TABLE 6-7
EPA-ITD SAMPLING PROGRAM
SEDIMENTATION EFFLUENT

FRACTION : METALS

PLANT NUMBER: C
EPISODE NUMBER: 1133
SAMPLE POINT: TREATED EFFLUENT

SAMPLE NO.	15358
SAMPLE DATE	Sep 18, 1986

PARAMETER	UNITS	
ALUMINUM	UG/L	340
ANTIMONY	UG/L	50
ARSENIC	UG/L	170
BARIUM	UG/L	43
BERYLLIUM	UG/L	2
BORON	UG/L	370
CADMIUM	UG/L	5
CALCIUM	UG/L	46000
CHROMIUM	UG/L	41
COBALT	UG/L	10
COPPER	UG/L	4
IRON	UG/L	5800
LEAD	UG/L	80
MAGNESIUM	UG/L	9500
MANGANESE	UG/L	320
MERCURY	UG/L	.2
MOLYBDENUM	UG/L	93
NICKEL	UG/L	12
SELENIUM	UG/L	25
SILVER	UG/L	2
SODIUM	UG/L	4800000
THALLIUM	UG/L	10
TIN	UG/L	650
TITANIUM	UG/L	10
VANADIUM	UG/L	100
YTTRIUM	UG/L	10
ZINC	UG/L	140

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

TABLE 6-8
EPA-ITD SAMPLING PROGRAM
OIL/WATER SEPARATOR PERFORMANCE

FRACTION : CONVENTIONALS AND NONCONVENTIONALS

PARAMETER	UNITS			
PLANT NUMBER:		A	A	
EPISODE NUMBER:		1128	1128	
SAMPLE POINT		RAW WASTEWATER	TREATED EFFLUENT	
SAMPLE NO.		15339	15340	PERCENT REMOVED
SAMPLE DATE		Jul 23, 1986	Jul 23, 1986	
AMMONIA	MG/L	13	18	0
BOD-5, TOTAL	MG/L	3900	3780	3
BOD5, DISSOLVED	MG/L	1980	1740	12
CHLORIDE	MG/L	50	125	0
COD, DISSOLVED	MG/L	3140	3990	0
COD, TOTAL	MG/L	6110	7380	0
DISSOLVED SOLIDS	MG/L	8850	7380	17
FLUORIDE	MG/L	30	34	0
OIL & GREASE	MG/L	3240	770	76
PHENOL	MG/L	1.61	1.13	30
SULFIDE	MG/L	.1	.1	0
SUSPENDED SOLIDS	MG/L	4980	1880	62
SUSPENDED VOL SOLIDS	MG/L	880	400	55
TKN	MG/L	5	13	0
TOTAL CYANIDE	MG/L	8.3	9	0
TOTAL ORGANIC CARBON	MG/L	1520	1530	0
TOTAL VOL SOLIDS	MG/L	3200	2500	22

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

TABLE 6-9
EPA-ITD SAMPLING PROGRAM
OIL/WATER SEPARATOR PERFORMANCE

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS			
PLANT NUMBER:		A	A	
EPISODE NUMBER:		1128	1128	
SAMPLE POINT		RAW WASTEWATER	TREATED EFFLUENT	
SAMPLE NO.		15339	15340	PERCENT
SAMPLE DATE		Jul 23, 1986	Jul 23, 1986	REMOVED
1,1,1-TRICHLOROETHANE	UG/L	355	590	0
2-BUTANONE (MEK)	UG/L	534	589	0
2-CHLORONAPHTHALENE	UG/L	4609	4483	3
ACETONE	UG/L		673	0
ALPHA-TERPINEOL	UG/L	4745	4322	9
BENZOIC ACID	UG/L		1460	0
ETHYLBENZENE	UG/L	221	308	0
N-DECANE (N-C10)	UG/L	11750		0
N-DOCOSANE (N-C22)	UG/L		147	0
N-DODECANE (N-C12)	UG/L	6950	10194	0
N-HEXADECANE (N-C16)	UG/L	1066		0
N-OCTACOSANE (N-C28)	UG/L		493	0
TOLUENE	UG/L	507	844	0
TRICHLOROETHENE	UG/L	95	95	0

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

TABLE 6-10
EPA-ITD SAMPLING PROGRAM
OIL/WATER SEPARATOR PERFORMANCE

FRACTION : METALS

PARAMETER	UNITS			
PLANT NUMBER:		A	A	
EPISODE NUMBER:		1128	1128	
SAMPLE POINT		RAW WASTEWATER	TREATED EFFLUENT	
SAMPLE NO.		15339	15340	PERCENT
SAMPLE DATE		Jul 23, 1986	Jul 23, 1986	REMOVED
ALUMINUM	UG/L	7800	5900	24
ANTIMONY	UG/L	562	562	0
ARSENIC	UG/L	31	44	0
BARIUM	UG/L	2600	2100	19
BERYLLIUM	UG/L	50	50	0
BORON	UG/L	880	960	0
CADMIUM	UG/L	29	18	38
CALCIUM	UG/L	47000	36000	23
CHROMIUM	UG/L	6700	5300	21
COBALT	UG/L	210	200	5
COPPER	UG/L	1400	1000	29
IRON	UG/L	10000	12000	0
LEAD	UG/L	27000	20000	26
MAGNESIUM	UG/L	14000	12000	14
MANGANESE	UG/L	700	480	31
MERCURY	UG/L	0.2	0.2	0
MOLYBDENUM	UG/L	340	640	0
NICKEL	UG/L	120	130	0
SELENIUM	UG/L	5	5	0
SILVER	UG/L	1	1	0
SODIUM	UG/L	1800000	1800000	0
THALLIUM	UG/L	10	10	0
TIN	UG/L	240	220	8
TITANIUM	UG/L	59	93	0
VANADIUM	UG/L	12	11	8
YTTRIUM	UG/L	10	10	0
ZINC	UG/L	13000	12000	8

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

6.3.3 Air Flotation

Air flotation is a wastewater treatment method that is used to break emulsions and to separate oil from water. First high pH, oily wastestreams are neutralized, then a flocculent and a coagulant are added. The mixed flow is sent to a clarifier where several hours detention are provided. At the bottom of the clarifier, fine bubbles of air are dispersed into the wastewater. The air bubbles rise and become enmeshed in oil agglomerations. The air-entrained agglomerations become bouyant and rise to the top of the clarifier where they are skimmed. Two facilities were sampled by EPA ITD that used air flotation systems, Plants B and D.

Plant B is a small drum washing plant that recycles caustic wash. The process wastewater consists of rinse water and is treated by air flotation. The treated effluent is discharged. The system detention time is 3.5 hours and the operating shift lasts 4 to 5 hours. Since the total treatment system volume is flushed only once per day, it was not possible to obtain a matched pair of raw wastewater and treated effluent for a given day. Therefore, sampling was conducted for two days. The raw wastewater sample from the first day matches best with the treated effluent sample from the second day.

Raw wastewater treated effluent and percent removal data for the Plant B air flotation system are shown in Tables 6-11 through 6-13. The pollutant removals are calculated as the percent difference between the August 6 raw wastewater sample and the August 7 treated wastewater, since the system had a 1-day detention period. No or low pollutant removals are calculated for the majority of parameters measured. These observations may be the result of lag time in the system. However, suspended solids and volatile solids removals are reasonable at 85 and 76 percent, respectively. P-cymene and toluene removals are also good at 81 and 99 percent, respectively.

Plant D is a large drum washing and burning plant that recycles caustic wash. The process wastewater consists of washing process rinses and miscellaneous wastestreams (74 percent) and quench water from the burning process (26 percent). Receiving area drainage is a component of the process wastewater. The combined process wastewater is treated by air flotation and the effluent is reused as make up to caustic wash. The system detention time

TABLE 6-11
EPA-ITD SAMPLING PROGRAM
AIR FLOTATION PERFORMANCE - PLANT B

FRACTION : CONVENTIONALS AND NONCONVENTIONALS

PARAMETER	UNITS					
	PLANT NUMBER:	B	B	B	B	
	EPISODE NUMBER:	1130	1130	1130	1130	
	SAMPLE POINT	RAW WASTEWATER	TREATED WSTWTR	RAW WASTEWATER	TREATED WSTWTR	
	SAMPLE NO.	15344	15345	15348	15349	PERCENT
	SAMPLE DATE	Aug 6, 1986	Aug 6, 1986	Aug 7, 1986	Aug 7, 1986	REMOVED
AMMONIA	mg/l	22.5	10.25	9.0	8.8	61
BOD-5, TOTAL	mg/l	2200	1980	418	1860	15
BOD5, DISSOLVED	mg/l	2550	2700	2160	2100	18
CHLORIDE	mg/l	1500	1500	1400	800	47
COD, DISSOLVED	mg/l	3860	2772	4400	2300	40
COD, TOTAL	mg/l	3860	3190	5400	2400	38
DISSOLVED SOLIDS	mg/l	5710	6600	8940	6370	0
FLUORIDE	mg/l	40		15	31	22
OIL & GREASE	mg/l	4810	2450	2940	4950	0
PHENOL	mg/l	1.51	.50	92	.58	62
SULFIDE	mg/l	.1	.1	.1	.1	0
SUSPENDED SOLIDS	mg/l	1850	72	780	264	86
SUSPENDED VOL SOLIDS	mg/l	63	14	50	206	0
TKN	mg/l	1.75	6.7	46	40	0
TOTAL CYANIDE	mg/l	1.9	.60	.66	.58	69
TOTAL ORGANIC CARBON	mg/l	1600	1100	210	900	44
TOTAL VOL SOLIDS	mg/l	3170	926	1175	740	77
pH		12.6	5.8	12.7	5.9	53

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

PERCENT REMOVED = PERCENT DIFFERENCE BETWEEN 15344 AND 15349

TABLE 6-12
EPA-ITD SAMPLING PROGRAM
AIR FLOTATION PERFORMANCE - PLANT B

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS				
PLANT NUMBER:		B	B	B	B
EPISODE NUMBER:		1130	1130	1130	1130
SAMPLE POINT		RAW WASTEWATER	TREATED WSTWTR	RAW WASTEWATER	TREATED WSTWTR
SAMPLE NO.		15344	15345	15348	15349
SAMPLE DATE		Aug 6, 1986	Aug 6, 1986	Aug 7, 1986	Aug 7, 1986
O-CRESOL	UG/L	143		37	
2-BUTANONE (MEK)	UG/L			1361630	1001760
2-CHLORONAPHTHALENE	UG/L	46		46	48
2-METHYLNAPHTHALENE	UG/L		11	24	16
2-NITROPHENOL	UG/L		64		45
4-NITROPHENOL	UG/L		100		
ACETONE	UG/L				1845
BENZENE	UG/L				182
BENZOIC ACID	UG/L			94999	
BENZYL ALCOHOL	UG/L			59	
BIPHENYL	UG/L	14			
CHLOROBENZENE	UG/L				56
ETHYLBENZENE	UG/L	3179	1217		2319
HEXANOIC ACID	UG/L	383	24		
ISOBUTYL ALCOHOL	UG/L	3517			
METHYLENE CHLORIDE	UG/L				500
NAPHTHALENE	UG/L	382			
NITROBENZENE	UG/L	16			
P-CYMENE	UG/L	72		49	14
STYRENE	UG/L	144		98	61
THIOXANTHONE	UG/L	311			
TOLUENE	UG/L	55572	86987	262	799

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
PERCENT REMOVED = PERCENT DIFFERENCE BETWEEN SAMPLES 15344 AND 15349

TABLE 6-13
EPA-ITD SAMPLING PROGRAM
AIR FLOTATION PERFORMANCE - PLANT B

FRACTION : METALS

PARAMETER	UNITS					
PLANT NUMBER:		B	B	B	B	
EPISODE NUMBER:		1130	1130	1130	1130	
SAMPLE POINT		RAW WASTEWATER	TREATED WSTWTR	RAW WASTEWATER	TREATED WSTWTR	
SAMPLE NO.		15344	15345	15348	15349	PERCENT
SAMPLE DATE		Aug 6, 1986	Aug 6, 1986	Aug 7, 1986	Aug 7, 1986	REMOVED
ALUMINUM	UG/L	9900	9900	9400	27000	0
ANTIMONY	UG/L	16	50	15	50	0
ARSENIC	UG/L	20	5	23	5	75
BARIUM	UG/L	1800	180	1500	410	77
BERYLLIUM	UG/L	1	1	1	1	0
BORON	UG/L	34	16	13	27	21
CADMIUM	UG/L	7	5	6	5	29
CALCIUM	UG/L	26000	26000	21000	22000	15
CHROMIUM	UG/L	1000	120	830	230	77
COBALT	UG/L	140	51	120	62	56
COPPER	UG/L	400	57	390	110	72
IRON	UG/L	46000	4300	40000	15000	67
LEAD	UG/L	2400	79	2400	510	79
MAGNESIUM	UG/L	7600	2900	6100	3600	53
MANGANESE	UG/L	2100	840	1800	980	53
MERCURY	UG/L	1.3	0.2	1.1	.34	74
MOLYBDENUM	UG/L	100	90	110	83	17
NICKEL	UG/L	34	170	36	150	0
SELENIUM	UG/L	25	5	25	5	80
SILVER	UG/L	1	1	1	1	0
SODIUM	UG/L	1500000	1600000	1800000	1600000	0
THALLIUM	UG/L	10	10	10	10	0
TIN	UG/L	120	130	150	130	0
TITANIUM	UG/L	700	26	580	200	71
VANADIUM	UG/L	60	19	59	31	48
YTTRIUM	UG/L	10	10	10	10	0
ZINC	UG/L	17000	14000	18000	13000	24

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

PERCENT REMOVED = PERCENT DIFFERENCE BETWEEN 15344 AND 15349

is approximately 1 hour. Daily paired raw wastewater and treated effluent samples were obtained for a 5-day sampling episode.

Raw wastewater, treated effluent, and percent removal data for the Plant D air flotation system are shown in Tables 6-14 through 6-17. Pollutant removals are calculated on a daily basis, since the system detention time is only 1 hour. The average percent removed is the mean of positive and zero removal. Pollutant removals for COD, oil and grease, and the various solids samples range between 45 and 63 percent. Positive removals are reported for most of the metals. The average removal calculated was 36 percent and the highest removal calculated was 77 percent. Positive average removals are calculated for all of the extractable and volatile organics found in the raw wastewater and the mean of the averages is 63 percent. However, 10 compounds are detected in treated effluents that were not detected in the raw wastewater. Eight pesticides/herbicides are removed and six are removed 100 percent. However, five compounds are found in the treated effluent that are not found in the raw wastewater.

6.4 ZERO DISCHARGE TECHNOLOGY

EPA ITD sampled four wastewater treatment systems that are representative of the wastewater treatment technologies used in the industry: sedimentation, oil/water separation, and air flotation. Poor removals were observed and this is probably due to poor operational control during the sampling episodes rather than being indicative of industry-wide practice. Therefore, few positive conclusions can be drawn regarding treatment system performance for this industry.

EPA observed that zero discharge is achieved by a significant number of the facilities that were visited. Five of the 16 facilities generate significant volumes of wastewater and also achieve zero discharge. All drum reconditioners are prohibited from discharging process wastewater in the Chicago Metropolitan Sanitation District (MSD). EPA identified 19 facilities that are potentially active in the city of Chicago (Appendicies A and B). Information is available on Plant D and four more facilities identified here as Plants N, O, P, and Q. The methods used to achieve zero discharge are described below for each facility.

TABLE 6-14

EPA-ITD SAMPLING PROGRAM

AIR FLOTATION PERFORMANCE - PLANT D

FRACTION : CONVENTIONALS AND NONCONVENTIONALS

PARAMETER	UNITS											
PLANT NO.		D	D	D	D	D	D	D	D	D	D	
EPISODE NO.		1179	1179	1179	1179	1179	1179	1179	1179	1179	1179	
SAMPLE NO.		15713	15714	15715	15716	15718	15719	15722	15723	15725	15726	AVERAGE
SAMPLE POINT		RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	PERCENT
SAMPLE DATE		Feb 2, 1987	Feb 2, 1987	Feb 3, 1987	Feb 3, 1987	Feb 4, 1987	Feb 4, 1987	Feb 5, 1987	Feb 5, 1987	Feb 6, 1987	Feb 6, 1987	REMOVED
AMMONIA	mg/l	6.59	6.22	16.1	14.4	5.53	5.62	2.25	2.5	11.8	13.8	3
BOD-5, TOTAL	mg/l	16800	9600	7500	4190	10900	4370	6300	4170	3140	2310	41
BOD5, DISSOLVED	mg/l	9000	6600	4400	3500	4640	2760	2790	3240	4710	1820	38
CHLORIDE	mg/l	2800	8000	5100	10800	4200	8800	3200	7400	3400	9100	0
COD, DISSOLVED	mg/l	45520	22100	26400	14900	15100	6890	19000	15000	22800	12500	43
COD, TOTAL	mg/l	75600	40600	38100	18500	102000	16500	31800	22300	40600	9210	58
DISSOLVED SOLIDS	mg/l	29900	26500	27200	23400	28200	18500	20000	21800	18800	20800	12
FLUORIDE	mg/l	89.7	.1	59	.1	53	.14	37.3	.52	29	.01	100
OIL & GREASE	mg/l	12900	19850	5600	252	33000	1480	4940	4800	2540	900	52
PHENOL	mg/l	169	347	87.4	44.5	68.8	58.4	64.7	71.5	53.2	23.4	24
SUSPENDED SOLIDS	mg/l	21800	6730	9270	3220	20600	2920	5220	3000	5710	6140	53
SUSPENDED VOL SOLIDS	mg/l	16000	5940	4033	3120	15500	2070	2675	1400	4700	210	63
TKN	mg/l	428	370	270	282	257	153	20.2	190	291	201	17
TOTAL CYANIDE	mg/l	.57	.55	.48	.32	.58	.50	.48	.58	.05	.43	10
TOTAL ORGANIC CARBON	mg/l	19300	14500	8500	4600	7200	4380	5650	4290	5690	3640	34
TOTAL VOL SOLIDS	mg/l	29940	12290	14280	20690	26370	5440	9880	7000	10590	4420	45

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

AVERAGE PERCENT REMOVED = MEAN OF POSITIVE AND ZERO REMOVALS

TABLE E-15
EPA ITD SAMPLING PROGRAM
AIR FLOTATION PERFORMANCE - PLANT D

SECTION : EXTRACTABLE AND VOLATILE ORGANICS

PLANT NO.	D	D	D	D	D	D	D	D	D	D	D	D	
SEQUENCE NO.	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179	
SAMPLE NO.	15713	15714	15715	15716	15718	15719	15722	15723	15725	15726		
SAMPLE POINT	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED		
SAMPLE DATE	Feb 2, 1987	Feb 2, 1987	Feb 3, 1987	Feb 3, 1987	Feb 4, 1987	Feb 4, 1987	Feb 5, 1987	Feb 5, 1987	Feb 6, 1987	Feb 6, 1987		
PARAMETER	UNITS												AVERAGE PERCENT REMOVED
1,1,1 TRICHLOROETHANE	UG/L	36179	4099	11825	2721	71613	6780	26035	14953		1893		60
1,1,2 TRICHLOROETHANE	UG/L	25206	332						1225				46
1,2-DICHLOROETHANE	UG/L				531				194				19
1,2 DIPHENYLHYDRAZINE	UG/L							315					0
2-BUTANONE (MEK)	UG/L	987690	174905						2451				58
2 CHLOROPHENOL	UG/L					18823	19097			1351260	108185		0
2 HEXANONE	UG/L								44272				0
2 NITROPHENOL	UG/L												0
4-CHLORO-2-NITROANILINE	UG/L				5359	3256	3379	2739	2082	2866	171		8
ACETONE	UG/L						2505						0
ACROLEIN	UG/L	438133	147138	677250				2045290	103307	209456			91
BENZYL ALCOHOL	UG/L								1783		1441		0
BIPHENYL	UG/L	9817	2788				4146			9051			57
BIS (2-ETHYLHEXYL) PHTHALATE	UG/L	1266				1294							100
BUTYL BENZYL PHTHALATE	UG/L	5113		43747	3462	43078	6603	9285		5719	900		93
DI N-BUTYL PHTHALATE	UG/L					3281			2675				50
DICHLOROETHYL ETHER	UG/L	2038				13561	2736			5012	1095		85
ETHYLBENZENE	UG/L					2457							100
ISOPHORONE	UG/L	186475	4518			75839	3014	7857	4532	62143	5715		81
METHACRYLONITRILE	UG/L	5392	3489	25392	3822	3371			3081	22228			64
METHYLENE CHLORIDE	UG/L						25						0
N,N-DIMETHYLFORMAMIDE	UG/L			15443	8161						1870		24
N-DECANE (N-C10)	UG/L						2690						0
N-DODOSANE (N-C12)	UG/L						2577		1551				0
N-HEXADOSANE (N-C26)	UG/L				4305			3424	6312	12309			22
N-HEXADECANE (N-C16)	UG/L										805		0
N-OCTADOSANE (N-C28)	UG/L				2642		160	1178					33
N-PENTADECANE (N-C15)	UG/L	3993						28081			2069		50
N TETRADECANE (N-C14)	UG/L					13354					320		67
NAPHTHALENE	UG/L	8642		44127	4924			5754	4652		932		55
P CYMENE	UG/L			17354	2119	5503	1823	2775			219		71
PHENANTHRENE	UG/L					1296							100
PHENOL	UG/L	272						11577					100
STYRENE	UG/L	34620	7572	22272	5193	18836	1127						50
TETRACHLOROETHENE	UG/L					86267	6395		3248	4350			66
TOLUENE	UG/L	107277	3487			42672	2776		5231		1869		32
TRANS-1,2 DICHLOROETHENE	UG/L						1940	6159	4248	54123			80
TRICHLOROETHENE	UG/L							917					100
VINYL ACETATE	UG/L		1242		151	4038	104	1279	199	4575	156		70
													0

NOTES: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER THOUSAND

AVERAGE PERCENT REMOVED = MEAN OF POSITIVE AND ZERO REMOVALS

TABLE 6-16
EPA-ITD SAMPLING PROGRAM
AIR FLOTATION PERFORMANCE PLANT D

FRACTION : METALS

PARAMETER	UNITS											
PLANT NO.		D	D	D	D	D	D	D	D	D	D	
EPISODE NO.		1179	1179	1179	1179	1179	1179	1179	1179	1179	1179	
SAMPLE NO.		15713	15714	15715	15716	15718	15719	15722	15723	15725	15726	AVERAGE
SAMPLE POINT		RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	PERCENT
SAMPLE DATE		Feb 2, 1987	Feb 2, 1987	Feb 3, 1987	Feb 3, 1987	Feb 4, 1987	Feb 4, 1987	Feb 5, 1987	Feb 5, 1987	Feb 6, 1987	Feb 6, 1987	REMOVED
ALUMINUM	UG/L	90800	91500	71700	64700	61300	57400	37900	75700	36100	150000	3
ANTIMONY	UG/L	33600	30100	9780	8990	10200	4140	6820	5640	6140	4650	24
ARSENIC	UG/L	500	103	62	100	72	100	16	19	78	19	31
BARIUM	UG/L	1230	170	2200	2680	1500	1930	7510	2930	5260	599	47
BERYLLIUM	UG/L	7	5	5	5	5	5	5	5	5	5	6
BORON	UG/L	7700	4870	6100	6170	7270	3960	6320	6640	7390	5650	21
CADMIUM	UG/L	635	138	285	229	4690	1170	1340	1270	883	909	36
CALCIUM	UG/L	120000	52700	77000	72400	97000	46200	40600	46900	50000	43600	25
CHROMIUM	UG/L	6430	2490	3360	1570	4720	1060	3420	1160	4120	977	67
COBALT	UG/L	1700	448	760	500	1170	410	1090	582	1320	587	55
COPPER	UG/L	4810	1540	4780	3020	5940	1610	2640	1270	3240	1350	58
IRON	UG/L	693000	74900	201000	84500	529000	96600	180000	88600	216000	43000	72
LEAD	UG/L	37600	8730	18200	5380	34600	4760	16500	4970	19300	3050	78
MAGNESIUM	UG/L	40400	20600	22600	22700	28300	13100	11600	12600	13800	11600	24
MANGANESE	UG/L	5130	1810	3250	2470	6890	1840	2510	2290	2720	1980	40
MERCURY	UG/L	41	27	20	11	28	.5	8.5	3.8	10	.6	65
MOLYBDENUM	UG/L	853	362	1040	705	1880	830	1540	1170	2230	1030	45
NICKEL	UG/L	991	161	376	286	1030	319	363	287	419	280	46
SELENIUM	UG/L	5	5	50	50	5	125	5	5	5	25	0
SILVER	UG/L	18	63	8.4	10	5.7	14.6	1	9.2	7.3	1	17
SODIUM	UG/L	8800000	8690000	9090000	8190000	9510000	6100000	7290000	7130000	6720000	6730000	10
THALLIUM	UG/L	100	100	100	50	50	100	50	50	50	50	10
TIN	UG/L	5730	692	4190	1220	6390	2180	5620	2550	4230	495	74
TITANIUM	UG/L	2610	578	860	434	1190	289	577	287	666	175	65
VANADIUM	UG/L	82	50	50	50	95	50	50	50	50	58	17
YTTRIUM	UG/L	50	50	50	50	50	50	50	50	50	50	0
ZINC	UG/L	80400	23200	54300	37400	108000	27900	44300	30600	43500	17900	53

NOTE: BLANK = NO VALUE REPORTED
MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION

AVERAGE PERCENT REMOVED = MEAN OF POSITIVE AND ZERO REMOVALS

TABLE 6-17. EPA-ITD SAMPLING PROGRAM

AIR FLOTATION PERFORMANCE - PLANT D

FRACTION: PESTICIDES/HERBICIDES						
PLANT NO.		D	D	D	D	
EPISODE NO.		1179	1179	1179	1179	AVERAGE
SAMPLE NO.		15713	15714	15718	15719	PERCENT
SAMPLE POINT		RAW	TREATED	RAW	TREATED	REMOVED
SAMPLE DATE		FEB. 2, 1987	FEB. 2, 1987	FEB. 4, 1987	FEB. 4, 1987	
PARAMETER	UNITS					
Dichloran	µg/l				282	0
Endosulfan I	µg/l	296				100
Endosulfan Sulfate	µg/l			528	951	0
Heptachlor	µg/l	284	1738			0
Etridazone	µg/l	252				100
Isodrin	µg/l		2829			0
Trifluralin	µg/l				322	0
Azinphos Ethyl	µg/l	4260				100
Azinphos Methyl	µg/l	6207	50466	4689	3769	9
Fensulfothion	µg/l	5795		7859	4148	74
Phosmet	µg/l		30972			0
Diazinon	µg/l			1035		100
Dimethoate	µg/l			1500		100
Leptophos	µg/l			3959		100
TEPP	µg/l				2323	0

NOTE: Blank = No Value Reported
µg/l = Micrograms per Liter
Average Percent Removed = Mean of Positive and Zero Removals

- Plant D - 15,000 gpd are generated as a result of the washing and burning of 6,000 drums. The process wastewater is treated by air flotation and reused as make up to caustic wash and intermediate rinses and as furnace quench. Most of the wastewater is lost from the system through evaporation at the furnace or from the hot causticwash. City water used as final rinse is the source of make up to the total system. Solids are removed by screening and as air floating sludge.

- Plant N - This facility washes 700 tight-head drums and burns 500 open-head drums. Process wastewater is treated by air flotation and then reused as an intermediate rinse or as furnace quench.

- Plant O - About 1,000 open-head and tight-head drums are reconditioned daily. Open-head drums are not burned, but are instead shot blasted. Hence, no wastewater is generated. Wastewater is generated by tight-head washing processes and is treated by air flotation. The treated wastewater is reused as an intermediate rinse or as caustic make up.

- Plant P - 1,500 open head drums are burned daily. Quench water is treated by sedimentation only before being reused. Because of high evaporation losses, the quench water supply is made up by wastewater trucked in from Plant Q.

- Plant Q - This tight-head plant washes 600 drums daily. Sedimentation and oil/water skimming are provided to the process wastewater. Some wastewater is reused onsite as caustic make up and the remainder is trucked to Plant P.

6.5 SUMMARY

- Zero discharge is demonstrated to be a practical control technology for open head facilities. Furnace quench water is typically reused after simple sedimentation.

- Tight head facilities generally discharge wastewater and nearly half of the dischargers do not treat wastewater.

- Wastewater treatment pollutant removal efficiencies were poor at the 4 plants sampled by the Agency.

- Sedimentation, oil/water separation and air flotation are the dominant treatment technologies at tight head plants. Reuse of treated effluent is possible, however, zero discharge is only attainable if wastestreams are segregated and water conservation measures are implemented.

7. COST OF WASTEWATER CONTROL AND TREATMENT

7.1 INTRODUCTION

This section provides cost estimates for installing and operating wastewater treatment technology that is currently in-place in the industry. In 1979, about half of the respondees to the National Barrel and Drum Association (NABADA) survey treat process wastewater prior to discharge. In this study, 13 out of 16 plants contacted provide wastewater treatment prior to discharge. However, as demonstrated in Section 6, the pollutant removal efficiencies of currently installed equipment are low. Therefore, a U.S. Environmental Protection Agency (EPA) decision to regulate the drum reconditioning industry will likely result in a significant investment in equipment and personnel.

7.2 MODEL TREATMENT SYSTEM

Physical/chemical treatment is the prevailing technology in the drum reconditioning industry. This technology takes the forms of sedimentation, oil/water separation, and air flotation. These technologies and related costs have been studied by the Industrial Technology Division (ITD) of EPA for numerous other industries. The Final Development Document for Effluent Limitations Guidelines and Standards for the Metal Finishing Point Source Category report costs for an emulsion breaking system that can be used as a model for estimating physical/chemical treatment costs for the drum reconditioning industry (U.S. EPA 1983).

Emulsion breaking is a demonstrated zero discharge technology for the drum reconditioning industry. The Agency visited three washing facilities that use air flotation, a variation of emulsion breaking, to achieve zero discharge. Each plant reconditions a variety of drum types that total between 500 and 3,000 drums daily per facility. Treated wastewater is used as make up to caustic wash and as a intermediate stage rinse water.

Open-head drum reconditioners also have achieved zero discharge of process wastewater through the use of physical/ chemical treatment. EPA visited a facility that recycles quench water after it is treated by sedimentation. Minor process wastestreams, such as paint booth water curtain

overflow, also are treated and recycled. Because of evaporation losses in the quench process, the make up water supply is supplemented with tap water. Two other drum burning plants discharge their quench water to emulsion breaking treatment systems that are employed to achieve zero discharge of their combined open-head and tight-head wastewaters.

The model emulsion breaking system is identified as treatment system - Option 1 for the Metal Finishing Category. The system was designed to treat raw wastewater with oil and grease and toxic organic levels in excess of those observed in drum reconditioning wastewaters. Figure 7-1 is a schematic of the system. Figures 7-2 and 7-3 are capital cost and operating cost curves, respectively, for the model system. All costs are reported in 1979 dollars, and a detailed discussion is presented in Appendix D.

Wastewater flows found in the drum reconditioning industry range from 100 to 20,000 gallons per day; therefore, the cost curves shown in Figures 7-2 and 7-3 are appropriate for the drum reconditioning industry. An average drum washing plant discharges 2,950 gallons per day. In terms of 1979 dollars, an average plant that installs batch mode treatment would incur a capital cost of $70,000 and an annual operating expense of $25,000. Based on the use of cost indicies, these costs would be $97,000 and $35,000, respectively in 1985 (Engineering News Record, 1985). A wastewater recycle system would add $13,000 to the capital cost (Means, 1986).

7.3 SUMMARY

- A model wastewater treatment system would include emulsion breaking technology and treated wastewater reuse. A typical facility would incur a capital cost of $110,000 and an annual operating cost of $35,000 to install and operate such a system.

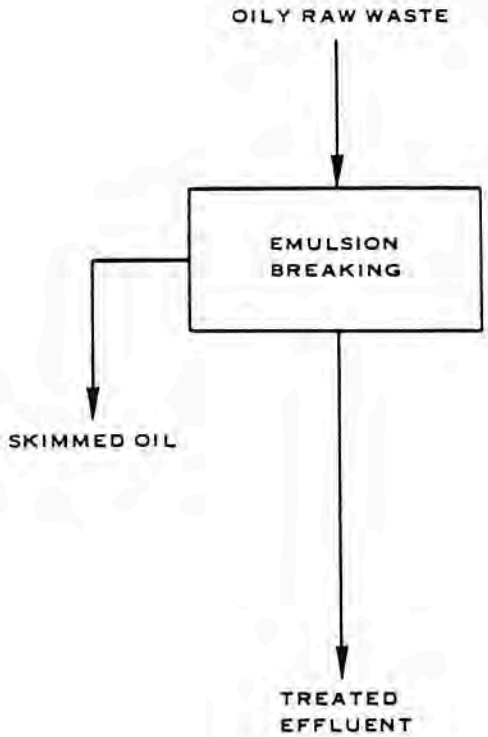

FIGURE 7-1
OPTION 1 TREATMENT SYSTEM
FOR SEGREGATED OILY WASTE STREAMS

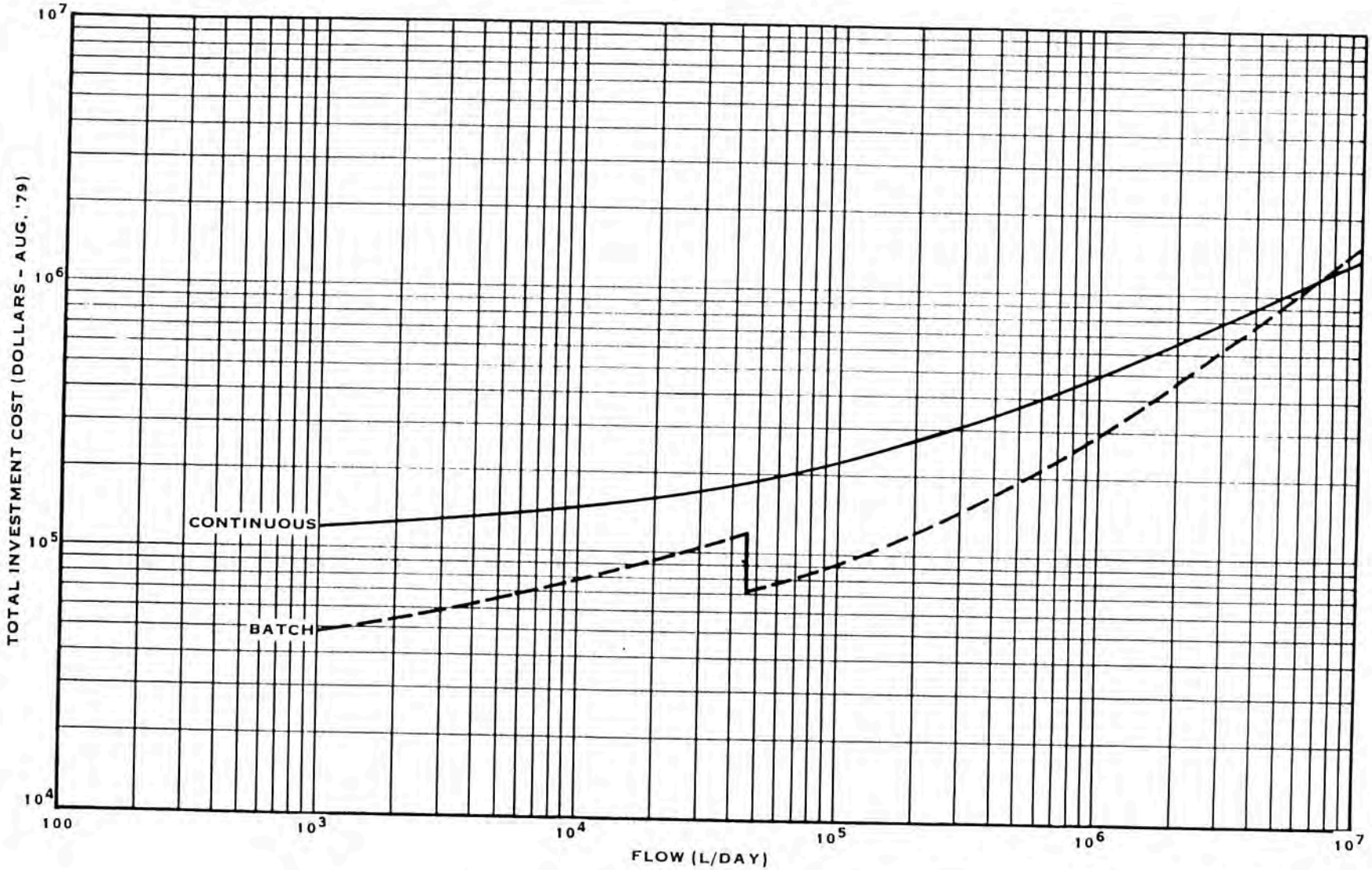

FIGURE 7-2
TOTAL INVESTMENT COSTS VS. FLOW RATE FOR OPTION 1 TREATMENT SYSTEM, CASE 6

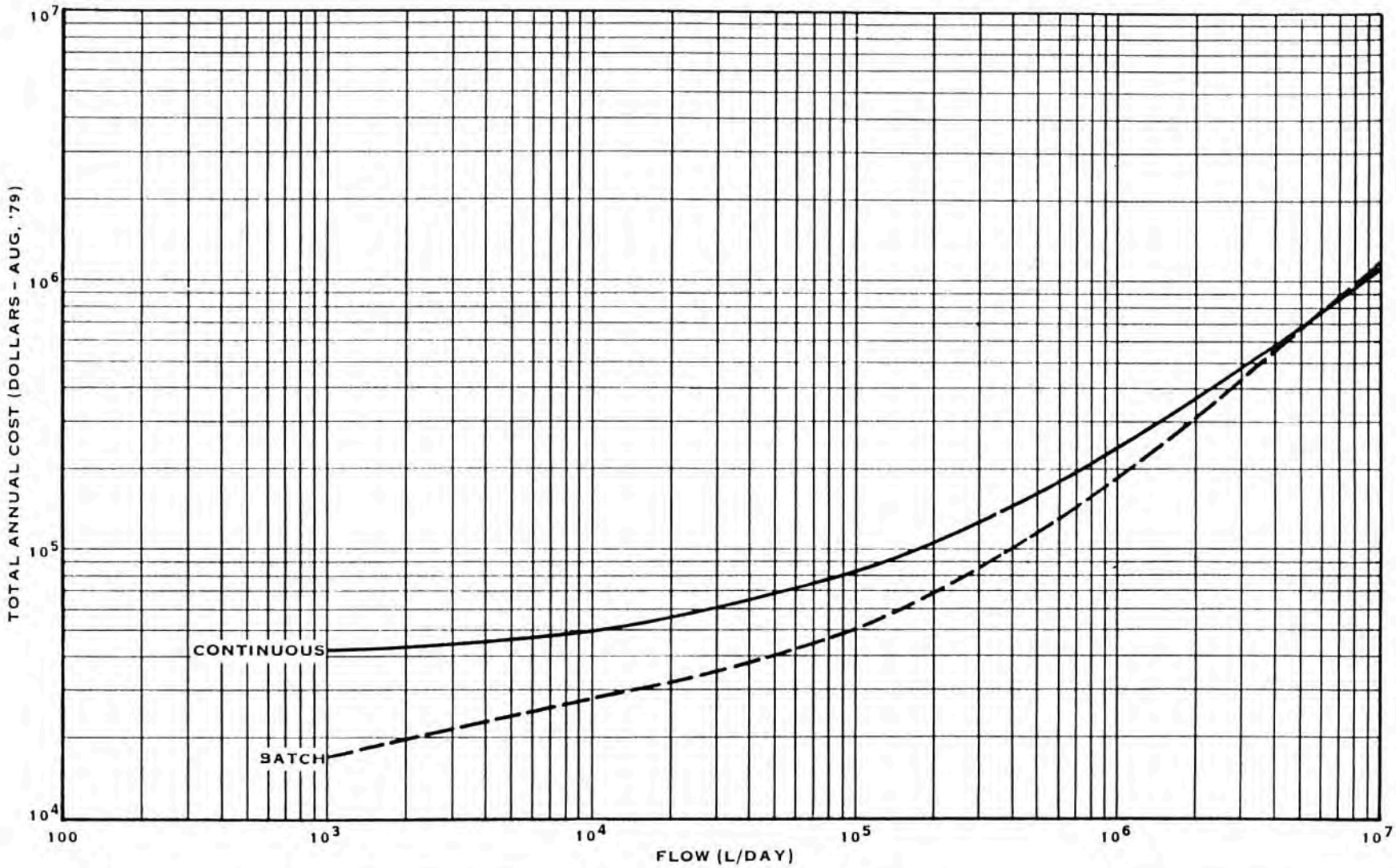

FIGURE 7-3

TOTAL ANNUAL COST VS. FLOW RATE FOR OPTION 1 TREATMENT SYSTEM, CASE 6

8. INDUSTRY POLLUTANT LOADINGS

This section estimates the total mass of pollutants present in wastewater generated by the drum reconditioning industry. The industry-wide mass of sludge generated and disposed also is estimated.

8.1 RAW WASTEWATER

The data generated by the Industrial Technology Division (ITD) of the U.S. Environmental Protection Agency (EPA) are the best available for estimating the total mass of pollutants in wastewater generated by the drum reconditioning industry. Representative industry raw wastewater concentrations were determined in Section 7 as the mean of four plant means. In this section, plant means are weighted by flow in the determination of potential mass loading to the environment. Flow-weighted mean concentrations are shown in Table 8-1 for conventional and nonconventional pollutants, in Table 8-2 for extractable and volatile organics, Table 8-3 for metals, and in Table 8-4 for pesticides/herbicides. Daily industry loadings also are shown and are computed as the product of industry daily flow and the flow-weighted means: 0.75 (MGD) x mean (mg/l) x 8.345 (conversion factor).

The loadings shown in Table 8-1 are realistic with respect to the amount of residue found in drums received by reconditioners. This conclusion is verified by adding the loadings for total volatile solids, dissolved solids, and oil and grease, and the difference between suspended total and suspended volatile solids. The sum is roughly equivalent to the quantity of solid and organic residue in a drum. This totals about 467,000 pounds per day, or 121 million pounds per year. For the 50 million drums reconditioned annually, 121 million pounds of pollutants are generated, or 2.4 pounds per drum. If a specific gravity of 1.2 is assumed, then 1 pound per drum is equivalent to 0.3 gallons per drum. The National Barrel and Drum Association (NABADA) (1981a) estimates that 0.65 gallons of residue are contained in drums received by reconditioners. The NABADA estimate includes liquids that are drained and disposed in drum receiving areas prior to washing.

PEI (1986) estimated that kerosene residue contained in drums that were emptied by pouring is 0.404 percent of the drum volume, or 0.22 gallons.

TABLE 8-1
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : CONVENTIONALS AND NONCONVENTIONALS

PARAMETER	UNITS	A	B	C	D	MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
AMMONIA	mg/l	13	15.75	0.1	7.061666666	10.38	147
BOD-5, TOTAL	mg/l	3900	1309	720	7440.333333	5280.90	74873
BOD5, DISSOLVED	mg/l	1980	2355	480	4257	3041.70	43125
CHLORIDE	mg/l	50	1450	200	3119	1574.77	22327
COD, DISSOLVED	mg/l	3140	4130	800	21472.33333	11609.60	164601
COD, TOTAL	mg/l	6110	4630	1330	48027.33333	25172.08	356890
DISSOLVED SOLIDS	mg/l	8850	7325	21000	20737.33333	14288.46	202582
FLUORIDE	mg/l	30	34	26	44.72333333	37.05	525
OIL & GREASE	mg/l	3240	3875	34000	9834.133333	6599.46	93567
PHENOL	mg/l	1.61	46.755	2.2	73.85183333	38.48	546
SUSPENDED SOLIDS	mg/l	4980	1315	20	10433.5	7133.49	101139
SUSPENDED VOL SOLIDS	mg/l	880	56.5	8	7151.5	3680.84	52187
TKN	mg/l	5	23.875	1.6	211.0933333	101.07	1433
TOTAL CYANIDE	mg/l	8.3	1.28	6.8	.3683333333	4.07	58
TOTAL ORGANIC CARBON	mg/l	1520	905	269	7723.666666	4303.46	61014
TOTAL VOL SOLIDS	mg/l	3200	2172.5	392	15193.33333	8590.93	121802

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE B-2
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
O-CRESOL	UG/L	10	90	10	235	120	1
1,1,1,2-TETRACHLOROETHANE	UG/L	10	10	10	385	182	1
1,1,1-TRICHLOROETHANE	UG/L	355	100	10	24294	11312	71
1,1,2,2-TETRACHLOROETHANE	UG/L	10	100	10	385	189	1
1,1,2-TRICHLOROETHANE	UG/L	10	100	10	385	189	1
1,1-DICHLOROETHANE	UG/L	10	100	10	385	189	1
1,1-DICHLOROETHENE	UG/L	10	100	10	4433	2046	13
1,2,3-TRICHLOROBENZENE	UG/L	100	10	10	235	154	1
1,2,3-TRICHLOROPROPANE	UG/L	10	10	10	385	182	1
1,2,3-TRIMETHOXYBENZENE	UG/L	10	10	10	235	113	1
1,2,4,5-TETRACHLOROBENZENE	UG/L	10	10	10	235	113	1
1,2,4-TRICHLOROBENZENE	UG/L	100	10	10	235	154	1
1,2-DIBROMO-3-CHLOROPROPANE	UG/L	20	20	20	470	226	1
1,2-DIBROMOETHANE (EDB)	UG/L	10	10	10	385	182	1
1,2-DICHLOROBENZENE	UG/L	100	10	10	235	154	1
1,2-DICHLOROETHANE	UG/L	10	100	10	421	206	1
1,2-DICHLOROPROPANE	UG/L	10	100	10	385	189	1
1,2-DIPHENYLHYDRAZINE	UG/L	200	20	20	470	307	2
1,2:3,4-DIEPOXYBUTANE	UG/L	20	20	20	470	226	1
1,3,5-TRITHIANE	UG/L	50	50	50	1175	566	4
1,3-BENZENEDIOL (RESORCINOL)	UG/L	50	50	50	1175	566	4
1,3-DICHLORO-2-PROPANOL	UG/L	10	10	10	235	113	1
1,3-DICHLOROBENZENE	UG/L	100	10	10	235	154	1
1,3-DICHLOROPROPANE	UG/L	10	10	10	385	182	1
1,3-DINITROBENZENE	UG/L	20	20	20	470	226	1
1,4-DICHLOROBENZENE	UG/L	100	10	10	235	154	1
1,4-NAPHTHOQUINONE	UG/L	99	99	99	2326	1121	7
1,5-NAPHTHALENEDIAMINE	UG/L	99	99	99	2326	1121	7
1-METHYLFLUORENE	UG/L	10	10	10	235	113	1
1-METHYLPHENANTHRENE	UG/L	10	10	10	235	113	1
1-PHENYLNAPHTHALENE	UG/L	10	10	10	235	113	1
2,3,4,6-TETRACHLOROPHENOL	UG/L	20	20	20	170	89	1
2,3,6-TRICHLOROPHENOL	UG/L	100	505	10	85	126	1
2,3-BENZOFLUORENE	UG/L	10	10	10	235	113	1
2,3-DICHLOROANILINE	UG/L	10	10	10	235	113	1
2,3-DICHLORONITROBENZENE	UG/L	50	50	50	1175	566	4
2,4,5-TRICHLOROPHENOL	UG/L	100	505	10	85	126	1

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
2,4,5-TRIMETHYLANILINE	UG/L	20	20	20	470	226	1
2,4,6-TRICHLOROPHENOL	UG/L	100	505	10	85	126	1
2,4-DIAMINOTOLUENE	UG/L	99	99	99	2326	1121	7
2,4-DICHLOROPHENOL	UG/L	100	505	10	85	126	1
2,4-DIMETHYLPHENOL	UG/L	100	10	10	235	154	1
2,4-DINITROPHENOL	UG/L	500	2525	50	425	629	4
2,4-DINITROTOLUENE	UG/L	100	10	11	235	154	1
2,6-DI-TERT-BUTYL-P-BENZOQINO	UG/L	99	99	99	2326	1121	7
2,6-DICHLORO-4-NITROANILINE	UG/L	99	99	99	2326	1121	7
2,6-DICHLOROPHENOL	UG/L	10	10	10	85	44	0
2,6-DINITROTOLUENE	UG/L	100	10	10	235	154	1
2-(METHYLTHIO)BENZOTHIAZOLE	UG/L	10	10	10	235	113	1
2-BROMOCHLOROBENZENE	UG/L	10	10	10	235	113	1
2-BUTANONE (MEK)	UG/L	534	681065	50	393887	237157	1483
2-CHLORO-1,3-BUTADIENE	UG/L	10	10	10	385	182	1
2-CHLOROETHYLVINYL ETHER	UG/L	10	100	10	385	189	1
2-CHLORONAPHTHALENE	UG/L	4609	46	10	235	2184	14
2-CHLOROPHENOL	UG/L	100	505	10	85	126	1
2-HEXANONE	UG/L	50	50	50	1925	910	6
2-ISOPROPYLNAPHTHALENE	UG/L	10	10	10	235	113	1
2-METHYL-4,6-DINITROPHENOL	UG/L	200	1010	20	170	251	2
2-METHYLBENZOTHIOAZOLE	UG/L	10	10	10	235	113	1
2-METHYLNAPHTHALENE	UG/L	10	17	10	235	114	1
2-NITROANILINE	UG/L	10	10	10	235	113	1
2-NITROPHENOL	UG/L	200	1010	20	1547	883	6
2-PHENYLNAPHTHALENE	UG/L	10	10	10	235	113	1
3,3'-DICHLOROBENZIDINE	UG/L	500	50	50	1175	768	5
3,3'-DIMETHOXYBENZIDINE	UG/L	50	50	50	1175	566	4
3,5-DIBROMO-4-HYDROXYBENZONITR	UG/L	50	50	50	425	222	1
3,6-DIMETHYLPHENANTHRENE	UG/L	10	10	10	235	113	1
3-BROMOCHLOROBENZENE	UG/L	10	10	10	235	113	1
3-CHLORONITROBENZENE	UG/L	50	50	50	1175	566	4
3-CHLOROPROPENE	UG/L	10	10	10	385	182	1
3-METHYLCHOLANTHRENE	UG/L	10	10	10	235	113	1
3-NITROANILINE	UG/L	20	20	20	470	226	1
4,4'-METHYLENEBIS(2-CHLOROANI)	UG/L	20	20	20	470	226	1
4,5-METHYLENEPHENANTHRENE	UG/L	10	10	10	235	113	1

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
4-AMINOBIPHENYL	UG/L	10	10	10	235	113	1
4-BROMOPHENYL PHENYL ETHER	UG/L	100	10	10	235	154	1
4-CHLORO-2-NITROANILINE	UG/L	20	20	20	470	226	1
4-CHLORO-3-METHYLPHENOL	UG/L	100	505	10	85	126	1
4-CHLOROANILINE	UG/L	10	10	10	235	113	1
4-CHLOROPHENYL PHENYL ETHER	UG/L	100	10	10	235	154	1
4-METHYL-2-PENTANONE	UG/L	50	50	50	1925	910	6
4-NITROANILINE	UG/L	50	50	50	1175	566	4
4-NITROBIPHENYL	UG/L	10	10	10	235	113	1
4-NITROPHENOL	UG/L	500	2525	50	425	629	4
5-CHLORO-O-TOLUIDINE	UG/L	10	10	10	235	113	1
5-NITRO-O-TOLUIDINE	UG/L	10	10	10	235	113	1
7,12-DIMETHYLBENZ(A)ANTHRACENE	UG/L	10	10	10	235	113	1
ACENAPHTHENE	UG/L	100	10	10	235	154	1
ACENAPHTHYLENE	UG/L	100	10	10	235	154	1
ACETONE	UG/L	50	500	50	571947	262425	1641
ACETOPHENONE	UG/L	10	10	10	235	113	1
ACROLEIN	UG/L	50	500	50	1925	947	6
ACRYLONITRILE	UG/L	50	500	50	1925	947	6
ALLYL ALCOHOL	UG/L	10	10	10	385	182	1
ALPHA NAPHTHYLAMINE	UG/L	0	0	0	10	5	0
ALPHA-NAPHTHYLAMINE	UG/L	10	10	10	280	134	1
ALPHA-PICOLINE	UG/L	500	50	50	1175	768	5
ALPHA-TERPINEOL	UG/L	4745	10	10	235	2242	14
ANILINE	UG/L	10	10	10	235	113	1
ANTHRACENE	UG/L	100	10	10	235	154	1
ARAMITE	UG/L	50	50	50	1175	566	4
B-NAPHTHYLAMINE	UG/L	500	50	50	1175	768	5
BENZANTHRONE	UG/L	50	50	50	1175	566	4
BENZENE	UG/L	10	100	10	385	189	1
BENZENETHIOL	UG/L	10	10	10	235	113	1
BENZIDINE	UG/L	500	50	50	1175	768	5
BENZO(A)ANTHRACENE	UG/L	100	10	10	235	154	1
BENZO(A)PYRENE	UG/L	100	10	10	235	154	1
BENZO(B)FLUORANTHENE	UG/L	100	10	10	235	154	1
BENZO(GHI)PERYLENE	UG/L	200	20	20	470	307	2
BENZO(K)FLUORANTHENE	UG/L	100	10	10	235	154	1

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D	FLOW	
EPISODE NO.		1128	1130	1133	1179	WEIGHTED	
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	MEAN	INDUSTRY
FLOW		14700	2700	300	15000	CONC.	LOADING (POUNDS/DAY)
BENZOIC ACID	UG/L	300	24014.75	120	425	2314	14
BENZYL ALCOHOL	UG/L	10	34.5	10	3346	1542	10
BIPHENYL	UG/L	100	12	71	495	274	2
BIS (2-CHLOROETHOXY) METHANE	UG/L	100	10	10	235	154	1
BIS (2-CHLOROETHYL) ETHER	UG/L	100	10	10	235	154	1
BIS (2-CHLOROISOPROPYL) ETHER	UG/L	100	10	10	235	154	1
BIS (2-ETHYLHEXYL) PHTHALATE	UG/L	100	10	10	17876	8246	52
BIS (CHLOROMETHYL) ETHER (NR)	UG/L	10	100	10	385	189	1
BROMODICHLOROMETHANE	UG/L	10	100	10	385	189	1
BROMOFORM	UG/L	10	100	10	385	189	1
BROMOMETHANE	UG/L	50	500	50	1925	947	6
BUTYL BENZYL PHTHALATE	UG/L	100	10	10	615	328	2
CARBAZOLE	UG/L	200	20	20	470	307	2
CARBON DISULFIDE	UG/L	10	10	10	385	182	1
CARBON TETRACHLORIDE	UG/L	10	100	10	385	189	1
CHLOROACETONITRILE	UG/L	10	10	10	385	182	1
CHLOROBENZENE	UG/L	10	100	10	385	189	1
CHLOROETHANE	UG/L	50	500	50	1925	947	6
CHLOROFORM	UG/L	10	100	10	385	189	1
CHLOROMETHANE	UG/L	50	500	50	1925	947	6
CHRYSENE	UG/L	100	10	10	235	154	1
CIS-1,3-DICHLOROPROPENE	UG/L	10	10	10	385	182	1
CROTONALDEHYDE	UG/L	50	50	50	1925	910	6
CROTOXYPHOS	UG/L	99	99	99	2326	1121	7
DI-N-BUTYL PHTHALATE	UG/L	100	10	10	3478	1642	10
DI-N-OCTYL PHTHALATE	UG/L	100	10	10	235	154	1
DIBENZO(A,H)ANTHRACENE	UG/L	200	20	20	470	307	2
DIBENZOFURAN	UG/L	100	10	10	235	154	1
DIBENZOTHIOPHENE	UG/L	100	10	10	235	154	1
DIBROMOCHLOROMETHANE	UG/L	10	100	10	385	189	1
DIBROMOMETHANE	UG/L	10	10	10	385	182	1
DICHLORODIFLUOROMETHANE (NR)	UG/L	10	100	10	385	189	1
DIETHYL ETHER	UG/L	50	500	50	1925	947	6
DIETHYL PHTHALATE	UG/L	100	10	10	235	154	1
DIMETHYL PHTHALATE	UG/L	100	10	10	235	154	1
DIMETHYL SULFONE	UG/L	10	10	10	235	113	1
DIPHENYL ETHER	UG/L	100	10	10	478	265	2

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
DIPHENYLAMINE	UG/L	100	10	10	235	154	1
DIPHENYLDISULFIDE	UG/L	20	20	20	470	226	1
ETHYL CYANIDE	UG/L	10	10	10	385	182	1
ETHYL METHACRYLATE	UG/L	10	10	10	385	182	1
ETHYL METHANESULFONATE	UG/L	20	20	20	470	226	1
ETHYLBENZENE	UG/L	221	1639.5	110	55424	25660	161
ETHYLENETHIOUREA	UG/L	20	20	20	470	226	1
ETHYNYLESTRADIOL 3-METHYL ETHE	UG/L	20	20	20	470	226	1
FLUORANTHENE	UG/L	100	10	10	235	154	1
FLUORENE	UG/L	100	10	12	235	154	1
HEXACHLORO-1,3-BUTADIENE	UG/L	100	10	10	235	154	1
HEXACHLOROBENZENE	UG/L	100	10	10	235	154	1
HEXACHLOROCYCLOPENTADIENE	UG/L	100	10	10	235	154	1
HEXACHLOROETHANE	UG/L	100	10	10	235	154	1
HEXACHLOROPROPENE	UG/L	20	20	20	470	226	1
HEXANOIC ACID	UG/L	55	350.75	587.5	85	98	1
INDENO(1,2,3-CD)PYRENE	UG/L	200	20	20	470	307	2
IODOMETHANE	UG/L	10	10	10	385	182	1
ISOBUTYL ALCOHOL	UG/L	10	1763.5	10	385	327	2
ISOPHORONE	UG/L	100	10	10	9384	4350	27
ISOSAFROLE	UG/L	10	10	10	235	113	1
LONGIFOLENE	UG/L	50	50	50	1175	566	4
MALACHITE GREEN	UG/L	10	10	10	235	113	1
METHACRYLONITRILE	UG/L	10	10	10	385	182	1
METHAPYRILENE	UG/L	10	10	10	235	113	1
METHYL METHACRYLATE	UG/L	10	10	10	385	182	1
METHYL METHANESULFONATE	UG/L	20	20	20	470	226	1
METHYLENE CHLORIDE	UG/L	10	100	4197	2792	1332	8
N,N-DIMETHYLFORMAMIDE	UG/L	10	10	10	235	113	1
N-DECANE (N-C10)	UG/L	11750	10	10	235	5391	34
N-DOCOSANE (N-C22)	UG/L	100	10	10	2824	1341	8
N-DODECANE (N-C12)	UG/L	6950	10	10	235	3233	20
N-EICOSANE (N-C20)	UG/L	100	10	10	235	154	1
N-HEXACOSANE (N-C26)	UG/L	100	10	10	235	154	1
N-HEXADECANE (N-C16)	UG/L	1066	10	10	415	670	4
N-NITROSODI-N-BUTYLAMINE	UG/L	10	10	10	235	113	1
N-NITROSODI-N-PROPYLAMINE	UG/L	200	20	20	470	307	2

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING (POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
N-NITROSODIETHYLAMINE	UG/L	10	10	10	235	113	1
N-NITROSODIMETHYLAMINE	UG/L	500	50	50	1175	768	5
N-NITROSODIPHENYLAMINE	UG/L	200	20	20	470	307	2
N-NITROSOMETHYLETHLAMINE	UG/L	10	10	10	0	5	0
N-NITROSOMETHYLETHYLAMINE	UG/L	0	0	0	235	108	1
N-NITROSOMETHYLPHENYLAMINE	UG/L	99	99	99	2326	1121	7
N-NITROSOMORPHOLINE	UG/L	10	10	10	235	113	1
N-NITROSOPIPERIDINE	UG/L	10	10	10	235	113	1
N-OCTACOSANE (N-C28)	UG/L	100	10	10	4898	2293	14
N-OCTADECANE (N-C18)	UG/L	100	10	10	2941	1395	9
N-TETRACOSANE (N-C24)	UG/L	100	10	10	235	154	1
N-TETRADECANE (N-C14)	UG/L	100	10	10	8515	3952	25
N-TRIACONTANE (N-C30)	UG/L	100	10	10	235	154	1
NAPHTHALENE	UG/L	100	196	174	5864	2753	17
NITROBENZENE	UG/L	100	13	12	235	154	1
O-ANISIDINE	UG/L	10	10	10	235	113	1
O-TOLUIDINE	UG/L	10	10	10	235	113	1
P-CRESOL	UG/L	10	10	10	85	44	0
P-CYMENE	UG/L	100	60.5	83	401	235	1
P-DIMETHYLAMINOAZOBENZENE	UG/L	20	20	20	470	226	1
P-DIOXANE	UG/L	10	100	10	385	189	1
PENTACHLOROBENZENE	UG/L	20	20	20	470	226	1
PENTACHLOROETHANE	UG/L	20	20	20	470	226	1
PENTACHLOROPHENOL	UG/L	500	2525	50	425	629	4
PENTAMETHYLBENZENE	UG/L	10	10	10	235	113	1
PERYLENE	UG/L	10	10	10	235	113	1
PHENACETIN	UG/L	10	10	10	235	113	1
PHENANTHRENE	UG/L	100	10	10	2148	1031	6
PHENOL	UG/L	100	10	10	374	217	1
PHENOTHIAZINE	UG/L	50	50	50	1175	566	4
PRONAMIDE	UG/L	10	10	10	235	113	1
PYRENE	UG/L	100	10	10	235	154	1
PYRIDINE	UG/L	10	10	10	235	113	1
SAFROLE	UG/L	10	10	10	235	113	1
SQUALENE	UG/L	99	99	99	2326	1121	7
STYRENE	UG/L	100	121	10	14815	6851	43
T-1,3-DICHLOROPROPENE	UG/L	10	100	10	385	189	1

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-2 (CONTINUED)
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : EXTRACTABLE AND VOLATILE ORGANICS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
TETRACHLOROETHENE	UG/L	10	100	10	14746	6777	42
THIANAPHTHENE	UG/L	10	10	10	235	113	1
THIOACETAMIDE	UG/L	20	20	20	470	226	1
THIOXANTHONE	UG/L	20	165.5	20	470	238	1
TOLUENE	UG/L	507	27917	25	35323	18737	117
TRANS-1,2-DICHLOROETHENE	UG/L	10	100	10	521	252	2
TRANS-1,4-DICHLORO-2-BUTENE	UG/L	50	50	50	1925	910	6
TRICHLOROETHENE	UG/L	95	100	13	1983	961	6
TRICHLOROFLUOROMETHANE	UG/L	10	10	10	385	182	1
TRICHLOROFLUOROMETHANE (NR)	UG/L	10	100	10	385	189	1
TRIPHENYLENE	UG/L	10	10	10	235	113	1
TRIPROPYLENEGLYCOL METHYL ETHE	UG/L	99	99	99	2326	1121	7
VINYL ACETATE	UG/L	50	50	50	1925	910	6
VINYL CHLORIDE	UG/L	10	100	10	385	189	1

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000

TABLE 8-3
RAW WASTEWATER POLLUTANT LOADINGS

FRACTION : METALS

PARAMETER	UNITS	A	B	C	D	FLOW WEIGHTED MEAN CONC.	INDUSTRY LOADING POUNDS/DAY)
PLANT NO.		A	B	C	D		
EPISODE NO.		1128	1130	1133	1179		
SAMPLE POINT		RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR	RAW WASTEWTR		
FLOW		14700	2700	300	15000		
ALUMINUM	UG/L	7800	9650	3100	49670	27116	170
ANTIMONY	UG/L	562	15.5	41	11093	5343	33
ARSENIC	UG/L	31	21.5	18	123	72	0
BARIUM	UG/L	2600	1650	89	2958	2663	17
BERYLLIUM	UG/L	50	1	2	5	25	0
BORON	UG/L	880	23.5	480	5828	3076	19
CADMIUM	UG/L	29	6.5	7	1316	617	4
CALCIUM	UG/L	47000	23500	9200	70283	55393	346
CHROMIUM	UG/L	6700	915	630	3677	4780	30
COBALT	UG/L	210	130	68	1015	571	4
COPPER	UG/L	1400	395	250	3572	2303	14
IRON	UG/L	10000	43000	9000	303182	147203	921
LEAD	UG/L	27000	2400	3300	21067	22030	138
MAGNESIUM	UG/L	14000	6850	3900	21467	16742	105
MANGANESE	UG/L	700	1950	63	3419	2045	13
MERCURY	UG/L	0.2	1.2	0.5	18	8	0
MOLYBDENUM	UG/L	340	105	280	1274	748	5
NICKEL	UG/L	120	35	16	536	303	2
SELENIUM	UG/L	5	25	11	13	10	0
SILVER	UG/L	1	1	1	7	4	0
SODIUM	UG/L	1800000	1650000	9000000	6903240	4194606	26237
THALLIUM	UG/L	10	10	10	60	33	0
TIN	UG/L	240	135	230	4367	2124	13
TITANIUM	UG/L	59	640	24	992	535	3
VANADIUM	UG/L	12	59.5	2	63	39	0
YTTRIUM	UG/L	10	10	10	50	28	0
ZINC	UG/L	13000	17500	3300	55092	32591	204

NOTE: MG/L = MILLIGRAMS PER LITER
UG/L = MICROGRAMS PER LITER
PPT = PARTS PER TRILLION
MEAN = FLOW WEIGHTED MEAN
INDUSTRY LOADING = MEAN (MG/L) * 0.75 MGD * 8.345 or
(MEAN (UG/L) * 0.75 MGD * 8.345)/1000