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Segment No. 05-10-01

WA-10-0020

PENNWALT CLASS II INSPECTION REPORT

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April 1989

ABSTRACT

A Class II inspection was conducted at the Pennwalt inorganic chemical plant in Tacoma on April 5-6, 1988. Chlorine, caustic soda, hydrogen, muratic acid, and sodium chlorate are produced. Discharge from the plant is into the Hylebos waterway as allowed by NPDES Permit No. WA-000311-5. The discharge appeared to be in compliance with NPDES permit limits during the inspection. Priority pollutant scans found low concentrations of several chemicals in the liquid stream and several different chemicals at concentrations above proposed sediment standard criteria in the sediments. Bioassay tests found no significant toxicity in the Pennwalt discharge or the sediments.

INTRODUCTION

A Class II inspection was conducted at the Pennwalt inorganic chemical plant in Tacoma on April 5-6, 1988 (Figure 1). The plant produces chlorine using an osmotic membrane process, along with caustic soda, hydrogen, muratic acid, and sodium chlorate. Water use is primarily once through cooling water with some consumption in production. Approximately 80-90 percent of the water used is saltwater from the Hylebos Waterway and the remaining 10-20 percent is city water. Cooling water is discharged into the Hylebos Waterway as specified in NPDES Permit No. WA-000311-5. The plant has a separate sanitary system that discharges into the city sewer.

Waste cooling water treatment consists of pH adjustment. Collection lines from areas of the plant most prone to pH variances are monitored and can be routed to a neutralization tank as necessary. The neutralization tank system lacks a centralized monitoring station for the collection system sensors, thus it is difficult to analyze all portions of the network simultaneously. The neutralization tank and other areas of the plant drain to an outfall box. Facilities for final pH adjustment before discharge are provided in the outfall box.

Conducting the inspection were Carlos Ruiz and Marc Heffner of the Ecology Compliance Monitoring Section. Fred Wolf, Manager for Environmental Affairs, represented Pennwalt. The inspection was performed for Greg Cloud of the Ecology Southwest Regional Office.

Objectives of the inspection were:

1. Verify compliance with NPDES permit limits by collecting independent samples and performing independent analyses.

2. Determine sampling and analytical performance by collecting side-by-side samples with Pennwalt and splitting samples for analysis by Ecology and Pennwalt.

3. Characterize toxicity of the influent, effluent, and receiving water sediments by performing priority pollutant scans and bioassays.

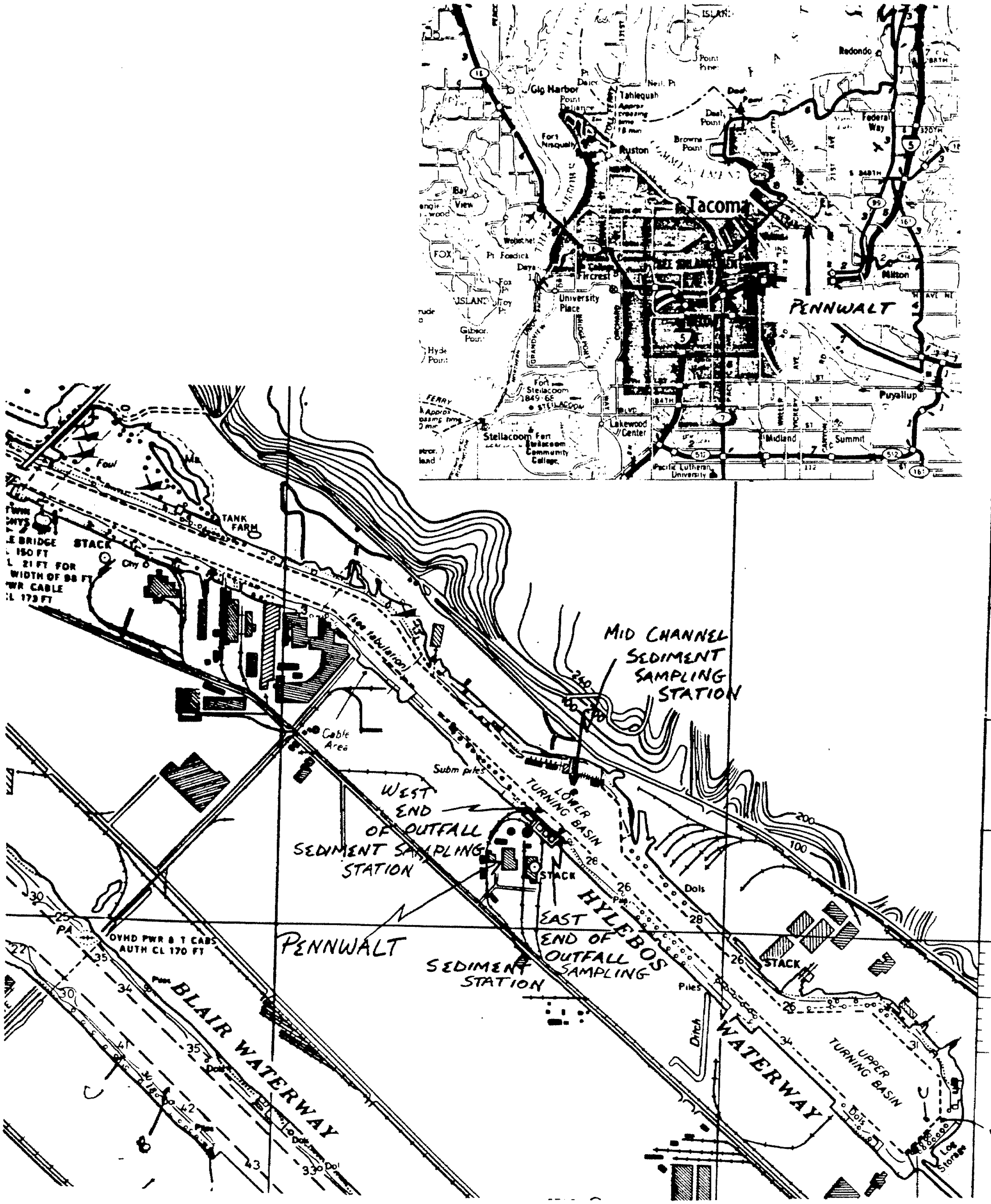

Figure 1. Site Location and Sediment Sampling Stations - Pennwalt, April 1988.

PROCEDURES

Ecology grab and composite samples of city water influent, saltwater influent, and plant effluent were collected during the inspection (Figure 2). Prior to the inspection, Ecology Isco composite samplers were cleaned for priority pollutant sampling (Figure 3). On site a field transfer blank sample was collected (Figure 3). The samplers were set up to collect approximately 180 mLs of sample every 30 minutes for 24 hours. Sample collection jugs were iced to cool samples as they were collected. City water and saltwater influent samples were collected from priority pollutant cleaned stainless steel buckets that were continuously overflowed from a tap in the appropriate line. The effluent sample was collected from the outfall box.

Pennwalt composite samples of the saltwater influent and plant effluent were also collected during the inspection. The samplers use air lift pumps that collect aliquots on a time basis. The samples were not cooled during collection.

Composite samples were split for analysis by Ecology and Pennwalt laboratories. Samples collected, sampling times, and parameters analyzed are included in Table 1.

Sediment samples were collected using a Van Veen grab sampler from two stations near the Pennwalt outfall and a third station mid-channel of the Hylebos Waterway near the Pennwalt dock (Figure 1). At each station, bottles for VOA analysis were filled directly from the sampler; one-half from each of the first two grabs. The top two centimeters of sediment were used from each grab. The remainder of the first two grabs and any subsequent grabs were composited until adequate sample for analysis was collected. The composite was stirred until homogenous and placed in appropriate containers. Sampling times and parameters analyzed are summarized in Table 1.

Samples for analysis by Ecology were iced and shipped to the Ecology/EPA Laboratory in Manchester. Ecology analytical methods are summarized in Table 2.

RESULTS AND DISCUSSION

NPDES Permit Parameters

NPDES monitoring at Pennwalt includes sampling and continuous monitoring. Continuous pH and temperature monitors are stationed in the outfall box. Effluent grab samples are collected four times daily for chlorine residual measurement with a Hach colorimetric kit. The permit specifies effluent load limits for total suspended solids (TSS), copper, lead, and nickel; the load being the difference between discharge and intake loads. Saltwater influent and plant effluent composite samples, and a city water grab sample are collected to calculate the portion of the effluent load contributed by Pennwalt.

Effluent flow is estimated as the sum of the city water and saltwater influent flows. City water is measured with a flow meter and the saltwater influent flow is estimated based on pump usage. Pennwalt has not devised an accurate effluent flow monitoring system. The effluent

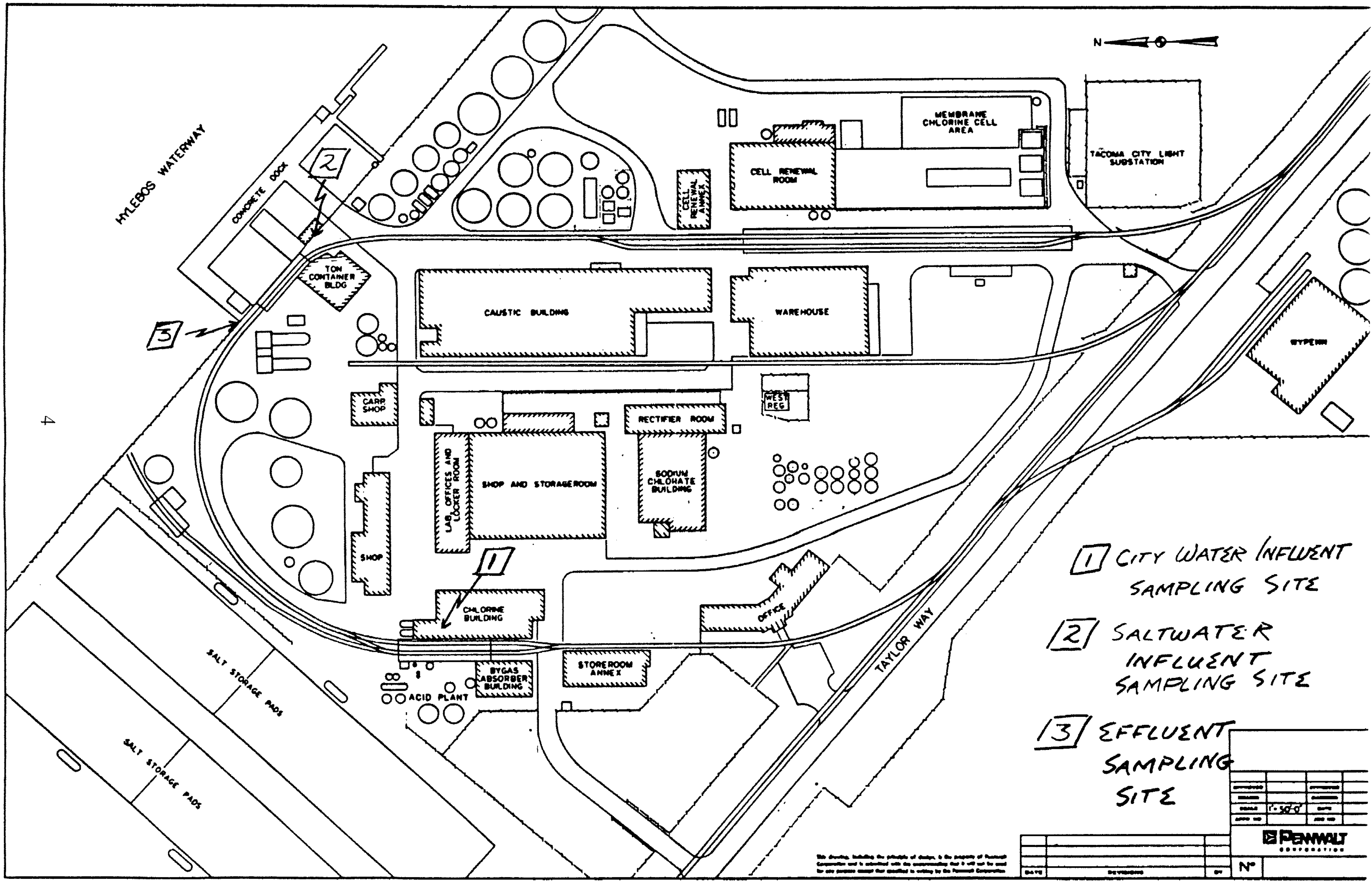

Figure 2. Water Sampling Stations - Pennwalt, April 1988.

Figure 3 - Priority Pollutant Cleaning and Field Transfer Blank Procedures - Pennwalt, April 1988.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

FIELD TRANSFER BLANK PROCEDURE

1. Pour organic free water directly into appropriate bottles for analysis of parameters collected with grab samples (VOA).

2. Run approximately 1L of organic free water through a compositor and discard.

3. Run approximately 6L of organic free water through the same compositor and put the water into appropriate bottles for analysis of parameters collected with composite samples (BNA, Pesticide/PCB, and metals).

Table 1 - Samples Collected and Parameters Analyzed - Pennwalt, 4/88.

	City Influent				Saltwater Influent				Plant Effluent					Sediment		
Sample:	#1	#2			#1	#2			#1	#2	#3			Mid-channel	E-end of outfall	W-end of outfall
Sampler:	Ecology	Ecology	Ecology	Pennwalt	Ecology	Ecology	Ecology	Pennwalt	Ecology	Ecology	Ecology	Ecology	Pennwalt	Ecology	Ecology	Ecology
Date:	4/5	4/6	4/5-6	4/6	4/5	4/6	4/5-6	4/5-6	4/5	4/6	4/6	4/5-6	4/5-6	4/6	4/6	4/6
Time:	1445	1105	1200-1200	1100	1425	1055	1100-1100	0800-0800	1330	1045	1230	1100-1100	0800-0800	1430	1510	1550
Laboratory Analyses / Type:	Grab	Grab	Composite	Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Composite	Composite	2 grabs	3 grabs	2 grabs
Conductivity			E	E			E	E				E	E			
TSS			E P	E			E P	E				E P	E			
Cu			E P	E			E P	E				E P	E			
Pb			E P	E			E P	E				E P	E			
Ni			E P	E			E P	E				E P	E			
TOC														E	E	E
% Solids														E	E	E
Grain Size														E	E	E
VOA (water)	E	E			E	E			E	E						
VOA (solids)														E	E	E
ABN (water)			E				E					E				
ABN (solids)														E	E	E
Pest/PCB (water)			E				E					E				
Pest/PCB (solids)														E	E	E
pp metals			E				E					E		E	E	E
Microtox			E				E					E				
Echinoderm							E					E				
Rheoporynius														E	E	E
Field Analyses																
pH		E				E			E P	E P	E P					
Temperature	E	E			E	E			E P	E P	E P					
Chlorine Residual									E	E						

E - analyzed by Ecology
P - analyzed by Pennwalt

Table 2 - Analytical Methods Used for Ecology Analysis - Pennwalt, April 1988.

Laboratory Analyses	Method Used
Conductivity	APHA, 1985: #205
TSS	APHA, 1985: #209C
Metals	EPA, 1983: #200 series
TOC	APHA, 1985: #505 *
% Solids	APHA, 1985: #209F
Grain Size	Holme and McIntyre, 1971
VOA (water)	EPA, 1984: #624
VOA (solids)	EPA, 1986a: #8240
ABN (water)	EPA, 1984: #625
ABN (solids)	EPA, 1986a: #8270
Pest/PCB (water)	EPA, 1984: #608
Pest/PCB (solids)	EPA, 1986a: #8080
Microtox	Beckman, 1982
Echinoderm	Dinnel et al., 1987
Rhepoxynius	Tetra Tech, 1986
Field Analyses	
pH	APHA, 1985: #423
Temperature	APHA, 1985: #212
Chlorine Residual	APHA, 1985: #408 E. (LaMotte Kit)

* - no HCl used per instrument instructions

weir is submerged during high tide and the outfall line does not flow full during low tide. The estimate is probably high because no allowances are made for in plant consumption or sanitary waste. The Pennwalt flow measurement estimates are used for calculations in this report. Installation of an accurate effluent flow measurement system is recommended.

Table 3 compares Ecology and Pennwalt results for field measured permit parameters. The pH and temperature measurements compare poorly, while chlorine residual comparison is acceptable. Ecology pH measurements were 0.4 to 0.8 unit less than the Pennwalt continuous recorder. Temperature measurements were 4 to 5 degrees Fahrenheit greater than the continuous Pennwalt meters. The Pennwalt meters are routinely calibrated every two weeks. Fred Wolf reported that the pH meter was calibrated the day after the inspection and found to be 0.3 unit too high. The calibration frequency and accuracy should be adjusted by Pennwalt to assure accurate measurements. Confirmation of accuracy by comparing meter readings with routine daily grabs by the Pennwalt lab is suggested.

Table 4 includes Ecology and Pennwalt laboratory results and compares them to NPDES permit limits. Flow, temperature, and pH were within permit limits during the inspection. Calculation of the Pennwalt TSS load using Ecology lab results indicated either substantial removal or addition of solids by Pennwalt. The variability of Ecology laboratory results forces reliance on the Pennwalt results which indicated permit compliance.

Copper, lead, and nickel results indicated permit compliance. Determination of permit compliance is difficult. The loading limits and corresponding flows require precise measurements at low metals concentrations. A variability of +/-50 percent can occur for measurements within ten times the detection limit. Table 5 illustrates that metals concentrations the permit requires be accurately measured fall below ten times the detection limit. Variability due to saltwater may also be considerable due to the high solids matrix (Twiss, 1988). Thus, assessment of compliance or violation of permit limits is difficult with the test methods used. Test methods with detection limits reduced by a factor of ten would provide results with less variability in the measurement range required in the permit.

Usual saltwater metals measurements report total aspirable metals, the result of directly injecting the sample into the atomic absorption unit after matrix modification (Twiss, 1988). Total aspirable metals are reported by Pennwalt for required permit testing. Thus, variability of Pennwalt metals data should be similar to those of the inspection. Special extraction procedures are available which might reduce variability, but they are labor intensive and were not requested for inspection samples.

Detection limits required for chlorine residual measurement were below detection limits of commonly used field test equipment (Table 5). Chlorine was not detected in the effluent. Routine use of more sensitive chlorine residual test equipment is recommended.

Priority Pollutant/Bioassay Results - Water

Table 6 summarizes the priority pollutants found in the water samples. Parameters analyzed and detection limits are included in the Appendix.

Table 3 - Field Analysis Results - Pennwalt, April 1988.

Sample	Date	Time	Laboratory	Temperature (C)	(F)	pH (S.U.)	Chlorine Residual (mg/L) Free	Total
Saltwater	4/5	1425	Ecology	9.0		*		
Influent	4/6	1055	Ecology	9.0		7.6		
City	4/5	1445	Ecology	14.0		*		
Influent	4/6	1105	Ecology	11.7		6.9		
Plant	4/5	1330	Ecology	19.0	66.2	7.4	< 0.1	< 0.1
Effluent			Pennwalt	16.1	61.0	7.8		
	4/6	1045	Ecology	15.6	60.1	7.1		< 0.1
			Pennwalt	13.3	56.0	7.7		< 0.1
		1230	Ecology	17.7	63.9	7.0		
			Pennwalt	15.0	59.0	7.8		

* - pH meter malfunctioned

Table 4 - NPDES Permit Comparison - Pennwalt, April 1988.

			Ecology Analysis								Pennwalt Analysis			
	Effluent Limits *		Ecology Samples				Pennwalt Samples				Ecology Samples			
Parameter	Daily Average	Daily Maximum	Saltwater Influent	City Influent	Plant Effluent	Pennwalt Load	Saltwater Influent	City Influent	Plant Effluent	Pennwalt Load	Saltwater Influent	City Influent	Plant Effluent	Pennwalt Load
Flow++ - (MGD)	12.9	15.4	10.4	2.4	12.8		10.4	2.4	12.8		10.4	2.4	12.8	
(CM/D)			39364	9084	48448		39364	9084	48448		39364	9084	48448	
Temperature+ - (F)	N/A	84												
- (C)	N/A	28.9			19.0;15.6; 17.7									
pH+ - (S.U.)	6.0 - 9.0				7.4; 7.1; 7.0									
TSS - (mg/L)			72	5	33		4	4	24		2.15	0.95	4.00	
- (Kg/D)			2834	45	1599		157	36	1163		85	9	194	
- (Kg/D)	104	258				-1280				970				100
Copper (T) - (ug/L)			<3	<3	<3		2	26	8		15	13	12	
- (Kg/D)			<0.12	<0.03	<0.15		0.08	0.24	0.39		0.59	0.12	0.58	
- (Kg/D)	1.15	2.82				0.00				0.07				-0.13
Lead (T) - (ug/L)			10	<5	<5		14	6	21		<5	<5	<5	
- (Kg/D)			0.39	<0.05	<0.24		0.55	0.05	1.02		<0.20	<0.05	<0.24	
- (Kg/D)	0.45	0.91				-0.20				0.42				0.00
Nickel (T) - (ug/L)			**	14	**		12	10	<5		<2	<2	<2	
- (Kg/D)			**	0.13	**		0.47	0.09	<0.24		<0.08	<0.02	<0.10	
- (Kg/D)	0.86	2.28				**				-0.32				0.00
Total Residual Chlorine+ - (mg/L)					<0.1									
- (Kg/D)	1.86	3.05			<4.8									
Conductivity - (umhos/cm)	--	--	34100	45	27300		34600	47	29200					

* Net values, (Discharge - Intake), are to be reported. Intake is the sum of saltwater influent and city influent.
** Analytical error. No valid result.
+ Analysis run on grab samples
++ Flow measurements provided by Pennwalt

Table 5 - Comparison of permit and detection limits - Pennwalt, April 1988.

	NPDES Permit Effluent Load Limits		Concentration at Effluent Limits*			
Parameter	Daily Average (Kg/D)	Daily Maximum (Kg/D)	Daily Average (ug/L)	Daily Maximum (ug/L)	Detection Limit (ug/L)	Detection Limit x 10 (ug/L)
Cu	1.15	2.82	23.7	58.2	3	30
Pb	0.45	0.91	9.3	18.8	5	50
Ni	0.86	2.28	17.8	47.1	5	50
Chlorine Residual	1.86	3.05	38.4	63.0	100	N/A

* Calculation assumes the inspection flow of 12.8 MGD and no influent load
N/A = not applicable

Table 6 - Compounds/Elements found in VOA, BNA, Pest/PCB and metal priority pollutant scans of Ecology water samples - Pennwalt, April 1988.

Station	Field Transfer Blank	Saltwater Influent		Plant Effluent		City Influent		Methods Blank	Saltwater Toxicity Criteria (EPA, 1986b)	
		#1	#2	#1	#2	#1	#2			
Date		4/5	4/6	4/5	4/6	4/5	4/6			
Time		1425	1055	1330	1045	1445	1105		Acute	Chronic
VOA Compounds (ug/L)										
Methylene Chloride	2 B	1 B	1 B	1 B	1 B	1 B	1 B	1 U	-	-
Acetone	32 B	15 B	20 B	11 B	16 B	20 B	19 B	8	-	-
Chloroform	1 U	1	1	8	6	19	20	1 U	-	-
Bromoform	1 U	1 U	1 U	13	2	1 U	1 U	1 U	-	-
Bromodichloromethane	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	-	-
Tetrachloroethene	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	-	-

Station	Field Transfer Blank	Saltwater Influent Composite	Plant Effluent Composite	City Influent Composite	Saltwater Toxicity Criteria (EPA, 1986b)	
Date		4/5-6	4/5-6	4/5-6		
Time		1100-1100	1100-1100	1200-1200	Acute	Chronic
Priority pollutant metals (ug/L)						
Arsenic	1 U	9	20 +	1 U	2319(69)*	13(36)*
Beryllium	1 U	3.4	2.1	1 U	-	-
Copper	137 ++	3 U	3 U	3 U	2.9	2.9
Lead	8 +	10 +	5 U	5 U	140	5.6
Nickel	50 U	**	**	14 +	75	8.3
Selenium	8	23	19	1 U	410	54
Silver	0.2 U	34.7 ++	10.9 ++	0.2 U	2.3	-
Thallium	1 U	8	9	1 U	2130	-
Zinc	23	3 U	5	311 ++	95	86

U indicates compound was analyzed for but not detected at the given detection limit

J indicates an estimated value when result is less than specified detection limit

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination

M indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters

* - penta(tri)

** - laboratory analytical error

+ - chronic toxicity criteria exceeded

++ - acute and chronic toxicity criteria exceeded

Several VOA compounds and metals were detected in the priority pollutant scans. The low concentrations of methylene chloride and acetone found in the Pennwalt samples and the field transfer blank are inconclusive. These compounds which are used in sample bottle preparation, are commonly found in the field transfer blank. Bromodichloromethane and tetrachloroethene were each detected in one of the effluent grab samples at the detection limit, which is again inconclusive. Chloroform and bromoform were detected in the effluent at concentrations between 2 and 13 ug/L. Saltwater toxicity criteria for chloroform and bromoform are not available.

Metals detected are compared to toxicity criteria in Table 6 (EPA, 1986b). Effluent concentrations fell below acute criteria for all metals except silver. The causes of the high concentration of copper in the field transfer blank and zinc in the city water sample are unclear.

Results of the Microtox (*Photobacterium phosphoreum*) and echinoderm (purple sea urchin, *Strongylocentrotus purpuratus*) bioassays are presented in Table 7. Microtox results indicated no toxicity in the saltwater influent or plant effluent samples. The city water sample had an EC_{50} (concentration at which 50 percent of the test organisms are affected) of approximately 30 percent. The analyst suggested chlorine residual as a possible cause. Microtox is known to be sensitive to chlorine at concentrations below those normally measured by conventional methods (Stinson, 1988).

The echinoderm tests indicate influent saltwater toxicity is below measurable levels. An EC_{50} of 19.9 percent was calculated for the effluent sample, but the 95 percent confidence limits of the test ranged from 5.1 to 347 percent. The high level of uncertainty suggests the test is inconclusive. The city water was not tested for toxicity to echinoderms because of difficulties associated with preparing a fresh water sample to run tests on saltwater organisms.

<u>Priority Pollutant/Bioassay Results - Sediment</u>

Three sediment samples were collected; one from mid-channel of the Hylebos waterway off the Pennwalt dock, and one each near the east and west ends of the Pennwalt outfall diffuser (Figure 1). The diffuser samples were collected approximately 15 feet north of the Pennwalt dock. Priority pollutants found are summarized in Table 8. Parameters analyzed and detection limits are included in the Appendix.

Numerous priority pollutants were found in the three samples. The BNA and Pesticide/PCB compounds found in the sediment were not detected in the discharge, although concentrations were generally higher in the samples collected closer to the outfall. Table 8 includes a comparison of the inspection data and the proposed Apparent Effects Threshold (AET) sediment standards (Ecology, 1988). All three samples contained compounds in excess of the proposed standards. Thus, all three would be designated as failing to meet sediment standards.

An amphipod bioassay (*Rhepoxynius abronius*) was run on the three inspection sediments and a control sediment (Table 9). The control sediment was collected along with the test amphipods. Mortalities in the inspection sediment samples were not significantly different statistically from each other, but all three samples showed statistically significant mortality

Table 7 - Water Bioassay Results - Pennwalt, April 1988.

Echinoderm (purple sea urchin, *Strongylocentrotus purpuratus*)

Sample	Sample #	EC_{50} (%)*	95% Confidence Limits (%)
Saltwater Influent	157918	> 100	--
Plant Effluent	157919	19.9	5.1 - 346.8
City Influent	157920		salinity too low to run test

Microtox (*Photobacterium phosphoreum*)

		EC_{50} (%)*		
Sample	Sample #	5 minutes	10 minutes	15 minutes
Saltwater Influent	157918	low toxicity - EC_{50} cannot be calculated		
Plant Effluent	157919	low toxicity - EC_{50} cannot be calculated		
City Influent	157920	31.6	28.8	27.1

*EC_{50} is the concentration at which 50% of the organisms tested are affected. EC_{50} analysis for the echinoderm was done with software provided by EPA, Biological Methods Branch, Cincinnati, OH. EC_{50} analysis for Microtox was done with "Microtox Calculation Program for the IBM-PC" my Microbics.

Table 8 - Compounds/Elements found in VOA, BNA, Pest/PCB and metal priority pollutant scans in sediments - Pennwalt, April 1988.

	Mid-Channel	East End of Outfall	West End of Outfall	Method Blank	Proposed Options for No Observable Effect Concentration** New LAET	ACR NOEC	
Water depth (ft)	32	30	31				
Latitude (degree-min-sec)	47-16-13	47-16-09	47-16-11				
Longitude(degree-min-sec)	122-22-21	122-22-22	122-22-25				
% solids	37.4	44.5	41.6				
TOC (% dry)	3.6	5.7	4.4				
Grain Size % solids	39.6	45.5	42.9				
Gravel (>2mm)	12.0	12.0	0.5				
Sand (2mm - 62um)	29.2	37.2	0.5				
Silt (62um - 4um)	43.9	34.9	72.7				
Clay (<4um)	11.8	11.7	23.9				
<u>VOA Compounds (ug/Kg - dry wt.)</u>							
Methylene Chloride	5 B	6 B	4 U	1 U			
Acetone	130	170	93	5 U			
2-Butanone	12 U	29	12 U	3 U			
Trichloroethene	4 U	4	4 U	1 U			
Tetrachloroethene	4 U	4 U	4	1 U	57	14	
<u>BNA Compounds (ug/Kg - dry wt.)</u>							
Hexachloroethane	350 U	1100	320 U	67 U			
1,2,4-Trichlorobenzene	170 U	200 *+	160 U	33 U	31	6.4	
Hexachlorobutadiene	170 U	160 *+	160 U	33 U	11	11	
Acenaphthene	170 U	250 +	160 U	33 U	500	200	
Dibenzofuran	170 U	160	160 U	33 U	540	170	
Fluorene	170	230	260	33 U	540	360	
Hexachlorobenzene	350 U	510 *+	320 U	67 U	22	22	
Phenanthrene	920 +	1400 +	2700 *+	33 U	1500	690	
Anthracene	430	510	430	33 U	960	1300	
Fluoranthene	1200	4300 *+	5800 *+	33 U	2500	4170	
Pyrene	2000 +	4500 *+	6000 *+	33 U	2600	1600	
Benzo(a)Anthracene	970 +	3400 *+	2600 *+	33 U	1300	510	
Bis(2-Ethylhexyl)phthalate	2200 *+	1300 *+	1500 *+	33	1300	190	
Chrysene	2200 *+	4800 *+	3800 *+	33 U	1400	920	
Benzo(b)Fluoranthene	3400 }*+	7100 }*+	5800 }*+	67 U	} 3200	990	} sum of the two
Benzo(k)Fluoranthene	3400 }	7100 }	5800 }	67 U	}		} Benzo Fluoranthenes
Benzo(a)Pyrene	970 +	2400 *+	1700 *+	67 U	1600	360	
Indeno(1,2,3-cd)Pyrene	450 +	1000 *+	710 *+	67 U	600	180	
Benzo(g,h,i)Perylene	500 +	750 *+	690 *+	67 U	670	260	

Table 8 - Continued

	Mid-Channel	East End of Outfall	West End of Outfall	Method Blank	Proposed Options for No Observable Effect Concentration** New LAET	ACR NOEC	
Pest/PCB Compound (ug/Kg - dry wt.)							
4,4'-DDE	16.0 U	76 *+	16.0 U	16.0 U	59	33 }	total DDT
Methoxychlor	80.0 U	165	80.0 U	80.0 U			
Aroclor-1248	80.0 U}	500 }	730 }	80.0 U	}	}	
Aroclor-1254	590 }*+	4600 }*+	1800 }*+	160.0 U	} 130	310 }	sum of all PCB's
Aroclor-1260	160.0 U}	1500 }	1000 }	160.0 U	}	}	
Priority pollutant metals (mg/Kg dry wt)							
Antimony	0.1 U	0.2	0.3		150	20	
Arsenic	120 *+	145 *+	127 *+		57	57	
Beryllium	0.5	0.5	0.5				
Cadmium	0.8	1.3 +	1.2 +		5.1	0.96	
Chromium	28.1 +	35.8 +	41.4 +		260	27	
Copper	224 +	381 +	223 +		390	130	
Lead	142 +	231 +	138 +		450	66	
Mercury	0.78 *+	0.85 *+	0.70 *+		0.41	0.21	
Nickel	44.1 +	51.3 +	46.4 +		140	14	
Selenium	1.1	0.5	0.1 U				
Silver	0.85 +	0.62 +	0.22		5.9	0.59	
Zinc	233 +	261 +	282 +		410	160	

U indicates compound was analyzed for but not detected at the given detection limit

J indicates an estimated value when result is less than specified detection limit

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination

M indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters

** - The New LAET are the New Lowest Apparent Effects Threshold values. The ACR NOEC are the Acute to Chronic Ratio - No Observable Effects Concentration (Ecology, 1988).

* - sample concentration exceeds New LAET concentration

+ - sample concentration exceeds ACR NOEC

Table 9 - Sediment Bioassay Results - Pennwalt, April 1988.

Amphipod (*Rhepoxynius abronius*)

Sample	Sample #	Mean % survival @ 10 days	Coefficient of Variation (%)
Control**		99.0	3.5
Mid-channel	157905	86.0*	2.9
East End of Outfall	157906	81.0*	18.6
West End of Outfall	157907	89.0*	10.6

* mean significantly less than control mean @ alpha = 0.05. Analysis done with software provided by EPA, Biological Testing Branch,Cincinnati, OH.

** control sample was sand collected at West Beach along with the amphipods when compared to the control sediment. All three inspection sediments had less than 25 percent mortality, indicating a passed bioassay based on interpretation of the proposed standards (Ecology, 1988). Two other bioassays specified in the draft standards would have to be passed before the failing designation based on chemicals exceeding AETs could be waived.

RECOMMENDATIONS AND CONCLUSIONS

The Pennwalt plant appeared to be operating in compliance with NPDES permit limits during the inspection. Priority pollutant scans found only small amounts of several chemicals in the liquid stream. No significant effects on the echinoderm or microtox bioassays were found as a result of Pennwalt activities. Sediment priority pollutant scans found several chemicals in concentrations above the proposed sediment standards in the two samples collected near the outfall diffuser and the sample collected from mid-channel of the Hylebos waterway (Ecology, 1988). The amphipod bioassay tests on the sediments resulted in survival greater than 75 percent, indicating a passed test.

Specific recommendations include:

1. Pennwalt continuous effluent pH and temperature measurements did not agree with Ecology instantaneous measurements. A more disciplined system of meter calibration and maintenance is needed. Daily checks of the recording meter's accuracy by the lab crew as they make daily grab measurements is recommended. The lab can notify maintenance people of needed adjustments.

2. The neutralization tank collection system sensors are not tied into a central monitoring station. Thus, alerting individuals to change valves for spill control is delayed. A centralized monitoring station is recommended.

3. Metals concentrations were near the detection limits of the analytical methods used, resulting in increased variability of results. The NPDES permit requires measurement of metals within ten times of the detection limit; thus, permit compliance or violation due to method variability becomes a real concern. Alternative techniques with lower detection limits and thus better precision at concentrations of interest are recommended for permit limit measurements. A lower detection limit for routine chlorine residual measurements is also recommended.

4. Pennwalt composite samples were not cooled during collection. Cooling samples as they are collected is recommended.

5. Installation of an accurate effluent flow measurement system is recommended.

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APPENDIX

Appendix - Results of VOA, BNA, Pest/PCB and metal priority pollutant scans of water samples - Pennwalt, April 1988.

Station	Field Blank	Saltwater Influent #1	Saltwater Influent #2	Plant Effluent #1	Plant Effluent #2	City Influent #1	City Influent #2	Methods Blank
Lab Log #	157508	157509	157512	157510	157513	157511	157514	
Contract #	1	5	8	6	9	7	10	
VOA Compounds (ug/L)								
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methylene Chloride	2 B	1 B	1 B	1 B	1 B	1 B	1 B	1 U
Acetone	32 B	15 B	20 B	11 B	16 B	20 B	19 B	8
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1	1	8	6	19	20	1 U
2-Butanone	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Acetate	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	13	2	1 U	1 U	1 U
4-Methyl-2-Pentanone	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Hexanone	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,2,2-Tetrachloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Appendix. Continued

Station	Field Blank	Ecology Saltwater Influent Composite	Ecology Plant Effluent Composite	Ecology City Influent Composite	Method Blank
Lab Log #	157508	157518	157519	157520	
Contract #	1	2	3	4	
BNA Compounds (ug/L)					
Phenol	2 U	2 U	2 U	2 U	2 U
Aniline	10 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethyl)Ether	2 U	2 U	2 U	2 U	2 U
2-Chlorophenol	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U
1,4-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U
Benzyl Alcohol	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U	2 U	2 U
2-Methylphenol	2 U	2 U	2 U	2 U	2 U
Bis(2-chloroisopropyl)ether	2 U	2 U	2 U	2 U	2 U
4-Methylphenol	2 U	2 U	2 U	2 U	2 U
N-Nitroso-Di-n-Propylamine	2 U	2 U	2 U	2 U	2 U
Hexachloroethane	4 U	4 U	4 U	4 U	4 U
Nitrobenzene	2 U	2 U	2 U	2 U	2 U
Isophorone	2 U	2 U	2 U	2 U	2 U
2-Nitrophenol	4 U	4 U	4 U	4 U	4 U
2,4-Dimethylphenol	2 U	2 U	2 U	2 U	2 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)Methane	2 U	2 U	2 U	2 U	2 U
2,4-Dichlorophenol	4 U	4 U	4 U	4 U	4 U
1,2,4-Trichlorobenzene	2 U	2 U	2 U	2 U	2 U
Naphthalene	4 U	4 U	4 U	4 U	4 U
4-Chloroaniline	2 U	2 U	2 U	2 U	2 U
Hexachlorobutadiene	2 U	2 U	2 U	2 U	2 U
4-Chloro-3-Methylphenol	4 U	4 U	4 U	4 U	4 U
2-Methylnaphthalene	2 U	2 U	2 U	2 U	2 U
Hexachlorocyclopentadiene	4 U	4 U	4 U	4 U	4 U
2,4,6-Trichlorophenol	4 U	4 U	4 U	4 U	4 U
2,4,5-Trichlorophenol	4 U	4 U	4 U	4 U	4 U
2-Chloronaphthalene	2 U	2 U	2 U	2 U	2 U
2-Nitroaniline	4 U	4 U	4 U	4 U	4 U
Dimethyl Phthalate	2 U	2 U	2 U	2 U	2 U
Acenaphthylene	2 U	2 U	2 U	2 U	2 U
3-Nitroaniline	10 U	10 U	10 U	10 U	10 U
Acenaphthene	2 U	2 U	2 U	2 U	2 U
2,4-Dinitrophenol	20 U	20 U	20 U	20 U	20 U
4-Nitrophenol	20 U	20 U	20 U	20 U	20 U
Dibenzofuran	2 U	2 U	2 U	2 U	2 U
2,4-Dinitrotoluene	4 U	4 U	4 U	4 U	4 U
2,6-Dinitrotoluene	4 U	4 U	4 U	4 U	4 U
Diethyl Phthalate	2 U	2 U	2 U	2 U	2 U
4-Chlorophenyl-Phenylether	2 U	2 U	2 U	2 U	2 U
Fluorene	2 U	2 U	2 U	2 U	2 U
4-Nitroaniline	4 U	4 U	4 U	4 U	4 U
4,6-Dinitro-2-Methylphenol	20 U	20 U	20 U	20 U	20 U
N-Nitrosodiphenylamine	2 U	2 U	2 U	2 U	2 U
1,2-Diphenylhydrazine	4 U	4 U	4 U	4 U	4 U
4-Bromophenyl-Phenylether	4 U	4 U	4 U	4 U	4 U
Hexachlorobenzene	2 U	2 U	2 U	2 U	2 U
Pentachlorophenol	20 U	20 U	20 U	20 U	20 U
Phenanthrene	2 U	2 U	2 U	2 U	2 U
Anthracene	2 U	2 U	2 U	2 U	2 U
Di-n-Butyl Phthalate	2 U	2 U	2 U	2 U	2 U
Fluoranthene	2 U	2 U	2 U	2 U	2 U
Pyrene	2 U	2 U	2 U	2 U	2 U
Benzidine	50 U	50 U	50 U	50 U	50 U
Butylbenxylphthalate	2 U	2 U	2 U	2 U	2 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)Anthracene	2 U	2 U	2 U	2 U	2 U
Chrysene	2 U	2 U	2 U	2 U	2 U
Bis(2-Ethylhexyl)phthalate	2 U	2 U	2 U	2 U	2 U
Di-n-Octyl Phthalate	2 U	2 U	2 U	2 U	2 U
Benzo(b)Fluoranthene	4 U	4 U	4 U	4 U	4 U
Benzo(k)Fluoranthene	4 U	4 U	4 U	4 U	4 U
Benzo(a)Pyrene	4 U	4 U	4 U	4 U	4 U
Indeno(1,2,3-cd)Pyrene	4 U	4 U	4 U	4 U	4 U
Dibenzo(a,h)Anthracene	4 U	4 U	4 U	4 U	4 U
Benzo(g,h,i)Perylene	4 U	4 U	4 U	4 U	4 U

Station Lab Log # Contract #	Field Blank 157508 1	Ecology Saltwater Influent Composite 157518 2	Ecology Plant Effluent Composite 157519 3	Ecology City Influent Composite 157520 4	Method Blank
Pest/PCB Compounds (ug/L)					
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor Epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan II	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDD	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan Sulfate	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Methoxychlor	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Endrin Ketone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
alpha-Chlordane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
gamma-Chlordane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Aroclor-1016	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1221	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1232	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1242	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1248	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1254	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Aroclor-1260	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Endrin Aldehyde	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Priority pollutant metals (ug/L)					
Antimony	1 U	1 U	1 U	1 U	
Arsenic	1 U	9	20	1 U	
Beryllium	1 U	3.4	2.1	1 U	
Cadmium	5 U	5 U	5 U	5 U	
Chromium	10 U	10 U	10 U	10 U	
Copper	137	3 U	3 U	3 U	
Lead	8	10	5 U	5 U	
Mercury	0.05 U	0.05 U	0.05 U	0.05 U	
Nickel	10 U	657	571	14	
Selenium	8	23	19	1 U	
Silver	0.2 U	34.7	10.9	0.2 U	
Thallium	1 U	8	9	1 U	
Zinc	23	3 U	5	311	

U indicates compound was analyzed for but not detected at the given detection limit

J indicates an estimated value when result is less than specified detection limit

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination

M indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters

Appendix - Results of VOA, BNA, Pest/PCB and metal priority pollutant scan in sediments - Pennwalt, April 1988.

Station	Mid-Channel	East End of Outfall	West End of Outfall	Method Blank
Lab Log #	157905	157906	157907	
Contract #	1	2	3	
Water depth (ft)	32	30	31	
Latitude (degree-min-sec)	47-16-13	47-16-09	47-16-11	
Longitude (degree-min-sec)	122-22-21	122-22-22	122-22-25	
% solids	37.4	44.5	41.6	
TOC (% dry)	3.6	5.7	4.4	
Grain Size % solids	39.6	45.5	42.9	
Gravel (>2mm)	12.0	12.0	0.5	
Sand (2mm - 62um)	29.2	37.2	0.5	
Silt (62um - 4um)	43.9	34.9	72.7	
Clay (<4um)	11.8	11.7	23.9	
<u>VOA Compounds (ug/Kg dry wt)</u>				
Chloromethane	4 U	4 U	4 U	1 U
Bromomethane	4 U	4 U	4 U	1 U
Vinyl Chloride	4 U	4 U	4 U	1 U
Chloroethane	12 U	12 U	12 U	3 U
Methylene Chloride	5 B	6 B	4 U	1 U
Acetone	130	170	93	5 U
Carbon Disulfide	4 U	4 U	4 U	1 U
1,1-Dichloroethene	4 U	4 U	4 U	1 U
1,1-Dichloroethane	4 U	4 U	4 U	1 U
1,2-Dichloroethene (total)	4 U	4 U	4 U	1 U
Chloroform	4 U	4 U	4 U	1 U
2-Butanone	12 U	29	12 U	3 U
1,2-Dichloroethane	4 U	4 U	4 U	1 U
1,1,1-Trichloroethane	4 U	4 U	4 U	1 U
Carbon Tetrachloride	4 U	4 U	4 U	1 U
Vinyl Acetate	4 U	4 U	4 U	1 U
Bromodichloromethane	4 U	4 U	4 U	1 U
1,2-Dichloropropane	4 U	4 U	4 U	1 U
Trichloroethene	4 U	4	4 U	1 U
Benzene	4 U	4 U	4 U	1 U
Dibromochloromethane	12 U	12 U	12 U	3 U
1,1,2-Trichloroethane	4 U	4 U	4 U	1 U
Bromoform	4 U	4 U	4 U	1 U
4-Methyl-2-Pentanone	12 U	12 U	12 U	3 U
2-Hexanone	12 U	12 U	12 U	3 U
1,1,2,2-Tetrachloroethane	12 U	12 U	12 U	3 U
Tetrachloroethene	4 U	4 U	4	1 U
Toluene	4 U	4 U	4 U	1 U
Chlorobenzene	12 U	12 U	12 U	3 U
trans-1,3-Dichloropropene	12 U	12 U	12 U	3 U
Ethylbenzene	4 U	4 U	4 U	1 U
cis-1,3-Dichloropropene	12 U	12 U	12 U	3 U
Styrene	4 U	4 U	4 U	1 U
Total Xylenes	4 U	4 U	4 U	1 U

Appendix - Continued

Station	Mid-Channel	East End of Outfall	West End of Outfall	Method Blank
Lab Log #	157905	157906	157907	
Contract #	1	2	3	
<u>BNA Compounds (ug/Kg dry wt)</u>				
Phenol	170 U	150 U	160 U	33 U
Aniline	870 U	730 U	800 U	170 U
Bis(2-Chloroethyl)Ether	170 U	150 U	160 U	33 U
2-Chlorophenol	170 U	150 U	160 U	33 U
1,3-Dichlorobenzene	170 U	150 U	160 U	33 U
1,4-Dichlorobenzene	170 U	150 U	160 U	33 U
Benzyl Alcohol	170 U	150 U	160 U	33 U
1,2-Dichlorobenzene	170 U	150 U	160 U	33 U
2-Methylphenol	170 U	150 U	160 U	33 U
Bis(2-chloroisopropyl)ether	170 U	150 U	160 U	33 U
4-Methylphenol	170 U	150 U	160 U	33 U
N-Nitroso-Di-n-Propylamine	170 U	150 U	160 U	33 U
Hexachloroethane	350 U	1100	320 U	67 U
Nitrobenzene	170 U	150 U	160 U	33 U
Isophorone	170 U	150 U	160 U	33 U
2-Nitrophenol	350 U	290 U	320 U	67 U
2,4-Dimethylphenol	170 U	150 U	160 U	33 U
Benzoic Acid	4300 U	3700 U	4000 U	830 U
bis(2-Chloroethoxy)Methane	170 U	150 U	160 U	33 U
2,4-Dichlorophenol	350 U	290 U	320 U	67 U
1,2,4-Trichlorobenzene	170 U	200	160 U	33 U
Naphthalene	350 U	290 U	320 U	67 U
4-Chloroaniline	170 U	150 U	160 U	33 U
Hexachlorobutadiene	170 U	160	160 U	33 U
4-Chloro-3-Methylphenol	350 U	290 U	320 U	67 U
2-Methylnaphthalene	170 U	150 U	160 U	33 U
Hexachlorocyclopentadiene	350 U	290 U	320 U	67 U
2,4,6-Trichlorophenol	350 U	290 U	320 U	67 U
2,4,5-Trichlorophenol	350 U	290 U	320 U	67 U
2-Chloronaphthalene	170 U	150 U	160 U	33 U
2-Nitroaniline	350 U	290 U	320 U	67 U
Dimethyl Phthalate	170 U	150 U	160 U	33 U
Acenaphthylene	170 U	150 U	160 U	33 U
3-Nitroaniline	870 U	730 U	800 U	170 U
Acenaphthene	170 U	250	160 U	33 U
2,4-Dinitrophenol	1700 U	1500 U	1600 U	330 U
4-Nitrophenol	1700 U	1500 U	1600 U	330 U
Dibenzofuran	170 U	160	160 U	33 U
2,4-Dinitrotoluene	350 U	290 U	320 U	67 U
2,6-Dinitrotoluene	350 U	290 U	320 U	67 U
Diethyl Phthalate	170 U	150 U	160 U	33 U
4-Chlorophenyl-Phenylether	170 U	150 U	160 U	33 U
Fluorene	170	230	260	33 U
4-Nitroaniline	350 U	290 U	320 U	67 U
4,6-Dinitro-2-Methylphenol	1700 U	1500 U	1600 U	330 U
N-Nitrosodiphenylamine	170 U	150 U	160 U	33 U
1,2-Diphenylhydrazine	350 U	290 U	320 U	67 U
4-Bromophenyl-Phenylether	350 U	290 U	320 U	67 U

Appendix - Continued

Station Lab Log # Contract #	Mid-Channel 157905 1	East End of Outfall 157906 2	West End of Outfall 157907 3	Method Blank
Hexachlorobenzene	350 U	510	320 U	67 U
Pentachlorophenol	1700 U	1500 U	1600 U	330 U
Phenanthrene	920	1400	2700	33 U
Anthracene	430	510	430	33 U
Di-n-Butyl Phthalate	170 U	150 U	160 U	33 U
Fluoranthene	1200	4300	5800	33 U
Pyrene	2000	4500	6000	33 U
Benzidine	4300 U	3700 U	4000 U	830 U
Butylbenxylphthalate	170 U	150 U	160 U	33 U
3,3'-Dichlorobenzidine	1700 U	1500 U	1600 U	330 U
Benzo(a)Anthracene	970	3400	2600	33 U
Chrysene	2200	4800	3800	33 U
Bis(2-Ethylhexyl)phthalate	2200	1300	1500	33
Di-n-Octyl Phthalate	170 U	150 U	160 U	33 U
Benzo(b)Fluoranthene	3400	7100	5800	67 U
Benzo(k)Fluoranthene	3400	7100	5800	67 U
Benzo(a)Pyrene	970	2400	1700	67 U
Indeno(1,2,3-cd)Pyrene	450	1000	710	67 U
Dibenzo(a,h)Anthracene	350 U	290 U	320 U	67 U
Benzo(g,h,i)Perylene	500	750	690	67 U
Pest/PCB Compound (ug/Kg dry wt)				
alpha-BHC	8.0 U	8.0 U	8.0 U	8.0 U
beta-BHC	8.0 U	8.0 U	8.0 U	8.0 U
delta-BHC	8.0 U	8.0 U	8.0 U	8.0 U
gamma-BHC (Lindane)	8.0 U	8.0 U	8.0 U	8.0 U
Heptachlor	8.0 U	8.0 U	8.0 U	8.0 U
Aldrin	8.0 U	8.0 U	8.0 U	8.0 U
Heptachlor Epoxide	8.0 U	8.0 U	8.0 U	8.0 U
Endosulfan I	8.0 U	8.0 U	8.0 U	8.0 U
Dieldrin	16.0 U	16.0 U	16.0 U	16.0 U
4,4'-DDE	16.0 U	76	16.0 U	16.0 U
Endrin	16.0 U	16.0 U	16.0 U	16.0 U
Endosulfan II	16.0 U	16.0 U	16.0 U	16.0 U
4,4'-DDD	16.0 U	16.0 U	16.0 U	16.0 U
Endosulfan Sulfate	16.0 U	16.0 U	16.0 U	16.0 U
4,4'-DDT	16.0 U	16.0 U	16.0 U	16.0 U
Methoxychlor	80.0 U	165	80.0 U	80.0 U
Endrin Ketone	16.0 U	16.0 U	16.0 U	16.0 U
alpha-Chlordane	80.0 U	80.0 U	80.0 U	80.0 U
gamma-Chlordane	80.0 U	80.0 U	80.0 U	80.0 U
Toxaphene	160.0 U	160.0 U	160.0 U	160.0 U
Aroclor-1016	80.0 U	80.0 U	80.0 U	80.0 U
Aroclor-1221	80.0 U	80.0 U	80.0 U	80.0 U
Aroclor-1232	80.0 U	80.0 U	80.0 U	80.0 U
Aroclor-1242	80.0 U	80.0 U	80.0 U	80.0 U
Aroclor-1248	80.0 U	500	730	80.0 U
Aroclor-1254	590	4600	1800	160.0 U
Aroclor-1260	160.0 U	1500	1000	160.0 U
Endrin Aldehyde	16.0 U	16.0 U	16.0 U	16.0 U

Appendix - Continued

Station	Mid-Channel	East End of Outfall	West End of Outfall	Method Blank
Lab Log #	157905	157906	157907	
Contract #	1	2	3	
<u>Priority pollutant metals (mg/Kg dry wt)</u>				
Antimony	0.1 U	0.2	0.3	
Arsenic	120	145	127	
Beryllium	0.5	0.5	0.5	
Cadmium	0.8	1.3	1.2	
Chromium	28.1	35.8	41.4	
Copper	224	381	223	
Lead	142	231	138	
Mercury	0.78	0.85	0.70	
Nickel	44.1	51.3	46.4	
Selenium	1.1	0.5	0.1 U	
Silver	0.85	0.62	0.22	
Thallium	0.1 U	0.1 U	0.1 U	
Zinc	233	261	282	

U indicates compound was analyzed for but not detected at the given detection limit

J indicates an estimated value when result is less than specified detection limit

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination

M indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters