MICHIGAN DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION BUREAU
POINT SOURCE STUDIES SECTION

Report of an
Industrial Wastewater Survey
Conducted at
PENNWALT CHEMICAL CORPORATION
All Outfalls No. 820298
Final Order of Abatement No. 1994 &
NPDES Permit No. MI0002381
Wayne County
Wyandotte, Michigan
August 17-18, 1981

US EPA RECORDS CENTER REGION 5
402901

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Survey Summary

Wastewater monitoring was performed during one twenty-four hour survey period starting Monday, August 17, 1981.

The results of this survey met the limitations in the facility's Final Order of Abatement, No. 1994.

The survey results are compared to the self-monitoring results reported in the company's Monthly Operating Report for August, 1981. These results compare reasonably with the following exceptions. The company reported much lower net loadings for suspended solids and chlorides and a lower COD concentration at outfall 821088 (006). The company also reported generally lower ammonia nitrogen concentrations at outfalls 820223 (005), 820193 (003), and 820190 (002) (Table 3).

Duplicate grab samples were collected at outfalls 821088 (006), 820223 (005), 820193 (003), 820190 (002), 820224 (001), and 820409 (Intake), for comparison of analytical results. These results compare reasonably, with the following exceptions. The company reported a greater suspended solids concentration and a lower COD concentration at outfall 821088 (006). Ammonia nitrogen concentrations reported by the company are generally less than those found by the Environmental Protection Bureau Laboratory, especially outfall 820224 (001) (Table 4).

The results of this survey are also compared to the results of the previous survey, performed 7-7-80. This comparison shows a reduction in COD and TOC concentrations at outfall 821088 (006) and a reduction in the suspended solids concentration at outfall 820223 (005) (Table 5).

Survey Comments

Final Order of Abatement, No. 1994 includes a COD loading limitation for outfall 820223 (005). Samples were collected for COD analyses at outfall 005

during the survey but an interference was encountered in the analyses which resulted in no obtainable values. The source of this interference was a high chlorides concentration which averaged approximately 9,000 mg/l in the composite and two individual grab samples. Standard Methods (APHA, 14th Ed., 1975, pg. 552) states that "As a general rule, COD cannot be measured accurately in samples containing more than 2,000 mg/l chlorides." Methods for Chemical Analysis of Water and Wastes (EPA 600-4-79-020, 1979) presents a method for determination of COD concentrations in saline waters. This method utilizes mercuric sulfate to complex the chlorides present, however it is limited to high level COD concentrations, greater than 250 mg/l. The company has adapted this method for their use by first determining the chlorides concentration of the sample and setting up a "salt interference blank" made up of distilled water and the chlorides concentration found in the sample. The sample and the blank are then both analyzed for COD, utilizing mercuric sulfate to complex the chlorides concentrations. The blank COD is then subtracted from the sample COD. This procedure resulted in a negative COD value being reported on the duplicate grab sample comparison in Table 4. Negative COD values were given for four of thirteen samples reported in the company's August, 1981 MOR. Environmental Protection Bureau (EPB) Laboratory personnel contend that comparison of the Total Organic Carbon (TOC) concentrations indicate COD concentrations up to two orders of magnitude below the 250 mg/l necessary to use the mercuric sulfate method (i.e. TOC's approximately 2.0 mg/l). It is the opinion of the EPB Laboratory personnel that the TOC concentrations are a much more reliable indication of oxygen demand in this situation.

Plant Processes

The Pennwalt Chemical Corporation in Wyandotte manufactures organic and inorganic chemicals in two separate, but adjacent, plants. The inorganics (east) plant produces chlorine, caustic soda, ferric chloride, ammonium chloride, and muriatic acid from salt brine, scrap iron, ammonia, and other raw materials. The organics (west) plant produces about 100 different organic compounds, chiefly alkylamines and rubber industry chemicals from ammonia, alcohols and other raw materials. Plant layout diagrams for the East and West plants are given in Figures 1 and 2, respectively. A process schematic for the East plant is given in Figure 3.

Production at both plants was considered normal during the survey. Both plants operate 24 hrs/day, 7 days/wk. The inorganic plant employs about 300 people and the organic plant about 250 people.

Water Supply, Wastewater & Treatment

All process and cooling water used in both plants is obtained through an intake on the Trenton Channel of the Detroit River. The south intake (820409) also services the Detroit Edison-Pennwalt Plant in the East complex. Intake screen backwash is discharged to the Detroit Edison outfall. The intake is chlorinated on a continuous basis during the summer months only, beginning in

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early May. The company uses an average of 77 kg/day (170 lbs/day) of chlorine to treat 15,000 M^3/day (39 MGD) of intake water. The company also maintains the north intake (820412) on a back-up basis.

Domestic water is supplied by the City of Detroit. All sanitary wastes are discharged to the Detroit sanitary sewer system.

All process and cooling waters from the organics (West) plant is treated as depicted in Figure 2. Pond 1 receives wastes from the pilot plant operation. Phenolic wastes are batch discharged from a sump to Pond 2 for equalization of loadings from the plant. The sump is tested prior to discharge to the pond, if high results are found the batch is bled into the system or hauled away for incineration. Following a third pond these wastes are mixed with other process wastes, the pH is adjusted and they are discharged to Pond 4. The cooling water, which comprises 55% of the total flow, is mixed with the effluent from Pond 4. The major treatment provided by this set-up includes equalization of slug loads, settling, oil skimming, and pH adjustment as necessary using sulfuric acid or caustic. Effluent from Pond 4 and cooling water are discharged to Mongaugon Creek via outfall 821088 (006).

Seal water from the liquid ferric pumps, water from the chlorine cell room drains, wash water from the evaporators, wash water from the tank room and back wash from two of the filters used to filter caustic are discharged via outfall 820223 (005). The combined waste streams are provided settling in one of two settling lagoons. Following continuous pH adjustment with carbon dioxide, sulfuric acid or caustic, if necessary, the wastewater is monitored and enters a Wayne County Drain prior to entering the Detroit River. The lagoon which is not being used for settling is dredged and the solids disposed of by deep well injection. The lagoon not in use is also used to receive any wastewater generated from the replacement of the asbestoes diaphram filters in the chlorine cell room.

Outfall 820193 (003) discharges cooling water from the ammonium chloride process. The pH is adjusted using sulfuric acid or caustic prior to monitoring and discharge into the Wayne County Drain No. 5, to the Detroit River.

Outfall 820190 (002) discharges cooling water from the barametric condensers and chlorine cell room, rinse wall from sodium hydroxide storage tanks, flue gas scrubber water, sulfuric acid tank cooling water and yard drainage. About 95 of the wastewater originates from the barometric condensers. The pH of the wastewater is adjusted using carbon dioxide, sulfuric acid or caustic prior to discharge.

Non-contact cooling water from the chlorine liquidation process is discharged without treatment via outfall 820224 (001) to a storm sewer to the Detroit River.

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Survey Procedure

The flows and samples were obtained as follows:

Outfall	Flow Measurement	Sampling Methods
821088 (006) Organics Plant Discharge	Company installed 278.25 inch, broadcrested weir, with a staff installed water level recorder.	Automatic air activated sampler + individual grabs.
820223 (005) Inorganics Plant Process Discharge	Company MOR	Automatic air activated sampler + individual grabs.
820193 (003) Inorganics Plant Cooling Water Discharge	Company totalizer	Automatic air activated sampler + individual grabs.
820190 (002) Inorganics Plant Cooling Water Discharge	Company totalizer	Automatic air activated sampler + individual grabs.
820224 (001) Inorganics Plant Cooling Water Discharge	Company MOR	Individual grabs.
820409 (South Intake)	None	Submergible sampler + individual grabs.
820298 (000) Total Chlorides Loading	--	Sum of outfalls 820223 (005), 820193 (003), 820190 (002), and 820224 (001).

A water level recorder provides a continuous account of the liquid level or head above the crest of a weir. A head versus time graph is obtained for the duration of the survey period. The total volume of wastewater over the weir during the survey period is computed from the graph.

An automatic sampler composites samples at timed intervals. Samples may be proportional to the instantaneous flow over the weir.

A submergible sampler obtains samples at a continuous rate.

Extractable organic and sulfide composite samples are collected by the grab composite method.

A grab composite consists of a series of individual grabs composited into one sample.

An individual grab is a single instantaneous sample.

Samples were analyzed by the Environmental Protection Bureau Laboratories located in Lansing.

Samples were preserved according to Table 6. The results of the physical, chemical and bacteriological analyses are presented in Tables 1 & 2. Letter codes for laboratory results are defined in Table 6.

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Table 1 Analyses of composite samples.

Outfalls	821088 (006)		820223 (005)	
Survey Period From	8-17-81 - 1530		8-17-81 - 1600	
To	8-18-81 - 1530		8-18-81 - 1600	
Computed flow rate[1] (M^3/day)	26,600		(4,900)	
	mg/l	kg/day	mg/l	kg/day
Suspended solids	18	480	< 4	--
Dissolved solids	160	4,300	16,000	78,000
[illegible]	26	690	INT	--
[illegible]	8.2	220	2.4	12
Sulfide	0.02	0.5	--	--
BOD_5	11.	290	--	--
Nitrite & nitrate nitrogen-N	0.49	13.	0.40	2.0
Ammonia nitrogen-N	0.58	15.	0.36	1.8
Kjeldahl nitrogen-N	1.5	40.	0.70	3.4
Total phosphorus-P	0.16	4.3	0.03	0.1
Chlorides	20.	530	8,300	41,000
Alkalinity (as $CaCO_3$)	76	--	1,620	--
Hardness (as $CaCO_3$)	100	--	55	--
	ug/l		ug/l	
Phenol	24 NA	0.64	3 NA	0.01
Total cadmium (Cd)	< 20	--	< 20	--
Total chromium (Cr)	< 50	--	< 50	--
Total copper (Cu)	35	0.93	85	0.42
Total nickel (Ni)	< 50	--	< 50	--
Total lead (Pb)	< 50	--	< 50	--
Total zinc (Zn)	< 50	--	< 50	--
Total iron (Fe)	460	12	410	2.0
Chlorinated Phenolics Scan	U	--	U	--

1 - Flow rates used in the computation of kg/day (obtained from company MOR).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 1 (continued)

Outfalls	820193 (003)		820190 (002)	
Survey Period From	8-17-81 - 1425		8-17-81 - 1505	
To	8-18-81 - 1425		8-18-81 - 1505	
Computed flow rate[1] (M^3/day)	[20,800]		[72,900]	
	mg/l	kg/day	mg/l	kg/day
Suspended solids	19	400	15	1,100
Dissolved solids	170	3,500	150	11,000
COD	9	200	8	600
TOC	2.6	54.	2.3	170
Nitrite & nitrate nitrogen-N	0.51	11	1.4	100
Ammonia nitrogen-N	0.34	7.1	0.29	21.
Kjeldahl nitrogen-N	0.53	11	0.55	40.
Total phosphorus-P	0.10	2.1	0.06	4
Chlorides	28.	580	22.	1,600
Alkalinity (as $CaCO_3$)	81	--	83	--
Hardness (as $CaCO_3$)	100	--	100	--
	ug/l		ug/l	
Phenol	4 NA	0.08	7 NA	0.5
Total copper (Cu)	13	0.27	--	--
Total lead (Pb)	< 5	--	< 5	--

1 - Flow rates used in the computation of kg/day [obtained from company totalizer].
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 1 (continued)

Outfall	820409 (Intake)
Survey Period From	8-17-81 - 1615
To	8-18-81 - 1615
	mg/l
Suspended solids	11
Dissolved solids	130
COD	9
TOC	1.7
Sulfide	< 0.02 PS
BOD_5	3.1
Nitrite & nitrate nitrogen-N	0.39
Ammonia nitrogen-N	0.33
Kjeldahl nitrogen-N	0.55
Total phosphorus-P	0.04
Chlorides	12.3
Alkalinity (as $CaCO_3$)	84
Hardness (as $CaCO_3$)	100
	ug/l
Phenol	9 NA
Total cadmium (Cd)	< 20
Total chromium (Cr)	< 50
Total copper (Cu)	60
Total nickel (Ni)	< 50
Total lead (Pb)	< 50
Total zinc (Zn)	< 50
Total iron (Fe)	380
Chlorinated Phenolics Scan	U

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Table 2 Analyses of grab samples.

Date	Time	Temp.[1] °C	pH[1] S.U.	Residual[1] Chlorine mg/l	Susp. solids mg/l	Diss. solids mg/l	COD mg/l	TOC mg/l	Sulfide mg/l	BOD_5 mg/l	Nitrite & nitrate nitrogen mg/l	Ammonia nitrogen mg/l
821088 (006)												
8-17-81	1200	29.0	7.2	U	--	--	--	--	--	--	--	--
8-17-81	1535	29.5	7.6	U	13	140	19	5.0	< 0.02 PS	9.3	0.41	0.43
8-18-81	0730	26.5	7.5	U	12	170	21	6.4	0.02 PS	9.8	0.41	0.58
8-18-81	1315	30.0	7.6	U	12	170	30	9.0	< 0.02	14.	0.45	0.43
820223 (005)												
8-17-81	1345	25.5	8.1	0.3	--	--	--	--	--	--	--	--
8-17-81	2121	26.5	8.0	U	< 4	17,000	INT	2.4	--	--	0.46	0.28
8-18-81	0805	24.0	8.0	U	5	19,000	INT	0.9	--	--	0.36	0.38
820193 (003)												
8-17-81	2222	26.5	8.2	U	15	160	10	2.5	--	--	0.51	0.34
8-18-81	0920	26.5	7.7	U	18	180	10	2.4	--	--	0.47	0.34
820190 (002)												
8-17-81	2200	30.0	8.2	U	15	140	10	2.4	--	--	0.37	0.29
8-18-81	0850	30.0	7.8	U	19	160	10	2.5	--	--	0.33	0.28
820224 (001)												
8-17-81	2235	24.0	7.7	U	13	360	8	1.0	--	--	0.42	0.22
8-18-81	0910	24.0	7.6	U	17	140	6	1.8	--	--	0.40	0.23
820409 (Intake)												
8-17-81	2140	21.5	7.9	--	10	200	10	--	--	--	--	--
8-18-81	0835	22.0	7.8	--	14	140	9	--	--	--	--	--

1 - Values determined in the field at time of sampling.

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Table 2 (continued)

Date	Time	Un-ionized Ammonia[2] (as NH_3) mg/l	Kjeldahl nitrogen mg/l	Total phosphorus-P mg/l	Chlorides mg/l	Alkalinity (as $CaCO_3$) mg/l	Hardness (as $CaCO_3$) mg/l	O&G I.R. mg/l	O&G Grav. mg/l	Phenol ug/l	Ca ug/l
821088 (006)											
8-17-81	1535	0.016	1.1	0.07	12.7	78	100	< 1	2	45 NA	< 20
8-18-81	0730	0.013	1.2	0.06	18.9	78	100	< 1	< 2	9 NA	< 20
8-18-81	1315	0.016	1.8	0.08	20.	79	100	< 1	< 2	12 NA	< 20
820223 (005)											
8-17-81	2121	--	0.75	0.03	8,600	1,980	50	< 1	< 2	5 NA	< 20
8-18-81	0805	--	0.72	0.04	10,000	1,370	45	< 1	< 2	< 2 NA	< 20
820193 (003)											
8-17-81	2222	--	0.58	0.06	26.	--	--	< 1	< 2	4 NA	--
8-18-81	0920	--	0.62	0.12	28.	--	--	< 1	< 2	7 NA	--
820190 (002)											
8-17-81	2200	--	0.54	0.04	23.	81	--	< 1	< 2	7 NA	--
8-18-81	0850	--	0.61	0.06	21.	84	--	< 1	< 2	4 NA	--
820224 (001)											
8-17-81	2235	--	0.52	0.05	12.2	81	100	< 1	< 2	6 NA	--
8-18-81	0910	--	0.48	0.06	13.9	87	100	< 1	< 2	5 NA	--
820409 (Intake)											
8-17-81	2140	--	--	--	11.8	--	--	--	--	--	--
8-18-81	0835	--	--	--	11.9	--	--	--	--	--	--

2 - Unionized ammonia concentrations are calculated from temperature, pH, and, ammonia values, the formula is given in Table 6.

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Table 2 (continued)

Date	Time	Total chromium ug/l	Total copper ug/l	Total nickel ug/l	Total lead ug/l	Total zinc ug/l	Total iron ug/l
821088 (006)							
8-17-81	1535	< 50	50	< 50	< 50	< 50	460
8-18-81	0730	< 50	45	< 50	< 50	< 50	570
8-18-81	1315	< 50	35	< 50	< 50	100	470
820223 (005)							
8-17-81	2121	< 50	100	< 50	< 50	< 50	160
8-18-81	0805	< 50	100	< 50	< 50	< 50	85
820193 (003)							
8-17-81	2222	--	10	--	< 5	--	--
8-18-81	0920	--	11	--	6	--	--
820190 (002)							
8-17-81	2200	--	--	--	< 5	--	--
8-18-81	0850	--	--	--	< 5	--	--

Purgeable Halocarbons Scan

	1,2-Dichloro-propane ug/l	Chloroform ug/l	1,2-Dichloro-ethane ug/l	Other Purgeable Halocarbons	Total Aromatic Amines (as Aniline) ug/l
821088 (006)					
8-17-81 1535	3	U	U	U	< 100
8-18-81 0730	2	U	U	U	< 100
8-18-81 1315	2	U	U	U	< 100
820223 (005)					
8-17-81 2121	U	5	4	U	--
8-18-81 0805	U	7	4	U	--
820409 (Intake)					
8-17-81 2140	3	U	3	U	--
8-18-81 0835	< 1	U	6	U	--

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Table 3 Comparison of survey results with the facility's Final Order and Monthly Operating Report.

Parameter (Unit)	Final Order Limitations		August Monthly Operating Report				Sur.
	Monthly Average	Daily Maximum	Monthly Average	Monthly Maximum	8-17-81	8-18-81	
821088 (006)							
Flow (M^3/day)	--	--	31,000	35,000	32,000	32,000	26,600
BOD_5 (kg/day)	661	967	269	355	--	221	290
COD (mg/l)	--	--	9	30	--	0	26 (19, 2 30)
Total susp. sol.-Net (kg/day)	173	259	0	0	--	- 1,681	190
Chlorides-Net (kg/day)	--	2,000	0	317	--	0	200
Ammonia (unionized) (mg/l)	--	0.2	0.029	0.197	0.017	--	(0.016, 0.013, 0.016)
Total residual chlorine (mg/l)	--	0.5	0.07	0.90	0.00	--	(U, U, U, U)
Phenol (ug/l)	--	200	22	50	--	20	24 (45, 9, 12
(kg/day)	--	4.5	0.707	1.56	--	0.649	0.64
Sulfide (mg/l)	--	--	0	0	--	--	0.02 (<0.02, 0.02, <0.02)
Total zinc (ug/l)	--	1,000	43	71	--	--	< 50 (<50, <50, 100)
Oil & Grease (visual)	--	--	0	0	0	0	--
(mg/l)	Quantitative analysis not required		--	--	--	--	(2, <2, <2)
Temperature (°C)			28	31	28		(29.0, 29.5, 26.5, 30.0)
pH (S.U.)	--	--	--	max. 9.4	8.9	7.6	(7.2, 7.6, 7.5, 7.6)
				min. 6.7	6.7	7.4	
				Monthly Minimum			
	not <6.0 nor >9.5 - 90% of time		--	100	100	100	--
	not <6.0 nor <10.0 - 100% of time		--	100	100	100	--

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ( ).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 3 (continued)

Parameter (Unit)	Final Order Limitations		August Monthly Operating Report				Survey Results[1]
	Monthly Average	Daily Maximum	Monthly Average	Monthly Maximum	8-17-81	8-18-81	
820223 (005)							
Flow (M^3/day)	--	--	5,300	6,800	4,900	4,900	4,900
COD	--	821	74.8	249	137	--	INT
Total susp. solids (mg/l)	35	70	21	94	26	23	< 4 (<4, 5)
(kg/day)	212	425	113	532.9	128	110	< 20.
Chlorides (mg/l)	--	--	7,683	12,060	--	6,517	8,300 (8,600; 10,00
Ammonia nitrogen-N (mg/l)	1.0	1.5	0.19	0.56	--	0.11	0.36 (0.29, 0.38)
Total residual chlorine (mg/l)	1.0	1.5	0.04	0.43	0.43	0.0	(0.3, U, U)
Total lead (ug/l)	100	200	8	10	--	--	< 50 (<50, <50)
(kg/day)	0.6	1.2	0.045	0.054	--	--	0.2
Oil & Grease (visual)	--	--	0	0	0	0	--
(mg/l)	Quantitative Analysis not required		--	--	--	--	(<2, <2)
Temperature (°C)	--	--	29	32	--	30	(25.5, 26.5, 24.0)
pH (S.U.)	--	--	--	max. 9.8	8.5	8.3	(8.1, 8.0, 8.
				min. 5.6	7.8	5.6	
				Monthly Minimum			
	not <6.0 nor >9.5 - 90% of time			99.7	100	99.9	--
	not <5.0 nor >10.0 - 95% of time			100	100	100	--
	not <3.0 nor >11.0 - 100% of time			100	100	100	--

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ( ).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Parameter (Unit)	Final Order Limitations Monthly Average	Final Order Limitations Daily Maximum	August Monthly Operating Report Monthly Average	August Monthly Operating Report Monthly Maximum	August Monthly Operating Report 8-17-81	August Monthly Operating Report 8-18-81	Survey
820193 (003)							
Flow (M^3/day)	--	--	22,000	23,000	21,000	20,000	20,800
Total susp. solids (kg/day)	1,481	2,963	353	741.5	361	320.	400
Chlorides (mg/l)	--	--	48	73	--	36	28. (26.,
Ammonia nitrogen-N (mg/l)	3	5	0.09	0.60	--	0.00	0.34 (0.34, 0.34)
Total residual chlorine (mg/l)	1.0	1.5	0.07	0.21	0.00	0.00	(U, U)
Total copper (Cu) (ug/l)	--	1,000	16	43	8	--	13 (10, 11)
Total lead (Pb) (kg/day)	0.45	0.9	0.23	0.23	--	--	< 0.1
Oil & Grease (visual)	--	--	0	0	0	0	--
(mg/l)	Quantitative Analysis not required		--	--	--	--	(<2, <2)
Temperature (°C)	--	--	28	29	--	29	(26.5, 26.5)
pH (S.U.)	--	--	--	max. 11.1 min. 2.9	8.9 7.3	8.5 7.9	(8.2, 7.7)
				Monthly Minimum			
	not <6.0 nor >9.5 - 90% of time			96.7	100	100	--
	not <6.0 nor >11.0 - 99% of time			97.0	100	100	--
	not <2.0 nor >11.0 - 100% of time			99.7	100	100	--

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ( ).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 3 (continued)

Parameter (Unit)	Final Order Limitations Monthly Average	Final Order Limitations Daily Maximum	August Monthly Operating Report Monthly Average	August Monthly Operating Report Monthly Maximum	August Monthly Operating Report 8-17-81	August Monthly Operating Report 8-18-81	Survey Results[1]
820190 (002)							
Flow (M^3/day)	--	--	72,300	76,500	73,100	76,500	72,900
COD (mg/l)	--	--	18	47	19	--	8 (10, 10)
Total susp. solids (kg/day)	4,103	8,206	2,017	6,513	805.4	3,509	1,100
Chlorides (mg/l)	--	--	26	35	--	26	22. (23., 21.
Ammonia nitrogen-N (mg/l)	1.4	2.3	0.09	0.49	--	0.00	0.29 (0.29, 0.28)
Total residual chlorine (mg/l)	1.0	1.5	0.21	0.83	0.00	0.00	(U, U)
Total lead (Pb) (kg/day)	0.6	1.25	0.526	0.535	--	--	< 0.4
Oil & Grease (visual)	--	--	0	0	0	0	--
(mg/l)	Quantitative Analysis not required		--	--	--	--	(<2, <2)
Temperature (°C)	--	--	33	37	34	34	(30.0, 30.0
pH (S.U.)	--	--	--	max. 10.9 min. 6.4	8.8 8.1	8.8 7.8	(8.2, 7.8)
				Monthly Minimum			
	not <6.0 nor >9.5 - 90% of time			96.0	100	100	--
	not <5.0 nor >10.0 - 95% of time			98.8	100	100	--
	not <3.0 nor >11.0 - 99% of time			100	100	100	--
	not <2.0 nor >12.0 - 100% of time			100	100	100	--

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ( ).
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

Table 3 (continued)

Parameter (Unit)	Final Order Limitations Monthly Average	Final Order Limitations Daily Maximum	August Monthly Operating Report Monthly Average	August Monthly Operating Report Monthly Maximum	August Monthly Operating Report 8-17-81	August Monthly Operating Report 8-18-81	Survey[1]
820224 (001)							
Flow (M^3/day)	--	--	8,700	10,000	7,900	7,900	--
COD (mg/l)	--	--	0	8	--	--	(8, 6)
Total susp. solids (mg/l)	--	--	20	24	--	--	(13, 17)
Chlorides (mg/l)	--	--	19	23	--	18	(12.2, 13.9
Ammonia nitrogen-N (mg/l)	--	--	0.21	0.49	--	0.18	(0.22, 0.23
Total Residual Chlorine (mg/l)	--	--	0.04	0.15	--	--	(U, U)
Oil & Grease (visual)	--	--	0	0	0	0	--
(mg/l)	Quantitative Analysis not required		--	--	--	--	(<2, <2)
Temperature (°C)	--	--	24	25	--	--	(24, 25)
pH (S.U.)	not <6.0 nor >9.0		--	max. 8.6 min. 8.1	--	8.6	(7.7, 7.6)
820298 (000)							
Chlorides (kg/day)	--	227,000	44,030	85,990	--	34,850	43,000[2]

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ( ).
2 - Sum of chlorides loadings from outfalls 820223 (005), 820193 (003), 820190 (002), and 820224 (001). The loading for outfall 001 was calculated from the arithmetic mean of two individual grab samples and the arithmetic mean of the flows reported on the company's MOR for the survey dates.
To obtain MGD multiply M^3/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

Table 4 Comparison of the laboratory analytical results obtained by Pennwalt Chemical Corporation and the Environmental Protection Bureau from the duplicate grab samples.

Outfall	821088 (006) Pennwalt	821088 (006) E.P.B.	820223 (005) Pennwalt	820223 (005) E.P.B.
Flow (M^3/day)	34,800	26,600	--	--
	mg/l	mg/l	mg/l	mg/l
Suspended solids	21.0	12	5.5	5
COD	7.1	21	15.4	INT
Sulfide	0	0.02	--	--
BOD5	6.8	9.8	--	--
Ammonia nitrogen-N	--	--	0.39	0.38
Ammonia (unionized)	0.02	0.013	--	--
Chlorides	20.8	16.9	10,050	10,000
	ug/l	ug/l	ug/l	ug/l
Phenol	< 20	9	--	--
Total copper (Cu)	--	--	--	--
Total lead (Pb)	--	--	4.28	< 50
Total zinc (Zn)	43	< 50	--	--

Outfall	820193 (003) Pennwalt	820193 (003) E.P.B.	820190 (002) Pennwalt	820190 (002) E.P.B.
	mg/l	mg/l	mg/l	mg/l
Suspended solids	16.9	18	18.4	19
COD	--	--	11.5	10
Sulfide	--	--	--	--
BOD5	--	--	--	--
Ammonia nitrogen-N	0.21	0.34	0.18	0.28
Ammonia (unionized)	--	--	--	--
Chlorides	33.8	28.	23.7	21.
	ug/l	ug/l	ug/l	ug/l
Total copper (Cu)	8.72	11	--	--
Total lead (Pb)	7.69	6	4.2	< 5

Table 6 Sample Preservation

Parameter	Preservative
COD/TOC/Phenol (Chlorine Absent)	10 drops conc. H_2SO_4/250 ml (to pH <2).
Total Metals	2 ml 1:1 HNO_3/250 ml (to pH <2).
Oil & Grease	10 drops conc. H_2SO_4/250 ml (to pH <2).
Sulfides	10 drops 1M ZnAc/250 ml.
Acid & Base-neutral Extractables Purgeable Organics	Dechlorinated (if needed) with sodium thiosulfate (1 drop 0.141 N/mg/l Cl_2/250 ml).

All samples cooled to 4°C and preserved upon collection and chain of custody maintained.

Lab Letter Codes

NA - Analytical method has not yet been approved by laboratory.
INT - Interference encountered during analysis resulted in no obtainable value.
PS - Possible interference may have affected the accuracy of the laboratory result.
U - Material was analyzed for but not detected.

$$\% \text{ unionized ammonia} = F = \frac{100}{[1 + 10^{(\exp.)}]} \quad \text{where } \exp. = 0.09018 + \frac{2729.92}{(T(^{o}C)+273.15)} - pH$$

To obtain unionized ammonia (as NH_3) multiply unionized ammonia(as N) by 17/14.

Survey by: David Yanochko, Environmental Engineer
L.J. McDonald, Water Quality Investigator
Richard Irvin, Water Quality Technician

Contact with Management: Robert Heineman, Manager--Energy-Environmental Control

Hydrocarbon Analyses by: Environmental Protection Bureau Laboratory

Physical, Chemical & Bacteriological Analyses by: Environmental Protection Bureau Laboratory

Report by: David Yanochko
L.J. McDonald
Point Source Studies Section
Environmental Services Division
Environmental Protection Bureau
Michigan Dept. of Natural Resources

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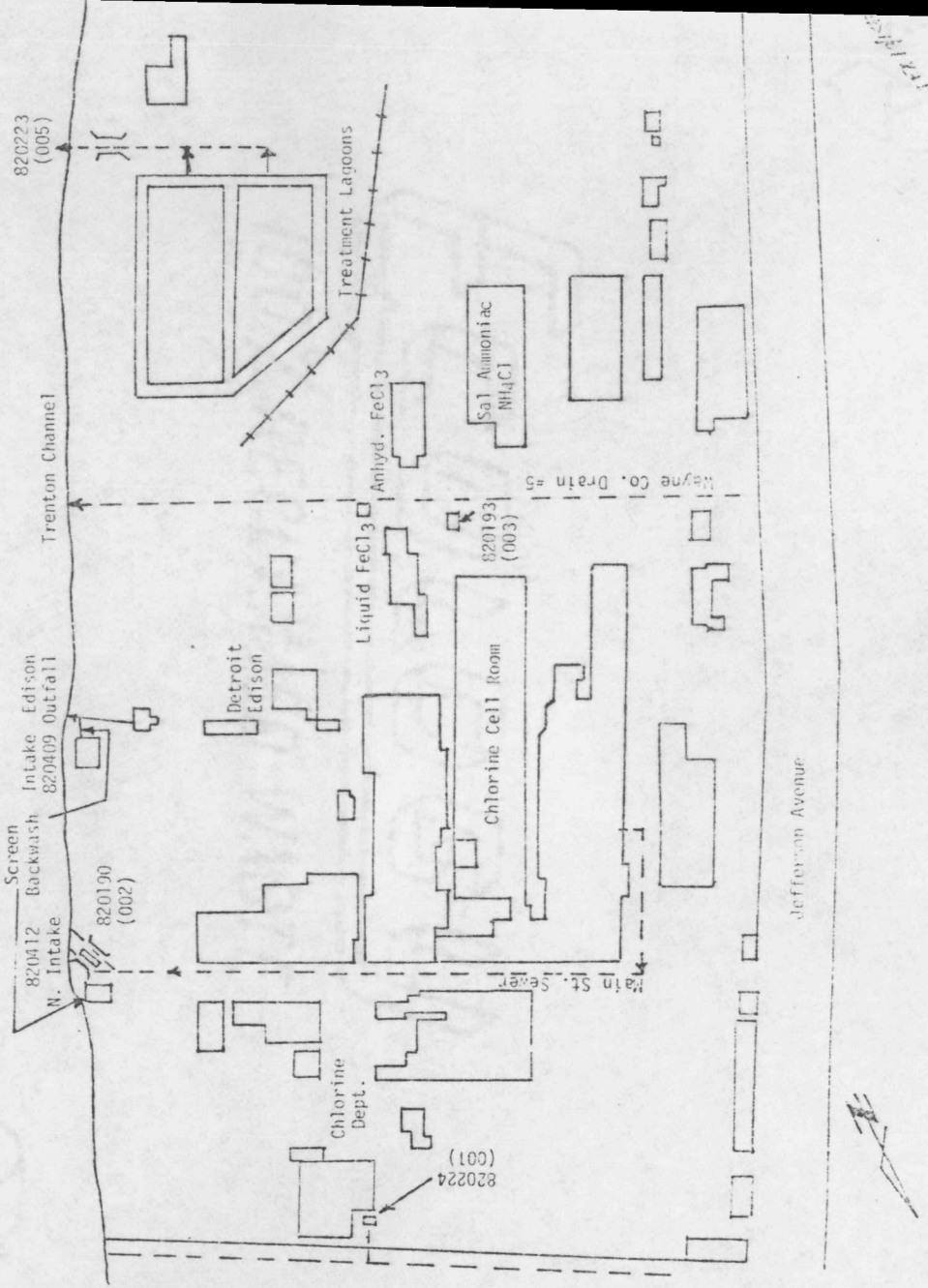
Figure 1 Pennwalt Corporation - East Plant Location Map



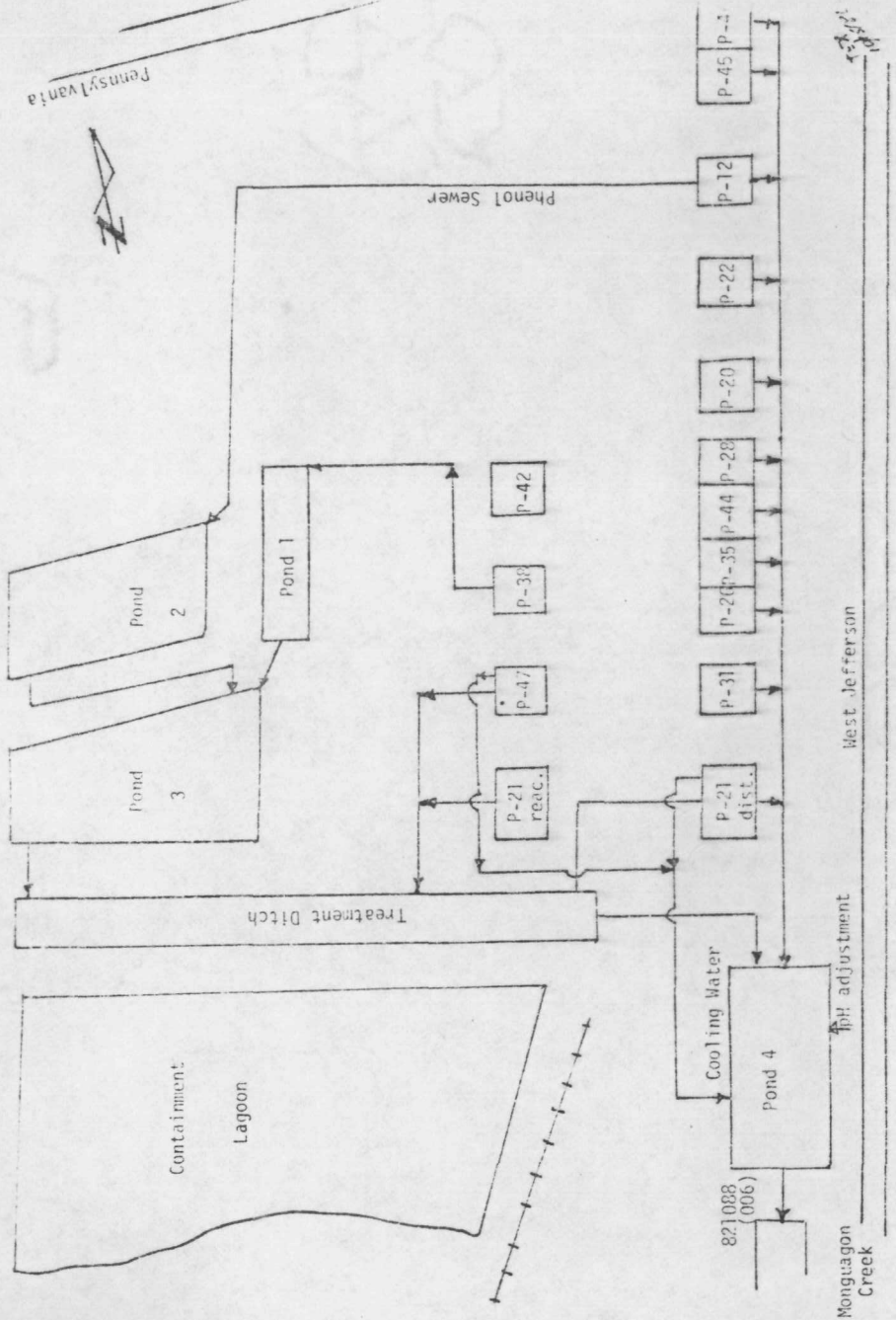
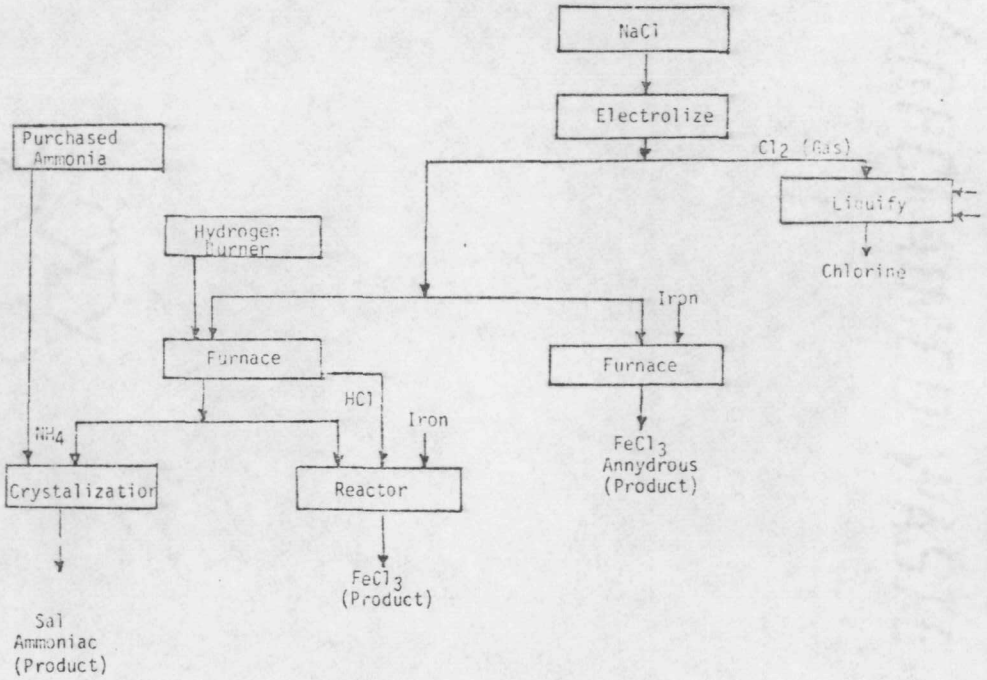


Figure 3 Pennwalt Corporation - East Plant

Process Flow Diagram



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