.P.A.

Water Year 1977

Station Date	Flow/cfs	Water Temp. C°	pH Field S.U.	Dissolved Oxygen mg/l	Conductivity-Field Micromhos	Suspended Solids mg/l	Dissolved Solids mg/l	TKN mg/l	Ammonia Nitrogen mg/l	Nitrite, N mg/l	Nitrate, N mg/l	Total Phosphorus mg/l	Soluble Phosphorus mg/l	BOD, 5 day mg/l	C.O.D. mg/l	T.O.C. mg/l
12-28-76	41	0.2	8.1	13.0		< 10	760	3.6	2.69	0.02	1.19	0.46			8	12
1-26-77	30		8.2			< 10	831	4.1	3.27		2.09	0.31		7.8		3
2-24-77	3488	0.4	7.2	14.1		512	206	1.15	0.58		3.9	0.14		13	72	21
3-24-77	1750	3.0	7.4	13.8	228	93	271	1.23	0.39		3.38	0.09		2.3	28	
4-13-77	167	14.5	7.7 7.8	9.1		13	388	5.32	2.29		1.57	0.16		2.0	14	11
5-25-77	27	23.0	7.8	4.6	1100	10	656	5.25	2.40	.48	1.19	0.20		5.0	32	
6-21-77	58	20	7.15	5		89	374	2.35	1.27	.34	2.76	0.60			37.9	20
7-28-77			7.9			39	360							3.8		
8-25-77	105	19.0	8.0	7.2		53	338	1.42	.27	.09	1.16	0.57		3.2	24	10
9-15-77	164	17.8	7.7	6.9	400	64	312	1.83	0.29	.06	0.64	0.68		3.8	28	

Station Code: [redacted] - 30152 [redacted] Black River [redacted] Elyria [redacted] (Cascade Park)

Samples Collected by: Ohio E.P.A.

Water Year 1977

Station Date	Chloride mg/l	MBAS mg/l	Fecal Coliform 100 ml	Fecal Strep 100 ml	Dissolved Fluoride mg/l	Hardness Total $CaCO_3$ mg/l	Copper Total ug/l	Zinc, Total ug/l	Arsenic Total ug/l	Barium Total ug/l	Cadmium Total ug/l	Chromium Total ug/l	Iron Total ug/l	Lead ug/l	Manganese ug/l
12-28-76	129		14,000	1900	0.31	401	<30	<30						<10	
1-26-77	147	.26	13,000	2600	0.51	420	50	30				<30	540	<10	
2-24-77	33	.18	4900	4700	0.16	146	100	160				40	19200	40	
3-24-77	24	.13	2200	670	0.15	156	<30					<30	4800	10	
4-13-77		.09	1700	430	0.20	250	<30	130						< 5	
5-25-77	135	.19	2700	140	0.74	316	30	<30	<10		< 5	<30	420	20	
6-21-77		.21	22,000	3600	0.41	198	<30	80					40	32	
7-28-77			860	260											
8-25-77	35	.15	2800	1400	0.31	217	<30	<30			< 5	<30		17	
9-15-77	32	.16	7500	5300	0.35	187	<30	< 30			< 5	<30		30	

Station Code: 50152-Black River at Elyria (Cascade Park)

Samples Collected by: Ohio E.P.A.

Water Year 1977

tation Date	Mercury Total ug/l	Nickel Total ug/l	Oil-Grease mg/l	Cyanide mg/l	Phenols ug/l	Pesticide (15) ug/l	Radiological Beta Total pc/l	Radiological Alpha Total pc/l	PCB's ug/l	Silica (Diss.) mg/l
12-28-76				<.01	10		9	0		
1-26-77	<0.5			<0.01	18		11	0		
2-24-77	<0.5			<0.01	11		20	0		
3-24-77	<0.5			<0.01	12					
4-13-77	<0.5			<0.01	16				<.5	
5-25-77	<0.5			<0.01	6				<.5	5.06
6-21-66					13		21	5		
7-28-77							11	4		6.47
8-25-77	<0.5			<0.01	2	0	16	0	<.5	7.99
9-15-77					<2.0	0	10	0		4.57

Attachment B

Lorain County Metropolitan Park District

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
BLACK RIVER AND TRIBUTARIES
TOTAL BACTERIAL COUNT, SOUTHERN SITES, NUMBER PER ML.

Date	Temp. °C	Flow Rate	East Branch LaPorte	West Branch Parsons Road	West Branch Plum Creek	West Branch Carlisle	Vermilion River Date	Vermilion River Mill Hollow
1-07-74	0	L.I.	1,100	500	80	600	1-02-74	----
1-16-74	0	L.I.	5,600	3,600	800	3,200	1-07-74	2,400
1-28-74	7	V.H.	10,000	1,300	3,200	9,000	1-14-74	1,400
2-06-74	0	N.	1,600	600	2,400	300	1-21-74	1,700
2-20-74	3	H.	5,600	3,200	8,000	4,000	1-28-74	2,000
3-04-74	8	H.	1,200	3,200	14,000	2,800	2-04-74	300
3-13-74	5	H.	2,900	3,000	18,000	4,900	2-18-74	400
3-25-74	1	N.	650	240	2,500	700	2-27-74	600
4-03-74	10	H.	3,600	1,200	2,000	1.600	3-04-74	300
4-15-74	11	N.	1,000	800	2,000	1,800	3-18-74	560
4-24-74	11	N.	2,300	2,000	7,000	900	3-25-74	200
5-08-74	12	N.	1,400	400	2,000	600	4-15-74	1,000
5-20=74	16	N.	1,200	700	2,000	700	4-23-74	280
5-29-74	17	N.	3,000	4,000	9,000	7,000	4-29-74	150
6-10-74	23	L.	1,400	600	160,000	2,400	5-06-74	100
6-19-74	18	L.	2,000	2,000	2,400	1,200	5-13-74	1,100
							5-20-74	300
							5-28-74	1,800
							6-03-74	600
							6-10-74	1,100
							6-17-74	2,800
							6-24-74	2,200

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO

BLACK RIVER AND TRIBUTARIES

TOTAL BACTERIAL COUNT, NORTHERN SITES, NUMBER PER ML.

Date	Temp.	Flow	main stream		French Creek				Sugar Creek
	°C		Cascade Park	B.R. Park Rt. 2 Bridge	1 E. River Road	3 Jaycox Rd. Ditch	4 Nagel Road	2 Root Road	5 E. River Road (2)
14-74	1	LI	2,000	800	2,800	4,200	9,000	1,200	1,200
23-74	6	VH	6,000	6,000	6,400	4,500	6,400	4,000	1,700
04-74	1	LI	3,000	1,400	4,000	2,400	7,300	2,200	1,600
13-74	2	N	3,600	3,400	4,800	3,600	12,000	1,000	1,200
27-74	1	N	2,500	600	3,700	3,200	3,000	1,800	1,000
11-74	8	F	7,000	110,000	3,00	1,200	5,000	1,000	1,400
21-74	5	N	2,800	2,600	3,700	1,300	1,900	1,300	560
01-74	7	H	2,800	4,000	800	500	400	1,400	520
10-74	5	N	1,600	2,000	2,200	1,200	11,000	1,300	600
22-74	14	N	2,600	800	1,300	500	1,400	1,300	800
06-74	12	N	2,000	800	7,000	3,000	10,000	600	760
13-74	17	H	5,400	2,600	8,000	5,200	7,500	2,200	600
28-74	17	L	22,000	2,900	1,600	6,000	8,000	3,600	300
05-74	20	L	89,000	50,000	2,000	600	19,000	1,900	2,100
17-74	17	L	36,000	15,000	2,500	3,000	2,400	500	3,200
26-74	19	L	32,000	44,000	1,100	2,000	2,000		600

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO

BLACK RIVER AND TRIBUTARIES

TOTAL BACTERIAL COUNT, NORTHERN SITES, NUMBER PER ML.

Date	Temp.	Flow	main stream		French Creek				Sugar Creek
	°C	°C	Cascade Park	B.R. Park Rt. 2 Bridge	E. River Road	Jaycox Rd. Ditch	Nagel Road	Root Road	E. River Road
7/8/74	24	Low	16,000	4,000	1,200	3,200	3,800	2.500	600
7/17/74	23	Low	60,000	40,000	6,000	8,000	7,000	7,000	800
7/29/74	24	Low	28,000	50,000	4,000	1,600	1,800	3,200	3,200
8/7/74	21	Low	24,000	111,000	4,300	4,000	5,200	4,200	6,800
9/4/74	17	Normal	30,000	20,000	4,400	2,600	10,060	7,000	3,200
9/16/74	18	Low	30,000	4,000	2,460	8,000	8,000	9,000	600
9/25/74	14	Low	18,000	15,000	2,800	9,400	3,200	2,000	800
10/7/74	12	Low	32,000	1,200	2,000	10,000	10,000	2,800	1,600
10/16/74	13	Low	50,000	8,000	500	8,400	10,000	7,000	500
10/28/74	10	Low	64,000	2,000	7,200	640	700	800	160
11/6/74	12	Normal	13,000	12,000	7,200	2,000	6,500	2.800	500
11/20/74	8	High	16,000	13,000	5,700	7,000	3,000	4,000	4,400
12/3/74	3	Normal	7,000	8,000	4,400	2,000	3,000	1,200	2,100
12/16/74	3	High	2,500	4,400	-	3,200	6,000	1,600	-
12/26/74	1	High	5,000	18,000	2,400	-	-	-	1,700

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
BLACK RIVER AND TRIBUTARIES
TOTAL BACTERIAL COUNT, SOUTHERN SITES, NUMBER PER ML.

Date	Temp. °C	Flow Rate	East Branch LaPorte	West Branch Parsons Road	West Branch Plum Creek	Carlisle	Vermilion River Date	Vermilion River Mill Hollow
7/1/74	19	Flood	5,600	6,000	12,000	4,800	6/3/74	600
7/14/74	24	Low	2,000	1,300	4,800	2,000	6/10/74	1,100
7/22/74	19	Low	1,200	1,500	3,000	1,600	6/17/74	2,800
7/31/74	20	Low	2,400	1,200	9,000	7,200	6/24/74	2,200
8/12/74	22	Low	1,400	2,400	4,000	3,000	7/1/74	3,500
9/9/74	17	Low	1,600	1,700	2,400	1,100	7/8/74	800
9/18/74	17	Low	1,600	3,100	16,000	4,000	7/15/74	900
9/30/74	14	Low	4,000	4,000	6,000	6,400	8/5/74	5,000
							8/12/74	3,600
10/9/74	10	Low	1,100	1,900	2,800	1,200	9/3/74	1,600
10/21/74	7	Low	700	400	640	700	9/30/74	1,200
10/30/74	10	Low	800	460	600	400	10/7/74	1,600
11/17/74	8	Normal	3,260	6,000	7,600	6,600	10/15/74	400
11/25/74	9	High	5,000	4,000	10,000	8,000	10/21/74	210
							10/28/74	500
12/9/74	1	High	6,000	3,000	9,000	3,400	11/4/74	400
12/18/74	1	Normal	1,800	600	3,000	1,800	11/12/74	900
12/30/74	4	High	900	1,600	7,100	800	11/18/74	680
							11/25/74	1,300
							12/3/74	1,200
							12/9/74	1,000
							12/16/74	1,500
							12/23/74	-
							12/30/74	1,100

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO, LAB TEST
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT BLACK RIVER RESERVATION, RT. 2 BRIDGE

Date	1/14/74	1/23	2/4	2/13	2/27	3/11	3/21	4/1	4/10	4/22
Temp.	1	6	1	2	3	7	6	6	5	14
Flow Rate	LI	VH	N	NI	N	F	N	H	H	N
[illegible] ppm	13	11	13	13	13	10	10	11	12	8.5
[illegible]ated	92	87	91	94	94	86	80	86	93	82
[illegible]. Ox. Dem.	30	10	0	20	0	50	0	10	50	30
	8.0	7.7	7.7	7.8	8.3	9.5	7.8	7.7	7.7	8.2
[illegible], Nitrate	60	140	100	40	80	800	120	140	140	80
[illegible]ity	70	120	40	40	40	500	50	110	90	30
[illegible] Bacteria per Ml.	800	6,000	1,400	3,400	600	10,000	2,600	4,000	2,000	800
Fecal Coliforms per 100 Ml.	100	1,300	350	170	600	1,200	760	360	550	100
[illegible] per Ml.	1,000	9,400	7,000	4,200	6,500	4,800	9,000	4,000	7,400	---
[illegible] ppm.	110	40	60	130	60	30	40	60	40	65
[illegible], ppm.	200	110	130	150	120	90	110	150	120	190
[illegible], ppm.	2.0	0.9	1.0	1.5	1.5	1.0	1.0	1.0	0.9	1.4

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River at Black River Reservation, Ford Rd.

)ate	5/6/74	5/13	5/28	6/5	6/17	6/26	7/8	7/17	7/29	8/7
'emp. °C	12	17	17	20	17	18	23	21	22	21
'low Rate	N	H	L	L	L	L	L	L	L	L
). O., ppm	8	9	7	5	6	7	6	6	5	4
%Saturated	74	92	72	55	62	74	69	67	51	45
'hem. Ox. Demand	40	20	26	60	20	70	20	46	50	60
H	7.8	7.6	7.7	7.4	7.5	7.6	7.6	7.3	7.5	7.3
olor, units	60	140	70	100	80	100	80	90	70	70
urbidity, JTU	10	100	20	25	45	60	20	30	30	30
otal bacterial o./1 ml.	800	2600	2,000	50,000	15,000	44,000	4,000	40,000	50,000	111,000
otal Coliforms o./100 ml.	110	5600	1200	4500	3300	31,000	1700	4300	6300	8,000
ecal Coliforms o./100 ml.	50	800	50	100	80	TNTC	200	300	100	350
hloride, ppm.	60	35	180	70	70	70	50	130	120	125
ulfate, ppm.	200	140	200	190	180	160	130	200	200	150
O4, Ortho, ppm.	1.3	1.3	2.7	2.8	2.5	4.8	4.0	7.0	3.0	3.8

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River at Black River Reservation, Rt. 2 Bridge

te	9/4/74	9/16	9/25	10/7	10/16	10/28	11/6	11/20	12/3	12/16	12/26
mp. °C	17	18	15	13	13	11	11	9	3	3	1
ow Rate	L	L	L	L	L	L	H	N	N	H	H
O., ppm	8	6	6	7	8	6	10	9	11	12	13
aturated	82	63	60	66	76	57	90	78	82	89	91
em. Ox. Demand	50	30	50	30	50	50	60	100	40	10	50
	7.6	7.5	7.4	7.5	7.6	7.9	7.6	7.9	7.6	7.4	7.3
lor, units	70	60	70	90	90	100	100	300	120	90	220
rbidity, JTU	30	30	20	20	20	30	70	500	60	70	130
tal bacterial											
./1 ml.	20,000	40,000	15,000	1,200	8,000	2,000	12,000	13,000	8,000	4,400	18,000
cal Coliforms											
./100 ml.	1,600	100-	150	100-	560	100-	2,000	23,000	77,000	28,000	7,000
tal Coliforms											
./100 ml.	16,000	1,600	6,300	300	7,400	800	15,000	12,000	13,000	2,200	1,400
loride, ppm.	80	90	120	60	90	90	70	50	60	35	20
lfate, ppm.	150	210	200	210	200	220	150	150	140	120	90
04, Ortho, ppm.	1.6	7.0	5.5	4.0	2.5	4.0	2.5	4.0	1.0	0.6	1.1

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO, LAB TEST
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT CASCADE PARK, ELYRIA

Date	1/14/74	1/23	2/4	2/13	2/27	3/11	3/21	4/1	4/10	4/22
Temp.	1	6	1	2	1	8	5	7	5	14
Flow Rate	LI	VH	NL	N	N	F	N	H	H	N
[illegible] ppm	13	11	41	13	13	12	11	12	12	9
[illegible] Saturated	89	87	99	94	91	100	86	98	93	87
Nor. Tk. Dem.	10	10	0	10	0	30	0	10	30	50
[illegible]	8.0	7.7	7.8	7.9	8.6	7.5	8.0	7.7	7.8	8.3
[illegible]	90	160	100	60	80	700	100	120	120	80
[illegible]	20	110	60	30	40	450	50	130	90	30
[illegible]	2,000	6,000	3,000	3,600	2,500	7,000	2,800	2,800	1,600	2,600
[illegible]	1,500	3,700	520	1,000	350	1,300	1,800	1,100	680	830
[illegible]	7,000	17,000	8,800	7,400	5,000	4,600	7,400	4,600	5,800	7,800
[illegible]	90	30	65	90	50	20	30	40	35	50
[illegible]	200	100	120	160	120	85	120	140	130	150
[illegible]	0.5	0.7	0.5	0.6	0.6	0.8	0.6	0.8	0.8	0.4

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

	Black River at Cascade Park, Elyria									
ate	5/6/74	5/13	5/28	6/5	6/17	6/26	7/8	7/17	7/29	8/7
emp. °C	12	17	17	20	17	19	24	23	24	21
low Rate	N	H	L	L	L	L	L	L	L	L
.O., ppm	9	9	7	7	7	8	7.5	7	9	7
Saturated	83	92	72	76	72	85	88	80	100	78
hem. Ox. Demand	40	10	0	50	26	50	20	20	30	10
H	8.1	7.8	8.2	8.0	7.8	8.0	8.1	7.7	8.0	7.8
olor, units	70	140	60	70	90	120	80	160	40	40
urbidity, JTU	30	100	30	30	50	70	15	40	30	30
otal bacterial o./1 ml.	2,000	5,400	12,000	80,000	36,000	32,000	16,000	60,000	28,000	24,000
otal Coliforms o./100 ml.	9,000	8,600	1600	6,000	12,000	33,000	17,000	15,000	4,000	28,000
ecal Coliforms o./100 ml.	400	1600	100	720	640	6,000	6,000	670	1200	1200
hloride, ppm.	50	30	120	70	65	65	40	110	180	100
ulfate, ppm.	200	130	200	200	200	160	130	240	220	200
O4, Ortho, ppm.	0.5	0.7	0.3	0.6	0.8	1.0	0.7	0.7	0.4	0.8

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River at Cascade Park, Elyria

ate	9/4/74	9/16	9/25	10/7	10/16	10/28	11/6	11/20	12/3	12/16	12/26
emp. °C	17	17	14	12	13	10	10	8	3	3	1
low Rate	N	L	L	L	L	L	N	H	N	H	H
.O., ppm	9	7	7	8	8	7	10	11	12	13	13
Saturated	93	74	63	76	76	62	94	92	89	96	91
hem. Ox. Demand	50	20	10	10	40	40	60	50	40	10	50
I	7.9	7.8	7.8	8.4	8.5	8.8	7.7	8.1	7.6	7.5	7.3
olor, units	80	40	70	90	90	90	120	140	110	90	200
urbidity, JTU	40	20	20	36	30	40	80	120	60	60	160
otal bacterial o./1 ml.	36,000	30,000	18,000	22,000	50,000	64,000	13,000	16,000	7,000	2,500	5,000
otal Coliforms o./100 ml.	10,000	7,300	4,300	21,000	18,000	3,700	28,000	32,000	9,700	14,000	8,700
ecal Coliforms o./100 ml.	1,600	360	620	560	3,600	320	3,900	11,000	2,100	1,800	2,200
loride, ppm.	60	120	115	55	70	90	65	50	60	30	25
lfate, ppm.	180	210	200	200	220	210	150	150	140	120	80
O4, Ortho, ppm.	0.7	0.6	0.5	1.0	0.7	1.0	3.0	1.2	0.7	0.5	1.0

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO, LAB TEST
WATER ANALYSIS TEST RESULTS

Black River, West Branch at Carlisle Reservation

Date	1/7/74	1/16	1/28	2/6	2/20	3/4	3/13	3/25	4/3	4/15	4/24
Temp.	0	1	6	0	1	8	4	1	10	11	10
Flow Rate	I	I	VII	I	II	II	II	IV	II	II	IV
D.O. ppm	13	13	11	13	13	11	12	11	10	9	10
% Saturated	90	91	88	89	91	93	91	78	89	81	87
Chem. Ox. Dem.	0	0	20	10	20	10	0	10	25	30	20
PH	7.7	7.8	7.8	7.6	7.5	7.6	7.7	7.8	7.7	7.8	7.8
Color, units	30	40	200	40	100	100	190	20	200	90	80
Turbidity	25	20	220	20	160	130	140	30	420	80	25
Total Bacteria No/Ml.	600	3,200	9,000	300	4,000	2,800	4,800	700	1,600	1,800	900
Fecal Coliforms No/100 Ml.	70	6,100	500	100-	1,800	1,000	320	140	1,300	270	200
Total Coliforms No/100 Ml.	1,300	2,600	10,000	1,900	11,000	13,000	7,100	1,100	3,600	2,300	10,00
Chloride, ppm.	90	75	35	40	35	30	30	35	25	25	40
Sulfate, ppm.	170	150	130	150	120	95	100	150	150	150	200
PO4, Ortho, ppm.	0.9	0.7	1.5	0.6	1.3	0.9	1.0	0.7	0.5	0.8	0.7

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River at Carlisle Reservation

te	5/8/74	5/20	5/29	6/10	6/19	7/1	7/10	7/22	7/31	8/12
mp. °C	10	16	17	23	17	18	20	19	20	20
ow Rate	N	N	H	L	L	F	L	L	L	L
O., ppm	9	8	7	6	6	8	5	6	6	6
aturated	79	80	72	68	62	84	59	64	65	65
em. Ox. Demand	10	10	10	50	50	50	50	0	25	30
	7.8	7.7	7.6	7.6	7.7	7.5	7.6	7.6	7.6	7.5
lor, units	50	80	100	90	80	250	80	80	50	40
rbidity, JTU	10	60	130	80	60	500	120	50	70	70
tal bacterial /1 ml.	600	700	7,000	2,000	1200	4800	2,000	1600	7200	3,000
al Coliforms /100 ml.	200	1500	8700	10,000	7,000	28,000	2300	1200	5400	3,000
al Coliforms /100 ml.	100	200	2200	120	640	11,000	600	170	9100	720
oride, ppm.	35	30	50	35	50	30	40	50	40	85
fate, ppm.	120	180	200	200	200	80	160	200	136	160
4, Ortho, ppm.	0.8	1.1	5.5	4.5	2.5	0.7	4.6	4.2	2.5	4.3

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River, West Branch at Carlisle Reservation

ıte	9/9/74	9/18	9/30	10/9	10/21	10/30	11/12	11/25	12/9	12/18	12/30
ımp. °C	17	17	14	9	6	12	9	9	0	1	5
ow Rate	L	L	N	L	L	N	N	H	H	N	H
O., ppm	7	6	7	7	7	5	8	11	12	12	12
Saturated	74	62	72	61	56	41	68	95	82	85	93
ıem. Ox. Demand	50	30	70	0	50	40	60	70	60	0	10
l	7.7	7.5	7.5	7.5	7.5	7.4	7.3	7.5	7.4	7.5	7.6
olor, units	60	80	120	90	90	100	120	170	140	130	80
rbidity, JTU	60	60	100	50	30	35	90	100	130	50	50
otal bacterial o./1 ml.	1,100	4,000	1,400	1,200	700	400	6,000	8,000	3,400	1,800	800
otal Coliforms o./100 ml.	1,500	5,600	9,600	1,000	620	826	23,000	25,000	29,000	2,600	1,600
ecal Coliforms o./100 ml.	150	3,200	4,100	320	100-	100	8,200	4,900	3,100	300	650
loride, ppm.	60	65	40	30	40	60	40	35	40	35	35
lfate, ppm.	200	180	200	206	140	150	150	120	140	120	140
O4, Ortho, ppm.	3.7	5.5	1.4	4.0	3.5	4.5	2.4	3.0	0.9	0.5	0.5

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO, LAB TEST
WATER ANALYSIS TEST RESULTS

BLACK RIVER, WEST BRANCH AT PARSONS ROAD

Date	1/3/74	1/16	1/28	2/6	2/20	3/4	3/13	3/25	4/3	4/15	4/24
Temp.	0	0	7	0	2	9	3	0	10	11	11
Flow Rate	LI	VH	VH	I	I	H	H	N	H	N	N
D.O. ppm	13	13	11	13	13	11	12	11	10	10	10
% Saturated	89	90	90	89	93	95	83	76	88	90	90
Chem. Ox. Dem.	10	40	20	0	10	10	0	10	40	60	20
PH	7.5	7.7	7.6	7.6	7.6	7.6	7.6	7.8	7.7	7.8	7.8
Color, units	30	40	180	40	120	110	130	30	180	80	80
Turbidity	20	150	200	30	150	140	110	30	320	80	20
Total Bacteria No/Ml.	500	3,600	1,300	600	3,200	3,200	3,000	240	1,200	800	2,000
Fecal Coliforms No/100 Ml.	180	1,700	300	20	940	320	170	60	660	100	2,000
Total Coliforms No/100 Ml.	720	660	7,800	1,000	5,400	2,400	2,500	100	1,100	100	6,800
Chloride, ppm.	40	70	30	65	40	30	30	40	25	30	35
Sulfate, ppm.	160	150	130	150	130	120	110	160	140	190	200
PO4, Ortho, ppm.	0.5	1.0	1.2	0.3	1.1	0.8	0.7	0.4	0.3	0.5	1.0

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River, West Branch at Parsons Road

ate	5/8/74	5/20	5/29	6/10	6/19	7/1	7/10	7/22	7/31	8/12
emp. °C	10	16	17	20	17	18	25	20	20	22
low Rate	N	N	N	L	L	F	L	L	L	L
.O., ppm	9	8	8	7	8	8	7	6	7	7
Saturated	83	80	83	80	83	84	83	65	76	79
hem. Ox. Demand	10	10	10	25	20	50	30	0	20	10
I	7.9	7.8	7.7	7.7	7.7	7.3	7.8	7.7	7.7	7.7
olor, units	60	60	100	60	110	300	60	50	30	50
urbidity, JTU	10	40	100	50	80	600	80	40	55	50
otal bacterial o./1 ml.	400	700	4,000	600	2,000	6,000	1300	1500	1200	2400
otal Coliforms o./100 ml.	470	1100	11,000	12,000	1600	18,000	2,000	1800	2200	1700
ecal Coliforms o./100 ml.	50	370	5100	1200	430	11,800	1200	200	1100	1700
loride, ppm.	40	30	40	35	30	30	40	45	60	50
lfate, ppm.	200	170	200	190	170	90	140	190	190	200
O4, Ortho, ppm.	0.7	0.4	0.8	0.6	2.0	0.5	0.7	0.6	0.5	0.6

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

West Branch Black River at Parsons Road

te	9/9/74	9/13	9/30	10/9	10/21	10/30	11/12	11/25	12/9	12/18	12/30
mp. °C	17	17	13	9	7	12	8	9	0	1	5
w Rate	L	L	L	L	L	L	N	H	H	N	H
O., ppm	8	7	9	9	10	7	9	9	11	12	12
turated	84	72	85	88	82	65	76	90	75	85	93
m. Cx. Demand	40	20	70	0	50	30	60	60	50	0	0
	7.8	7.7	7.7	7.7	7.6	7.6	7.5	7.5	7.4	7.4	7.5
or, units	80	90	140	80	80	60	80	200	130	120	100
bidity, JTU	60	70	100	30	30	30	50	120	120	50	50
al bacterial /1 ml.	5,100	3,600	4,000	1,000	400	460	6,000	4,000	3,000	600	1,600
al Coliforms /100 ml.	2,000	4,000	15,000	3,400	660	410	7,400	10,000	7,600	2,100	2,200
al Coliforms /100 ml.	600	5,300	7,000	300	100-	500	3,500	6,400	2,400	200	400
oride, ppm.	45	50	40	35	30	40	50	35	40	35	40
ate, ppm.	170	210	200	140	110	110	210	130	120	120	160
4, Ortho, ppm.	1.1	0.6	1.0	0.7	1.2	0.9	0.6	1.0	0.9	0.4	0.5

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO, LAB TEST
WATER ANALYSIS TEST RESULTS

EAST BRANCH BLACK RIVER AT LAPORTE

Date	1/7/74	1/16	1/28	2/6	2/20	3/4	3/13	3/25	4/3	4/15	4/24
Temp.	0	0	7	0	3	8	5	1	10	11	11
Flow Rate	LI	LI	VH	I	H	H	H	N	H	N	N
D.O. ppm	13	13	11	13	12	11	12	12	9	10	10
% Saturated	89	90	90	89	89	93	93	84	80	90	90
Chem. Ox. Dem.	0	10	50	10	10	10	0	10	50	50	20
PH	7.6	7.8	7.5	7.7	7.6	7.5	7.6	7.7	7.6	7.8	7.9
Color, units	30	20	280	70	70	100	160	20	200	70	80
Turbidity	10	20	450	70	60	90	100	20	400	45	20
Total Bacteria No/Ml.	1,000	6,300	1,000	400	720	470	200	550	3,600	1,000	2,300
Fecal Coliforms No/100 Ml.	1,100	5,600	10,000	1,600	5,600	1,200	2,900	650	1,800	940	1,300
Total Coliforms No/100 Ml.	1,200	4,100	5,200	6,000	12,000	2,800	2,900	4,300	3,700	2,500	4,100
Chloride, ppm.	50	70	35	60	35	45	30	40	30	30	40
Sulfate, ppm.	150	160	100	140	120	90	90	150	110	130	200
PO4, Orthc, ppm.	0.4	0.5	1.0	0.6	0.5	0.6	0.8	0.3	0.4	0.4	0.3

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

East Branch Black River at LaPorte

ate	5/8/74	5/20	5/29	6/10	6/19	7/6	7/14	7/22	7/31	8/12
emp. °C	12	16	17	23	18	19	24	19	20	22
low Rate	N	N	N	L	L	F	L	L	L	L
.O., ppm	10	7	7	8	8.5	6	7	6	7	6
Saturated	93	70	72	91	88	64	82	64	76	65
hem. Ox. Demand	10	10	10	30	30	50	30	0	10	10
H	8.1	7.9	7.7	7.8	7.9	7.7	8.0	7.9	7.9	7.7
olor, units	40	80	80	70	70	300	80	70	70	40
urbidity, JTU	5	30	90	40	30	700	40	20	30	40
otal bacterial o./1 ml.	1400	1200	3,000	1400	2,000	5600	2,000	1200	2400	1400
otal Coliforms o./100 ml.	3400	1200	7700	20,000	1600	20,000	1700	1500	3800	3700
ecal Coliforms o./100 ml.	80	70	1500	300	100	16,200	250	80	640	440
loride, ppm.	40	35	50	40	50	40	50	40	50	60
lfate, ppm.	150	150	160	170	170	80	150	160	140	150
O4, Ortho, ppm.	0.4	0.4	0.8	0.8	0.7	0.4	0.6	0.7	0.9	1.0

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

East Branch Black River at LaPorte

te	9/9/74	9/18	9/30	10/9	10/21	10/30	11/12	11/25	12/9	12/18	12/30
mp. °C	17	17	14	10	7	12	8	9	1	1	4
ow Rate	L	L	L	L	L	L	N	H	H	N	H
O., ppm	9	8	9	9	9	9	10	10	12	13	11
aturated	94	83	86	80	75	83	84	90	82	91	84
em. Ox. Demand	30	30	30	0	30	50	50	50	30	0	0
	7.7	7.8	7.5	7.7	7.5	7.4	7.5	7.4	7.3	7.3	7.5
lor, units	50	60	80	60	60	40	50	170	120	100	70
rbidity, JTU	40	160	50	15	30	15	30	80	60	30	25
al bacterial /1 ml.	6,000	1,600	4,000	1,100	7,000	800	3,200	5,000	6,000	1,800	900
al Coliforms /100 ml.	2,100	4,000	13,000	4,600	1,500	1,600	7,600	9,200	2,600	1,300	3,500
cal Coliforms /100 ml.	210	1,000	1,900	160	100-	50	860	3,200	1,300	500	1,400
loride, ppm.	50	70	65	50	50	60	60	40	40	35	25
lfate, ppm.	190	200	160	170	130	150	200	130	140	120	150
)i, Ortho, ppm.	0.7	1.1	1.1	0.8	0.6	1.1	0.4	0.7	0.5	0.3	0.4

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT BLACK RIVER RESERVATION, RT. #2 BRIDGE

	1/2/73	1/8	1/15	1/22	2/5	2/12	2/20	2/28	3/7	3/21	4/2	4/16	4/23
ıp. °C	4	0	3	5	4	0	4	0	10	2	12	6	16
y Rate	N	L	I	N	N	I	I	I	H	H	N	H	N
., ppm	12	13	11	11	11.5	12	11	12	11	12	10	12	8
urated	91	89	82	86	88	82	84	82	97	86	92	96	80
n. Ox. Demand	0	70	20	80	50	10	10	110	50	10	30	70	0
	7.8	7.6	8.0	7.9	7.4	7.6	7.6	7.7	7.8	7.6	7.7	7.6	7.6
or, units	70	200	90	80	180	60	50	50	120	120	60	190	40
idity, JTU	25	90	40	60	110	30	30	2	60	80	35	220	20
l bacterial '1 ml.	1,900	7,800	800	7,300	12,800	1,500	2,600	24,000	7,700	5,500	2,300	10,000	42,00
l Coliforms '100 ml.	-	-	-	-	44,000	15,000	41,000	14,000	18,000	21,000	9,400	21,000	3,900
al Coliforms '100 ml.	820	5,400	240	6,100	1,400	600	2,400	2,400	1,300	2,600	1,500	120	100
ride, ppm.	35	25	60	70	25	45	110	100	50	35	30	25	40
ıte, ppm.	150	150	200	200	130	190	200	190	135	120	150	130	170
Ortho, ppm.	1.2	2.0	3.0	2.8	1.6	2.2	2.1	2.1	1.05	0.9	1.4	3.0	1.5

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

Black River At Black River Reservation, Rt. 2 Bridge

Date	5/2/73	5/14	5/23	6/06	6/19	6/27	7/09	7/16	7/30	8/29	9/10	9/19
Temp. °C	N.	L.	H.	F.	H.	N.	L.	L.	L.	L.	L.	L.
Flow Rate	14	14	15	21	21	22	24	22	22	25	19	16
D.O., ppm	10	8	7	7	8	5	6	5.5	6	4	5	7
% Saturated	96	77	68	78	90	57	70	63	68	48	54	70
Chem. Ox. Demand	10	10	50	90	35	10	0	0	10	30	30	100
pH	7.8	7.6	7.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.4	7.3
Color, units	80	110	140	180	150	140	100	80	100	130	80	140
Turbidity, JTU	50	80	500	450	100	60	30	20	45	30	20	40
Total bacteria No/ 1 ml.	16,000	2200	16,000	40,000	11,000	80,000	6000	27,000	16,000	120,000	90,000	40,000
Fecal Coliforms No/ 100 ml.	400	1300	22,000	23,000	660	2000	50	100	150	10,000	100	1500
Total Coliforms No/ 100 ml.	6200	7200	44,000	32,000	39,000	40,000	2000	6200	2500	31,000	24,000	8600
Chloride, ppm.	35	40	25	25	35	50	35	60	50	135	135	200
Sulfate, ppm.	130	130	130	70	95	120	130	150	145	200	210	320
PO_4, Ortho, ppm	1.5	1.3	1.6	4.2	1.9	2.4	3.6	4.3	2.9	16	11	8.5

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT BLACK RIVER RESERVATION, RT. 2 BRIDGE

ate	10/1/73	10/10	10/23	10/31	11/12	12/05	12/17	12/26
mp. °C	16	17	14	13	6	9	1	4
low Rate	N	L	L	N	L	N	N	H
.O., ppm	7	5	7	9	11	9	11	13
Saturated	70	52	68	85	86	77	78	100
hem. Ox. Demand	10	50	50	0	10	30	10	20
	7.6	7.4	7.4	8.1	7.6	7.8	7.7	7.9
olor, units	60	90	70	40	60	60	130	120
urbidity, JTU	30	20	30	30	10	40	110	310
otal bacteria / 1 ml.	5000	85,000	16,000	26,000	800	8000	6800	16,000
tal Coliforms / 100 ml.	3200	5300	2900	24,000	100	11,000	9000	15,000
cal Coliforms / 100 ml.	250	150	-100	1700	-100	3800	-100	4800
loride, ppm.	90	110	140	100	135	90	55	35
lfate, ppm.	140	150	200	150	170	140	140	90
4, Ortho, ppm	5.0	3.0	3.0	1.5	6.0	1.1	1.7	2.7

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT CASCADE PARK, ELYRIA, OHIO @ Bridge in Park above dam

ate	1/2/73	1/8	1/15	1/22	2/5	2/12	2/20	2/28	3/7	3/20	4/2	4/11	4/23
emp. °C	4	0	3	3	5	0	1	1	10	2	12	6	16
low Rate	N	L	I	N	N	L	I	I	H	H	N	H	N
.O., ppm	13	13	13	13.5	13	13	13	13	10	13	10	11	8
Saturated	100	89	95	97	94	89	92	91	88	94	92	88	80
hem. Ox. Demand	40	70	25	20	30	40	50	70	35	50	40	50	0
H	7.8	7.7	8.0	7.8	7.5	7.7	7.7	7.8	7.8	7.6	7.8	7.6	7.8
olor, units	70	160	80	70	180	70	70	100	120	120	70	200	50
urbidity, JTU	35	100	45	50	110	70	100	10	70	70	20	200	25
otal bacterial o./1 ml.	200	6,500	2,000	9,000	9,800	5,000	5,600	8,600	3,100	1,700	7,900	8,800	9,000
otal Coliforms o./100 ml.	-	-	-	-	64,000	66,000	82,000	68,000	19,000	18,000	11,000	20,000	15,000
ecal Coliforms o./100 ml.	2,400	3,100	5,100	9,700	1,800	5,700	6,100	4,200	2,400	4,000	2,000	200	66
ıloride, ppm.	35	30	50	50	35	35	75	40	40	30	30	35	35
ılfate, ppm.	160	140	200	200	110	170	180	185	140	85	140	130	170
O4, Ortho, ppm.	0.8	1.1	2.0	1.5	1.1	1.0	1.0	0.8	0.7	0.8	0.8	1.5	0.6

H=HIGH
N=NORMAL
L=LOW
I =ICED

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT CASCADE PARK, ELYRIA, OHIO

ate	5/2/73	5/14	5/23	6/06	6/18	6/27	7/09	7/18	7/30	8/23	9/10	9/19
emp. °C	N.	L.	H.	F.	H.	N.	L.	L.	L.	L.	L.	L.
low Rate	14	13	15	20	21	22	25	23	23	26	20	17
.O., ppm	9	9	7	9	9	6.5	7	5	7	3	5	6
Saturated	86	85	68	98	100	75	83	58	80	37	55	62
hem. Ox. Demand	0	10	10	140	20	10	0	0	10	70	25	30
i	8.0	7.7	7.8	7.3	7.5	7.9	7.5	7.4	7.5	7.9	8.3	7.2
olor, units	160	120	70	260	190	120	80	90	110	180	90	50
urbidity, JTU	60	90	100	600	120	60	20	10	50	20	15	20
otal bacteria / 1 ml.	8500	4000	27,000	40,000	6400	80,000	32,000	44,000	43,000	300,000	40,000	450,000
ecal Coliforms / 100 ml.	230	1600	23,000	22,000	800	8300	1600	1200	4000	2300	1400	3300
otal Coliforms / 100 ml.	15,000	11,000	42,000	46,000	19,000	78,000	27,000	22,000	47,000	33,000	8000	20,000
loride, ppm.	30	40	50	20	40	40	40	50	40	130	240	250
lfate, ppm.	130	120	130	70	105	90	120	190	140	320	320	320
4, Ortho, ppm	0.8	1.0	1.3	2.4	1.7	0.9	0.9	1.2	0.9	1.2	1.4	0.6

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER AT CASCADE PARK, ELYRIA

ce	10/1/73	10/10/	10/23	10/31	11/12	12/05	12/17	12/26
mp. °C	17	19	13	12	4	8	10	4
w Rate	N.	L.	L.	U.	L.	N.	N.	U.
O., ppm	8	8	8	10	11	11	10	12
Saturated	82	85	75	92	84	93	84	92
em. Ox. Demand	0	50	0	0	0	20	0	30
	8.2	8.8	8.8	8.6	8.6	8.3	7.7	7.5
lor, units	50	90	50	20	40	60	130	80
rbidity, JTU	30	30	30	50	20	70	110	320
al bacteria / 1 ml.	96,000	250,000	76,000	26,000	8000	4400	16,000	14,000
al Coliforms / 100 ml.	29,000	18,000	16,000	30,000	15,000	20,000	18,000	24,000
al Coliforms 100 ml.	5100	7600	1800	4700	4400	5400	1200	4800
oride, ppm.	80	125	125	110	140	50	90	35
fate, ppm.	150	170	190	150	180	140	145	88
, Ortho, ppm	1.4	0.9	0.8	0.8	0.7	0.6	1.0	2.5

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

EAST BRANCH, BLACK RIVER AT LAPORTE

.e	1/3/73	1/09	1/16	1/29	2/07	2/14	2/26	3/12	3/26	4/4	4/16	4/25
p. °C	3	0	2	0.5	6	2	0	12	7	9	11	14
w Rate	N.	Ice	Ice	N.	N.	L.	Ice	H.	H.	N.	N.	L.
., ppm	13	12	13	13	12	13	10	10	11	11	11	9.5
aturated	96	82	94	89	96	94	71	90	90	95	100	91
m. Ox. Demand	10	30	10	70	35	0	0	30	10	0	0	0
	7.8	7.5	7.6	7.6	7.6	7.7	7.6	7.5	7.6	7.6	7.8	7.9
or, units	40	100	40	60	65	50	10	140	100	40	60	10
bidity, JTU	20	60	30	40	40	20	0	140	60	10	20	12
al bacteria 1 ml.	900	3100	1500	3200	1100	320	600	3200	2400	600	400	600
al Coliforms 100 ml.	7500	1300	20,000	28,000	7000	15,000	8700	28,000	4900	4700	1900	1400
al Coliforms 100 ml.	440	2400	1300	350	640	1300	1400	1300	150	720	20	15
oride, ppm.	40	30	50	40	35	40	60	35	40	30	40	40
fate, ppm.	130	150	200	170	140	200	150	120	90	150	140	150
, Ortho, ppm	0.5	0.8	0.8	0.7	0.9	1.4	0.2	1.0	0.8	0.5	0.5	0.7

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

EAST BRANCH AT LAPORTE, ROBSON ROAD Bridge Elyria Brighton Rd West Side of Bridge

Date	5/7/73	5/16	5/29	6/11	6/20	7/02	7/11	7/23	8/22	9/04	9/12	9/24
Temp. °C	L.	N.	H.	N.	H.	N.	H.	H.	L.	L.	L.	L.
Flow Rate	13	13	18	24	21	22	22	21	19	23	17	15
D.O., ppm	9	8	8	7	8	8	6	8	8	5	7	9
% Saturated	85	76	84	82	89	91	68	89	86	58	72	88
Chem. Ox. Demand	0	10	170	80	60	150	10	0	20	50	40	0
pH	7.9	7.7	7.3.	7.4	7.3	7.5	7.1	7.2	7.5	7.6	7.5	7.8
Color, units	60	100	60	70	150	80	120	110	60	50	90	60
Turbidity, JTU	10	30	60	90	65	40	170	00	40	20	30	20
Total bacteria No/ 1 ml.	700	900	1400	1200	5000	3000	25,000	6000	5600	3800	10,000	3400
Fecal Coliforms No/ 100 ml.	350	900	540	400	1400	960	23,000	1200	400	100	940	200
Total Coliforms No/ 100 ml.	1300	2700	1900	9300	1100	9700	16,000	12,000	3300	2800	10,000	3900
Chloride, ppm.	40	25	20	20	25	40	35	35	45	60	60	75
Sulfate, ppm.	150	130	110	75	65	110	70	120	150	170	200	180
PO_4, Ortho, ppm	1.3	0.7	0.8	0.6	1.9	1.2	2.3	1.0	1.0	1.6	2.0	1.6

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

EAST BRANCH BLACK RIVER AT LAPORTE

Date	10/3/73	10/15	10/24	11/05	11/14	12/10	12/19	1/7/74
Temp., °C	17	15	11	8	8	3	0	0
Flow Rate	N	N	L	N	L	N	N-I	L-I
D.O., ppm	6	8	10	11	11	11	13	13
% Saturated	62	78	90	93	92	82	90	89
Chem. Ox. Demand	30	10	10	30	20	10	20	0
pH	7.6	7.7	7.6	7.6	7.8	7.7	7.5	7.6
Color, units	60	30	40	20	20	40	80	30
Turbidity, JTU	45	20	30	60	10	30	60	10
Total bacteria No/ 1 ml.	4800	3200	2400	2400	3700	2300	6300	1100
Total Coliforms No/ 100 ml.	330	120	400	250	100	310	550	1000
Fecal Coliforms No/ 100 ml.	3400	2400	1100	3900	800	1000	1900	1200
Chloride, ppm.	60	60	70	80	60	40	40	50
Sulfate, ppm.	140	150	160	200	170	145	130	150
PO_4, Ortho, ppm	2.0	0.8	1.1	0.5	0.8	0.4	0.7	0.4

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

WEST BRANCH, BLACK RIVER AT PARSONS ROAD

ıte	1/3/73	1/09	1/16	1/29	2/07	2/14	2/26	3/12	3/26	4/04	4/16	4/25
ɔmp. °C	2	0	2	0	5	1	0	11	7	9	11	13
.ow Rate	Ice	Ice	N.	N.	Ice	Ice	Ice	H.	H.	N.	N.	L.
.O., ppm	13	12	11	11	12	12	12	9	11	10	10	8
Saturated	94	82	90	91	94	84	82	81	90	86	90	75
ıem. Ox. Demand	30	50	10	50	50	15	0	50	50	0	0	0
ı	7.7	7.5	7.5	7.6	7.6	7.6	7.6	7.5	7.7	7.6	7.7	7.8
ılor, units	80	100	45	60	55	30	60	220	170	60	80	50
ırbidity, JTU	40	50	20	80	50	25	10	280	120	15	40	20
·tal bacteria / 1 ml.	1200	1200	400	4000	960	320	1200	2800	5400	900	1000	1600
tal Coliforms / 100 ml.	2800	4900	2400	17,000	3400	2400	1400	13,000	9600	2800	110	880
cal Coliforms / 100 ml.	80	100	0	600	150	50	87	1500	2200	200	100	20
loride, ppm.	30	30	40	30	35	40	50	35	30	40	25	35
lfate, ppm.	150	170	220	180	150	220	190	100	100	150	160	200
4, Crtho, ppm	1.1	0.8	-	1.3	1.4	1.6	1.2	1.6	1.2	0.8	1.0	0.7

H-High
N-Normal
L-Low
I- Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

WEST BRANCH AT PARSONS ROAD

:e	5/7/73	5/16	5/29	6/11	6/20	7/02	7/11	7/23	8/22	9/04	9/12	9/24
:p. °C	L.	N.	H.	N.	H.	N.	H.	H.	L.	L.	L.	L.
)w Rate	13	12	18	23	21	21	22	22	18	24	17	15
)., ppm	9	7	8	8	8	7	7	8	7	6	6	8
Saturated	85	65	84	92	89	78	80	91	74	70	62	78
em. Ox. Demand	0	10	40	50	30	50	50	0	30	20	30	0
	7.7	7.7	7.4	7.4	7.4	7.4	7.3	7.4	7.5	7.6	7.5	7.6
.or, units	70	50	60	70	160	80	160	110	80	60	110	60
'bidity, JTU	40	30	70	80	130	100	170	170	90	30	35	40
:al bacteria												
1 ml.	700	1000	1400	2400	3000	2500	20,000	11,000	8800	2400	3600	2700
cal Coliforms												
100 ml.	27	250	320	100	1500	840	22,000	2200	4800	1800	960	1000
tal Coliforms												
100 ml.	590	1200	1900	7100	5100	8400	32,000	9400	5600	4500	1400	4100
oride, ppm.	30	30	30	25	25	30	35	30	40	40	40	45
fate, ppm.	170	150	130	100	80	120	85	180	200	130	150	200
, Ortho, ppm	1.0	0.7	0.8	2.0	2.1	2.0	3.0	1.2	1.4	0.9	1.2	2.0

h=High
n=Normal
l=Low
i=Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER, WEST BRANCH AT PARSONS ROAD

Date	10/3/73	10/15	10/24	11/05	11/14	12/10	12/19	1/7/74
Temp. °C	17	15	12	8	8	2	0	0
Flow Rate	N	N	L	N	L	N	N-I	L-I
D.O., ppm	7	6	9	9	8	13	13	13
% Saturated	72	59	83	76	68	94	90	89
Chem. Ox. Demand	10	10	10	20	10	10	10	10
pH	7.6	7.5	7.6	7.7	7.7	7.8	7.6	7.5
Color, units	70	50	50	60	30	40	80	30
Turbidity, JTU	140	70	80	90	15	40	80	20
Total bacteria No/ 1 ml.	12,000	4000	800	2400	1000	800	3100	500
Total Coliforms No/ 100 ml.	5600	1800	1600	3000	1200	1000	1700	720
Fecal Coliforms No/ 100 ml.	1400	800	200	400	200	200	270	180
Chloride, ppm.	40	40	40	40	40	30	30	40
Sulfate, ppm.	120	150	120	190	180	150	150	160
PO_4, Ortho, ppm	4.2	1.1	0.7	0.9	1.1	0.5	0.7	0.5

~~59-2~~ 780

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

West Ridge Rd
Rt 20 S of L+K

BLACK RIVER, WEST BRANCH AT CARLISLE RESERVATION

ate	1/3/73	1/09	1/16	1/29	2/07	2/14	2/26	3/12	3/26	4/04	4/16	4/25
emp. °C	2	0	1	0	3	2	0	10	6	9	12	14
low Rate	L	Ice	Ice	N	N	L	Ice	F	H	N	L	L
.O., ppm	13	11	11	12	12	12	12	9	11	11	10	6
Saturated	94	75	78	82	89	87	82	80	88	95	92	58
hem. Ox. Demand	35	100	50	60	40	20	0	100	30	0	10	0
H	7.6	7.5	7.4	7.6	7.5	7.6	7.6	7.6	7.6	7.6	7.7	7.7
olor, units	90	105	40	20	70	35	30	220	140	70	60	20
urbidity, JTU	40	50	30	70	50	10	10	330	100	30	60	25
otal bacteria o/ 1 ml.	1100	1500	2700	4000	2000	360	2200	11,000	5900	1600	1500	1600
otal Coliforms o/ 100 ml.	11,000	8500	-	33,000	10,000	4100	10,200	51,000	56,000	1800	3000	2100
ecal Coliforms o/ 100 ml.	280	400	6000	1400	400	200	6600	1700	1300	80	100	25
nloride, ppm.	30	25	30	30	30	40	60	70	20	30	20	35
ulfate, ppm.	150	180	200	190	170	220	180	110	95	150	150	180
O_4, Ortho, ppm	1.3	1.2	3.0	1.2	1.1	1.6	1.0	1.6	1.5	1.4	1.1	2.8

H-High
Normal-N
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

WEST BRANCH, BLACK RIVER AT CARLISLE RESERVATION

	5/7/73	5/16	5/29	6/11	6/20	7/02	7/11	7/23	8/22	9/04	9/12	9/24
°C	L.	L.	H.	N.	H.	L.	H.	N.	L.	L.	V.L.	L.
Rate	13	12	17	23	22	21	22	18	21	23	16	15
ppm	8	9	7	7	8	7	6	6	5	5	6	9
urated	75	89	72	81	91	78	68	66	52	57	60	88
Ox. Demand	0	10	40	50	50	20	150	0	35	20	10	0
	7.7	7.6	7.4	7.4	7.4	7.4	7.1	7.4	7.4	7.5	7.4	7.7
units	60	90	60	70	120	100	280	105	80	70	100	50
lity, JTU	40	40	100	80	160	60	600	220	50	40	60	35
bacteria ml.	700	3000	3000	2000	4000	60,000	54,000	6200	16,000	8000	6000	3500
Coliforms 0 ml.	20	10,000	800	200	2200	4400	14,000	2600	5600	1600	3100	1700
Coliforms 0 ml.	2100	10,000	7300	7800	5100	4500	17,000	11,000	30,000	5100	7000	16,000
ie, ppm.	35	30	30	20	30	30	25	75	45	75	50	50
e, ppm.	130	140	140	100	90	100	70	145	170	190	190	250
tho, ppm	1.7	1.3	1.1	3.4	1.1	2.0	3.0	1.4	5.5	11	17	2.8

H=High
N=Normal
L=Low
I =Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

BLACK RIVER, WEST BRANCH AT CARLISLE RESERVATION

te	10/3/73	10/15	10/24	11/05	11/14	12/10	12/19	1/7/74
mp. °C	16	15	11	7	9	3	0	0
ow Rate	N	N	L	N	L	N	L	L
O., ppm	6	5	8	9	12	12	13	13
Saturated	60	49	72	73	78	88	90	90
em. Ox. Demand	50	20	10	20	0	10	10	0
	7.6	7.5	7.5	7.6	7.6	7.8	7.7	7.7
lor, units	70	60	100	60	40	50	70	30
rbidity, JTU	90	70	50	50	20	20	60	25
al bacteria								
1 ml.	4800	20,000	4800	2000	1200	1200	4400	600
al Coliforms								
100 ml.	21,000	29,000	4300	3700	2000	5400	2900	1300
al Coliforms								
100 ml.	1400	23,000	430	330	250	2600	160	70
oride, ppm.	30	50	50	50	60	40	40	40
fate, ppm.	90	150	120	140	150	150	150	170
, Ortho, ppm	4.1	10.0	6.5	1.5	6.0	1.2	1.2	0.9

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

PLUM CREEK AT RT. 10-20, CARLISLE

:e	5/7/73	5/16	5/29	6/11	6/20	7/02	7/11	7/23	8/22	9/04	9/12	9/24
ıp. °C	L.	L.	H.	N.	H.	L.	H.	L.	L.	L.	L.	L.
w Rate	13	12	16	22	20	20	21	19	17	22	16	15
)., ppm	7	7	6	6	5	6	7	5	5	4	6	6
aturated	66	65	60	68	54	65	78	53	52	46	60	59
m. Ox. Demand	10	10	30	40	30	10	20	10	50	30	50	30
	7.4	7.4	7.3	7.3	7.3	7.2	7.2	7.3	7.4	7.4	7.4	7.3
or, units	60	80	80	60	90	90	160	70	80	80	120	70
bidity, JTU	5	15	40	50	50	15	80	30	40	10	30	20
al bacteria	1000	10000	8000	6000	20,000	8000	60,000	12,000	21,000	5000	17,000	6400
1 ml.												
:al Coliforms	-	53,000	2000	100	2100	50	11,000	600	32,000	1200	51,000	8300
100 ml.												
al Coliforms	2400	60,000	32,000	12,000	13,000	6900	25,000	9000	76,000	12,000	86,000	77,000
100 ml.												
oride, ppm.	50	40	40	55	30	60	20	55	45	80	70	50
fate, ppm.	200	150	150	140	110	150	80	150	135	200	190	180
, [redacted] ppm	11	10	9	7.5	7.5	8.5	3.5	14	8.5	25	42	12
ho, ppm	11	8.5	4	9.0	7.5	8.0	4.0	12	7.0	35	40	9

H=HIGH
N=Normal
L=Low
I =Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

PLUM CREEK AT Rts. 10-20, CARLISLE TOWNSHIP

e	1/3/73	1/09	1/16	1/29	2/07	2/14	2/26	3/12	3/26	4/04	4/16	4/25
p. °C	2	1	2	0	5	4	2	10	6	8	12	12
v Rate	L.	L.	Ice	N.	L.	L.	L.	H.	IL.	N.	I.	L.
., ppm	11	10	10	12	10	9	10	8	11	9	8	8
iturated	80	69	73	82	78	62	73	71	88	68	74	74
n. Ox. Demand	80	80	19	40	40	70	0	50	30	10	10	0
or, units	7.5 80	7.5 70	7.5 60	7.5 110	7.4 60	7.5 50	7.4 20	7.5 200	7.7 180	7.5 50	7.5 80	7.6 60
idity, JTU	30	75	30	70	30	30	10	140	110	15	25	15
al bacteria 1 ml.	600	400	9600	8000	8800	16,000	14,000	13,000	9300	2000	3000	4000
al Coliforms 100 ml.	-	-	-	130,000	90,000	240,000	72,000	47,000	3500	5900	1000	6800
al Coliforms 100 ml.	800	0	12,600	3000	840	1400	39,000	4800	5200	100	40	25
ride, ppm.	50	50	70	50	40	80	90	40	25	50	50	70
ate, ppm.	160	220	250	180	190	200	170	120	85	170	200	200
[redacted]	-	9.0	12	4.0	9.0	12	7.5	2.5	1.8	9.0	13	15
no, ppm	5.0	8.5	10.5	3.7	6.5	11	5.5	2.5	1.6	7.0	12	13

H-High
N-Normal
L-Low
I -Iced

LORAIN COUNTY METROPOLITAN PARK DISTRICT, ELYRIA, OHIO
WATER ANALYSIS TEST RESULTS

PLUM CREEK AT RT. 10-20

ıte	10/3/73	10/15	10/24	11/05	11/14	12/10	12/19	1/7/74
ɜmp. °C	17	15	12	7	11	4	2	1
.ow Rate	N	N	L	N	N	N	N	I.-Ice
O., ppm	6	4	5	8	6	9	11	12
Saturated	62	49	46	65	55	65	80	83
ɜem. Ox. Demand	30	50	20	30	15	20	20	10
I	7.3	7.4	7.5	7.4	7.5	7.5	7.5	7.6
·lor, units	60	50	70	50	50	50	80	20
ırbidity, JTU	20	30	20	25	10	20	20	5
ɔtal bacteria / 1 ml.	8000	50,000	4800	1800	4000	6000	1200	80
·tal Coliforms / 100 ml.	41,000	50,000	5000	15,000	18,000	36,000	560	100
·cal Coliforms / 100 ml.	4400	TNTC	330	600	560	6400	100	100
loride, ppm.	50	70	70	60	70	60	80	85
lfate, ppm.	110	140	150	150	160	150	160	170
[redacted] ppm	13	25	25	13		8	8	7
O_4, Ortho, ppm	16	20	24	11	20	7.5	6	5.5

Attachment C

Municipal Sewage Treatment Plants

Amherst STP
Little Beaver Creek Upstream of Outfall
1977

Month	D.O. (mg/l) Min.	D.O. (mg/l) Ave.	D.O. (mg/l) Max.	BOD 5-day (mg/l) Min.	BOD 5-day (mg/l) Ave.	BOD 5-day (mg/l) Max.	pH s.u. Min.	pH s.u. Ave.	pH s.u. Max.
January	9.7	10.975	11.8	4.6	5.7	7.1	7.2	7.4	7.6
February	11.2	11.533	11.8	5.6	5.7	5.8	7.4	7.4	7.4
March	8.4	10.143	12.4	2.7	4.2	5.6	7.4	7.5	7.6
April	8.7	9.212	10.2	2.3	4.1	5.5	7.3	7.4	7.5
May	6.6	7.878	9.8	2.8	3.5	4.4	7.2	7.5	8.0
June	6.6	7.600	8.6	2.0	3.7	9.9	6.7	7.2	7.6
July	6.6	7.133	7.6	1.8	2.7	4.3	7.1	7.3	7.6
August	5.8	7.289	8.6	2.7	3.6	5.8	7.2	7.4	7.8
September	6.2	7.222	8.0	2.2	3.2	5.4	7.2	7.4	7.6
October	7.6	8.6	10.0	3.1	4.1	4.7	7.4	7.6	7.7
November	7.4	9.7	11.8	3.9	4.9	5.9	7.4	7.6	7.7
December	9.8	11.4	12.0	2.7	4.2	5.8	7.5	7.6	7.8

Amherst STP
Little Beaver Creek Downstream of Outfall
1977

Month	D.O. (mg/l) Min.	D.O. (mg/l) Ave.	D.O. (mg/l) Max.	BOD 5 day (mg/l) Min.	BOD 5 day (mg/l) Ave.	BOD 5 day (mg/l) Max.	pH (s.u.) Min.	pH (s.u.) Ave.	pH (s.u.) Max.
January	7.5	8.4	8.9	17.0	19.6	23.0	7.0	7.2	7.4
February	8.3	9.6	10.4	15.0	18.0	20.0	7.2	7.2	7.4
March	7.9	9.0	10.3	16.0	19.0	24.0	7.1	7.3	7.4
April	6.8	8.0	9.4	17.0	20.0	26.0	7.1	7.2	7.4
May	6.0	6.9	8.5	20.0	22.0	25.0	7.1	7.3	7.6
June	6.1	7.0	7.6	9.0	18.0	24.0	6.8	7.1	7.3
July	6.0	6.7	7.2	11.0	16.3	22.0	7.1	7.3	7.5
August	5.9	6.5	7.2	12.0	16.0	19.0	7.1	7.2	7.6
September	5.7	6.4	7.4	16.0	19.0	22.0	6.9	7.1	7.4
October	6.3	7.3	7.8	15.0	19.0	26.0	7.2	7.3	7.4
November	7.1	7.7	8.6	17.0	20.0	28.0	7.2	7.3	7.4
December	8.8	9.8	10.4	14.0	18.0	20.0	7.3	7.4	7.6

Lorain STP
Black River Upstream of Outfall
Water Year 1977

Month	D.O. (mg/l)			BOD 5 day (mg/l)			pH (s.u.)			Residue T. NFLT (mg/l)			Fecal Col MF-FCBR #/100 ml		
	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.
October 1976	3.5	5.7	7.7	2	4	7	6.6	7.4	7.5	8	8	8	150	1582	19000
November	2.7	4.9	10.4	2	4	9	6.8	7.3	7.7		No Sample		400	10798	60000
December	9.5	11.6	13.1	2.0	3.6	6.0	7.1	7.4	7.6		No Sample		9	2708	13000
January 1977								No Readings							
February	9.9	13.8	15.0	1.8	3.6	6.3	7.5	7.7	8.0		No Sample		100	1900	5100
March	8.5	12.1	13.8	2.2	3.4	5.3	7.3	7.6	7.9		No Sample		270	4000	11000
April	6.2	7.6	9.5	1.6	2.8	4.5	7.4	7.6	8.0		No Sample		140	1000	2500
May	4.9	6.0	7.9	1.8	2.8	4.6	7.4	7.5	7.7		No Sample		50	1300	3100
June	4.2	5.0	6.3	0.9	1.9	3.0	7.2	7.4	7.5		No Sample		260	2064	9200
July	2.9	4.0	6.6	1.0	2.4	4.1	7.2	7.4	7.5		No Sample		800	4400	10000
August	3.2	4.1	5.3	3.9	6.0	9.0	7.2	7.4	7.6		No Sample		500	4900	18000
September	3.6	4.6	1.2	4.4	7.2	7.2	7.3	7.4	7.6		No Sample		320	4000	28000

Lorain STP
Black River Downstream of Outfall
Water Year 1977

Month	D.O. (mg/l) Min.	D.O. (mg/l) Ave.	D.O. (mg/l) Max.	BOD 5 day (mg/l) Min.	BOD 5 day (mg/l) Ave.	BOD 5 day (mg/l) Max.	pH (s.u.) Min.	pH (s.u.) Ave.	pH (s.u.) Max.	Residue T. NFLT (mg/l) Min.	Residue T. NFLT (mg/l) Ave.	Residue T. NFLT (mg/l) Max.	Fecal Col. MF-FCBR #/100 ml Min.	Fecal Col. MF-FCBR #/100 ml Ave.	Fecal Col. MF-FCBR #/100 ml Max.
October 1976	4.2	6.0	8.0	1	3	6	7.2	7.4	7.7	0	0	0	3	137	9500
November	3.6	6.1	11.3	1	3	6	7.2	7.3	7.7	No Sample			2	2321	18000
December	9.7	11.9	13.2	1	3	5	7.4	7.5	7.7	No Sample			500	2645	7300
January	No Samples Reported														
February	9.7	13.1	15.0	2.1	4.1	6.3	7.6	7.7	8.0	No Sample			100	2600	6400
March	8.5	12.0	13.9	1.2	3.6	5.6	7.4	7.7	8.0	No Sample			400	4900	22000
April	6.4	7.6	9.5	1.6	2.8	4.3	7.4	7.5	7.8	No Sample			8	1000	11000
May	4.9	6.1	7.5	1.7	3.1	4.7	7.4	7.5	7.7	No Sample			50	1300	3100
June	4.3	5.1	6.2	0.2	2.2	3.8	7.2	7.4	7.6	No Sample			20	2900	15000
July	2.9	3.9	6.2	0.1	1.9	3.4	7.2	7.4	7.6	No Sample			700	5200	21000
August	3.1	4.1	5.2	2.5	6.7	11.3	7.2	7.4	7.6	No Sample			100	5400	25000
September	3.5	4.7	5.4	1.6	4.4	7.8	7.3	7.4	7.6	No Sample			10	4100	28000

Elyria Wastewater Treatment Plant
Black River Upstream of Outfall
1977

	D.O. (mg/l)			BOD 5 day (mg/l)			pH (s.u.)			Residue T. NFLT (mg/l)			Fecal Col. MF-FCBR #/100 ml			Ammonia NH_3-N (mg/l)		
Month	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.
January	9.1	9.7	11.0	4.0	6.0	8.0	7.5	7.7	7.8	3	18	35	1900	2400	3000	No Sample		
February	9.4	10.7	12.3	3.0	7.0	9.0	7.8	7.8	7.8	3	23	51	1100	1600	3000	No Sample		
March	11.0	12.0	13.3	2.0	3.0	4.0	7.9	8.0	8.1	22	34	41	640	1213	2000	No Sample		
April	10.4	11.4	13.1	2.0	6.0	9.0	7.9	8.3	8.8	5	10	17	230	320	400	No Sample		
May	8.8	9.9	11.4	2.0	3.0	5.0	7.7	7.8	7.9	2	25	83	< 77	716	1300	No Sample		
June	6.4	7.5	8.2	2.0	4.0	9.0	7.6	7.8	7.9	21	24	36	43	2409	5200	No Sample		
July	6.9	7.4	8.0	1.0	5.2	10.0	7.7	7.8	7.9	19	52	136	43	3260	9800	No Sample		
August	7.0	8.6	5.0	1.0	2.8	6.0	7.8	7.9	8.0	14	26	48	1500	2500	4000	No Sample		
September	6.4	7.9	9.6	2.0	4.0	7.0	7.7	7.9	8.1	5	40	88	1100	2700	4000	No Sample		
October	6.3	8.5	9.9	2.0	2.0	4.0	7.8	7.8	7.9	3	9	13	43	851	2400	.356	.400	.445
November	8.2	9.9	12.2	2.0	4.3	9.6	7.7	7.9	8.0	8	38	75	200	673	1000	1.75	3.19	4.09
December	No Samples Taken																	

Elyria Wastewater Treatment Plant
Black River Downstream of Outfall
1977

Month	BOD 5 day (mg/l)			pH (s.u.)			Residue T. NFLT (mg/l)			Fecal Col. MF-FCBR #/100 ml			Ammonia NH_3-N (mg/l)		
	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.
January	3	5	8	7.4	7.5	7.7	9	22	36	<14	19	29	No Sample		
February	9	11	12	7.6	7.7	7.8	6	31	62	<14	679	1500	No Sample		
March	4	6	9	7.7	7.8	7.9	30	36	41	480	873	1400	No Sample		
April	7	9	13	7.6	7.8	7.9	13	16	19	29	48	86	No Sample		
May	10	24	55	7.7	7.8	7.9	7	46	91	<77	776	2000	No Sample		
June	2	16	21	7.5	7.6	7.7	0	28	58	<14	108	250	No Sample		
July	3	10	20	7.6	7.7	7.9	33	63	138	<14	942	3700	No Sample		
August	5	8	12	7.5	7.7	7.8	24	27	39	14	256	580	No Sample		
September	6	10	15	7.5	7.7	7.9	10	43	78	190	758	1300	No Sample		
October	3	8	13	7.7	7.7	7.8	2	13	20	<14	29	29	6.23	7.843	14.818
November	5	13	16	7.7	10.8	7.9	40	58	100	150	237	400	.5	7.73	14.24
December	No Samples Taken														

SURVEY OF THE BLACK RIVER IN THE ELYRIA, OHIO AREA.

Introduction

This survey was conducted at the request of the staff of the Division of Engineering, Ohio Department of Health, in September, 1970. The purpose of the survey was to determine the effect of untreated municipal, industrial and storm sewer discharges on the Black River. The survey was conducted from Rt. 20 bridge on the west branch and Coonville Road bridge on the east branch of the Black River to the Ford Road bridge on the Main Stem of the Black River which is one-half mile down stream of the Elyria sewage treatment plant. River samples were collected at ten locations as shown in Table I.

Three individual surveys were conducted to collect Black River water samples (1) October 7, 1970, (2) October 13, 1970 and (3) November 11, 1970. On October 7, 1970, and October 19, 1970, samples were also collected from the overflow of the Mount Street Pumping Station, Elyria Foundry, a combined sewer overflow west of Harshaw Chemical on October 19, 1970. A sample was also obtained of the Harshaw discharge to the east branch.

During the survey, the Fischer Body plant of General Motors was on strike. This plant is a large plating operation involving the use of chromium, copper and zinc.

Sample Analysis

All stream samples were analyzed for field dissolved oxygen and temperature, BOD, COD, color, conductivity, pH, total alkalinity, suspended solids, volatile suspended solids, dissolved solids, chlorides, fecal coli, and heavy metals: cadmium total chromium, total iron, nickle and zinc. The results are tabulated in Table II through Table V. The most significant data are shown graphically in Figures 1 through 4.

Observations

During all surveys the west branch of the Black River was very black in color. The source of this black color was traced to the discharge of Elyria Foundry. An engineer from the Northeast District Office visited the foundry to initiate procedures to place them under a Water Pollution Control Board discharge permit and to begin corrective measures.

Large brown oil slicks were also observed on the east branch of the Black River for considerable distances upstream and downstream of Harshal Chemical. The exact source of the oil was not determined, but was traced to a storm sewer discharge just downstream of the East Bridge Street bridge.

Foam was observed along the banks of the east branch at Washington Avenue, and was generally orange in color. It is believed that this material is discharged by Obetts Chemical Company.

Results

The data are tabulated in Tables I through V and are shown graphically in Figures 1 through 4.

The data show a substantial increase in BOD and NH_3 at station 10, Washington Avenue, on the east branch of the river. This increase undoubtedly reflects the overflow of domestic sewage from the combined sewer west of Harshaw and the overflow from the Mound Street pumping station. It is also noted that the fecal coli. count at all stations exceed the standard of 200 per 100 ml. This substantiantiates the fact that there is domestic wastes being discharged to the river over the entire section under study.

The data also show that in general there is a substantial increase in heavy metal concentration on the east branch below East Bridge Street. The data in Table V indicate that there is heavy metals being discharged to the river from the combined sewer overflow and the Mound Street pumping station overflow. While

part of this increase in heavy metals can be contributed to Harshaw Chemical, the data also indicate there are other sources in the City of Elyria which are discharging heavy metals to the sanitary sewer.

WL:akf
1-25-71

TABLE I

Sample Locations

A. Black River

1. Below Elyria Sewage Plant at Ford Road bridge.
2. At entrance to Cascade Park.
3. In Cascade Park above dam.

B. West Branch Black River

4. Lodi Street Bridge
5. W. Third Street Bridge
6. Mussey Avenue Bridge
7. Rt. 20 Bridge

C. East Branch Black River

8. Coonville Road Bridge
9. East Bridge Street Bridge
10. Washington Avenue Bridge

TABLE II. BLACK RIVER SURVEY

Sample Date: 10-7-70

LOCATION	TIME	TEMP. °F	SO_4 (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (ppm)	Ni (ppm)	Zn (ppm)	Cl^- (ppm)	COND.	pH	ALK. (ppm)	SUSP. SOLIDS (ppm)	VOLITILE SUSP. SOLIDS (ppm)	COLOR Pt-Co Units	TURB.	DO (ppm)	BOD (ppm)	COD (ppm)	DIS. SOLIDS (ppm)	NH_3 as N (ppm)	FECAL COLI. #/100ml
MAIN STEM																							
FORD ROAD	11:00am	58	106	.02	.95	.10	.82	.26	1.15	89	660	7.6	107	10	5	92	25	6.9	4.5	52.7	470	6.9	<3000
CASCADE PARK	11:20am	58	136	.06	.13	.05	1.25	.09	.31	69	560	7.3	84	15	6	87	26	6.8	7.4	36.8	433	6.6	<3000
CASCADE PARK	11:30am	58	121	.06	.10	.05	1.38	.06	.08	69	570	7.3	84	20	8	69	28	6.6	5.9	38.1	400	7.1	<3000
WEST BRANCH																							
LODI STREET	11:41am	58	174	0	0	.01	3.55	.06	.16	27.4	560	7.4	77	32	7	97	40	8.1	2.7	70.8	418	1.5	<3000
W. THIRD ST.	12:29am	57	121	0	0	.02	4.14	0	.08	6.8	480	7.3	84	24	5	81	34	10.2	6.1	38.6	392	0.32	<3000
MUSSEY AVE.	12:45pm	55	98	0	0	.01	2.58	.04	.61	13.6	390	7.5	94	20	1	91	35	8.4	3.0	30.0	290	1.2	1350
RT. 20	1:00pm	55	106	0	0	0	1.86	0	.39	13.6	400	7.7	98	21	3	82	47	7.8	2.8	26.3	323	1.2	760
EAST BRANCH																							
COONVILLE ROAD	1:23pm	59	113	0	0	0	1.41	0	.05	41.1	400	8.1	94	20	5	88	28	9.7	2.5	19.5	346	0.75	700
E. BRIDGE ST.	2:25pm	58	106	0	0	0	.89	.01	.43	27.4	410	7.9	92	14	5	81	24	9.3	3.7	27.7	308	0.75	850
WASHINGTON AVE.	2:42pm	62	144	.05	.13	.07	1.01	.17	.31	164.3	690	8.2	102	9	4	72	27	7.2	8.6	37.7	585	25.8	490

TABLE III. BLACK RIVER SURVEY

Sample Date: 10-13-7.

LOCATION	TIME	TEMP. °F	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (ppm)	Ni (ppm)	Zn (ppm)	Cl^- (ppm)	COND.	pH	ALK. (ppm)	SUSP. SOLIDS (ppm)	VOLITILE SUSP. SOLIDS (ppm)	COLOR Pt-Co Units	TURB.	DO (ppm)	BOD (ppm)	COD (ppm)	DIS. SOLIDS (ppm)	NH_3 as N (ppm)	FECAL COLI. #/100ml
MAIN STEM																						
FORD ROAD	8:29am	59	0	.37	.11	1.95	.1	.1	74.9	720	7.5	98	35	11	75	52	6.5	7.1	36.3	493	10.1	<2000
CASCADE PARK	9:10am	59	.05	.35	.07	1.66	.22	.17	102.1	800	8.0	111	35	11	97	53	7.4	4.8	41.1	427	14.6	<12000
CASCADE PARK	9:30am	59	.06	.29	.07	1.69	.17	.20	102.1	780	8.3	102	33	12	93	58	7.1	4.8	40.3	427	13.3	<12000
WEST BRANCH																						
LODI STREET	9:51am	59	0	0	.03	4.50	.08	.32	20.4	490	7.6	57	106	32	73	250	7.1	3.1	91.0	404	3.0	<12000
W. THIRD ST.	10:15am	60	0	.05	.02	4.98	.06	.05	13.6	510	7.1	63	45	13	92	58	7.6	6.4	32.6	419	0.9	<12000
MUSSEY AVE.	10:43am	58	0	.14	.01	2.17	.13	.26	20.4	530	7.4	96	15	2	73	21	7.5	1.7	33.3	399	1.2	1250
RT. 20	11:02am	57	0	0	.03	.86	.01	.11	34.0	580	7.3	96	17	5	38	35	6.6	1.4	34.8	481	2.3	[illegible]
EAST BRANCH																						
COONVILLE ROAD	11:30am	58	0	0	.02	1.58	0	.36	34.0	570	7.6	104	30	4	62	54	8.5	4.0	34.4	450	0.94	<3000
E. BRIDGE ST.	12:12pm	58	0	0	.03	.72	.01	.10	34.0	520	7.7	94	16	7	58	27	8.1	3.7	32.6	438	0.92	<3000
WASHINGTON AVE.	12:31pm	60	.05	.20	.08	1.67	.19	.14	108.9	780	8.4	94	37	7	78	69	7.2	13.9	34.4	553	12.4	<3000

TABLE IV. BLACK RIVER SURVEY

Sample Date: 11-11-70

LOCATION	TIME	TEMP. °F	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (ppm)	Ni (ppm)	Zn (ppm)	Cl^- (ppm)	COND.	pH	ALK. (ppm)	SUSP. SOLIDS (ppm)	VOLITILE SUSP. SOLIDS (ppm)	COLOR Pt-Co Units	DO (ppm)	BOD (ppm)	COD (ppm)	DIS. SOLIDS (ppm)	NH_3 as N (ppm)	FECAL COLI. #/100ml	TOTAL COLI. #/100ml
MAIN STEM																						
FORD STREET	9:04am	51	.04	.07	.04	1.37	.09	.38	51.0	530	7.5	109	11	7	60	9.6	12.0	47.0	501	4.6	<2000	<20000
CASCADE PARK	9:35am	51	.03	.02	.04	1.58	.12	.21	45.9	508	7.7	107	10	5	53	10.1	7.4	35.6	480	2.1	4700	30000
CASCADE PARK	9:54am	51	.03	.06	.05	1.60	.12	.29	43.2	503	7.1	107	12	5	68	10.6	7.4	33.7	502	2.2	3200	14000
WEST BRANCH																						
LODI STREET	10:15am	51	.02	.05	.03	2.73	.09	.34	19.1	442	7.4	98	28	5	58	10.7	3.6	38.3	468	0.5	15500	48000
W. THIRD ST.	10:34am	52	.03	.04	.01	2.89	.15	.30	20.4	450	7.5	96	21	1	49	11.0	2.8	32.4	445	0.6	9200	27000
MUSSLY AVE.	10:58am	49	.03	.06	.02	2.06	.15	.15	20.4	464	7.5	111	27	7	73	10.5	4.1	34.2	435	0.5	2600	11000
RT. 20	11:20am	50	.03	0	.01	2.61	.02	.31	23.8	495	7.7	121	44	9	45	8.2	1.2	26.9	482	0.6	775	6000
EAST BRANCH																						
COOKVILLE ROAD	11:55am	51	.04	0	.01	1.14	.04	.12	34.0	530	7.6	111	9	7	48	11.6	2.9	25.5	519	0.3	1025	9000
E. BRIDGE ST.	12:20pm	50	.03	0	.01	1.14	.05	.29	30.6	520	7.6	109	13	6	35	10.4	3.6	28.2	483	0.5	2400	20000
WASHINGTON AVE.	12:40pm	52	.05	.03	.03	1.03	.09	.27	51.0	595	7.6	107	10	5	39	10.3	22.0	49.0	512	2.32	1065	9000

TABLE V. BLACK RIVER SURVEY

LOCATION	COLOR Pt-Co Units	$THOR_A$	COD_A	pH	SUSP. SOLIDS (ppm)	SO_4 (ppm)	NO_3 as N (ppm)	NH_3 as N (ppm)	Cl (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (ppm)	Ni (ppm)	Zn (ppm)	BOD (ppm)	COD (ppm)
Sample Date: 10-7-70																	
ELYRIA COMBINED SEWER OVERFLOW WEST OF HARSHAW	6	84	1505	3.2	620	15	69.8	20.1	110	8.4	.24	3.21	1.69	1.36	.82	74.3	416
MOUND STREET PUMP STATION OVERFLOW	10	73	2480	7.5	632	83	137.4	4.1	305	.3	.49	2.95	.45	10.8	.55	7.4	24
ELYRIA FOUNDRY DISCHARGE	8	392	443	7.3	1750	53	0	0	30	-	-	-	22.7	-	-	4.3	756
Sample Date: 10-19-70																	
ELYRIA COMBINED SEWER OVERFLOW WEST OF HARSHAW	37	15.4	3210	9.2	115	53	51.4	2.5	750	1.04	.01	1.95	.28	.1	.2	10.7	104
HARSHAW CHEMICAL DISCHARGE	51	25.2	2700	9.0	290	45	28	127	650	1.87	1.24	13.3	1.16	.1	.54	4.6	48
MOUND STREET PUMP STATION OVERFLOW	2	518	1275	6.8	4460	144	30.0	32.3	200	24.1	24.1	73.5	29.6	12.6	20.5	18.0	332
ELYRIA FOUNDRY DISCHARGE	79	9800	608	7.3	11400	91	.53	1.12	35	-	-	-	117.0	-	-	28.0	800

Attachment E

U.S. EPA Survey, March 1-3, 1972

D. Fish Flesh Tainting Study

From March 1, 1972 to March 3, 1972, a fish flesh tainting study using caged channel catfish (Ictalurus punctatus) was conducted in the Black River in the area of the U.S. Steel - Lorain Works. The flow of the river at the USGS cage in Elyria was 585 cfs on March 1, 1972, 2720 cfs on March 2, 1972, and 2670 cfs on March 3, 1972, generally above the average March flow of 800 cfs. The survey was conducted in March to avoid low dissolved oxygen concentrations prevalent in the warmer months which would tend to cause fish mortality.

At each location baskets containing three catfish (one pound average) were placed on both the right and left bank of the river. The fish remained in the river for two days (48 hours). Mortality controls were maintained in well water for the same period. Upon recovery, all fish were cleaned and immediately frozen using dry ice, and then shipped to the Department of Food Science and Technology at Oregon State University for taste evaluation.

The fish were thawed in the laboratory at 3.3°C and then wrapped in aluminum foil. After baking, the fish were removed from the oven and flesh from each sample was flaked and subdivided for the test panel. Panelist were given a known reference along with the test samples. Each sample was prepared as two replicates and was rated by ten judges on a seven point scale. "Blind" references were also included in the study. Fish scoring five to seven points were considered to have acceptable flavor. Analysis of variance techniques were used to determine least significant differences between test and reference samples.

The results of the study are tabulated in Table III-3. Thes data indicate that fish flavor was significantly affected in the stream segment from the coke plant discharge (Outfall 002) to below Outfalls 003 and 004 at the downstream end of the turning basin. The effect on flavor was most likely due to phenolics and possibly oils. Concentrations of phenolics were highest on March 1, 1972 when the stream flow was much lower than on March 2 and 3, 1972. The improvement in flavor below the turning basin was probably the result of the stream mixing with intruding lake water. These results must be evaluated in terms of the stream flow encountered during the survey and the time of year. Since the effects of the discharges from the Lorain Works were mitigated by the large amount of dilution afforded by the stream, more severe results at lower stream flows and similar waste loadings would be expected. However, significant reductions in the coke plant phenolics discharges since 1972 may have improved the situation at critcal flows.

TABLE III-3

BLACK RIVER FISH TAINTING STUDY

March 1-3, 1972

Station	Mile Point 4/	Fish Flavor Scores 1/			Mid-Stream Surface Water Quality			
		Right Bank 2/	Left Bank 3/	Average	Phenolics (ug/l) 3/1/72	Phenolics (ug/l) 3/3/72	Oil & Grease (ug/l) 3/1/72	Oil & Grease (ug/l) 3/1/72
1	0.5	5.32	4.20	4.76	< 0.002	0.014	2.0	1.8
2	1.2	-	4.77	4.77 3/	-	-	-	-
3	1.3	4.95	5.60	5.28	0.002	0.011	2.4	1.1
4	1.6	4.40	5.10	4.75	0.003	0.011	2.3	0.5
5	2.3	-	4.65	4.65 3/	-	-	-	-
6	2.45 Below Outfalls 003-004	(4.15)	(4.05)	(4.10)	0.002	0.010	1.8	1.6
7	2.7 Above Outfalls 003-004	-	(3.80)	(3.80 3/)	0.002	0.009	1.5	19.6
8	2.85	4.50	(3.35)	(3.92)	0.080	0.014	2.2	2.4
9	3.10	-	(4.30)	(4.30 3/)	-	-	-	-
10	3.35 Below Outfall 002	(3.47)	5.05	(4.26)	0.090	< 0.002	1.3	3.1
11	3.7 Above Outfall 002	4.85	5.67	5.26	0.003	0.003	2.2	1.0
12	4.75	-	-	-	< 0.002	0.002	3.5	1.5
13	4.85 Below Outfall 001	4.65	-	4.65 3/	0.002	< 0.002	1.7	1.6
14	5.1 Mouth of French Cr.	4.60	5.22	4.91	< 0.002	0.002	1.9	1.1

1/ Fish flavor scores 5-7 are considered to be acceptable flavor ± 0.7

2/ Looking upstream

3/ Single value

4/ Mile Points adjusted to conform with Mile Points employed in 1974 U.S. EPA survey.

Attachment F

U.S. EPA Survey, September 12-14, 1972

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: September 12, 1972
Concentration (mg/l)

	Total Solids	Suspended Solids	Dissolved Solids	Chlorides	Fluorides	Sulfates	Total Hardness	COD	Ammonia-N	Total Cyanide	Phenolics	pH	Manganese
MP 6.6	622	9	570	109	0.80	146	245	36.0	1.4	0.03	0.004	7.1	0.31
MP 5.3	532	14	482	79	0.65	140	203	32.3	1.2	0.03	0.003	7.4	0.20
MP 4.5	506	12	448	71	0.59	124	222	32.1	2.2	0.06	0.002	7.4	0.23
MP 3.4	399	11	362	53	0.48	96	175	19.2	6.5	0.04	0.003	7.4	0.18
MP 2.0 (Top)	321	15	282	37	0.45	56	147	14.4	2.2	0.04	0.004	7.1	0.11
MP 2.0 (Middle)	301	6	288	37	0.45	51	143	11.3	1.7	0.03	0.003	7.3	0.10
MP 2.0 (Bottom)	316	24	268	30	0.24	37	133	12.8	1.1	0.01	0.003	7.4	0.07
MP 1.0 (Top)	295	10	281	36	0.34	49	119	10.7	5.7	0.02	0.003	7.5	0.07
MP 1.0 (Middle)	294	8	263	31	0.28	42	132	9.8	1.3	0.02	0.003	7.6	0.06
MP 1.0 (Bottom)	286	22	235	27	0.17	27	118	9.6	1.1	0.01	0.002	7.6	0.05
MP 0 (Top)	266	< 5	241	30	0.21	37	124	10.0	0.7	Lost	<0.002	7.7	0.02
MP 0 (Middle)	248	11	226	25	0.11	26	122	11.1	0.31	Lost	0.002	8.0	0.01
MP 0 (Bottom)	246	9	218	25	0.11	27	124	10.9	0.18	Lost	<0.002	8.0	0.01
Harbor (Lake)	242	< 5	209	25	0.11	27	118	11.1	<0.01	<0.005	<0.002	8.0	0.01

Notes:
As < 0.01 mg/l at all stations
Cd^{+6} < 0.01 mg/l at all stations
Cr^{+6} < 0.005 mg/l at all stations
Fe(Dis) < 0.1 mg/l at all stations
Pb < 0.1 mg/l at all stations

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: September 13, 1972
Concentration (mg/l)

	Total Solids	Suspended Solids	Dissolved Solids	Chlorides	Fluorides	Sulfates	Total Hardness	COD	Ammonia-N	Total Cyanide	Phenolics	pH	Manganese
MP 6.6	625	34	595	114	0.74	170	208	41.1	8.0	0.05	<0.002	7.4	0.40
MP 5.3	546	24	521	83	0.65	144	214	34.2	7.0	0.04	0.003	7.5	0.27
MP 4.5	540	18	492	80	0.67	140	209	33.5	4.6	0.04	0.002	7.5	0.23
MP 3.4	451	24	411	58	0.52	120	187	32.4	6.2	0.09	<0.002	7.4	0.19
MP 2.0 (Top)	290	23	226	39	0.44	48	147	13.9	2.1	0.04	0.002	7.3	0.10
MP 2.0 (Middle)	337	30	283	34	0.35	44	142	14.5	1.8	0.03	<0.002	7.5	0.10
MP 2.0 (Bottom)	272	41	230	32	0.31	46	136	14.7	1.4	0.03	<0.002	7.6	0.09
MP 1.0 (Top)	278	12	219	36	0.35	45	135	12.5	1.7	0.04	0.002	7.6	0.08
MP 1.0 (Middle)	247	25	225	31	0.28	41	135	13.0	1.3	0.03	<0.002	7.7	0.05
MP 1.0 (Bottom)	252	16	226	29	0.19	35	119	11.8	0.8	0.01	<0.002	7.8	0.01
MP 0 (Top)	216	12	169	26	0.12	29	118	8.9	0.10	<0.005	<0.002	8.0	0.01
MP 0 (Middle)	192	9	180	25	0.11	27	124	10.1	0.10	<0.005	<0.002	8.2	0.03
MP 0 (Bottom)	190	12	182	25	0.11	28	--	10.0	0.10	<0.005	<0.002	8.2	0.02
Harbor (Lake)	231	25	226	24	0.11	30	111	10.5	<0.01	<0.005	<0.002	7.9	<0.01

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: September 14, 1972
Concentration (mg/l)

	Total Solids	Suspended Solids	Dissolved Solids	Chlorides	Fluorides	Sulfates	Total Hardness	COD	Ammonia-N	Total Cyanide	Phenolics	pH	Manganese
MP 6.6	546	236	298	38	0.26	65	141	50.4	1.4	0.01	0.006	7.1	0.29
MP 5.3	579	271	299	37	0.28	72	141	52.6	1.2	0.01	0.005	7.4	0.30
MP 4.5	501	179	315	49	0.31	74	142	40.6	2.2	0.02	0.003	7.6	0.24
MP 3.4	557	129	405	77	0.48	87	157	34.0	6.5	0.04	0.170	7.9	0.23
MP 2.0 (Top)	298	21	251	40	0.37	45	143	14.5	2.2	0.02	<0.002	7.3	0.10
MP 2.0 (Middle)	281	28	234	34	0.34	37	140	13.5	1.7	0.02	<0.002	7.5	0.11
MP 2.0 (Bottom)	274	28	223	34	0.31	33	132	14.9	1.1	0.02	<0.002	7.5	0.10
MP 1.0 (Top)	271	25	220	36	0.30	35	141	14.7	5.7	0.02	<0.002	7.6	0.08
MP 1.0 (Middle)	261	42	250	34	0.25	35	143	13.9	1.3	0.02	<0.002	7.6	0.07
MP 1.0 (Bottom)	276	47	268	32	0.19	34	138	13.3	1.1	0.02	<0.002	7.6	0.06
MP 0 (Top)	258	18	219	27	0.15	31	131	11.8	0.7	0.01	<0.002	7.9	0.02
MP 0 (Middle)	222	24	214	26	0.24	27	126	10.5	0.31	0.01	<0.002	8.0	0.03
MP 0 (Bottom)	215	23	215	25	0.11	27	125	12.0	0.18	0.01	<0.002	8.1	0.02
Harbor (Lake)	207	31	207	24	0.10	27	124	11.3	<0.01		<0.002	8.2	0.02

Attachment G

U.S. EPA Survey, April 30, 1974

April 30, 1974 Survey

Table G-1 presents station descriptions for the 43 sampling points employed during the spring survey. The data obtained are presented at the end of this attachment. Figure G-1 illustrates the station locations. Beaver Creek and the East and West Branches of the Black River and one point on the main stem (USGS gage - Cascade Park) were sampled on April 30, 1974. The lower Black River from Elyria to its mouth and two stations in Lake Erie were sampled on May 2, 1974. These data are reviewed in Attachment H.

Beaver Creek (Stations BC1 to BC5)

On April 30, 1974 the flow of Beaver Creek ranged from 2.7 cfs at RM 10.7 (Russia Road), above Amherst, to 20.6 cfs at Kolbe Road about 1.7 miles above its mouth in Lake Erie. This is about 10 times the estimated water quality design flow of about 2 cfs which would be expected during extremely dry weather. The pH of the stream ranged from 6.5 to 7.0 standard units. Dissolved oxygen concentrations ranged from 7.1 to 11.5 mg/l at the six stations, with Stations BC3 and BC4 having concentrations in excess of saturation values indicating possible algae problems. The dissolved oxygen dropped from 11.5 mg/l at Station BC3 to 8.5 mg/l (100% saturation) at Station BC2 due to the effects of the Amherst STP, but was again above saturation at 9.8 mg/l at Station BC1. An ammonia concentration of 2.38 mg/l was recorded below the Amherst STP, a violation of the previous 1.5 mg/l water quality standards. The BOD_5 concentration increased by a factor of 4 below the Amherst STP and the total phosphorus concentration more than doubled. Figure G-2 illustrates these trends.

Aside from arsenic concentrations at the detectable limit of 2 µg/l found below the Amherst STP, Beaver Creek was free of contamination by heavy metals on the sampling date. The bacteriological data indicate the possibility of continuing violations of fecal coliform criteria most probably the result of discharges from the numerous semi-public sewage treatment plants and the Amherst STP.

East Branch of Black River (Stations E1 to E9)

On April 30, 1974, the flow in the main stem of the Black River at the USGS gaging station in Elyria was 132.5 cfs, or about 15 times the estimated water quality design flow of about 9 cfs at that point. This flow is only about one-fifth of the average April flow of 645 cfs. Hence, the flow on the East Branch was probably below normal for April, but well above critical flows on the sampling date. Aside from bacterial contamination at all nine stations, the water quality of the East Branch was generally within Ohio Water Quality Standards on the sampling date. There were increasing levels of organic contamination and phosphorus with travel downstream toward Elyria. Cadmium was detected at concentrations of 10 and 12 µg/l at Stations E7 and E8, respectively, the new water quality standard is 12 µg/l and the standard in effect at the time of the survey was 5 µg/l. Lead was detected above the water quality standard of 30 µg/l at Station E3, just upstream of Elyria, and at 42 and a 48 µg/l at Stations E4 and E5, just below Grafton. Sources of cadmium and lead have not been positively identified. However, the lead appears to originate in the Grafton area, and cadmium may be nonpoint source oriented, as was found in the Grand River, Ashtabla River, and Conneaut Creek basins in Northeast Ohio.

West Branch (W1 to W8)

The upper West Branch was well within water quality standards on the sampling date as evidenced by data obtained at Station W6, however, Charlemont Creek (Station W8) exhibited severe bacterial contamination and high concentrations of BOD_5, phosphorus, ammonia, and total Kjeldahl nitrogen, suggesting contamination by the Wellington STP. There does not appear to be any metals contamination in the upper West Branch. The poor quality of Plum Creek is a result of the Oberlin STP which was being upgraded during the survey. The stream BOD_5 concentration was 18 mg/l and the ammonia concentration was 12.7 mg/l, greatly exceeding the 1974 1.5 mg/l standard. The phosphorus concentration was 4.66 mg/l. With the flow of Plum Creek close to 5 cfs, the loadings from the Oberlin STP were

exceptionally high on the sampling date. The effect of this discharge is also seen at Stations W5 and W4, although mitigated somewhat by dilution. Lead appears at 48 µg/l at Station W5, which is above the 30 µg/l standard, and it would appear that Plum Creek is the source, but data at Station W7 on Plum Creek show no lead. Arsenic was also found at the detectable limit of 2 µg/l at Stations W3, W4, and W5. Dissolved oxygen concentrations in excess of saturation at Station W2, W3, and W4 indicate algae problems, no doubt aggravated by the Oberlin STP discharge. Bacterial contamination in the lower West Branch probably results from the Oberlin STP and numerous semi-public discharges in the area.

TABLE G-1

BLACK RIVER PLANNING AREA
STREAM SAMPLING STATIONS
April 30-May 2, 1974

U. S. EPA SURVEY

Station No.	Stream	Station Description	Station Location		
			River Mile	Latitude	Longitude
LE1	Lake Erie	Harbor between breakwall	-	41°28'40"	82°11'20"
LE2	Lake Erie	Northwest of Harbor mouth	-	41°28'48"	82°12'29"
B1	Black River	Mouth of Black River	0.0	41°28'26"	82°11'05"
B2	Black River	Erie Avenue Bridge - Lorain	0.40	41°28'12"	82°10'33"
B3	Black River	New York, Chicago & St. Louis RR Bridge - Lorain	1.04	41°27'52"	82°10'09"
B4	Black River	Below E. 21st St. Bridge - Lorain	1.30	41°27'37"	82°09'51"
B5	Black River	East 21st St. Bridge - Lorain	1.85	41°27'27"	82°09'33"
B6	Black River	Below U. S. Steel turning basin	2.40	41°27'09"	82°09'11"
B7	Black River	Middle of U. S. Steel turning basin	2.75	41°27'11"	82°09'00"
B8	Black River	Above U. S. Steel turning basin	2.85	41°27'18"	82°08'49"
B9	Black River	Cromwell Park (below U. S. Steel Outfall 002 - Lorain	3.35	41°27'23"	82°08'33"
B10	Black River	Near U. S. Steel Outfall 005	4.0	41°27'17"	82°08'03"
B11	Black River	Confluence with Ziegman Ditch	4.5	41°27'37"	82°07'22"
B12	Black River	U. S. Steel Outfall 001	5.0	41°27'31"	82°07'11"

TABLE G-1 (Cont'd)

BLACK RIVER PLANNING AREA
STREAM SAMPLING STATIONS
April 30-May 2, 1974

U. S. EPA SURVEY

Station No.	Stream	Station Description	Station Location		
			River Mile	Latitude	Longitude
B13	Black River	Between French Creek & USS Outfall 001	5.05	41°27'30"	82°06'55"
B14	Black River	300' upstream of French Creek	5.15	41°27'25"	82°06'48"
B15	Black River	31st street bridge - Lorain	6.5	41°26'34"	82°06'25"
B16	Black River	Ford Road Bridge - Lorain	10.1	41°24'42"	82°05'44"
B17	Black River	Spring Valley Golf Club - Elyria	11.5	41°23'55"	82°05'44"
B18	Black River	Cascade Park (USGS Gaging Station) - Elyria	15.2	41°22'49"	82°06'17"
B19	French Creek (Black River MP 5.1)	Gulf Road - Elyria	0.1	41°27'30"	82°06'20"
E1	East Branch Black River	Washington Ave. - Elyria	0.4	41°22'07"	82°06'27"
E2	East Branch Black River	East Bridge Street - Elyria	1.1	41°22'09"	82°05'53"
E3	East Branch Black River	East Fuller Road - Elyria	3.3	41°20'49"	82°05'40"
E4	East Branch Black River	Grafton Road - Elyria Twp.	5.7	41°19'39"	82°04'26"

TABLE G-1 (Cont'd)

BLACK RIVER PLANNING AREA
STREAM SAMPLING STATIONS
April 30-May 2, 1974

U. S. EPA SURVEY

Station No.	Stream	Station Description	Station Location		
			River Mile	Latitude	Longitude
E5	East Branch Black River	B&O RR Bridge Northwest of Grafton	10.2	41°17'06"	82°04'48"
E6	East Branch Black River	Parsons Road	11.3	41°16'28"	82°04'02"
E7	East Branch Black River	Crook Street - Grafton	13.0	41°15'51"	82°03'38"
E8	East Branch Black River	State Rt. 162	38.8	41°06'30"	82°05'00"
E9	East Branch Black River	Sanford Road - Harrisville Twp.	44.9	41°02'44"	82°02'10"
W1	West Branch Black River	State Rt. 57 - Elyria	0.3	41°22'18'	82°06'45"
W2	West Branch Black River	Third Street - Elyria	1.0	41°21'56"	82°06'45"
W3	West Branch Black River	15th Street - Elyria	2.0	41°21'11"	82°06'50"
W4	West Branch Black River	U. S. Rt. 20	4.2	41°20'12"	82°07'16"
W5	West Branch Black River	State Rt. 10	8.0	41°18'50"	82°07'52"

TABLE C-1 (Cont'd)

BLACK RIVER PLANNING AREA
STREAM SAMPLING STATIONS
April 30-May 2, 1974

U. S. EPA SURVEY

Station No.	Stream	Station Description	Station Location		
			River Mile	Latitude	Longitude
W6	West Branch Black River	State Rt. 18	33.1	41°10'11"	82°16'48"
W7	Plum Creek (West Branch MP 10.2)	Peck-Wadsworth Road	0.7	41°18'02"	82°09'36"
W8	Charlemont Cr. (West Branch MP 26.6)	U. S. Route 20	0.4	41°11'22"	82°13'38"
BC1	Beaver Creek	Kolbe Road	1.7	41°25'34"	82°13'58"
BC2	Beaver Creek	Cooper-Foster Park Road	2.9	41°25'01"	82°13'32"
BC3	Beaver Creek	West Martin Drive	4.4	41°24'08"	82°14'00"
BC4	Beaver Creek	Middle Ridge Road	6.8	41°22'53"	82°14'26"
BC5	Beaver Creek	Russia Road	10.7	41°20'17"	82°14'41"

FIGURE G-1
BLACK RIVER PLANNING AREA
STREAM SURVEY STATIONS
APRIL 30 - MAY 2, 1974

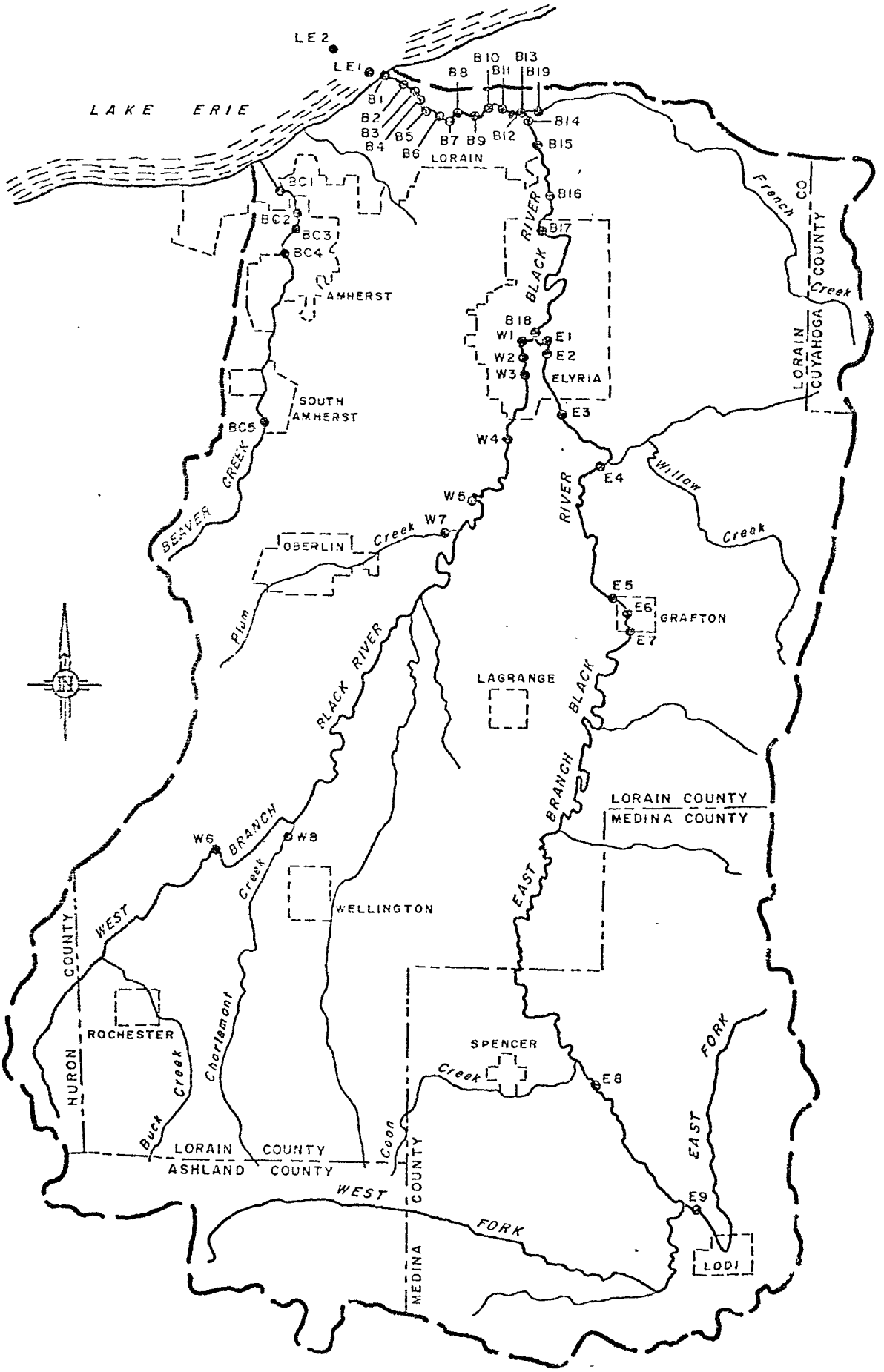


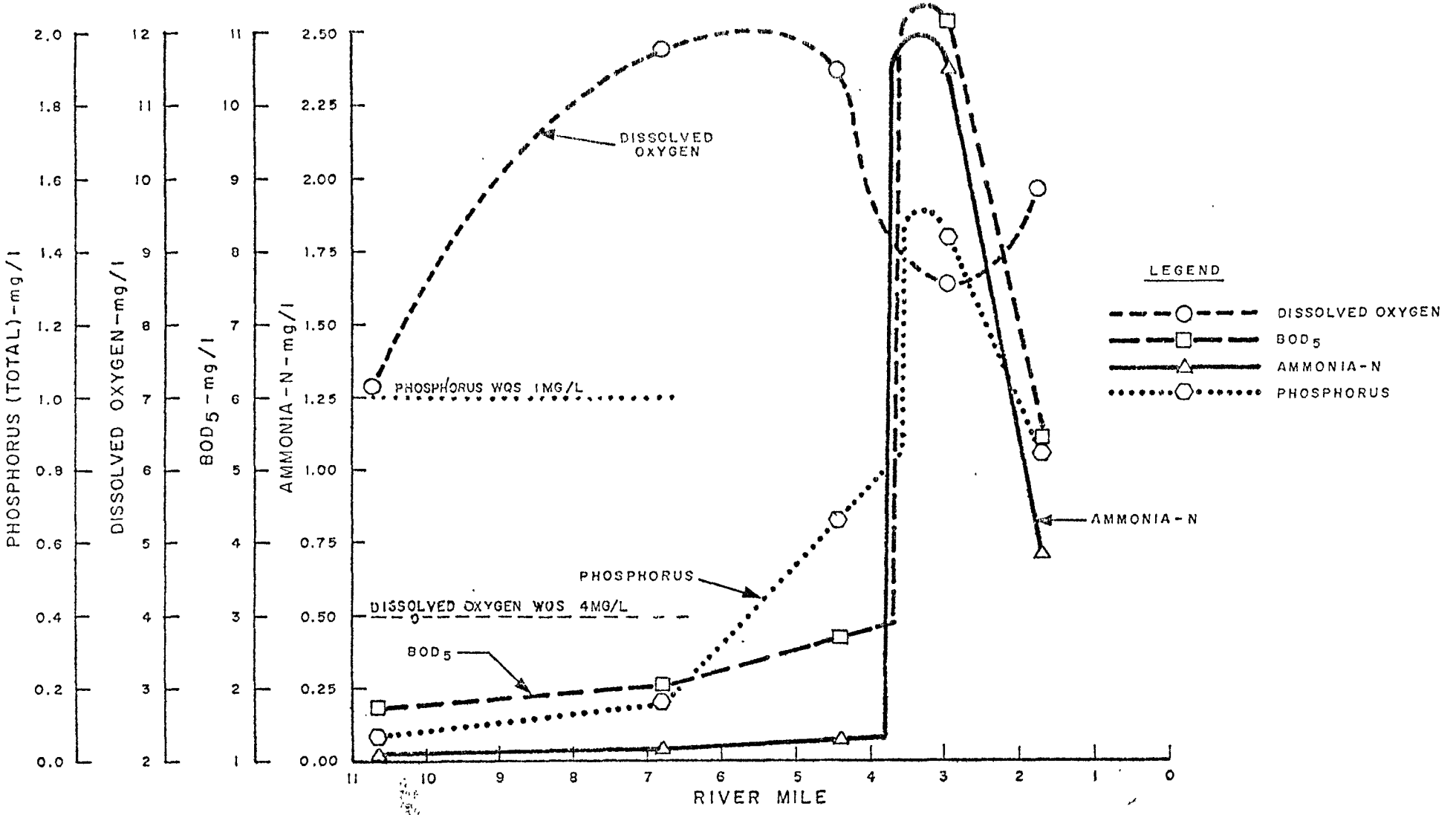
FIGURE G-2

BLACK RIVER BASIN STUDY

BEAVER CREEK

DISSOLVED OXYGEN, BOD_5, AMMONIA-N AND PHOSPHORUS VS RIVER MILE

APRIL 30, 1974



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: BEAVER CREEK
STATION IDENTIFICATION: See below
SURVEY DATE: April 30, 1974

TABLE

STATION NUMBER	BC1	BC2	BC3	BC4	BC5			
RIVER MILE	1.7	2.9	4.4	6.8	10.7			
MODO SAMPLE NUMBER	9274	9275	9276	9277	9278			
Flow (cfs)	20.6	12.2	8.5	6.0	2.7			
pH (STD. units)	7.0	6.5	7.0	7.0	7.0			
Temperature (°F)	-	75	75	75	68			
Conductivity (umhos/cm)	2200	2000	1900	1800	1500			
Dissolved Oxygen (mg/l)	9.8	8.5	11.5	10.7	7.1			
Dissolved Oxygen % Sat.	-	100	135	126	76			
BOD_5 (mg/l)	5.4	11.2	2.7	2.0	1.7			
BOD_{20} (mg/l)	14.9	35	6.0	3.8	4.0			
COD (mg/l)	41	55	43	36	33			
TOC (mg/l)	11	13	8	8	7			
Solids, Total (mg/l)	448	456	412	375	333			
Solids, Dissolved (mg/l)	420	416	382	350	297			
Solids, Suspended (mg/l)	5	12	7	<5	8			
Hardness (mg/l $CaCO_3$)	197	192	178	184	169			
Alkalinity (mg/l $CaCO_3$)	123	127	114	121	125			
Chloride (mg/l)	65	53	44	31	17			
Fluoride (mg/l)	0.26	0.26	0.23	0.17	0.16			
Sulfate (mg/l)	98	82	76	78	68			
Phosphorus, Total (mg/l P)	0.847	1.44	0.653	0.157	0.068			
Total Kjeldahl–N (mg/l)	0.9	5.1	<0.05	<0.05	<0.05			
Ammonia–N (mg/l)	0.70	2.38	0.05	<0.03	<0.03			
Nitrate–Nitrite–N (mg/l)	0.83	1.31	2.03	0.12	0.04			
Oil and Grease (mg/l)	1	2	1	<1	<1			
Cyanide, Total (mg/l)	-	-	-	-	<0.005			
Phenol (mg/l)	-	-	-	-	<2			
MBAS (mg/l)	0.36	0.40	0.08	0.07	0.05			
Fecal Coliform (Nos/100 ml)	4400	1300	1300	1200	3200			
Fecal Strep. (Nos/100 ml)	650	180	600	120	400			
Aluminum, Total (ug/l)	<200	<200	300	210	290			
Arsenic, Total (ug/l)	2	2	<2	<2	<2			
Barium, Total (ug/l)	<50	<50	<50	<50	<50			
Beryllium, Total (ug/l)	<2	<2	<2	<2	<2			
Cadmium, Total (ug/l)	<10	<10	<10	<10	<10			
Chromium, Total (ug/l)	<30	<30	<30	<30	<30			
Chromium, Hexavalent (ug/l)	<5	<5	<5	<5	<5			
Copper, Total (ug/l)	<15	<15	<15	<15	<15			
Iron, Total (ug/l)	440	760	490	860	890			
Iron, Dissolved (ug/l)	55	40	40	45	45			
Lead, Total (ug/l)	<40	46	<40	<40	<40			
Manganese, Total (ug/l)	70	80	20	20	30			
Manganese, Dissolved (ug/l)	85	90	10	11	25			
Mercury, Total (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2			
Nickel, Total (ug/l)	<30	<30	<30	30	<30			
Selenium, Total (ug/l)	<5	<5	<5	<5	<5			
Silver, Total (ug/l)	<10	<10	<10	<10	<10			
Tin, Total (ug/l)	<400	<400	<400	<400	<400			
Zinc, Total (ug/l)	<5	10	<5	<5	<5			

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: EAST BRANCH BLACK RIVER
STATION IDENTIFICATION: See below
SURVEY DATE: April 30, 1974

TABLE

STATION NUMBER	E1	E2	E3	E4	E5	E6	E7	E8
RIVER MILE	0.4	1.1	3.3	5.7	10.2	11.3	13.0	38.8
MODO SAMPLE NUMBER	9287	9288	9289	9290	9291	9292	9293	9294
Flow (cfs)	-	-	-	-	-	-	-	-
pH (STD. units)	8.1	7.5	7.1	8.0	7.9	7.6	7.4	7.7
Temperature (°F)	63	63	61	64	64	65	65	63
Conductivity (umhos/cm)	690	700	700	545	540	530	525	620
Dissolved Oxygen (mg/l)	7.2	8.6	9.4	9.2	9.2	10.0	8.5	7.8
Dissolved Oxygen % Sat.	77	91	97	100	100	110	93	84
BOD_5 (mg/l)	6.2	5.2	2.6	2.3	2.6	1.7	1.7	2.1
BOD_{20} (mg/l)	14.5	7.4	5.6	5.5	6.0	3.8	3.8	4.2
COD (mg/l)	41	35	35	29	23	25	19	18
TOC (mg/l)	9	7	7	7	7	10	7	7
Solids, Total (mg/l)	444	430	433	426	426	446	500	533
Solids, Dissolved (mg/l)	436	413	427	401	404	403	412	475
Solids, Suspended (mg/l)	7	12	5	8	9	9	18	20
Hardness (mg/l $CaCO_3$)	234	248	246	255	245	249	257	301
Alkalinity (mg/l $CaCO_3$)	144	146	146	144	138	140	146	174
Chloride (mg/l)	37	35	26	24	29	23	29	30
Fluoride (mg/l)	0.19	0.17	0.16	0.15	0.17	0.14	0.17	0.16
Sulfate (mg/l)	116	126	111	112	124	117	140	142
Phosphorus, Total (mg/l,P)	0.227	0.197	0.156	0.094	0.168	0.033	0.043	0.100
Total Kjeldahl–N (mg/l)	1.1	0.8	0.8	0.6	0.8	0.5	0.6	0.6
Ammonia–N (mg/l)	0.19	0.04	0.06	<0.03	0.05	<0.03	<0.03	<0.03
Nitrate–Nitrite–N (mg/l)	0.28	0.04	<0.03	<0.03	0.23	<0.03	<0.03	0.25
Oil and Grease (mg/l)	3	1	<1	<1	2	1	1	2
Cyanide, Total (mg/l)	<0.005	<0.005	<0.005	-	-	-	-	-
Phenol (mg/l)	<2	<2	<2	-	-	-	-	-
MBAS (mg/l)	0.14	0.10	0.05	0.03	0.08	0.04	0.33	0.05
Fecal Coliform (Nos/100 ml)	-	22000	1200	530	7600	1200	480	210
Fecal Strep. (Nos/100 ml)	-	2000	1670	480	1400	1100	370	460
Aluminum, Total (ug/l)	<200	230	<200	<200	220	250	460	250
Arsenic, Total (ug/l)	<2	<2	<2	<2	<2	<2	<2	<2
Barium, Total (ug/l)	55	<50	60	<50	<50	<50	<50	<50
Beryllium, Total (ug/l)	<2	<2	<2	<2	<2	<2	<2	<2
Cadmium, Total (ug/l)	<10	<10	<10	<10	<10	<10	10	12
Chromium, Total (ug/l)	<30	<30	<30	<30	<30	<30	<30	<30
Chromium, Hexavalent (ug/l)	15	<5	<5	<5	<5	<5	<5	<5
Copper, Total (ug/l)	25	<15	<15	<15	<15	<15	<15	<15
Iron, Total (ug/l)	620	580	400	570	640	710	1340	1320
Iron, Dissolved (ug/l)	25	30	25	13	30	25	25	25
Lead, Total (ug/l)	<40	<40	40	42	48	<40	<40	<40
Manganese, Total (ug/l)	60	50	30	40	60	30	80	100
Manganese, Dissolved (ug/l)	40	18	37	35	55	25	30	65
Mercury, Total (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, Total (ug/l)	<30	<30	<30	<30	<30	<30	<30	<30
Selenium, Total (ug/l)	<5	<5	<5	<5	<5	<5	<5	<5
Silver, Total (ug/l)	<10	<10	<10	<10	<10	<10	<10	<10
Tin, Total (ug/l)	<400	<400	<400	<400	<400	<400	<400	<400
Zinc, Total (ug/l)	10	<5	<5	20	10	<5	25	<5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: See below
STATION IDENTIFICATION: See below
SURVEY DATE: April 30, 1975

TABLE

STATION NUMBER	E9	B18						
RIVER MILE	44.9	15.2						
MODO SAMPLE NUMBER	9292	9296						
Flow (cfs)	-	-						
pH (STD. units)	7.3	7.7						
Temperature (°F)	63	63						
Conductivity (umhos/cm)	630	760						
Dissolved Oxygen (mg/l)	6.6	9.5						
Dissolved Oxygen % Sat.	71	101						
BOD_5 (mg/l)	2.4	5.2						
BOD_{20} (mg/l)	5.2	11.6						
COD (mg/l)	16	17						
TOC (mg/l)	7	8						
Solids, Total (mg/l)	533	475						
Solids, Dissolved (mg/l)	489	456						
Solids, Suspended (mg/l)	20	10						
Hardness (mg/l $CaCO_3$)	316	246						
Alkalinity (mg/l $CaCO_3$)	182	138						
Chloride (mg/l)	31	41						
Fluoride (mg/l)	0.15	0.20						
Sulfate (mg/l)	143	126						
Phosphorus, Total (mg/l,P)	0.138	0.150						
Total Kjeldahl–N (mg/l)	0.7	0.9						
Ammonia–N (mg/l)	0.05	0.12						
Nitrate–Nitrite–N (mg/l)	0.49	0.32						
Oil and Grease (mg/l)	<1	4						
Cyanide, Total (mg/l)	<0.005	-						
Phenol (mg/l)	<2	-						
MBAS (mg/l)	0.05	0.09						
Fecal Coliform (Nos./100 ml)	250	9900						
Fecal Strep. (Nos/100 ml)	430	950						
Aluminum, Total (ug/l)	680	240						
Arsenic, Total (ug/l)	<2	<2						
Barium, Total (ug/l)	<50	<50						
Beryllium, Total (ug/l)	<2	<2						
Cadmium, Total (ug/l)	<10	<10						
Chromium, Total (ug/l)	<30	<30						
Chromium, Hexavalent (ug/l)	<5	10						
Copper, Total (ug/l)	<15	20						
Iron, Total (ug/l)	1040	830						
Iron, Dissolved (ug/l)	25	25						
Lead, Total (ug/l)	<40	<40						
Manganese, Total (ug/l)	80	90						
Manganese, Dissolved (ug/l)	70	60						
Mercury, Total (ug/l)	<0.2	<0.2						
Nickel, Total (ug/l)	<30	<30						
Selenium, Total (ug/l)	<5	<5						
Silver, Total (ug/l)	<10	<10						
Tin, Total (ug/l)	400	<400						

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: WEST BRANCH BLACK RIVER
STATION IDENTIFICATION: See below
SURVEY DATE: April 30, 1974

TABLE

STATION NUMBER		W1	W2	W3	W4	W5	W6	W7	W8
RIVER MILE		0.3	1.0	2.0	4.2	8.0	33.1	0.7	0.
MODO SAMPLE NUMBER		9279	9280	9281	9282	9283	9284	9286	928
Flow	(cfs)	-	-	32.03	33.56	25.94	1.62	4.93	7
pH	(STD. units)	7.9	7.6	8.3	7.5	7.7	6.9	6.1	8
Temperature	(°F)	62	62	68	68	66	66	67	67
Conductivity	(umhos/cm)	750	700	625	625	625	725	800	725
Dissolved Oxygen	(mg/l)	9.3	13.1	10.7	9.7	6.6	6.7	7.5	7
Dissolved Oxygen	% Sat.	95	135	116	105	70	71	83	82
BOD_5	(mg/l)	4.8	6.0	6.0	4.8	6.8	1.9	17.6	8
BOD_{20}	(mg/l)	9.8	10.8	11.8	8.5	12.5	4.2	>50	16
COD	(mg/l)	28	30	31	42	32	30	46	36
TOC	(mg/l)	8	9	9	12	11	12	15	11
Solids, Total	(mg/l)	532	487	496	462	494	537	528	519
Solids, Dissolved	(mg/l)	491	448	456	420	450	491	505	485
Solids, Suspended	(mg/l)	13	9	24	27	45	32	15	36
Hardness	(mg/l $CaCO_3$)	262	266	268	260	267	309	244	287
Alkalinity	(mg/l $CaCO_3$)	129	134	157	157	161	176	197	157
Chloride	(mg/l)	31	20	26	24	17	22	52	27
Fluoride	(mg/l)	0.31	0.24	0.21	0.22	0.22	0.16	0.69	0
Sulfate	(mg/l)	164	147	126	132	113	155	139	152
Phosphorus, Total	(mg/l,P)	0.119	0.122	0.252	0.296	0.549	0.091	4.66	1
Total Kjeldahl–N	(mg/l)	1.3	1.0	1.2	2.2	1.8	1.5	14.2	2
Ammonia–N	(mg/l)	0.23	<0.03	<0.03	0.29	0.65	0.14	12.7	0
Nitrate–Nitrite–N	(mg/l)	0.59	0.22	0.24	0.47	0.41	0.04	0.17	1
Oil and Grease	(mg/l)	2	<1	<1	<1	<1	<1	2	<1
Cyanide, Total	(mg/l)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0
Phenol	(mg/l)	2	<2	<2	<2	-	<2	.4	<2
MBAS	(mg/l)	0.09	0.06	0.07	0.06	0.07	0.04	0.72	0
Fecal Coliform	(Nos/100 ml)	14000	5400	1800	800	530	200	6700	21000
Fecal Strep.	(Nos/100 ml)	470	620	140	250	240	760	4000	5400
Aluminum, Total	(ug/l)	220	220	340	760	870	860	<200	<200
Arsenic, Total	(ug/l)	<2	<2	2	2	2	<2	<2	2
Barium, Total	(ug/l)	<50	<50	<50	60	480	<50	<50	<50
Beryllium, Total	(ug/l)	<2	<2	<2	<2	<2	<2	<2	<2
Cadmium, Total	(ug/l)	<10	<10	<10	<10	<10	<10	<10	<10
Chromium, Total	(ug/l)	<30	<30	<30	<30	<30	<30	<30	<30
Chromium, Hexavalent	(ug/l)	<5	<5	<5	<5	<5	<5	<5	<5
Copper, Total	(ug/l)	<15	<15	<15	<15	25	<15	<15	<15
Iron, Total	(ug/l)	1070	4800	1680	1570	5330	1950	1090	1620
Iron, Dissolved	(ug/l)	20	20	15	15	25	25	75	40
Lead, Total	(ug/l)	40	46	56	48	42	40	<40	<40
Manganese, Total	(ug/l)	110	110	80	120	130	110	220	90
Manganese, Dissolved	(ug/l)	100	110	5	40	80	60	225	50
Mercury, Total	(ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0
Nickel, Total	(ug/l)	<30	<30	<30	40	<30	<30	<30	40
Selenium, Total	(ug/l)	<5	<5	<5	<5	<5	<5	<5	<5
Silver, Total	(ug/l)	<10	<10	<10	<10	<10	<10	<10	<10
Tin, Total	(ug/l)	<400	<400	<400	<400	<400	<400	<400	<400
Zinc, Total	(ug/l)	10	5	-	-	-	-	-	-

UNITED STATES ENVIRONMENTAL PROTECTION AGEN
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: Black River Basin

SURVEY DATE: See below

TABLE

(µg/l Unless Otherwise Stated)

STATION NUMBER	ENDRIN	α-BHC	LINDANE	HEPTACHLOR	GAMMA-γ-CHLORDANE	HEPTACHLOR EPOXIDE	DIELDRIN	HE CA
April 30, 1975								
B18	>0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0
E3	>0.001	0.004	0.001	<0.001	<0.001	<0.001	>0.001	0
E9	>0.001	<0.001	0.001	<0.001	<0.001	<0.001	>0.001	<0
W4	<0.001	<0.001	0.002	0.004	<0.001	<0.001	<0.001	<0
BC3	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0
May 2, 1974								
B1	>0.001	<0.001	<0.001	<0.001	<0.001	<0.001	>0.001	<0
B6	>0.001	0.007	0.003	<0.001	0.002	<0.001	<0.001	<0
B15	>0.001	0.005	0.002	<0.001	<0.001	0.002	<0.001	0
B18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0

STATION NUMBER	Di-n-BUTYL PHTHALATE	DIETHYLHEXYL PHTHALATE	o,p-DDE	p,p-DDE	o,p-DDD	p,p-DDD	o,p-DDT	p,
April 30, 1974								
B18	0.63	0.12	<0.001	<0.001	<0.001	<0.001	<0.001	<0
E3	0.35	0.70	<0.001	<0.001	<0.001	<0.001	<0.001	<0
E9	0.56	0.36	<0.001	<0.001	<0.001	<0.001	<0.001	<0
W4	1.5	0.73	<0.001	<0.001	<0.001	<0.001	<0.001	<0
BC3	2.1	0.59	<0.001	<0.001	<0.001	<0.001	<0.001	0
May 2, 1974								
B1	1.8	0.56	<0.001	0.001	<0.001	0.001	<0.001	0
B6	0.67	1.1	0.004	<0.001	<0.001	<0.001	0.002	<0
B15	2.1	1.4	<0.001	<0.001	<0.001	<0.001	<0.001	<0
B18	0.17	0.36	0.001	<0.001	<0.001	<0.001	<0.001	<0

Attachment H

U.S. EPA Survey, May 2, 1974

B. Existing Water Quality

Water quality data for the Black River from surveys conducted prior to 1974 indicated violations of water quality standards for temperatures, dissolved oxygen, ammonia, cyanide, phenolics, and various metals. These violations were attributed to discharges from the Elyria sewage treatment plant and the U.S. Steel - Lorain Works. These previous studies also indicated the possibility of a pronounced inflow of water from Lake Erie well up into the Black River in the vicinity of the Lorain Works. Because of the complicated hydrology caused by lake inflow, two additional stream and discharge surveys were completed to adequately determine allowable waste loadings to the river. The first completed in May 1974 by U.S. EPA provided a preliminary evaluation of the stream. Based upon

this survey, sampling locations and sampling frequencies were established for a more comprehensive study conducted in July 1974. The May 1974 survey was unannounced by U.S. EPA, while the July 1974 survey was completed in cooperation with U.S. Steel. The results of both surveys are presented below:

1. May 2, 1974 U.S. EPA Survey

The river flow as recorded at the USGS gaging station at RM 15.2 was 168 cfs, slightly less than half of the mean flow for May of 346 cfs. Grab samples were taken at eighteen stations in the Black River, two in Lake Erie, one in French Creek, and at U.S. Steel Intake WI-2 and Outfall 002. Sampling locations are shown in Figure III-1 and described in Table III-1. Data obtained from the survey are presented in Appendix III, Attachment A. Figures III-2 to III-10 present graphs of temperature, dissolved oxygen, ammonia, cyanide, phenol, lead, and zinc vs. river mile. Profile analyses for temperature (Figure III-3), dissolved oxygen (Figure III-5) and conductivity were conducted at 12 stations in the Black River from river mile 5.0 to its mouth and at the two Lake Erie stations. Samples could not be obtained from U.S. Steel Outfalls 003 and 004 because of the positioning of two ore boats in front of the outfalls just prior to sampling. This was done shortly after the U.S. EPA sampling boat entered the turning basin.

Figure III-2 illustrates the significant increases in stream temperature resulting from U.S. Steel - Lorain Works discharges between mile point 5.0 and 2.4. A violation of the $5^{o}F\Delta T$ temperature standard occured immediately below Lorain Works Outfall 001 at RM 5.0, where surface river temperatures were increased from $56^{o}F$ to nearly $70^{o}F$ with a further increase to $74^{o}F$ below Outfall 002 at RM 3.4. Although some cooling occured, surface conditions did not significantly improve in the turning basin from RM 2.9 to 2.4 where discharges from Outfall 003 and 004 enter the river. Figure III-3 demonstrates temperature stratification in the turning basin at RM 2.9 and continuing to the mouth of the river, strongly suggesting intrusion of colder Lake Erie water. This had the effect of lowering the average temperature of the river as illustrated in Figure III-2. The lake water intrusion effect is confirmed by analysis of the conductivity profiles and chloride data found in Appendix III, Attachment A.

Figures III-4 and III-5 illustrate the adverse effects of the Elyria STP and U.S. Steel on the dissolved oxygen content of the stream. Above the Elyria STP, dissolved oxygen concentrations slightly above saturation values, about 11 mg/l, were measured. The dissolved oxygen dropped to 9 mg/l just below the STP at RM 10.0 and to 8.3 mg/l about four miles further downstream at the East 31st Street bridge. From this point, the velocity of the river becomes very low as [illegible] Lake level. Aggravated by higher

FIGURE III-1
LOWER BLACK RIVER WATER QUALITY SAMPLING STATIONS
MAY 2, 1974 STREAM SURVEY

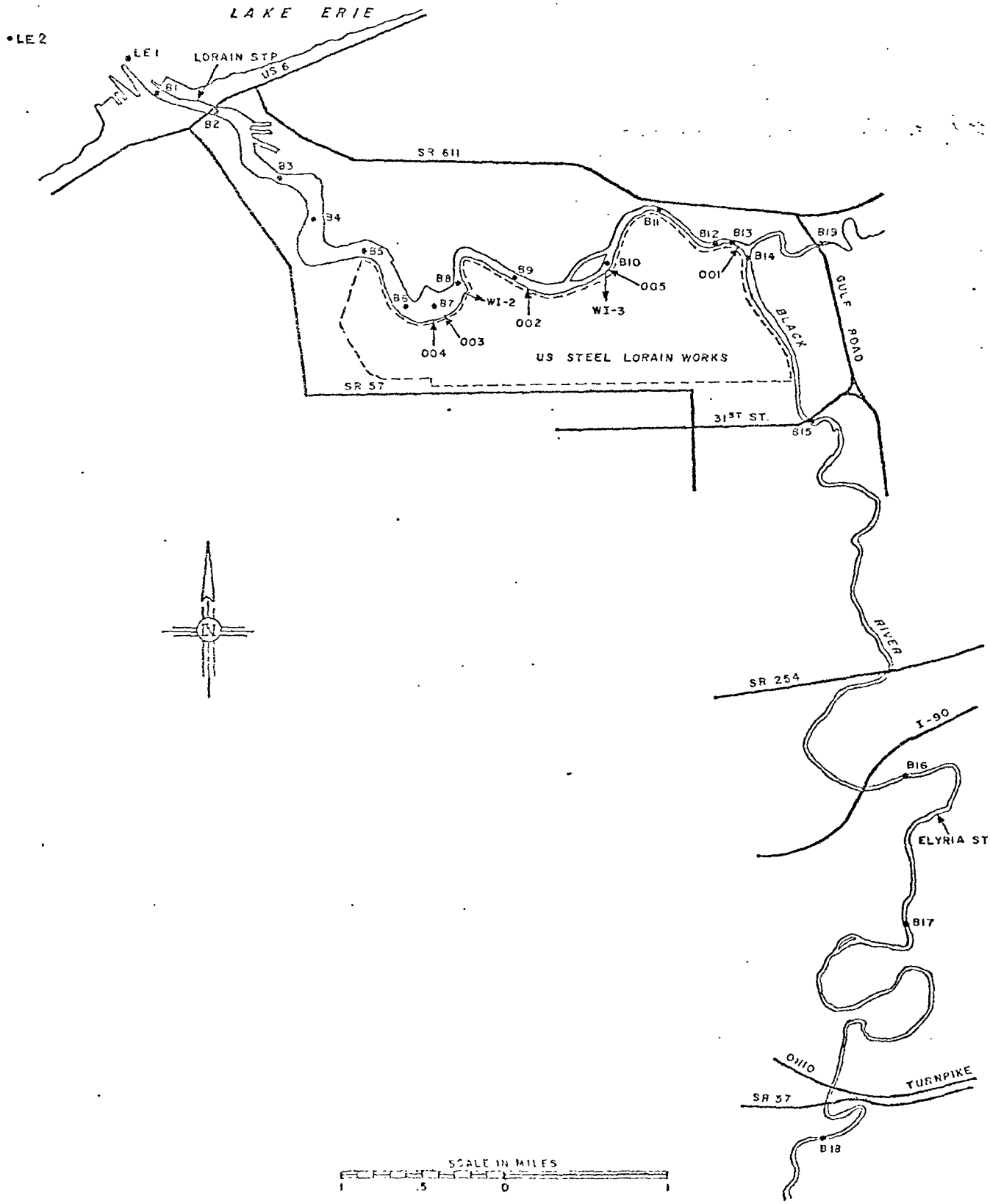


TABLE III-1
BLACK RIVER SAMPLING STATIONS
May 2, 1974 USEPA Survey

STATION NO.	STREAM	STATION DESCRIPTION	RIVER MILE	STATION LOCATION LATITUDE	STATION LOCATION LONGITUDE
LE1	Lake Erie	Harbor between breakwalls	----	41° 28' 40"	82° 11' 20"
LE2	Lake Erie	NW of harbor mouth	----	41° 28' 48"	82° 12' 29"
B1	Black River	Mouth of Black River	0.0	41° 28' 26"	82° 11' 05"
B2	Black River	Erie Avenue Bridge Lorain	0.40	41° 28' 12"	82° 10' 33"
B3	Black River	NY, Chicago + St. Louis RR Bridge Lorain	1.04	41° 27' 52"	82° 10' 09"
B4	Black River	Below E. 21st Street Bridge Lorain	1.30	41° 27' 37"	82° 09' 51"
B5	Black River	East 21st Street Bridge Lorain	1.85	41° 27' 27"	82° 09' 33"
B6	Black River	Below U.S. Steel Turning Basin	2.40	41° 27' 09"	82° 09' 11"
B7	Black River	Middle of U.S. Steel Turning Basin	2.75	41° 27' 11"	82° 09' 00"
B8	Black River	Above U.S. Steel Turning Basin	2.90	41° 27' 18"	82° 08' 49"
B9	Black River	Cromwell Park (below U.S. Steel Outfall 002) Lorain	3.35	41° 27' 23"	82° 08' 33"
B10	Black River	Near U.S. Steel Outfall 005	4.0	41° 27' 17"	82° 08' 03"
B11	Black River	Confluence with Ziegman Ditch	4.5	41° 27' 37"	82° 07' 22"
B12	Black River	At U.S. Steel Outfall 001	5.0	41° 27' 31"	82° 07' 11"
B13	Black River	Between French Creek + USS Outfall 001	5.05	41° 27' 30"	82° 06' 55"
B14	Black River	300' upstream of French Creek	5.15	41° 27' 25"	82° 06' 48"
B15	Black River	31st Street Bridge Lorain	6.5	41° 27' 34"	82° 06' 25"
B16	Black River	Ford Road Bridge Lorain	10.1	41° 24' 42"	82° 05' 44"
B17	Black River	Spring Valley Golf Club Elyria	11.5	41° 23' 55"	82° 05' 44"
B18	Black River	Cascade Park (USGS Gaging Station) Elyria	15.2	41° 22' 49"	82° 06' 17"
				41° 22' 20"	82° 06' 20"

FIGURE III-2

BLACK RIVER SURVEY
TEMPERATURE VS. RIVER MILE
MAY 2, 1974

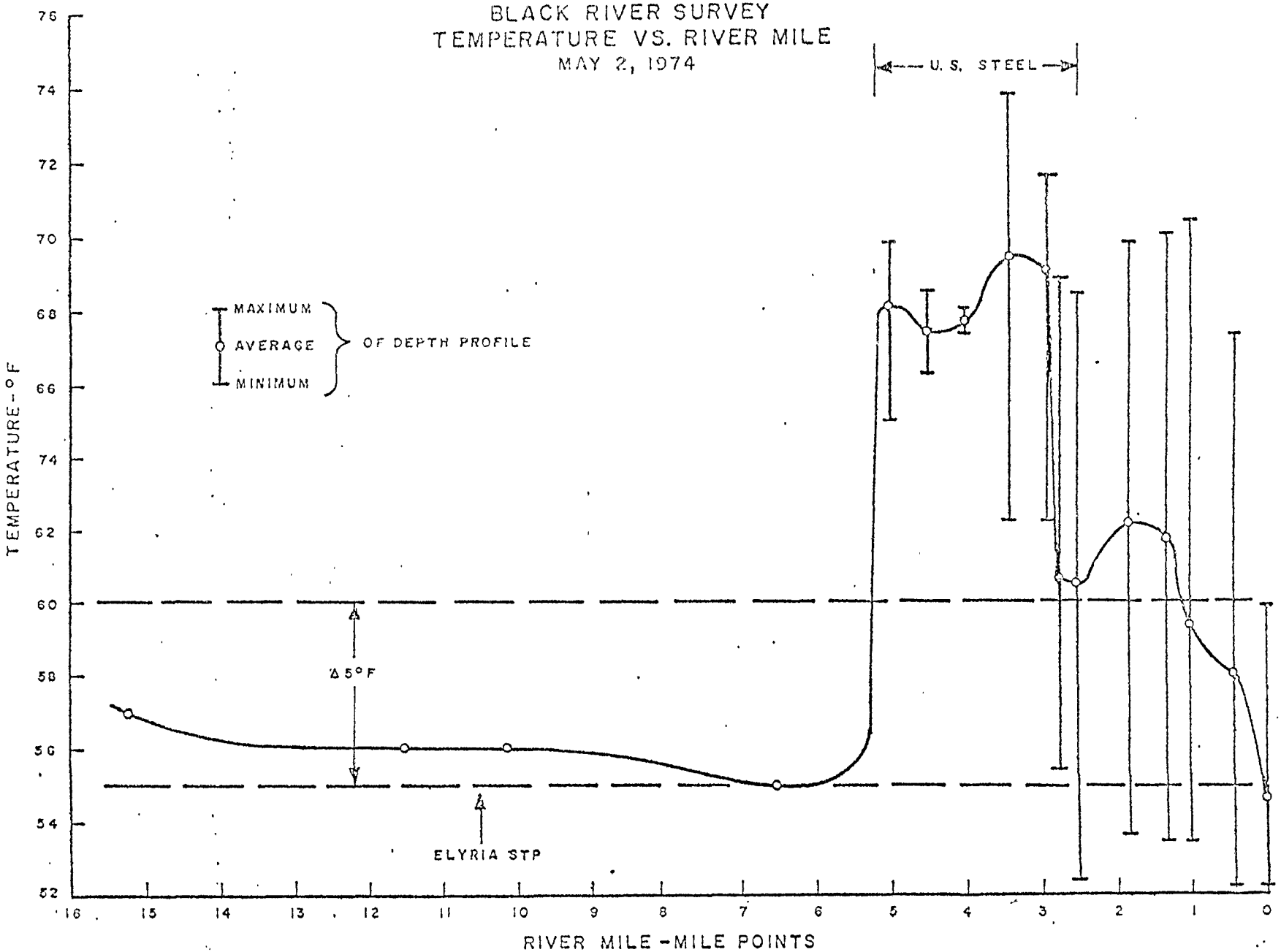
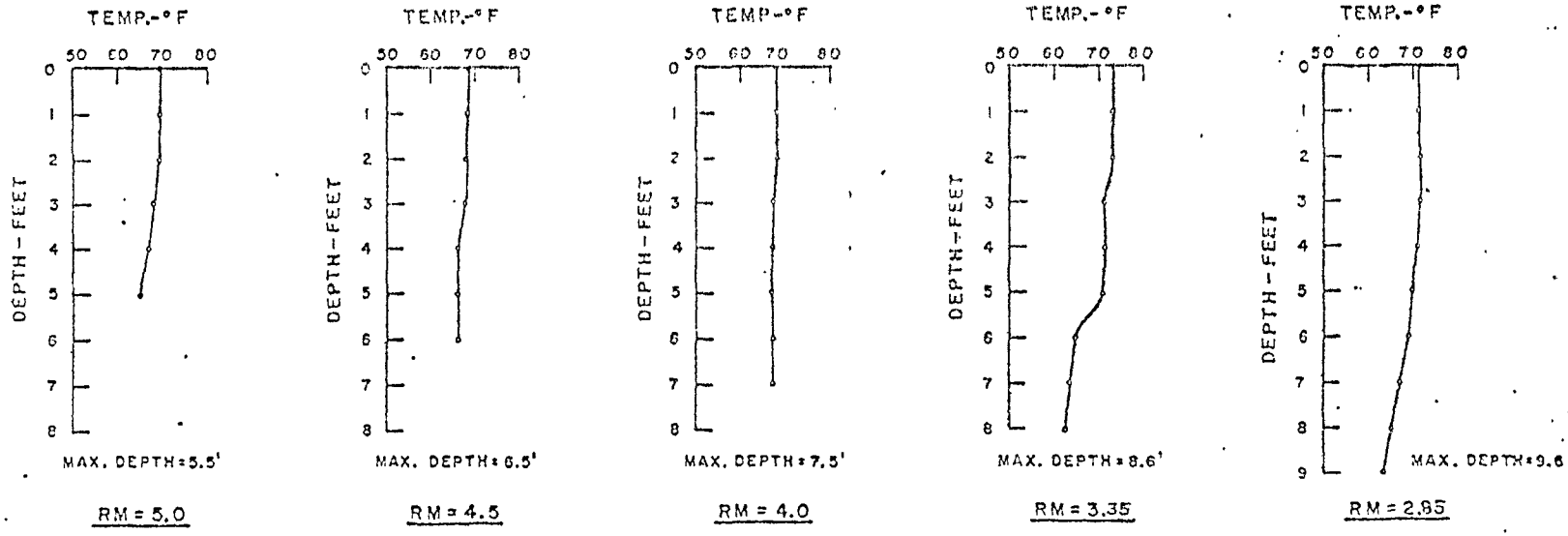


FIGURE III-3

BLACK RIVER SURVEY

DEPTH VS. TEMPERATURE AT VARIOUS MILE POINTS

MAY 2, 1974



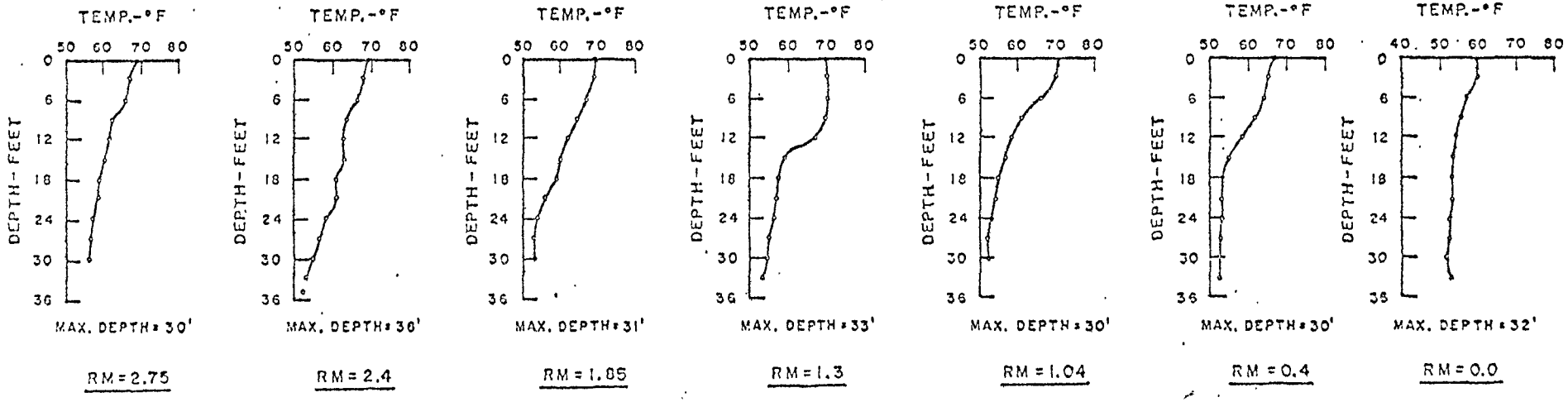


FIGURE III-4

BLACK RIVER SURVEY
DISSOLVED OXYGEN VS. RIVER MILE
MAY 2, 1974

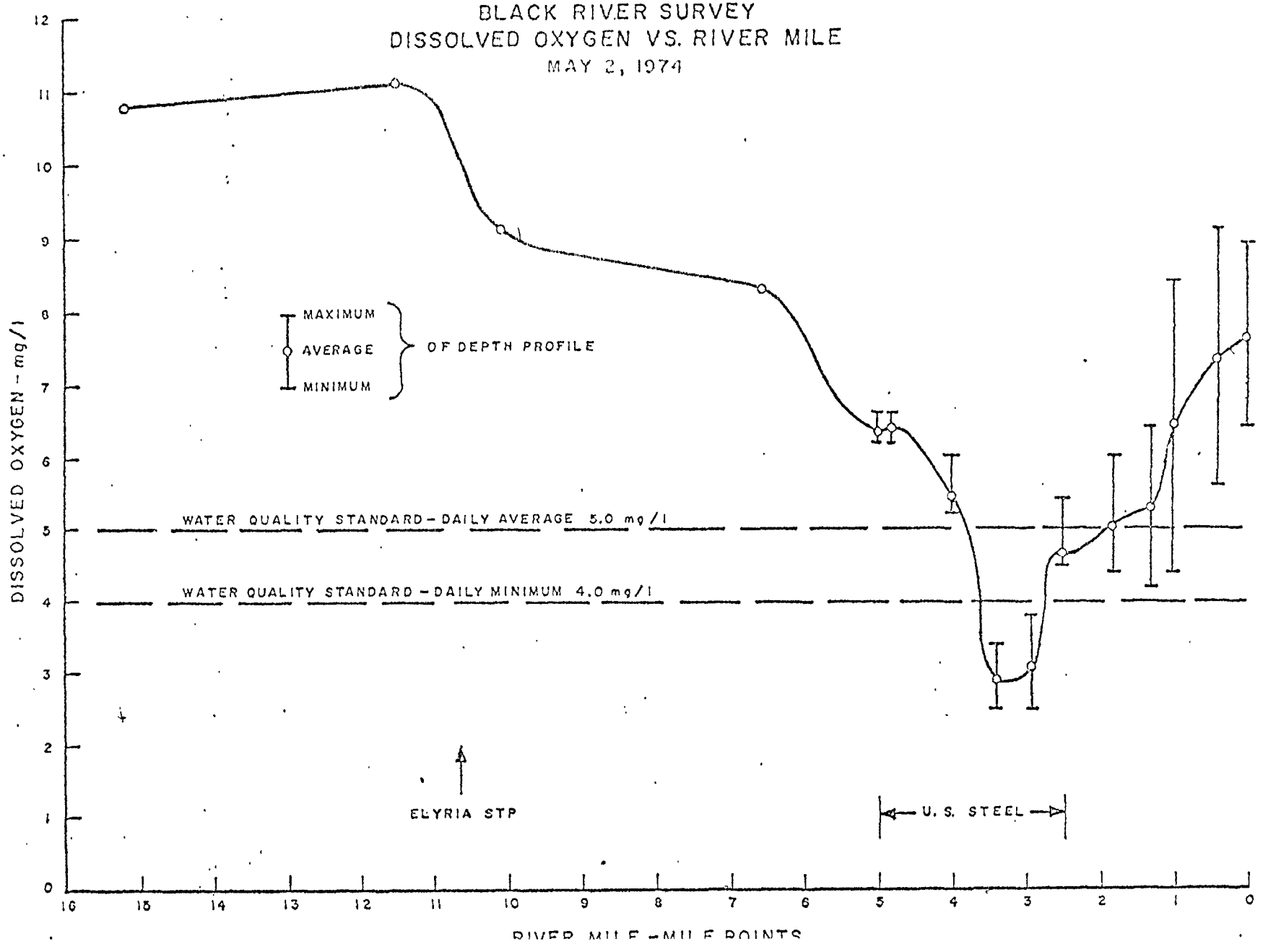
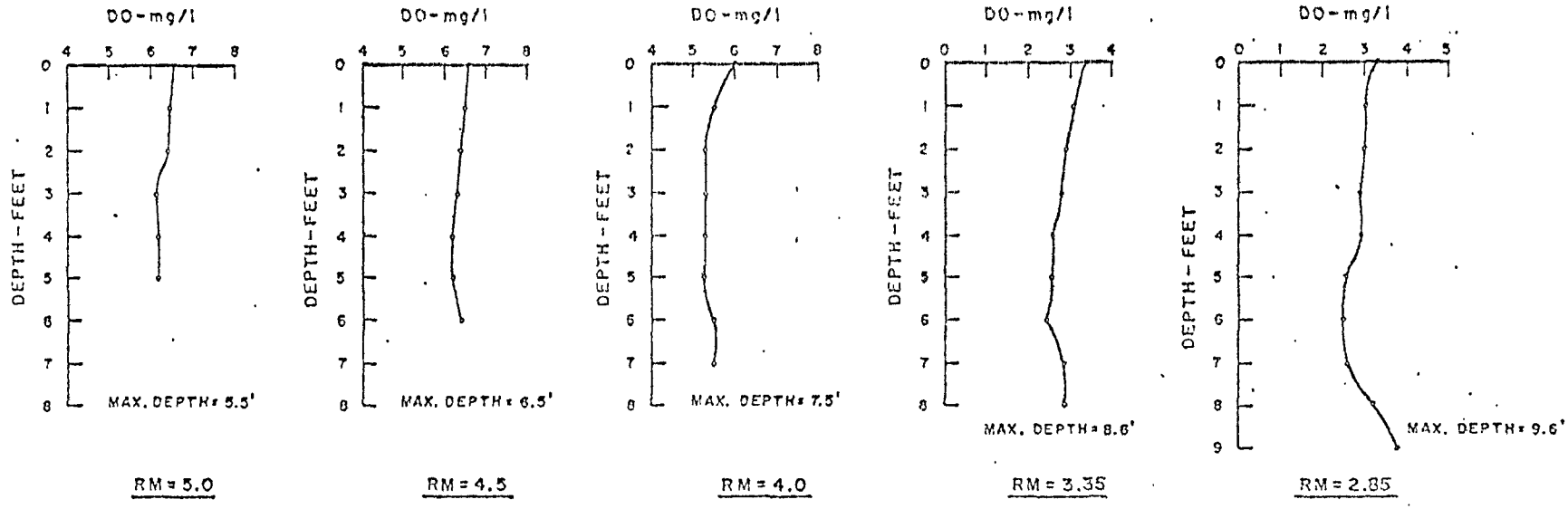


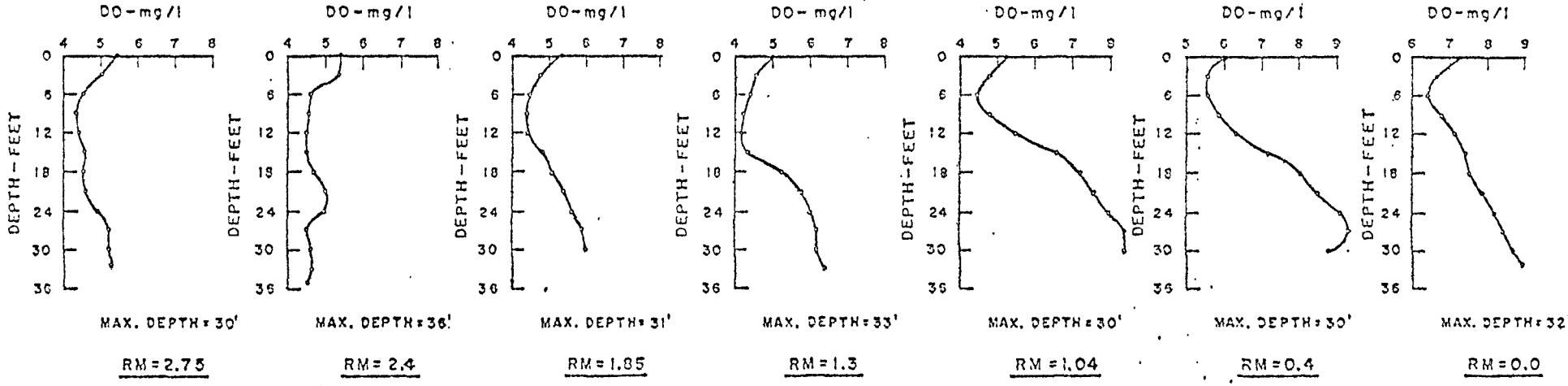
FIGURE III-5

BLACK RIVER SURVEY

DEPTH VS. DISSOLVED OXYGEN AT VARIOUS MILE POINTS

MAY 2, 1974





temperatures from U.S. Steel discharges, which lower saturation concentrations and increase oxidation rates, the dissolved oxygen continued to drop to a range of 6.2 to 6.5 mg/l near Outfall 001 at RM 5.0 and to 5.3 to 6.0 mg/l at RM 4.0 near U.S. Steel Intake WI-3. The dissolved oxygen concentration dropped to 2.5 to 3.4 mg/l below Outfall 002 at RM 3.4, well below the 4.0 daily minimum water quality standard as well as the 5.0 mg/l daily average standard.

Figure III-5 further illustrates the lake water intrusion effect occurring in the lower stretches of the river. From the turning basin downstream, the lowest dissolved oxygen concentrations were not found at the bottom of the stream as expected but at mid-depth, a trend which continued to the mouth of the stream. Violations of water quality standards did not persist below the turning basin owing to the significant inflow of cleaner lake water.

Significant violations of the 1.5 mg/l ammonia standard are illustrated in Figure III-6. High concentrations above the Elyria STP were most likely the result of discharges from the Elyria sewerage system. The Elyria STP discharge increased the concentration to over 3.2 mg/l. Ammonia decreased to 1.1 mg/l above the U.S. Steel coke plant, Outfall 002, but was increased to 2.1 mg/l below the outfall, and to over 3 mg/l at the downstream end of the turning basin. U.S. Steel was discharging about 1500 lbs/day of ammonia from Outfall 002 on the sampling date. Slightly higher values observed just below the turning basin at RM 2.4 may have been the result of flow patterns from the Lorain Works Outfalls 003 and 004, which may not have fully mixed with the receiving stream at that point. However, higher concentrations reaching 3.6 mg/l at RM 1.0 appear to result from discharges from the Lorain sewerage system.

Figure III-7 illustrates the effect of the Elyria STP and the U.S. Steel coke plant discharge on cyanide concentrations in the river. The STP discharge raised the stream concentration from 6 to 42 ug/l, which corresponds to a loading of about 35 lbs/day. Cyanide concentrations dropped to 26 ug/l above U.S. Steel Outfall 002 but were increased to 230 ug/l by the coke plant discharge, a violation of the 200 ug/l total cyanide water quality standard. Cyanide loadings from the coke plant were about 580 lbs/day on the sampling date. The cyanide concentration dropped below the standard to 110 ug/l at the head of the turning basin and to 98 ug/l at the downstream end of the turning basin. Loadings from U.S. Steel's blast furnace discharges, Outfall 003 and 004, could not be determined because of the inaccessibility of the outfalls as described above.

FIGURE III-6

BLACK RIVER SURVEY
AMMONIA-N VS. RIVER MILE
MAY 2, 1974

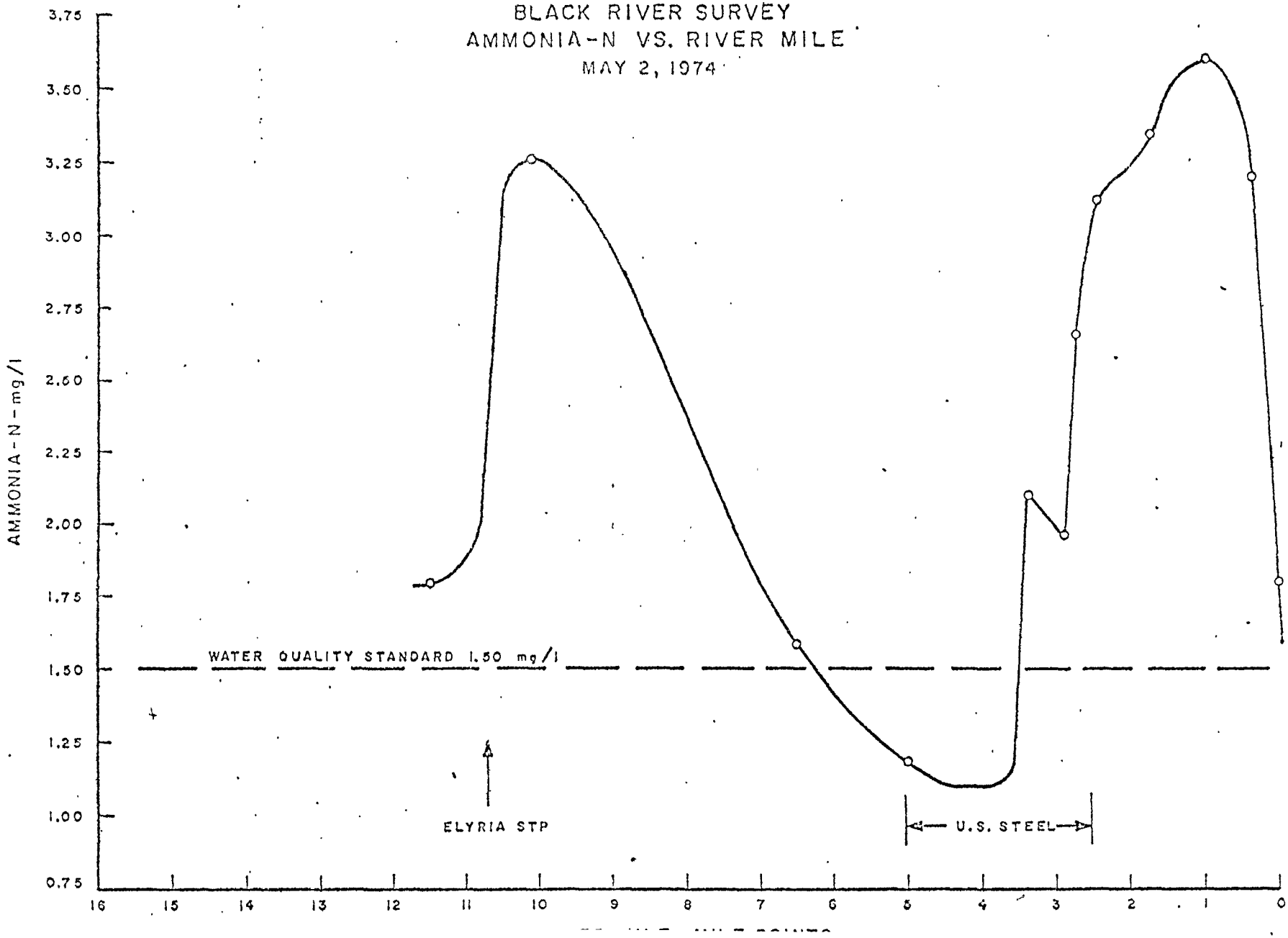


FIGURE III-7

BLACK RIVER SURVEY
CYANIDE VS. RIVER MILE
MAY 2, 1974

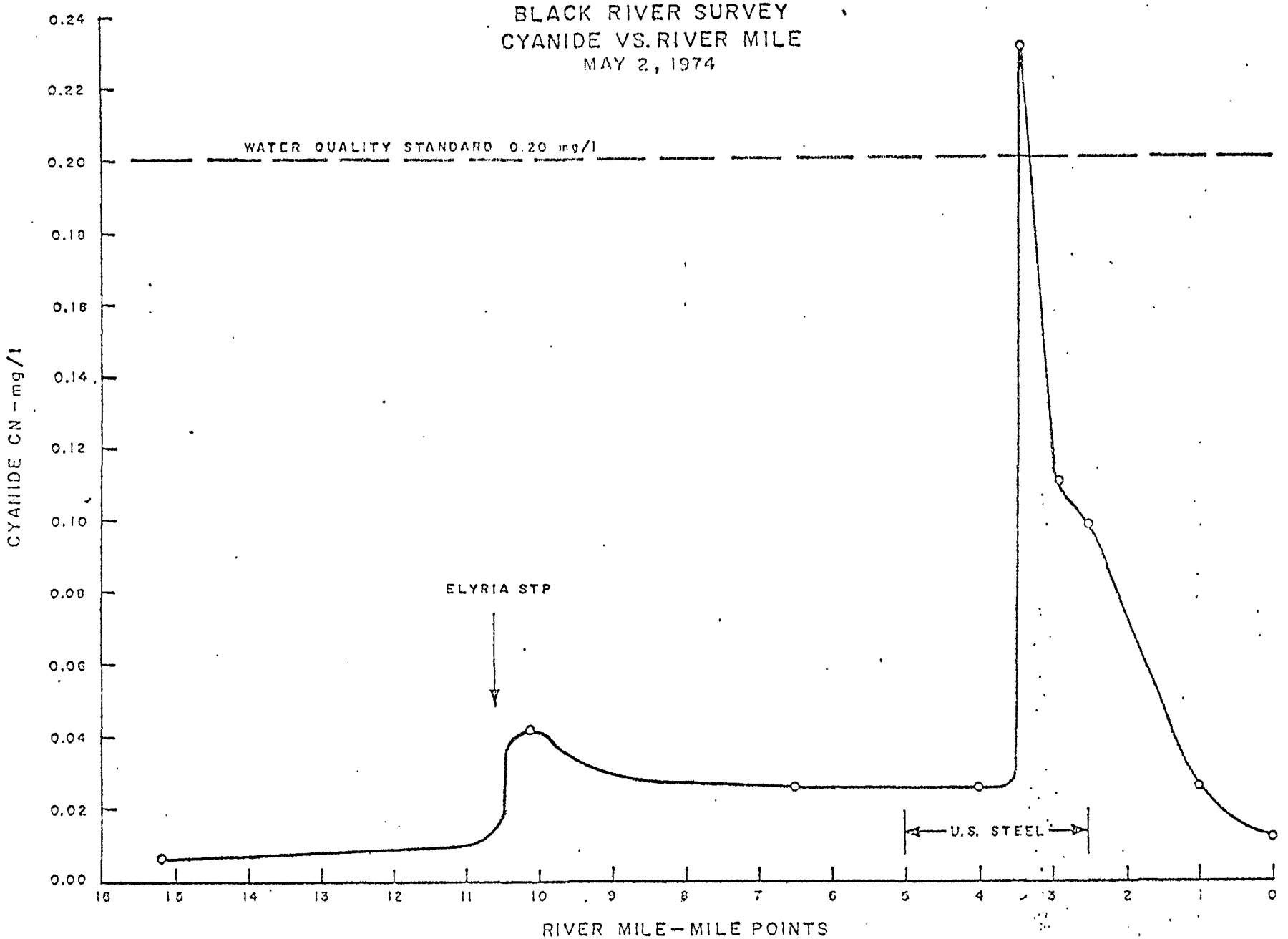


Figure III-8 indicates a violation of the water quality standard for phenol (10 ug/l) just below U.S. Steel's coke plant discharge at RM 3.4. The measured phenol concentration was 19 ug/l and the loading from the outfall was about 140 lbs/day. Phenolics were not detected above Outfall 002. Figure III-9 shows the effect the discharge of Outfall 001 on zinc concentrations in the river, which caused an increase to the 100 ug/l water quality standard. This increase is particularly significant considering that the streamflow at the time of sampling was about eight times greater than the water quality design flow. Figure III-10 shows a violation of the 40 ug/l lead standard also caused by U.S. Steel's discharge at Outfall 001. Lead concentrations reached a peak of 72 ug/l below the outfall and persisted above the standard to RM 3.4. Outfall 001 also caused an increase from 30 ug/l to 50 ug/l of the chromium concentration in the river. The total chromium water quality standard is 300 ug/l. Finally, data obtained also suggested a continuing violation of the fecal coliform standard of 200 organisms/100 ml. The standard was exceeded at every station in the river.

FIGURE III-8

BLACK RIVER SURVEY
PHENOL VS. RIVER MILE
MAY 2, 1974

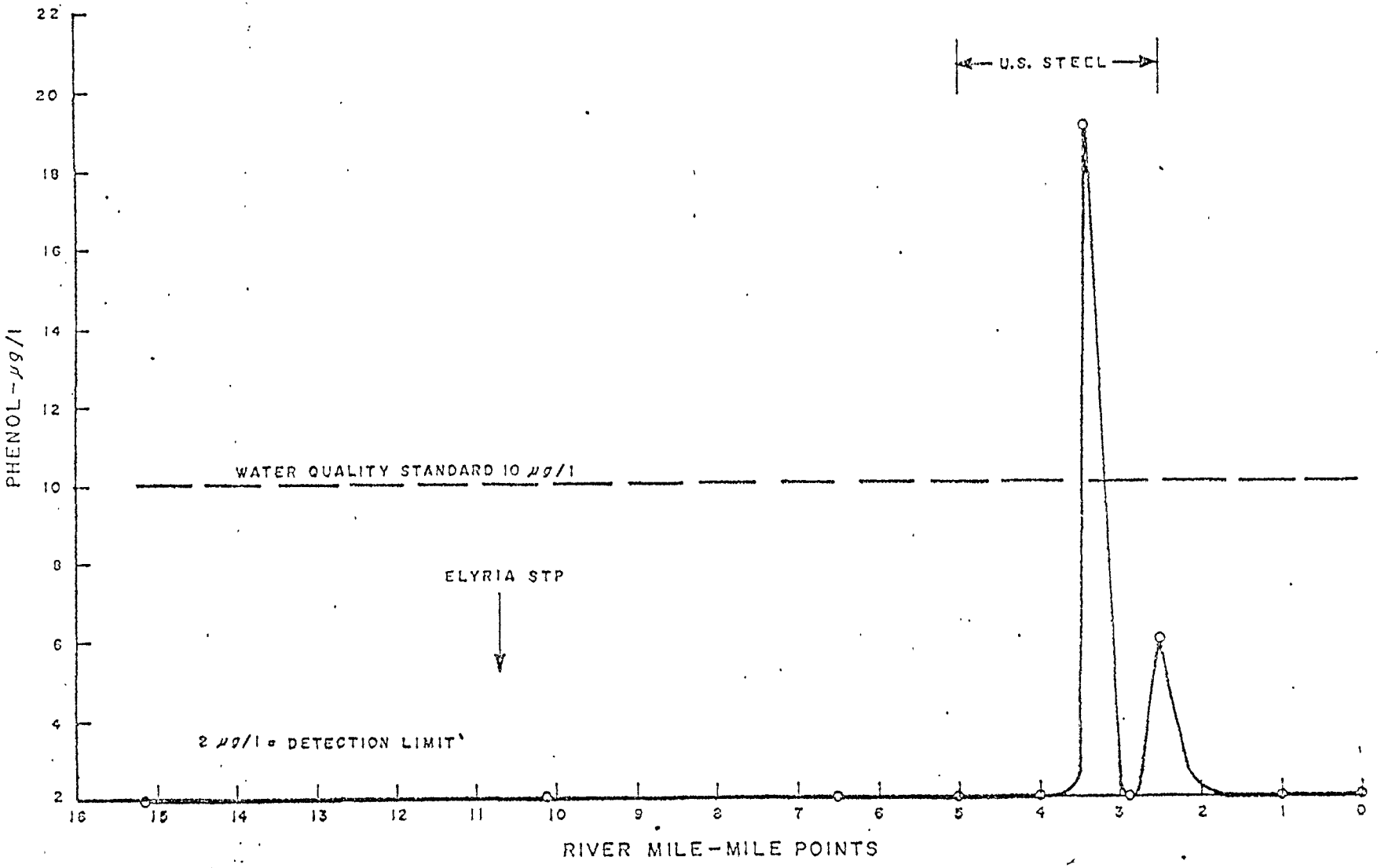


FIGURE III-9

BLACK RIVER SURVEY
ZINC VS. RIVER MILE
MAY 2, 1974

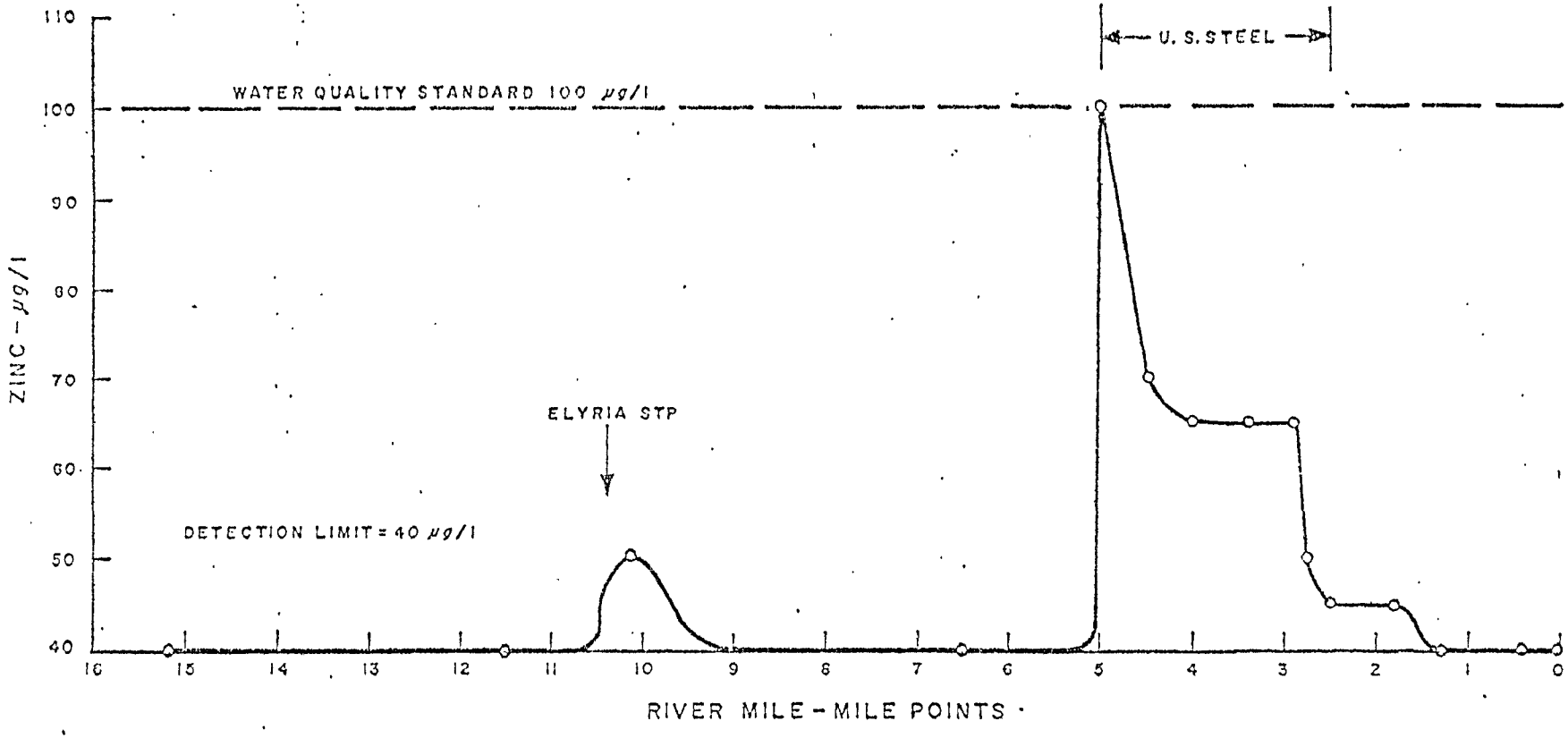
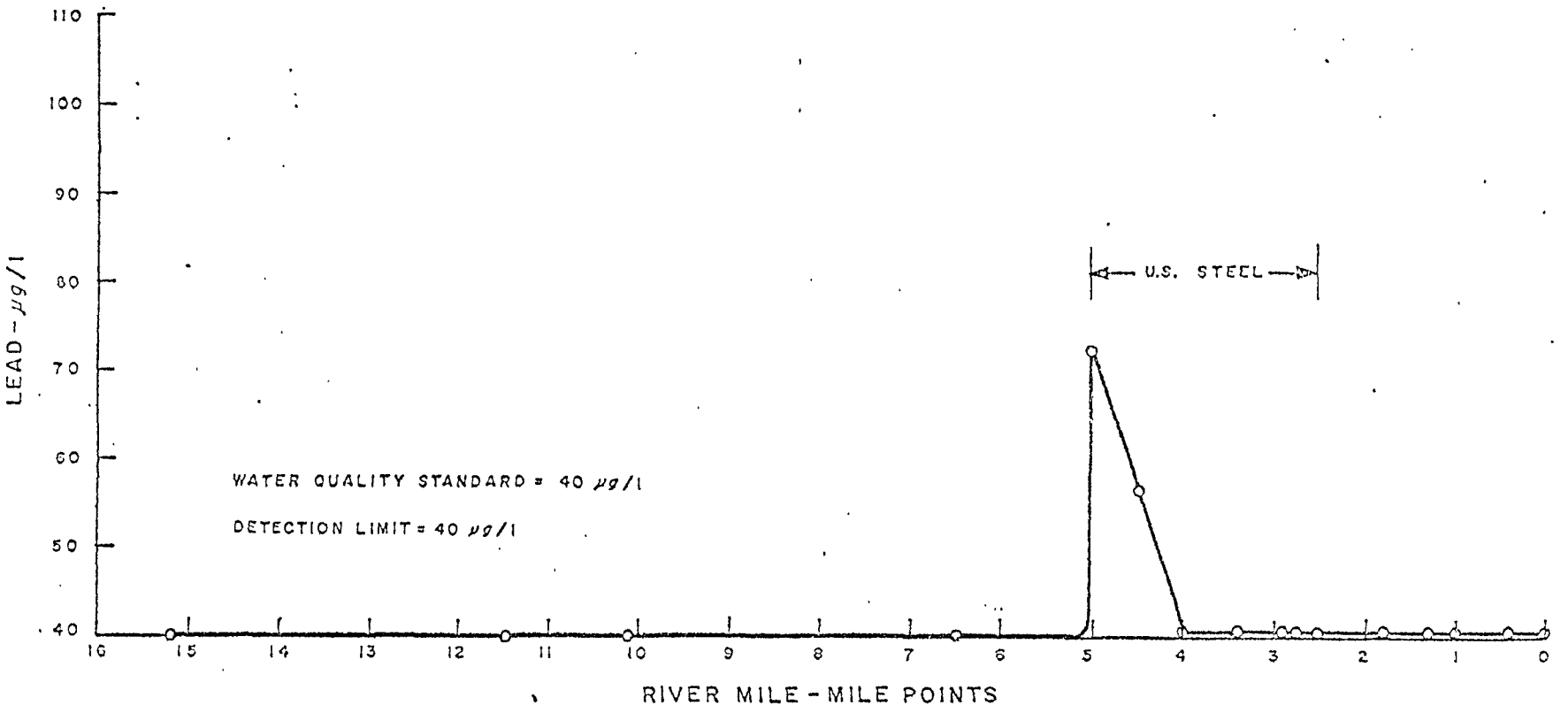


FIGURE III-10

BLACK RIVER SURVEY
LEAD VS. RIVER MILE
MAY 2, 1974



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: BLACK RIVER
STATION IDENTIFICATION: See Below.
SURVEY DATE: May 2, 1974

TABLE

STATION NUMBER	LE 1	LE 2	B1	B2	B3	B4	B5	B6
RIVER MILE	--	--	0.0	0.4	1.04	1.3	1.85	2.40
MODO SAMPLE NUMBER	9301	9302	9303	9304	9305	9306	9307	9308
Flow (cfs)								
pH (surface) (STD units)	8.3	8.5	8.6	8.5	8.5	8.5	8.5	8.4
Temperature (°F)	P	P	P	P	P	P	P	P
Conductivity (umhos/cm)	r	r	r	r	r	r	r	r
Dissolved Oxygen (mg/l)	o	o	o	o	o	o	o	o
Dissolved Oxygen % Sat.	f	f	f	f	f	f	f	f
BOD_5 (mg/l)	l	l	l	l	l	l	l	l
BOD_{20} (mg/l)	e	e	e	e	e	e	e	e
COD (mg/l)	14	16	20	25	26	29	29	25
TOC (mg/l)	6	4	5	7	8	9	6	11
Solids, Total (mg/l)	245	283	312	367	398	377	365	377
Solids, Dissolved (mg/l)	222	260	290	344	374	360	363	348
Solids, Suspended (mg/l)	19	25	30	20	16	20	20	23
Hardness (mg/l $CaCO_3$)	125	147	160	182	199	185	192	182
Alkalinity (mg/l $CaCO_3$)	93	100	107	119	124	123	123	123
Chloride (mg/l)	15	26	25	41	49	42	37	37
Fluoride (mg/l)	0.16	0.25	0.30	0.42	0.50	0.46	0.44	0.40
Sulfate (mg/l)	26	49	52	84	97	89	83	79
Phosphorus, Total (mg/l,P)	0.075	0.115	0.165	0.172	0.200	0.208	0.219	0.212
Total Kjeldahl–N (mg/l)	0.8	1.7	2.4	4.0	4.4	4.3	4.2	3.9
Ammonia–N (mg/l)	0.23	1.10	1.82	3.20	3.59	3.49	3.34	3.13
Nitrate–Nitrite–N (mg/l)	1.43	1.40	1.37	1.21	1.16	1.16	1.15	1.12
Oil and Grease (mg/l)	--	--	<1	--	3	--	--	<1
Cyanide, Total (mg/l)	--	--	0.012	--	0.026	--	--	0.093
Phenol (mg/l)	--	--	<0.002	--	<0.002	--	--	0.006
MBAS (mg/l)	0.03	0.05	0.05	0.07	0.09	0.08	0.09	0.09
Fecal Coliform (Nos/100 ml)	--	360	870	--	1200	--	1200	--
Fecal Strep. (Nos/100 ml)	--	20	20	--	10	--	30	--
Aluminum, Total (ug/l)	1040	870	900	660	260	340	300	410
Arsenic, Total (ug/l)	2	2	2	2	2	2	2	2
Barium, Total (ug/l)	50	<50	----	----	----	----	----	---→
Beryllium, Total (ug/l)	<2	----	----	----	----	----	----	---→
Cadmium, Total (ug/l)	<8	----	----	----	----	----	----	---→
Chromium, Total (ug/l)	<30	----	----	----	----	----	----	---→
Chromium, Hexavalent (ug/l)	<5	----	----	----	----	----	----	---→
Copper, Total (ug/l)	<15	----	----	----	----	----	----	---→
Iron, Total (ug/l)	1370	1470	1740	1590	1560	1630	1950	2230
Iron, Dissolved (ug/l)	25	25	20	25	20	20	30	25
Lead, Total (ug/l)	50	<40	----	----	----	----	----	---→
Manganese, Total (ug/l)	25	100	160	270	300	290	300	310
Manganese, Dissolved (ug/l)	<10	50	110	200	240	240	220	210
Mercury, Total (ug/l)	<0.2	----	----	----	----	----	----	---→
Nickel, Total (ug/l)	<30	----	----	----	----	40	40	30
Selenium, Total (ug/l)	<5	----	----	----	----	----	----	---→
Silver, Total (ug/l)	<10	----	----	----	----	----	----	---→
Tin, Total (ug/l)								
Zinc, Total (ug/l)	<40	<40	<40	40	40	<40	45	45

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER
STATION IDENTIFICATION: See Below
SURVEY DATE: May 2, 1974

TABLE

STATION NUMBER		B7	B8	B9	B10	B11	B12	B15	B16
RIVER MILE		2.75	2.9	3.35	4.0	4.5	5.0	6.5	10.1
MODO SAMPLE NUMBER		9309	9310	9311	9312	9313	9314	9340	9341
Flow	(cfs)								
pH	(STD. units)	8.4	8.4	--	8.4	8.4	8.4	7.8	8.0
Temperature	(°F)	Profile	Profile	Profile	Profile	Profile	Profile	55	55
Conductivity	(umhos/cm)							800	790
Dissolved Oxygen	(mg/l)							8.3	9.05
Dissolved Oxygen	% Sat.							78	86
BOD_5	(mg/l)	2.7	5.0	6.6	6.2	5.4	5.9	4.3	7.4
BOD_{20}	(mg/l)	15.2	17.2	18.2	14.6	16.1	16.6	16.5	28.1
COD	(mg/l)	34	40	39	37	57	38	36	45
TOC	(mg/l)	7	12	10	9	12	11	9	11
Solids, Total	(mg/l)	364	453	441	470	493	452	463	477
Solids, Dissolved	(mg/l)	339	422	404	444	441	426	445	458
Solids, Suspended	(mg/l)	18	18	11	14	<5	21	<5	8
Hardness	(mg/l $CaCO_3$)	181	224	215	226	230	232	248	256
Alkalinity	(mg/l $CaCO_3$)	114	129	125	129	131	130	146	144
Chloride	(mg/l)	44	52	45	45	50	43	51	28
Fluoride	(mg/l)	0.40	0.36	0.34	0.32	0.35	0.32	0.34	0.32
Sulfate	(mg/l)	95	121	111	124	127	119	145	110
Phosphorus, Total	(mg/l,P)	0.256	0.470	0.439	0.422	0.417	0.401	0.483	0.666
Total Kjeldahl-N	(mg/l)	3.5	3.1	3.3	2.0	2.1	2.1	3.2	5.1
Ammonia-N	(mg/l)	2.66	1.97	2.11	1.11	1.11	1.19	1.59	3.26
Nitrate-Nitrite-N	(mg/l)	1.09	0.86	0.89	0.93	0.74	0.74	0.47	0.40
Oil and Grease	(mg/l)	--	2	--	2	--	4	1	1
Cyanide, Total	(mg/l)	--	0.110	0.230	0.026	--	--	0.026	0.042
Phenol	(mg/l)	--	<0.002	0.019	<0.002	--	--	<0.002	<0.002
MBAS	(mg/l)	0.11	0.19	0.15	0.16	0.21	0.20	0.23	0.26
Fecal Coliform	(Nos/100 ml)	--	9000	--	2900	2700	--	680	700
Fecal Strep.	(Nos/100 ml)	--	230	--	100	60	--	20	460
Aluminum, Total	(ug/l)	500	200	300	380	150	240	<100	220
Arsenic, Total	(ug/l)	2	2	2	2	3	3	<2	<2
Barium, Total	(ug/l)	<50	<50	<50	60	50	60	<50	<50
Beryllium, Total	(ug/l)	<2	----------	----------	----------	----------	----------	----------	---------->
Cadmium, Total	(ug/l)	<8	----------	----------	----------	----------	----------	----------	---------->
Chromium, Total	(ug/l)	<30	----------	----------	----------	---------->	50	<30	<30
Chromium, Hexavalent	(ug/l)	<5	----------	----------	----------	---------->	5	<5	
Copper, Total	(ug/l)	<15	----------	----------	----------	----------	----------	---------->	20
Iron, Total	(ug/l)	3570	3070	2690	2940	3150	3460	740	1060
Iron, Dissolved	(ug/l)	20	25	30	45	35	30	20	20
Lead, Total	(ug/l)	<40	<40	40	40	56	72	<40	<40
Manganese, Total	(ug/l)	270	220	230	190	180	180	110	120
Manganese, Dissolved	(ug/l)	180	170	170	140	120	130	70	80
Mercury, Total	(ug/l)	<0.2	----------	----------	----------	----------	----------	----------	---------->
Nickel, Total	(ug/l)	<30	30	<30	35	70	55	35	45
Selenium, Total	(ug/l)	<5	----------	----------	----------	----------	----------	----------	---------->
Silver, Total	(ug/l)	<10	----------	----------	----------	----------	----------	----------	---------->
Tin, Total	(ug/l)								
Zinc, Total	(ug/l)	50	65	65	65	70	100	<40	50

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN–OHIO DISTRICT OFFICE

STREAM: See Below
STATION IDENTIFICATION: See Below
SURVEY DATE: May 2, 1974

	Black River		French Creek	United States Steel		
STATION NUMBER	B17	B18	B19	Outfall	Intake	Outfall
RIVER MILE	11.5	15.2	0.6	002	WI-2	002
MODO SAMPLE NUMBER	9342	9343	9344	9336	9339	(lbs/day)
Flow (cfs)		168.2				
pH (STD. units)	8.1	7.4	8.6	8.6	8.6	
Temperature (°F)	56	57	54	92.3	59	
Conductivity (umhos/cm)	730	700	680	650		
Dissolved Oxygen (mg/l)	11.1	10.8	14.5	5.2		
Dissolved Oxygen % Sat.	106	104	134	72		
BOD_5 (mg/l)	4.2	3.1	2.7	6.8		
BOD_{20} (mg/l)	16.6	9.8	6.2	41.1		
COD (mg/l)	27	24	39	44	28	
TOC (mg/l)	8	8	9	8	7	
Solids, Total (mg/l)	481	449	418	397	372	
Solids, Dissolved (mg/l)	441	422	391	366	336	
Solids, Suspended (mg/l)	7	<5	<5	28	28	
Hardness (mg/l $CaCO_3$)	355	246	196			
Acidity (mg/l $CaCO_3$)	154	146	113			
Chloride (mg/l)	33	34	44	60	34	
Fluoride (mg/l)	0.24	0.22	0.24			
Sulfate (mg/l)	125	126	95	100	80	
Phosphorus, Total (mg/l P)	0.153	0.168	0.587			
Total Kjeldahl–N (mg/l)	3.1	1.8	1.1	10.1	3.4	
Ammonia–N (mg/l)	1.81	0.90	0.04	7.20	2.26	1525
Nitrate–Nitrite–N (mg/l)	0.41	0.27	0.95	1.49	1.09	
Oil and Grease (mg/l)	1	1		<1	1	
Cyanide, Total (mg/l)		0.005		2.000	0.110	584
Phenol (mg/l)		<0.002		0.454	<0.002	1.8
MBAS (mg/l)	0.08	0.06	0.08	0.20	0.09	
Fecal Coliform (Nos/100 ml)	8300	7300		from river mile 2.8		
Fecal Strep (Nos/100 ml)	250	440				
Aluminum, Total (ug/l)	180	140	200			
Arsenic, Total (ug/l)						
Barium, Total (ug/l)	60	<50	<50			
Beryllium, Total (ug/l)	<2	<2	<2			
Cadmium, Total (ug/l)	<8	<8	<8			
Chromium, Total (ug/l)	<30	<30	<30	<30	<30	
Chromium, Hexavalent (ug/l)	Trace	<5	<5			
Copper, Total (ug/l)	<15	<15	<15	<15	<15	
Iron, Total (ug/l)	840	790	880			
Iron, Dissolved (ug/l)	15	10	20			
Lead, Total (ug/l)	<40	<40	<40	<40	<40	
Manganese, Total (ug/l)	100	73	88			
Manganese, Dissolved (ug/l)	40	30	60			
Mercury, Total (ug/l)	<0.2	<0.2	<0.2			
Nickel, Total (ug/l)	<30	<30	<30			
Selenium, Total (ug/l)	<5	<5	<5			
Silver, Total (ug/l)	<10	<10	<10			
Tin, Total (ug/l)						
Zinc, Total (ug/l)	<40	<40	<40	90	95	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (umho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
LAKE ERIE	0	50	11.5	360	222	15		
(LE-1)	3	50	11.5	360				
	6	49.6	11.5	360				
	9	48.7	11.7	350				
	12	47.3	11.8	340				
	15	46.2	11.8					
	18		11.9			18		
	21		12.0					
	24							
	27							
	30							
	33							
	36		12.2					
	38		12.2			18		
HARBOR MOUTH	0	56.8	9.2	450	260	26		
(LE-2)	3	57	9.0	475				
	6	56.5	9.0	450				
	9	50.9	10.2	360				
	12	49.3	10.6	370				
	15	49.3	11.0	375				
	18	48.6	11.0	360		21		
	21	48.2	11.0	370				
	24	46.4	11.4	340				
	27	46.4	11.5	340				
	30	46.4	11.5	340				
	33	46.2	11.7	345				
	35	46.2	11.8	350		19		
RIVER MILE 0.0	0	59.9	7.3	520	290	25		
(B-1)	3	59.7	6.6	520				
	6	56.3	6.4	500				
	9	55.0	6.8	460				
	12	54.0	7.1	425				
	15	53.6	7.4	425		25		
	18	53.4	7.5	410				
	21	53.4	7.9	425				
	24	53.2	8.2	425				
	27	52.9	8.3	425				
	30	51.8	8.7	380				
	32	52.2	8.9	400		22		

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (µmho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
RIVER MILE 0.4	0	67.3	6.1	650	344	41		
(B-2)	3	65.3	5.6	590				
	6	64.2	5.6	575				
	9	61.7	5.9	525				
	12	59.0	6.3	450				
	15	55.4	7.1	440		26		
	18	53.6	8.1	400				
	21	53.2	8.5	400				
	24	52.9	9.1	400				
	27	52.9	9.4	400				
	30	52.2	8.8	390		24		
RIVER MILE 1.04	0	70.3	5.2	700	374	49		
(B-3)	3	70.0	4.8	690				
	6	66.4	4.4	590				
	9	61.5	4.8	500				
	12	58.3	5.5	460				
	15	57.4	6.6	475		34		
	18	55.8	7.2	440				
	21	54.7	7.5	420				
	24	53.4	7.9	390				
	27	52.2	8.4	380				
	30	51.8	8.4	380		25		
RIVER MILE 1.35	0	70.0	5.0	700	360	42		
(B-4)	3	70.0	4.6	675				
	6	70.3	4.4	675				
	9	68.9	4.3	640				
	12	67.5	4.2	600				
	15	59.0	4.3	475				
	18	57.6	5.3	475		35		
	21	57.2	5.8	490				
	24	55.8	6.0	490				
	27	55.4	6.2	475				
	30	54.3	6.2	450				
	33	53.4	6.4	450		31		

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (umho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
RIVER MILE 1.85	0	69.8	5.4	700	363	37		
(B-5)	3	68.9	4.8	650				
	6	67.6	4.5	625				
	9	64.9	4.4	590				
	12	62.1	4.4	540				
	15	60.4	4.9	540		37		
	18	59.9	5.1	540				
	21	56.8	5.2	480				
	24	54.5	5.6	450				
	27	53.6	5.9	460				
	30	53.6	6.0	470				
	31					30		
RIVER MILE 2.40	0	68.4	5.4	675	348	37		
(B-6)	3	67.8	5.4	650				
	6	66.2	4.6	610				
	9	63.9	4.6	610				
	12	62.6	4.5	600				
	15	63.0	4.5	590				
	18	61.5	4.7	560		40		
	21	60.8	5.0	550				
	24	58.3	5.0	525				
	27	56.8	4.5	500				
	30	55.4	4.6	475				
	33	53.3	4.6	475				
	35	52.3	4.5	460		33		
		50.3	4.4	460				
RIVER MILE 2.75	0	68.9	5.5	640	339	44		
(B-7)	3	67.3	5.0	625				
	6	66.2	4.5	625				
	9	62.6	4.3	560				
	12	61.7	4.4	550				
	15	61.2	4.5	550		38		
	18	59.4	4.5	525				
	21	59.0	4.6	520				
	24	57.2	4.9	510				
	27	56.8	5.2	510				
	29	56.3	5.2	525		37		
		55.4	5.3	525				
		55.4	4.0	525				

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (umho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
U. S. STEEL	0	71.6	3.3	790	336	34		
Water Intake - 2	1	71.6	3.3	760				
RIVER MILE 2.85	2	71.4	3.1	740				
	3	69.8	3.0	710				
	4	68	3.0	640				
	5	64.4	3.4	575				
	6	60.4	3.9	525				
	7	60.0	4.4	540				
	8	59.0	4.6	540				
	9	58.8	4.8	540				
	10	58.8	4.9	540				
	11	58.6	4.9	550				
	12	58.1	5.0	540				
	13	57.2	5.0	525				
	14	56.3	5.0	525				
	15	56.3	5.0	525				
	16	55.9	5.0	525				
	17	55.7	5.0	525				
	17.5							
RIVER MILE 2.9	0	71.6	3.3	790	422	52		
(9-8)	1	71.6	3.0	775				
	2	71.6	3.0	775				
	3	71.6	2.9	775				
	4	71.6	2.9	775				
	5	69.8	2.6	725		58		
	6	69.4	2.5	700				
	7	66.2	2.6	610				
	8	64.4	3.3	575				
	9	62.6	3.6	550				
	9' 6"					47		

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (umho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
RIVER MILE 3.35	0	73.8	3.4	750	404	45		
(B-9)	1	73	3.1	725				
	2	73	2.9	725				
	3	71.8	2.8	725				
	4	71.8	2.6	725				
	5	71.6	2.6	725				
	6	64.4	2.5	590				
	7	63.0	2.9	560				
	8	62.2	2.9	660				
	8.5							
RIVER MILE 4.0	0	68.0	6.0	790	444	45		
(B-10)	1	68.0	5.5	790				
	2	68.0	5.3	750				
	3	67.6	5.3	750				
	4	67.5	5.3	750				
	5	67.5	5.3	750				
	6	67.3	5.5	750				
	7	67.3	5.5	750				
	7.5							
RIVER MILE 4.5	0	68.5	6.6	790	441	50		
(B-11)	1	68.4	6.5	790				
	2	68	6.4	750				
	3	68	6.3	750				
	4	66.2	6.2	750				
	5	66.2	6.2	750				
	6	66.2	6.4	750				
	6.6							
RIVER MILE 5.0	0	69.8	6.6	790	426	43		
(B-12)	1	69.8	6.5	790				
	2	69.8	6.4	775				
	3	68.0	6.1	750				
	4	66.2	6.2	740				
	5	64.9	6.2	740				
	5.5							

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STREAM: BLACK RIVER Planning Area

SURVEY DATE: May 2, 1974
Stream Monitoring Data

STATION NUMBER	DEPTH (feet)	TEMP. (°F)	DISSOLVED OXYGEN (mg/l)	COND. (umho/cm)	DISSOLVED SOLIDS (mg/l)	CHLORIDE (mg/l)		
BLACK RIVER	0	69.4	6.5	800				
(Between French	1	68.9	6.4	790				
Creek & USS	2	67.2	6.3	800				
COE 001)	3	64	6.3	750				
(B-13)	4	62.6	6.3	750				
	5	61.5	6.3	750				
BLACK RIVER &	0	61.7	6.6	800				
300' above mouth	1	60.8	6.6	790				
of French Creek	2	60.8	6.6	790				
(B-14)	3	60.8	6.4	790				
	4	60.8	6.5	790				

Attachment I

U.S. EPA Survey, July 23-26, 1974

2. July 23-26, 1974 Survey U.S. EPA

The July 1974 survey was conducted to obtain sufficient data to validate dissolved oxygen and temperature water quality simulation models. These models were used to determine acceptable waste loadings for the Elyria STP and the U.S. Steel - Lorain Works consistent with Ohio Water Quality Standards. Data obtained during the May 1974 survey were used to establish stream and effluent sampling stations and to determine the method and frequency of sampling and other data needs. A complete review of the July survey is presented below.

a. Sampling Locations

Figure III-11 illustrated the location of the stream and effluent sampling points. Table III-2 presents the river mile indices for each station and describes the types of samples and measurements made. The main stem of the Black River was sampled at 12 locations from above the Elyria sewage treatment plant to Lake Erie. One station on French Creek and one in Lake Erie were also sampled. Temperature monitors were set at six additional stations surrounding the Lorain Works. Surface, mid-depth, and bottom samples were obtained at six stations for dissolved oxygen, temperature, chlorides and sodium. River Station 7 was sampled at Intake WI-3 and served as the intake sample as well. Effluent samples were also obtained at the Elyria and Lorain sewage treatment plants.

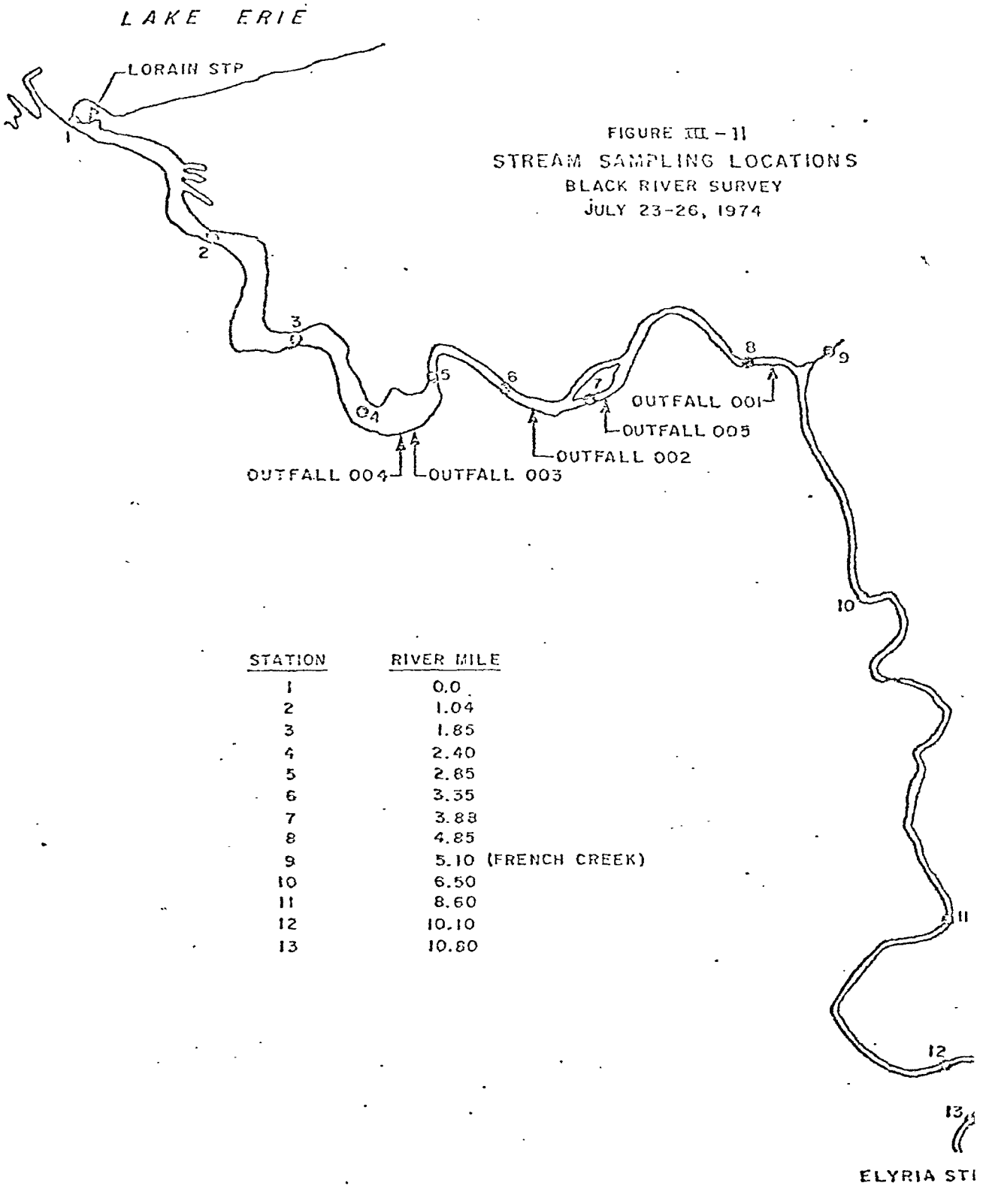


FIGURE III - 11
STREAM SAMPLING LOCATIONS
BLACK RIVER SURVEY
JULY 23-26, 1974

STATION	RIVER MILE
1	0.0
2	1.04
3	1.85
4	2.40
5	2.85
6	3.35
7	3.88
8	4.85
9	5.10 (FRENCH CREEK)
10	6.50
11	8.60
12	10.10
13	10.80

TABLE III-2

U.S. EPA BLACK RIVER SURVEY

JULY 23-26, 1974

SAMPLE STATION LOCATIONS

STATION NUMBER	RIVER MILE	SAMPLE TYPE (See below)
13	10.8	B
12	10.1	B,E
11	8.6	B
10	6.5	B
9	(French Creek)	B,E
8	4.85	B
8a	4.76	D
8b	4.66	D
7	3.88	B
7a	3.79	D
7b	3.69	D
6	3.35	A
6a	3.35	C
6b	3.26	D
6c	3.16	D
5	2.85	A
5a	2.85	C
4	2.40	A
3	1.84	A
2	1.04	A
1	0.0	A
LAKE ERIE	--	F

SAMPLE TYPES

A. 24 hour composite of surface sample for all constituents (see Appendix III). 24 hour composite of mid-depth and bottom samples for dissolved solids, sodium, chloride, fluoride, sulfate. 12 measurements/24 hours for temperature, dissolved oxygen, pH, and conductivity. . . at surface, mid-depth and bottom.
B. Same as "A". Except only surface samples were taken.
C. Continuous temperature and dissolved oxygen monitor
D. Continuous temperature monitor.
E. Stream flow measurement at time of sample collection.
F. Grab sample for dissolved oxygen, dissolved solids, conductivity, sodium, chloride, fluoride, and sulfate.

b. Sample Types and Sampling Frequency

Three consecutive 24-hour equal volume composite samples were obtained at Stations 1 through 13 from July 23-26, 1974. The composites were made up of 12 grab samples obtained at two hour intervals for Stations 1-8 and 10 which were sampled by boat, while eight to twelve grabs were combined to form the composites for Stations 9 and 11-13 which were sampled from land. Fewer grabs were employed in the latter composites because of the time requirements for stream gaging at Stations 9 and 12. Grab samples for dissolved oxygen, pH, and conductivity were obtained at the time of sampling for other constituents.

c. Sampling Methods and Analytical Procedures

Samples were collected in polyethylene containers for all constituents except polychlorinated biphenyls which were collected in glass containers with teflon-lined caps. Dissolved oxygen grab samples were obtained directly in BOD bottles by hand for surface samples and with APHA samplers for mid-depth and bottom samples. Samples were composited in the field from the polyethylene sample containers on an equal volume basis. Dissolved oxygen samples were fixed at the time of collection and titrated within a maximum of one hour of collection. All samples collected at Stations 1-8 and 10 were iced immediately upon collection and kept iced until analysis, although samples from Stations 9 and 11-13 were not iced as well as samples from other stations. Preservatives were added to the composite sample containers before the incremental grab samples were added. The metals sample for Station 13 on July 23-24, 1974 was contaminated prior to analysis and was discarded.

Stream flows were measured at the time of sample collection at Stations 9 and 12 in accordance with established USGS procedures. Standard U.S. EPA, Region V custody procedures were employed throughout the survey. Sample preservatives and analytical methodology in conformance with Section 304(g) of the 1972 Amendments were employed for all laboratory analyses except for fluoride and sulfate which were determined with laboratory techniques currently under consideration as alternate test procedures in accordance with Section 304(g). MBAS analyses were not completed within the recommended holding period of 24 hours.

d. General Conditions

1. Weather - Climatological data were obtained for the survey period from the U.S. Coast Guard Station at Lorain and the U.S. Department of Commerce weather station at Elyria. Daily maximum air temperatures at Elyria ranged from 73 to 81°F with daily minima from 54 to 61°F, while daily maximum air temperatures at Lorain ranged from 70 to 77°F and daily minima from 62 to 68°F. Winds were from the northeast at 0 to 10 knots as measured at Elyria, while the Coast Guard recorded wind velocities ranging from 3 to 15 knots with highly variable direction. (One knot is equal to 1.151 mph). There was no precipitation throughout the survey and weather conditions ranged from clear to partly cloudy and cloudy. The Coast Guard also reported haze at times. Air pressure varied from 30.00 to 30.14 inches of mercury as measured at Lorain.

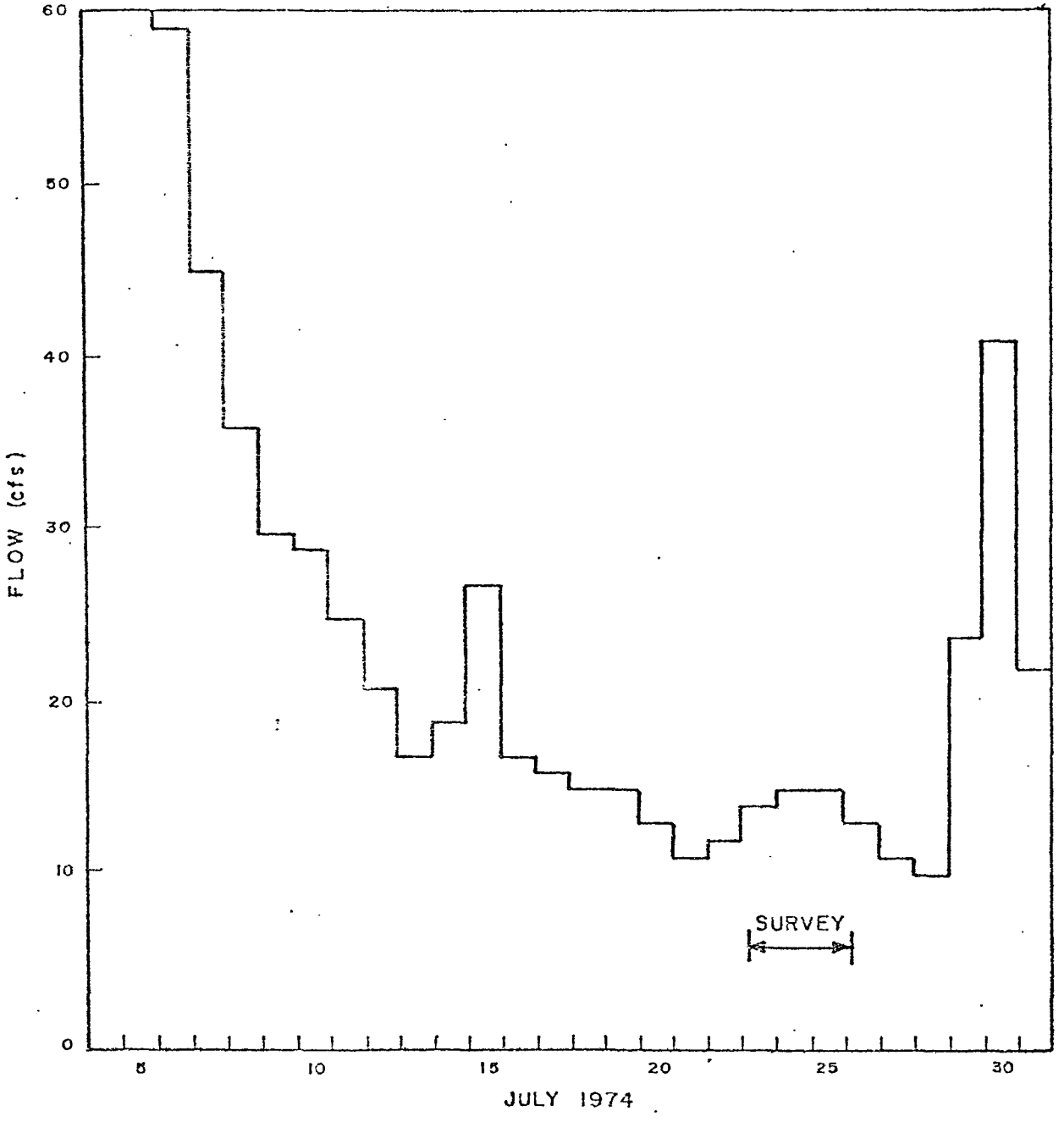
2. Hydrology - Figure III-12 is a daily hydrograph of the Black River for the month of July 1974 at the USGS gage in Elyria, RM 15.2. As shown, the hydrograph was declining for the entire month preceding the survey and was extremely stable during the sampling period. The 1974 summer period preceding the survey was abnormally dry, resulting in relatively low sustained flows in many streams. The flow recorded at the USGS gage during the survey approximated the combined discharger flow above the gage indicating the Black River was at or near critical flows.

In addition to conventional stream gaging, the amount of lake intrusion near the Lorain Works was determined four times during the survey by taking velocity and cross-section measurements at Stations 4 and 5. Velocity data were obtained boat with a Bendix Q-15 current meter employing a two-point anchoring system for stability. Velocity profiles were made at three points on a line perpendicular to the direction of flow at Station 5 and at four points at Station 4. Instantaneous flow values were determined at each station by applying the upstream and downstream velocities to the corresponding stream cross-sections. These data confirm that lake water actually flows upstream into and above the U.S. Steel turning basin. Because of manpower and equipment limitations such measurements could not be completed around the clock. Twenty-four hour sodium and chloride composite samples were obtained at all stream stations and at multiple depths for Stations 1-6. Using these data in conjunction with measured flow rates above U.S. Steel and flow and loading data from the Lorain

FIGURE III-12

DAILY HYDROGRAPH OF THE BLACK RIVER

U.S.G.S. STREAMFLOW GAGE AT ELYRIA (RM 15.2)



Works, estimates of 24 hour average lake instrusion flows were made consistent with the remainder of the sampling survey. A more detailed discussion of these data and their use in stream temperature simulation is presented in Appendix V. The sodium and chloride data were also used to compute a dispersion coefficient for dissolved oxygen simulation as discussed in Appendix VI.

e. Discussion of Results

Figures III-13 to III-23 summarize the results of the three-day survey. The complete stream data and effluent data for the Elyria and Lorain sewage treatment plants can be found in Attachements B, C, and D, respectively, of Appendix III.

Figure III-13 contains plots of sodium and chloride concentrations vs. river mile for each day. These data illustrate that the daily average streamflow and discharge loadings of sodium and chloride were approximately constant throughout the survey. Hence, steady state conditions in terms of streamflows and intrusion flows were encountered. Any significant variations of streamflow would produce vastly differing plots for each day. Since the flow remained remarkably stable, the three plots for each constituent are nearly identical in terms of concentrations at each sampling statior and at each depth. The drop in concentration as the stream flows to the lake indicates longitudenal mixing as a result of lake intrusion and U.S. Steel pumpage. A substantial amount of dilution is afforded by Lake Eri

Surface temperatures vs. river mile are illustrate in Figures III-14, III-15, and III-16. The effect of the Lorain Works was quite evident downstream of Outfall 001, RM 5.0. Increases in stream temperatures of about 15°F were recorded each day on a 24-hour average basis, a substantial violation of the 5°F increase in temperature allowed by the water quality standards. The stream cooled by about 4 to 5°F by the time it reached Intake WI-3, RM 3.88. At this point, the heat loading from Outfall 005 appeared to have had a negligible effect.

Downstream of Intake WI-3 the combined effects of Outfall 002 at RM 3.5 and Outfalls 003 and 004 at RM 2.63 and 2.56, respectively, elevated the entire stream surface from RM 3.8 to 2.4 to a range of approximately 84 to 86°F on an average basis. Figure III-17 presents temperature profile data for various sampling stations in the turning basin indicating stratification of cooler lake water on the stream bottom vs. the heated effluent at the surface. This also confirmed the results of the May 2, 1974 survey.

FIGURE III-13

CHLORIDE AND TOTAL SODIUM VS RIVER MILE

BLACK RIVER SURVEY

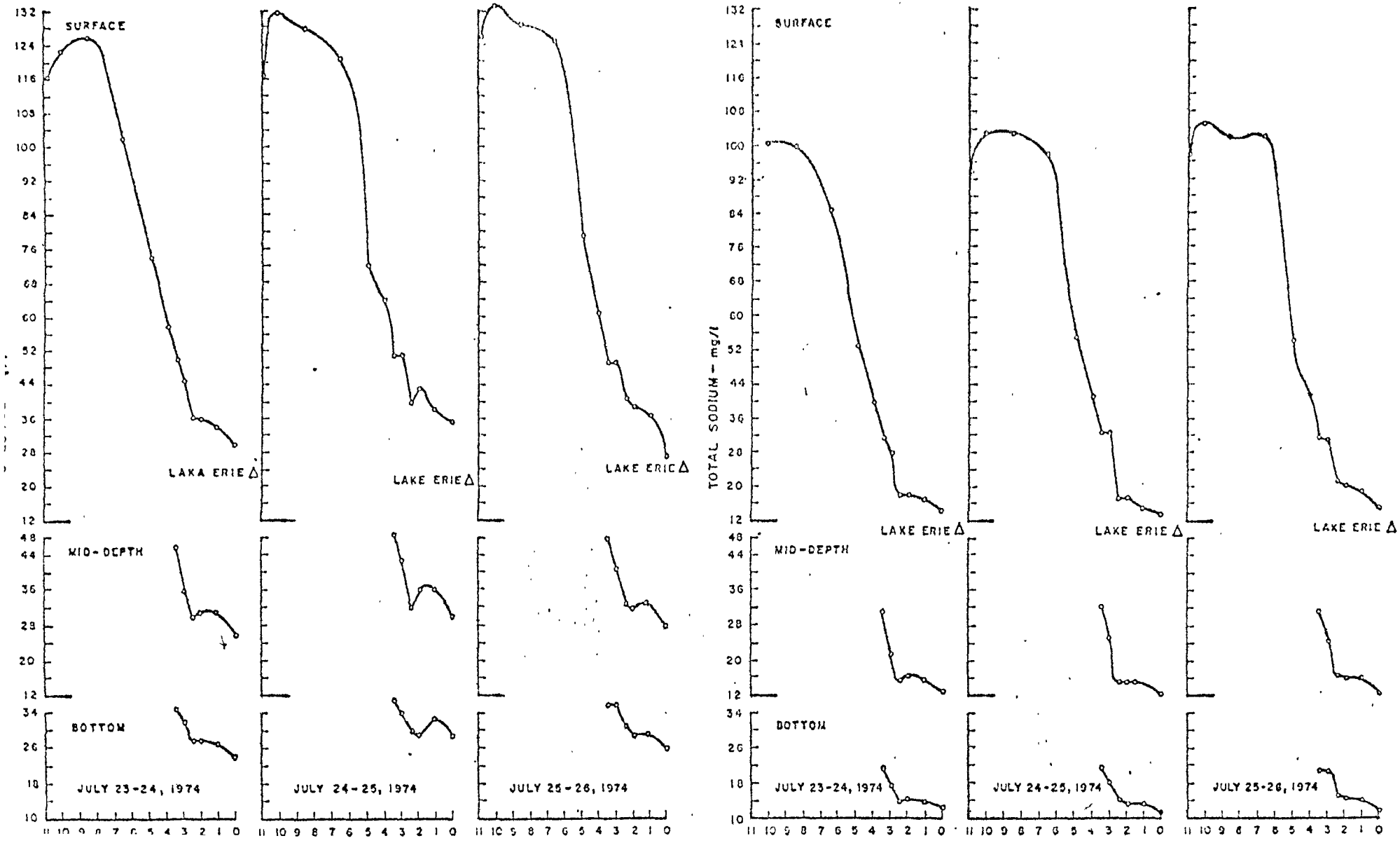
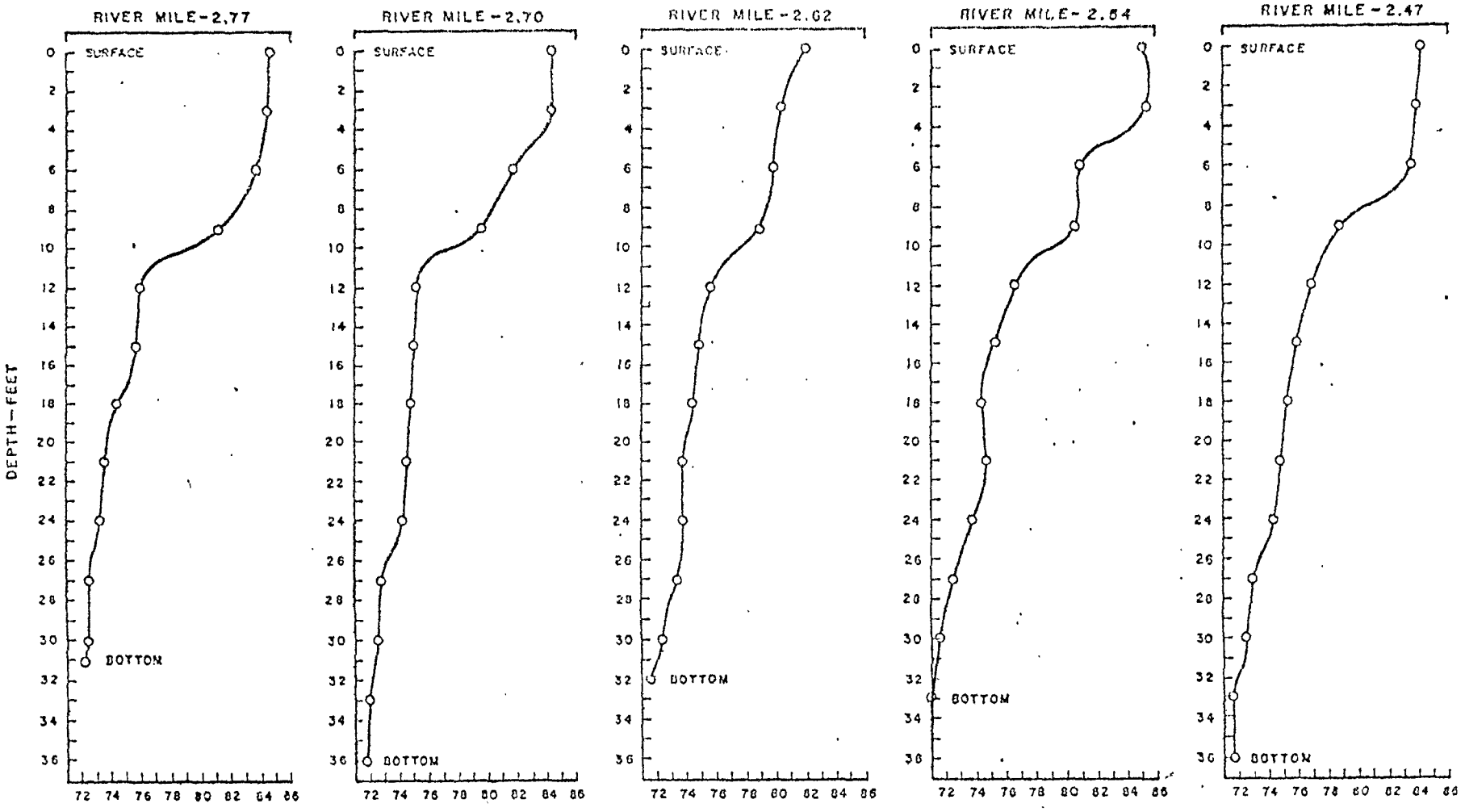


FIGURE III-17
DEPTH VS TEMPERATURE
BLACK RIVER SURVEY
JULY 24, 1974



Figures III-18 to III-21 depict the dissolved oxygen levels in the stream and levels of related carbonaceous and nitrogenous oxygen demanding substances. Figure III-17 illustrates maximum, minimum, and average dissolved oxygen concentrations at each sampling station for the three 24 hour sampling periods. Data at mid-depth and at the bottom are also presented from Stations 1-6. These data demonstrate that discharges from the Elyria sewage treatment plant resulted in a violation of the 5.0 mg/l dissolved oxygen water quality standard with 24-hour average values of 2 to 3 mg/l recorded. The stream recovered to 4 to 5 mg/l above the Lorain Works, but because of the extended time-of-travel in the lower portion of the stream, elevated stream temperatures at the Lorain Works, and discharge loadings from the Lorain Works, the surface dissolved oxygen concentratic was lowered to between 1.5 and 3.0 mg/l from the Lorair Works to the mouth of the river. Mid-depth and bottom concentrations were somewhat lower except near the mouth of the river due to lake intrusion.

The diurnal variation of dissolved oxygen at Stations 7, 8, 10, 11, 12 and 13 is presented in Figure III-19. These data demonstrate considerable photosynthetic activity at Station 13 above the Elyria sewage treatment plant on July 24 and July 25, 1974. There was relatively little photosynthetic activity on July 23, which was the cloudiest of the three days. Photosynthesis was evident at Station 12 just below the Elyria sewage treatment plant, but only to a minor extent since the discharge from the plant adversely affects the stream at this point. Data at Station 11 show some photosynthetic activity similar to that at Station 13. However, data at Stations 10, 8, and 7 do not evidence daytime photosynthetic activity.

Plots of chemical oxygen demand, total organic carbon, and 5 and 20-day biochemical oxygen demand are presented in Figure III-20. Plots of total kjeldahl nitrogen (TKN), ammonia-nitrogen, and nitrite nitrate-nitrogen are presented in Figure III-21. The general trend of all plots are similar, demonstrating the severe effect of the Elyria sewage treatment plant discharge which is followed by an apparent recovery at the Lorain Works. However, the flow regime of the area must be considered, i.e. an increase in streamflow of about 4 times by the discharge from Lorain Works Outfall 001 at RM 5.0. The Lorain sewage treatment plant discharge is hardly noticeable near the mouth of the river. The BOD_5 and BOD_{20} concentrations at Stations 13, 12, 11, and French Creek (not shown) may be somewhat low due to inadequate icing of the samples during collection.

FIGURE III-18

DISSOLVED OXYGEN VS RIVER MILE

BLACK RIVER SURVEY

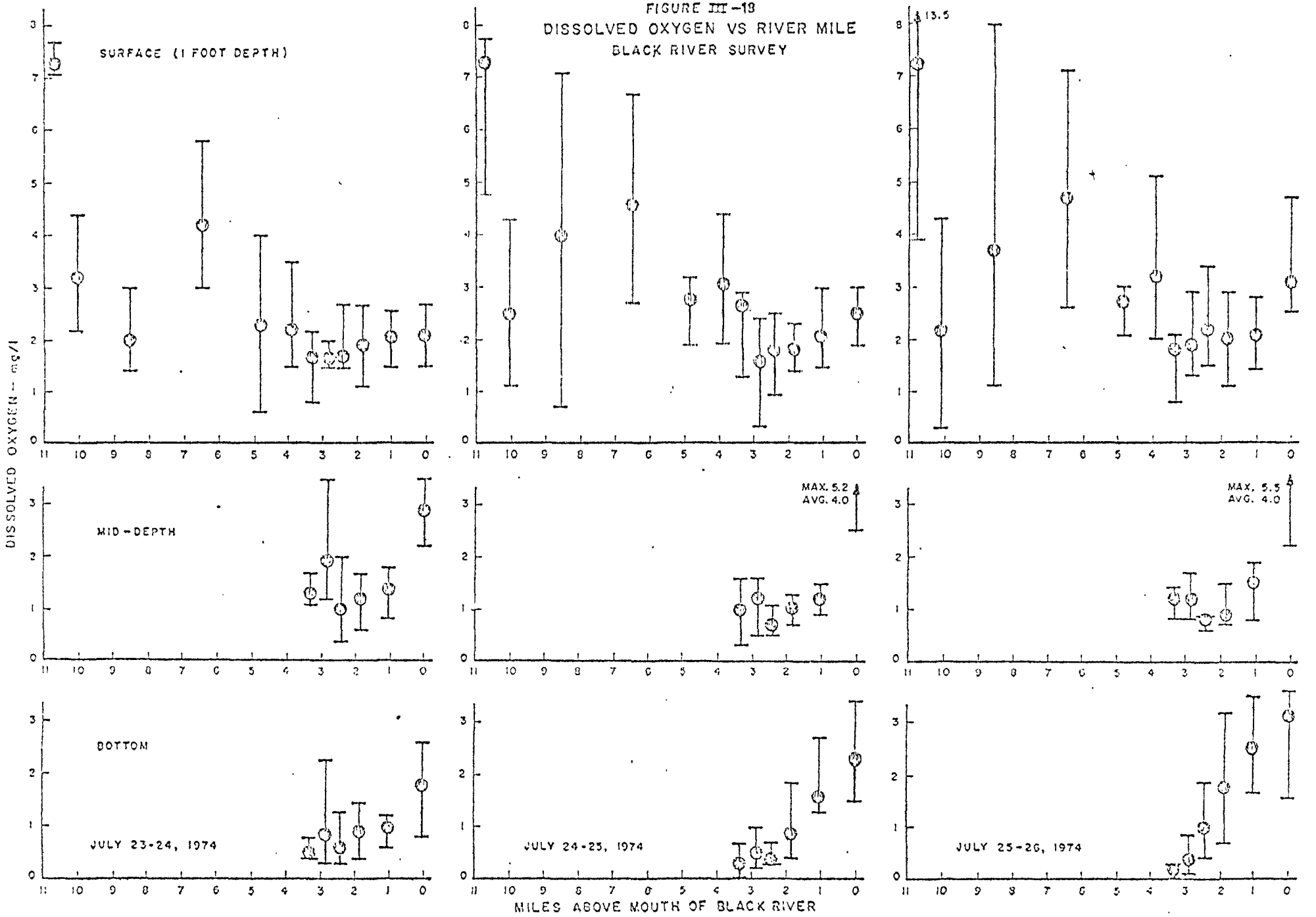


FIGURE III-19

DISSOLVED OXYGEN VS TIME

BLACK RIVER SURVEY

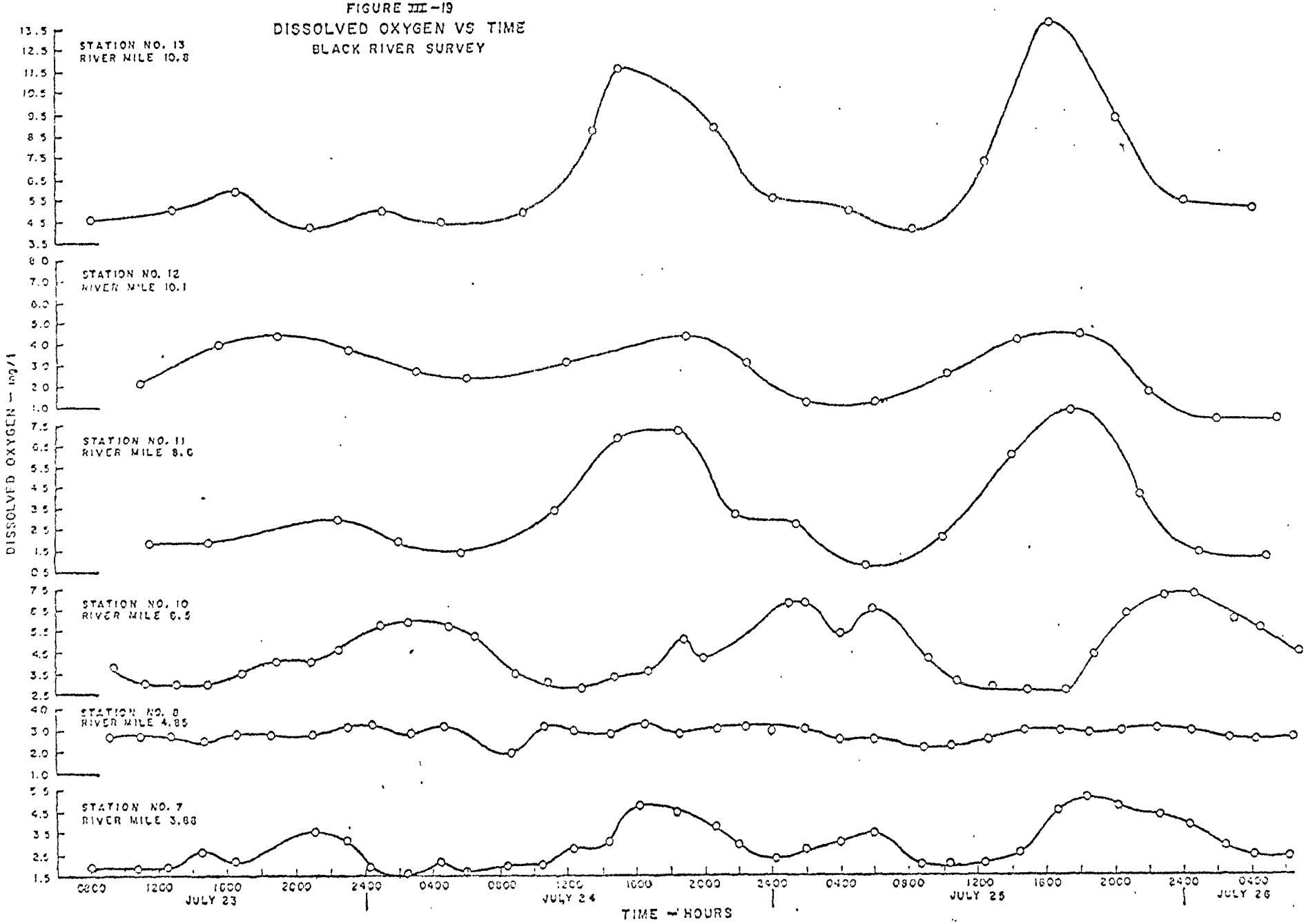


FIGURE III-20
COD, TOC, BOD_5, BOD_{20} VS RIVER MILE
BLACK RIVER SURVEY

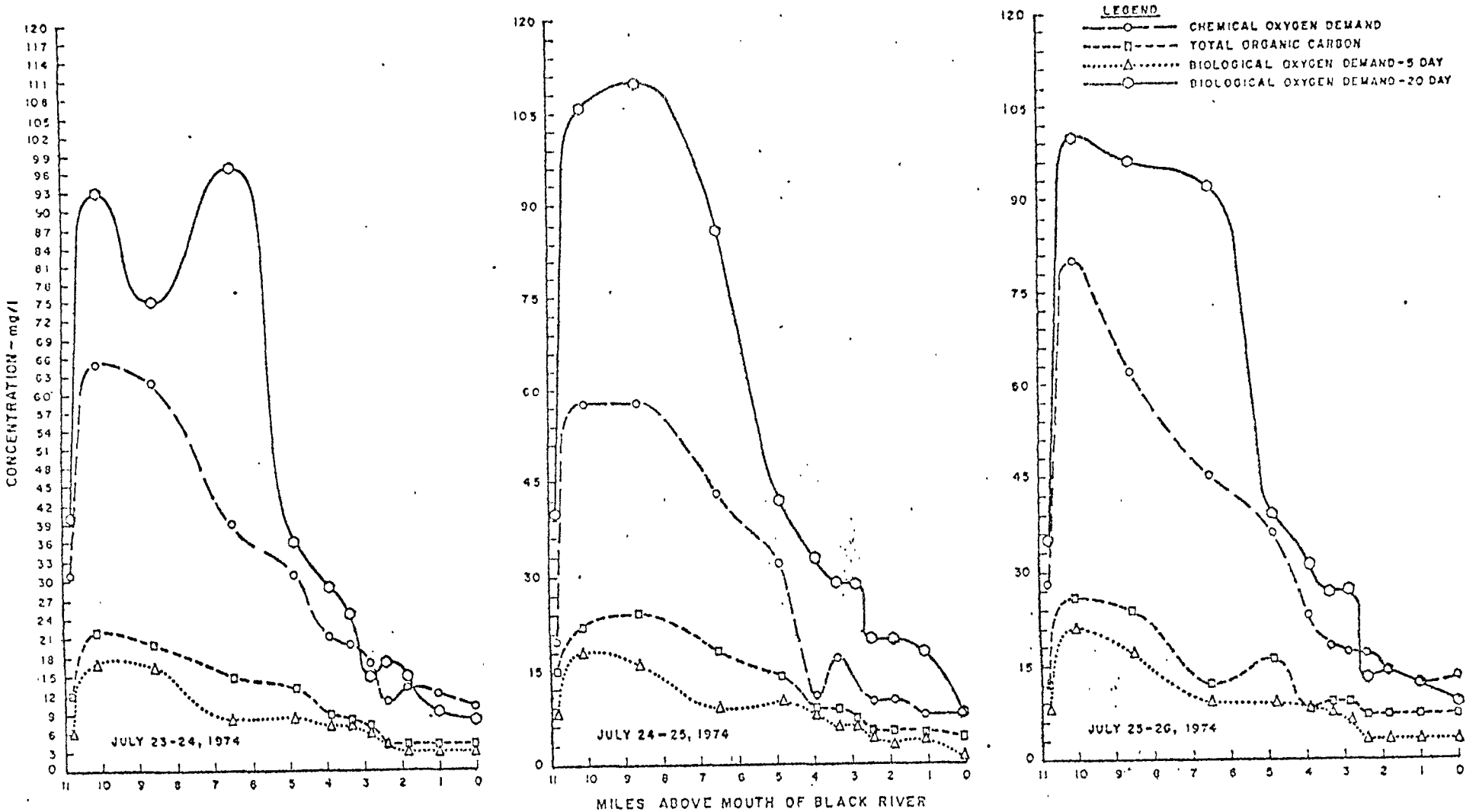
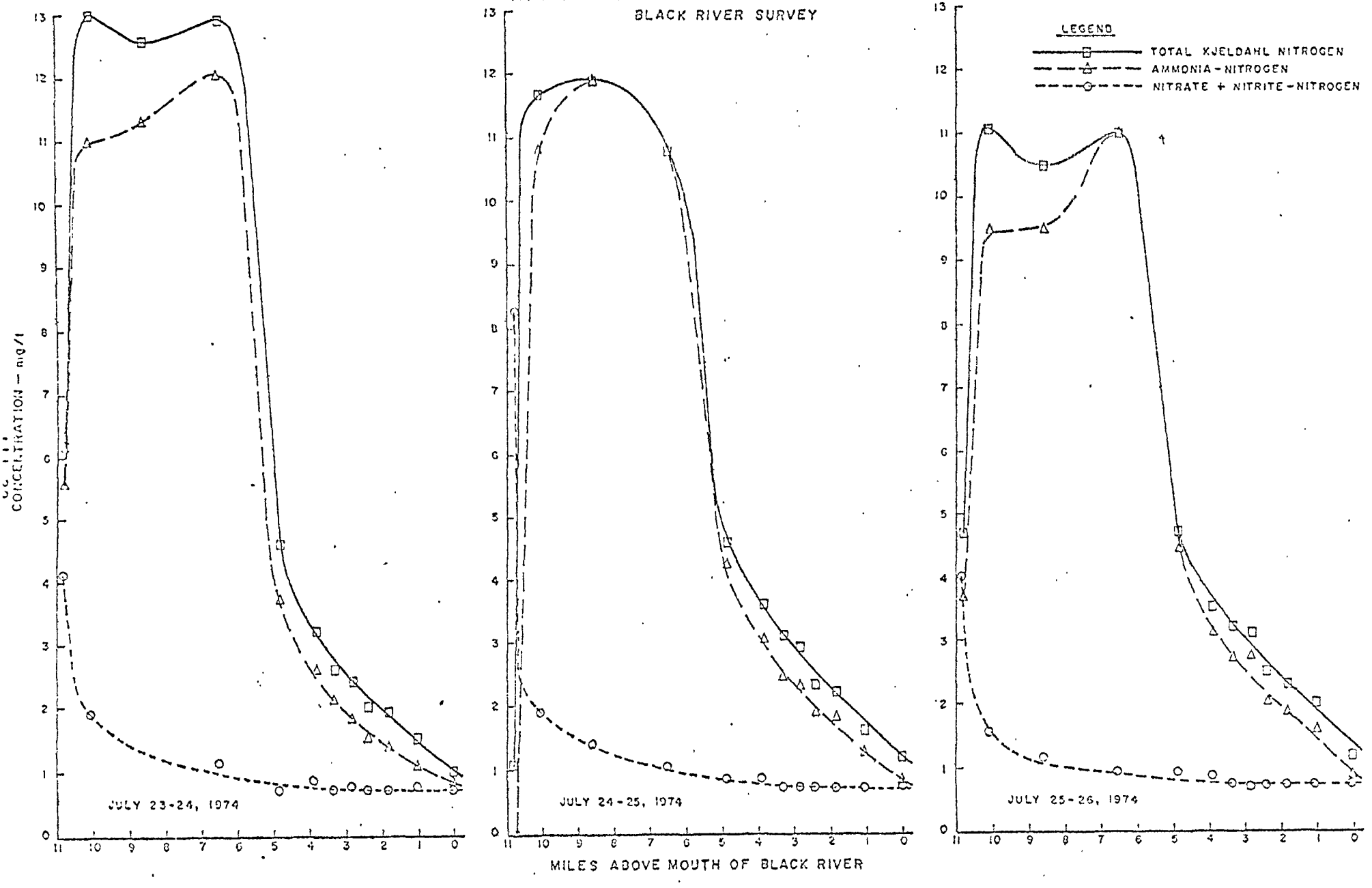


FIGURE III-21

TOTAL KJELDAHL NITROGEN, AMMONIA-NITROGEN, NITRATE + NITRITE-NITROGEN VS RIVER MILE

BLACK RIVER SURVEY



Nitrogen series data presented in Figure III-21 are particularly significant in that gross violations of the 1.5 mg/l ammonia criterion are shown above and below the Elyria sewage treatment plant and downstream past the Lorain Works. Violations above the Elyria sewage treatment plant are attributed to discharges from the Elyria sewerage system, while the Elyria sewage treatment plant and U.S. Steel cause the downstream violations. Most of the TKN discharged from the Elyria sewage treatment plant was in the form of ammonia rather than organic nitrogen. Although the TKN and ammonia concentrations sharply decreased at Lorain Works Outfall 001, the nitrite-nitrate concentrations remained relatively constant. Considering the large volumes of water circulated in the stream by Lorain Works pumpage and Lake intrusion, these data indicate that conversion of ammonia to nitrate was occurring.

Figure III-22 contains plots of total cyanide and phenolics vs. river mile for the three-day survey. The abnormally high cyanide discharges from the Elyria STP nearly resulted in violations of the 200 ug/l stream standard on each day with a high value of 180 ug/l recorded on July 24, 1974. The sewage treatment plant loadings result from discharges of untreated and partially treated metal finishing wastes to the Elyria sewerage system. The STP discharge has a much greater adverse impact at low flow periods as evidenced by a comparison of these data with data obtained during the May survey. The effects of the Lorain Works are evident below Outfall 002 and Outfall 003 and 004, but water quality standards for cyanides were not violated. The 10 ug/l stream standard for phenolics was exceeded below the Elyria STP each day and slightly on July 24 below Lorain Works Outfalls 003 and 004. However, the phenol standard was achieved in the area of U.S. Steel for the most part during the entire survey. Due to the high reaction rate of phenolics and the dilution afforded by the stream, the minor violations of standards were not persistent. It is important to note that discharges of ammonia, cyanide, and phenol from the Lorain Works Coke Plant were significantly less than encountered on May 2, 1974 when unannounced samples were obtained. However, during the May to July 1974 period the company was in the process of repairing a substantial portion of the flushing liquor piping in the coke plant which may account for the substantial reduction in waste loadings.

The adverse effects of the Elyria sewage treatment plant and the Lorain Works are also demonstrated in Figure III-23 where metals data are presented. Data for Station 13, RM 10.8 upstream of the Elyria STP, are not available for July 23, 1974 as the sample was contaminated prior to analysis. However, data for the

remaining two days at Station 13 demonstrate violation of the chromium, copper, and zinc stream standards of 300 ug/l, 10 ug/l, and 100 ug/l respectively. The stream standards for copper and zinc are for a hardness range of 80-160 mg/l. These violations can be attributed to discharges from the Elyria sewerage system and metal finishing and chemical plants in the area. The Elyria sewage treatment plant also contributed abnormally high metals loadings to the stream as evidenced by a comparison of data from Stations 12 and 13. The effects of the Lorain Works are evident at Station 8, RM 4.85, where the zinc standard was exceeded as a result of the discharge from Outfall 001. Effects of Outfalls 003 and 004 are shown at Station 4, RM 2.40, where zinc concentrations increased causing violation of standards on July 25-26, 1974. The violation of the copper standard at RM 2.40 apparently did not result from Lorain Works discharges as copper was generally not detected in Outfalls 003 and 004. The sharp increase in zinc and copper near the mouth of the river on July 25-26, 1974 appeared to result from the Lorain sewage treatment plant discharge.

FIGURE III-22
TOTAL CYANIDE AND PHENOLICS VS RIVER MILE
BLACK RIVER SURVEY

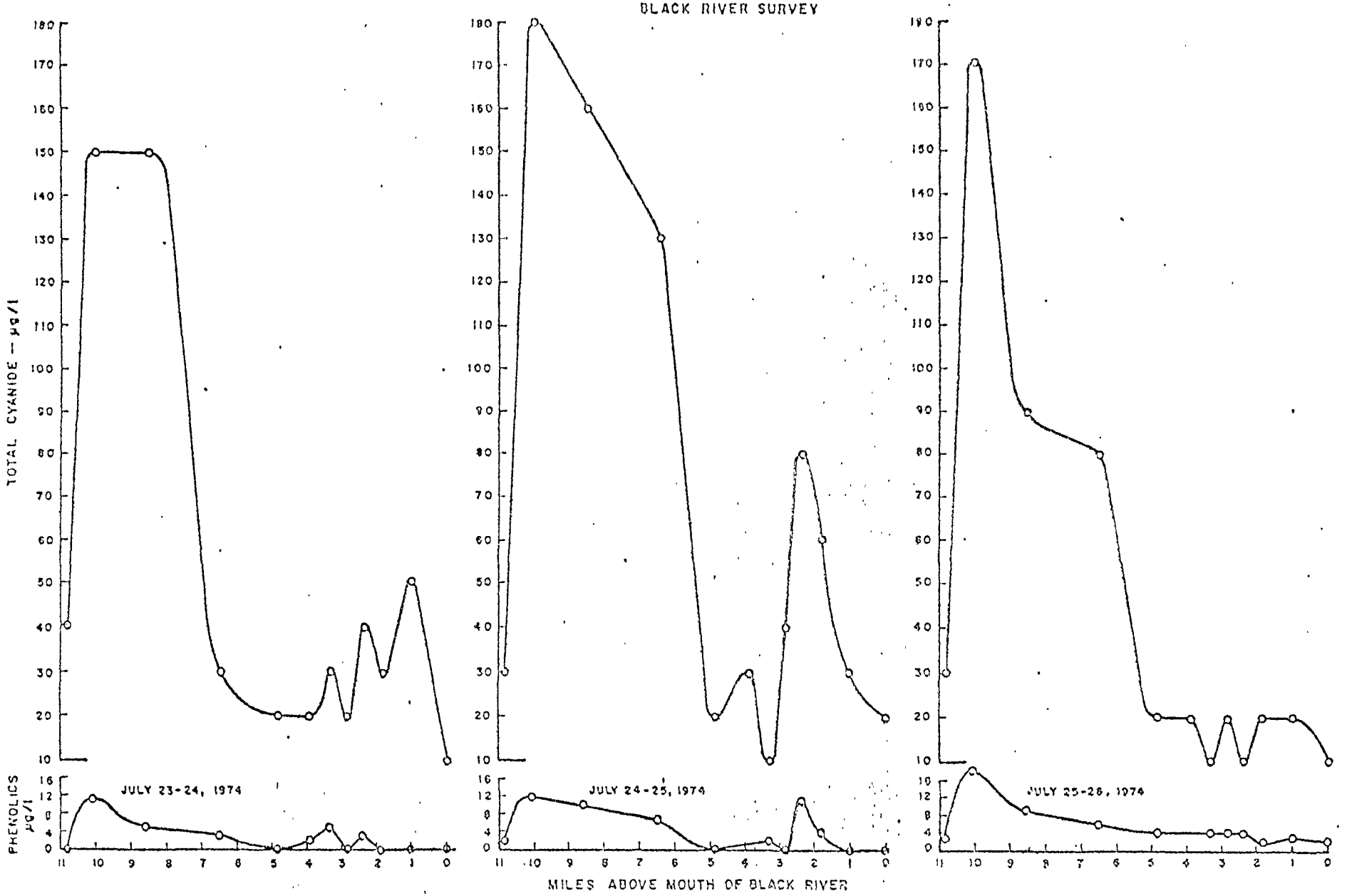


FIGURE III-23
TOTAL CHROMIUM, COPPER, NICKEL, AND ZINC VS RIVER MILE
BLACK RIVER SURVEY

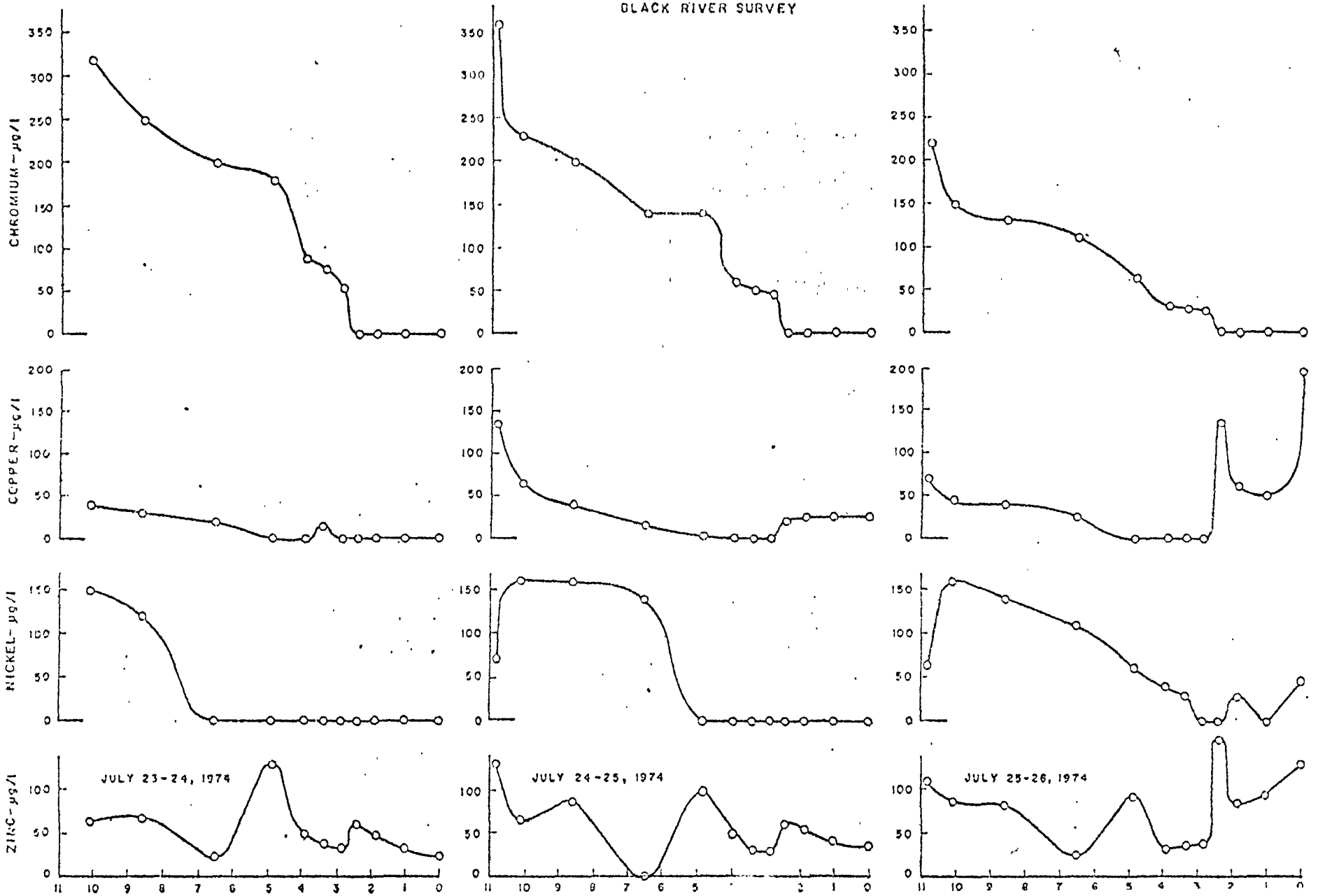


TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 23-24, 1974

UNITED STATES ENVIRONMENTAL PROTECTION AGENC

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

(mg/l unless otherwise noted)

STATION NUMBER	13	12	11	10	8	8a	8b	7
RIVER MILE	10.8	10.1	8.6	6.5	4.85	4.76	4.66	3.88
Flow, cfs (average)		19.8						
pH, range	7.1-7.5	7.1-7.5	7.0-7.6	6.3-7.5	5.7-7.3			6.4-7.1
Cond. (μmhos/cm)	825 -1000	870 -1050	920 -1020	510 -900	500 -690			480 -590
Temperature °F max.	71.6	73.4		69.8	85.6	84.9	85.8	83.8
avg.	69.7	72.9		68.7	84.6	84.1	85.2	80.4
min.	66.4	71.8		68.0	83.1	82.8	84.0	78.8
DO max.	7.7	4.4	3.0	5.8	4.0			3.5
avg.	7.3	3.2	2.0	4.2	2.3			2.2
min.	7.1	2.2	1.4	3.0	0.6			1.5
Total Solids	635	635	635	575	450			370
Dissolved Solids	590	555	590	535	410			320
Suspended Solids	9	15	15	7	12			12
COD	31	65	62	39	31			21
TOC	12	22	20	15	13			9
BOD_5	6	17	16	8	8			7
BOD_{10}	36	25	26	19	29			24
BOD_{20}	40	93	75	97	36			29
BOD_{30}	42	93	87	97	36			29
Phosphorus, Total	0.219	2.53	2.71	2.60	0.787			0.4
TKN	6.2	13.0	12.6	12.9	4.6			3.2
Ammonia-N	5.58	11.0	11.3	12.02	3.72			2.62
Nitrate-Nitrite-N	4.15	1.91		1.15	0.74			0.87
Chloride	117	123	126	102	74			53
Fluoride	0.81	0.78	0.72	0.76	0.56			0.55
Sulfate	188	166	166	153	107			84
T. Sodium		101	100	85	53			40.2
MBAS	0.18	0.24	0.24	0.21	0.17			
T. Cyanide (μg/l)	40	150	150	30	20			20
Phenolics (μg/l)	<2	11	5	3	<2			2
T. Cadmium (μg/l)		10	10	<8	<8			<8
T. Chromium (μg/l)		320	250	200	180			90
T. Copper (μg/l)		40	30	20	<15			<15
T. Iron (μg/l)		480	600	500	2300			920
T. Lead (μg/l)		<50	<50	<50	75			<50
T. Mercury (μg/l)		<0.2	<0.2	<0.2	<0.2			<0.2
T. Nickel (μg/l)		150	120	<30	<30			<30
Zinc (μg/l)		64	67	26	130			50

TABLE:
STREAM: BLACK RIVER
SURVEY DATE: July 23-24, 1974
(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	7a	7b	6T	6M	6B	6a	6b	6c	5a
RIVER MILE	3.79	3.69	3.35	3.35	3.35	3.35	3.26	3.16	2.85
Flow, cfs									
pH, range			6.3-7.7	5.7-7.7	5.7-7.8				
Cond. (µmhos/cm)			390 -500	400 -500	370 -490				
Temperature °F max.	83.8	83.8	82.4	80.6	80.6	85.1	85.1	84.0	86.2
avg.	82.4	82.9	81.4	79.0	76.4	83.1	84.5	83.0	84.6
min.	81.5	82.0	80.6	77.0	75.2	81.0	84.0	82.2	82.4
DO max.			2.2	1.7	0.8	2.4			1.4
avg.			1.7	1.3	0.5	2.1			1.0
min.			0.8	1.1	0.4	1.9			0.8
Total Solids			335						
Dissolved Solids			300	235	205				
Suspended Solids			11						
COD			20						
TOC			8						
BOD_5			7						
BOD_{10}			22						
BOD_{20}			25						
BOD_{30}			25						
Phosphorus, Total			0.302						
TKN			2.6						
Ammonia-N			2.13						
Nitrate+Nitrite-N			0.24						
Chloride			50	46	35				
Fluoride			0.43	0.43					
Sulfate			69	70	55				
T. Sodium			31.5	30.6	21.5				
MBAS			0.03						
T. Cyanide (µg/l)			30						
Phenolics (µg/l)			5						
T. Cadmium (µg/l)			<8						
T. Chromium (µg/l)			77						
T. Copper (µg/l)			15						
T. Iron (µg/l)			1300						
T. Lead (µg/l)			<50						
T. Mercury (µg/l)			<0.2						
T. Nickel (µg/l)			<30						
T. Zinc (µg/l)			40						

TABLE:
STREAM: BLACK RIVER
SURVEY DATE: July 23-24, 1974
(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	5T	5M	5B	4T	4M	4B	3T	3M	3B
RIVER MILE	2.85	2.85	2.85	2.40	2.40	2.40	1.84	1.84	1.84
Flow, cfs									
pH, range	6.4-7.5	6.5-7.8	6.2-7.8	6.3-7.6	6.4-7.6	6.1-7.7	6.1-7.4	6.4-7.5	6.7-7.6
Cond. (μmhos/cm)	$^{400}_{-490}$	$^{370}_{-450}$	$^{350}_{-400}$	$^{310}_{-410}$	$^{240}_{-360}$	$^{220}_{-360}$	$^{350}_{-410}$	$^{220}_{-380}$	$^{200}_{-350}$
Temperature °F max.	81.5	80.6	77.9	82.4	76.6	76.3	79.3	76.8	75.2
avg.	80.5	77.2	74.8	80.5	75.7	74.5	78.8	75.9	73.9
min.	78.8	75.2	73.4	79.3	74.3	73.4	77.9	75.2	73.0
DO max.	2.0	3.5	2.3	2.7	2.0	1.3	2.7	1.7	1.5
avg.	1.7	1.9	1.0	1.7	1.0	0.6	1.9	1.2	0.9
min.	1.5	1.2	0.3	1.5	0.4	0.3	1.1	0.6	0.4
Total Solids	300			260			260		
Dissolved Solids	260	200	230	230	190	170	200	195	210
Suspended Solids	7			16			12		
COD	17			11			13		
TOC	7			4			4		
BOD_5	6			4			3		
BOD_{10}	13			12			10		
BOD_{20}	15			17			15		
BOD_{30}	17			17			15		
Phosphorus, Total	0.261			0.122			0.116		
TKN	2.4			2.0			1.9		
Ammonia-N	1.83			1.54			1.37		
Nitrate+Nitrite-N	0.77			0.70			0.72		
Chloride	45	36	32	36	30	28	36	31	28
Fluoride	0.44	0.40	0.43	0.43	0.30	0.42		0.35	0.35
Sulfate	62	56	45	43	44	40	43	45	45
T. Sodium	27.9	21.4	17.8	18.0	15.7	14.2	18.2	16.4	14.4
MBAS	0.08			0.06			0.06		
T. Cyanide (ug/l)	20			40			30		
Phenolics (ug/l)	<2			3			<2		
T. Cadmium (ug/l)	<8			<8			<8		
T. Chromium (ug/l)	54			<20			<20		
T. Copper (ug/l)	<15			<15			<15		
T. Iron (ug/l)	980			1500			1100		
T. Lead (ug/l)	<50			<50			<50		
T. Mercury (ug/l)	<0.2			<0.2			<0.2		
T. Nickel (ug/l)	<30			<30			<30		
Zinc (ug/l)	34			62			49		

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 23-24, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	2T	2M	2B	1T	1M	1B	Lake Erie	French Creek	
RIVER MILE	1.04	1.04	1.04	0.0	0.0	0.0		5.1	
Flow, cfs (average)								1.8	
pH, range	6.2-8.1	6.7-7.5	6.6-7.5	6.4-8.0	6.7-7.4	6.9-7.5		7.3-8.2	
Cond. (μmhos/cm)	310 -395	340 -375	300 -350	310 -370	250 -350	190 -330		950 -1050	
Temperature °F max.	77.9	76.4	73.8	76.1	73.4	71.6		70.9	
avg.	77.1	75.5	72.5	74.5	72.3	70.9		68.3	
min.	76.3	74.7	71.2	73.4	71.8	68.0		66.2	
DO max.	2.6	1.8	1.4	2.7	3.5	2.6		10.3	
avg.	2.1	1.4	1.0	2.1	2.9	1.8		7.5	
min.	1.5	0.8	0.6	1.5	2.2	0.8		4.6	
Total Solids	265			235				715	
Dissolved Solids	175	170	150	185	120	140	140	665	
Suspended Solids	13			12				13	
COD	12			10				29	
TOC	4			4				12	
BOD_5	3			3				2	
BOD_{10}	8			5				7	
BOD_{20}	9			8				13	
BOD_{30}	9			8				14	
Phosphorus, Total	0.149			0.158				1.52	
TKN	1.5			0.98				1.1	
Ammonia-N	1.03			0.85				<0.03	
Nitrate+Nitrite-N	0.76			0.73				1.53	
Chloride	34	31	27	30	26	24	23	108	
Fluoride	1.2	0.46	0.33	0.32	0.25	0.29	0.15	0.62	
Sulfate	43	41	33	40	39	38	32	224	
T. Sodium	17.2	15.9	13.9	14.4	13.3	12.5	10.0	122	
MBAS	0.05			0.05				0.13	
T. Cyanide (μg/l)	50			10				10	
Phenolics (μg/l)	<2			<2				<2	
T. Cadmium (μg/l)	<8			<8				<8	
T. Chromium (μg/l)	<20			<20				<20	
T. Copper (μg/l)	<15			<15				<15	
T. Iron (μg/l)	800			610				750	
T. Lead (μg/l)	<50			<50				<50	
T. Mercury (μg/l)	<0.2			<0.2				<0.2	
T. Nickel (μg/l)	<30			<30				<30	
Zinc (μg/l)	33			25				24	

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 24-25, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGE

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	13	12	11	10	8	8a	8b	7
RIVER MILE	10.8	10.1	8.8	6.5	4.85	4.76	4.66	3.86
Flow, cfs (average		21						
pH, range	7.2-8.3	6.8-7.7	6.8-7.7	6.3-7.5	6.4-7.2			6.8-7.3
Cond. (µmhos/cm)	850-1000	900-1100	985-1050	900-960	550-680			520-610
Temperature °F max.	78.8	75.2	73.4	71.6	86.0	85.8		86.0
avg.	71.2	73.6	72.5	69.8	84.3	84.5		82.6
min.	67.1	72.7	68.0	68.0	82.4	83.0		80.6
DO max.	11.5	4.3	7.1	6.7	3.2			4.4
avg.	7.3	2.5	4.0	4.6	2.8			3.1
min.	4.8	1.1	0.7	2.7	1.9			1.9
Total Solids	605	650	645	620	455			390
Dissolved Solids	575	585	585	585	400			360
Suspended Solids	6	21	10	7	15			9
COD	20	58	58	43	32			11
TOC	15	22	24	18	14			9
BOD_5	8	18	16	9	10			8
BOD_{10}	32	30	24	18	22			19
BOD_{20}	40	106	170	86	42			33
BOD_{30}	44	114	172	86	46			36
Phosphorus, Total	0.230	2.69	2.44	2.44	0.806			0.426
TKN	1.1	11.7	11.9	10.8	4.6			3.6
Ammonia-N	<0.03	10.8	11.8	10.8	4.07			2.88
Nitrate-Nitrite-N	8.28	1.37	1.38	1.86	0.84			0.86
Chloride	117	132	128	121	72			64
Fluoride	0.83	0.88	0.86	0.73	0.57			0.52
Sulfate	167	153	156	157	105			84
T. Sodium	94	138	133	93	55			41.3
MBAS	0.16	0.21	0.21	0.19	0.20			
T. Cyanide (ug/l)	30	180	160	130	20			30
Phenolics (µg/l)	2	12	13	7	<2			
T. Cadmium (ug/l)	10	14	10	<10	<10			<10
T. Chromium (ug/l)	360	230	220	140	140			60
T. Copper (ug/l)	135	68	40	15	15			<15
T. Iron (ug/l)	350	570	550	530	2400			1200
T. Lead (ug/l)	<50	<50	<50	<50	<50			<50
T. Mercury (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2
T. Nickel (ug/l)	70	160	160	140	<30			<30
T. Zinc (ug/l)	130	67	57	120	100			49

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 24-25, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	7a	7b	6T	6M	6B	6a	6b	6c	5a
RIVER MILE	3.79	3.69	3.35	3.35	3.35	3.35	3.26	3.16	2.85
Flow, cfs									
pH, range			6.5-7.5	6.4-7.3	6.5-7.2				
Cond. (µmhos/cm)			450-520	460-510	390-490				
Temperature°F max.	85.3	85.6	85.1	81.5	77.0	86.0		84.9	87.8
avg.	83.8	84.3	82.5	80.6	76.1	83.8		83.7	85.9
min.	82.2	82.4	80.6	79.7	73.4	81.5		82.8	84.2
DO max.			2.9	1.6	0.7	2.4			1.2
avg.			1.8	1.0	0.3	1.9			0.9
min.			1.3	0.3	0.0	1.6			0.6
Total Solids			365						
Dissolved Solids			315						
Suspended Solids			17						
COD			17						
TOC			7						
BOD_5			6						
BOD_{10}			16						
BOD_{20}			29						
BOD_{30}			35						
Phosphorus, Total			0.340						
TKN			3.1						
Ammonia-N			2.44						
Nitrate+Nitrite-N			0.72		—				
Chloride			51	49	37				
Fluoride			0.46	0.50	0.4				
Sulfate			67	72	53				
T. Sodium			32.4	32.2	21.4				
MBAS			0.10						
T. Cyanide (µg/l)			10						
Phenolics (µg/l)			2						
T. Cadmium (µg/l)			<10						
T. Chromium (µg/l)			50						
T. Copper (µg/l)			<15						
T. Iron (µg/l)			1500						
T. Lead (µg/l)			<50						
T. Mercury (µg/l)			<0.2						
T. Nickel (µg/l)			<30						
T. Zinc (µg/l)			32						

TABLE:
STREAM: BLACK RIVER
SURVEY DATE: July 24-25, 1974
(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	2T	2M	2B	1T	1M	1B	Lake Erie	French Creek
RIVER MILE	1.04	1.04	1.04	0.0	0.0	0.0		5.1
Flow, cfs (average)								2.0
pH, range	6.6-7.3	6.5-7.1	6.8-7.2	6.6-7.3	6.7-7.3	6.6-7.3	6.8	7.5-8.2
Cond. (µmhos/cm)	310-400	330-370	320-350	320-370	300-340	300-320	290	880-950
Temperature °F max.	79.2	76.1	74.7	76.1	73.2	72.7		75.4
avg.								70.5
min.	77.0	74.7	72.0	73.8	70.2	68.9		66.0
DO max.	3.0	1.5	2.7	3.0	5.2	3.4	-	11.4
avg.	2.1	1.2	1.6	2.5	4.0	2.3	7.0	6.3
min.	1.5	0.9	1.3	1.9	2.5	1.5	-	5.2
Total Solids	255			245				680
Dissolved Solids	225			210			195	620
Suspended Solids	11			23				20
COD	8			8				24
TOC	5			4				11
BOD_5	4			1				3
BOD_{10}	14			8				6
BOD_{20}	18			8				9
BOD_{30}	22			9				9
Phosphorus, Total	0.11			0.427				2.22
TKN	1.6			1.2			-	1.2
Ammonia-N	1.26			0.82				0.06
Nitrate+Nitrite-N	0.72			0.73				2.37
Chloride	38	36	33	35	30	29	21	93
Fluoride	0.39	0.37	0.35	0.28	0.21	0.23	0.16	0.55
Sulfate	42	43	39	39	37	33	23	201
T. Sodium	15.2	15.3	13.1	13.5	12.3	11.5	9.5	107
MBAS	0.06			0.05				0.13
T. Cyanide (µg/l)	30			20				<5
Phenolics (µg/l)	<2			<2				<2
T. Cadmium (µg/l)	<10			10				<10
T. Chromium (µg/l)	<20			<20				<20
T. Copper (µg/l)	25			25				25
T. Iron (µg/l)	850			870				920
T. Lead (µg/l)	<50			<50				<50
T. Mercury (µg/l)	<0.2			<0.2				<0.2
T. Nickel (µg/l)	<30			<30				<30
Zinc (µg/l)	42			36				21

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 25-26, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	13	12	11	10	9	8a	8b	7	
RIVER MILE	10.8	10.1	8.6	6.5	4.85	4.76	4.66	3.88	
Flow, cfs (average)		22.2							
pH, range	6.5-8.0	6.4-7.6	6.4-7.9	6.3-7.4	6.3-7.2			6.3-7.3	
Cond. (umhos/cm)	1030 -1100	1075 -1200	1000 -1125	900 -980	560 -700			520 -610	
Temperature°F max.	77.0	75.2	75.2	73.4	86.0	85.8		85.1	
avg.	70.7	73.9	71.1	71.6	84.8	84.9		82.4	
min.	66.2	72.5	68.0	69.8	82.4	84.0		80.6	
DO max.	13.5	4.3	8.0	7.1	3.0			5.1	
avg.	7.3	2.2	3.7	4.7	2.7			3.2	
min.	3.9	0.3	1.1	2.6	2.1			2.0	
Total Solids	635	645	630	615	440			385	
Dissolved Solids	535	610	535	580	410			360	
Suspended Solids	7	20	15	10	18			18	
COD	28	80	62	45	36			23	
TOC	12	26	24	12	16			8	
BOD_5	8	21	17	9	9			8	
BOD_{10}	29	25	22	16	25			20	
BOD_{20}	35	100	95	92	39			31	
BOD_{30}	35	100	95	92	39			31	
Phosphorus, Total	0.317	2.82	2.63	2.18	0.860			0.483	
TKN	4.7	11.1	10.5		4.7			3.5	
Ammonia-N	3.63	9.48	9.48	11.0	4.30			3.09	
Nitrate-Nitrite-N	1.02	1.54	1.16	0.94	0.92			0.83	
Chloride	126	133	129	125	73			61	
Fluoride	0.85	0.82	0.82	0.85	1.2			0.56	
Sulfate	182	160	155	157	122			88	
T. Sodium	98	105	102	102	54			42.0	
MBAS	0.17	0.21	0.22	0.18	0.29				
T. Cyanide (ug/l)	30	170	90	80	20			20	
Phenolics (ug/l)	3	18	9	6	4				
T. Cadmium (ug/l)	10	10	12	<8	<8			<8	
T. Chromium (ug/l)	220	150	130	110	62			30	
T. Copper (ug/l)	70	45	40	25	<15			<15	
T. Iron (ug/l)	380	530	490	570	2300			1100	
T. Lead (ug/l)	<50	<50	<50	<50	<50			<50	
T. Mercury (ug/l)	0.3	<0.2	<0.2	<0.2	<0.2			<0.2	
T. Nickel (ug/l)	64	160	140	110	62			42	
T. Zinc (ug/l)	110	88	92	24	93			33	

TABLE:
STREAM: BLACK RIVER
SURVEY DATE: July 25-26, 1974
(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	7a	7b	6T	6M	6B	6a	6b	6c	5a
RIVER MILE	3.79	3.69	3.35	3.35	3.35	3.35	3.26	3.16	2.85
Flow, cfs									
pH, range			6.4-7.2	6.4-7.2	6.4-7.2				
Cond. (µmhos/cm)			460-510	410-530	360-450				
Temperature °F max.	85.5	86.0	85.1	82.4	77.0	85.6		85.1	89.2
avg.	84.0	84.7	83.0	81.0	76.2	84.2	>86.0	84.7	86.9
min.	82.4	83.3	82.4	80.6	75.2	82.8	86.0	84.4	86.0
DO max.			2.1	1.4	0.3	2.4			1.2
avg.			1.8	1.1	0.2	1.9			1.0
min.			0.8	0.8	0.0	1.6			0.8
Total Solids			340						
Dissolved Solids			290	275	360				
Suspended Solids			12						
COD			18						
TOC			9						
BOD_5			7						
BOD_{10}			19						
BOD_{20}			27						
BOD_{30}			27						
Phosphorus, Total			0.336						
TKN			3.2						
Ammonia-N			2.69						
Nitrate+Nitrite-N			0.72						
Chloride			49	48	36				
Fluoride			0.42	0.45	0.36				
Sulfate			69	78	58				
T. Sodium			31.6	31.6	20.7				
MBAS			.0.10						
T. Cyanide (µg/l)			10						
Phenolics (µg/l)			4						
T. Cadmium (µg/l)			<8						
T. Chromium (µg/l)			27						
T. Copper (µg/l)			<15						
T. Iron (µg/l)			1200						
T. Lead (µg/l)			<50						
T. Mercury (µg/l)			<0.2						
T. Nickel (µg/l)			32						
T. Zinc (µg/l)			37						

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 25-26, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	5T	5M	5B	4T	4M	4B	3T	3M	3B
RIVER MILE	2.85	2.85	2.85	2.40	2.40	2.40	1.84	1.84	1.84
Flow, cfs									
pH, range	6.3-7.2	6.3-7.1	6.4-7.1	6.4-7.2	6.4-7.1	6.4-7.1	6.3-7.1	6.3-7.1	6.3-7.1
Cond. (umhos/cm)	440-500	400-500	380-450	400-440	350-380	340-380	390-440	350-380	320-350
Temperature°F max.	84.2	81.5	77.0	83.8	77.9	77.9	82.3	78.1	76.1
avg.	81.9	79.7	75.2	82.2	76.5	75.2	81.1	76.6	74.7
min.	80.6	77.5	73.4	80.1	75.2	74.3	79.2	75.7	73.4
DO max.	2.9	1.7	0.7	3.4	0.9	1.9	2.9	1.5	3.2
avg.	1.9	1.2	0.4	2.1	0.7	1.0	2.0	0.9	1.8
min.	1.3	0.8	0.1	1.5	0.6	0.4	1.1	0.7	0.7
Total Solids	335			280			265		
Dissolved Solids	295	295	240	255	270	270	255	285	250
Suspended Solids	10			17			13		
COD	17			17			14		
TOC	9			7			7		
BOD_5	6			3			3		
BOD_{10}	19			8			8		
BOD_{20}	27			13			14		
BOD_{30}	27			14			14		
Phosphorus, total	0.346			0.163			0.128		
TKN	3.1			2.5			2.3		
Ammonia-N	2.74			2.02			1.85		
Nitrate+Nitrite-N	0.70			0.72			0.72		
Chloride	43	41	36	41	33	31	39	32	29
Fluoride	0.44	0.41	0.36	0.46	0.32	0.28	0.55	0.46	0.42
Sulfate	69	63	55	52	46	43	48	45	45
T. Sodium	31.1	24.9	20.7	21.6	16.8	15.1	20.3	16.2	14.5
MBAS	0.10			0.07			0.06		
T. Cyanide (ug/l)	20			10			20		
Phenolics (ug/l)	4			4			2		
T. Cadmium (ug/l)	<8			<8			<8		
T. Chromium (ug/l)	26			<20			<20		
T. Copper (ug/l)	<15			135			60		
T. Iron (ug/l)	1000			1200			1100		
T. Lead (ug/l)	<50			<50			<50		
T. Mercury (ug/l)	1.8			<0.2			<0.2		
T. Nickel (ug/l)	<30			<30			<30		
T. Zinc (ug/l)	39			150			86		

TABLE:

STREAM: BLACK RIVER

SURVEY DATE: July 25-26, 1974

(mg/l unless otherwise noted)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

MICHIGAN-OHIO DISTRICT OFFICE

STATION NUMBER	2T	2M	2B	1T	1M	1B	Lake Erie	French Creek	
RIVER MILE	1.04	1.04	1.04	0.0	0.0	0.0		5.1	
Flow, cfs (average)								0.95	
pH, range	6.3-7.2	6.3-7.1	6.3-7.2	6.4-7.2	6.3-7.1	6.3-7.2	6.6	6.9-8.4	
Cond. (μmhos/cm)	360-400	340-380	320-350	330-370	300-350	260-330	300	1000-1175	
Temperature °F max.	82.0	77.2	74.8	78.8	77.0	74.5		75.7	
avg.	79.3	76.3	73.7	75.7	73.1	72.3		71.2	
min.	77.5	75.7	72.0	70.7	70.7	68.9		65.8	
DO max.	2.8	1.9	3.5	4.7	5.5	5.2	-	11.1	
avg.	2.1	1.5	2.5	3.1	4.0	3.1	8.8	8.3	
min.	1.4	0.8	1.7	2.5	2.2	1.6	-	5.3	
Total Solids	265			235				750	
Dissolved Solids		250	255	210	185	165	180	690	
Suspended Solids	16			11				35	
COD	12			13				25	
TOC	7			7				14	
BOD_5	3			3				4	
BOD_{10}	8			3				7	
BOD_{20}	12			9				9	
BOD_{30}	13			13				9	
Phosphorus, Total	0.103			0.108				2.34	
TKN	2.0			1.2				1.2	
Ammonia-N	1.57			0.82				0.05	
Nitrate+Nitrite-N	0.74			0.75				3.27	
Chloride	37	33	29	27	28	26	24	107	
Fluoride	0.39	0.39	0.35	0.31	0.27	0.22	0.16	0.66	
Sulfate	47	47	40	36	40	39	35	224	
T. Sodium	19.1	16.1	14.2	15.2	12.9	11.8	10.5	121	
MBAS	0.07			0.05				0.14	
T. Cyanide (μg/l)	20			10				10	
Phenolics (μg/l)	3			2				<2	
T. Cadmium (μg/l)	<8			<8				<8	
T. Chromium (μg/l)	<20			<20				<20	
T. Copper (μg/l)	50			195				<15	
T. Iron (μg/l)	930			820				1700	
T. Lead (μg/l)	<50			<50				<50	
T. Mercury (μg/l)	0.4			<0.2				<0.2	
T. Nickel (μg/l)	<30			49				<30	
Zinc (μg/l)	94			130				32	

DISCHARGER: ELYRIA SEWAGE TREATMENT PLANT

SAMPLE DATE: July 23-24, 1974

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

MODO#	INTAKE		PLANT EFFLUENT 5553				PLANT EFFLUENT 5519 5523 5527					
SAMPLE TYPE			24 hr. Composite				Grab					
TIME			0800-0600									
FLOW			3.9-8.8 mgd Avg.6.83 mgd									
TEMPERATURE			68.0-73.4°F Avg. 71.2°F									
pH			7.3-7.7									
DISSOLVED OXYGEN			1.8-3.2 mg/l Avg.2.7 mg/l									
SPECIFIC CONDUCTANCE			960-1080 µmhos/cm									
PARAMETER	PPM		PPM	NET #/day	GROSS #/day		PPM	PPM	PPM			
Total Solids			645		36763							
Dissolved Solids			590		33628							
Suspended Solids			39		2223							
Chloride			131		7467							
Fluoride			1.0		57							
Sulfate			123		7011							
Chemical Oxygen Demand			180		10259							
Total Organic Carbon			52		2964							
BOD_5			71		4047							
BOD_{20}			253		14420							
BOD_{30}												
Total Kjeldahl Nitro.			20.8		1186							
Ammonia Nitrogen			18.5		1054							
Nitrate+Nitrite Nit.			0.08		5							
Phosphorus, Total			14.5		826							
Cyanide, Total (µg/l)			320		18.2							
Phenolics (µg/l)			47		2.7							
Cadmium, Total (µg/l)			20		1.1							
Chromium, Tot. (µg/l)			70		4.0							
Copper, Total (µg/l)			30		1.7							
Iron, Total (µg/l)			1100		62.7							
Lead, Total (µg/l)			<50		-							
Mercury, Tot. (µg/l)			<0.2		-							
Nickel, Total (µg/l)			320		18.2							
Sodium, Total (µg/l)			13000		6440							

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: ELYRIA SEWAGE TREATMENT PLANT

SAMPLE DATE: July 24-25, 1974

MODO#	INTAKE	PLANT EFFLUENT 5554			PLANT EFFLUENT 5531 5535 5539			
SAMPLE TYPE		24 hr. Composite			Grab			
TIME		0800-0800						
FLOW		3.8-9.0 mgd Avg. 7.05 mgd						
TEMPERATURE		67.6-73.4°F Avg. 70.0°F						
pH		7.0-8.3						
DISSOLVED OXYGEN		2.9-4.4 mg/l Avg. 3.7 mg/l						
SPECIFIC CONDUCTANCE		1000-1300 umhos/cm						
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	PPM	PPM	
Total Solids		730		42947				
Dissolved Solids		645		37947				
Suspended Solids		50		2942				
Chloride		149		8766				
Fluoride		1.0		59				
Sulfate		121		7119				
Chemical Oxygen Demand		190		11178				
Total Organic Carbon		56		3295				
BOD_5		84		4942				
BOD_{20}		274		16120				
BOD_{30}								
Total Kjeldahl Nitro.		23.4		1377				
Ammonia Nitrogen		20.8		1224				
Nitrate+Nitrite Nit.		0.04		2				
Phosphorus, Total		10.4		612				
Cyanide, Total (µg/l)		350		20.6				
Phenolics (µg/l)		39		2.3				
Cadmium, Total (µg/l)		24		1.4				
Chromium, Tot. (µg/l)		71		4.2				
Copper, Total (µg/l)		25		1.5				
Iron, Total (µg/l)		770		45.3				
Lead, Total (µg/l)		<50		-				
Mercury, Tot. (µg/l)		<0.2		-				
Nickel, Total (µg/l)		370		21.8				
Sodium, Total (µg/l)		115000		6766				
Zinc, Total (µg/l)		110		6.5				
MBAS		1.2		70.6				
Oil & Grease					<1	<1	1	

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: ELYRIA SEWAGE TREATMENT PLANT

SAMPLE DATE: July 25-26, 1974

MODO#	INTAKE		PLANT EFFLUENT 5555				PLANT EFFLUENT 5543 5547 5551					
SAMPLE TYPE			24 hr. Composite				Grab					
TIME			0800-0600									
FLOW			4.0-8.4 mgd Avg. 6.68 mgd									
TEMPERATURE			68.0-71.6°F Avg. 70.3°F									
pH			6.3-7.7									
DISSOLVED OXYGEN			3.0-4.8 mg/l Avg. 3.8 mg/l									
SPECIFIC CONDUCTANCE			1150-1300 mhos/cm									
PARAMETER	PPM		PPM	NET #/day	GROSS #/day		PPM	PPM	PPM		----	
Total Solids			735		40972							
Dissolved Solids			675		37621							
Suspended Solids			33		1840							
Chloride			146		8319							
Fluoride			1.1		61							
Sulfate			132		7358							
Chemical Oxygen Demand			210		11706							
Total Organic Carbon			65		3623							
BOD_5			96		5351							
BOD_{20}			282		15720							
BOD_{30}												
Total Kjeldahl Nitro.			21.3		1187							
Ammonia Nitrogen			18.4		1026							
Nitrate+Nitrite Nit.			0.03		-							
Phosphorus, Total			7.58		423							
Cyanide, Total (µg/l)			220		12.3							
Phenolics (µg/l)			54		3.0							
Cadmium, Total (µg/l)			20		1.1							
Chromium, Tot. (µg/l)			68		3.8							
Copper, Total (µg/l)			25		1.4							
Iron, Total (µg/l)			620		34.6							
Lead, Total (µg/l)			<50		-							
Mercury, Tot. (µg/l)			<0.2		-							
Nickel, Total (µg/l)			320		17.8							
			112000		6243							

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: LORAIN SEWAGE TREATMENT PLANT

SAMPLE DATE: July 23-24, 1974

MODO#	INTAKE	PLANT EFFLUENT 5592			PLANT EFFLUENT 5553 5562 5566				
SAMPLE TYPE		24 hr. Composite			Grab				
TIME		0800-0600							
FLOW		12.706 mgd							
TEMPERATURE		73.4-77.0°F Avg.74.0°F							
pH		6.8-7.05							
DISSOLVED OXYGEN		3.2-4.4 mg/l							
SPECIFIC CONDUCTANCE		660-780 µmhos/cm							
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	PPM	PPM		
Total Solids		505		53546					
Dissolved Solids		460		48774					
Suspended Solids		18		1909					
Chloride		81		8589					
Fluoride		1.2		127					
Sulfate		121		12830					
Chemical Oxygen Demand		50		5302					
Total Organic Carbon		19		2015					
BOD_5		5		530					
BOD_{20}		34		3605					
BOD_{30}									
Total Kjeldahl Nitro.		7.1		753					
Ammonia Nitrogen		4.79		508					
Nitrate+Nitrite Nit.		3.72		394					
Phosphorus, Total		6.7		710					
Cyanide, Total (µg/l)		<5		-					
Phenolics (µg/l)		8		0.8					
Cadmium, Total (µg/l)		<8		-					
Chromium, Tot. (µg/l)		<20		-					
Copper, Total (µg/l)		45		4.8					
Iron, Total (µg/l)		550		58.3					
Lead, Total (µg/l)		<50		-					
Mercury, Tot. (µg/l)		<0.2		-					
Nickel, Total (µg/l)		<30		-					
Sodium, Total (µg/l)		78000		8270					
Zinc, Total (µg/l)		76		8.1					
MBAS		0.29		30.7					
Oil & Grease					<1	<1	<1		

DISCHARGER: LORAIN SEWAGE TREATMENT PLANT

SAMPLE DATE: July 24-25, 1974

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

MODO#	INTAKE	PLANT EFFLUENT 5593			PLANT EFFLUENT 5570 5574 5578				
SAMPLE TYPE		24 hr. Composite			Grab				
TIME		0800-0600							
FLOW		13.123 mgd							
TEMPERATURE		73.4-75.2°F Avg. 74.5°F							
pH		6.7-7.0							
DISSOLVED OXYGEN		3.1-3.6 mg/l							
SPECIFIC CONDUCTANCE		680-795 µmhos/cm							
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	PPM	PPM		
Total Solids		610		66802					
Dissolved Solids		480		52565					
Suspended Solids		25		2738					
Chloride		87		9527					
Fluoride		1.2		131					
Sulfate		120		13141					
Chemical Oxygen Demand		41		4490					
Total Organic Carbon		20		2190					
BOD_5		6		657					
BOD_{20}		74		8104					
BOD_{30}									
Total Kjeldahl Nitro.		6.4		701					
Ammonia Nitrogen		4.25		465					
Nitrate+Nitrite Nit.		4.46		488					
Phosphorus, Total		6.85		750					
Cyanide, Total (µg/l)		< 5		-					
Phenolics (µg/l)		6		0.7					
Cadmium, Total (µg/l)		< 10		-					
Chromium, Tot. (µg/l)		25		2.7					
Copper, Total (µg/l)		45		4.9					
Iron, Total (µg/l)		560		61.3					
Lead, Total (µg/l)		< 50		-					
Mercury, Tot. (µg/l)		< 0.2		-					
Nickel, Total (µg/l)		.30		-					
Sodium, Total (µg/l)		76000		8323					
Zinc, Total (µg/l)		77		8.4					
MBAS		0.24		26.3					
Oil & Grease					<1	<1	<1		

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: LORAIN SEWAGE TREATMENT PLANT

SAMPLE DATE: July 25-26, 1974

MODO#	INTAKE		PLANT EFFLUENT 5594				PLANT EFFLUENT 5582 5586 5590					
SAMPLE TYPE			24 hr. Composite				Grab					
TIME			0800-0600									
FLOW			13.352 mgd									
TEMPERATURE			75.2°F									
pH			6.7-6.9									
DISSOLVED OXYGEN			3.4-4.1 mg/l									
SPECIFIC CONDUCTANCE			680-790 umhos/cm									
PARAMETER	PPM			NET #/day	GROSS #/day		PPM	PPM	PPM			
Total Solids			500		55711							
Dissolved Solids			465		51811							
Suspended Solids			16		1783							
Chloride			74		8245							
Fluoride			0.6		67							
Sulfate			105		11699							
Chemical Oxygen Demand			35		3900							
Total Organic Carbon			19		2117							
BOD_5			7		780							
BOD_{20}			31		3454							
BOD_{30}												
Total Kjeldahl Nitro.			5.7		635							
Ammonia Nitrogen			3.73		416							
Nitrate+Nitrite Nit.			6.48		722							
Phosphorus, Total			7.7		858							
Cyanide, Total (µg/l)			20		2.2							
Phenolics (µg/l)			6		0.7							
Cadmium, Total (µg/l)			<8		-							
Chromium, Tot. (µg/l)			<20		-							
Copper, Total (µg/l)			35		3.9							
Iron, Total (µg/l)			470		52.4							
Lead, Total (µg/l)			<50		-							
Mercury, Tot. (µg/l)			<0.2		-							
Nickel, Total (µg/l)			34		3.8							
Sodium, Total (µg/l)			74000		8245							
Zinc, Total (µg/l)			75		8.4							
XRAC			0.18		20.1							

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: See Below

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24 C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-2		OUTFALL 002 COKE PLANT SEWER			OUTFALL 003 EAST DOCK OUTFALL			OUTFALL 004 WEST DOCK OUTFALL					
SAMPLE TYPE TIME	GRAB See below		GRAB See below			GRAB See below			GRAB See below					
FLOW TEMPERATURE PH TOXICITY														
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Oil & Grease														
July 23-24, 1974				30.2 mgd										
1200	2		6			1			5					
2000	3		4			1			<1					
0400	1		2			<1			<1					
Average	2		4	504	1008	<1	-	-	1.7	-	-			
July 24-25, 1974				29.0 mgd										
1200	3		3			2			<1					
2000	3		9			<1			1					
0400	2		6			<1			<1					
Average	2.7		6	799	1452	<1	-	-	<1	-	-			
July 25-26, 1974				29.7 mgd										
1200	<1		5			<1			1					
2000	<1		1			<1			<1					
0400	<1		5			<1			<1					
Average	<1		3.7	917	917	<1	-	-	<1	-	-			

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 23-24, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24 C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-2 MODO-#4425		OUTFALL 002 COKE PLANT SEWER MODO #4426			OUTFALL 003 EAST DOCK OUTFALL MODO #4427			OUTFALL 004 WEST DOCK OUTFALL MODO #4428					
SAMPLE TYPE	24 EVC		24 EVC			24 EVC			24 EVC					
TIME	0800-0600		0800-0600			0800-0600			0800-0600					
FLOW			26.4-34.0mgd Avg.30.2mgd			66 mgd			22 mgd					
TEMPERATURE	73.4-78.8°F-Avg.76.1°		98.6-107.6°F Avg.105.6°F			94.1-98.6°F Avg.96.3°F			94.1-109.8°F Avg.99.7°F					
PH	6.7-7.7		6.6-8.8			6.2-7.4			5.5-7.3					
DISSOLVED OXYGEN			5.9-6.6mg/l Avg.6.2mg/l			4.6-5.2mg/l Avg.4.9mg/l			4.8-5.6mg/l Avg.5.2mg/l					
SPECIFIC CONDUCTANCE	260-420umhos/cm		350-550umhos/cm			350-480umhos/cm			430-600umhos/cm					
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	270		335	16,381	84,427	295	14,187	167,401	380	20,195	69,764			
Dissolved Solids	220		295	18,902	74,346	220	-	124,841	265	8,262	48,651			
Suspended Solids	22		28	1,512	7,057	26	2,270	14,754	48	4,773	8,812			
Chloride	35		47	3,024	11,845	42	3,972	23,833	73	6,976	13,402			
Fluoride	0.56		0.50	-	126	0.67	62	380	0.92	84	169			
Sulfate	43		64	5,292	16,129	48	2,837	27,238	46	551	8,445			
Chemical Oxygen Demand	11		30	4,788	7,561	11	-	6,242	14	551	2,570			
Total Organic Carbon	5		12	1,764	3,024	5	-	2,837	7	367	1,285			
BOD_5	5		10	1,260	2,520	6	567	3,405	6	184	1,102			
BOD_{20}	13		33	5,040	8,137	30	9,647	17,024	43	5,508	7,894			
BOD_{30}	14													
Total Kjeldahl Nitrogen	2.0		3.2	302	806	3.0	567	1,702						
Ammonia-Nitrogen	1.65		2.42	194	610	2.84	675	1,612	6.84	953	1,256			
Nitrate+Nitrite Nit.	0.62		1.46	212	368	0.83	119	471	0.75	24	138			
Cyanide, Total (ug/l)	<5		<5	-	-	100	56.7	56.7	80	146.9	146.9			
Phenolics (ug/l)	2		15	3.3	3.8	31	16.5	17.6	23	3.9	4.2			
Cadmium, Total (ug/l)	<8		<8	-	-	<8	-	-	<8	-	-			
Chromium, Total (ug/l)	<20		56	14.1	14.1	<20	-	-	<20	-	-			
Copper, Total (ug/l)	20		25	1.3	6.3	<15	-	-	<15	-	-			
Iron, Total (ug/l)	1,300		2,100	202	529	1,600	170	908	3,900	477	716			
Lead, Total (ug/l)	<50		80	20.2	20.2	<50	-	-	70	12.9	12.9			
Nickel, Total (ug/l)	<30		<30	-	-	<30	-	-	<30	-	-			
Sodium, Total (ug/l)	18.4×10^3		28.0×10^3	2,419	7,057	21.8×10^3	1,929	12,371	26.3×10^3	1,450	4,828			
Zinc, Total (ug/l)	74		150	19.2	37.8	180	59	102	330	47.0	60.6			

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 24-25, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24 C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-2 NODO #4435		OUTFALL 002 COKE PLANT SEWER NODO #4436			OUTFALL 003 EAST DOCK OUTFALL NODO #4437			OUTFALL 004 WEST DOCK OUTFALL NODO #4438					
SAMPLE TYPE	24 EVC		24 EVC			24 EVC			24 EVC					
TIME	0800-0600		0800-0600			0800-0600			0800-0600					
FLOW			25.7-31.2 mgd Avg.29.0mgd			68 mgd			22 mgd					
TEMPERATURE	73.4-78.8°F-Avg.77.0°F		104.0-109.4°F Avg.106.8°F			94.1-101.6°F Avg.97.3°F			88.7-110.3°F Avg.101.2°F					
PH	6.1-7.3		6.5-8.0			5.8-7.4			5.8-7.4					
DISSOLVED OXYGEN	-		5.7-6.9 mg/l Avg.6.1mg/l			3.1-5.6 mg/l Avg. 4.0mg/l			4.5-5.4 mg/l Avg.4.9mg/l					
SPECIFIC CONDUCTANCE	260-400μmhos/cm		450-550μmhos/cm			360-470μmhos/cm			350-600μmhos/cm					
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	280		350	16,940	84,702	325	25,536	184,425	390	20,195	71,600			
Dissolved Solids	250		305	13,310	73,812	270	11,349	153,214	320	12,851	58,749			
Suspended Solids	21		32	2,662	7,744	34	7,377	19,294	54	6,058	9,914			
Chloride	37		48	2,662	11,616	47	5,675	26,670	73	6,609	13,402			
Fluoride	0.41		0.46	12	111	0.73	182	414	0.87	84	160			
Sulfate	41		60	4,598	14,520	52	6,242	29,508	44	551	8,073			
Chemical Oxygen Demand	11		24	3,146	5,808	16	2,837	9,079	13	367	2,387			
Total Organic Carbon	5		9	968	2,178	7	1,135	3,972	6	184	1,102			
BOD_5	4		10	1,452	2,420	3	-	1,702	5	184	918			
BOD_{20}	12		36	5,808	8,712	31	10,782	17,591	43	5,691	7,894			
BOD_{30}	16		39	5,566	9,438	36	11,349	20,429	48	5,875	8,812			
Total Kjeldahl Nitrogen	1.9		3.3	339	799	3.4	851	1,929						
Ammonia-Nitrogen	1.68		2.54	208	615	3.10	806	1,759	7.42	1,054	1,362			
Nitrate+Nitrite Nit.	0.55		1.58	249	382	0.86	176	488	0.69	26	127			
Cyanide, Total (ug/l)	40		70	7.3	16.9	140	56.7	79.4	140	18.4	25.7			
Phenolics (ug/l)	16		30	3.4	7.3	110	53.3	62.4	34	3.3	6.2			
Cadmium, Total (ug/l)	<10		<10	-	-	<10	-	-	<10	-	-			
Chromium, Total (ug/l)	<20		49	11.9	11.9	<20	-	-	<20	-	-			
Copper, Total (ug/l)	15		20	1.2	4.8	<15	-	-	<15	-	-			
Iron, Total (ug/l)	1,800		2,600	194	629	4,000	1,248	2,270	8,000	1,138	1,469			
Lead, Total (ug/l)	<50		<50	-	-	<50	-	-	75	4.6	13.8			
Nickel, Total (ug/l)	<30		<30	-	-	<30	-	-	<30	-	-			
Sodium, Total (ug/l)	17.6×10^3		27.8×10^3	2,468	6,728	21.5×10^3	2,213	12,200	26.6×10^3	165 ±	4,883			
Zinc, Total (ug/l)	46		86	9.7	20.8	81	19.9	46.0	340	54.0	62.4			

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 25-26, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-2 MODO-#4445		OUTFALL 002 COKE PLANT SEWER MODO # 4446			OUTFALL 003 EAST DOCK OUTFALL MODO #4447			OUTFALL 004 WEST DOCK OUTFALL MODO #4448					
SAMPLE TYPE	24 EVC		24 EVC			24 EVC			24 EVC					
TIME	0800-0600		0800-0600			0800-0600			0800-0600					
FLOW			23.8-33.1 mgd Avg.29.7 mgd			68 mgd			22 mgd					
TEMPERATURE	71.6°F-78.8°F Avg.75.6		100.0°-105.8°F-Avg.104.3°F			95.0-100.4°F Avg.98.4°F			94.1°-110.6°F Avg.104.4°F					
PH	6.3-7.1		6.9-7.9			6.3-7.6			6.2-7.2					
DISSOLVED OXYGEN	-		5.8-6.1mg/l Avg.5.9 mg/l			2.8-4.6mg/l Avg.3.9mg/l			4.0-5.6 mg/l Avg. 4.9 mg/					
SPECIFIC CONDUCTANCE	390-410umhos/cm		460-525umhos/cm			420-490umhos/cm			530-710umhos/cm					
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	275		340	16,110	34,268	310	19,861	175,913	420	26,621	77,108			
Dissolved Solids	235		300	16,110	74,354	275	22,698	156,052	330	17,441	60,585			
Suspended Solids	27		31	991	7,683	22	-	12,484	75	8,812	13,769			
Chloride	34		45	2,726	11,153	48	7,944	27,238	83	8,996	15,238			
Fluorice	0.42		0.50	20	124	0.80	22	454	0.81	72	149			
Sulfate	41		62	5,205	15,366	57	9,079	32,345	51	1,836	9,363			
Chemical Oxygen Demand	10		28	4,461	6,940	14	2,270	7,944	11	184	2,019			
Total Organic Carbon	5		9	991	2,231	5	-	2,837	5	-	918			
BOD_5	4		12	1,983	2,974	3	-	1,702	9	918	1,652			
BOD_{20}	11		36	6,196	8,922	27	9,079	1,531						
BOD_{30}	11								35	4,406	6,425			
Total Kjeldahl Nitrogen	1.9		3.5	397	867	3.6	965	2,403						
Ammonia-Nitrogen	1.61		3.12	374	773	3.51	1,078	1,992	7.44	1,070	1,366			
Nitrate+Nitrite Nit.	0.55		1.03	119	255	0.71	91	403	0.68	24	125			
Cyanide, Total(µg/l)	20		70	12.4	17.3	220	113.5	124.8	60	7.3	11.0			
Phenolics (µg/l)	3		39	8.9	9.7	<2	-	-	21	3.3	3.9			
Cadmium, Total(µg/l)	<8		<8	-	-	<8	-	-	<8	-	-			
Chromium,Total(µg/l)	<20		42	10.4	10.4	<20	-	-	<20	-	-			
Copper, Total (µg/l)	<15		50	12.4	12.4	<15	-	-	<15	-	-			
Iron, Total (µg/l)	1,600		3,000	347	743	2,700	624	1,532	7,200	1,028	1,322			
Lead, Total (µg/l)	<50		140	34.7	34.7	<50	-	-	80	14.7	14.7			
Nickel, Total (µg/l)	<30		<30	-	-	<30	-	-	<30	-	-			
Sodium, Total (µg/l)	18.7×10^3		28.3×10^3	2,379	7,014	22.7×10^3	2,270	12,881	31.9×10^3	2,423	5,857			
Zinc, Total (µg/l)	57		95	9.4	23.5	95	21.6	53.9	400	63.0	73.4			

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 23-24, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-3 MODO #4429		OUTFALL 001 PIPE MILL LAGOON MODO 4430			OUTFALL 005 BAR MILL COOLING WATER MODO 4431								
SAMPLE TYPE	24 EVC		24 EVC			24 EVC								
TIME	0300-0600		0300-0600			0600-0600								
FLOW			46.0-49.7 mgd Avg. 48.2 mgd			2.78-4.02 mgd Avg. 3.24 mgd								
TEMPERATURE	78.8-83.3°F-Avg.80.4°F		89.6-93.2°F Avg. 92.1°F			89.6-95.0°F Avg. 93.0°F								
PH	6.4-7.4		6.6-8.5			5.9-8.4								
DISSOLVED OXYGEN	1.5-3.5 mg/l Avg.2.2mg/l		4.8-5.6 mg/l Avg. 5.2 mg/l			5.5-6.0 mg/l Avg. 5.7 mg/l								
SPECIFIC CONDUCTANCE micromhos/cm	480-590		425-625			450-700								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	370		410	16,089	164,914	415	1,218	11,220						
Dissolved Solids	320		365	18,100	146,814	385	1,757	10,410						
Suspended Solids	12		14	804	5,631	15	81	406						
Chloride	58		64	2,413	25,743	67	243	1,812						
Fluoride	0.55		0.60	20	241	0.60	1.4	16.2						
Sulfate	84		95	4,425	38,212	100	433	2,704						
Chemical Oxygen Demand	21		30	3,620	12,067	29	216	784						
Total Organic Carbon	9		12	1,207	4,827	11	54	297						
BOD_5	7		9	804	3,620	11	108	297						
BOD_{20}	29		34	2,011	13,676	32	81	865						
BOD_{30}														
Tot. Kjeldahl Nitrogen	3.2		3.2	-	1,287	3.6	11	97						
Ammonia Nitrogen	2.62		2.48	-	998	2.70	2	73						
Nitrate+Nitrite Nit.	0.87		1.10	93	442	2.86	54	77						
Chromium, Total (µg/l)	90		130	16.1	52.2	130	1.1	3.5						
Copper, Total (µg/l)	<15		15	6.0	6.0	<15	-	-						
Iron, Total (µg/l)	920		2,000	434	804	1,200	7.6	32.4						
Sodium, Total (µg/l)	40.2×10^3		45.4×10^3	2,092	18,261	49.8×10^3	260	1,346						
Zinc, Total (µg/l)	50		300	101	121	260	5.7	7.0						

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 24-25, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-3 NODO #4439		OUTFALL 001 PIPE MILL LAGOON NODO #4440			OUTFALL 005 BAR MILL COOLING WATER NODO #4441								
SAMPLE TYPE	24 EVC		24 EVC			24 EVC								
TIME	0800-0600		0800-0600			0800-0600								
FLOW			44.8-48.9 mgd Avg.47.1mgd			2.80-3.44 mgd Avg.3.12 mgd								
TEMPERATURE	80.6-86.0°F-Avg.82.6°		87.8°F-96.8°F Avg,93.2°F			89.6°F-96.8°F Avg.94.4°F								
PH	6.4-7.3		6.3-7.4			6.3-7.6								
DISSOLVED OXYGEN	1.9-4.7mg/l-Avg.3.1mg/l		2.8-4.2mg/l Avg.3.3mg/l			5.3-5.9mg/l Avg 5.5 mg/l								
SPECIFIC CONDUCTANCE	520-610		550-625			600-650								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	390		415	9,826	163,116	420	781	10,935						
Dissolved Solids	360		375	5,896	147,394	395	651	10,024						
Suspended Solids	9		18	3,537	7,075	13	104	338						
Chloride	64		67	1,179	26,334	72	208	1,875						
Fluoride	0.52		0.47	-	185	0.58	1.6	15.1						
Sulfate	84		89	1,965	34,981	97	338	2,526						
Chemical Oxygen Demand	11		41	11,792	16,115	27	417	703						
Total Organic Carbon	9		16	2,751	6,289	13	104	338						
BOD_5	8		10	786	3,931	14	156	365						
BOD_{20}	33		38	1,965	14,936	29	-	755						
BOD_{30}	36		43	2,751	16,901	34	-	885						
Tot. Kjeldahl Nitrogen	3.6		3.3	-	1,297	3.6	-	94						
Ammonia Nitrogen	2.88		2.52	-	990	2.83	-	74						
Nitrate+Nitrite Nit.	0.86		1.06	79	417	1.25	10.2	33						
Chromium, Total (ug/l)	60		130	27.5	51.1	84	0.6	2.2						
Copper, Total (ug/l)	<15		<15	-	-	<15	-	-						
Iron, Total (ug/l)	1,200		2,400	472	943	1,500	7.8	39.0						
Sodium, Total (ug/l)	41.3×10^3		45.8×10^3	1,769	18,002	47.9×10^3	172	1,247						
Zinc, Total (ug/l)	49		170	47.6	66.8	110	1.6	2.9						

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 23-24, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-3 MODO #		OUTFALL 001 PIPE MILL LAGOON MODO #			OUTFALL 005 BAR MILL COOLING WATER MODO #								
SAMPLE TYPE	GRAB		GRAB			GRAB								
TIME	See Below		See Below			See Below								
FLOW			48.2 mgd (Average)			3.24 mgd (Average)								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Oil & Grease														
Time 0800	<1		5											
1000			6											
1200	<1		5			1								
1400			3											
1600	2		6											
1800			6											
2000	<1		5			1								
2200			17											
2400	1		19											
0200			29											
0400	26*		12			1								
0600			6											
Average	<1		9.9		3,982	1	27	27						
	* Not Included In average					7								

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 25-26, 1974

SAMPLE TYPE: 8 C = 8 HOUR FLOW PROPORTIONED COMPOSITE
24C = 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC = EQUAL VOLUME COMPOSITE
G = GRAB

	INTAKE W1-3 NODO #4449		OUTFALL 001 PIPE MILL LAGOON NODO #4450			OUTFALL 005 BAR MILL COOLING WATER NODO #4451								
SAMPLE TYPE	24 EVC		24 EVC			24 EVC								
TIME	0800-0600		0800-0600			0800-0600								
FLOW			48.0-51.4mgd Avg.50.2mgd			2.80-3.76mgd Avg.3.17mgd								
TEMPERATURE	82.4-85.1°F-Avg.82.4°F		89.6-93.2°F Avg. 92.0°F			89.6°F-95.0°F Avg. 92.1°F								
PH	6.3-7.2		6.3-7.4			6.9-7.5								
DISSOLVED OXYGEN	2.0-5.1mg/l-Avg.3.2		2.8-4.0mg/l Avg.3.2 mg/l			4.7-5.9mg/l Avg.5.4 mg/l								
SPECIFIC CONDUCTANCE	520-610 micromhos/cm		600-620			575-650 micromhos/cm								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Solids	385		415	12,571	173,851	405	529	10,714						
Dissolved Solids	360		375	6,286	157,095	385	661	10,185						
Suspended Solids	18		22	1,676	9,216	18	-	476						
Chloride	61		61	-	25,554	68	185	1,799						
Fluoride	0.56		0.56	-	235	0.58	0.5	15.3						
Sulfate	88		90	838	37,703	99	291	2,619						
Chemical Oxygen Demand	23		38	6,284	15,919	25	53	661						
Total Organic Carbon	8		14	2,514	5,865	14	159	370						
BOD_5	8		10	838	4,189	20	317	529						
BOD_{20}	31		33	838	13,824	34	79	899						
BOD_{30}														
Tot. Kjeldahl Nitrogen	3.5		3.5	-	1,466	2.9	-	77						
Ammonia Nitrogen	3.09		2.69	-	1,127	2.95	-	78						
Nitrate+Nitrite Nit.	0.88		1.01	54	423	1.44	11	38						
Chromium, Total (µg/l)	30		54	10.1	22.6	48	0.5	1.3						
Cooper, Total (µg/l)	<15		15	6.3	6.3	<15	-	-						
Iron, Total (µg/l)	1,100		3,000	796	1,257	1,200	2.6	31.7						
Sodium, Total (µg/l)	42.0×10^3		44.2×10^3	923	18,516	46.7×10^3	124	1,235						
Zinc, Total (µg/l)	33		140	44.8	58.6	81	1.3	2.1						

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 24-25, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24 C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-3 MODO #		OUTFALL 001 PIPE MILL LAGOON MODO #			OUTFALL 005 BAR MILL COOLING WATER MODO #								
SAMPLE TYPE	GRAB		GRAB			GRAB								
TIME	See Below		See Below			See Below								
FLOW			47.1 mgd (Average)			3.12 mgd (Average)								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Oil & Grease														
Time 0800	<1		11											
1000			3											
1200	<1		1			<1								
1400			2											
1600	<1		5											
1800			3											
2000	<1		3			1								
2200			3											
2400	<1		6											
0200			6											
0400	1		11			<1								
0600			7											
Average	<1		5.1		2,005	<1	-	-						
						7								

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
MICHIGAN-OHIO DISTRICT OFFICE

DISCHARGER: UNITED STATES STEEL CORPORATION
LORAIN WORKS

SAMPLE DATE: July 25-26, 1974

SAMPLE TYPE: 8 C - 8 HOUR FLOW PROPORTIONED COMPOSITE
24 C - 24 HOUR FLOW PROPORTIONED COMPOSITE
EVC - EQUAL VOLUME COMPOSITE
G - GRAB

	INTAKE WI-3 MODO #4429		OUTFALL 001 PIPE MILL LAGOON MODO #4430			OUTFALL 005 BAR MILL COOLING WATER MODO #4431								
SAMPLE TYPE	GRAB		GRAB			GRAB								
TIME	See Below		See below			See Below								
FLOW			50.2 mgd (Average)			3.17 mgd (Average)								
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day		PPM	NET #/day	GROSS #/day		PPM	NET #/day	GROSS #/day
Oil & Grease																
Time 0300	1		5													
1000			2													
1200	<1		3			<1										
1400			1													
1600	<1		1													
1800			2.													
2000	<1		3			<1										
2200			4													
2400	<1		3													
0200			4													
0400	<1		4			<1										
0600			4													
Average	<1		3.0		1257	<1	-	-								

Attachment J

U.S. EPA Survey, July 9-11, 1974
(Benthic and Sediment Chemistry)

APPENDIX IV

BIOLOGY OF THE BLACK RIVER

U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT & GENERAL COUNSEL
NATIONAL FIELD INVESTIGATION CENTER - CINCINNATI
WATER SCIENCES BRANCH

SUMMARY

The benthic data collected during the survey of July 1974, show the Black River to be degraded downstream from the Elyria, Ohio, sewage treatment plant. The river is further contaminated through the reach, river miles 4.85 to 3.45, apparently by the U.S. Steel outfalls 001 (from the plant hot forming operations) and 002 (from the coke plant). The river recovers slightly at river mile 2.85, at the head of the navigation channel, but is again degraded, although not as severely as upstream (river mile 4.85 to 3.45), at river mile 2.6 in the turning basin. The U. S. Steel discharges servicing the blast furnaces, sinter plant, power house, steel plant and lime plant discharge into the turning basin and could cause this degradation. Also the effect of these discharges could be moderated by lake water intrusion to the head of the navigation channel (personal communication with Phil Gehring NODO-EPA). From river mile 2.36 to 0.83 the river generally shows signs of recovery from the upstream conditions. At river mile 0.0, and the harbor mouth, the river is again degraded probably as a result of the discharge of the Lorain, Ohio, sewage treatment plant.

Sediment chemistry data show the reach from river miles 4.85 to 3.45 to have the greatest concentrations of pollutants. The most affected station is station 8, river mile 3.45. This coincides with the biological data which show station 8 to be the least productive.

Comparing data obtained by the Michigan-Ohio District Office of Region V, U. S. Environmental Protection Agency, in July of 1972 (Table III) with the present biological data, it appears the water quality in the Black River has degraded in the past two years. The July 1972 data show that midges and leeches in significant numbers, in addition to sludgeworms, were inhabiting the reach of the river from downstream of U. S. Steel outfall 002 to upstream from U. S. Steel outfall 001. The present data indicate that only sludgeworms now are found in this area (with the exception of station 8-A where pollution tolerant snails were found). The navigable portion of the river also shows signs of further degradation. This is indicated by a large reduction in the gill breathing snails (Prosobranchia) in this reach, and the disappearance of midges from river miles 2.36 to 2.85.

INTRODUCTION

At the request of the Enforcement Branch, Region V, U. S. Environmental Protection Agency, a biological and chemical water quality investigation of the Black River of Ohio from upstream of Elyria, Ohio, to the Lorain, Ohio, Harbor (Figure 1) was conducted from July 9 to 11, 1974, by the National Field Investigations Center-Cincinnati of the U. S. Environmental Protection Agency. The purpose of the study was to delineate the effect, if any, of the wastewater discharges of the Lorain Works of the United States Steel Company, which is situated on the west side of the river from approximately river mile 2.4 to 5.0, on the biota and sediments of the river and harbor. The biological results of this study were also to be compared with benthic data collected in July of 1972 by the Michigan-Ohio District Office, Region V, U. S. Environmental Protection Agency, to ascertain whether any change in water quality had occurred.

The purpose of macroinvertebrate studies is the measurement of the density, diversity and generic composition of the benthic organisms living in the substrate of a river or lake. These organisms are totally dependent on the aquatic environment for their needs, thus changes in the water quality are reflected by modifications in the benthic population.

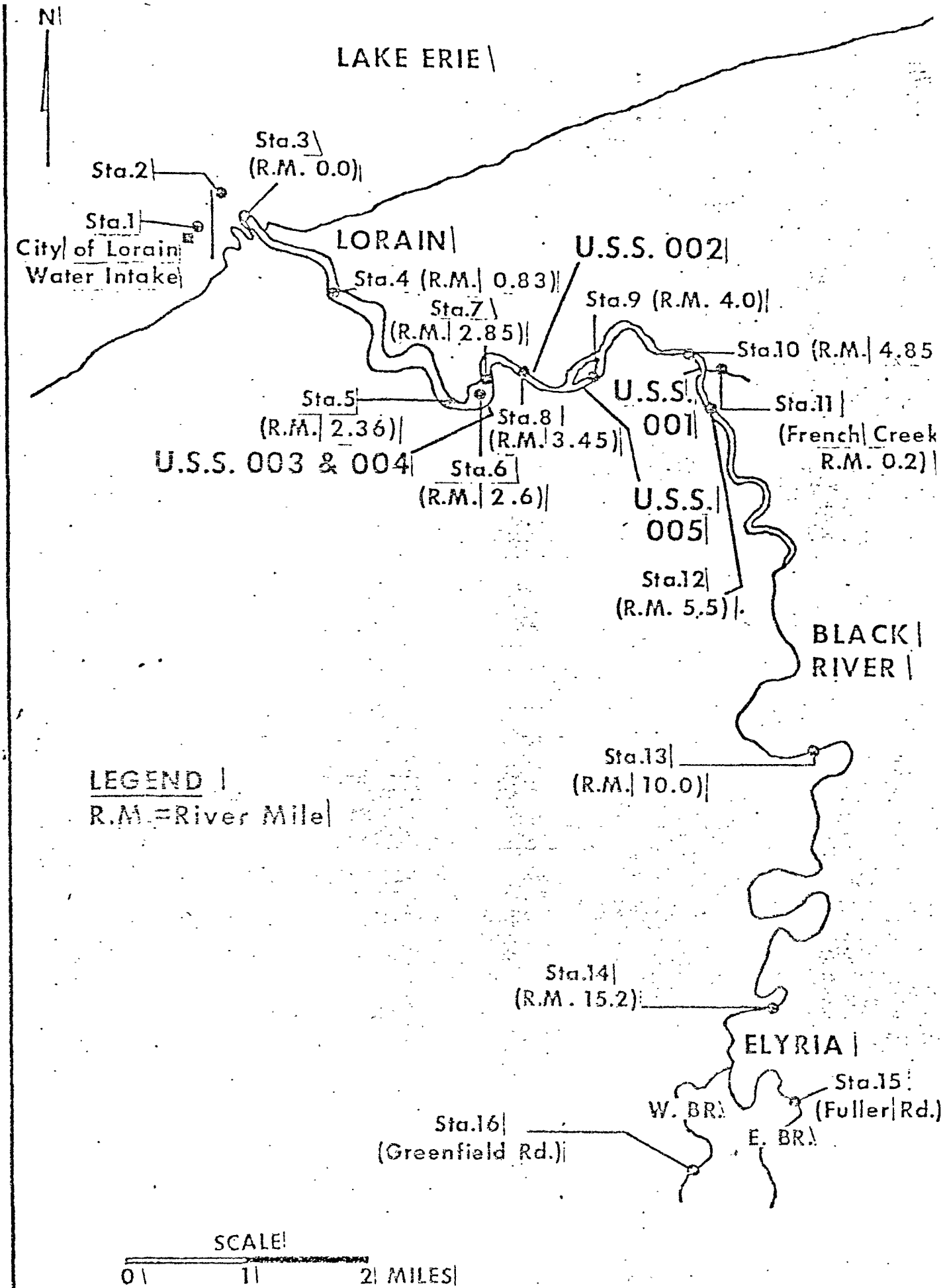


FIGURE 1 - SAMPLING LOCATIONS - BLACK RIVER, OHIO
JULY - 1974

For the purpose of this report the terms pollution intolerant, facultative and pollution tolerant will be used when referring to the ability of an organism to withstand environmental stress. Intolerant organisms are those which are unable to withstand any major deterioration in water quality. Facultative organisms are able to withstand a wider range of ecological conditions. Members of this group can be found in clean water as well as in dilute organic wastes. Tolerant forms are found in the widest range of situations from clean to grossly polluted water. Under extreme conditions, (e.g. toxic wastes), even this group can be eliminated.

METHODS AND MATERIALS

Benthic Macroinvertebrates

Samples in the study area were collected, in most cases, at sites previously established by the Michigan-Ohio District office of Region V. Many of the stations were sampled at three sections (A,B,C). Across the river facing upstream, section A was located near the left bank, section B at midstream, and section C near the right bank. All samples in pool (lentic) areas were collected with a Petersen dredge while those samples from riffle (lotic) areas were taken with a Surber sampler or were qualitative samples from the various substrates at the sampling point. In most cases, three replicate samples were collected at each station section.

After collection the samples were washed in a standard No. 30 sieve to remove the bulk of the substrate material. The sample remaining in the sieve was placed in a labeled plastic jar and preserved with a solution of formalin, alcohol, water and Rose Bengal dye. The jar was then capped and sealed with an EPA seal. All samples were kept in the possession of the field team until their return to NFIC-Cincinnati, where the samples were logged into the Biology Section sample log book and placed in locked storage until analysis.

In the laboratory each sample was washed again to remove the preservative and excess sediment and placed in a white enamelled pan. The benthic organisms, except for sludgeworms (oligochaeta), were picked from the samples and placed in plastic petri dishes according to general groupings. Later all organisms were identified to genus when possible.

Because of the large number of sludgeworms per sample only approximately four hundred individuals from each sample were picked at random. The sludgeworms remaining in the pan were counted and returned with the other sample residue to the original sample jar.

Sediment Chemistry

Sediment samples were collected for chemical analysis with a Peterson dredge at one section per station from river mile 5.5 downstream to the Lorain Harbor mouth and Lorain water intake. The three sediments were placed in plastic tubs and only the top layer of sediment taken for the sample. The sample was placed into a labeled one pint plastic jar sealed with an EPA seal, and iced. The samples were kept in the possession of the field crew until their return to NFIC-Cincinnati where they were turned over to the laboratory sample custodian, who logged them into the Chemistry Section sample log book and placed them in locked storage until analysis could be made.

Mercury was analyzed by the flameless atomic absorption method developed by the National Field Investigations Center-Cincinnati.

Samples for the remaining metals (see Table IV) were acid digested and also analyzed by atomic absorption.

Cyanide, phenol, percent moisture, volatile solids and oil and grease were analyzed as outlined in Standard Methods for the Examination of Water and Wastewater, 13th Edition, 1971. Acid leachates of the sediments were analyzed for ammonia nitrogen using the automated sodium phenolate method.

Methods and results of the organic analyses of the sediments can be obtained from a report titled "United States Steel, Lorain, Ohio, Works, Black River Survey: Analysis for Hexane Extractables and Polynuclear Aromatic Hydrocarbons," October 1974 by Herbert Brass, et al.

RESULTS AND DISCUSSION

Benthic Macroinvertebrates

Data on the taxonomy and diversity of the benthic organisms at each sampling site are displayed in Table I. The sediment types encountered during the survey as well as the type of area sampled (riffle or pool) are given in Table II.

Control stations 15 and 16 were located upstream from Elyria, Ohio, on the east and west branches of the Black River, respectively. Samples 16-1 and 16-2 were collected in a pool area. The substrate at this station consisted of gray sandy clay, silt, and detritus. The benthic fauna was indicative of a clean water situation, composed of low numbers of sludgeworms, a few faculative fingernail clams, and pollution intolerant midges, amphipods, burrowing mayflies, alderflies, and beetles.

Findings at station 15 were indicative of a clean water riffle situation. The station was characterized by low numbers of individuals but a large number of taxa. The benthic fauna was composed of mayflies, caddisflies, beetles, tolerant and intolerant midges and sludgeworms. Sample 15-1 was collected with a Petersen dredge in an eddy area where the substrate was composed of detrital accumulations, while sample 15-2 and 15-3 were collected with a Surber sampler from large flat bedrock areas. As might be expected,

sample 15-1 contained a somewhat different midge population than 15-2 and 15-3 and was devoid of the caddisflies found in the other two samples.

Station 14 was located between Elyria, Ohio, and the Elyria sewage treatment plant at river mile 15.2. Sample 14-1, a quantitative Surber sample, and sample 14-2, a qualitative sample, were both collected in a riffle area, while sample 14-3, a qualitative sample, was collected just upstream in a pool area. The substrate of the lentic environment was composed of large rocks and no sediment. The benthos indicated a slight decrease in water quality from the upstream control stations. This is exhibited by a decrease in diversity of the riffle organisms when compared with these collected at station 15. The fauna, however, was still composed of mainly facultative and intolerant types and not pollution tolerant organisms.

Station 13, downstream from the Elyria sewage treatment plant, at river mile 10.0, was another riffle-pool situation. Here a Surber sample (sample 13-1) and two Petersen samples (samples 13-2 and 13-3) were collected. The substrate in the riffle was shale while in the pool it was composed mainly of sand, gravel and detritus. The benthic fauna collected show an abrupt decline in water quality when compared to the upstream station (station 14). The increase in organic load to the river, by the sewage treatment plant, is shown by

a large increase in sludgeworms, and a drastic decrease in the diversity of the benthic fauna.

All samples at station 12 (river mile 5.5) were taken in a sludge deposit located along the west bank of the river. Here the soft gray sediment had an oily smell and gas bubbles were emerging at the surface. The remainder of the river width at this station was composed of shale and gravel. The slack current at this station indicated the possibility of pollutants being carried upstream from U. S. Steel during of flow reversals caused by varying lake levels and wind direction. However, the paucity of sediment deposited at this location, indicates scouring during high flow conditions. The benthic fauna was indicative of an organically enriched environment. Numbers of sludgeworms were extremely high (502.2 x $10^3/m^2$ in sample 2) while the diversity of organisms was low with only facultative and pollution tolerant taxa being present.

At station 11, on French Creek, the bottom material was rubble and organic sludge with a brown silt overlay. Traces of oil were present. The benthic community indicated only slightly better conditions than those found at station 12. It is concluded that the input from French Creek has little or no effect on the water quality of the Black River.

At station 10, river mile 4.35, downstream from the U.S. Steel hot forming operation discharge, outfall 001, the diversity of the

benthic fauna was limited to large numbers of sludgeworms. This indicates poorer water quality than that found at station 12. The difficulty in obtaining replicate samples at this station because of the rock, shale and gravel indicated that the area is scoured.

At station 9, river mile 4.0, gray brown sludge with a silt overlay was found at all sections, indicating that suspended solids readily settle in this area of the river. The benthic fauna was again limited to sludgeworms, showing no improvement over conditions found at station 10.

Sludgeworms were again the only benthic organisms found at station 8, river mile 3.45, downstream from the discharge from the U. S. Steel coke plant discharge, outfall 002, except at section 8A, sample 1 where pollution tolerant snails were present. The effluent discharged from outfall 002 apparently inhibited the proliferation of sludgeworms at sections 8B and 8C. At these locations the average number of sludgeworms for the three replicate samples was much less than at section 8A ($14.6 \times 10^3/m^2$ at section 8B, $41.4 \times 10^3/m^2$ at section 8C, as compared with $353.1 \times 10^3/m^2$ at section 8A). The substrate also differed between the three sections (8A - gray brown sludge, 8B - black sludge with a brown silt overlay and 8C - gray sludge). However, oil was abundant at all locations.

The appearance of a few genera of leeches and fingernail clams at station 7, at the head of the navigation channel, river mile 2.85,

indicates a slight improvement over the conditions noted in the reach from stations 8 through 10. The sediments at this station were composed of black silt and sand, fly ash and detritus. Oil was abundant in the samples collected from all sections.

United States Steel discharges the wastes from its blast furnace area, lime plant, and steel plant into the turning basin (outfalls 003 and 004) near the head of the navigation channel. Results from station 6, river mile 2.6, located in the turning basin, indicate a slight decrease in water quality by a reduction in the diversity of the benthos when compared to station 7. The seidments in the turning basin were composed of gray sludge with a light brown silt overlay and oil was noted in the sediments at all sections.

At station 5, river mile 2.36, sections A and C, pollution tolerant leeches and facultative fingernail clams again begin to proliferate, indicating improving water quality. However, the benthos collected at section 5B show conditions to be similar to those at station 6. This could result from pollutants flowing downstream in the center dredged portion of the river, the dredging operation upsetting the benthic population or propeller wash from commercial shipping. Sediments in this area were similar to those at station 6.

The diversity of the benthic population increases further at station 4, river mile 0.83. Here, in addition to the leeches and

fingernail clams found upstream, were pollution tolerant midges and snails, and facultative to intolerant snails and scuds. Samples from midstream, section B, at this location show a less diverse benthic community, similar to that at station 5B. The sediments, differing from those found upstream were composed of a gray brown sludge with a brown silt overlay. Some detritus was noted in the samples from section C and oil was present in samples from all sections.

The effect of the Lorain sewage treatment plant discharge near the mouth of the river was not dramatically evident on the benthic fauna at station 3, river mile 0.0 and at the harbor mouth, station 2. There was a some reduction in diversity of the population, involving mainly the leeches and fingernail clams. The moderate of the treatment plant effect could be due to proper wastewater treatment or lake water dilution. Sediments at this locations were similar to those at station 4.

The benthic fauna collected at station 1, near the Lorain, Ohio, water intake, were devoid of the scuds which one might expect to associate with the sand substrate at this location. Only pollution tolerant midges and sludgeworms were collected at this location.

Sediment Chemistry

The results of the chemical analyses of sediment samples from the Black River are displayed in Table IV.

In general the sediment chemistry data show increases in all parameters except percent moisture downstream from the U. S. Steel discharges 001 and 002, river miles 4.85 to 3.45 respectively. In most cases the concentrations near outfall 002 were the highest found in the study area.

Downstream from river mile 3.45 (station 8) the levels of pollutants in the sediments decline until station 6 (river mile 2.6) adjacent to U. S. Steel where most of the parameter values increase although not as much as upstream. Many of the parameter values increase still more at station 5 (river mile 2.36). This increase may be because the sample for the sediment chemistry was taken from an undredged area of the river. The pollutants in the sediment, therefore, were not subject to periodic removal. From station 5 to the Lorain Harbor mouth and the water intake the levels of all pollutants in sediments generally decrease.

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		1			2			3A			3B	
Location		Water Intake			Harbor Mouth			River Mile 0.0			River Mile (	
Section		1	2	3	1	2	3	1	2	3	1	2
Oligocheata X 10^3		10.3	4.3	9.3	16.2	21.0	19.0				7.0	47.8
Hirudinea												468
Hellobdella sp.												47
H. Stagnalis	T											47
H. Elongata												
Erpobdella sp.	T										62	
Sphaeriidae												
Sphaerium sp.	F				16		125					
S. Tranversum												
S. (Musculium)							16					
Pisidium sp.	F											16
Chironomidae												
Chironominae												
Chironomus sp.	T	1278	623	998								
Cryptochironomus sp.	T			16								
Polypedilum sp.	F-I											
Tribelos sp.	I											
Stictochironomus sp.	I											
Endochironomus sp.	F-I											
Tanytarsus sp.	F-I											
Psectrocladius sp.	I											
Chironominae pupae												
Orthocladinae	I											
Cricotopus sp.	I											
Orthocladinae pupae	I											
Tanypodinae												
Procladius sp.	T-F	468	172	218	109	47	62					
Ablabesmyia sp.	I											
Simulidae												
Simulium sp.												
Pulmonata												
Physa sp.	T									47		31
Prosobranchia												
Pleurocera sp.	F											16
Valvata sincera	F-I									31		16
Bithynia tentaculata	I				16							156
Ammicola sp.	I				16							
Planorbula sp.	F											
Amphipoda												
Hyalella azteca	F											
Gammarus fasciatus	F											
Ephemeroptera												
Hexigenia limbata	I											
Caenis sp.	F-I											
Baetis sp.	I											
Trichoptera												
Agraylea sp.	I											
Chimarra obscura	I											
Hydropsyche sp.	F-I											
Cheumatopsyche sp.	F											
Trichoptera pupae												
Coleoptera												
Helodidae												
Dubiraphia sp.	I											
Stenelmis sp.	I											
Megaloptera												
Sialis sp.	F-I											
Turbellaria	F											
Hydracarina	I											
Total Number X 10^3		12.8	5.0	10.6	16.4	21.0	19.9	59.1	186.5	128.1	7.1	47.8
Total Taxa		3	3	4	5	2	4	2	1	3	2	9

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		3C			4A			4B			4C	
Location		River Mile 0.0			River Mile 0.35			River Mile 0.35			River Mile	
Section		1	2	3	1	2	3	1	2	3	1	2
Oligocheata X 10^3		26.6		20.2	6.0	4.1	7.2	53.1	67.4	69.0	34.1	38.3
Hirudinea												
Hellobdella sp.												
H. Stagnalis	T						16			173		
H. Elongata		16				561	108	187	561			94
Erpobdella sp.	T							16				16
Sphaeriidae												
Sphaerium sp.	F	47				3664	2822					1828
S. Tranversum					795	187	218	109	125	135		234
S. (Musculium)						47	94					47
Pisidium sp.	F					125	218				136	78
Chironomidae												
Chironominae												
Chironomus sp.	T											
Cryptochironomus sp.	T											
Polypedilum sp.	F-I											
Tribelos sp.	I											
Stictochironomus sp.	I											
Endochironomus sp.	F-I											
Tanytarsus sp.	F-I											
Psectrocladius sp.	I											
Chironominae pupae												
Orthocladiinae	I											
Cricotopus sp.	I											
Orthocladiinae pupae	I											
Tanypodinae												
Procladius sp.	T-F				16	31						
Ablabesmyia sp.	I											
Simulidae												
Simulium sp.												
Pulmonata												
Physa sp.	T	62					16					16
Prosobranchia												
Pleurocera sp.	F											
Valvata sincera	F-I					312	405					16
Bithynia tentaculata	I	47										
Amnicola sp.	I											
Planorbula sp.	F											
Amphipoda												
Hyalella azteca	F								16			
Gammarus fasciatus	F											
Ephemeroptera												
Hexigenia limbata	I											
Caenis sp.	F-I											
Baetis sp.	I											
Trichoptera												
Agraylea sp.	I											
Chimarra obscura	I											
Hydropsyche sp.	F-I											
Cheumatopsyche sp.	F											
Trichoptera pupae												
Coleoptera												
Helodidae												
Dubiraphia sp.	I											
Stenelmis sp.	I											
Megaloptera												
Sialis sp.	F-I											
Turbellaria	F											
Hydracarina	I											
Total Number X 10^3		20.8		29.1	6.9	9.0	11.1	54.2	68.1	69.5	34.2	100.7
Total Taxa		6		1	3	8	3	4	4	3	2	9

Sample Lost

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		5A			5B			5C			6A	
Location		River Mile 2.36			River Mile 2.36			River Mile 2.36			River Mile	
Section		1	2	3	1	2	3	1	2	3	1	2
Oligocheata X 10^3		42.3	63.7	43.8	11.3	16.2	21.3	68.5	40.6	37	49.4	28.0
Hirudinea												
Hellobdella sp.												
H. Stagnalis	T							16				
H. Elongata		47	31		16			16	78	16		109
Erpobdella sp.	T									16		
Sphaeriidae												
Sphaerium sp.	F	62	16					78	31	62		
S. Tranversum			94			16			16			16
S. (Musculum)			16									
Pisidium sp.	F		16					16	16	16		
Chironomidae												
Chironominae												
Chironomus sp.	T											
Cryptochironomus sp.	T											
Polypedilum sp.	F-I											
Tribelos sp.	I											
Stictochironomus sp.	I											
Endochironomus sp.	F-I											
Tanytarsus sp.	F-I											
Psectrocladius sp.	I											
Chironominae pupae												
Orthocladinae	I											
Cricotopus sp.	I											
Orthocladinae pupae	I											
Tanypodinae												
Procladius sp.	T-F											
Abiabesmyia sp.	I											
Simuliidae												
Simulium sp.												
Pulmonata												
Physa sp.	T											
Prosobranchia												
Pleurocera sp.	F											
Valvata sincera	F-I											
Bithynia tentaculata	I											
Amnicola sp.	I											
Planorbula sp.	F											
Amphipoda												
Hyalella azteca	F											
Gammarus fasciatus	F											
Ephemeroptera												
Hexigenia limbata	I											
Caenis sp.	F-I											
Baetis sp.	I											
Trichoptera												
Agraylea sp.	I											
Chimarra obscura	I											
Hydropsyche sp.	F-I											
Cheumatopsyche sp.	F											
Trichoptera pupae												
Coleoptera												
Helodidae												
Dubiraphia sp.	I											
Stenelmis sp.	I											
Megaloptera												
Sialis sp.	F-I											
Turbellaria	F											
Hydracarina	I											
Total Number X 10^3		12.4	63.9	43.2	11.3	16.2	21.3	63.7	40.7	37.2	49.4	28.1
Total Taxa		3	6	1	2	2	1	5	5	5	1	3

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER

JULY 1974

Station Number		6B			6C			7A			7B		
Location		River Mile 2.6			River Mile 2.6			River Mile 2.85			River Mile 2.85		
Section		1	2	3	1	2	3	1	2	3	1	2	3
Oligocheata X 10^3		16.1	9.1	22.5	16.6	5.3	8.0	24.0	25.5	41.5		177.1	161.4
Hirudinea													
Hellobdella sp.											Sample Lost		
H. Stagnalis	T												
H. Elongata									125				47
Erpobdella sp.	T				16								16
Sphaeriidae													
Sphaerium sp.	F											16	
S. Tranversum													16
S. (Musculium)													16
Pisidium sp.	F												
Chironomidae													
Chironominae													
Chironomus sp.	T												
Cryptochironomus sp.	T												
Polypedilum sp.	F-I												
Tribelos sp.	I												
Stictochironomus sp.	I												
Endochironomus sp.	F-I												
Tanytarsus sp.	F-I												
Psectrocladius sp.	I												
Chironominae pupae													
Orthocladinae	I												
Cricotopus sp.	I												
Orthocladinae pupae	I												
Tanypodinae													
Procladius sp.	T-F												
Ablabesmyia sp.	I												
Simuliidae													
Simulium sp.													
Pulmonata													
Physa sp.	T				16								
Prosobranchia													
Pleurocera sp.	F												
Valvata sincera	F-I												
Bithynia tentaculata	I												
Amnicola sp.	I												
Planorbula sp.	F												
Amphipoda													
Hyalella azteca	F												
Gammarus fasciatus	F												
Ephemeroptera													
Hexigenia limbata	I												
Caenis sp.	F-I												
Baetis sp.	I												
Trichoptera													
Agraylea sp.	I												
Chimarra obscura	I												
Hydropsyche sp.	F-I												
Cheumatopsyche sp.	F												
Trichoptera pupae													
Coleoptera													
Helodidae													
Dubiraphia sp.	I												
Stenelmis sp.	I												
Megaloptera													
Sialis sp.	F-I												
Turbellaria	F												
Hydracarina	I												
Total Number X 10^3		16.1	9.1	22.5	17.7	5.3	8.9	24.0	25.5	41.5		177.1	161.4
Total Taxa		1	1	1	4	1	1	1	2	1		2	5

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		7C			8A			8B			8C		
Location		River Mile 2.85			River Mile 3.45			River Mile 3.45			River Mile 3.45		
Section		1	2	3	1	2	3	1	2	3	1	2	3
Oligochaeta X 10^3		141.2	136.8	60.8	322.8	316.4	420.1	26.2	7.9	15.8	47.8	48.1	28.2
Hirudinea													
Helobdella sp.													
H. Stagnalis	T												
H. Elongata													
Erpobdella sp.	T												
Sphaeriidae													
Sphaerium sp.	F												
S. Tranversum													
S. (Musculium)													
Pisidium sp.	F												
Chironomidae													
Chironominae													
Chironomus sp.	T												
Cryptochironomus sp.	T												
Polypedilum sp.	F-I												
Tribelos sp.	I												
Stictochironomus sp.	I												
Endochironomus sp.	F-I												
Tanytarsus sp.	F-I												
Psectrocladius sp.	I												
Chironominae pupae													
Orthocladiinae	I												
Cricotopus sp.	I												
Orthocladiinae pupae	I												
Tanypodinae													
Procladius sp.	T-F												
Ablabesmyia sp.	I												
Simulidae													
Simulium sp.													
Pulmonata													
Physa sp.	T				16								
Prosobranchia													
Pleurocera sp.	F												
Valvata sincera	F-I												
Bithynia tentaculata	I												
Amnicola sp.	I												
Planorbula sp.	F												
Amphipoda													
Hyalella azteca	F												
Gammarus fasciatus	F												
Ephemeroptera													
Hexigenia limbata	I												
Caenis sp.	F-I												
Baetis sp.	I												
Trichoptera													
Agraylea sp.	I												
Chimarra obscura	I												
Hydropsyche sp.	F-I												
Cheumatopsyche sp.	F												
Trichoptera pupae													
Coleoptera													
Helodidae													
Dubiraphia sp.	I												
Stenelmis sp.	I												
Megaloptera													
Sialis sp.	F-I												
Turbellaria	F												
Hydracarina	I												
Total Number X 10^3		141.2	136.8	60.8	322.8	316.4	420.1	26.2	7.9	15.8	47.8	48.1	28.2
Total Taxa		1	1	1	2	1	1	1	1	1	1	1	1

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER

JULY 1974

Station Number		9A			9B			9C			10A		
Location		River Mile 4.0			River Mile 4.0			River Mile 4.0			River Mile 4.85		
Section		1	2	3	1	2	3	1	2	3	1	2	3
Oligocheata X 10^3		167.6	151.4	282.2	321.8	139.5	59.3	107.4	153.8	209.9		365.2	
Hirudinea													
Hellobdella sp.													
H. Stagnalis	T												
H. Elongata													
Erpobdella sp.	T												
Sphaeriidae													
Sphaerium sp.	F												
S. Tranversum													
S. (Musculium)													
Pisidium sp.	F												
Chironomidae													
Chironominae													
Chironomus sp.	T												
Cryptochironomus sp.	T												
Polypedilum sp.	F-I												
Tribelos sp.	I												
Stictochironomus sp.	I												
Endochironomus sp.	F-I												
Tanytarsus sp.	F-I												
Psectrocladius sp.	I												
Chironominae pupae													
Orthocladinae	I												
Cricotopus sp.	I												
Orthocladinae pupae	I												
Tanypodinae													
Procladius sp.	T-F												
Ablabesmyia sp.	I												
Simulidae													
Simulium sp.													
Pulmonata													
Physa sp.	T												
Prosobranchia													
Pleurocera sp.	F												
Valvata sincera	F-I												
Bithynia tentaculata	I												
Amnicula sp.	I												
Planorbula sp.	F												
Amphipoda													
Hyalella azteca	F												
Gammarus fasciatus	F												
Ephemeroptera													
Hexigenia limbata	I												
Caenis sp.	F-I												
Baetis sp.	I												
Trichoptera													
Agraylea sp.	I												
Chimarra obscura	I												
Hydropsyche sp.	F-I												
Cheumatopsyche sp.	F												
Trichoptera pupae													
Coleoptera													
Helodidae													
Dubiraphia sp.	I												
Stenelmis sp.	I												
Megaloptera													
Sialis sp.	F-I												
Turbellaria	F												
Hydracarina	I												
Total Number X 10^3		167.6	151.4	282.2	321.8	139.5	59.3	107.4	155.8	209.9		365.2	
Total Taxa		1	1	1	1	1	1	1	1	1		1	

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		10B	10C			11			12		
Location		River Mile 4.85	River Mile 4.85			French Creek River Mile 0.2			River Mile 5.5		
Section			1	2	3	1	2	3	1	2	3
Oligocheata X 10^3		491.9	342.5	529.2	249.7	41.8	143.9	40.8	188.8	502.8	291.4
Hirudinea											
Hellobdella sp.											
H. Stagnalis	T										
H. Elongata											
Erpobdella sp.	T					47		31			
Sphaeriidae											
Sphaerium sp.	F								16		
S. Tranversum											
S. (Musculium)											
Pisidium sp.	F						16				
Chironomidae											
Chironominae											
Chironomus sp.	T										
Cryptochironomus sp.	T										
Polypedilum sp.	F-I										
Tribelos sp.	I									16	
Stictochironomus sp.	I										
Endochironomus sp.	F-I										
Tanytarsus sp.	F-I										
Psectrocladius sp.	I										
Chironominae pupae											
Orthocladinae	I										
Cricotopus sp.	I										
Orthocladinae pupae	I										
Tanypodinae											
Procladius sp.	T-F										
Ablabesmyia sp.	I					62	31				16
Simulidae											
Simulium sp.											
Pulmonata											
Physa sp.	T										
Prosobranchia											
Pleurocera sp.	F										
Valvata sincera	F-I										
Bithynia tentaculata	I										
Amnicola sp.	I										
Pleurobula sp.	F										
Amphipoda											
Hyalella azteca	F										
Gammarus fasciatus	F										
Ephemeroptera											
Hexagenia limbata	I										
Caenis sp.	F-I										
Baetis sp.	I										
Trichoptera											
Agraylea sp.	I										
Chimarra obscura	I										
Hydropsyche sp.	F-I										
Cheumatopsyche sp.	F										
Trichoptera pupae											
Coleoptera											
Helodidae											
Dubiraphia sp.	I						16				
Stenelmis sp.	I							16			
Megaloptera											
Sialis sp.	F-I										
Turbellaria	F										
Hydracarina	I										
Total Number X 10^3		491.9	342.5	529.2	249.7	41.9	143.9	40.8	188.8	502.8	291.
Total Taxa		1	1	1	1	3	4	3	2	2	2

BLACK RIVER, OHIO, BENTHIC MACROINVERTEBRATES PER SQUARE METER
JULY 1974

Station Number		13-A	13-B	13-C	14			15 Miller Road West Branch			16 Queenfield Road West Branch	
Location		River Mile 19.0			River Mile 15.2							
Section					1	2	3	1	2	3	1	2
Oligocheata X 10^3		30.6	34.2	30.1	.4			1.5	0.5		1.6	1.8
Hirudinea												
Helobdella sp.												
H. Stagnalis	T											
H. Elongata												
Erpobdella sp.	T											
Sphaeriidae												
Sphaerium sp.	F											16
S. Tranversum												
S. (Musculum)												
Pisidium sp.	F											
Chironomidae												
Chironominae												
Chironomus sp.	T			16		Q						
Cryptochironomus sp.	T				65			1325	3572			
Polypedilum sp.	F-I							78				
Tribelos sp.	I							795		538	8	
Stictochironomus sp.	I			16								
Endochironomus sp.	F-I							202				
Tanytarsus sp.	F-I											
Psectrocladius sp.	I								6930	6343		
Chironominae pupae										22		
Orthocladiinae	I				775				1076			
Cricotopus sp.	I			31								
Orthocladiinae pupae	I	12697		31	1108	Q	Q		646			
Tanypodinae		5294					Q					
Procladius sp.	T-F											
Ablabesmyia sp.	I											
Simulidae		344			22		Q	78	1398	215	125	62
Simulium sp.												
Pulmonata					11			16				
Physa sp.	T									1489		
Prosobranchia					108							
Pleurocera sp.	F											
Valvata sincera	F-I											
Bithynia tentaculata	I											
Amnicola sp.	I											
Planorbula sp.	F											
Amphipoda												
Hyalella azteca	F											
Gammarus fasciatus	F							16	22		78	62
Ephemeroptera						Q						
Hexigenia limbata	I											
Caenis sp.	F-I										156	187
Baetis sp.	I					Q		47				
Trichoptera					344		Q	16	1550			
Agraylea sp.	I											
Chimarra obscura	I								2840	538		
Hydropsyche sp.	F-I								236			
Cheumatopsyche sp.	F				11		Q		710	366		
Trichoptera pupae									4062	646		
Coleoptera									215			
Helodidae												
Dubiraphia sp.	I											
Stenelmis sp.	I							171				16
Megaloptera						Q		94				
Sialis sp.	F-I											
Turbellaria	F											
Hydracarina	I								Q	Q	156	94
Total Number X 10^3		48.9	34.2	30.2	2.9	Qual	Qual	4.1	19.3	13.5	2.0	2.2
Total Taxa		4	1	5	10	7	6	12	15	3	6	7

TABLE IV

U. S. STEEL - LORAIN WORKS, SEDIMENT CHEMISTRY

JULY 1974

mg/kg dry weight

Station	River Mile	Fe	Cr	Cd	Cu	Zn	Mn	As	Hg	Pb	Ni	NH_3-N	Cn	Phenol	Volatile[1] Solids	Oil and Grease	Percent Moisture
1	Water Supply	21,400	20	<2.0	20	100	434	13.0	<0.2	27	20	36.4	0.05	0.15	34	837	40.2
2	Harbor Mouth	32,000	39	6.6	46	178	540	12.0	<0.2	54	30	61.5	0.71	0.15	53	2320	47.4
3B	0.0	38,400	73	9.6	100	329	566	11.0	0.4	100	46	131.0	2.4	0.35	72	4050	52.8
4B	0.83	42,800	107	18.0	97	447	554	9.2	0.2	79	58	64.8	3.4	0.22	88	1620	59.1
5C	2.36	80,500	189	33.0	163	805	1040	15.0	0.5	250	88	112.0	8.4	0.38	96	10,700	62.1
6B	2.6	72,900	162	23.0	127	590	984	13.0	0.5	200	69	102.0	4.9	0.35	162	9420	57.5
7B	2.85	68,900	134	19.0	134	526	832	12.0	0.5	180	67	98.6	3.1	0.41	91	14,100	58.9
8B	3.45	114,600	270	17.0	180	944	2080	15.0	1.2	420	82	240.0	7.4	2.2	146	25,900	66.4
9B	4.0	56,200	159	20.0	204	443	545	12.0	<0.3	270	68	146.0	2.6	1.9	100	18,200	61.8
10	4.85	54,500	130	16.0	140	360	490	8.0	<0.2	200	80	121.0	1.4	1.8	104	24,800	55.3
11	0.2 French Creek	38,400	74	9.6	89	280	472	12.0	<0.3	120	59	96.3	1.2	0.42	93	6580	67.9
12	5.5	30,600	136	33.0	158	306	374	10.0	0.2	160	91	128.0	3.5	3.8	79	5530	57.4

[1] Volatile solids given in gms/kg

TABLE II

U. S. STEEL - LORAIN WORKS

Substrate Types

JULY 1974

Station	River Mile	Type of Station	Substrate
1	Water Intake	Lake	Sand
2	Harbor Mouth	Lake	Gray Brown mud with gray brown silt overlay, oil present
3.	0.0	Pool	Gray brown mud with gray brown silt overlay, oil present some scouring at section B
4	0.83	Pool	Gray brown sludge with brown silt overlay, oil present and detritus present at Section C
5	2.36	Pool	Gray sludge with light brown overlay, oil present
6	2.6	Pool	Gray sludge with light brown overlay, oil present
7	2.85	Pool	Black silt sand, fly ash, detritus, oil abundant
8	3.45	Pool	Section A - gray brown sludge; Section B - black sludge with brown silt overlay; Section C - gray sludge; oil abundant at all sections
9	4.0	Pool	Gray brown sludge with silt overlay; oil present at all sections; Section A had sticks and detritus and Section B had flyash.
10	4.85	Pool	Section A and B had rocks and gravel with clay and some silt; Section C had shale and mud with silt overlay; oil was noted in mud at Section C.
11	0.2 French Creek	Pool	Shale, brown silt over claying organic sludge rocks, oil in sample.
12	5.5	Pool	Soft gray mud, detritus, oily smell
13-1	10.0	Riffle	Rock . id shale
13-2&3	10.0	Pool	Sand, gravel and detritus
14-1&2	15.4	Riffle	Rock
14-3	15.4	Pool	Rock
15-1	Fuller Road	Pool	Detritus

Table III

U. S. STEEL, BLACK RIVER, LORAIN, OHIO - JULY 26, 1972
Benthic Macroinvertebrates/square meter

OHDO No.	Mile Point	Section	(Ft.) Depth	Amphipoda	Isopoda	Gastropoda: Prosobranchia	Gastropoda: Pulmonata	Annelida: Hirudinea	Annelida: Oligochaeta	Pelecepoda: Sphaeriidae	Insecta: Diptera
2288	0.0	B	27				57	29	59,431	772	29
	0.0	C	36	14					20,692		
	0.0	D	35		14		43		28,271	29	
2289	1.0	B	20			2,989	29	43	19,848	2,231	286
	1.0	C	28			443		472	50,265	6,650	29
	1.0	D	26			1,702		501	35,936	4,705	86
2290	1.8	B	10			14	43	172	19,005	114	
	1.8	C	36						13,428	1,230	
	1.8	D	15					14	8,254		57
2291	2.1	B	5					29	11,497		
	2.1	C	34					43	21,207	958	
	2.1	D	2					29	5,248	14	
2292	2.5	B	20						2,288	29	14
	2.5	C	34					100	37,666	1,258	14
	2.5	D	15					129	10,897	143	
2293	2.55	C	34						34,735	157	14
2294	2.65	B	2					100	8,051	14	
	2.65	C	34					43	28,228	200	29
	2.65	D	23					21	1,073		
2295	2.75	C	30					43	108,122	300	43
2296	2.85	B	6					2,760	4,819	14	14
	2.85	C	28						91,034	358	29
	2.85	D	26						5,649	87	
2297	2.95	C	24					29	16,974	43	
2298	3.0	B	4					815	12,970		14
	3.0	C	20						32,919		
	3.0	D	5					43	26,941	43	
2299	3.5	B	3				29		31,975		
	3.5	C	15						787		14
		D	5						38,567		14
2300	3.7	B	5						46,976		14
	3.7	C	10				43	14	66,581		14
	3.7	D	5						30,430		14
2301	5.0	B	5					172	27,971		72
	5.0	C	9						26,555		157
	5.0	D	3						134,992		172
2302	5.2	B	2						80,930		1,716
	5.2	C	9						20,420		200
	5.2	D	2					14	59,831		114
2303	6.6	B	1					14	243,729		2,288

Attachment K

U.S. EPA Survey, July 9-11, 1974
(PAH Survey)

Stirrup

UNITED STATES STEEL, LORAIN, OHIO, WORKS, BLACK RIVER SURVEY:

ANALYSIS FOR HEXANE ORGANIC EXTRACTABLES AND POLYNUCLEAR AROMATIC HYDROCARBONS

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SUMMARY

Three water and twelve sediment samples, collected at the U. S. Steel, Lorain, Ohio, works, were analyzed as part of an extensive biological and chemical survey of the Black River in the vicinity of the U. S. Steel site. Two water samples, taken from blast furnace effluents, were free of contamination. The coke sewer (002) sample did show the presence of small amounts of organic compounds, possibly paraffins, cycloparaffins, and/or olefins. The concentration of any individual component was less than 20 ppm (wt/v). Small amounts (<1 ppm) of polynuclear aromatic hydrocarbons (PAH) may have been present in the coke sewer sample. Water sampleswere analyzed by gas chromatography/mass spectrometry (GC/MS).

The sediment samples were extracted with n-hexane to determine organic solvent extractables - "Oil and Grease". Values ranged from 810 to 25,700 mg/kg based on dried sample weight. Highest values were at sampling sites in close proximity to the plant.

PAH were determined in sediment samples by gas chromatography (GC) and GC/MS. Liquid chromatography (LC) was used to separate PAH from other classes of organic compounds in hexane extracted residues. Quantitation of ten PAH in eight samples was then made by GC. These PAH represented an envelope of polynuclears of increasing ring complexity ranging from phenanthrene and anthracene (molecular weight 178) through two dibenzanthracenes

(MW 278). Several of the PAH quantitated are known carcinogens. Values of benz[a]- plus benz[e]pyrene ranged from 0.91 mg/kg (sample 19466) to 19 mg/kg (sample 19472). Values for dibenzanthracenes ranged from 0.37 (19467) to 12 mg/kg (19472). Sample 19472, collected just downstream from plant outfall 002, contained the largest concentrations of PAH; this sample was examined in detail by GC/MS. A broad spectrum of PAH was seen to be present; these included unsubstituted as well as methyl substituted polynuclears. Specialized GC/MS data system techniques were used to determine the presence of PAH. Isotope abundances were used to confirm molecular formulas.

INTRODUCTION

At the request of EPA Region V, NFIC-Cincinnati's Organic Chemistry Laboratories were asked to analyze twelve sediment and three water samples, collected by NFIC-Cincinnati personnel, at the U. S. Steel, Lorain, Ohio, works; this plant discharges into the Black River. This request is part of an extensive biological and chemical survey of the Black River in the vicinity of the U. S. Steel site in conjunction with EPA's pending court case against U. S. Steel. The sediment samples were to be analyzed for compounds extractable into an organic solvent; this procedure is better known as an Oil and Grease Determination. In addition the sediments were to be scanned for Polynuclear Aromatic Hydrocarbons (PAH). Certain PAH, for example benz[a]pyrene, are known to be powerful carcinogens. The three water samples were to be analyzed for the presence of organic compounds and in particular PAH. Chain of custody procedures were followed in handling the samples.

The request for PAH analysis arose out of the survey, conducted by Mr. Allen Lucas of these laboratories,[1] in which substantial concentrations of benz[a]pyrene (BaP) were found to be present in sediment samples collect at a U. S. Steel - Calumet site. Dr. Paul Clifford, who analyzed these samples, reported concentrations of BaP ranging from 1 to 380 mg/kg (dry sample weight) using gas chromatography/mass spectrometry (GC/MS) and fluorescence spectroscopy as analytical tools.

The approach taken in our laboratory to analyze for PAH in the Lorain sediment survey was different than in the Calumet case. In the latter

instance PAH were found as part of a general scan for organic compounds; phenanthrene, anthracene, and BaP were then selected as measures of PAH and carcinogenic content. In the Lorain case it was decided to analyze the samples for a broad spectrum of PAH from phenanthrene and anthracene (MW=178) to the dibenzanthracenes (MW= 278). It was felt that it would be of greater value scientifically to examine selected sediments for many individual PAH than all samples for, say, BaP. In fact a detailed PAH scan was obtained for eight of the twelve Lorain sediment samples.

EXPERIMENTAL

A. HEXANE EXTRACTABLES (OIL AND GREASE)

The method used for hexane organic extractables is essentially the same as outlined in the Standard Methods procedure.[2]

Samples were weighed into individual wide mouth porcelain crucibles. I removal each sample was agitated in its original container to assure adequat mixing. A control was prepared. It contained 25 g of silica gel and 25 ml of water. Samples and the control, ca 50 g wet weight, were air dried at 30°C overnight in the individual crucibles. They were then crushed to fine particles and allowed to dry an additional two hours. Each residue was placed in a soxhlet thimble and extracted in individual soxhlet apparatuses into "distilled-in-glass" n-hexane for 10 hours. Hexane was evaporated to 15 ml by allowing a stream of nitrogen to flow over the solvent in the extraction flasks which were heated by a steam bath held at 80°C. The remaining sample and solvent from each flask were transferred to appropriate size vials. The extraction flasks were washed with small portions of n-hexa which were transferred to the vials. No apparent residue remained in the ex traction flasks. A stream of nitrogen was allowed to flow over each sample vial, at room temperature, until the hexane solvent had evaporated. Checks were made to be certain that samples had reached a constant weight indicating complete hexane loss. Oil and grease is reported as mg, organic residue per kg, dry sample. It should be noted, that in all procedures, attempts were made to keep sample exposure to light in the laboratory to a minimum to prevent decomposition of compounds to be analyzed for in the resi

B. LIQUID CHROMATOGRAPHIC FRACTIONATION

Polynuclear aromatic hydrocarbons were separated from other classes of organic compounds in the hexane extractable residues by a liquid chromatographic (LC) procedure given by Hoffmann and Wynder.[3-5] In order to determine recovery of PAH from the LC column an experiment was performed.

Florisil, 60/100 mesh, was heated for an hour at 110°C and cooled in a dessicator. Forty grams of the activated Florisil was weighed and placed in a column chromatography tube whose dimensions were 40 X 2 cm (id). The volume occupied by the Florisil was 20.5 X 2 cm (id). Aluminum foil was placed around the column to prevent any possible photochemical reactions. With the stopcock in an open position, hexane was poured into the column. (It is imperative that the solid packing be uniform and without air bubbles). The initial hexane elutant was discarded. The volume of eluting solvent passing through the column was determined to be 37 ml. Five ml of a 1 mg/ml standard of BaP in cyclohexane was applied and adsorbed onto the column.

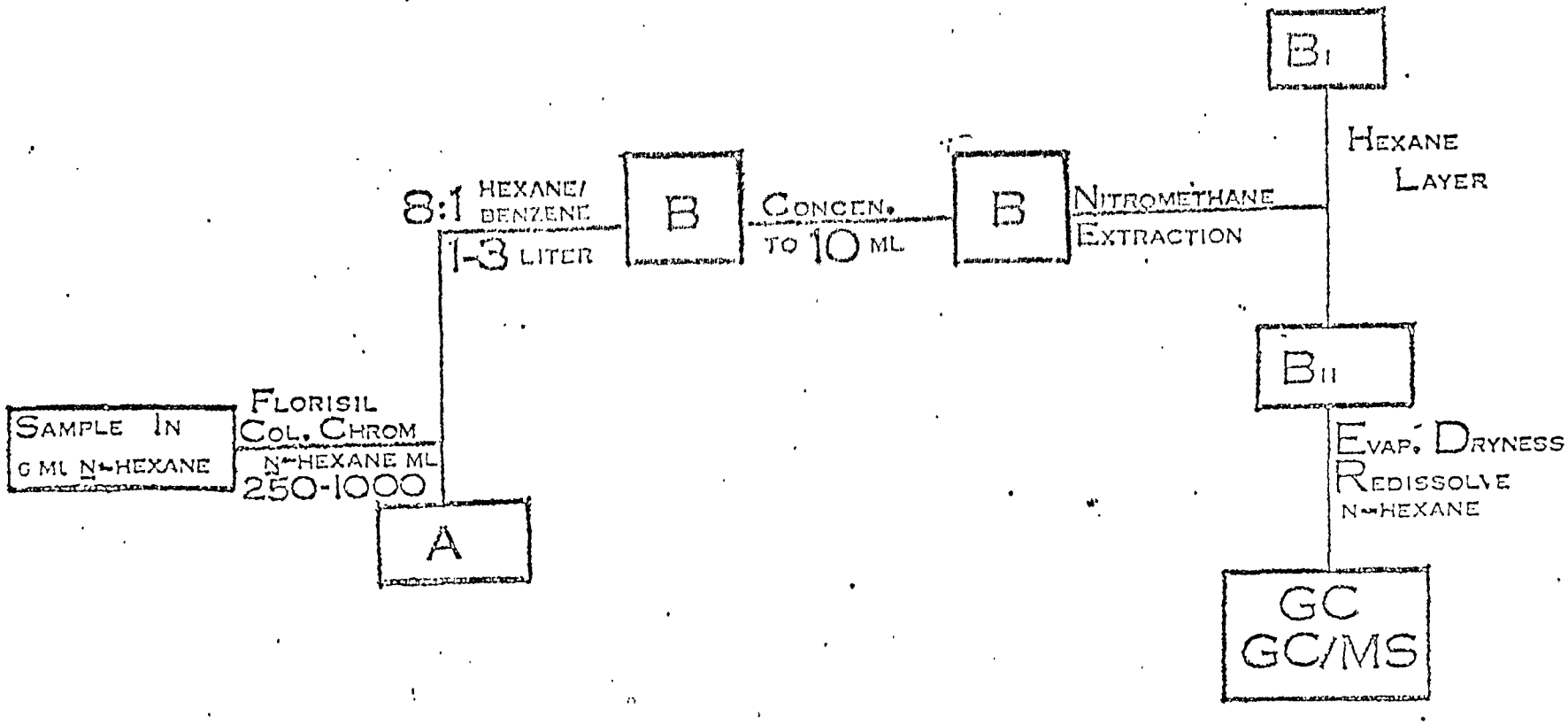
The first eluting solvent was n-hexane - 200 ml. The flow rate was 375 ml/hour. Twenty-five ml fractions were collected and viewed under ultraviolet (UV) light (long wavelength - 365 nm) and observed for fluoresence. No fluorescence was observed for all eight fractions.

The second eluting solvent was an 8:1 hexane/benzene (V/V) solution. The volume of this solution to be applied was determined experimentally. A critical variable which affects the total volume of the solvent used

is the flow rate (i.e., slower flow rates require less eluting volume). A flow rate of 340 ml/hour was established. Fifty ml fractions were collected in 100 ml reagent bottles. Each fraction collected was covered with aluminum foil and viewed under UV (365 nm) light. The total volume after which no further fluorescence was observed was 700 ml. The fractions were pooled and the total volume (700 ml) was concentrated in a 1 liter round bottom flask by use of a Büchi ROTAVAPOR-R. After the solvent was evaporated to approximately 30 ml, the concentrate was transferred to a 250 ml wide-mouth flask. The original container was washed with 8:1 hexane/benzene and the washings transferred to the 250 ml flask. Under a steam bath (at ca 70°C) and a gentle stream of nitrogen, the volu was further reduced to 2-5 ml. This solution was transferred to a 15 ml centrifuge tube and the 250 ml flask washed with 8:1 hexane/benzene; washings were added to the centrifuge tube and this volume was reduced to ca 2 ml and stored in a refrigerator until ready for analysis by GC.

Samples were chromatographed in a fashion similar to that in the BaP recovery experiment. The Scheme (Page 8) outlines the procedures used. samples (i.e., hexane extractable organic residues) were dissolved in 6 m n-hexane and applied to Florisil columns. n-Hexane was the first solvent it was employed to elute non-polar paraffinic type material. Depending o the sample, 250 to 1000 ml of n-hexane were used. The n-hexane fraction is defined as fraction A. For one sample, number 19470, where a duplicat oil and grease determination was made, ten 100 ml fractions were collecte

FLOWCHART OF TYPICAL SAMPLE WORKUP



SCHEME

in 125 ml Erlenmeyer flasks. No fluorescence was observed indicating no breakthrough of PAH. Fractions 2, 4, 6, and 10 were concentrated to ca 5 ml on a steam bath under a stream of nitrogen. The concentrates of these fractions were examined by gas chromatography.

After n-hexane, an 8:1 n-hexane/benzene (V/V) solution was used to elute fraction B which contains the PAH. As fractions were collected they were checked for fluorescence. Certain of the samples less concentrated in PAH, particularly in higher molecular weight PAH, displayed no fluorescence after ca one liter of solvent had been eluted from the column. For these samples elution was terminated when fluorescence was no longer observed. Other samples, for example 19472, displayed fluorescence after elution by 3.5 liters of solvent. For this sample eluate from 0-2500 ml and 2500-3500 ml were separated.

Fraction B was concentrated to 10 ml by previously described methods. It was then extracted four times with 10 ml portions of nitromethane (NM).[3,4] The NM extracts (fraction B_{II} in Scheme) were pooled and evaporated to dryness and redissolved in n-hexane--1 to 5 ml depending on the sample.

C. GAS CHROMATOGRAPHY

A gas chromatographic (GC) method was employed to analyze for specific PAH, based on the system of Lao et al.[6] A 10 ft X 1/8 in stainless steel column was employed which was packed with 6% Dexsil 300 on 80/100 mesh Supelcoport. A similar column packed with 3% Dexsil 300 was equally efficient and eluted compounds in a shorter time. A Varian 1400 GC equipped with a flame ionization detector (FID) and a Hewlett Packard Model 7100B, 1 MV recorder, were used. Injector temperature was 225°C and detector temperature 325°C. After injection the column was held at 165°C for two minutes then programmed at 4°C per minute to 295°C and held until the dibenzanthracenes had eluted. Total analysis time for the 6% and 3% Dexsil columns were ca 120 and 80 minutes, respectively. The carrier gas was helium and its flow rate 30 ml/min. The cylinder pressure regulator was set to deliver 80 psig to minimize pressure drop accross the column during the temperature program. Extreme care had to be taken to prevent helium leaks in the carrier gas line. A Gow-Mac Model 21-110 Leak Detector was useful in detecting leaks in gas lines.

Hamilton 10 µl syringes were employed for injection of standards and samples onto the GC column. Standards (1000 ppm) were prepared in Burdick and Jackson distilled-in-glass n-hexane using PAH obtained from commercial sources. Perylene was dissolved in benzene due to its low solubility in n-hexane. For quantitation, a standard mixture of ten PAH (see Results) was prepared in n-hexane. The standard mixture consisted of phenanthrene,

anthracene, fluoranthene, pyrene, benz[a]anthracene, benz[a]pyrene, benz[e]pyrene, perylene, dibenz[a,h]anthracene, and dibenz[a,c]anthracene. The concentration of each PAH in the standard was 50 ppm (wt/v) except for dibenz[a,h]anthracene which was 25 ppm. Concentrations of PAH in the samples were calculated by comparison with the standard mixture. Peak heights were used to compare the earlier eluting PAH (through benz[a]anthracene); peak areas were used for quantitations of BaP and BeP and later eluting compounds. In calculating concentrations of PAH components, corrections were applied for volumes of samples and standards analyzed and for total sample volumes. For comparison, the standard mixture was analyzed prior to sample analysis. When more than one sample was to be analyzed, the standard was run after every 2 - 3 samples.

In analyzing the paraffinic fraction A, a Perkin-Elmer Model 900 gas chromatograph equipped with a dual FID system and a Honeywell potentiometric recorder was employed. The GC was operated in the dual differential mode. Two 6 ft X 2 mm (id) glass columns packed with 3% OV-1 on 60/80 mesh Supelcoport were employed. Injector and detector temperatures were 220° and 320°C, respectively. The column was held at 80°C for five minutes after injection and then programmed at 10°C/minute to 220°C. The temperature was then held for ca 10 minutes.

D. GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

Analysis of standards and samples by GC/MS employed a Finnigan Model 1015 quadrupole GC/MS equipped with a System Industries Model 250 data system. Inasmuch as the GC on the Finnigan unit is a modified Varian 1400 instrument, columns could be interchanged with the GC possessing the FID.

The mass spectrometer (MS) was scanned by applying mass set voltages to the quadrupole rods from a 15-bit digital-to-analog convertor. At a given mass set voltage, only ions of a specific mass-to-charge ratio pass through the quadrupole field to the electron multiplier detector.[7] The high mass range of the MS was used; the preamplifier setting was 10^{-7} amp/volt an 2600-2800 volts were applied to the electron multiplier.

Direct aqueous injection of water samples by GC/MS was accomplished using the method of Budde et al.[8] A 6 ft X 2 mm id, glass column was packed with Chromosorb 101 and conditioned at 270°C for two days. Five µl of sample was injected and the column oven held at 80°C for two minutes and then programmed at 4° or 8°C/minute to 220°C. The final temperature was held so that the total analysis time was 35-40 minutes. The MS ionizer and data system were turned on after water had eluted from the GC column and bee pumped from the ion source. It was allowed to scan from 33-200 amu.

Water samples were also extracted and the extracts examined by GC/MS. One liter of sample was extracted twice with distilled-in-glass methylene ch ide. The extracts were combined and dried by passage through two inches of

prewashed (with methylene chloride) anhydrous sodium sulfate in a glass column. After the combined extracts had been dried, 100 ml of distilled-in-glass acetone was poured through the column. The extract plus acetone was evaporated to 5 ml employing a Kuderna-Danish apparatus. In this way the methylene chloride (BP 39.8°C) was removed, leaving the sample dissolved in acetone (BP 56.1°C).

A 6 ft X 2 mm (id) glass column packed with 1.5% OV-17 + 1.95% QF-1 on Supelcoport, 100/120 mesh, was used to analyze extracted water samples. It was conditioned at 250°C for two days prior to analysis. Two to four µl of sample was injected onto the column and the MS was "turned on" after the solvent, acetone, had been pumped from the ion source, ca 1 to 2 minutes, and allowed to scan from 33-450 amu.

For sediment samples the 3% Dexsil column described in the section on gas chromatography was used. At the high temperatures needed for these analyses (ca 300°C) GS/MS separator and transfer lines had to be adjusted to 280°C and 230°C, respectively.

The System 250 data system has certain special features which were applicable to these analyses.[9] These include choosing mass set voltages so that one can acquire data for selected ions of interest. This technique has the advantage of allowing the detection of compounds at 10-100 times lower concentrations than by normal scanning techniques. Another feature is being able to search the reconstructed gas chromatogram (RGC) for a limited number of ions. The RGC is a plot of ion current, normalized to 100% for the spectrum yielding the highest ion current against spectrum number.

The limited mass search allows the operator to ignore background and search for contributions to the ion current by selected ions of interest as a function of spectrum number.

RESULTS

A. WATER SAMPLES

Three water samples were received. The first was taken at the 1, 2, 5 blast furnace (east clarifier), the second at the 3, 4 blast furnace (west clarifier), and the third at the 002 discharge coke plant sewer. The sample were scanned for organic compounds, using the laboratory's gas chromatograph mass spectrometer (GC/MS) unit. Two approaches were taken. First, a direct aqueous injection of sample was made into the GC/MS. This allows the determination of low molecular weight, volatile, organic compounds of varying types. The second procedure involved extraction of the sample into methylene chloride, addition of acetone, evaporation, and concentration (see Experimental Section).

The water samples were found to be essentially free of contamination. The direct aqueous injection technique showed that the two blast furnace effluents were free of lower molecular weight compounds though one of them probably contained a small amount of acetone. The coke plant sewer sample did show small quantities of organic compounds; the concentration of any individual component was likely less than 20 ppm (wt/v). While individual components were not identified, two or three classes of compounds were found possibly to be present; these are paraffins, cycloparaffins, and olefi These classes were searched for by allowing the computer to scan the GC/MS reconstructed gas chromatograph for the presence of particular ions - m/e 43 and 57 for paraffins and m/e 55 and 69 for cycloparaffins and olefins.[10]

Few organic compounds were present in samples extracted with methylene chloride, even though the extraction procedures concentrated the samples some 200 fold. Blast furnace effluents showed no detectable compounds, while the coke plant sewer again showed small GC/MS peaks. For this sample the GC/MS was set to acquire data solely for ions corresponding to base peaks, which are also the molecular ions, of certain PAH. The ions were m/e 128 (naphthalene), 166 (fluorene), 178 (phenanthrene and anthracene 202 (fluoranthene and pyrene), 228 (benz[a]anthracene and chrysene), and 252 (benz[a]pyrene and benz[e]pyrene).

GC/MS peaks were obtained, for the coke sewer extracted sample corresponding to m/e 166, 178, and 202 with 178 being the largest. These data indicate the presence of low concentrations (<1-5 ppm wt/v) of certain PAH. Phenanthrene and anthracene have a molecular weight of 178 and their presence would not be surprising, particularly since substantial amounts of these two PAH were found in sediment samples.

B. HEXANE EXTRACTABLES (OIL AND GREASE)

Table I presents data for the n-hexane extraction of organic compound from the twelve sediment samples collected at the Lorain site. Table II gives a description of the sampling sites. Values ranged from 810 to 26,7 mg/kg based on the weight of samples dried overnight at 30°C. A blank containing 25 g of silica gel and 25 ml of water yielded no significant oil and grease. Five duplicate determinations were made and yielded excellent reproducability.

TABLE I

"OIL AND GREASE" DATA
Lorain Sediment Samples

Sample Number	Wet Sample Wt., Grams	Dry Sample Wt., Grams	Percent Volatiles	Weight Organic Residues, Grams	Oil and Grease, ppm mg/kg Dry Sample
Blank *				0.0031	
19465	70.46	30.79	56.4	0.0258	837
19466	50.83	25.62	49.6	0.0595	2,320
19467	53.02	28.84	45.6	0.1170	4,050
19467(A)	52.98	28.85	45.6	0.0956	3,310
19468	51.96	33.35	35.9	0.0543	1,620
19469	60.43	34.53	42.9	0.3683	10,700
19469(A)	57.82	33.30	42.5	0.3319	9,960
19470	52.67	32.69	38.0	0.3080	9,420
19470(A)	49.70	30.83	38.0	0.3007	9,750
19471	49.57	20.46	58.8	0.2889	14,100
19472	55.53	36.74	33.9	0.9539	25,900
19472(A)	55.27	36.09	34.8	0.9919	27,480
19473	49.08	29.08	39.6	0.5297	18,200
19474	64.79	39.26	39.5	0.9758	24,800
19474(A)	62.34	36.31	41.8	0.9560	26,410
19475	50.83	31.26	38.7	0.2065	6,580
19476	73.05	37.25	49.1	0.2061	5,530

* Blank contained 25 g. Silica Gel and 25 ml. water

A - Duplicate determinations

TABLE II

DESCRIPTION OF BLACK RIVER SAMPLING STATIONS[a]

Sample Number	Sample Station	Mile Point	Site Description
19465	1	-	Lake Water Treatment Intake
19466	2	-	Mouth of Harbor: Lake Erie-Black River
19467	3B	0.0	Center of Black River (River Mouth)
19468	4B	1.0	Center of River
19469	5C	2.5	Right Hand Side of River, Looking Upstream
19470	6B	2.75	Middle of Turning Basin Opposite Outfalls 003 and 004
19471	7B	2.9	Head of River Turning Basin - End of Commercial Navigation
19472	8B	3.4	ca 500 ft. Downstream from Outfall 002
19473	9B	4.0	Near Plant Water Intake
19474	10	5.0	ca 0.2 mi. Downstream from Outfall 001
19475	11	0.2	0.2 mi Upstream on French Creek
19476	12	5.3	ca 0.2 mi. Upstream from Outfall 001

[a]All samples taken from the surface of the sediment layer.

C. POLYNUCLEAR AROMATIC HYDROCARBON ANALYSIS IN SEDIMENT SAMPLES

The organic residues obtained in the Oil and Grease determinations were used to analyze for PAH. These residues are complex mixtures of organic compounds of varying classes and a method of separating the PAH (fraction) was necessary. The largest body of information on the separation and analysis of PAH, other than in the air pollution field, lies in the tobacco smoke chemistry area. PAH determinations in organic residues obtained from sediments should be similar to determinations of PAH in tobacco tars. Separation of PAH was affected by the method of Wynder and Hoffmann.[3-5] Several gas chromatographic (GC)[11-18] and gas chromatographic/mass spectrometric (GC/MS)[19] methods of measuring PAH are available. Techniques for GC and GC/MS analysis advanced by Lao et al.[6] appeared to be most applicable and were employed.

1. Liquid Chromatographic Separations of PAH

PAH were separated by the liquid chromatographic (LC) procedures outlined in the Scheme and detailed in the Experimental Section. Paraffinic type compounds are eluted from an LC Florisil Column by n-hexane (fraction A) The next solvent is an 8:1 hexane/benzene solution which elutes the PAH (fraction B). B is concentrated and PAH extracted into nitromethane (fraction B_{II}) to separate the PAH from other organic compounds that are eluted in fraction B.

Prior to analysis of the sediment organic residues an experiment was devised to measure PAH recovery from the LC column. Five ml of a 1 mg/ml (1000 ppm) benz[a]pyrene (BaP) solution was applied to a column and eluted

as in the Scheme except that the nitromethane (NM) extraction was omitted. The recovery of BaP was 97%.

It was determined that 1 liter of n-hexane was likely a sufficient amount of solvent to elute fraction A. For sample 19470 1 liter of n-hexane was eluted from the LC column with ten 100 ml fractions being collected. Fractions 2, 4, 6 and 10 were concentrated and examined by gas chromatography using OV-1 as the liquid phase; OV-1 is efficient for non-polar materials. Fractions 2 and 4 contained a broad envelope of paraffinic type material which eluted from the OV-1 column as temperature was programmed. Fraction 6 was free of GC peaks until a high column temperature was reached, ca 200°C. Reasonably, this indicates high molecular weight compounds which were late eluters from the LC column. Fraction 10 contained no GC peaks, thus signifying a complete separation of total fraction A.

Table III lists the volumes of n-hexane used to elute fraction A in each sample. Prior to GC analysis of the n-hexane cuts of sample 19470, it was felt that 200-400 ml of n-hexane would be sufficient to elute a total fraction A. Clearly this is not the case. Fortunately, however, any carryover of paraffinic material into Fraction B did not appear to adversely affect the final analysis; the nitromethane extraction apparently is almost exclusive for PAH, leaving behind other organic compounds in the hexane layer. For example GC/MS analysis of sample 19472 (see below) revealed only PAH; few other types of compounds were present. An exception was

TABLE III

VOLUMES OF n-HEXANE USED TO ELUTE FRACTION A

Sample Number	Volume n-Hexane, ml
19466	1000
19467	400
19469	400
19470	400
19471	1000
19472	200
19474	200
19475	1000
19470 (Duplicate)[a]	1000

[a] A second "Oil and Grease" determination was made on this sample - see Table I.

sample 19474 where an exceedingly high paraffin content (see explanation below) did interfere somewhat with PAH analysis. Elution of fraction A with greater than 200 ml of n-hexane was obviously necessary for this sample.

No fluorescence was observed in the 1 liter of n-hexane eluted for sample 19474. However, a low level of fluorescence was detected for samples 19466 and 19476. The possibility does exist that small amounts of low molecular weight PAH were lost.

One to three liters of 8:1 hexane/benzene was used to elute Fraction B. Table IV gives the volumes of solvent used. Elution of samples 19466 and 19476 was terminated at 1600 and 1250 ml respectively since fluorescence was no longer observed in solvent passing through the column. For sample 19472 2.5 liters of solvent were eluted; this was followed by elution with an additional liter which was separated from the initial 2.5 liters. Each was concentrated and extracted with nitromethane (NM); the NM extracts (fraction B_{II}) were evaporated to dryness, redissolved in n-hexane and analyzed by GC. All PAH through the dibenzanthracenes (MW 278) were found to be in the initial 2.5 liters fraction. Since fluorescence was observed in the 2.5 to 3.5 liter fraction, including the last 100 ml of this fraction, higher molecular weight strongly fluorescing PAH are no doubt responsible for fluorescence at high elution volumes. Sample 19472 contained the highest amounts of PAH. Thus, it was acceptable to terminate elution after 2 liters of solvent on all other samples (see Table IV).

TABLE IV

VOLUME OF 8:1 HEXANE/BENZENE USED TO ELUTE FRACTION B

Sample Number	Volume 8:1 Hexane/Benzene, ml
19466	1600[a]
19467	2000
19469	2200
19470	2100
19471	2000
19472	3500
19474	2050
19476	1250[a]

[a] No fluorescence observed when these volumes had eluted.

2. Gas Chromatographic Analysis

Excellent separations of PAH were achieved employing Dexsil 3% and 6% columns. Figure 1 shows a gas chromatographic trace representing a typical analysis of a ten component PAH standard mixture. Table V gives the structures and properties of these compounds. Figure 2 shows a gas chromatographic trace representing the analysis of sample 19472; the sample represents the first 2.5 liters of 8:1 hexane/benzene from the LC column (see page 9).

In Figure 1 it can be seen that phenanthrene and anthracene (peaks 1 and 2) are partially separated, benz[a]pyrene (BaP) and benz[e]pyrene (BeP) (Peaks 6 and 7) are not separated and dibenz[a,h]- and dibenz-[a,c]-anthracene (peaks 9 and 10) are not separated. These observations reproduce the data of Lao et al.[6]

Components in the standard mixture were chosen to represent a PAH envelope that might be observed in sediment samples. Phenanthrene and anthracene are three ring PAH with molecular weights (MW) of 178. The dibenzanthracenes are five ring PAH with MW's of 278. In between there can be PAH with varying number of rings, ring structures, and substitutions on the rings. Over 100 PAH are known between MW 178 and 278. Effective separations are both critical and difficult; with caution they can be accomplished and compound assignments be made.

Figure 2 shows assignment of PAH to components of the standard mixture. In addition to comparing gas chromatograms of standards and samples, a comparison with the data of Lao[6] was useful in chromatogram interpretation.

FIGURE I. Recorder trace of detector response in gas chromatographic analysis of PAH standard mixture using 6% Dexsil 300 column; Attenuation and amplifier settings are given in the figure as is recorder chart speed; Peak numbers correspond to the following PAH: 1. phenanthrene; 2. anthracene; 3. fluoranthene; 4. pyrene; 5. benz[a]anthracene; 6 and 7. benz[a]pyrene and benz[e]pyrene; 8. perylene; 9 and 10. dibenz[a,c]anthracene and dibenz[a,h]anthracene.

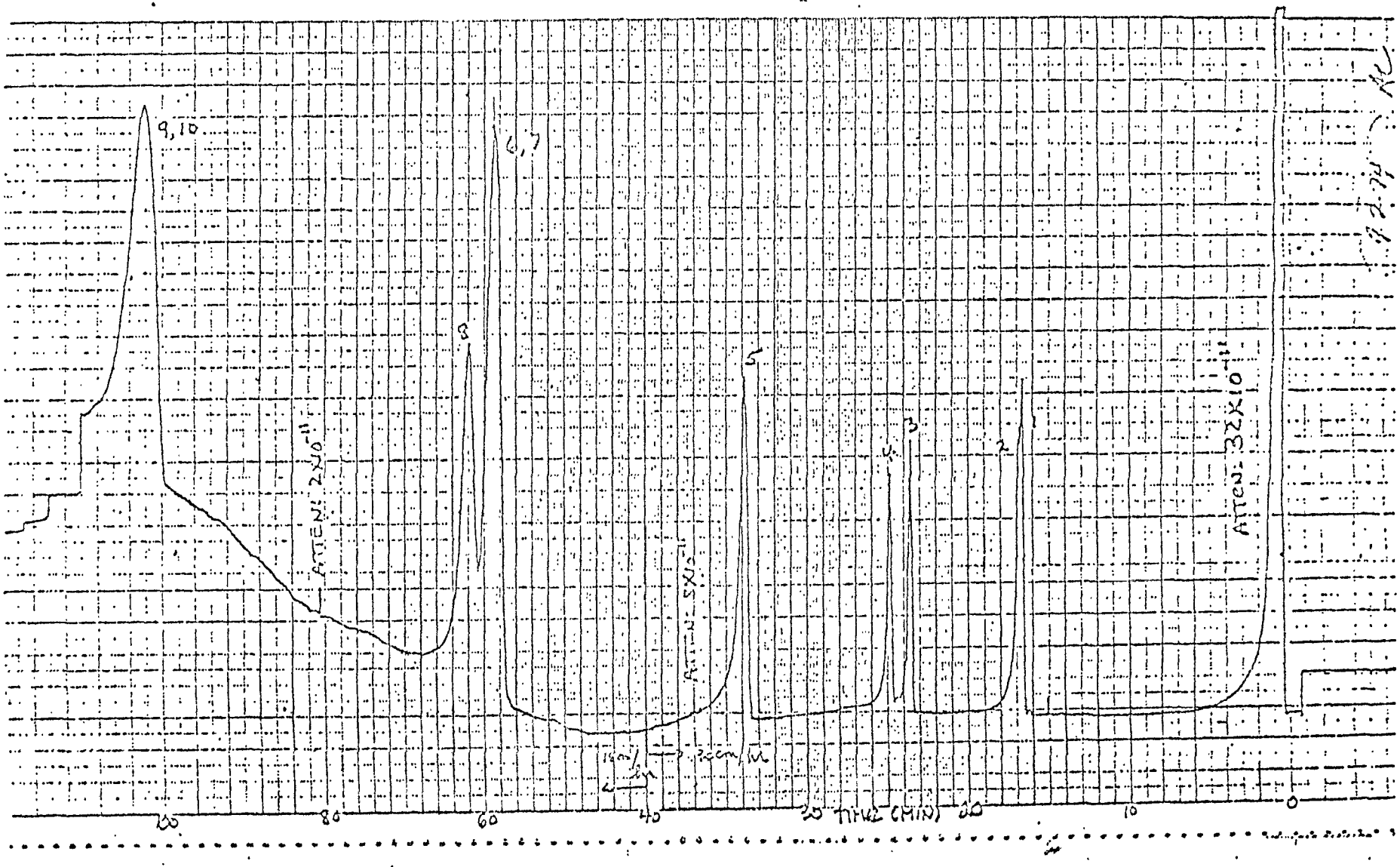


FIGURE II. GC trace for analysis of sample 19472, 0-2.5 liter, 8:1 hexane/benzene fraction. Attenuation, amplifier, and recorder settings are as indicated in the figure.

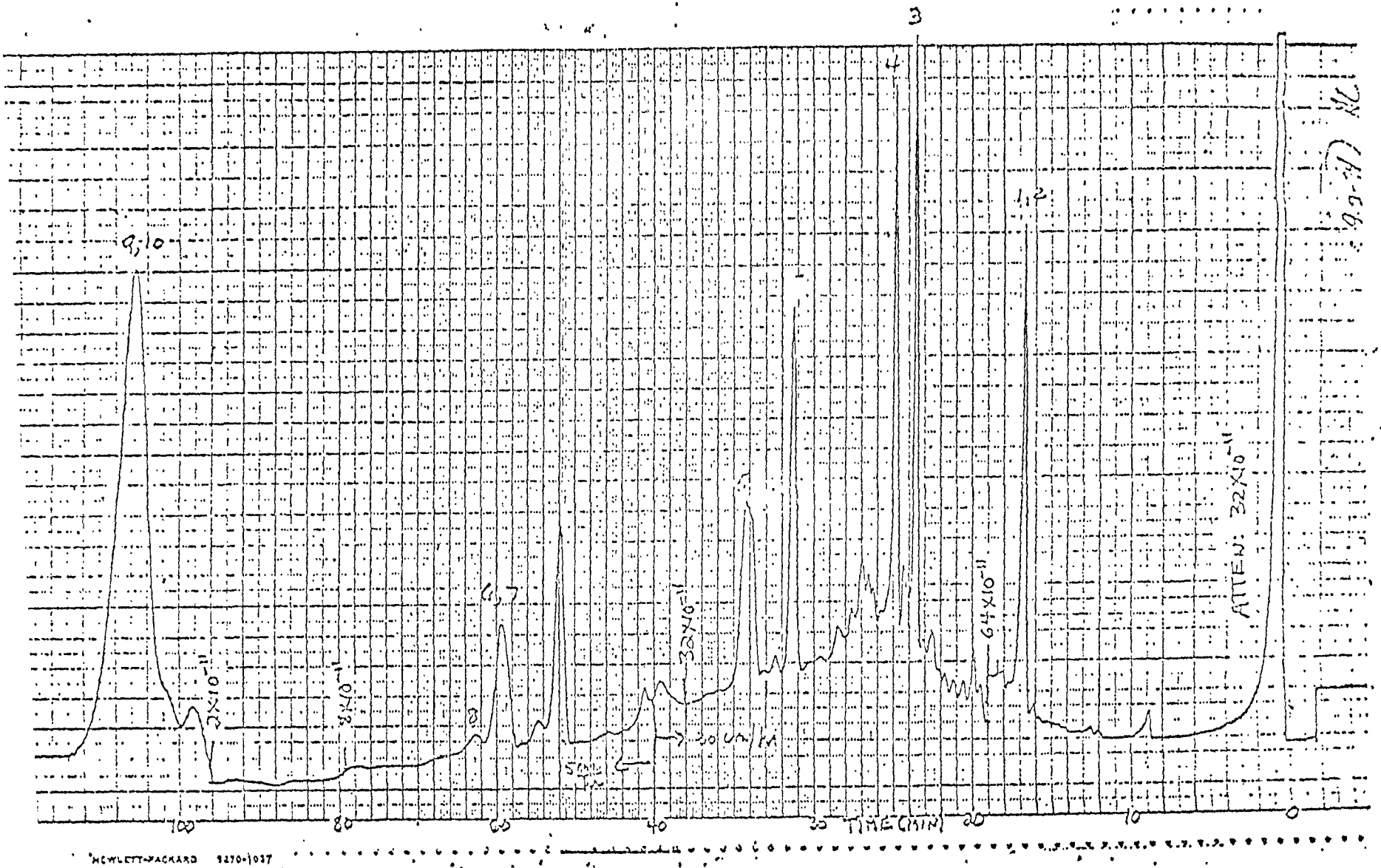
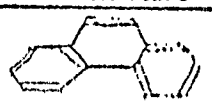
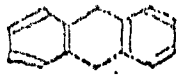
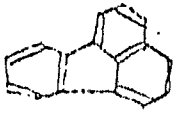
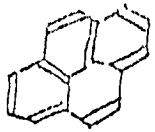
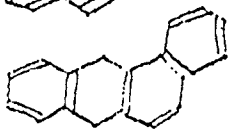
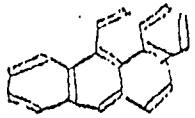
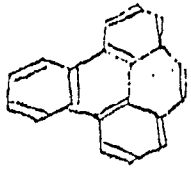
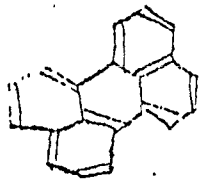
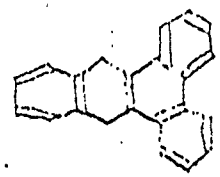
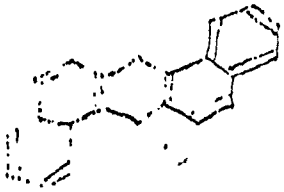


TABLE V

STRUCTURES AND PROPERTIES OF CERTAIN POLYNUCLEAR AROMATIC HYDROCARBONS

PAH	Formula	Molecular Weight	Structure	Carcinogenic Behavior
Phenanthrene	$C_{14}H_{10}$	178		-
Anthracene	$C_{14}H_{10}$	178		-
Fluoranthene	$C_{16}H_{10}$	202		-
Pyrene	$C_{16}H_{10}$	202		-
Benz[a]anthracene	$C_{18}H_{12}$	228		+
Benz[a]pyrene	$C_{20}H_{12}$	252		++++
Benz[e]pyrene	$C_{20}H_{12}$	252		±
Perylene	$C_{20}H_{12}$	252		-
Dibenz[a,c]anthracene	$C_{22}H_{14}$	278		+
Dibenz[a,h]anthracene	$C_{22}H_{14}$	278		+++

[a] Ratings of carcinogenic behavior obtained from reference 20; (-) indicates not carcinogenic; (±) uncertain or weakly carcinogenic, (+) carcinogenic; (++, +++, ++++) strongly carcinogenic.

The first major peak (labeled 1 and 2) in Figure 2 represents phenanthrene and anthracene. The assignment of these compounds is clear. Howeve since only one GC peak appeared it is probable that either phenanthrene or anthracene predominates. One cannot distinguish unequivocally between the and quantitation must be made as the sum of phenanthrene and anthracene; th situation obtains for all other samples. For sample 19472 GC/MS experiment suggest that the major peak (1 and 2) is predominantly phenanthrene with a minor contribution from anthracene (see Figure 5, page 42).

The peaks labeled 3 and 4 can be assigned to fluoranthene and pyrene.[6] Further support for these (and other) assignments will be given in the GC/MS data to be presented below. Peak 5 certainly represents at least two overlapping peaks. This is consistent with the observation of Lao et al[6] which notes that benz[a]anthracene is not separated from chrysene and triphenylene using the Dexsil GC system. Peak 5, then, should be assigned to these three compounds; no other PAH of MW 228 elutes near these pounds[6] and GC/MS data show that the peak is due to PAH having molecular weights of 228. Benz[a]anthracene and chrysene are carcinogens[20] while triphenylene is not.

Peaks labeled 6 and 7 are assigned to BaP and BeP; peak 8 is assigned to perylene. GC/MS data show these peaks to have molecular weights of 252. The doublet consisting of a large and a small peak eluting before BaP and BeP also have molecular weights of 252 (see below). Based on the data of Lao[6] the compounds represented by these peaks may be the benzofluoranthene isomers.

Peaks 9 and 10 are assigned to the dibenzanthracenes. Other PAH which elute in the dibenzanthracene region[6] and which may be present in certain samples are the benzochrysenes, picene, the benzoperylenes, o-phenylenepyrene, and the benzotetraphenes.

Table VI reports the concentrations of PAH determined in sediment samples (from fractions B_{II}). Matching of individual components in the samples was not always as simple as in 19472 described above and in Figure 2. For samples where certain components could not be compared with the standard mixture a value is not reported in Table VI.

Samples 19466 and 19476 display the lowest levels of PAH. This is consistent with their low oil and grease values and the fact that fluorescence terminated after 1-1.5 liters of solvent in collecting fraction B. It is also consistent with the locations of these two sampling sites. Sample 19472 being just downstream from outfall 002 shows by far the highest concentrations of PAH. No explanation can be offered for the absence of lower molecular weight PAH in sample 19471.

Sample 19474 was different than all other sediments collected. Fraction A showed an apparently high paraffinic content. This was observed by analysis of fraction A employing the Dexsil column. Fractions A of several samples were scanned for qualitative information as to paraffinic content. Sample 19474 contained at least a ten fold higher paraffinic level than any other sample examined. In addition examination of Fraction B_{II} for PAH showed a different shaped GC elution pattern. The GC trace in Figure 2

TABLE VI

CONCENTRATIONS OF PAH DETERMINED IN LORAIN SEDIMENT SAMPLES

Sample Number	Concentration, mg/kg (dry sample weight)[a]						
	Phenanthrene & Anthracene	Fluoranthene	Pyrene	Benz[a]anthracene	Benz[a]pyrene & Benz[e]pyrene	Perylene	Dibenzanthracenes
19466	0.43	b	b	0.83[d]	0.91	0.10	0.67[c]
19467	2.8	2.5	2.9	1.6[d]	1.5	0.04	0.37
19469	2.6	3.9	5.2	2.9[d]	4.6	e	2.6
19470	3.2	3.3	4.4	2.8[d]	2.9	e	e
19471	b	e	e	3.1[d]	4.7	3.9	3.9
19472	18	29	30	24	19	2.0	12
19474	~3[b]	b	b	b	1.1	e	e
19476	0.68	0.75	0.61	1.2[d]	1.5	0.35	0.66[c]

[a] Data calculated by comparison of PAH in the sample fraction B_{II} and a standard mixture of ten PAH.

[b] Overlapping peaks in the gas chromatogram precluded analysis of this PAH.

[c] Other major peaks occurred in the dibenzanthracene area of the GC. Concentration reported represents only GC peak at retention time of dibenzanthracenes in the standard mixture.

[d] The GC peak clearly represents more than one compound, as reported in reference 6. The values given are for the total PAH present based on the benz[a]anthracene standard.

[e] Less than detectable.

for 19472 is typical of samples analyzed except 19474. Consistent with our observations concerning sample 19474 is the fact that U.S. Steel apparently discharges waste oils from outfall 001; sample 19474 was taken 0.2 miles downstream from this outfall.

3. Gas Chromatographic/Mass Spectrometric (GC/MS) Analysis

Sample 19472 was examined in detail by GC/MS. In addition the ten component PAH solution was analyzed. Both analyses employed the 3% Dexsil column. The "real-time" and reconstructed gas chromatogram (RGC) for the standard mixture showed separations to be identical to these shown in Figure 1. Mass spectra for the standard compounds were consistent with spectra for known PAH.[6,21,22]

Figure 3 shows the "real-time" gas chromatogram for the analysis of sample 19472. (All further mass spectral data reported are for this sample). The GC is essentially the same as the trace shown in Figure 2. In GC/MS analysis the total ion current is plotted, as in Figure 3, after each spectrum scan during the run. Over sixty peaks can be counted. Figure 4 shows the reconstructed gas chromatogram (RGC) of the same run shown in Figure 3. The data system has normalized the largest peak in the RGC to an amplitude of 100. Because of the way the data system acquires and processes information relative peak heights between the "real-time" and reconstructed chromatograms are not always the same. Further explanation cannot be given in this section, owing to space limitations.

FIGURE 3: "Real-time" gas chromatogram of GC/MS analysis of sample 19472. Times in minutes and seconds written above each peak represent retention times of the eluting components.

FIGURE 4: Reconstructed gas chromatogram for GC/MS analysis of sample 19472.

FIGURE 5: Reconstructed gas chromatogram for GC/MS analysis of sample 19472 employing a limited mass search for ions m/e 178, 202, 228, 252, and 278.

FIGURE 6: Reconstructed gas chromatogram for GC/MS analysis of sample 19472 employing a limited mass search for ions m/e 192, 216, 242, 266, and 292.

FIGURE 3

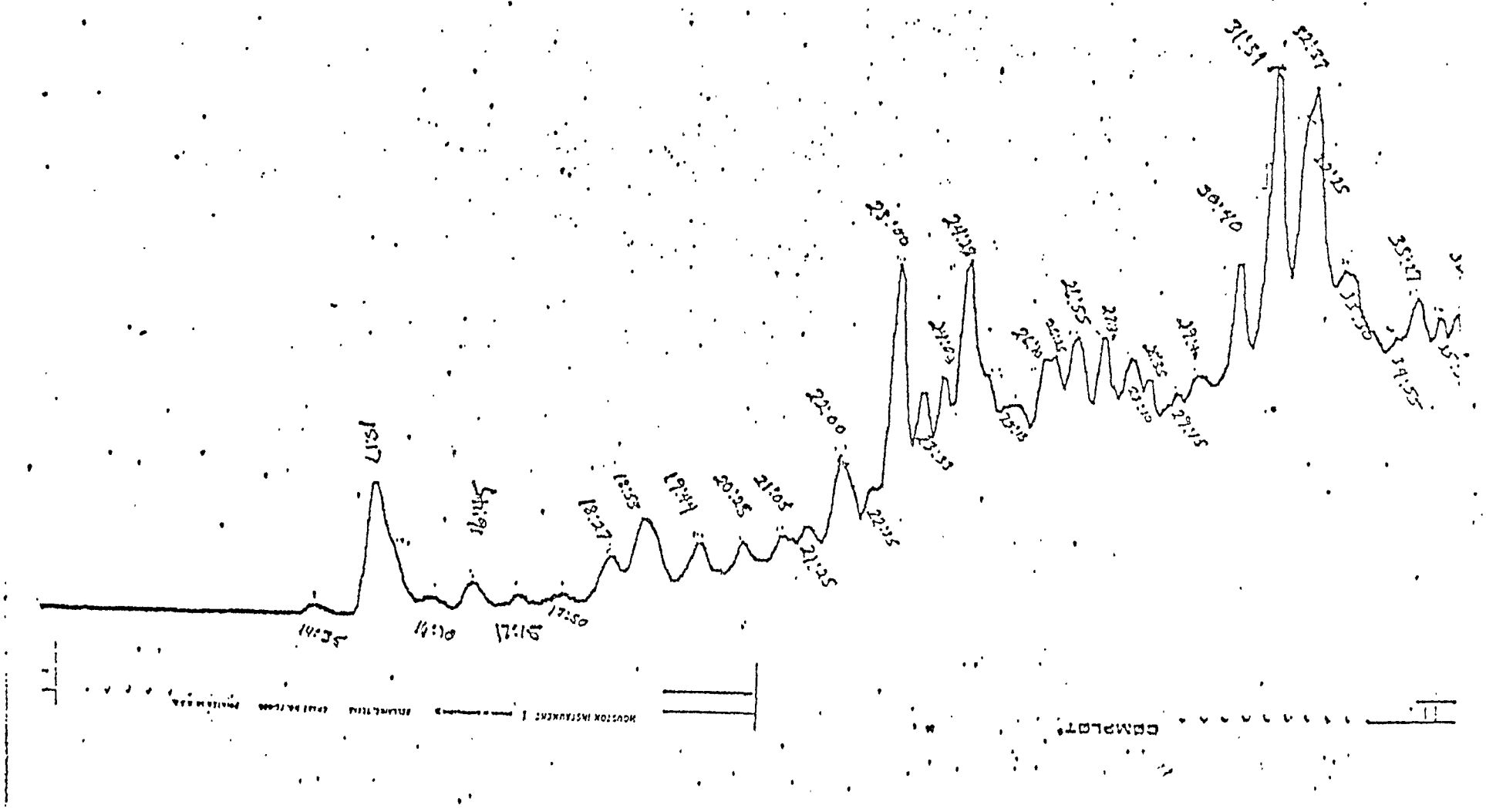

14:35
14:10
17:15
17:50
18:27
18:53
19:44
20:25
21:05
21:25
22:00
22:35
23:00
23:33
24:29
30:40
31:51
32:37
35:27
34:55

FIGURE 3 (CONT)

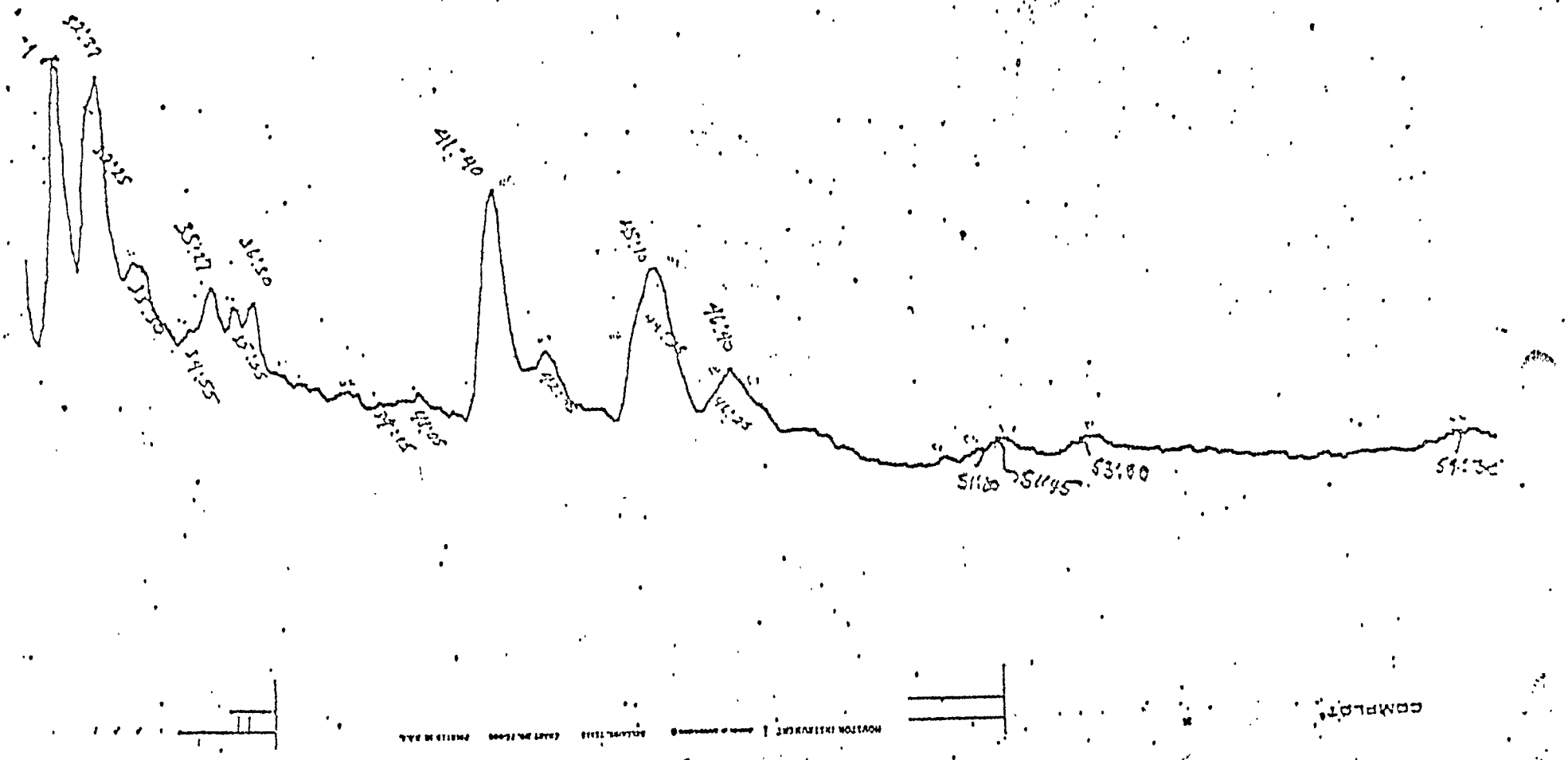


FIGURE 3 (CONT)

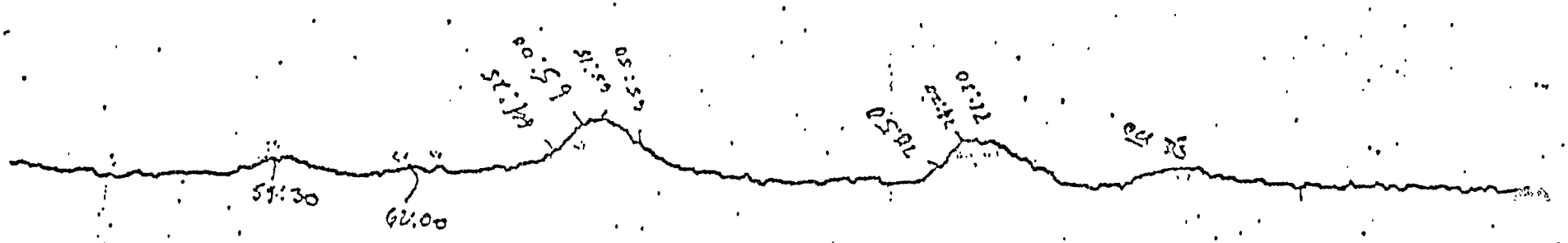


FIGURE 4

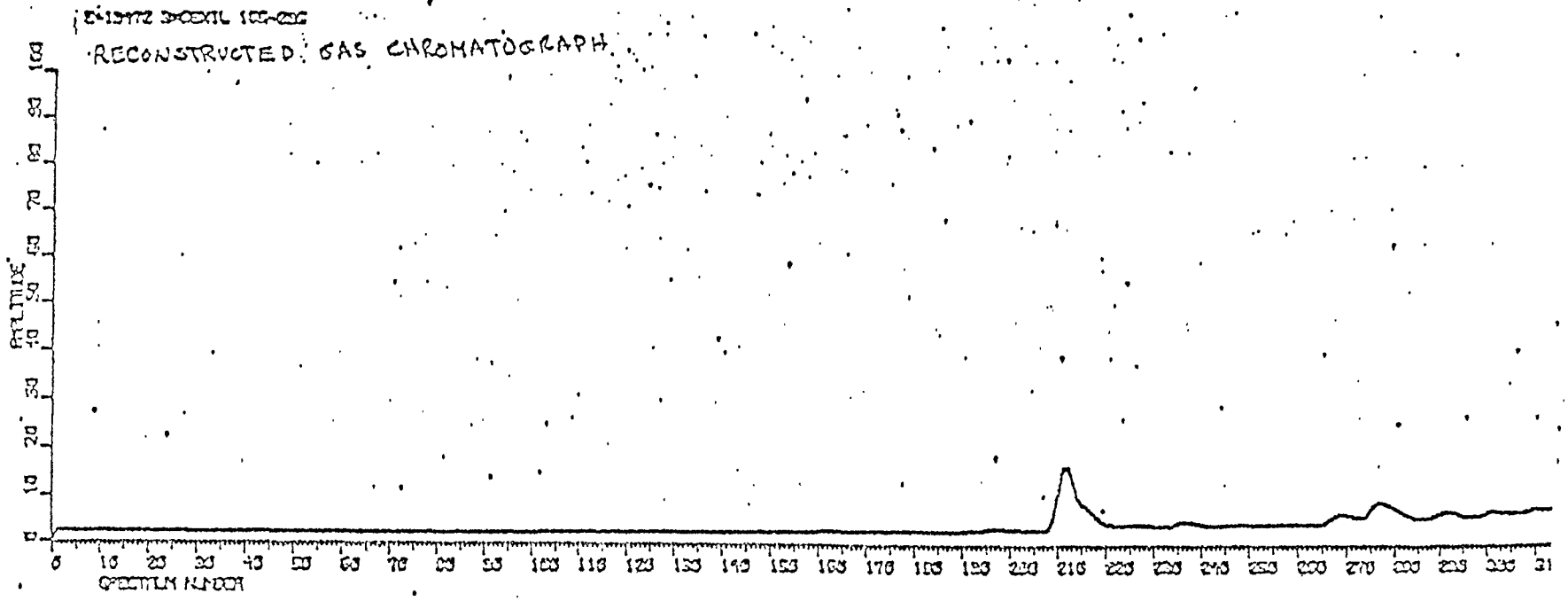


FIGURE 4 (CONT)

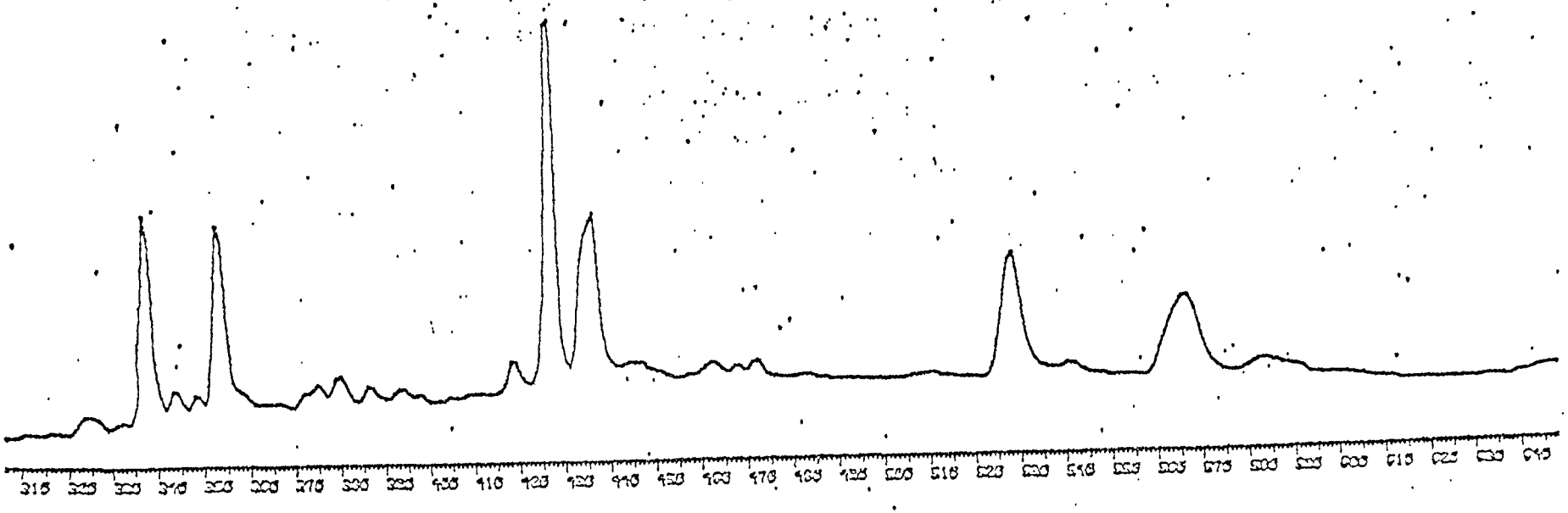


FIGURE 4 (CONT)

Figure 5 gives an RGC limited mass search for the parent ions corresponding to the compounds in the PAH standard mixture. The ions causing the RGC-peaks are indicated above each individual peak. A peak corresponding to m/e 278 is not observed since it is small compared to the 202 peak on which the RGC is normalized. The mass spectra of PAH almost always display intense parent ions. The parent is usually the base peak. Thus performing a limited mass search for the parent is an effective way of defining particular PAH. A cluster is often present about the parent representing the P-1, P-2, P-3, P+1, and P+2 masses; - tha is the parent less one, two, and three and plus one and two amu.

Figure 6 gives an RGC limited mass search for the methyl-substituted derivatives of compounds in the PAH standard mixture. Thus the unsubstituted parents +14 amu were searched. Again, the molecular ions causing the RGC peaks have been indicated.

A limited mass search for dimethyl derivatives, the unsubstituted parents +28 amu, was made but the data were not conclusive and are not being presented.

Searching for unsubstituted ions in the standard and their methyl derivatives produced thirty-three separate GC/MS peaks indicating at least that many compounds. In certain cases two or more PAH were present for a specific RGC peak indicating more than one PAH was eluting from the Dexsil column into the ion source at the same time; this observation is quite reasonable. Searching for the dimethyl derivatives produced an additional eight distinct GC/MS peaks.

FIGURE 5

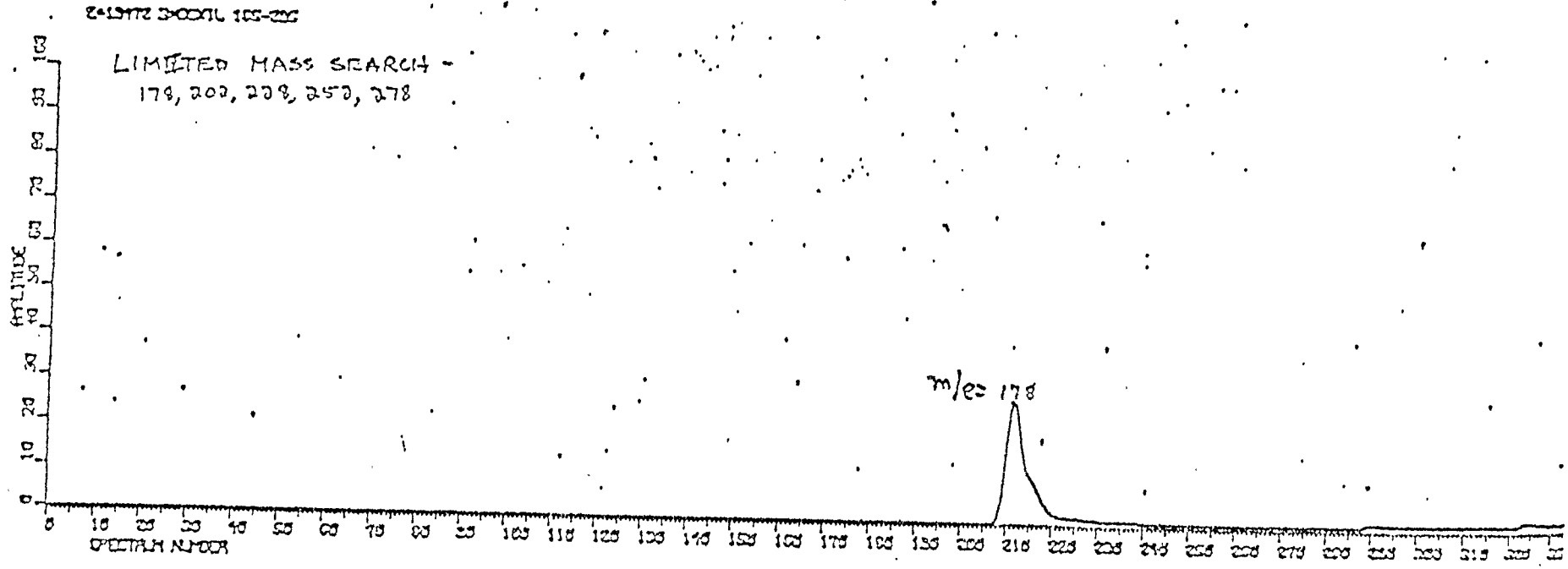


FIGURE 5 (CONT)

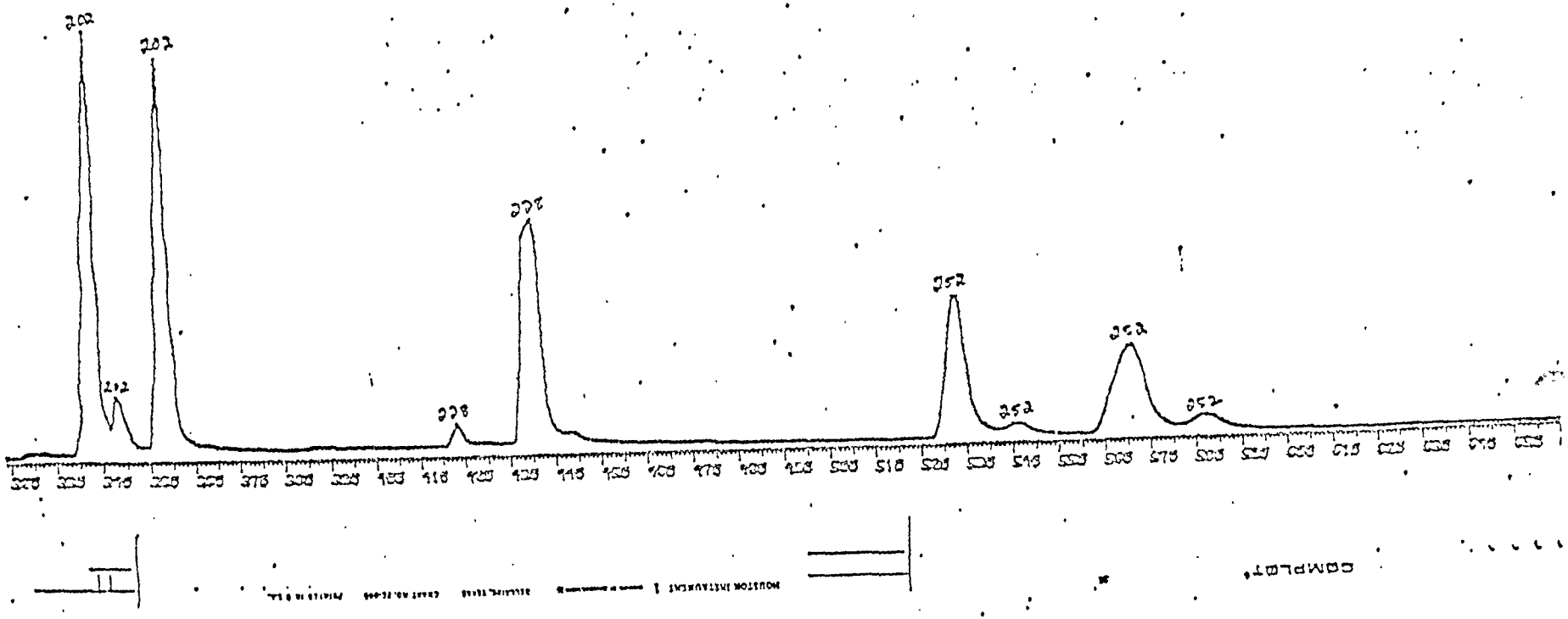


FIGURE 5 (CONT)

FIGURE 6

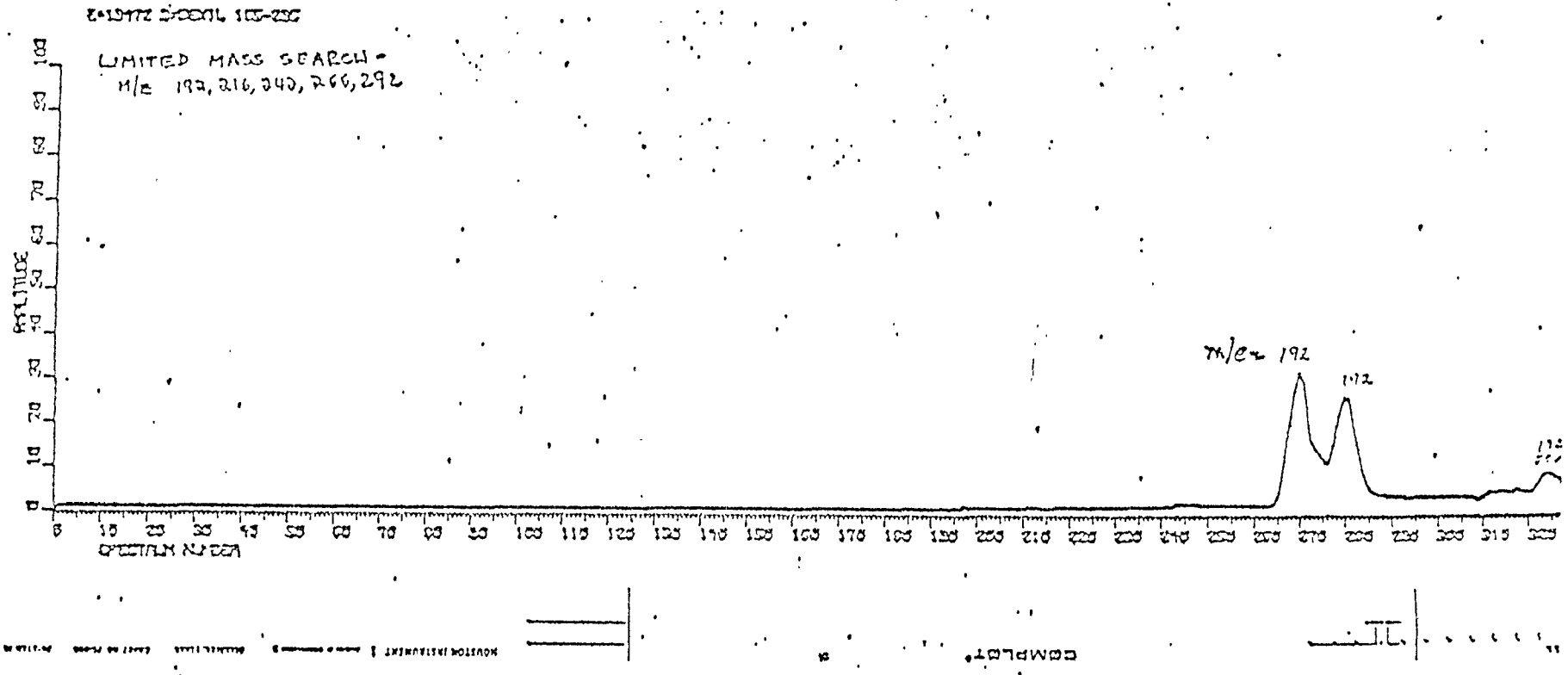
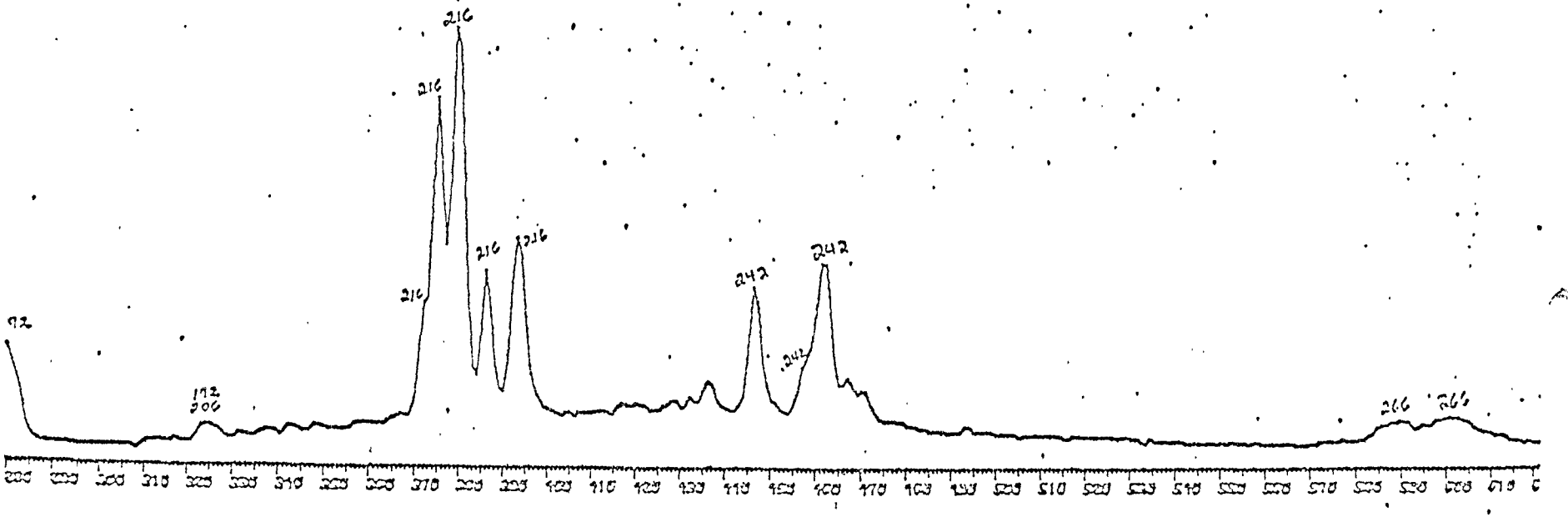


FIGURE 6(CONT)



Mass spectral data show that the sample extract contained almost exclusively PAH. The largest peak in the RGC (Figure 4) was not a PAH but a phthalate derivative with a strong base peak of m/e 149. The presence of this compound cannot be explained.

Presentation of all mass spectra is precluded by space limitations. In Figure 5, however, it can be seen that peaks for phenanthrene + anthracene (m/e 178), fluoranthene (first m/e 202), pyrene (second large m/e 202), benz[a]anthracene and probably chrysene and tetraphene (large broad m/e 228), benz[a]- and benz[e]pyrene (large peak of second m/e 252 doublet) and perylene (last m/e 252 peak) are present. Comparison should be made with Figure 2.

Presentation of selected spectra is useful. Figures 7 through 11 show the mass spectra of major RGC peaks (Figure 5) having m/e 252 as the base peak - the benzfluoranthene, benzpyrene, perylene area. Figures 12 through 15 show the mass spectra of major RGC peaks (Figure 6) having m/e 242 as the base peak. These likely represent methyl-PAH which are not identified. Other unsubstituted PAH having molecular weights of 242 are possible but unlikely. It should be noted the computer was allowed to subtract background from spectra of interest. Thus in Figure 7 spectrum 526-520 signifies that spectrum 520 has been subtracted from 526.

Another method in identifying and confirming molecular formulas by mass spectroscopy employs isotope abundances of the common elements. For PAH one need consider only carbon and hydrogen. For every carbon atom,

FIGURES 7, 8, 9, 10, 11: Mass spectra of PAH having m/e 252 as the base peak in sample 19472.

FIGURES 12, 13, 14, 15: Mass spectra of PAH having m/e 242 as the base peak in sample 19472.

FIGURE 7

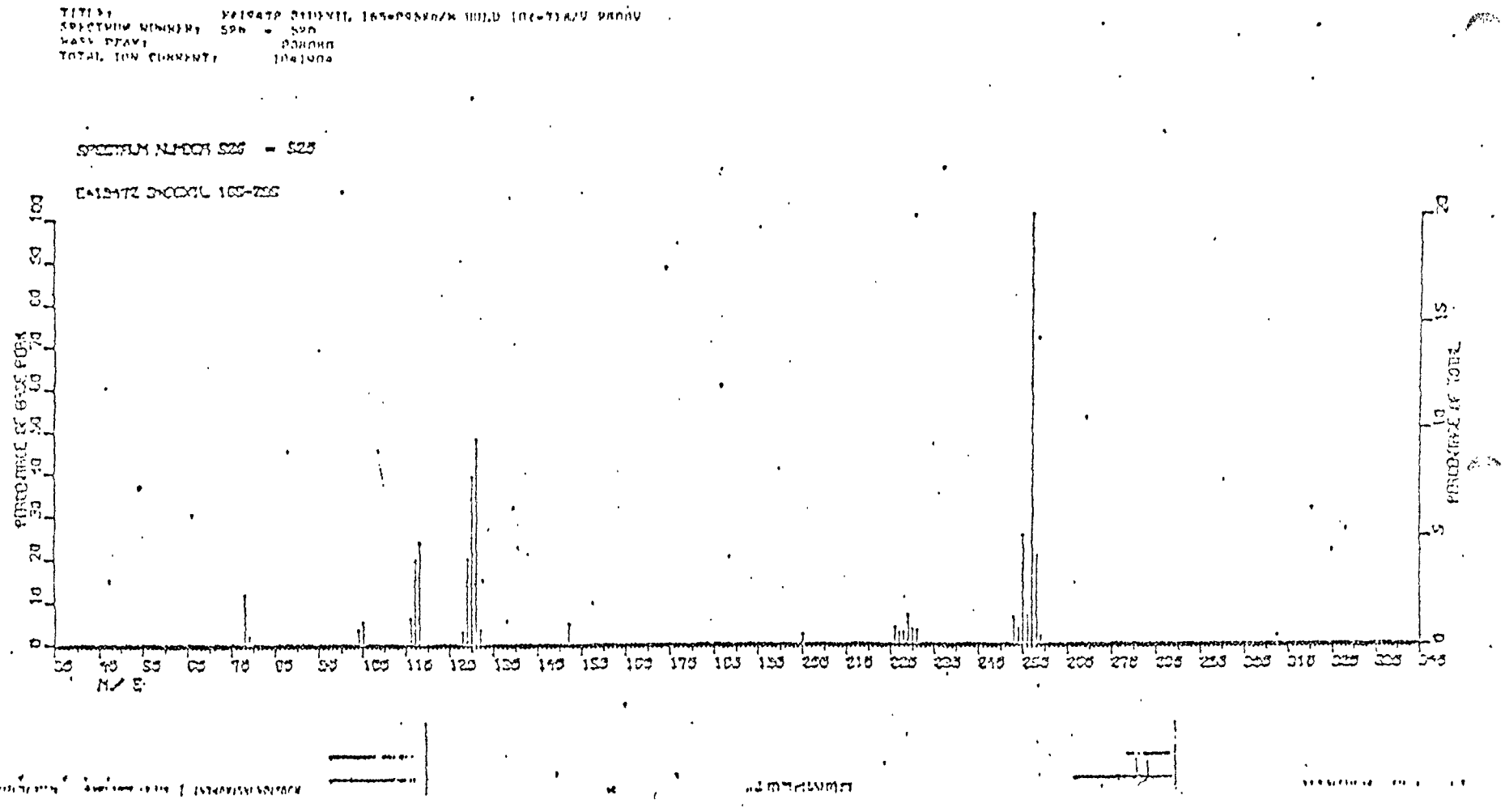


FIGURE 8

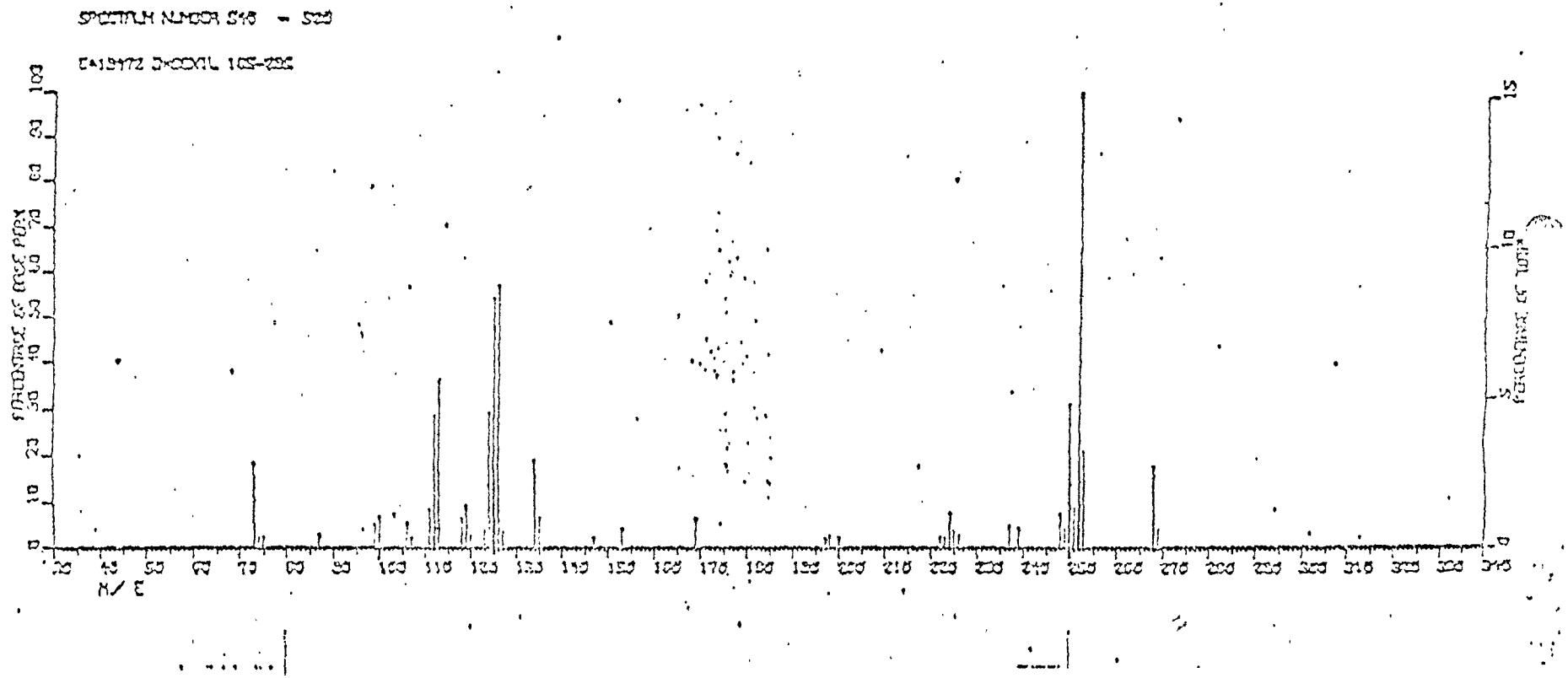


FIGURE 9

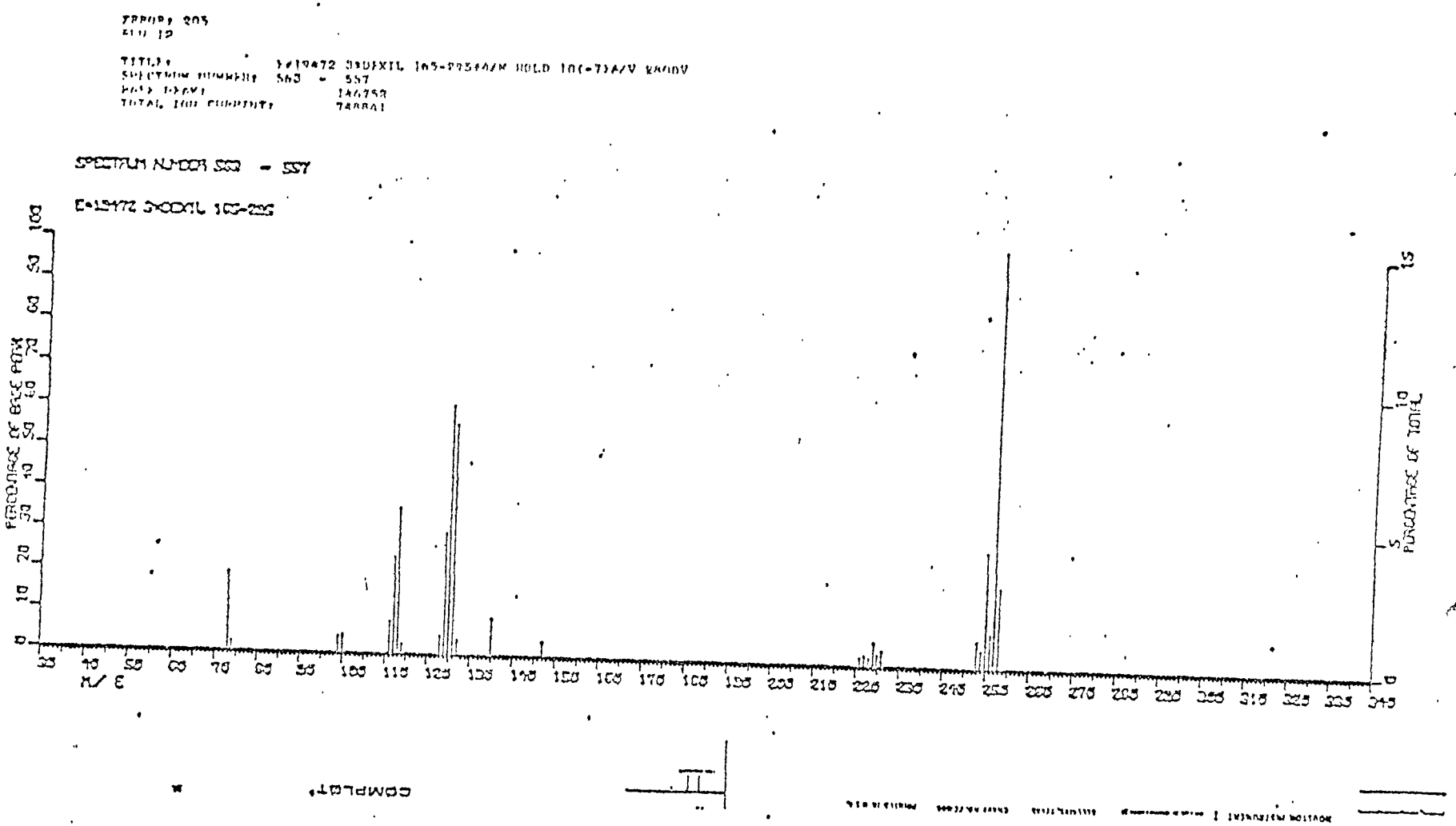

SPECTRUM NUMBER 553 - 557
PERCENTAGE OF BASE PEAK
M/E
PERCENTAGE OF TOTAL
COMPLOT

FIGURE 10

FIGURE 11

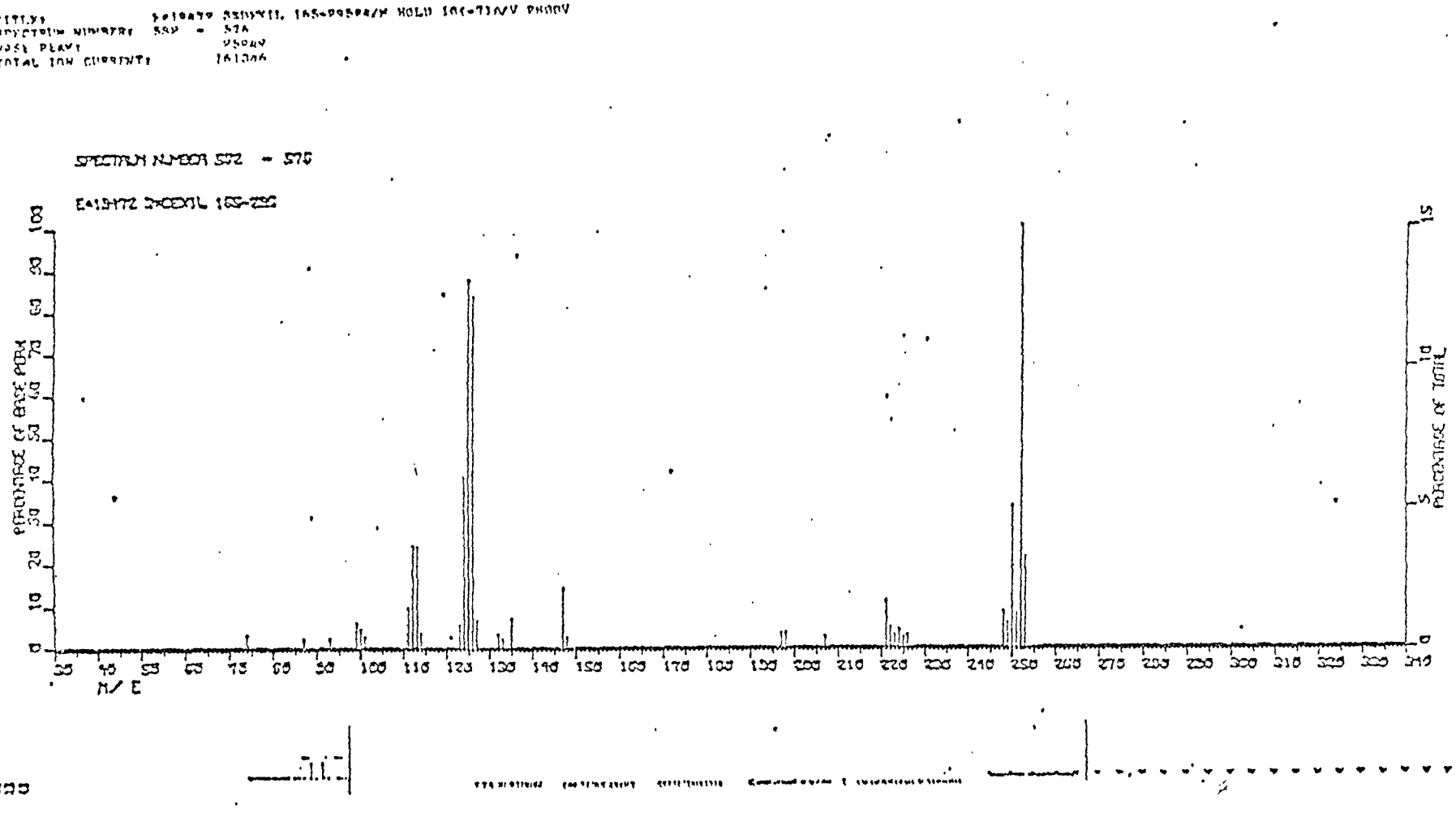

SPECTRUM NUMBER 572 - 575
PERCENTAGE OF BASE PEAK
PERCENTAGE OF TOTAL
M/E

FIGURE 12

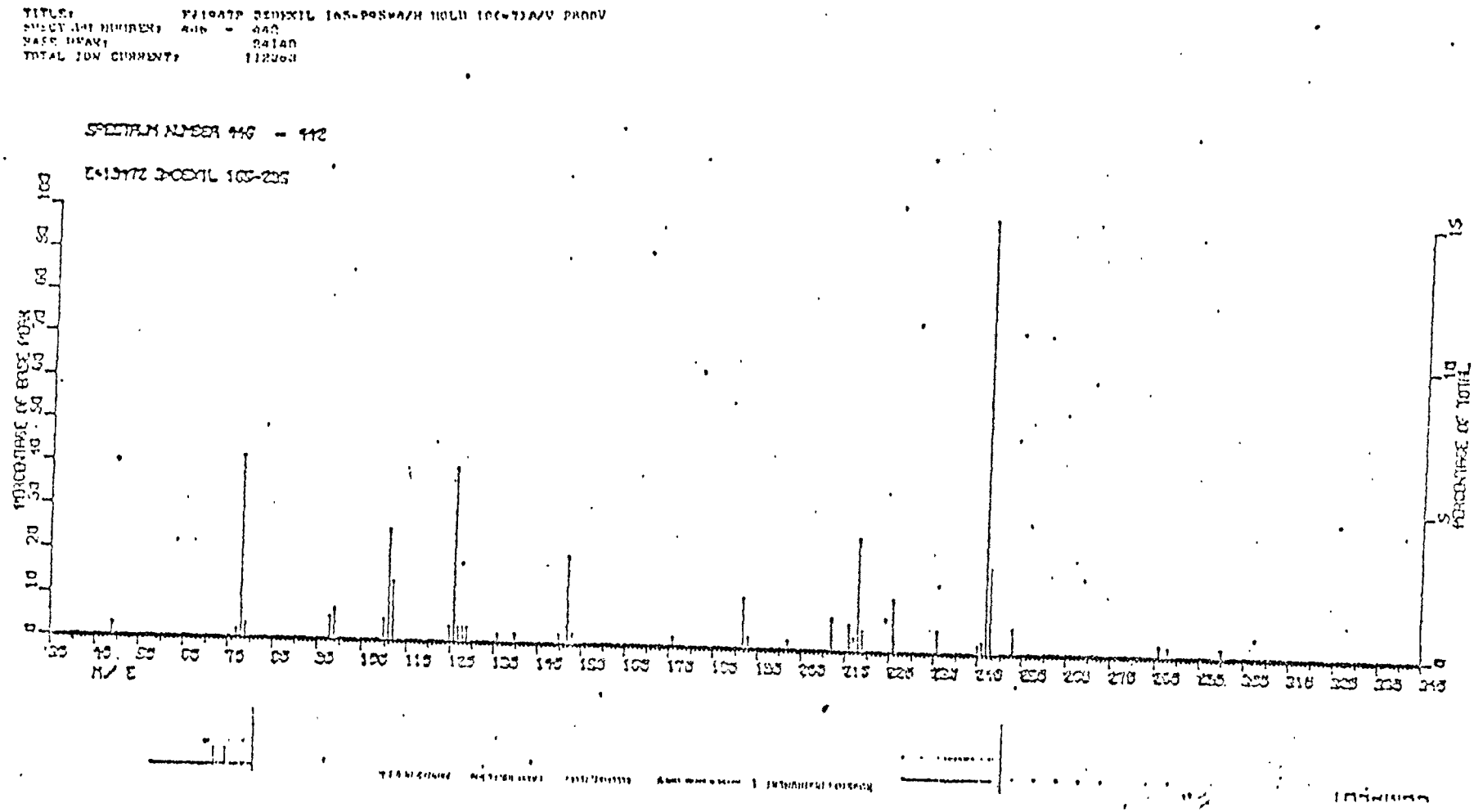


FIGURE 13

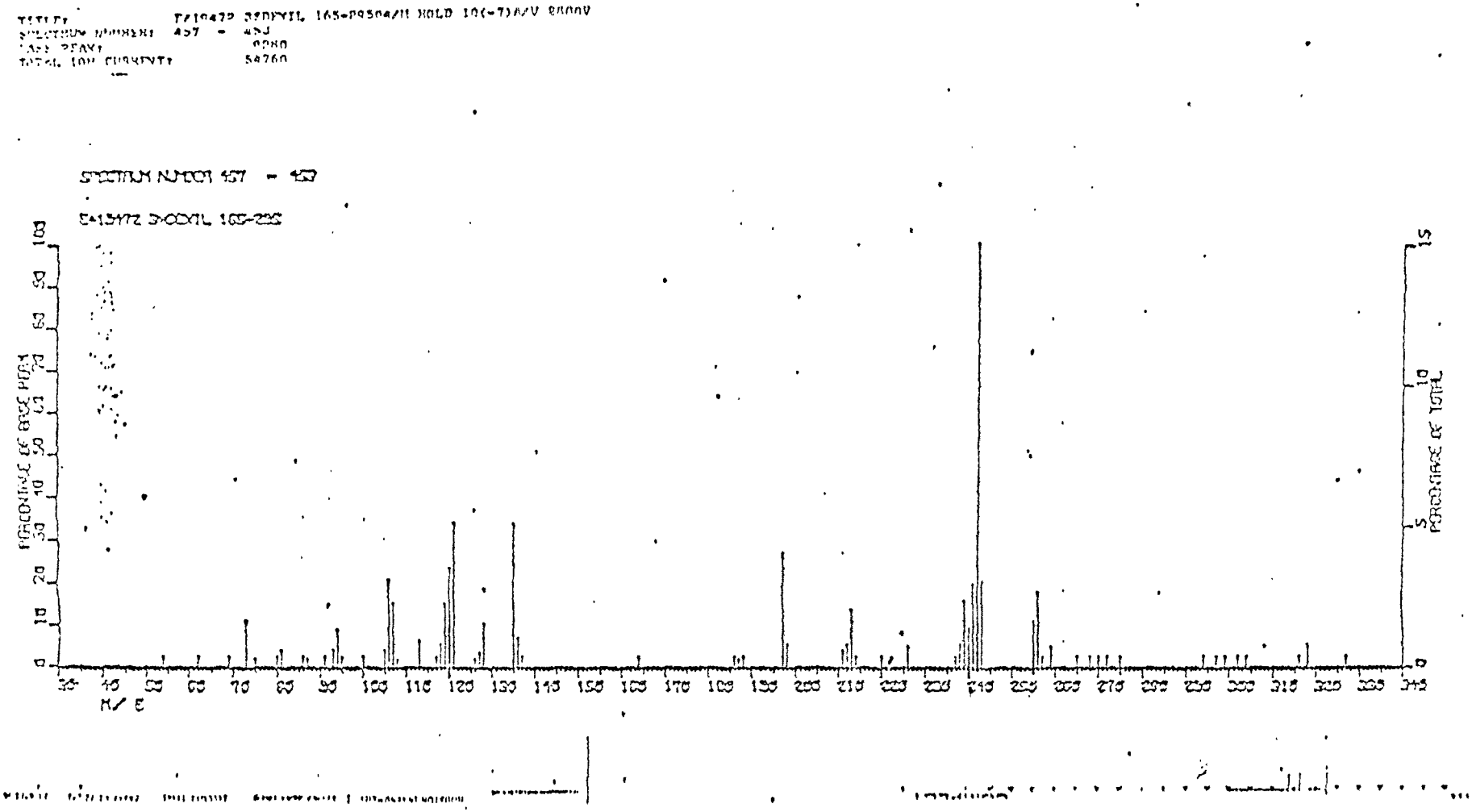

SPECTRUM NUMBER 457 - 457
PERCENTAGE OF BASE PEAK
PERCENTAGE OF TOTAL
M/E

FIGURE 14

TITLE: E/19472 3SDEXIL 165-29504/M HOLD 10(-7)A/V 2800V
SPECTRUM NUMBER: 460 - 453
BASE PEAK: 20577
TOTAL ION CURRENT: 120165

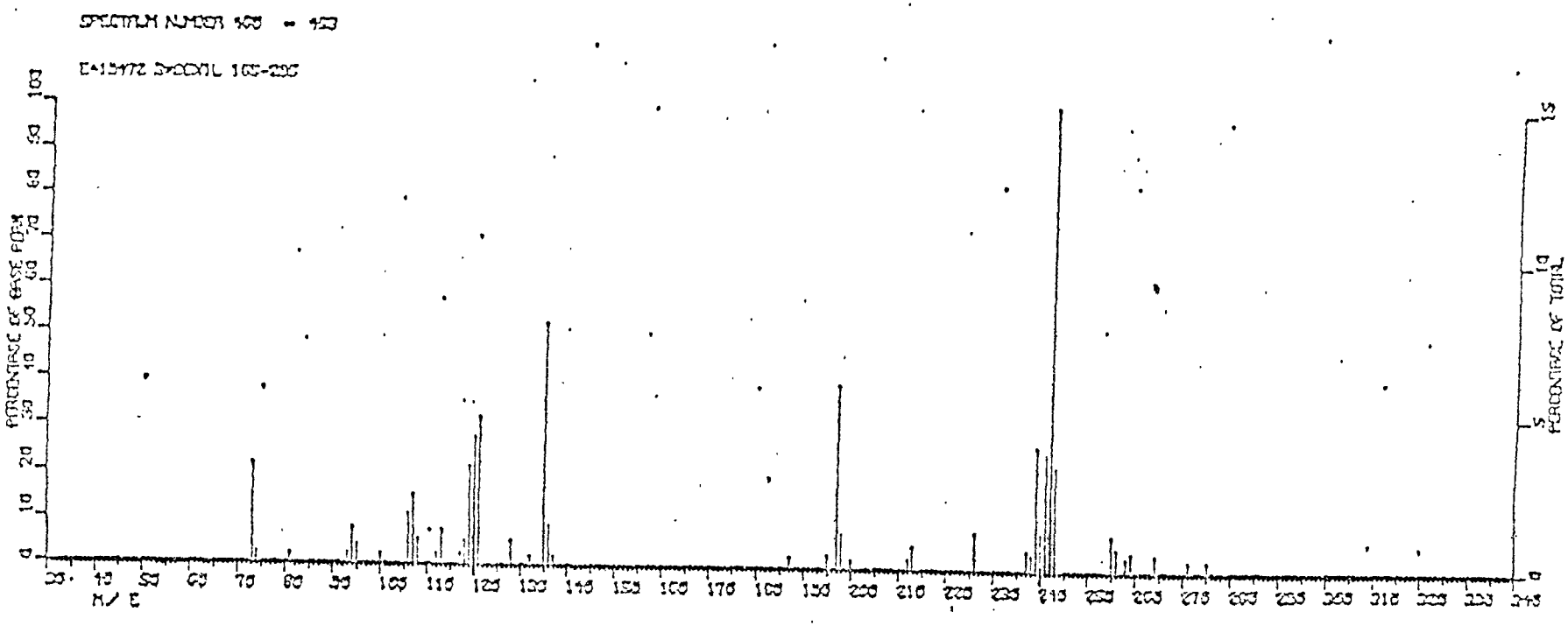
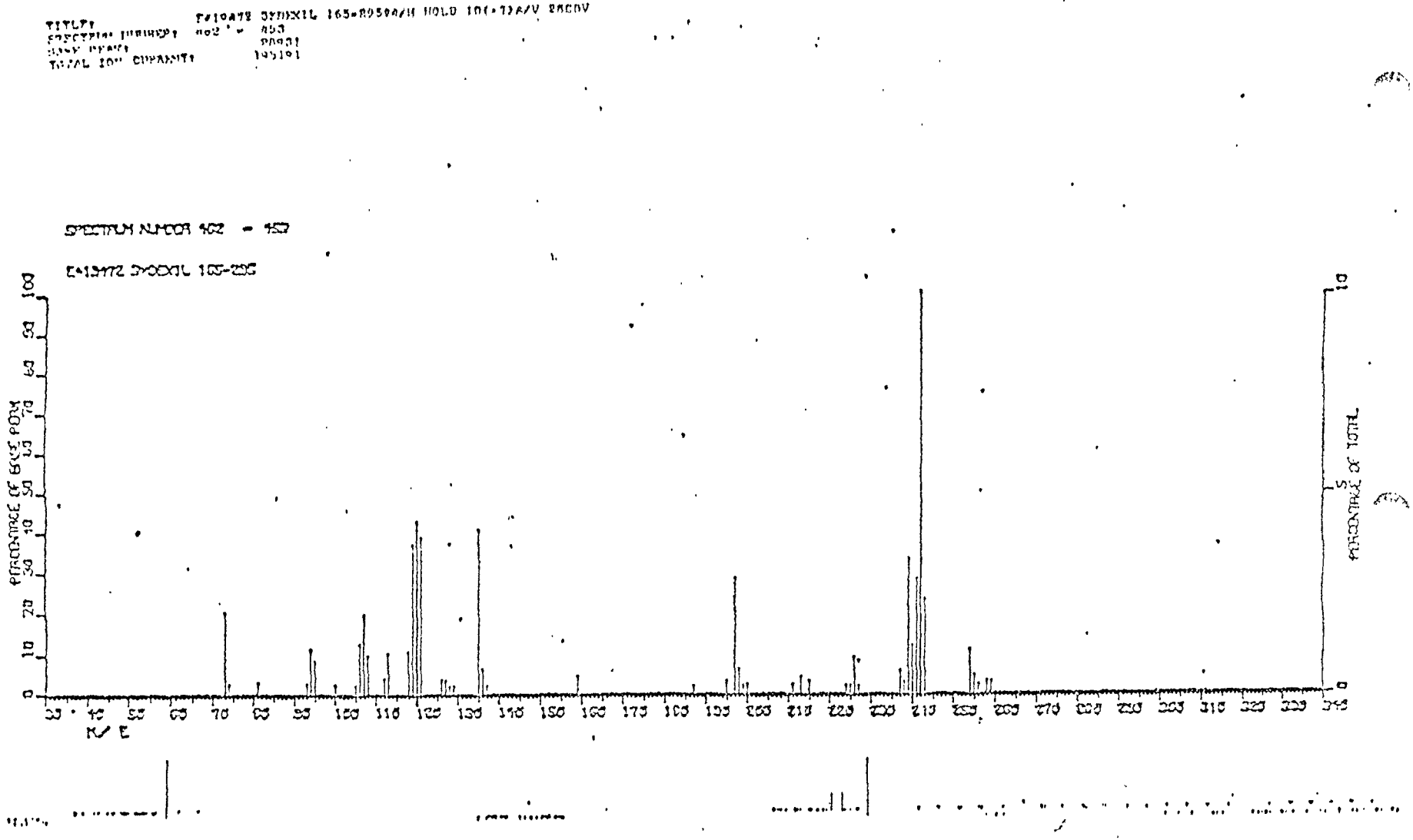


FIGURE 15



ca 1.08% of the molecules containing carbon possess a ^{13}C atom and produce a P + 1 (parent +1) peak. Each atom in an ion contributes an amount to the intensity of the isotope peak that is equal to the relative abundance of the isotope of that atom.[24] Thus if a strong molecular ion is present, as in the case of PAH, the P+1 abundance is useful in identifying a particular molecular formula.[24] The P+2 is also considered, for there exists a probability that two ^{13}C atoms exist in a single ion. Values of P+1 and P+2 have been calculated for the various molecular formulas and are presented in tables.[23,25]

Table VII list P+1 and P+2 isotope abundances for selected PAH of interest. The values are theoretical except for two molecular formulas which represent experimentally determined literature data. Table VIII gives P+1 and P+2 values for the PAH in the ten component standard mixture. Excellent agreement is observed.

Table IX gives the values found for certain major PAH present in sample 19472. The values were obtained from spectra defined by the reconstructed gas chromatograms shown in Figure 5 for unsubstituted and Figure 6 for methyl substituted PAH. Agreement for the unsubstituted PAH is good. In a sample containing often overlapping GC peaks one would not expect agreement to be ideal. This is especially true for the P+2 isotope abundances which is a second-order effect. In addition, spectra were defined by limited mass reconstructed gas chromatographic searches. Overlapping compounds present which are not seen in the limited mass search can easily

interfere with isotope abundance calculations. The total amounts of methyl substituted PAH present are considerably smaller than unsubstituted polynuclears. Thus, one would not expect isotope abundance calculations to be nearly as satisfactory for these cases; this is exactly the situation.

TABLE VII

ISOTOPE ABUNDANCES FOR MOLECULAR FORMULAS CORRESPONDING TO PAH OF INTEREST[a] [22,23,25]

Formula	Molecular Weight	P+1	P+2
$C_{14}H_{10}$	178	15.29	1.09
$C_{15}H_{12}$	192	16.40	1.26
$C_{16}H_{10}$	202	17.45	1.43
$C_{17}H_{12}$	216	18.56	1.62
$C_{18}H_{12}$	228	19.64	1.82
$C_{19}H_{14}$	242	20.76	2.04
$C_{20}H_{12}$	252	21.9	2.4
$C_{22}H_{14}$	278	23.5	3.2

[a] Values are theoretical (reference 23) except for MW 252 and 278; these values are experimental findings (reference 25).

TABLE VIII

ISOTOPE ABUNDANCE FOR PAH STANDARD MIXTURE

Compound Assigned	Formula	Molecular Weight	P+1	P+2
Phenanthrene Anthracene	$C_{14}H_{10}$	178	15.2[a] 15.5[a]	1.3[a] 1.4[a]
Fluoranthene	$C_{16}H_{10}$	202	17.6	1.6
Pyrene	$C_{16}H_{10}$	202	17.7	1.9
Benz[a]anthracene	$C_{18}H_{12}$	228	19.7	2.1
Benz[a]pyrene Benz[e]pyrene	$C_{20}H_{12}$	252	21.1[b]	2.2[b]
Dibenz[a,c]anthracene Dibenz[a,h]anthracene	$C_{22}H_{14}$	278	23.5[b]	3.1[b]

[a] Phenanthrene and anthracene were slightly separated as in Figure 4. Values for each side of the peak were calculated.

[b] Values given are averages for several sections of each peak; each peak represents two compounds; see Figure 2.

TABLE IX

ISOTOPE ABUNDANCES FOR CERTAIN PAH FOUND IN SAMPLE 19472[a]

	Spectrum	PAH Parent Peak	P+1	P+2
A.	Unsubstituted			
	211-206	178	15.4	1.1
	215-206	178	15.6	1.2
	337-333	202	18.3	1.4
	343-333	202	16.8	0.9
	353-349	202	17.9	2.0
	433-430	228	20.1	1.4
	436-430	228	20.0	1.2
	526-520	252	20.3	2.1
	540-530	252	21.9	1.9
	563-557	252	19.6	1.9
	566-557	252	20.4	1.9
	582-576	252	21.5	2.0
	784-775	278	26.7	e
	821-805	278	19.3	e
B.	Methyl Substituted			
	268-262	192	18.2	1.2
	278-262	b	b	b
	372-369	216	16.0	c
	375-369	216	16.6	4.5
	378-369	216	16.0	c
	386-383	216	b	b
	393-390	216	b	b
	446-442	242	19.6	c
	457-453	242	20.7	c
	460-453	242	22.4	c
	462-453	242	23.2	cc

TABLE IX (CONT)

a. Refer to Figure 5 for unsubstituted PAH and Figure 6 for methyl substituted PAH.

b. Overlapping of two or more compounds prevented analysis by this method.

c. P+2 value small or not present.

DISCUSSION

A. SURVEY FINDINGS

Water samples were found not to be contaminated to any significant degree. The coke sewer (002) did show small quantities of organic compounds and likely contained lower molecular weight polynuclear aromatic hydrocarbons (PAH).

The data of Table I shows the presence of substantial amounts of hexane extractable organic residues in sediment samples. All Lorain sediments were surface samples. n-Hexane was used as the extracting solvent for two reasons. First it was felt that use of a halogenated solvent such as Freon would later interfere with gas chromatographic/mass spectrometric analysis of the residues for PAH. In addition, n-hexane was the extracting solvent used in the U. S. Steel Calumet survey and it was felt that comparisons between the two surveys would need to be drawn.

Calumet data[26] show "oil and grease" values as high as 120,000 ppm for one sample and over 60,000 ppm for many others; some of these were core samples. Lorain data show, overall, slightly lower oil and grease values. This could be consistent with the fact that the Black River has recently been dredged.

Reasonably, the highest "oil and grease" values in the Lorain survey were found in the vicinity of the plant discharge points. The lowest values determined were at the harbor mouth and 2-3 miles downstrean from the outfalls. The low value for sample 19468 cannot be explained.

It is tempting to try to draw analogies between amounts of organic residue and particular classes of organic compounds present in sediment samples. In certain cases this can no doubt be done; however, caution must be exercised. For example while samples 19472 and 19474 yielded similar amounts of organic residue, their chemical compositions are quite different.

Table VI and other data presented in the Results section shows that a broad spectrum of PAH is present in the sediment samples. The highest concentrations are in the vicinity of the plant outfalls with the levels in 19472 being 2-10 fold greater, depending on specific PAH, than for any other sample analyzed. Lowest values are found for sample 19466 (harbor mouth), 19467 (center of the river mouth), and 19476 (0.2 miles upstream from outfall 001). It is reasonable that PAH were found in all samples since the sampling sites were in close proximity to the plant. A lake effect is known to occur carrying water upstream at least five miles from the river mouth.[27] Because this survey represented the first attempt in this laboratory to quantitatively analyze for many PAH, one probably should place wide tolerance limits on the accuracy of the data in Table VI. The data certainly reflect the levels of PAH in the analyzed samples; however, errors of $\pm$ 15% would not be unexpected.

Many of the PAH found in the sediment samples are without question carcinogenic. These include not only compounds reported in Table VI (see also Table V). Since a broad envelope of PAH was shown qualitatively to be present, many unidentified compounds containing four or more rings, are no doubt carcinogenic. In particular are the methyl substituted PAH which have been shown to possess a high degree of carcinogenicity.[5,20]

B. OTHER COMMENTS

The general philosophy taken at the outset of the survey was to analyze for a broad envelope of PAH rather than for one or two compounds. This approach proved to be successful and we believe that future surveys should be handled in a similar fashion.

The analysis for complex mixtures of PAH constitutes one of the most difficult determinations in organic chemistry; the data presented in this report are clear evidence of this fact. Optimum conditions for separating PAH from other classes of organic compounds had to be determined. GC and GC/MS analyses techniques had to be perfected. The PAH fraction (B_{II}) is complex and requires careful and detailed analysis and interpretation. These criteria were met and meaningful data were obtained.

In subsequent surveys, in other geographical locations, our capabilities will be extended. For example, we intend on obtaining a stock of PAH primary standards available from the Canadian Air Pollution Control Directorate, Department of the Environment, Ottawa.[28] These will allow us to quantitate upwards of 50 PAH.

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Attachment L

U.S. EPA Survey, September 16, 1975

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: September 16, 1975

(mg/l unless otherwise noted) FLOW: 61 cfs at RM 10.1

Station #	9	8	7	6T	6M	6B	5T	5M	5B	4T	4M	4B
Location	WI-3	RM 3.35	Above turning basin		RM 2.8			RM 2.4			RM 1.2	RM 1.2
Conductivity (µmho/cm)	485-557	479-535	467-500	503	499	494	531	492	527	425	413	322
Temp. °C												
Max.	23.0	24.7	24.5	24.8			22.2	21.0	19.1	21.3	21.0	19.1
Ave.	21.6	22.6	23.8	24.2								
Min.	21.0	21.3	22.9	23.5								
D.O.												
Max.	4.57	4.07	3.57	3.52			2.4	1.8	3.6	2.1	1.8	3.9
Ave.	4.16	3.67	3.12	3.39								
Min.	3.92	3.38	1.93	3.21								
Dissolved Solids				320	330	360				290	270	270
COD				26	27	36				24	20	18
TOC				9	9	12				7	7	6
BOD_5							9.0	8.0	8.9	6.3	4.9	4.1
BOD_{20}							13.6	11.7	13.6	8.4	6.0	5.6
Phosphorus Total				0.30	0.32	0.31				0.10	0.10	0.10
TKN				3.30	2.80	2.91				1.60	1.30	1.00
Ammonia-N				2.11	1.58	1.68				0.96	0.72	0.49
Nitrate + Nitrite-N				1.54	1.48	1.55				1.35	1.28	0.88
Chloride				47	43	46				35	32	28
Fluoride				0.45	0.36	0.45				0.39	0.36	0.30
Sulfate				84	81	91				60	54	45
T. Sodium				30.2	28.2	34.0				19.1	17.3	14.6

Region V
Eastern District Office

Stream: Black River
Survey Date: September 16, 1975

(mg/l unless otherwise noted) FLOW: 61 cfs at RM 10.1

Station #	3T	3M	3B	2T	2M	2B	1T	1M	1B
Location		River Mouth			Harbor Mouth			Open Lake	
Conductivity (µmho/cm)	402	366	263	305	281	256	255	252	251
Temp. °C Max.	20.9	19.4	18.5	19.6	18.6	18.3	18.6	18.6	18.6
Ave.					6.7	7.3			
Min.									
D.O. Max.	2.5	3.3	2.5	5.5	6.7	7.3	6.9	6.9	6.9
Ave.									
Min.									
Dissolved Solids	300	360	250	250	240	230	220	210	230
COD	19	16	17	11	19	18	18	11	8
TOC	5	5	5	5	4	4	5	4	3
BOD_5	5.1	3.5	2.9	2.6	1.9	1.6	1.1	0.8	0.9
BOD_{20}	7.2	5.2	4.2	4.3	4.5	3.9	2.4	2.0	1.9
Phosphorus Total	0.10	0.10	0.10	0.11	0.07	0.04	0.06	0.05	0.06
TKN	1.30	0.70	0.60	0.64	0.48	0.37	0.56	0.36	0.40
Ammonia-N	0.77	0.32	0.23	0.20	0.08	0.07	0.08	<0.03	<0.03
Nitrate + Nitrite-N	1.28	0.70	0.42	0.53	0.26	0.22	0.10	0.10	0.10
Chloride	32	25	23	22	19	19	18	18	18
Fluoride	0.35	0.27	0.20	0.21	0.18	0.18	0.13	0.14	0.13
Sulfate	54	40	35	35	28	26	25	21	21
T. Sodium	17.3	11.9	11.3	11.1	9.6	9.3	8.5	8.1	8.1

Attachment M

U.S. EPA Survey, July 16-19, 1979

Table M-1

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

Station Number	LE	H	1	2	3	4	5
River Mile		-.6	0.0	1.04	1.85	2.40	2.85
Flow, cfs (avg.)							
pH (range)	6.9	6.9	6.3-7.2	6.2-7.1	7.1-7.9	7.4-7.9	7.4-7.8
Cond. (µmhos/cm)	180-290	180-320	210-380	210-435	220-580	230-550	300-650
Temp.°C max.	25.1	27.5	28.5	28.5	30.0	31.0	30.5
avg.	23.5	23.8	24.1	24.8	25.4	25.7	28.9
min.	20.5	21.0	21.0	22.0	21.2	21.5	26.5
DO max.	10.5	12.4	12.4	11.2	10.2	11.5	6.3
avg.	9.0	8.4	7.0	4.8	4.5	4.0	4.1
min.	4.0	4.2	1.9	2.8	2.8	1.8	3.0
Dissolved Solids	146	202	200	199	315	245	312
Suspended Solids	17	16	11	22	25	15	14
BOD_5	3.25	3.1	3.25	4.0	4.5	4.6	5.7
BOD_{30}	5.6	6.0	6.6	8.8	9.8	10.4	13.8
COD	10	13	12	15	17	11	18
TOC	4	4	4	4	4	2	5
TKN	0.16	0.65	0.74	1.47	1.36	1.04	2.19
Ammonia-N	0.05	0.18	0.34	0.64	0.93	0.71	1.62
Nitrate+Nitrite-N	0.64	0.89	1.03	1.01	1.08	0.66	1.53
Chloride	19	21	24	28	30	31	41
Sulfate	27	29	35	43	47	48	70
Cyanide (µg/l)	< 5	< 5	< 5	< 5	7	14	18
Phenolics (µg/l)	5	4	< 2	5	3	< 2	3

Table M-1

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

				French Creek			
Station Number	6	7	8	9	10	11	12
River Mile	3.35	3.88	4.85	5.10	6.50	8.60	10.10
Flow, cfs (avg)							
pH (range)	7.3-7.8	7.0-7.6	7.3-7.8	7.5-8.0	7.3-7.7	7.1-7.9	7.0-7.8
Cond. (µmhos/cm)	340-700	600-700	650-820	670-920	660-740	640-750	680-770
Temp.°C max.	32.0	31.0	32.0	27.5	29.0	28.0	28.5
avg.	29.7	29.7	29.2	24.1	26.2	25.3	25.7
min.	27.0	28.0	24.0	21.0	24.0	23.0	22.2
DO max.	4.5	6.5	5.4	9.6	7.9	6.2	9.2
avg.	3.0	3.8	4.2	7.7	4.9	4.4	7.0
min.	1.4	1.2	2.9	5.8	2.1	2.7	4.7
Dissolved Solids	294	468	473	662	523	521	522
Suspended Solids	9	14	6	5	18	< 5	8
BOD_5	6.25	8.1	9.25	3.4	8.7	13.25	14.0
BOD_{30}	14.5	17.4	21.1	6.3	22.1	30.8	35.6
COD	24	30	45	18	34	44	50
TOC	6	12	16	5	12	15	20
TKN	2.36	2.03	2.66	0.58	3.95	4.98	5.50
Ammonia-N	1.75	1.09	1.51	0.08	2.86	3.59	3.90
Nitrate+Nitrite-N	1.95	1.66	2.92	8.46	3.20	3.12	3.11
Chloride	45	65	62	92	58	60	60
Sulfate	78	123	117	174	108	106	110
Cyanide (µg/l)	18	28	27	< 5	31	25	16
Phenolics (µg/l)	5	6	7	2	5	3	3

Table M-1

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

Station Number	13
River Mile	10.80
Flow, cfs (avg)	
pH (range)	6.8-8.4
Cond. (µmhos/cm)	510-600
Temp.°C max.	29.5
avg.	26.2
min.	24.0
DO max.	11.6
avg.	7.9
min.	5.8
Dissolved Solids	396
Suspended Solids	< 5
BOD_5	6.1
BOD_{30}	12.3
COD	33
TOC	14
TKN	1.05
Ammonia-N	0.10
Nitrate+Nitrite-N	3.94
Chloride	46
Sulfate	112
Cyanide (µg/l)	< 5
Phenolics (µg/l)	3

Table M-2

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

(mg/l unless otherwise stated)

Station Number	LE	H	1	2	3	4	5
River Mile		-.6	0.0	1.04	1.85	2.40	2.85
Flow, cfs (avg)							
pH (range)	7.3-8.7	7.4-8.6	7.2-8.4	7.3-8.3	7.2-7.8	7.4-7.8	7.4-7.8
Cond. (µmhos/cm)	220-325	240-330	250-410	260-450	295-720	300-570	380-660
Temp. °C max.	25.0	25.0	26.5	27.0	29.0	29.0	29.7
avg.	24.0	23.8	24.2	25.2	26.2	26.6	28.2
min.	22.0	22.0	21.5	22.5	23.0	23.6	24.5
DO max.	9.7	9.2	9.7	12.0	6.3	4.4	4.1
avg.	8.6	7.7	6.8	5.5	2.9	2.3	2.3
min.	5.8	4.3	3.9	3.0	1.9	1.8	1.7
Dissolved Solids	179	192	226	247	275	274	296
Suspended Solids	9	< 5	12	12	24	15	19
BOD_5	2.1	1.8	2.6	3.2	3.4	3.2	3.9
BOD_{30}	4.3	4.2	6.8	9.6	10.2	10.2	12.0
COD	9	11	13	14	15	13	14
TOC	4	3	5	5	8	7	9
TKN	0.63	0.44	0.69	1.38	1.65	1.84	2.38
Ammonia-N	0.09	0.10	0.32	0.80	1.23	1.37	1.78
Nitrate+Nitrite-N	0.57	0.71	1.08	1.20	1.04	1.12	1.41
Chloride	19	21	20	27	33	32	39
Sulfate	25	26	29	41	54	52	67
Cyanide (µg/l)	< 5	< 5	< 5	6	12	13	13
Phenolics (µg/l)	< 2	2	2	< 2	4	4	4

Table M-2

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

(mg/l unless otherwise stated)

				French Creek			
Station Number	6	7	8	9	10	11	12
River Mile	3.35	3.88	4.85	5.10	6.50	8.60	10.10
Flwo, cfs (avg)							
pH (range)	7.4-7.8	7.0-7.8	7.2-7.8	7.9	7.5-7.8	7.5-7.7	7.8-8.0
Cond. *µmhos/cm)	375-700	600-700	500-850	850-940	670-790	625-830	650-830
Temp.°C max.	31.0	32.0	31.0	24.5	26.8	25.5	26.0
avg.	28.6	29.8	28.6	21.6	24.3	23.4	23.4
min.	25.0	28.0	25.0	18.7	22.5	21.0	20.5
DO max.	2.4	6.2	3.2	10.6	5.4	4.6	9.7
avg.	1.6	3.5	2.6	8.2	3.9	3.5	6.9
min.	.6	1.4	1.0	6.3	2.2	2.5	4.8
Dissolved Solids	325	465	443	624	462	503	506
Suspended Solids	10	11	18	11	30	13	24
BOD_5	3.6	7.9	6.3	1.7	9.2	11.1	11.0
BOD_{30}	12.7	3.3	18.9	4.6	24.0	31.6	38.5
COD	18	36	39	18	38	40	24
TOC	8	31	7	8	16	16	51
TKN	2.64	2.73	2.96	0.67	4.38	5.08	5.73
Ammonia-N	1.85	1.50	1.69	0.03	3.12	3.71	3.93
Nitrate+Nitrite-N	1.51	2.48	2.32	9.39	2.93	2.55	2.50
Chloride	42	62	61	93	64	71	71
Sulfate	73	117	115	180	118	130	133
Cyanide (µg/l)	25	31	33	< 5	29	24	18
Phenolics (µg/l)	6	2	4	4	4	8	8

Table M-2

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

(mg/l unless otherwise stated)

Station Number		13
River Mile		10.80
Flow, cfs (avg)		
pH (range)		8.4-8.8
Cond. (µmhos/cm)		620-700
Temp. °C	max.	26.5
	avg.	24.4
	min.	22.0
DO	max.	13.7
	avg.	9.6
	min.	6.0
Dissolved Solids		442
Suspended Solids		26
BOD_5		6.2
BOD_{30}		13.2
COD		30
TOC		14
TKN		1.49
Ammonia-N		0.07
Nitrate+Nitrite-N		3.36
Chloride		47
Sulfate		133
Cyanide (µg/l)		5
Phenolics (µg/l)		—

Table M-3

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number	LE	H	1	2	3	4	5
River Mile		-.6	0.0	1.04	1.85	2.40	2.85
Flow,cfs (average)							
pH (range)	8.3	8.0-8.2	8.0-8.1	7.7-7.9	6.8-7.9	7.0-7.7	7.0-7.7
Cond. (µmhos/cm)	220-285	270-345	220-435	320-500	300-525	300-525	380-700
Temp.°C max.	24.5	26.0	26.5	27.0	28.5	29.7	30.0
avg.	23.5	24.2	24.6	24.8	26.5	26.9	28.0
min.	22.0	22.0	22.0	22.0	23.0	23.2	25.0
DO max.	9.0	8.8	8.9	9.8	4.7	6.2	4.6
avg.	8.7	8.0	7.4	5.8	3.5	2.9	2.7
min.	8.1	7.2	6.0	3.2	2.1	2.0	2.2
Dissolved Solids	196	208	230	269	268	283	341
Suspended Solids	11	14	23	17	25	15	17
BOD_5	1.3	1.9	2.4	3.3	3.9	4.1	3.9
BOD_{30}	3.0	4.3	5.6	8.8	11.0	12.0	12.0
COD	7	11	12	18	13	16	17
TOC	<3	3	1.3	4	5	5	5
TKN	0.71	0.40	0.72	1.45	2.08	1.82	2.33
Ammonia-N	0.06	0.05	0.18	0.81	1.15	1.31	1.69
Nitrate+Nitrite-N	0.58	0.68	0.91	1.22	1.21	1.23	1.48
Chloride	18	20	24	31	33	33	40
Sulfate	27	29	36	50	56	55	70
Cyanide (µg/l)	<5	<5	<5	<5	<5	<5	7
Phenolics (µg/l)	4	4	12	4	2	<2	<2

Table M-3

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number	6	7	8	French Creek 9	10	11	12
River Mile	3.35	3.88	4.85	5.10	6.50	8.60	10.10
Flow, cfs (average)							
pH (range)	7.0-7.6	6.8-7.5	7.0-7.6	6.9-8.1	6.3-7.7	6.4-7.7	6.6-8.0
Cond. (µmhos/cm)	360-710	580-650	600-850	890-960	710-810	700-850	700-860
Temp.°C max.	31.0	30.0	29.5	23.5	25.5	25.0	25.5
avg.	28.9	28.9	28.1	20.9	23.9	23.0	22.9
min.	26.0	28.0	26.5	18.0	22.0	21.0	20.0
DO max.	2.8	4.9	3.7	10.4	5.5	4.0	10.6
avg.	2.0	3.7	3.0	8.6	3.8	3.3	7.3
min.	.7	2.4	2.0	6.8	2.3	2.1	4.6
Dissolved Solids	354	433	476	645	537	555	539
Suspended Solids	7	34	22	6	17	16	14
BOD_5	3.9	11.0	7.8	2.0	6.6	10.8	12.7
BOD_{30}	13.4	2.4	20.9	5.2	27.4	33.0	$\geq$41.2
COD	21	38	40	16	34	43	55
TOC	9	14	14	7	18	15	19
TKN	2.56	2.96	3.15	0.68	4.65	5.36	6.51
Ammonia-N	1.77	1.67	1.76	0.06	3.25	3.84	4.49
Nitrate+Nitrite-N	1.60	2.25	2.28	8.68	2.27	2.00	1.96
Chloride	44	59	63	97	74	79	84
Sulfate	78	115	120	182	137	140	140
Cyanide (µg/l)	7	< 5	9	< 5	17	10	19
Phenolics (µg/l)	6	4	< 2	4	4	6	8

Table M-3

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number	13
River Mile	10.80
Flow, cfs (average)	
pH (range)	6.6-8.4
Cond. (µmhos/cm)	615-700
Temp.°C max.	26.5
avg.	23.8
min.	20.5
DO max.	15.0
avg.	10.8
min.	5.7
Dissolved Solids	458
Suspended Solids	10
BOD_5	6.5
BOD_{30}	15.0
COD	34
TOC	15
TKN	1.96
Ammonia-N	0.12
Nitrate+Nitrite-N	2.69
Chloride	50
Sulfate	138
Cyanide (µg/l)	< 5
Phenolics (ug/l)	4

Table M-4

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

Station Number		LE	H	1	2	3	4	5
River Mile			-.6	0.0	1.04	1.85	2.4	2.85
Calcium				44.5		45.5	57.5	58.7
Magnesium				9.5		10.1	11	11.2
Sodium				12.9		15.7	19.7	24
Silver	(µg/l)			< 1		< 1	< 1	< 1
Aluminum	(µg/l)			296		384	161	< 90
Boron	(ug/l)			< 80		100	106	163
Barium	(µg/l)			20		25	24	19
Beryllium	(µg/l)			< 1		< 1	< 1	< 1
Cadmium	(µg/l)			< 2		< 2	< 2	< 2
Cobalt	(µg/l)			< 2		< 2	< 2	< 2
Chromium	(µg/l)			< 5		9	< 5	8
Copper	(µg/l)			< 9		10	< 9	< 9
Iron	(µg/l)			1010		1540	1200	741
Manganese	(µg/l)			88		180	211	201
Molybdenum	(µg/l)			< 6		< 6	< 6	< 6
Nickel	(µg/l)			< 5		12	< 5	6
Lead	(µg/l)			< 15		< 15	< 15	< 15
Tin	(µg/l)			116		< 8	< 8	< 8
Titanium	(µg/l)			12		14	11	9
Vanadium	(µg/l)			< 2		3	< 2	3
Yttrium	(µg/l)			< 2		3	< 2	< 2
Zinc	(µg/l)			< 50		< 50	88	115

Table M-4

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

Station Number		6	7	8	9	10	11	12
River Mile		3.35	3.88	4.85	5.1	6.5	8.6	10.1
Calcium		59.5		72.7	85.2	72.1	70.3	69.6
Magnesium		12.7		15.8	17.7	17.2	17.4	17.5
Sodium		30.2		46.7	72	41.0	44.8	43.5
Silver	(µg/l)	< 1		< 1	< 1	< 1	< 1	< 1
Aluminum	(µg/l)	< 90		< 90	< 90	< 90	< 90	< 90
Boron	(µg/l)	193		355	411	239	296	370
Barium	(µg/l)	22		26	24	182	190	165
Beryllium	(µg/l)	< 1		< 1	< 1	< 1	< 1	< 1
Cadmium	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Cobalt	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Chromium	(µg/l)	6		10	< 5	11	16	21
Copper	(µg/l)	< 9		10	< 9	12	18	20
Iron	(µg/l)	745		1750	251	721	479	507
Manganese	(µg/l)	202		147	36	86	72	73
Molybdenum	(µg/l)	< 6		< 6	< 6	< 6	7	16
Nickel	(µg/l)	< 5		< 5	< 5	38	22	34
Lead	(µg/l)	< 15		< 15	< 15	< 15	< 15	< 15
Tin	(µg/l)	< 8		116	< 8	< 8	< 8	< 8
Titanium	(µg/l)	9		12	7	15	14	9
Vanadium	(µg/l)	< 2		< 2	4	8	3	4
Yttrium	(µg/l)	< 2		< 2	4	< 2	< 2	< 2
Zinc	*µg/l)	52		98	< 50	< 50	< 50	< 50

Table M-4

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 16-17, 1979

(mg/l unless otherwise stated)

Station Number		13
River Mile		10.8
Calcium		65.9
Magnesium		15.9
Sodium		30.6
Silver	(µg/l)	< 1
Aluminum	(µg/l)	< 90
Boron	(µg/l)	214
Barium	(µg/l)	35
Beryllium	(µg/l)	< 1
Cadmium	(µg/l)	< 2
Cobalt	(µg/l)	< 2
Chromium	(µg/l)	16
Copper	(µg/l)	16
Iron	(µg/l)	363
Manganese	(µg/l)	41
Molybdenum	(µg/l)	< 6
Nickel	(µg/l)	< 5
Lead	(µg/l)	< 15
Tin	(µg/l)	< 8
Titanium	(µg/l)	8
Vanadium	(µg/l)	< 2
Yttrium	(µg/l)	< 2
Zinc	(µg/l)	85

Table M-5

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

(mg/l unless otherwise stated)

Station Number		LE	H	1	2	3	4	5
River Mile			-.6	0.0	1.04	1.85	2.4	2.85
Calcium		42.5	41.5	41.1	53	50.2	48.6	54.5
Magnesium		9.1	8.5	9.4	11	11.2	11.2	11.9
Sodium		11	10.7	14.8	19.6	21.3	22.1	27
Silver	(µg/l)	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Aluminum	(µg/l)	326	127	483	387	476	498	342
Boron	(µg/l)	107	< 80	157	130	158	170	178
Barium	(µg/l)	19	18	22	24	25	28	25
Beryllium	(µg/l)	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	(µg/l)	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cobalt	(µg/l)	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chromium	(µg/l)	< 5	23	906	< 5	< 5	7	10
Copper	(µg/l)	10	10	19	< 9	< 9	< 9	< 9
Iron	(µg/l)	684	429	4660	1140	1250	1310	1190
Manganese	(µg/l)	27	34	139	176	208	230	236
Molybdenum	(µg/l)	< 6	< 6	63	< 6	< 6	< 6	< 6
Nickel	(µg/l)	< 5	< 5		< 5	< 5	< 5	< 5
Lead	(µg/l)	< 15	26	< 15	< 15	< 15	< 15	< 15
Tin	(µg/l)	< 8	< 8	< 8	< 8	< 8	< 8	< 8
Titanium	(µg/l)	11	9	13	9	11	11	65
Vanadium	(µg/l)	< 8	< 2	4	< 2	< 2	< 2	< 2
Yttrium	(µg/l)	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zinc	(µg/l)	119	161	63	106	73	67	72

Table M-5

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

Station Number		6	7	8	9	10	11	12
					French Creek			
River Mile		3.35	3.88	4.85	5.1	6.5	8.6	10.1
Calcium		55		70.7	82.8	70.4	70.5	66.8
Magnesium		12.6		16.9	18	17.7	17.5	17.4
Sodium		33		55.1	87.8	49.2	57	56.1
Silver	(µg/l)	< 1		< 1	< 1	< 1	< 1	< 1
Aluminum	(µg/l)	235		229	< 90	258	< 90	< 90
Boron	(µg/l)	217		331	449	467	558	599
Barium	(µg/l)	25		29	18	70	71	47
Beryllium	(µg/l)	< 1		< 1	< 1	< 1	< 1	< 1
Cadmium	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Cobalt	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Chromium	(µg/l)	< 5		< 5	< 5	15	13	33
Copper	(µg/l)	< 9		< 9	< 9	13	18	17
Iron	(µg/l)	1010		2480	321	1080	682	518
Manganese	(µg/l)	227		168	32	96	80	75
Molybdenum	(µg/l)	< 6		< 6	< 6	11	< 6	< 6
Nickel	(µg/l)	< 5		< 5	< 5	< 5	< 5	8
Lead	(µg/l)	< 15		< 15	< 15	< 15	< 15	< 15
Tin	(µg/l)	< 8		< 8	< 8	< 8	< 8	< 8
Titanium	(µg/l)	7		8	< 6	11	< 6	< 6
Vanadium	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Yttrium	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Zinc	(µg/l)	73		102	< 50	76	68	< 50

Table M-5

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 17-18, 1979

(mg/l unless otherwise stated)

Station Number		13
River Mile		10.8
Calcium		69.2
Magnesium		17.3
Sodium		43.4
Silver	(µg/l)	< 1
Aluminum	(µg/l)	< 90
Boron	(µg/l)	131
Barium	(µg/l)	35
Beryllium	(µg/l)	< 1
Cadmium	(µg/l)	< 2
Cobalt	(µg/l)	< 2
Chromium	(µg/l)	291
Copper	(µg/l)	19
Iron	(µg/l)	1330
Manganese	(µg/l)	68
Molybdenum	(µg/l)	21
Nickel	(µg/l)	97
Lead	(µg/l)	< 15
Tin	(µg/l)	< 8
Titanium	(µg/l)	< 6
Vanadium	(µg/l)	< 2
Yttrium	(µg/l)	< 2
Zinc	(µg/l)	54

Table M-6

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number		LE	H	1	2	3	4	5
River Mile			-.6	0.0	1.04	1.85	2.4	2.85
Calcium		38.7	42.4	45.8	51.6	56.9	53.7	59.5
Magnesium		8.7	8.9	9.5	10.6	10.2	10.8	11.8
Sodium		9.1	11.1	14.8	20.8	17.7	20	24.5
Silver	(µg/l)	< 1	< 1	< 1	< 1	3	3	3
Aluminum	(µg/l)	217	256	485	410	277	305	< 90
Boron	(µg/l)	< 80	< 80	< 80	102	139	112	158
Barium	(µg/l)	15	18	20	24	23	24	23
Beryllium	(µg/l)	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	(µg/l)	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cobalt	(µg/l)	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chromium	(µg/l)	10	11	10	10	12	11	12
Copper	(µg/l)	< 9	< 9	< 9	< 9	11	< 9	< 9
Iron	(µg/l)	461	557	1020	1210	1020	1260	830
Manganese	(µg/l)	13	31	68	167	229	230	246
Molybdenum	(µg/l)	< 6	< 6	< 6	< 6	9	< 6	7
Nickel	(µg/l)	< 5	< 5	< 5	< 5	27	19	22
Lead	(µg/l)	17	< 15	< 15	< 15	22	< 15	< 15
Tin	(µg/l)	< 8	< 8	< 8	< 8	< 8	< 8	< 8
Titanium	(µg/l)	11	14	17	16	12	15	10
Vanadium	(µg/l)	< 2	< 2	< 2	< 2	6	6	5
Yttrium	(µg/l)	< 2	< 2	< 2	< 2	4	3	3
Zinc	(µg/l)	< 50	< 50	< 50	52	84	< 50	< 50

Table M-6

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number		6	7	8	9	10	11	12
River Mile		3.35	3.88	4.85	5.1	6.5	8.6	10.1
Calcium		56.9		72.8	93.7	72.2	77.6	80
Magnesium		11.9		15.7	17.8	16	17.2	17.3
Sodium		23.8		44.6	79	48.8	54.6	56.1
Silver	(µg/l)	5		< 1	< 1	< 1	< 1	< 1
Aluminum	(µg/l)	< 90		< 90	< 90	< 90	< 90	< 90
Boron	(µg/l)	188		349	449	471	438	563
Barium	(µg/l)	22		26	20	257	139	112
Beryllium	(µg/l)	< 1		< 1	< 1	< 1	< 1	< 1
Cadmium	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Cobalt	(µg/l)	< 2		< 2	< 2	< 2	< 2	< 2
Chromium	(µg/l)	32		17	6	16	17	19
Copper	(µg/l)	11		< 9	< 9	14	16	19
Iron	(µg/l)	860		2730	282	660	527	502
Manganese	(µg/l)	236		172	38	84	95	90
Molybdenum	(µg/l)	8		10	< 6	< 6	< 6	< 6
Nickel	(µg/l)	46		34	< 5	46	46	67
Lead	(µg/l)	21		< 15	< 15	< 15	< 15	< 15
Tin	(µg/l)	< 8		< 8	< 8	< 8	< 8	< 8
Titanium	(µg/l)	9		10	7	12	7	8
Vanadium	(µg/l)	8		5	< 2	7	5	4
Yttrium	(µg/l)	6		< 2	< 2	< 2	< 2	< 2
Zinc	(µg/l)	< 50		102	< 50	< 50	< 50	94

Table M-6

United States Environmental Protection Agency
Region V
Eastern District Office

Stream: Black River
Survey Date: July 18-19, 1979

(mg/l unless otherwise stated)

Station Number		13
River Mile		10.8
Calcium		77.4
Magnesium		17.3
Sodium		33.8
Silver	(µg/l)	3
Aluminum	(µg/l)	<90
Boron	(µg/l)	275
Barium	(µg/l)	35
Beryllium	(µg/l)	< 1
Cadmium	(µg/l)	< 2
Cobalt	(µg/l)	< 2
Chromium	(µg/l)	22
Copper	(µg/l)	21
Iron	(µg/l)	409
Manganese	(µg/l)	62
Molybdenum	(µg/l)	< 6
Nickel	(µg/l)	26
Lead	(µg/l)	< 15
Tin	(µg/l)	< 8
Titanium	(µg/l)	25
Vanadium	(µg/l)	6
Yttrium	(µg/l)	5
Zinc	(µg/l)	67

Discharger: Lorain STP

Sample Date: July 16-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	July 16-17, 1979		July 17-18, 1979		July 18-19, 1979	
Sample Type Time	24C 1132 to 0545		24C 1415 to 1025		24C 0910 to 0810	
Flow (MGD) Temperature (°F) pH (su) Conductivity, umho/cm Dissolved Oxygen, mg/l	16.85 62.6-63.3, Avg 63.0 7.0 490 3.4-4.3, Avg 3.7		16.38 61.2-63.3, Avg 62.5 8.0 460 3.4-4.1, Avg 3.6		15.28 61.5-62.6, Avg 61.9 8.0 460 3.5-4.2, Avg 3.7	
PARAMETER	PPM	GROSS #/day	PPM	GROSS #/day	PPM	GROSS #/day
Total Dissolved Solids	437	61450	449	61400	430	58000
Total Suspended Solids	< 5	--	< 5	--	< 5	--
Chem. Oxygen Demand	31	4360	26	3550	23	3100
Total Organic Carbon	13	1830	14	1910	16	2160
BOD_5	2.3	323	2.0	270	0.6	81
BOD_{20}	2.7	380	3.5	480	3.8	510
T. Kjeldahl Nitrogen	3.93	550	2.98	400	4.07	550
Ammonia-Nitrogen	3.02	420	2.01	275	3.13	420
NO_2-NO_3-N	5.09	700	4.94	675	5.00	675
Chloride	65	9140	70	9570	61	8200
Sulfate	134	18800	135	18500	134	18100
T. Cyanide	.009	1.3	.013	1.8	< .005	--
Phenolics	.005	.7	.004	.6	.010	1.4

Discharger: Lorain STP

Sample Date: July 16-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

PARAMETER	July 16-17, 1979 mg/l	July 16-17, 1979 GROSS #/day	July 17-18, 1979 mg/l	July 17-18, 1979 GROSS #/day	July 18-19, 1979 mg/l	July 18-19, 1979 GROSS #/day
T. Calcium	55.6	7820	64.4	8800	74.1	9450
T. Magnesium	13.7	1930	14.2	1940	13.1	1700
T. Sodium	65.1	9200	75.0	9600	56.9	7300
T. Silver	<.001	--	<.001	--	<.001	--
T. Aluminum	.379	53	.522	70	.449	60
T. Boron	.386	54	.479	66	.318	40
T. Barium	<.006	--	<.006	--	<.006	--
T. Beryllium	<.001	--	<.001	--	<.001	--
T. Cadmium	<.002	--	<.002	--	<.002	--
T. Cobalt	<.002	--	<.002	--	<.002	--
T. Chromium	<.005	--	<.005	--	.007	.9
T. Copper	.024	3.4	<.009	--	.026	3.3
T. Iron	.145	20.4	.296	40.5	.195	24.8
T. Manganese	.049	6.9	.063	8.6	.060	7.6
T. Molybdenum	<.006	--	<.006	--	<.006	--
T. Nickel	<.005	--	<.005	--	<.005	--
T. Lead	<.015	--	<.015	--	<.015	--
T. Tin	<.008	--	<.008	--	<.008	--
T. Titanium	<.006	--	<.006	--	<.006	--
T. Vanadium	<.002	--	<.002	--	<.002	--
T. Yttrium	<.002	--	<.002	--	<.002	--
T. Zinc	<.050	--	.099	13.5	.404	51.5

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Discharger: Elyria STP

Sample Date: July 16-19, 1979

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	July 16-17, 1979			July 17-18, 1979			July 18-19, 1979		
Sample Type Time	1208 to 1202			1230 to 1200			1220 to 1222		
Flow (MGD) Temperature (°F) pH (su) Conductivity, umho/cm Dissolved Oxygen, mg/l	6.083 69.8-72.8, Avg 72.1 6.9 770 to 1200 2.5-4.2, Avg 3.2			6.487 68.9-72.8, Avg 71.7 7.2 850 to 1200 3.0-3.7, Avg 3.4			6.408 68-71.6, Avg 71.4 7.2 1120 to 1300 2.9-3.6, Avg 3.4		
PARAMETER	PPM		GROSS #/day	PPM		GROSS #/day	PPM		GROSS #/day
Total Dissolved Solids	705		35800	700		37900	758		40500
Total Suspended Solids	19		965	13		704	<5		--
Chem. Oxygen Demand	106		5380	134		7250	126		6740
Total Organic Carbon	29		1470	44		2380	38		2030
BOD_5	34		1730	33		1790	13		695
T. Kjeldahl Nitrogen	19.1		970	19.8		1070	18.7		1000
Ammonia-Nitrogen	18.3		929	18.0		974	17.0		909
NO_2-NO_3-N	0.31		16	0.05		2.7	<.05		--
Chloride	123		6240	147		7960	170		9090
Sulfate	126		6400	134		7250	148		7910
T. Cyanide	*		--	.050		2.7	.056		3.0
Phenolics	N.S.			.024		1.3	.014		0.8

*Cyanide sample not preserved properly

Discharger: Elyria STP

Sample Date: July 16-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	July 16-17, 1979		July 17-18, 1979		July 18-19, 1979	
	PPM	GROSS #/day	PPM	GROSS #/day	PPM	GROSS #/day
T. Calcium	65.9	3350	72.5	3930	72.9	3900
T. Magnesium	14.2	721	16.3	882	15.4	823.5
T. Sodium	80.9	4110	96.0	5200	95.2	5090
T. Silver	<.001	--	<.001	--	<.001	--
T. Aluminum	.099	5	.222	12	<.090	--
T. Boron	.960	48.7	1.370	74	1.210	64.7
T. Barium	.018	.9	.024	1.3	.014	.8
T. Beryllium	<.001	--	<.001	--	<.001	--
T. Cadmium	.007	.3	.005	.3	.005	.3
T. Cobalt	<.002	--	<.002	--	<.002	--
T. Chromium	.041	2	.103	5.6	.035	1.9
T. Copper	.038	1.9	.041	2.2	.033	1.8
T. Iron	1.070	54.3	1.060	57.4	.597	31.9
T. Manganese	.083	4.2	.105	5.7	.093	4.9
T. Molybdenum	.073	3.7	.010	.5	.018	1
T. Nickel	.167	8.5	.188	10.2	.289	15.5
T. Lead	<.015	--	<.015	--	<.015	--
T. Tin	<.008	--	<.008	--	<.008	--
T. Titanium	<.006	--	<.006	--	<.006	--
T. Vanadium	.010	.5	.003	.2	.010	.5
T. Yttrium	<.002	--	<.002	--	<.002	--
T. Zinc	.115	5.8	.261	14.1	.174	9.3

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16-17, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA13S35	Outfall 001 EA13S39			Outfall 005 EA13S31		
Sample Type							
Time	1237 to 1115	1315 to 1142			1255 to 1130		
Flow (MGD)		62.93			7.3		
Temperature (°F)	82.4-87.8, Avg 85.4	86.0-91.4, Avg 89.2			87.8-95.0, Avg 90.8		
pH (su)	7.0 to 7.6	7.1 to 7.8			7.3 to 8.7		
Conductivity, umho/cm	600 to 700	610 to 690			625 to 750		
Dissolved Oxygen, mg/	1.2-6.5, Avg 3.8	0.0 to 2.3, Avg .97			4.4 to 6.2, Avg 5.7		
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	468	389	--	204000	468	--	8980
Total Suspended Solids	14	49	18400	22100	14	--	269
Chem. Oxygen Demand	30	40	5250	21000	37	134	710
Total Organic Carbon	12	13	325	6835	14	38	269
BOD_5	8.1	8.6	267	4520	7.9	--	152
BOD_{20}	16.0	22.0	2100	11600	16.0	--	307
T. Kjeldahl Nitrogen	2.03	1.64	--	861	2.34	6	45
Ammonia-Nitrogen	1.09	0.54	--	284	1.30	4	25
NO_2-NO_3-N	1.66	1.19	--	625	2.90	24	56
Chloride	65	63	--	33100	66	19	1270
Sulfate	123	115	--	60400	132	173	2530
T. Cyanide	.028	.022	--	11.6	.024	--	.5
Phenolics	.006	.004	--	2.1	.005	--	.1
Thermal Discharge		83×10^6 BTU/hr			4×10^6 BTU/hr		

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16-17, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA13S46	Outfall 002 EA13S24			Outfall 003 EA13S50			Outfall 004 EA13S54		
Sample Type Time	1213 to 1003	1218 to 1103			1234 to 1035			1240 to 1042		
Flow (MGD)		23.45			68 (USS)			22 (USS)		
Temperature (°F)	80.6-83.3, Avg 82.0	104.0-111.2, Avg 105.9			87.8-95.0, Avg 92.2			87.9-99.5, Avg 94.6		
pH (su)	6.0 to 7.0	7.3 to 8.1			6.4 to 7.5			6.6 to 7.35		
Conductivity, umho/cm	410 to 500	450 to 650			400 to 590			450 to 890		
Dissolved Oxygen, mg/l	2.5-3.4, Avg 2.9	4.4-6.8, Avg 5.2			3.3-5.3, Avg 4.4			4.2-5.5, Avg 4.6		
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	269	340	13900	66500	335	12460	190000	346	14100	63500
Total Suspended Solids	18	25	1370	4890	22	2270	12500	29	2020	5320
Chem. Oxygen Demand	19	31	2350	6020	21	1130	11900	18	--	3300
Total Organic Carbon	5	13	1560	2540	5	--	2840	6	184	1100
BOD_5	6.6	6.3	--	1230	4.6	--	2610	4.6	--	845
BOD_{20}	12.0	23.0	2150	4500	--	--	--	30.0	3300	5500
T. Kjeldahl Nitrogen	2.33	4.88	499	955	3.28	539	1860	5.70	619	1050
Ammonia-Nitrogen	1.48	3.94	481	771	2.71	698	1540	4.86	620	892
NO_2-NO_3-N	1.42	2.96	301	579	1.48	34	840	.91	--	167
Chloride	37	49	2350	9590	48	6240	27200	62	4590	11400
Sulfate	62	85	4500	16600	80	10200	45400	69	1280	12700
T. Cyanide	.017	.039	4.3	7.6	.021	2.3	11.9	.66	119.0	121.7
Phenolics	.012	.180	32.9	35.2	.004	--	2.3	.009	--	1.7
Thermal Discharge		203 x 10^6 BTU/hr			241 x 10^6 BTU/hr			96 x 10^6 BTU/hr		

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 17-18, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: S C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA14S35		Outfall 001 EA14S39			Outfall 005 EA14S31		
Sample Type Time	1343 to 1040		1413 to 1100			1355 to 1030		
Flow (MGD) Temperature (°F) pH (su) Conductivity,umho/cm Dissolved Oxygen,mg/l	82.4-89.6,Avg 85.7 7.0 to 7.8 600 to 700 1.8-6.2,Avg 3.5		62.0 84.2-91.7, Avg 88.7 6.7 to 7.6 610 to 650 0.1-1.3, Avg 0.7			2.3 84.2-98.6, Avg 89.9 7.0 to 7.8 640 to 775 6.1-7.1, Avg 6.6		
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	465		429	--	223050	445	--	8560
Total Suspended Solids	11		13	1980	6230	11	--	211
Chem. Oxygen Demand	35		51	7760	26400	35	--	673
Total Organic Carbon	31		19	--	9539	26	--	499
BOD_5	7.9		6.4	--	3310	6.8	--	131
$COD_{3?}$	16.0		21.0	2590	10900	14.0	--	269
T. Kjeldahl Nitrogen	2.73		2.54	--	1310	2.83	2	54
Ammonia-Nitrogen	1.50		0.82	--	424	1.28	--	25
NO_2-NO_3-N	2.48		2.05	--	1060	2.64	3	51
Chloride	62		61	--	31600	64	38	1230
Sulfate	117		114	--	59000	117	--	2250
T. Cyanide	.031		.028	--	14.5	.023	--	.1
Phenolics	.002		.006	2.1	3.1	.004	.04	.1
Thermal Discharge			63 x 10^6 BTU/hr			1 x 10^6 BTU/hr		

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 17-18, 1979

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA14546	Outfall 002 EA14524			Outfall 003 EA14550			Outfall 004 EA14554		
Sample Type Time	1300 to 1000	1321 to 1030			1335 to 1012					
Flow (MGD)		23.50			68 (USS)			22 (USS)		
Temperature (°F)	78.8-82.4, Avg 80.5	102.2-111.2, Avg 104.9			87.8-94.1, Avg 91.2			86.0-105.8, Avg 95.1		
pH (su)	6.4 to 7.7	7.2 to 7.9			6.6 to 7.4			6.8 to 7.5		
Conductivity, umho/cm	420 to 500	520 to 650			470 to 560			500 to 1250		
Dissolved Oxygen, mg/l	1.9-3.6, Avg 2.8	4.8-5.7, Avg 5.3			2.7-5.9, Avg 4.3			3.3-5.8 Avg 4.7		
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	363	357	10600	70000	326	13100	183000	375	13270	63800
Total Suspended Solids	13	10	--	1960	22	5110	12000	39	4770	7160
Chem. Oxygen Demand	19	28	1770	5490	20	567	11400	32	2390	5870
Total Organic Carbon	7	12	980	2352	8	567	4560	10	551	1840
BOD$_5$	5.2	5.4	32	1060	4.0	--	2270	4.0	--	734
BOD$_{20}$	11.0	29.0	3530	5690	16.0	2840	9080	28.0	3120	5140
T. Kjeldahl Nitrogen	2.28	6.82	993	1390	3.86	897	2090	6.98	863	1280
Ammonia-Nitrogen	1.65	5.69	792	1120	3.18	868	1800	6.24	843	1150
NO$_2$-NO$_3$-N	1.44	1.90	99	373	1.41	--	800	1.32	--	242
Cyanide*	30	51	4120	10000	46	9080	26100	72	7710	13200
Sulfate	54	88	6670	17300	74	11400	42000	70	2940	12900
T. Cyanide	.014	.035	4.1	6.9	.005	--	2.8	.106	16.5	19.4
Phenolics	.004	.299	36.1	56.9	.006	1.13	3.4	.030	4.77	5.5
Thermal Discharge		200 x 10^6 BTU/hr			253 x 10^6 BTU/hr			112 x 10^6 BTU/hr		

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 18-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA15S46	Outfall 002 EA15S24			Outfall 003 EA15S50			Outfall 004 EA15S54		
Sample Type Time	1205 to 1003	1158 to 1030			1225 to 1006			1235 to 1011		
Flow (MGD) Temperature (°F) pH (su) Conductivity, umho/cm Dissolved Oxygen, mg/l	78.8-82.4, Avg 81.1 6.5-7.1 410-505 2.2-3.1, Avg 2.7	23.54 104.0-107.6, Avg 106.4 7.0-7.7 525-600 5.1-5.7, Avg 5.4			68 (USS) 93.2-97.7, Avg 94.8 7.1-7.7 490-625 4.7-5.9, Avg 5.3			22 (USS) 86.0-104.0, Avg 97.1 7.0-7.5 500-910 4.2-5.5, Avg 5.0		
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	303	319	3140	62700	341	15900	188000	409	12500	75100
Total Suspended Solids	12	26	2250	5110	6	--	3400	51	2160	9360
Chem. Oxygen Demand	18	32	2750	6290	22	2270	12500	22	734	4040
Total Organic Carbon	5	9	786	1770	7	1130	3970	6	184	1100
BOD_5	4.8	3.0	--	589	2.8	--	1590	4.0	--	734
BOD_{20}	11.0	21.0	1960	4130	16.0	2840	9080	30.0	3590	5510
T. Kjeldahl Nitrogen	2.12	4.68	503	919	3.35	698	1900	7.20	933	1320
Ammonia-Nitrogen	1.63	3.73	412	733	2.77	647	1570	6.46	887	1190
NO_2-NO_3-N	1.42	1.90	94	373	1.51	51	857	1.29	--	237
Chloride	38	49	2160	9620	47	5110	26700	67	5320	12300
Sulfate	66	87	4120	17100	77	6290	43700	71	918	13000
T. Cyanide	.009	.014	1.9	2.8	<.005	--	--	.326	58.2	59.9
Phenolics	.008	.170	31.8	33.4	.004	--	2.3	.100	16.9	18.4
Thermal Discharge		207 x 10^6 BTU/hr			324 x 10^6 BTU/hr			123 x 10^6 BTU/hr		

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 18-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA15535	Outfall 001 EA15539			Outfall 005 EA15531		
Sample Type Time	1212 to 1039	1240 to 1056			1225 to 1045		
Flow (MGD) Temperature (°F) pH (su) Conductivity, umho/cm Dissolved Oxygen, mg/l	82.4-86.0, Avg 84. 6.8 to 7.3 580 to 650 2.4-4.9, Avg 3.7	60.89 84.2-89.6, Avg 86.6 6.5 to 7.3 600 to 660 0.1-2.1, Avg 1.1			2.3 82.4-89.6, Avg 86.6 7.0 to 7.4 600 to 650 6.5-7.1, Avg 6.9		
PARAMETER	PPM	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
Total Dissolved Solids	433	447	4520	225000	424	--	8140
Total Suspended Solids	34	25	--	12700	11	--	211
Chem. Oxygen Demand	38	55	5660	27900	35	--	672
Total Organic Carbon	14	20	3050	10200	13	--	250
BOD_5	11.0	6.4	--	3250	2.0	--	38
BOD_{20}	17.0	21.0	2030	10200	14.0	--	269
T. Kjeldahl Nitrogen	2.96	2.40	--	1220	2.47	--	47
Ammonia-Nitrogen	1.67	1.60	--	905	1.45	--	28
NO_2-NO_3-N	2.25	1.89	--	960	2.47	4.2	47
Chloride	59	60	508	30500	60	14	1150
Sulfate	115	121	3050	61500	113	--	2170
T. Cyanide	<.005	.013	4.1	6.6	.012	.1	0.2
Phenolics	.004	.008	2.0	4.	.004	--	0.08
Thermal Discharge		33 x 10^6 BTU/hr			2 x 10^6 BTU/hr		

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16-17, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA13535		Outfall 001 EA13539			Outfall 005 EA13531		
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
T. Calcium	71.1		71.1	--	37650	75.5	80.6	1430
T. Magnesium	16.3		16.9	--	7820	16.0	--	302
T. Sodium	52.5		63.2	--	22700	59.6	136	1140
T. Silver	<0.001		<0.001	--	--	<0.001	--	--
T. Aluminum	<0.090		<0.090	--	--	<0.090	--	--
T. Boron	0.486		0.465	--	181	0.316	--	6.1
T. Barium	0.034		0.030	--	16.5	0.027	0.1	0.5
T. Beryllium	<0.001		0.001	--	--	<0.001	--	--
T. Cadmium	<0.002		<0.002	--	--	<0.002	--	--
T. Cobalt	<0.002		<0.002	--	--	<0.002	--	--
T. Chromium	<0.005		0.026	3.2	3.7	<0.005	--	--
T. Copper	<0.009		<0.009	--	--	0.011	0.2	0.2
T. Iron	1.020		2.420	735	1270	0.960	--	18.4
T. Manganese	0.171		0.174	1.6	91.3	0.168	--	3.2
T. Molybdenum	<0.006		0.014	7.4	7.4	<0.006	--	--
T. Nickel	<0.005		<0.005	--	--	<0.005	--	--
T. Lead	<0.015		0.224	117.6	117.6	<0.015	--	--
T. Tin	<0.003		<0.003	--	--	<0.003	--	--
T. Titanium	0.005		<0.006	--	--	0.007	--	0.1
T. Vanadium	<0.002		<0.002	--	--	<0.002	--	--
T. Yttrium	<0.002		<0.002	--	--	<0.002	--	--
T. Zinc	0.131		0.140	4.7	73.5	0.112	--	2.2

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16-17, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA13546		Outfall 002 EA13526			Outfall 003 EA13550			Outfall 004 EA13554					
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day			
T. Calcium	56.1		56.7	117	11100	58.1	1130	33000	62.0	1083	11400			
T. Magnesium	11.6		11.9	29	2340	11.4	--	6410	12.5	163	2290			
T. Sodium	26.1		32.4	1590	6370	29.5	1930	16700	28.3	404	5200			
T. Silver	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--			
T. Aluminum	0.157		0.220	16.2	42.0	0.256	27.8	116.9	0.446	53.1	81.7			
T. Boron	0.178		0.187	7.6	36.6	0.151	2.8	86.8	0.120	--	22.0			
T. Barium	0.025		0.025	0.4	4.9	0.025	1.1	14.2	0.033	1.8	6.1			
T. Beryllium	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--			
T. Cadmium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--			
T. Cobalt	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--			
T. Chromium	<0.005		0.010	2.0	3.0	0.010	5.7	5.7	<0.005	--	--			
T. Copper	<0.009		0.015	2.9	2.9	0.013	7.4	7.4	0.014	2.6	2.6			
T. Iron	1.280		1.002	23.4	274	4.350	1750	2470	1.270	365	699			
T. Manganese	0.237		0.231	--	45.2	0.353	65.8	200	0.967	139	174			
T. Molybdenum	<0.006		<0.006	--	--	0.268	4.5	4.5	<0.006	--	--			
T. Nickel	<0.005		<0.005	--	--	<0.005	--	--	<0.005	--	--			
T. Lead	<0.015		<0.015	--	--	<0.015	--	--	0.017	3.1	3.1			
T. Tin	<0.008		<0.008	--	--	<0.008	--	--	<0.008	--	--			
T. Titanium	0.010		0.014	0.8	2.7	0.011	0.6	6.2	0.011	0.2	2.0			
T. Vanadium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--			
T. Yttrium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--			
T. Zinc	0.065		0.099	6.7	19.4	0.103	21.6	58.4	0.102	6.8	18.7			

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 17-18, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA14535		Outfall 001 EA14539				Outfall 005 EA14531														
PARAMETER	PPM		PPM	NET #/day	GROSS #/day		PPM	NET #/day	GROSS #/day												
T. Calcium	72.5		75.3	1950	39000		73.2	13	1400												
T. Magnesium	16.8		16.4	--	8990		15.5	--	297												
T. Sodium	56.9		57.0	51	29500		51.3	--	985												
T. Silver	<0.001		<0.001	--	--		<0.001	--	--												
T. Aluminum	<0.090		<0.090	--	--		0.119	2.3	2.3												
T. Boron	0.402		0.396	--	205		0.393	--	7.2												
T. Barium	0.027		0.026	--	13.5		0.025	--	0.5												
T. Beryllium	<0.001		<0.001	--	--		<0.001	--	--												
T. Cadmium	<0.002		<0.002	--	--		<0.002	--	--												
T. Cobalt	<0.002		<0.002	--	--		<0.002	--	--												
T. Chromium	<0.005		0.014	7.2	7.2		<0.005	--	--												
T. Copper	<0.009		<0.009	--	--		0.011	0.2	0.2												
T. Iron	0.992		1.515	1360	1520		0.945	--	19.1												
T. Manganese	0.172		0.208	18.6	108		0.159	--	3.1												
T. Molybdenum	<0.006		<0.006	--	--		<0.006	--	--												
T. Nickel	<0.005		<0.005	--	--		<0.005	--	--												
T. Lead	<0.015		0.018	9.3	9.3		<0.015	--	--												
T. Tin	<0.008		<0.008	--	--		<0.008	--	--												
T. Titanium	<0.006		<0.006	--	--		0.007	0.1	0.1												
T. Vanadium	<0.002		<0.002	--	--		<0.002	--	--												
T. Yttrium	<0.002		<0.002	--	--		<0.002	--	--												
T. Zinc	0.077		0.351	116	196		0.170	3.3	3.3												

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 17-18, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA14S46		Outfall 002 EA14S24			Outfall 003 EA14S50			Outfall 004 EA14S54		
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
T. Calcium	64.6		67.2	510	13200	70.5	3330	16000	61.0	--	11200
T. Magnesium	12.6		13.5	176	2650	11.3	--	6410	13.6	184	2500
T. Sodium	29.6		38.4	1730	7550	29.7	--	16900	36.7	1300	6740
T. Silver	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--
T. Aluminum	0.451		0.361	--	70.8	0.396	--	225	0.704	46.4	129
T. Boron	0.172		0.245	13.9	47.7	<0.080	--	--	0.166	--	30.5
T. Barium	0.028		0.030	0.4	5.9	0.034	3.4	19.3	0.036	1.3	6.6
T. Beryllium	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--
T. Cadmium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Cobalt	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Chromium	<0.005		<0.005	--	--	0.021	11.9	11.9	0.026	--	--
T. Copper	<0.009		0.016	3.1	3.1	0.023	13.1	13.1	<0.009	--	--
T. Iron	1.550		1.580	--	271	5.000	1960	2840	3.460	351	635
T. Manganese	0.273		0.265	--	52.0	0.491	124	279	0.725	83.0	133
T. Molybdenum	<0.006		<0.006	--	--	0.011	6.2	6.2	0.007	0.2	1.3
T. Nickel	<0.005		<0.005	--	--	<0.005	--	--	<0.015	--	--
T. Lead	<0.015		<0.015	--	--	0.025	14.2	14.2	0.042	2.7	7.7
T. Tin	<0.008		<0.008	--	--	0.008	--	--	<0.008	--	--
T. Titanium	0.011		0.010	--	2.0	0.012	0.6	6.8	0.014	0.6	2.6
T. Vanadium	<0.002		<0.002	--	--	0.006	2.3	2.3	<0.002	--	--
T. Yttrium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Zinc	0.131		0.177	9.0	34.2	0.304	98.2	173	0.144	2.4	26.4

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 18-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-3 EA15535		Outfall 001 EA15539			Outfall 005 EA15531		
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
T. Calcium	67.5		66.9	--	54000	74.5	134	1430
T. Magnesium	15.1		13.9	--	7670	15.3	3.8	294
T. Sodium	44.4		42.0	--	21300	50.6	119	971
T. Silver	<0.001		<0.001	--	--	<0.001	--	--
T. Aluminum	0.573		<0.090	--	--	<0.090	--	--
T. Boron	0.260		0.374	57.9	190	0.301	0.8	5.8
T. Barium	0.028		0.020	--	10.2	0.023	--	0.4
T. Beryllium	<0.001		<0.001	--	--	<0.001	--	--
T. Cadmium	<0.002		<0.002	--	--	<0.002	--	--
T. Cobalt	<0.002		<0.002	--	--	<0.002	--	--
T. Chromium	0.014		0.018	2.0	9.1	0.009	--	0.2
T. Copper	0.017		0.010	--	5.1	<0.009	--	--
T. Iron	3.210		4.460	605	2260	1.190	--	21.1
T. Manganese	0.273		0.219	--	111	0.174	--	3.3
T. Molybdenum	<0.006		0.013	6.6	6.6	<0.006	--	--
T. Nickel	<0.005		0.009	4.6	4.6	<0.005	--	--
T. Lead	<0.015		<0.015	--	--	<0.015	--	--
T. Tin	<0.008		<0.008	--	--	<0.008	--	--
T. Titanium	0.016		<0.006	--	--	0.009	--	0.2
T. Vanadium	0.004		<0.002	--	--	<0.002	--	--
T. Yttrium	<0.002		<0.002	--	--	<0.002	--	--
T. Zinc	0.138		0.238	50.5	121	0.080	--	1.5

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 18-19, 1979

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
Eastern District Office

Sample Type: 8 C-8 hour flow proportioned composite
24C-24 hour flow proportioned composite
EVC-Equal Volume Composite
G-Grab

	Intake WI-2 EA15S46		Outfall 002 EA15S24			Outfall 003 EA15S50			Outfall 004 EA15S54		
PARAMETER	PPM		PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day	PPM	NET #/day	GROSS #/day
T. Calcium	52.5		60.6	1520	11200	60.8	4710	34500	71.1	3410	13100
T. Magnesium	11.3		12.0	138	2360	12.0	397	6810	14.5	287	2660
T. Sodium	24.9		34.4	1820	6760	31.0	3960	17600	30.1	935	5530
T. Silver	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--
T. Aluminum	<0.090		0.141	27.7	27.7	0.217	134	134	0.339	99	99
T. Boron	0.137		0.205	13.4	40.3	0.138	--	89.7	0.157	3.7	23.8
T. Barium	0.022		0.024	0.4	4.7	0.028	3.4	15.9	0.036	2.6	6.6
T. Beryllium	<0.001		<0.001	--	--	<0.001	--	--	<0.001	--	--
T. Cadmium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Cobalt	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Chromium	0.009		0.010	0.2	2.0	0.015	3.4	8.5	0.012	0.6	2.2
T. Copper	<0.009		<0.009	--	--	<0.009	--	--	<0.009	--	--
T. Iron	1.250		1.050	--	206	3.830	1460	2170	4.250	550	780
T. Manganese	0.248		0.239	2.7	50.9	0.559	176	317	0.813	104	149
T. Molybdenum	<0.006		<0.006	--	--	0.011	6.2	6.2	<0.006	--	--
T. Nickel	<0.005		<0.005	--	--	<0.005	--	--	<0.005	--	--
T. Lead	<0.015		<0.015	--	--	<0.015	--	--	0.020	3.7	3.7
T. Tin	<0.008		<0.008	--	--	<0.008	--	--	<0.008	--	--
T. Titanium	0.009		0.017	0.6	2.4	0.012	1.7	6.8	0.012	0.6	2.2
T. Vanadium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Yttrium	<0.002		<0.002	--	--	<0.002	--	--	<0.002	--	--
T. Zinc	0.098		0.086	--	16.9	0.074	--	42.0	0.273	32.1	50.1

U.S. Environmental Protection Agency
Region V
Eastern District Office

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16, 1979

Sample Number	Location	Total PCB (µg/l)
79EA13S36	Intake WI-3	< 5.6
79EA13S40	Outfall 001	< 11.0
79EA13S32	Outfall 005	< 4.9
79EA13S47	Intake WI-2	< 0.3
79EA13S25	Outfall 002	< 0.3
79EA13S51	Outfall 003	< 0.6
79EA13S55	Outfall 004	< 0.3
79EA13S62	Waste Oil at Outfall 001	< 60

Sample Types - Grab

U.S. Environmental Protection Agency
Region V
Eastern District Office

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 16-17, 1979

Oil and Grease Samples

Sample No.	Time	Oil (mg/l)
Intake WI-2		
EA13S47	1628	< 1
EA13S48	1816	< 1
EA13S49	0425	< 1
Average		< 1
Intake WI-3		
EA13S36	1247	3
EA13S37	2050	1
EA13S38	0431	2
Average		2
Outfall 001		
EA13S40	1319	3
EA13S41	1705	5
EA13S42	2135	7
EA13S44	0507	9
EA13S45	1142	6
Average		6.0

Sample No.	Time	Oil (mg/l)
Outfall 005		
EA13S32	1255	2
EA13S33	2114	3
EA13S34	0445	< 1
Average		1.7
Outfall 002		
EA13S25	1216	5
EA13S26	1629	2
EA13S27	2028	2
EA13S28	0013	2
EA13S29	0425	3
EA13S30	0906	< 1
Average		2.3

U.S. Environmental Protection Agency
Region V
Eastern District Office

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 17-18, 1979

Oil and Grease Samples

Sample No.	Time	Oil (mg/l)
Intake WI-2		
EA14S47	1300	2
EA14S48	2020	1
EA14S49	0420	< 1
EA14S89	1000	< 1
Average		< 1
Intake WI-3		
EA14S36	1343	< 1
EA14S37	2050	< 1
EA14S38	0424	< 1
Average		< 1
Outfall 001		
EA14S40	1413	3
EA14S41	1845	3
EA14S42	2115	5
EA14S43	0046	6
EA14S44	0447	13
EA14S45	0848	6
Average		6.0
Outfall 005		
EA14S32	1355	< 1
EA14S33	1830	< 1
EA14S34	0440	< 1
Average		< 1
Outfall 002		
EA14S25	1323	5
EA14S26	1812	2
EA14S27	2035	2
EA14S28	0100	< 1
EA14S29	0410	8
EA14S30	0807	< 1
Average		2.8

U.S. Environmental Protection Agency
Region V
Eastern District Office

Discharger: United States Steel Corporation
Lorain Works
Sample Date: July 18-19, 1979

Oil and Grease Samples

Sample No.	Time	Oil (mg/l)
Intake WI-2		
EA15S47	1448	< 1
EA15S48	2104	< 1
EA15S49	0413	2
Average		< 1
Intake WI-3		
EA15S36	1212	1
EA15S37	2122	< 1
EA15S38	0425	< 1
Average		< 1
Outfall 001		
EA15S40	1240	7
EA15S41	1648	4
EA15S42	2150	4
EA15S43	0053	10
EA15S44	0450	5
EA15S45	0838	10
Average		6.7

Sample No.	Time	Oil (mg/l)
Outfall 005		
EA15S32	1225	3
EA15S33	2133	2
EA15S34	0435	< 1
Average		1.7
Outfall 002		
EA15S25	1158	2
EA15S26	1619	3
EA15S27	2109	2
EA15S28	0020	1
EA15S29	0410	3
EA15S30	0804	< 1
Average		1.8

Attachment N

Discharger Monitoring Data

Lodi Wastewater Treatment Plant
Effluent Quality
1978

Month	Flow MGD	Temp. °C	BOD_5 mg/l	pH	TSS mg/l	NH_3-N mg/l	TKN mg/l	Total Phosphorus mg/l	Fecal Coliform #/100 ml	T.Res. Cl_2 mg/l
January										
Avg.	.38		10	—	7					.3
Max.	.88		17		16					.8
Min.	.27		5		0					0
February										
Avg.	.31		5	—	3					.3
Max.	.36		9		16					.6
Min.	.26		3		0					.05
March										
Avg.	.62		11	—	1					.2
Max.	1.5		14		8					.5
Min.	.3		7		0					0
April										
Avg.	.54		13	—	8					.2
Max.	.79		18		12					.25
Min.	.38		8		0					.1
May										
Avg.	.5		9	—	12					.2
Max.	.74		12		64					.3
Min.	.38		6		0					0
June										
Avg.	.43		7	—	3					.2
Max.	.56		14		8					.3
Min.	.38		3		0					0
July										
Avg.	.4		6.5	—	2.6					.2
Max.	.5		12		8					.4
Min.	.2		1		0					0
August										
Avg.	.4		5	—	4					.2
Max.	.5		10		16					.3
Min.	.145		1		0					0
September										
Avg.	.4		7.1	—	0					.3
Max.	.46		16		0					1.3
Min.	.38		2		0					0
October										
Avg.	.39		10	—	6.7					.29
Max.	.56		14		16					.40
Min.	.34		5		0					0
November										
Avg.	.34		9	—	13.4					.2
Max.	.42		17		32					.4
Min.	.27		5		0					0
December										
Avg.				—						
Max.										
Min.										

Lodi Wastewater Treatment Plant
Effluent Quality
1979

Month	Flow MGD	Temp. °C	BOD_5 mg/l	pH	TSS mg/l	NH_3-N mg/l	TKN mg/l	Total Phosphorus mg/l	Fecal Coliform #/100 ml	T.Res. Cl_2 mg/l
January										
Avg.	.3		14	—	13					.15
Max.	.45		24		24					.25
Min.	.22		2		8					0
February										
Avg.	.33		18	—	16					.18
Max.	.97		13		16					.2
Min.	.20		8		16					.1
March										
Avg.	.46		13	—	15					.2
Max.	1.04		19		24					.3
Min.	.31		9		8					0
April										
Avg.	.58		15	—	14					.24
Max.	.89		13		16					.3
Min.	.39		9		8					.2
May										
Avg.				—						
Max.										
Min.										
June										
Avg.	.43		10	—	10					.24
Max.	.48		2		16					.3
Min.	.37		8		8					.15
July										
Avg.	.42		12	—	8					.21
Max.	.55		16		8					.25
Min.	.32		7		8					.05
August										
Avg.	.45		10	—	9					.21
Max.	1.01		15		16					.25
Min.	.39		4		8					.10
September										
Avg.	.45		10	—	8					.22
Max.	1.02		14		8					.25
Min.	.35		6		8					.10
October										
Avg.	.37		10	—	13					.24
Max.	.41		15		32					.25
Min.	.29		6		8					.2
November										
Avg.	.41		7	—	20					.11
Max.	.66		9		52					.25
Min.	.33		4		8					.1
December										
Avg.	.46		6	—	10					
Max.	1.28		8		24					
Min.	.30		4		8					

Lorain Wastewater Treatment Plant
Effluent Quality
1978

Month	Flow MGD	Temp. °C	BOD_5 mg/l	pH	TSS mg/l	NH_3-N mg/l	TKN mg/l	Total Phosphorus mg/l	Fecal Coliform #/100 ml	T.Res. Cl_2 mg/l
January										
Avg.	14.9	11	30.2	—	33.4	9.5	11.8	6.0	31	.6
Max.	25.5	12	90	7.2	118	14.7	19.4	9.5	260	.9
Min.	12.4	9	6.6	7.0	8.8	4.8	2.3	2.6	4	.3
February										
Avg.	12.8	10	16.7	—	30.4	8.4	12.5	6.3	18	.6
Max.	14.5	11	33.3	7.2	56	14.9	20.4	8.1	38	.8
Min.	12.2	10	6.6	7.0	12	3.6	7.3	3.8	3	.5
March										
Avg.	18.7	9	17.4	—	41	7.9	10.8	4.8	21	.6
Max.	29.3	11	43.5	7.2	142	15.3	21.9	8.5	170	.7
Min.	12.5	8	6.0	7.0	10.0	1.1	4.9	1.3	4	.5
April										
Avg.	18.6	11	19.4	—	36.8	6.2	9.7	5.2	98	.7
Max.	26.5	14	45	7.2	76.7	11.2	16.5	7.5	1100	.8
Min.	13.9	9	9.8	7.0	13	1.4	3.97	2.9	4	.6
May										
Avg.	16.4	15	15.2	—	35.8	6.4	9.8	6.3	28	.7
Max.	21.5	17	65.6	7.3	150	9.4	19.5	8.8	72	.8
Min.	12.5	13	2.6	7.0	11	3.2	5.6	4.2	4	.6
June										
Avg.	15.4	20	9.2	—	23.3	7.5	9.4	6.1	44	.8
Max.	30.3	21	42.2	7.3	98	14.3	14.9	9.0	400	.9
Min.	12.6	18	1.7	7.0	1.2	3.2	5.6	2.7	< 1	.7
July										
Avg.	14.9	22	12.3	—	26.7	12.4	15.5	7.7	38	.8
Max.	24.9	24	113	7.5	202	16.9	20.5	12.2	80	.9
Min.	12.9	19	2.5	6.8	2.0	5.3	6.8	4.8	6	.5
August										
Avg.	16.7	24	8.1	—	13.7	7.5	8.9	8.43	39	.7
Max.	24.5	24	23.5	7.4	41	13.3	17.1	10.2	180	.9
Min.	12.6	23	2.1	7.0	1.8	1.8	3.8	4.9	1	.4
September										
Avg.	17.6	24	6.8	—	14.9	10.2	12.7	7.1	40	.8
Max.	22	25	18.4	7.3	31.3	13.9	16.3	10.1	330	1.0
Min.	14.6	24	3.6	6.9	5.6	3.4	9.1	2.2	2	.7
October										
Avg.	19.2	21	9.8	—	22.8	9.9	13.9	7.6	85	.7
Max.	29.0	24	19.7	7.2	43	14.1	17.5	10.5	640	.9
Min.	14.8	19	5.4	6.9	8.5	3.0	6.2	5.11	15	.4
November										
Avg.	15.4	18	14.7	—	44.7	8.5	14.5	9.4	80	.7
Max.	16.7	20	24.9	7.1	84	15.1	20.9	12.9	550	.8
Min.	12.4	14	8.6	7.0	17	1.7	7.9	5.9	4	.5
December										
Avg.	16.2	14	9.8	—	24.4	6.02	9.3	7.2	19	.7
Max.	20.5	15	17.5	7.2	59	8.8	12.6	10.4	110	.8
Min.	13.3	11	5.7	6.9	12	1.7	7.1	4.8	3	.5

Lorain Wastewater Treatment Plant
Effluent Quality
1979

Month	Flow MGD	Temp. °C	BOD_5 mg/l	pH	TSS mg/l	NH_3-N mg/l	TKN mg/l	Total Phosphorus mg/l	Fecal Coliform σ/100 ml	T. Res. Cl_2 mg/l
January										
Avg.	16.5	11	16.7	—	27.3	4.5	8.1	6.2	34	.6
Max.	24.0	12	36	7.2	75	10	13	9.4	150	.8
Min.	13.5	10	6.4	6.9	9	.32	4.5	2.6	2	.3
February										
Avg.	15.8	10	9.9	—	17.4	10.97	14.4	6.5	17	.6
Max.	28.5	11	25.2	7.3	43	17.1	21.8	8.3	52	.8
Min.	12.3	8	6.5	7.0	8.5	5.2	12.0	3.7	1	.5
March										
Avg.										
Max.										
Min.										
April										
Avg.	19.0	11	6.4	—	12.8		5.7		16	.6
Max.	28.0	14	9.2	7.2	24		11.5		68	.7
Min.	15.1	10	4.8	6.9	6.0		2.1		1	.5
May										
Avg.										
Max.										
Min.										
June										
Avg.	16.8	19	2.5	—	4.7	2.6	4.1	1.6	24	.7
Max.	27.2	21	4.5	7.3	9.8	6.1	7.8	3.2	120	.8
Min.	10.7	16	1.3	6.7	2.2	.32	1.8	.7	2	.5
July										
Avg.	17.2	21	1.9	—	6.1	3.4	4.6	.9	21	.7
Max.	26.9	23	4.0	7.1	11.4	6.4	7.0	1.3	68	.9
Min.	14.2	19	.5	6.4	3.2	1.3	1.8	7	1	.6
August										
Avg.	15.9	23	2.7	—	4.8	3.5	5.0	.8	20	.7
Max.	19.1	24	6.3	7.1	18.8	5.9	7.5	1.1		.9
Min.	13.8	22	.8	6.6	1.8	1.8	2.1	.5	1	.5
September										
Avg.	14.1	23	3.4	—	9.6	5.4	7.8	.9	55	.7
Max.	30.3	27	8.9	7.1	28	15.0	34.4	1.7	360	.9
Min.	11.5	21	1.7	6.7	4.2	3.2	4.2	.3	1	.4
October										
Avg.	13.2	20	3.9	—	7.2	4.8	6.5	.82	26	.7
Max.	22.4	22	6.7	7.2	9.7	9.0	11.5	1.85	130	.9
Min.	10.6	17	2.7	6.7	4.4	.9	2.4	.32	1	.5
November										
Avg.	16.2	16	4.9	—	11.2	4.5	6.0	.97	11	.7
Max.	24.4	18	15.6	7.1	40	8.6	11.3	2.01	46	.8
Min.	12.7	14	2.7	6.7	6.6	1.45	2.9	.63	< 1	0
December										
Avg.	15.7	13	3.4	—	7.9	5.4	6.5	.66	7	.7
Max.	25.9	14	4.4	7.6	15.2	9.3	8.6	.97	40	18
Min.	12.2	10	2.7	6.6	4.4	.58	1.9	.31	1	.5

AMHERST WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APRIL 1978 TO AUG 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
APRIL 1978										
AVE	1.4	10	32	—	169					.3
MAX	1.5	11.1	36	7.6	188					.6
MIN	1.1	8.9	30	7.3	148					.2
MARCH 1978										
AVE	1.3	8.3	34	—	33					.3
MAX	1.7	9.9	39	7.6	40					.5
MIN	.9	7.2	29	7.3	24					.1
FEB 1978										
AVE	1.1	5.6	31	—	32					.4
MAX	1.4	7.2	30	7.8	40					.6
MIN	.95	4.4	28	7.4	24					.1
JAN 1978										
AVE	1.2	6.7	28	—	30					.5
MAX	1.5	8.3	31	7.8	36					.7
MIN	1.0	5.6	24	7.4	24					.2
DEC										
AVE	1.4	11	29	—	33					.2
MAX	1.5	13	34	7.0	40					.3
MIN	1.3	9	25	6.6	24					.1
NOV 1979										
AVE	1.3	14	31	—	32					.3
MAX	1.5	18	40	7.1	40					.4
MIN	1.1	11	22	6.7	20					.1
OCT 1979										
AVE	1.2	18	31	—	32					.2
MAX	1.5	21	37	7.3	40					.3
MIN	1.1	15	25	6.4	20					.2
SEPT No data										
AUG, 1979										
AVE	1.3	21	30	—	35					.4
MAX	1.5	23	37	7.0	40					.6
MIN	1.1	20	24	6.6	28					.3

(2

FOREST WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1978 TO MAY 1979

MONTH	FLOW MGD	TEMP °C	BOD_5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
DEC 1978										
AVE	1.3	11.1	30	—	31					.3
MAX	1.5	12.3	34	7.9	36					.5
MIN	1.1	9.4	28	7.6	24					.2
NOV 1978										
AVE	1.1	15.6	35	—	38					.3
MAX	1.3	17.2	37	7.6	44					.5
MIN	1.0	12.8	33	7.3	32					.2
OCT 1978										
AVE	1.2	17.8	33	—	36					.4
MAX	1.5	19.4	38	7.5	40					.6
MIN	1.1	16.1	27	7.2	32					.3
SEPT 1978										
AVE	1.1	22	32	—	36					.3
MAX	1.5	24	37	7.7	56					.9
MIN	1.0	20	30	7.3	32					.2
AUG 1978										
AVE	1.2	22.2	32	—	35					.9
MAX	1.5	23.3	38	7.5	44					.8
MIN	.98	21.1	25	7.1	20					.2
JULY 1978										
AVE	1.3	20.	32	—	37					.4
MAX	1.5	21.7	36	7.4	64					.7
MIN	1.1	18.3	29	7.0	28					.2
JUNE 1978										
AVG	1.4	17.8	30	—	34					.3
MAX	1.5	20.6	36	7.5	44					.6
MIN	1.2	15.	21	6.9	20					.1
MAY 79										
AVE	1.4	13.3	30	—	31					.3
MAY	1.5	17.2	36	7.6	40					.7
MIN	1.3	9.4	22	7.2	26					.2

(3)

AMHERST WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

JULY 1979 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl. mg/l
JULY 1979										
AVE	1.3	20	34	—	36					.4
MAX	1.4	22	44	7.2	44					.6
MIN	1.1	18	26	6.6	28					.2
JUNE 1979										
AVE	1.1	18	36	—	38					.3
MAX	1.5	19	40	7.2	48					.5
MIN	.96	16	31	6.7	32					.2
MAY 1979										
AVE	1.3	14	32	—	37					.4
MAX	1.5	16	38	7.2	40					.5
MIN	1.1	12	26	6.6	32					.3
APRIL 1979										
AVE	1.4*	10	33	—	34					.3
MAX	1.5	11	42	7.2	44					.5
MIN	1.1	9	23	6.8	28					.2
MARCH 1979										
AVE	1.3	10	30	—	34					.3
MAX	1.5	11	42	7.3	44					.4
MIN	.98	8	26	6.6	24					.2
FEB 1979										
AVE	1.1	5.6	28	—	28					.3
MAX	1.5	8	31	7.9	32					.5
MIN	.99	5	26	7.4	24					.2
JAN 1979										
AVE	1.2	6	29	—	31					.3
MAX	1.5	8	31	8.5	36					.6
MIN	.91	5	26	7.5	28					.2
JAN 1980										
AVE	1.4	9	25	—	29					.1
MAX	1.5	12	31	7.0	44					.3
MIN	1.1	7	18	6.6	20					0

(1)

EFFINGHAM WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APRIL 19 78 TO SEPT 19 79

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
APR 1978										
AVE	.06	12	4.8	—	0				.78	.95
MAX	.28	12	9.8	7.6	0				2.2	.9
MIN	.02	12	1.4	7.4	0				0	0
MARCH 1978										
AVE	.08	12	10.9	—	2.5					.8
MAX	.16	12	32.2	7.9	6.4					2.0
MIN	.05	12	.43	6.7	0					0
FEB 1978										
AVE	.14	12.3	10	—	6.9				3	0
MAX	.05	13	28	7.7	16				9	0
MIN	.04	12	4	7.1	0				0	0
JAN 1978										
AVE	.07	12	12.8	—	24				0	.7
MAX	.23	12	10.8	7.9	24				0	1.8
MIN	.02	12	12.8	7.4	24				6	.4
(4) DEC 1978										
AVE	.07	17	2.3	—	6.5				0	.3
MAX	.87	17	5.6	7.5	9				0	1.0
MIN	.05	17	1.0	6.7	4				0	.1
NOV 1979										
AVG	.08	18	1.35	—	7				9.3	.5
MAX	.19	19	1.5	7.4	10				9.5	2.1
MIN	.05	17	1.1	6.8	4				0	.1
OCT. 1979										
AVG	.06	19.7	6.5	—	9.7				6.1	.5
MAX	.14	20	12.2	7.4	15				9.2	2.1
MIN	.04	19	1.7	6.8	2				0	.1
SEPT 1979										
AVE	.06	21.6	2.9	—	4.7				0	.8
MAX	.11	23	4.7	8.1	9				0	1.7
MIN	.04	21	1.2	7.1	0				0	.1

(2)

BRENTWOOD WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1978 TO NOV 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	Fecal Coliform #/100 ml	T.R Cl2 mg/l
DEC 1978										
AVE	.026	11.55	1.7	—	4					
MAX	.096	12	2.5	7.9	4				0	.75
MIN	.014	10	.1	7.1	0				0	1.0
									0	.3
NOV 1978										
AVE	.02	12.5	.5	—	36				0	.5
MAX	.03	13	.5	7.6	64				0	.9
MIN	.005	12	.5	7.3	4				0	.2
OCT 1978										
AVE	.03	12	1.4	—	6.7				.55	.3
MAX	.05	13	3.7	7.6	24				2.2	1.9
MIN	.02	12	.3	7.3	0				0	.1
SEPT 1978										
AVE	.02	14	5.7	—	3.6				0	.2
MAX	.07	14	8.0	7.6	7.2				0	.4
MIN	.01	14	4.2	7.1	0				0	0
AUG 1978										
AVE	.3	17.6	3.8	—	10.6				0	.3
MAX	.5	21	6.9	7.6	20				0	.4
MIN	.02	15	2.1	7.6	0				0	.1
JULY 1978										
AVE	.03	13.4	2.9	—	12				0	.2
MAX	.12	14	9.8	7.8	32.8				0	.3
MIN	.02	13	1.8	6.9	0				0	0
JUNE 1978										
AVE	.46	13	10.2	—	14.7				12.3	1.1
MAX	.08	13	13	7.4	24				16	3.0
MIN	.03	13	7.0	6.8	9				9	.1
MAY 78										
AVE	.05	13	3.2	—	17					
MAX	.08	15	9.8	7.8	36				9.6	.9
MIN	.03	13	.1	6.5	8				9.2	.9
									0	0

(3)

GREENWOOD WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

JULY 1979 TO _____ 19__

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R.Cl2 mg/l
JULY 1979										
AVE	.02	19.3	5.3	—	6				563	.5
MAX	.06	21	12.3	7.6	10				16	1.5
MIN	.02	17	1.0	7.1	0				0	0
JUNE 1979										
AVE	.03	11.7	4.8	—	8.3				6.1	.6
MAX	.13	13	6.2	7.5	9				9.7	1.1
MIN	.01	11	2.6	7.0	8				0	.1
MAY 1979										
AVE	.04	11	3	—	5				14	.6
MAX	.12	11	5	7.6	7.6				16	.6
MIN	.02	11	1.5	7.3	0				10	.1
APRIL 1979										
AVE	.06	11	3.5	—	8.7				0	.5
MAX	.14	11	9.3	7.9	16				0	1.4
MIN	.02	11	.25	6.9	4.8				0	.2
MARCH 1979										
AVE	.06	10	10.9	—	10.9				0	.5
MAX	.2	10	21.7	7.5	13				0	1.0
MIN	.02	10	.2	7.1	9.6				0	.1
FEB 1979										
AVE	.07	10	1.1	—	21.2				1	.3
MAX	.18	10	2.4	7.5	44.0				4	.6
MIN	.04	10	.05	7.2	8.8				0	.1
JAN 79										
AVE	.07	10	3.9	—	20				8	.5
MAX	.15	10	8.6	7.6	44				0	1.1
MIN	.05	10	.2	6.8	7.6				0	.1
DEC 78										
AVE	.062	16.1	4.7	—	10.8					.4
MAX	.064	17	11.2	7.5	17					.9
MIN	.044	16	1.2	7.0	6					.2

(1)

ELYRIA WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APRIL 1978 TO SEPT 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
APRIL 1978										
AVE	11.9	11.2	39	—	13	33.7	25.5	7.9		
MAX	24.0	13	130	8.6	110	85	79.5	23.5		
MIN	6.7	9	21	7.1	18	20	0	0.6		
MARCH 1978										
AVE	7.7	14	35	—	28	27.9	22.1	6.2		
MAX	17.0	17	68	7.6	86	49.5	45.4	15.3		
MIN	5.2	11	6	7.2	5	17.0	9.8	1.3		
FEB 1978										
AVE	7.5	11	28	—	38	42.0	33.4	9.5		
MAX	5.0	12	68	7.9	59	66.2	50.4	17.3		
MIN	6.4	9	25	7.2	19	25.5	19.6	2		
JAN 1978										
AVE	8.7	11	36	—	37	39.2	31.1	7.6		
MAX	17.4	14	55	80	100	60.5	49.3	13.9		
MIN	5.7	9	18	7.6	20	7.5	8.7	3.3		
DEC 1979										
AVE	8.2	15	34	—	27	22.5	28.8	4	1416667	
MAX	12.8	18	49	7.5	44	40.8	46	7	26000000	
MIN	5.3	3	21	6.4	8	4.2	6	1	45000	
NOV 1979										
AVE	8.5	18	38	—	20	23	31	4	215000	
MAX	11.0	20	52	7.8	36	31	47	6	4600000	
MIN	6.2	15	15	6.5	6	9	16	2	8	
OCT 1979										
AVG	7.8	22	30	—	32	21.6	28	4.5	92	
MAX	10.9	25	53	7.6	56	31.4	48	7.4	160	
MIN	5.7	19	10	7.1	8	10.2	16	2.6	2	
SEPT 1979										
AVE	7.6	25	31	—	33	21	27	4	163715	
MAX	10.4	27	68	7.9	56	29	38	6	2300000	
MIN	5.4	22	10	6.7	4	9	10	1	8	

(2)

ELYRIA WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 19 78 TO MAY 19 78

MONTH	FLOW MGD	TEMP °C	BOD_5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R.Cl_2 mg/l
DEC. 1978	COMP. T	°C								
AVE	8.1	13	56	—	46	39.9	31.2	5.9	1075000	
MAX	15.2	16	125	8.3	150	65	51.8	9.7	1500000	
MIN	6.7	9	17	7.2	12	27.5	20.2	1.8	700000	
NOV. 1978										
AVE	7.5	18	43	—	29.2	40.6	33.4	11.6		
MAX	11.1	22	66	8.2	114	68.7	51.8	52.5		
MIN	5.6	13	24	6.4	14	27.5	19.6	5.25		
OCT. 1978										
AVE	7.7	20	35	—	18	37.1	33.5	7.8	208	
MAX	12.0	23	59	7.4	57	64.7	64.9	11.1	AK	
MIN	5.8	18	13	7.0	5	19.5	19.9	4.2	4	
SEPT. 1978										
AVE	7.2	25	40	—	22	33.2	29.2	8.3	126	
MAX	9.1	26	68	7.4	55	62.5	56.8	12.1	1200	
MIN	5.6	22	22	6.9	11	17.2	12.9	5.5	<6	
AUG. 1978										
AVE	7.3	25	46	—	36	32.6	27.8	8.1	3558	.4
MAX	11.1	27	69	7.6	108	51.2	51.2	11.1	1500000	.9
MIN	5.9	23	20	6.9	10	16.2	12.0	3.8	6	.1
JULY 1978										
AVE	7.3	23.6	43	—	17.6	33.2	25.4	7.8		.4
MAX	16.4	26	69	7.7	78	65	41.4	13.8		.7
MIN	5.5	20	20	6.9	5	20.2	14.5	3.1		.1
JUNE 1978										
AVE	7.5	22	37	—	25	35.7	28	7.6	237	.4
MAX	14.6	24	53	7.8	35	60.0	45.6	12.6	1400	.9
MIN	6.2	18	11	6.8	9	22.5	16.8	1.2	3	.1
MAY 1978										
AVE	7.9	17	58	—	38	90.3	36.2	7.13	261	.3
MAX	10.7	21	104	8.4	220	57	47.9	12.2	1900	.6
MIN	5.7	14	14	7.2	4	22.5	21.0	2.0	<4	0

(3)

EATON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APR 1979 TO SEP 1979

MONTH	FLOW MGD	TEMP °C	BOD_5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
AUG 1979										
AVE	7.8	26	26	—	30	20.5	27	4	591	
MAX	10.7	28	40	7.9	58	28.6	43	6.5	11300	
MIN	5.8	23	12	7.0	10	11.9	14	2	7	
JULY 1979										
AVE	6.9	24	30	—	19	17	22	4	351	
MAX	9.9	26	62	7.7	37	30.5	39.5	6	1400	
MIN	5.0	19	4	6.7	6	9.5	14	1	7	
JUNE 1979										
AVE	7.0	21	34	—	22	31	29	7	61	
MAX	7.9	23	63	7.8	38	44	43	10	AK	
MIN	5.7	19	14	7.3	10	16	14	3	4	
MAY 1979										
AVE	7.4	19	39	—	28	37	29	9	8744	
MAX	11.2	21	61	7.7	54	45	41	27	170000	
MIN	5.2	14	13	7.4	6	24	16	5	4	
APR 1979										
AVE	7.5	15	29	—	27	34	27	6		
MAX	10.9	19	51	7.8	50	52	41	10		
MIN	5.5	10	7	7.3	10	18	13	2		
MARCH 1979										
AVE	8.1	12	30	—	23	34.5	28	6.4		
MAX	12.2	16	47	7.9	66	42.5	41	80		
MIN	5.9	9	9	7.3	6	22	13	3.4		
FEB 1979										
AVE	6.9	10	67	—	58	51	42	6.4		
MAX	11.0	12	127	8.2	232	66	56.5	12		
MIN	5.3	7	23	7.5	8	26	21.5	2		
JAN 1979										
AVE	7.4	11	55	—	51	45	33	6		
MAX	11.0	13	119	8.2	120	73	58	10		
MIN	5.7	7	23	7.2	6	17	12	2.5		

ENTON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APR 1978 TO SEPT 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T. RCL mg/l
APRIL 1978										
AVE	.2	12.9		—	0				1.5	.4
MAX	.55	15		7.8	0				2.2	.6
MIN	AN	AN		6.9	0				0	AN
MARCH 1978										
AVE	.22	12	29.5	—	19.1				4	.8
MAX	.35	10	63.7	7.9	20				0	1.7
MIN	0	AN	2.8	7.1	10				0	AN
FEB 1978										
AVE	.1	12	8	—	8.5				5.3	.6
MAX	.2	13	8.5	7.9	16				16.0	1.1
MIN	AN	AN	6	7.4	0				0	AN
JAN 1978										
AVE	.12	12.9	23	—	28				0	.9
MAX	.49	13	24	7.9	28				5	1.1
MIN	AN	AN	23	7.4	28				0	0
DEC 1979										
AVE	.26	17	2	—	10				0	.5
MAX	.4	18	2.0	7.8	10				0	.5
MIN	.15	17	1.2	6.9	4				0	.2
NOV 1979										
AVE	.03	17.5	3.3	—	6.7					.5
MAX	1.25	19	4.9	7.8	12.0					.8
MIN	.028	17	1.5	7.0	0				0	.2
OCT 1979										
AVE	.17	19.6	2.3	—	16.7				3	.5
MAX	.29	20	2.7	7.4	32				9	.7
MIN	.07	19	1.9	7.0	2				0	.1
SEPT 1979										
AVE	.22	20.7	5.8	—	8				3	.5
MAX	.62	21	8.3	7.7	15				9	.7
MIN	.08	20	1.7	6.8	4				0	.3

EATON WASTEWATER TREATMENT PLANT

(2) EFFLUENT QUALITY

DEC 19 78 TO MAY 19 78

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
DEC 1978										
AVE	.16	12	.65	—	22				0	.35
MAX	.57	13	1.2	7.5	36				0	.6
MIN	.002	11	.1	7.0	8				0	.1
NOV 1978										
AVE	.16	11.5	3.2	—	6.6				0	.6
MAX	.36	13	4.1	7.6	12				0	1.7
MIN	.001	12	1.5	7.1	0				6	.2
OCT 1978										
AVE	.[illegible]	13	2.9	—	15				1.8	.3
MAX	.6[illegible]	13	5.6	7.3	36				5.1	.7
MIN	[illegible]	13	1.2	7.3	0				0	0
SEPT 1978										
AVE	.16	13.7	1.7	—	10.9				0	.5
MAX	.33	2	3.0	7.6	14				0	1.3
MIN	.09	13	.6	7.1	7.2				0	.2
AUG 1978										
AVE	.[illegible]	13	15	—	3				0	.4
MAX	.33	13	22	7.6	4				0	.7
MIN	.03	13	9	7.0	0				0	.2
JULY 1978										
AVE	.167	13.6	2	—	15				5.3	.1
MAX	.368	14	5.4	7.4	32				16	.9
MIN	AN	AN	.1	6.9	5.6				0	AN
JUNE 1978										
AVE	.15	13	5.6	—	4.8				11.6	.5
MAX	.34	13	10	7.3	9.5				160	.9
MIN	.05	13	2.5	6.8	0				9.2	.3
MAY 78										
AVE	.12	15	2	—	6.8				8.6	.9
MAX	.32	15	4.4	7.4	160				16.0	1.2
MIN	AN	AN	.4	6.9	2				0	AN

8

EFFLUENT WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

AUG 1971 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
AUG 1979										
AVE	.19	21.9	3.3	—	4.9				10	.3
MAX	.47	22	4.7	7.5	7				19	.7
MIN	.08	21	2.1	7.0	2				10	.1
JULY 1979										
AVE	.13	20.3	5.0	—	8.7				9.3	.3
MAX	.34	22	6.1	7.3	12				16	.7
MIN	.02	18	3.1	7.0	4				0	.1
JUNE 1979										
AVE	.17	12	9.9	—	16,13				16	.5
MAX	.45	13	14.7	7.6	20				16	.9
MIN	.03	11	5.3	6.9	10				16	.3
MAY 1979										
AVE	.23	11	7.3	—	4.7				0	.4
MAX	.85	11	17.2	7.4	7.2				0	.8
MIN	.0000	11	1.0	6.8	0.0				0	.1
APR. 1979										
AVE	.07	10.9	3.2	—	.8				8.4	.6
MAX	.58	11	5.3	7.5	2.4				16	1.5
MIN	0	10	1.4	7.1	0				0	.3
MARCH 1979										
AVE	.25	10.2	2,8	—	8.8				0	.3
MAX	1.5	11	7.5	7.6	12				0	1.3
MIN	.05	10	.2	7.1	3.2				0	.1
FEB 1979										
AVG	.14	9.5	2.1	—	12,8				2,3	.4
MAX	.35	10	3.9	7.5	36				9.2	.7
MIN	.02	9	.3	7.1	2				0	.1
JAN 1979										
AVE	.13	10.3	3,4	—	9.2				3	.3
MAX	.44	11	9,1	7.6	19.4				9.2	.9
MIN	.01	10	2,4	7.2	4				0	.1

(1)

FREDERICK CR WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APRIL 1978 TO SEPT 1979

MONTH	FLOW MGD	TEMP °E	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
APR. 1978										
AVE	1.93	11.4	1.5	—	1.1	0		.76	5338	—
MAX	2.25	12.	3.5	7.9	1.2	0		1.25	14500	—
MIN	1.05	10.5	.6	7.8	1.0	0		.5	1100	—
MAR 1978										
AVE	2.6	9.1	1.6	—	1.1	0		.55	5535	.4
MAX	8.6	10.0	6.2	7.9	1.6	0		1.0	34000	2.0
MIN	1.3	8.0	.7	7.7	1.0	0		.12	0	0
FEB 1978										
AVE	1.4	8.1	1.1	—	1.1	0		1.1	157	.11
MAX	1.6	8.5	1.8	7.9	1.2	0		1.8	2000	1.0
MIN	1.2	7.0	.6	7.7	1.0	0		.45	0	.02
JAN 1978										
AVE	1.7	8.2	1.1	—	1.1	0		.9	137	.09
MAX	3.7	10.0	2.6	7.9	2.0	0		1.35	670	.22
MIN	1.15	7.0	.4	7.5	0	0		.5	0	0
(4) DEC 1978										
AVE	2.5	11.8	1.2	—	1.4	0		.34	1750	
MAX	3.9	13	2.5	8.1	4.4	0		.9	5400	
MIN	1.9	10	.7	7.5	.8	0		.17	300	
NOV 1979										
AVE	2.12	13.7	1.2	—	1.2	0		.58	1330	
MAX	3.8	15	2.9	8.0	3.0	0		.91	3900	
MIN	1.5	11.5	.6	7.5	.6	0		.39	7	
OCT 1979										
AVE	1.9	16	.9	—	1.1	0		.78	43	
MAX	2.7	18.5	1.4	7.9	1.9	0		1.04	360	
MIN	1.6	13	.5	7.6	.8	0		.56	0	
SEPT 1979										
AVE	1.96	18.6	1.0	—	1.1	0			70	
MAX	3.4	20	1.5	8.0	1.6	0			520	
MIN	1.5	17	.6	7.6	.8	0			0	

(2)

FRENCH CR. WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1978 TO MAY 1978

MONTH	FLOW MGD	TEMP °F	BOD_5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R. Cl_2 mg/l
DEC 78										
AVE	1.8	10.5	.8	—	.8	0		.48	216	
MAX	3.0	13.5	1.4	8.1	2.0	0		.65	560	
MIN	1.4	9.0	0	7.6	.4	0		.28	0	
NOV 1978										
AVE	1.5	14.1	1.0	—	1.2	0		.51	37	.12
MAX	2.0	17.5	1.8	7.8	2.8	0		.67	470	.3
MIN	1.3	11.5	.2	7.3	.2	0		.34	0	.05
OCT 1978										
AVE	1.65	16.5	8	—	1.4	0		.52	173	.12
MAX	2.5	18.5	1.2	7.9	3.4	0		.63	1500	.34
MIN	1.4	15.5	.2	7.5	1.0	0		.48	0	.01
SEPT 1978										
AVE	1.4	19.3	.7	—	1.1	0		.59	367	.21
MAX	2.0	20.5	1.4	7.9	1.4	0		.7	4600	1.0
MIN	1.2	17.5	.4	7.7	1.0	0		.5	0	.04
AUG 1978										
AVE	.4	19.1	1.0	—	1.1	0		.55	1916	.03
MAX	2.12	21	2.6	8.0	1.4	0		.68	21000	.39
MIN	.2	17.5	.3	7.6	0.5	0		.35	0	.02
JULY 1978										
AVE	1.4	18.6	.8	—	1.4	0		.65	5138	.01
MAX	3.2	21	1.8	7.8	2.8	0		1.05	40000	.05
MIN	.3	17	.1	7.4	.4	0		.38	0	T
JUNE 1978										
AVE	1.5	16.6	1.9	—	1.3	5.7		1.2	142	.08
MAX	2.8	19	4.4	7.9	2.0	7.1		3.8	2400	.5
MIN	1.1	15	0	7.4	1.0	0		0.25	0	T
MAY 78										
AVE	1.56	13.8	.9	—	1.0	0		.64	365	.1
MAX	2.25	16	1.4	7.9	1.2	0		1.25	1200	.23
MIN	.93	11.5	.6	7.6	1.0	0		.45	0	.03

(3)

FREEDOM WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

AUG 1979 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R. Cl_2 mg/l
AUG 1979										
AVE	1.9	19	1.2	—	1.2	0.2		.8	35	
MAX	3.2	20	2.3	7.8	1.8	2.0		1.04	390	
MIN	1.5	17.5	.4	7.2	1.0	0		.16	0	
JULY 1979										
AVE	1.7	18	.8	—	1.2	0		.77	13	
MAX	3.1	20	1.9	7.9	1.6	0		1.00	150	
MIN	1.2	16	.4	7.4	.6	0		.46	0	
JUNE 1979										
AVE	1.8	16.5	.8	—	1.1	0		.84	274	
MAX	3.2	17.5	1.1	8.0	1.6	0		1.15	2280	
MIN	1.5	15.5	.4	7.6	.6	0		.46	0	
MAY 1979										
AVE	1.97	13.7	1.4	—	1.3	0		.54	277	
MAX	5.5	16	3.7	7.9	2.6	0		.80	1940	
MIN	1.4	11	.5	7.6	.4	0		.21	0	
APR 1979										
AVE	2.2	10.8	1.2	—	1.5	0		.89	3550	
MAX	4.6	13.5	1.7	8.1	2.6	0		1.61	8500	
MIN	1.3	8.0	.6	7.7	.6	0		.27	0	
MARCH 1979										
AVE	2.4	8.9	1.7	—	2.1	0		1.22	3100	
MAX	5.7	11.5	2.9	8.2	7.2	0		3.32	14000	
MIN	1.3	7.0	.4	7.4	.8	0		.45	0	
FEB 1979										
AVE	1.7	7.0	1.2	—	1.4	0		.71	2100	
MAX	2.7	9.0	2.1	8.0	2.2	0		1.43	5100	
MIN	1.3	5.5	.4	7.6	.4	0		.40	2200	
JAN 1979										
AVE	2.0	8.4	1.9	—	1.2	0		.5	2565	
MAX	4.8	12	2.9	8.2	2.8	0		.73	8400	
MIN	1.5	7	.7	7.6	.4	0		.33	0	

GRAFTON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

[illegible] 1978 TO SEPT 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
[illegible] 1978										
AVE		18		—	37.6					.5
MAX		13		8.0	52					1.3
MIN		9		7.6	20					0
[illegible] 1978										
AVE		9		—	45					.6
MAX		10		8.1	68					1.8
MIN		8		7.5	24					0
FEB 1978										
AVE		10		—	60.5					.6
MAX		11		7.9	116					1.2
MIN		8		7.6	28					0
JAN 1978										
AVE		11	44	—	[illegible]					.6
MAX		13	[illegible]	7.0	51					1.0
MIN		9	34	7.6	30					0
[illegible] 1979										
AVE		12		—	41				197	.5
MAX		15		7.5	60				TNTC	.7
MIN		10		7.4	24				197	0
NOV 1979										
AVE		14		—	36				86	.5
MAX		17		7.8	50				TNTC	.6
MIN		12		7.6	16				5.3	0
OCT 1979										
AVE		17		—	32				90	.5
MAX		20		7.9	48				67	.7
MIN		14		7.5	16				15	.2
SEPT 1979										
AVE		19		—	28				142	.5
MAX		20.5		7.8	40				302	.7
MIN		18		7.4	16				12.5	0

(8.

CLIFTON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

[illegible] 19[illegible] TO [illegible] 19 78

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	PH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R. Cl2 mg/l
[illegible] 1976										
AVE		11.3		—	[illegible]					.66
MAX		[illegible]		7.9	[illegible]					1.5
MIN		10		[illegible]	3					0
NOV 1978										
AVE		15		—	33				20	.7
MAX		17		7.9	44				TNTC	1.8
MIN		12		7.3	20				23	0
OCT 1978										
AVE		17		—	[illegible]6				9	.7
MAX		19		7.7	[illegible]				[illegible]	[illegible]
MIN		16		7.0	5				5.8	0
SEPT 1978										
AVE		20		—	46				137	.5
MAX		[illegible]		7.9	72				223	1.5
MIN		18		7.3	20				52	0
AUG. 1978										
AVE		[illegible]		—	[illegible]				[illegible]	
MAX		[illegible]		7.8	[illegible]				TI	
MIN		19		[illegible]	[illegible]				[illegible]	
JULY 1978										
AVE		19.5		—	[illegible]				330	.5
MAX		21		7.9	[illegible]				TNTC	1
MIN		17		7.2	[illegible]				[illegible]	0
JUNE 1978										
AVE		18		—	[illegible]					.9
MAX		20		7.7	[illegible]					.7
MIN		15		7.1	[illegible]					0
MAY 1978										
AVE		14		—	32					.5
MAX		17		8.0	[illegible]					.9
MIN		11		7.4	[illegible]					0

(3)

BRETON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

AUG 1978 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100ml	T.R Cl2 mg/l
AUG 1979										
AVE		20	—		24				81	.6
MAX		21	7.8		36				260	2.3
MIN		18	7.6		14				18	.1
SEPT 1979										
AVE		19	—		24				498	.6
MAX		21	8.0		40				TNTC	1.4
MIN		17	7.5		12				18	0
JUNE 1979										
AVE		17.5	—		24				217	.5
MAX		20	7.9		36				470	.8
MIN		15	7.6		16				35	0
MAY 1979										
AVE		15	—		16.6				640	.4
MAX		19	7.9		24				TNTC	.9
MIN		12	7.5		10				350	0
APR 1979										
AVE		13	—		49				1032	.5
MAX		17	8.0		88				2300	.8
MIN		10	7.4		32				34	0
MAR 1979										
AVE		10	—		32				51 000	.3
MAX		12	7.8		38				TNTC	.9
MIN		8	7.5		26				2300	0
FEB 1979										
AVE		9	—		37				TNTC	.15
MAX		11	7.9		44				TNTC	.4
MIN		6	7.6		28				TNTC	0
JAN 1979										
AVE.		11	—		39				204	.3
MAX		13	7.9		50				TNTC	.8
MIN		9	7.0		25				204	0

(6)

AGRENCO WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APRIL 1978 TO JULY 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
APRIL 1978										
AVE	.096	14	30.2	—	29					
MAX	.238	18	46.5	7.9	46					
MIN	.067	10	20.2	6.8	12					
MARCH 1978										
AVE		12	17.8	—	36					
MAX		17	17.8	7.7	36					
MIN		4	7.8	6.5	36					
(4) DEC 78										
AVE	.11	21	9.6	—	11.2				54	.4
MAX	.25	23	25.5	6.8	20				88	1.0
MIN	.07	18	3.2	6.4	4				19	.1
NOV 1979										
AVE	.12	11	5.4	—	11.2					
MAX	.29	4	9.4	7.4	24					
MIN	.09	8	1.5	6.2	4					
OCT 1979										
AVE	.092	15	10.7	—	9				11	.3
MAX	1.16	1	20.2	7.8	16				12	.5
MIN	.053	12	6.6	5.6	4				10	.1
SEPT 1979										
AVE	.11	19	4.05	—	4				2	.1
MAX	.32	22	11.1	6.9	4				2	.1
MIN	.05	16	0	6.5	4				<1	0
AUG 1979										
AVE				—						
MAX										
MIN										
JULY 79										
AVE	.09	21	7.5	—	12.5				248	.3
MAX	.17	23	19.6	8.1	28				410	.8
MIN	.06	18	1.4	6.7	2				81	0

(2)

[illegible] WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1977 TO AUG 1978

MONTH	FLOW MGD	TEMP °C	BOD_5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl₂ mg/l
DEC 77										
AVE	.1	5.5	10.6	—	20.5					
MAX	.27	9	16.6	8.1	52					
MIN	.08	4	5.6	6.9	4					
NOV 1978										
AVE	[illegible]	9	23.4	—	14					.3
MAX	.5	15	69	7.9	22					.9
MIN	[illegible]	6	6.7	6.8	12					0
OCT 1978										
AVE	.078	14	12.5	—	13				43	.2
MAX	.14	18	20	7.6	24				86	.4
MIN	.08	11	3	6.8	4				1	0
SEPT 1978										
AVE	.09	22	11.5	—	28				20	.3
MAX	.12	28	17.8	7.8	68				40	.4
MIN	.08	18	6	7.0	8				<1	0
AUG 1978										
AVE	[illegible]	25	2.5	—	18				1.5	.2
MAX	.19	28	13.5	8.3	24				3	.5
MIN	.09	20	1.3	6.9	4				<1	0
JULY 1978										
AVE	.074	26	12.3	—	17				<1	.2
MAX	.014	29	19.7	8.1	36				<1	1.5
MIN	.047	19	9.3	7.4	4				<1	0
JUNE 1978										
AVE				—						
MAX	.118	30	55	8.2	62					1.5
MIN	.052	16	13	7.4	16					0
MAY 1978										
AVE	.08	19	36.8	—	68					
MAX	.18	28	45.5	8.1	120					
MIN	.06	12	24.9	7.4	32					

[illegible] WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

(3) [illegible] 19 79 TO [illegible] 19 80

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R. Cl2 mg/l
[illegible] 79										
AVE	.09	[illegible]	8.[illegible]	—	17				<1	.4
MAX	.0[illegible]	[illegible]	12.7	7.[illegible]	52				<1	1.0
MIN	.06	17	1.5	7.0	4				<1	.[illegible]
[illegible] 1979										
AVE	.09	15	6.2	—	13				[illegible]6.	.25
MAX	.20	19	29	7.7	64				75	16
MIN	.06	11	5.5	6.7	4				[illegible]	[illegible]
APR 1979										
AVE	.12	13	[illegible]2	—	6.7					
MAX	.[illegible]	21	[illegible]	7.[illegible]	10					
MIN	.[illegible]	[illegible]	[illegible]	[illegible]	3.5					
MAY - 1979										
AVE	.12	10	7.2	—	5.8					
MAX	.33	[illegible]	16	7.6	12					
MIN	.07	5	.9	6.9	3.0					
[illegible] 1979										
AVE	.15	[illegible]	[illegible]	—	[illegible]					
MAX	.29	[illegible]	[illegible]	[illegible]	2					
MIN	.[illegible]	[illegible]	[illegible]	[illegible]	.5					
[illegible] 19										
AVE	.10	4.5	16.8	—	14.8					
MAX	.13	7	29	8.5	27.0					
MIN	.09	4	11	6.9	1.0					
(5) JLY 80										
AVE	.11	5	6	—	7.6					
MAX	.28	[illegible]	[illegible]	7.8	16					
MIN	.09	3	[illegible]7	7.0	2					
FEB 80										
AVE	.12	4.2	3.1	—	6.5					
MAX	.2[illegible]	7	4.2	8.[illegible]	10					
MIN	.[illegible]5	[illegible]	19	6.7	4					

CEDAR LN WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

FEB 19[illegible] TO SEPT 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
FEB 1978										
AVE	1.8	11.1	4.6	—	1	16.8				.3
MAX	4.4	13.9	9.6	7.8	2.8	27.2				1.9
MIN	1.1	7.8	1.5	6.6	.6	4.0				.1
MAR 1978										
AVE	2.1	8.3	7.5	—	3.0	15.8				.4
MAX	3.4	10.	10.3	7.5	7.1	24.5				1.5
MIN	1.1	5.6	2.4	6.7	0	6.5				AG
APR 1978										
AVE	1.2	8.9	7.4	—	4.5	25.1				.1
MAX	1.4	10	15.2	7.6	11	45				.4
MIN	1.1	7.8	3.1	6.5	.6	9.5				.1
MAY 1978										
AVE	1.4	8.9	4.3	—	1.0	21.9				.2
MAX	3.6	11.1	7.1	7.5	3.2	42.2				.7
MIN	1.0	7.2	2.7	6.6	.2	9.5				.1
DEC 1979										
AVE	1.8	12	3.9	—	1.3	14.35		.6		
MAX	4.0	15	10	7.4	2.6	32		1.0		
MIN	.3	10	1.6	6.7	.4	7.7		.4		
NOV 1979										
AVE	1.7	15.7	4.2	—	3.9	16.9		.9		
MAX	3.6	19.5	11.7	7.5	8.4	24.5		1.5		
MIN	1.3	13.5	1.7	6.4	1.2	11.7		.3		
OCT 1979										
AVG	1.3	18	7.2	—	4.4	15.1		.9		
MAX	2.3	21	18.1	7.3	28	21.5		2.3		
MIN	1.1	16	3.6	6.45	1.2	9.5		.6		
SEPT 1979										
AVE.	1.5	21	12.7	—	3.8	11.2		1.3		.4
MAX	3.0	23	23.4	7.3	6.8	21		1.9		1.3
MIN	1.2	20	1.2	6.7	.8	3.4		1.1		0

(2)

OBERLIN WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1978 TO MAY 1978

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R.Cl2 mg/l
DEC 1978										
AVE	1.3	12.5	3.4	—	1.8	16		.9		.5
MAX	3.0	15.5	6.9	7.7	6.0	28.5		1.96		.7
MIN	.9	10	.6	6.9	.4	7.0		.43		.2
NOV 1978										
AVE	1.1	17.2	6.3	—	2.9	23.4				.2
MAX	1.6	18.9	11.3	7.4	7.3	36				.4
MIN	.9	13.9	2.6	6.5	0	6.7				0
OCT 1978										
AVE		18.3	3.2	—	3.2	13.3			6	.2
MAX	.5	21.1	6.2	7.2	8.6	24.0			66	1.25
MIN	.8	12.8	.8	6.5	.4	3.5			<1	0
SEPT 1978										
AVE	.1	22.2	2.8	—	3.4	20			3	
MAX	.5	23.9	5.6	7.0	9.2	65.5			AK	
MIN	.9	20	.3	6.3	.8	2.5			<1	
AUG 1978										
AVE	.9	23.8	2	—	2	7.4				.3
MAX	1.5	23.9	5.4	7.0	5.2	15.5				1.6
MIN	.8	22.2	.5	6.2	.2	2.4				.1
JULY 1978										
AVE	1.1	20.6	1.9	—	1.1	14				.3
MAX	2.17	22.2	4.5	7.2	1.8	33.5				.9
MIN	.9	18.3	.7	6.2	.2	1.2				0
JUNE 1978										
AVE	1.7	17.8	3.1	—	1.3	11.2				.2
MAX	1.7	20.0	7.6	7.7	2.6	18.4				.6
MIN	.8	16.7	.2	6.1	0	4.7				.1
MAY 78										
AVE	1.5	15	8.4	—	2.3	16.2				.1
MAX	2.7	17.8	11.5	7.1	5.2	26.7				.4
MIN	1.1	12.8	5.2	6.4	.2	9.1				0

(3)

OBERLIN WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

AUG 1979 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
AUG 1979										
AVE	1.3	21	2.8	—	1.3	9.4		.85		.2
MAX	2.4	23.5	5.3	7.0	3.2	19.5		1.7		.6
MIN	1.0	20	1.1	6.2	.4	2.5		.5		0
JULY 1979										
AVE	.4	20	4.3	—	2.4	17.2		1.1		.3
MAX	[illegible]	24.5	9.8	7.3	6.4	21.0		1.8		.9
MIN	[illegible]	18	2.4	6.7	.4	9.0		.5		.1
JUNE 1979										
AVE	1.3	17.5	3.7	—	1.5	18.7		.7		.3
MAX	2.6	20	8.0	7.8	34	22		.9		.4
MIN	.0	15.5	2.0	6.8	.8	17		.3		.2
MAY 1979										
AVE	1.6	15	3.6	—	1.7	24.5		1.5		.3
MAX	3.2	17	13.3	7.3	2.8	31.5		2.5		.6
MIN	.1	12	5.1	6.9	.8	18.7		.6		.2
APR 1979										
AVE	.9	11	9.6	—	2.8	20.5		.7		
MAX	3.7	14.5	14	8.1	7.0	27.7		1.0		
MIN	1.2	8.5	5.5	7.0	.4	16.2		.07		
MARCH 1979										
AVE	1.9	9.2	7.3	—	4	24.9		1.0		
MAX	3.6	13.0	9.8	8.0	18	33.7		1.7		
MIN	1.2	7.0	2.1	6.7	.8	14.5		.4		
FEB 1979										
AVG	1.4	8.8	7.4	—	1.5	23.6		1.2		
MAX	5.6	11	11.6	7.3	2.7	25.5		3.2		
MIN	.9	7	4.8	6.4	.4	17.5		.6		
JAN 1979										
AVE	.5	9.6	6.5	—	1.2	18.2		1.0		
MAX	[illegible]	13.5	11.4	7.5	3.6	31.5		2.3		
MIN	.1	6	1.8	6.0	.4	11.0		.4		

SPENCER WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APR 19~~78~~ TO SEPT 19_77

(1)

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
APL 1978										
AVE	.068	5.1	24	—	26.5					.5
MAX	.073	7	26	7.5	30					.6
MIN	.063	3	22	7.0	22					.4
MAR 1978										
AVE	.065	1.97	20.8	—	26.4					.5
MAX	.074	4	24	7.5	28					.6
MIN	.055	0	18	7.0	24					.4
FEB 1978										
AVE	.057	.7	20.5	—	27.5					.5
MAX	.066	1	22	7.4	32					.6
MIN	.051	0	18	7.1	24					.4
JAN 1978										
AVE	.056	.8	20.5	—	27					.5
MAX	.062	1	24	7.5	32					.6
MIN	.049	0	18	7.0	24					.3
(4) DEC 1977										
AVE	.[illegible]	1.8	23.5	—	32					.4
MAX	.[illegible]	3	25	7.1	34					.5
MIN	.[illegible]	1	24	6.8	30					.3
NOV 1977										
AVE	.049	7.9	.5	—	29					.2
MAX	.045	16	.16	7.3	32					.4
MIN	.035	2	.9	6.9	26					0
OCT 1977										
AVG	.[illegible]	17.6	26	—	25					.5
MAX	.045	20	28	7.4	30					.6
MIN	.[illegible]	15	22	7.0	22					.4
SEPT 1977										
AVE	.058	21.6	27	—	27					.5
MAX	.[illegible]	24	30	7.5	28					.7
MIN	.035	19	24	7.1	26					.4

(2)

SPENCER WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1976 TO MAY 19 79

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R.Cl2 mg/l
DEC 1978										
AVE	.044	3.9	20	—	25.5					.4
MAX	.053	9	22	7.5	28					.5
MIN	.04	0	18	7.0	22					.3
NOV 1978										
AVE	.05	13.4	4	—	20.8				26	
MAX	.056	17	6	7.4	24				28	
MIN	.045	9	3	7.0	18				24	
OCT 1978										
AVE	.053	18.8	20	—	28					.4
MAX	.053	20	22	7.5	30					.5
MIN	.045	17	18	6.9	26					.2
SEPT 1978										
AVE	.051	23.5	21.5	—	28					.4
MAX	.054	23	24	7.6	30					.5
MIN	.046	21	20	7.0	26					.3
AUG 1978										
AVE	.054	22.7	25.2	—	28.4					.4
MAX	.057	24	28	7.5	32					.5
MIN	.049	22	24	7.0	26					.3
JULY 1978										
AVE	.059	21	20.5	—	26					.4
MAX	.076	23	22	7.5	28					.6
MIN	.051	17	18	6.9	24					.3
JUNE 1978										
AVE	.057	16.5	23.5	—	26					.5
MAX	.059	18	26	7.5	28					.6
MIN	.054	14	20	6.9	25					.3
MAY 1978										
AVE	.058	10.9	26	—	27.0					.5
MAX	.065	14	28	7.5	30					.6
MIN	.050	7	24	7.1	25					.3

(3)

[illegible] WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

[illegible] 1978 TO [illegible] 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R. Cl_2 mg/l
AUG 1979										
AVE	.053	23.4	20.8	—	27.2					.5
MAX	.123	24	24	7.1	30					.1
MIN	.051	22	18	7.3	24					.2
JULY 1979										
AVE	.038	21	26	—	27					.5
MAX	.063	22	28	7.5	30					.6
MIN	.051	20	24	7.0	26					.4
JUNE 1979										
AVE	.06	18.6	24.5	—	28.5					.5
MAX	.057	20	26	7.5	30					.6
MIN	.057	16	24	7.0	26					.3
MAY 1979										
AVE	.046	13.3	24.4	—	28.4					.5
MAX	.064	16	26	7.5	30					.6
MIN	.056	8	20	7.0	26					.4
APR 1979										
AVE	.049	5.5	24	—	29					.45
MAX	.064	8	26	7.6	30					.6
MIN	.036	2	22	6.8	28					.4
MAR. 1979										
AVE	.051	2.1	26.5	—	29.5					.5
MAX	.065	4	28	7.5	32					.6
MIN	.055	0	24	7.0	28					.3
FEB 1979										
AVE	.06	.25	24.5	—	27.5					.4
MAX	.064	1	26	7.6	30					.5
MIN	.056	0	22	7.0	26					.3
JAN 1979										
AVE	.051	.3	20.9	—	25.6					.4
MAX	.057	1	24	7.5	29					.5
MIN	.046	0	18	6.8	22					.3

(1)

WELLINGTON WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

APR 1978 TO SEPT 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
APR 1978										
AVE	.7	9.5	7.7	—	13					.4
MAX	1.6	12	13.7	8.0	16					.8
MIN	.3	3	1.0	7.7	2					.1
MAY 1978										
AVE	1.0	5.2	8.9	—	9.6					.3
MAX	1.9	9	12.1	7.9	16					.5
MIN	.3	2	6.6	7.7	2					.2
JUN 1978										
AVE	.35	4.8	19.1	—	14					.3
MAX	.5	6	20.6	8.2	26					.6
MIN	.3	3	6.8	7.7	2					.1
JUL 1978										
AVE	.4	5	24.6	—	9.4					.4
MAX	1.5	7	8.[illegible]	8.3	15					.7
MIN	.4	4	2.5	7.5	2					.1

(4)

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH SU	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS mg/l	FECAL COLIFORM #/100 ml	T.R Cl_2 mg/l
DEC 1979										
AVE				—						
MAX										
MIN										
NOV 1979										
AVE	.5	11.5	9.7	—	10.7					.7
MAX	1.1	15	24.9	7.5	20					1.0
MIN	.2	9	4.2	6.9	4					.3
OCT 1979										
AVE	.5	14.7	7.1	—	12					.7
MAX	.[illegible]	[illegible]	15.4	7.6	18					.9
MIN	.[illegible]	10	3.2	6.8	6					.3
SEPT 1979										
AVE	.4	16.6	7.6	—	15					.6
MAX	1.3	32	13.9	8.1	31					.9
MIN	.3	16	4.5	6.8	8					.2

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[illegible] WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

DEC 1978 TO MAY 1978

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R Cl2 mg/l
DEC 1978										
AVE	.5	7.7	8.3	—	14.7					
MAX	1.3	12	18.5	7.6	35					
MIN	.3	5	4.6	6.8	8					
NOV 1978										
AVE	.3	11.9	5.6	—	18					.6
MAX	.8	15	9.1	8.8	36					.8
MIN	.2	8	2.5	6.7	6					.4
OCT 978										
AVE	.3	19.9	6	—	11.8					.7
MAX	.6	13	8.4	7.3	18					1.1
MIN	.3	12	3.6	6.7	4					0
SEPT 1978										
AVE	.3	19.8	7.4	—	7.8					.7
MAX	.5	22	12.9	7.2	12.0					1.3
MIN	.2	15	2.1	6.5	4					.5
AUG. 1978										
AVE	.3	20.4	5.8	—	11.0					.6
MAX	.5	22	8.6	7.5	16.0					.8
MIN	.25	19	3.3	6.7	2.0					.4
JULY 1978										
AVE	.3	20	6.9	—	20.5					.7
MAX	.9	23	10.5	7.7	40					1.2
MIN	.2	18	4.9	6.9	4					.5
JUNE 1978										
AVE	.4	18.2	4.9	—	20					.7
MAX	1.1	20	14.3	7.7	32					1.3
MIN	.2	14	1.4	7.2	12					.2
MAY 1978										
AVE	.6	13.4	3.5	—	7.3					.4
MAX	.1	17	5.6	7.9	14					.7
MIN	.2	10	.7	7.1	2					.2

(3)

[illegible] WASTEWATER TREATMENT PLANT

EFFLUENT QUALITY

AUG 1979 TO JAN 1979

MONTH	FLOW MGD	TEMP °C	BOD5 mg/l	pH su	TSS mg/l	NH_3-N mg/l	TKN mg/l	T. PHOS. mg/l	FECAL COLIFORM #/100 ml	T.R. Cl_2 mg/l
AUG 1979										
AVE	.5	20.2	4.8	—	9.3					.55
MAX	1.1	23	5.3	7.4	20					.8
MIN	.3	16	4.3	7.0	4					AA
JULY 1979										
AVE	.4	19.2	7.1	—	10.4					.6
MAX	.7	21	11.7	8.0	18					.9
MIN	.3	16	3.3	7.2	8					.3
JUNE 1979										
AVE	.4	17.4	8.9	—	12					.6
MAX	.8	20	17.2	7.4	20					.8
MIN	.3	15	5.2	7.0	6					.3
MAY 1979										
AVE	.55	19.2	8.7	—	19.5					.55
MAX	.6	18	13	7.8	36					.8
MIN	.3	10	7.7	6.8	8					.3
APR. 1979										
AVE	.7	10.1	8.7	—	21					.5
MAX	1.5	15	12.2	8.0	40					.8
MIN	.3	8	5.7	6.9	6					.2
MAR. 1979										
AVE	.8	7	10.2	—	15.5					.5
MAX	1.9	11	15.9	7.7	30					.7
MIN	.4	2	6.6	6.9	6					.2
FEB 1979										
AVG	.5	2.7	13.7	—	18.8					.6
MAX	1.6	7	17.8	7.6	30					1.0
MIN	.3	1	8.6	7.0	6					.3
JAN 1979										
AVE	.5	5.6	10.5	—	21.7					.7
MAX	1.5	9	16.2	7.5	68					1.2
MIN	.3	2	7.4	7.0	6					.2