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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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MEMORANDUM
October 22, 1981

To: Fred Fenske

From: Bill Yake

Subject: U.S. Oil and Refining Co., Class II Inspection of May 5 and 6, 1981

INTRODUCTION

On May 5 and 6, 1981 a combination source/receiving environment monitoring survey was conducted at U.S. Oil and Refining Co., Tacoma. This study was one of a series of specific source-oriented surveys conducted cooperatively by the Washington State Department of Ecology (WDOE) and Region X, U.S. Environmental Protection Agency (USEPA). The focus of these surveys is to identify and quantify priority pollutants in wastewaters from specific sources, as well as in adjacent surface waters and sediments in and near Commencement Bay.

Participants in the source survey included Fred Fenske and Roger Stanley (WDOE Industrial Section), Dan Tangerone (USEPA, Region X), and Bill Yake (WDOE, Water Quality Investigations Section). U.S. Oil was represented by Bill Dabrock, John Meland, and Bob Carrell. The receiving water study was conducted by John Bernhardt, Art Johnson, and Shirley Prescott (WDOE, Water Quality Investigations Section) and will be reported in a separte report.

Setting

The U.S. Oil facility is located in the Tacoma industrial area between the Blair Waterway and the Puyallup River. The study area is shown in Figure 1. Treated wastewaters at U.S. Oil are of two general types: process wastewaters and general drainage from the plant site. Storm drainage, drainage from the bermed areas around oil storage tanks, and tank roof drainage is routed to an unlined pond and then to two of three lined storage ponds (Figure 1). This drainage is then bled into the treatment system with process wastewaters. The treatment train consists of an API oil/water separator followed by a corrugated plate oil/water separator. A polyelectrolyte flocculating agent is then added and wastewater passed through an induced air flotation unit. The oil separated from the waste stream in the latter two processes is returned

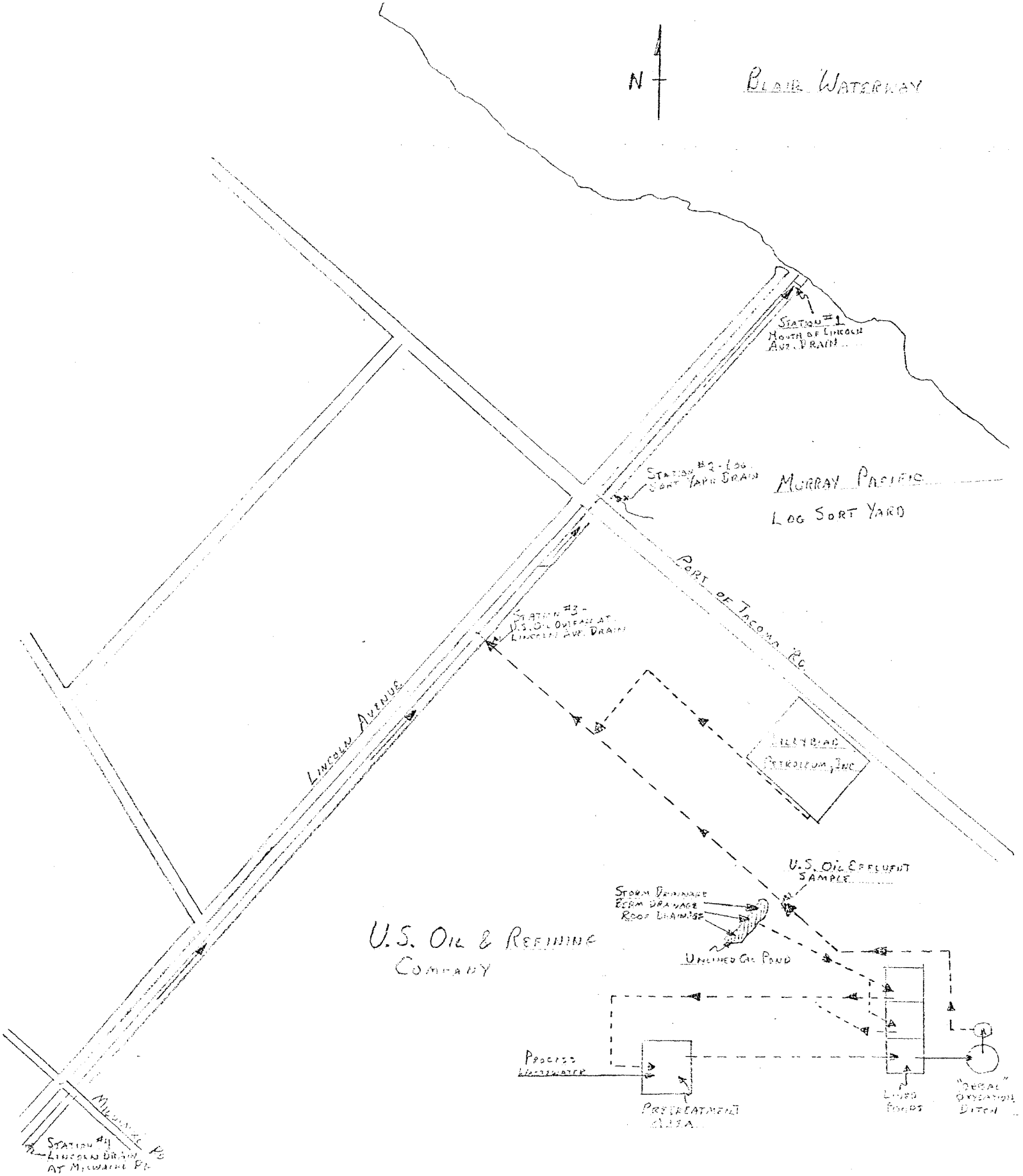

Figure 1 - Study Area

to the API separator while the oil removed from the API separator is returned to the plant for recycling. Wastewater is then passed through two in-line rotating biological contacters (RBCs), then to the third (south) lined pond, and finally to an oxidation ditch with secondary clarification and aerobic digestion. Treated wastewater is routed to a Parshall flume and discharged to a sewer line running along U.S. Oil's northeast property line to the Lincoln Avenue drain.

Although we were initially unaware of it at the time of the inspection, this sewer has at least one and probably several additional sources connected to it between U.S. Oil's discharge and the Lincoln Avenue drain. A discharge from Lillyblad Petroleum, Inc. to this sewer (Figure 1) has been confirmed by WDOE personnel (Southwest Region Office) who dye-tested the line subsequent to a spill at Lillyblad on September 20, 1981. Additional discharges to the sewer are surmised by the observation (Anderson, personal communication) that even with the U.S. Oil and Lillyblad discharges shut off, the sewer was discharging a substantial flow to the Lincoln Avenue drain.

SAMPLING DESIGN

Effluent wastewater samples were collected at two locations: immediately above the effluent Parshall flume and at the point where the sewer line discharges to the Lincoln Avenue drain. Flows were also obtained at both locations, with the flow at the Parshall flume being about 40 percent of the flow at the sewer outfall. This discrepancy, as well as subsequent information on other connections to the sewer, means that the sewer discharge sample may be contaminated by sources other than U.S. Oil. Details regarding location, timing, and type of samples are included in Table 1. Briefly, analyses for most conventional pollutants and metals were obtained from samples collected using Manning composite samplers (24-hour composite samples at U.S. Oil effluent, 4-hour composite at sewer discharge). Analyses for the organic priority pollutants were conducted on grab composite samples. Grab samples were used for certain conventional pollutants analyses (oil and grease, fecal coliforms, etc.), while temperature, dissolved oxygen, pH, sulfides, and hexavalent chromium were determined in the field.

Analyses were performed at two laboratories (see Table 2).

Table 2. Laboratories Providing Analytical Services.

Constituents	Responsible Agency	Laboratory
Oils and grease, phenols, COD, BOD, pH, conductivity, solids, nutrients, metals, salinity, turbidity	WDOE	WDOE Tumwater (except for mercury, Redmond)
Organic priority pollutants, other organic constituents	USEPA	California Analytical Laboratories, Inc.

Table I. Grab and Composite samples - times and location.

Sample	Date (Time) Installed	Location
U.S. Oil Effluent 250 ml/30 min.	5/5/81 (1025) - 24-hr Comp.	Immed. upstream of effluent Parshall flume
Discharge to Lincoln Avenue Ditch	5/5/81 (1215) - 4-hr Comp.	Between discharge pipe and Lincoln Ave. ditch at U.S. Oil property boundary

Field Analysis - Time and Location

Location	Date (Time)	Analyses
U.S. Oil Effluent	5/5/81 (1030)	pH, Spec. Cond., Temp., D.O.
U.S. Oil Effluent	5/6/81 (1030)	pH, Spec. Cond., Temp., D.O.
U.S. Oil Effluent	5/5/81 (1040)	Total Sulfides, Hexavalent Chromium
Discharge to Lincoln Ave. Ditch	5/5/81 (1215)	pH, Spec. Cond., Temp., D.O.

Grab Samples - Time and Location

Location	Date (Time)	Analysis
U.S. Oil Effluent	5/6/81 (1010)	Fecal Coliform
U.S. Oil Effluent	5/6/81 (1030)	Oil and Grease
U.S. Oil Effluent	5/5/81 (1500)	Grease and Oils, Phenols

Priority Pollutant Grab Composite

Location	Date Time) - Amount	Analyses
U.S. Oil Effluent	5/5/81 (1020)-.125 gal. (1330)-.125 gal. 5/5/81 (1120)-.125 gal. (1500)-.250 gal. 5/5/81 (1145)-.125 gal. (1600)-.250 gal.	Volatile Organics, Pesticides, Acid Extractables, Base/ Neutral Extractables
Discharge to Lincoln Avenue Ditch	Equal volumes every 15 min. from 5/5/81 (1215 to 1545)	As above

The flow at the Parshall flume was checked to determine the accuracy of U.S. Oil's flow meter and totalizer. The results are given below in Table 3.

Table 3. Flow Meter Calibration.

Time	Actual Flow		Script Chart Flow		Totalizer Flow	
	MGD	GPM	MGD	GPM	MGD	GPM
1005	.193	(134)	(.225)	156	.222	(154)
1015	.193	(134)	(.225)	156		

Based on these measurements, it appears that both the script chart and the totalizer were recording flows 15 to 16 percent higher than actual flows determined from head measurements in the flume.

RESULTS AND DISCUSSION

The following section discusses observations and results in general areas:

1. Compliance with the NPDES discharge permit.
2. Findings with regard to specific pollutants including organics, metals, and other constituents.
3. U.S. Oil sampling and analysis procedures with respect to fulfilling self-reporting obligations (DMRs).

Compliance with Effluent Limitations

NPDES waste discharge permit No. WA 000178-3, setting conditions for U.S. Oil's discharge of wastewater, expired on September 30, 1980. It was extended by letter pending publication by U.S. EPA of standards for "Best Available Technology" for control and treatment of pollutants.

Table 4 summarizes WDOE field and laboratory results and compares these results with the applicable permit limits. Table 5 reports and compares results obtained by WDOE and U.S. Oil on samples collected during the inspection period. These results also are compared to permit limits.

In general, U.S. Oil's effluent was well with NPDES permit limitations. COD analyses on U.S. Oil effluent samples were not reported because WDOE analyses of the two U.S. Oil effluent samples (WDOE and U.S. Oil composites) yielded substantially different results when analyses were rerun one week after the initial analyses. However, U.S. Oil analysis of their composite samples (Table 5) and WDOE analysis of the sewer discharge to the Lincoln Avenue drain (Table 4) indicate compliance with the COD limit.

Table 4. WDOE field and laboratory results.

	U.S. Oil Effluent	DOE Effluent Samples		DOE Samples at Discharge to Lincoln Ave. Ditch		Permit Limits - Daily Average
	Composite	Composite	Grab	Composite	Grab	
Flow (MGD)	.238	.230	.230	.577	.577	
COD (mg/L)	**	**		65		
(lbs/day)	**	**		310		465
BOD (mg/L)	11	13				
(lbs/day)	23	25				95
Tot. Solids (mg/L)	490	500		280		
TNVS (mg/L)	410	420		220		
TSS (mg/L)	24	24		12		
(lbs/day)	48	46		58		62
TNVSS (mg/L)	6	6		3		
Oil & Grease (mg/L)			7		<1, 3	15
(lbs/day)			13		<5, 14	30
Sulfides (mg/L)			<0.1*			
(lbs/day)			<0.2*			0.52
Phenols (mg/L)	.014	.008	.015, .013		.014, .006	
(lbs/day)	.028	.015	.029, .025		.067, .029	.59
NH_3-N (mg/L)	0.20	0.30		.09		
(lbs/day)	0.40	0.58		0.43		22***
NO_2-N (mg/L)	<.05	<.05		<.01		
NO_3-N (mg/L)	4.4	5.3		2.1		
O-PO_4-P (mg/L)	.05	.05		.08		
T-PO_4-P (mg/L)	.30	.34		.19		
Turbidity (NTU)	31	35		16		
Temperature (°C)			16.8*, 17.8*		17.8*	
Dis. Oxygen (mg/L)			9.3*		8.0*	
Cond. (umhos/cm)	761	791	790*, 850*	408	435, 480*	
Salinity (o/oo)	0.6	0.4		0.3	0.3	
pH (S.U.)	8.2	7.6	7.1*, 6.8*	7.5	7.2, 5.9*	6.0-9.0
As (mg/L)	<.016	<.016		<.016		
Cd (mg/L)	<.002	<.002		<.002		
Cr (mg/L)	.045	.045		.01		
(lbs/day)	.099	.099		<.05		2.7***
Hex. Cr (mg/L)			<0.1*			
(lbs/day)			<0.2			0.054***
Cu (mg/L)	.017	<.01		.005		
Hg (mg/L)	.00023	.00045		<.0002		
Ni (mg/L)	<.01	<.01		<.01		
Pb	<.014	.015		<.014		
Zn (mg/L)	.140	.125		.070		
Fecal Coliform (#/100 ml)	--		<1		4 est.	

*Field data
**Invalid data
***Daily maximum

Table 5. Comparison of laboratory results.

	U.S. Oil Effluent Sample			WDOE Effluent Sample		
	WDOE Analysis	U.S. Oil Analysis		WDOE Analysis		Permit Limits - Daily Average
	Composite	Composite	Grab	Composite	Grab	
Flow	(.238)	.238		.230		
COD (mg/L)	**	84		**		
(lbs/day)	**	166.6		**		465
BOD (mg/L)	11	5.9		13		
(lbs/day)	23	11.7		25		95
TSS (mg/L)	24	31.6		24		
(lbs/day)	48	62.7		46		62
Total Cr (mg/L)	.045	.02		.045		
(lbs/day)	.09	.04		.09		2.7*
Hex. Cr (mg/L)		<.01			<0.1*	
(lbs/day)		<.02			<0.2*	.054*
Sulfides (mg/L)		<0.1			<0.1*	
(lbs/day)		<0.2			<0.2*	0.52
Phenols (mg/L)	.014	.03		.008	.015, .013	
(lbs/day)	.025	.06		.015	.029, .025	0.59
NH_3-N (mg/L)	0.20	<0.1		0.30		
(lbs/day)	0.40	<0.2		0.58		22***
pH (S.U.)	8.2		7.4	7.6	7.1*, 6.8*	6.0-9.0
Oils & Grease (mg/L)			6.8		7	15
(lbs/day)			13.5		13	30

*Field analysis
**Invalid data
***Daily maximum

A field colormetric method was used to determine hexavalent chromium. This method has a detection limit of 0.1 mg/L which was not adequate to determine compliance with the hexavalent chromium permit limit. U.S. Oil's analysis (USEPA 218.4: chelation and extraction, followed by atomic absorption analyses) detected no hexavalent chromium with a detection limit of .01 mg/L. This detection limit is adequate to determine permit compliance. Subsequent discussions with the WDOE laboratory and industrial section personnel have resulted in the recommendation that if, after review of pertinent information (permit, DMRs, etc.), it appears that the colormetric method will not provide an adequate detection limit, analysis using USEPA method 218.4 should be performed by the WDOE laboratory. It should be noted that the aliquot for this analysis would not come from an acidified metals sample bottle as preservation of hexavalent chromium requires only 4°C storage and minimum delay between sample collection and analysis.

All other results showed compliance with permit limits during the inspection period.

Specific Priority Pollutants

Organics - U.S. Oil effluent and sewer discharge to Lincoln Avenue drain samples were analyzed for the 114 organic priority pollutants. Concentrations of detected pollutants are noted in Table 6; loadings are also tabulated for the discharge to the Lincoln Avenue drain. Table 6 also includes the results of U.S. Oil's consolidated permit analyses. In addition to priority pollutants, several additional organic chemicals were reported as tentatively identified in the wastewater samples. Although these tentatively identified chemicals were not quantified, their presence is noted in Table 6.

The U.S. Oil effluent sample was essentially free of organic priority pollutants. However, there were detectable concentrations of approximately a dozen organic priority pollutants in the discharge to the Lincoln Avenue drain. It is clear from both these sets of data and from the flow data that there are other discharges to the sewer line which runs from the U.S. Oil outfall to the Lincoln Avenue Drain.

Of those compounds detected in the sewer discharge, seven (possibly eight) are commonly used as chemical or organic solvents: chloroform; methylene chloride; toluene; napthalene; 1,1-dichloroethane; 1,1,1-trichloroethane; tetrachloroethylene; and possibly 1,2-trans-dichloroethylene. Three of the compounds can be used as insecticides: aldrin; 1,4-dichlorobenzene; and methylene chloride; while two compounds (chloroform and napthalene) can be used in the synthesis of plastics. The source of these contaminants has not been confirmed; however, field work presently being conducted by Southwest Regional WDOE personnel in response to this study and a subsequent spill at Lillyblad, should help in pinpointing the source(s).

Table 6. Comparison of priority pollutant analyses for U.S. Oil effluent and sewer discharge to Lincoln Avenue drain.

Constituent (units - ug/L)	U.S. Oil Effluent		Sewer Discharge to Lincoln Avenue Drain	
	U.S. Oil Consol. Permit App. 11/12/80	Present Study 5/5/81	Present Study 5/5/81	
	Concentration		Concentration	Loading (lbs/day)
Metals (total recoverable)				
As	<10	<16	<16	<.07
Cd	<1	<2	<2	<.01
Cr	10	45	10	.05
Cu	41	10	5	.02
Hg	<10	0.43	<0.2	<.001
Ni	<10	<10	<10	<.05
Pb	<10	15	<14	<.07
Zn	14	125	70	.34
Organics				
Recoverable phenolics as Phenol	22	8,15*,13*	14*,6*	.07,.03
Chloroform	<10	N.D.	3.9	.019
Methylene Chloride	<10	N.D.	310	1.5
1,1-dichloroethane	<10	N.D.	2.0	.010
1,1,1-trichloroethane	<10	N.D.	6.0	.029
1,2-trans-dichloroethylene	<10	N.D.	1.1	.005
Tetrachloroethylene	<10	N.D.	2.2	.011
1,4-dichlorobenzene	<10	N.D.	0.9	.004
Napthalene	<10	N.D.	9.7	.047
Toluene	<10	N.D.	1.1	.005
Aldrin	<10	N.D.	0.4†	.002
-BHC A	<10	N.D.	.1†	<.001
-BHC B	<10	N.D.	N.D.	--
Pentachlorophenol	<25	N.D.	3	.014
Hexadecanoic Acid		P	N.D.	--
2-Ethylhexanoic Acid		N.D.	P	--
1-H Indene		N.D.	P	--

* = Grab Sample
N.D. = None detected
† = Value not confirmed
P = Tentatively identified as present

Table 7. Comparison of selected priority pollutants concentrations in discharge to Lincoln Avenue drain to EPA criteria (ug/L units).

Constituents	Sewer to Lincoln Ave. Drain: Results	WATER QUALITY CRITERIA								Human Health: Food Intake (Fish)*	
		Aquatic Life									
		Freshwater				Saltwater					
		Criteria		Sample/Criteria Ratio		Criteria		Sample/Criteria Ratio			
		Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic	Criteria	Sample/ Criteria Ratio
Pentachlorophenol	3	55	3.2	.05	.94	53	34	.06	.09	1010	3×10^{-8} 1×10^{-7}
Methylene Chloride	310	11,000	Unk.	.03	Unk.	12,000	6,400	.03	.05	15.7	/20/
1,1,1-trichloroethane	6.0	18,000	Unk.	.0003	Unk.	31,200	Unk.	.0002	Unk.	1.30×10^{6t}	6×10^{-6}
Tetrachloroethylene	2.2	5,280	840	.0004	.003	10,200	450	.0002	.005	8.85	.25
1,4-dichlorobenzene	0.9	250	50	.004	.02	160	129	.006	.007	Unk.	Unk.
Napthalene	9.7	2,300	620	.004	.02	2,350	Unk.	.004	Unk.	Unk.	Unk.
Aldrin	0.4**	3.0	Unk.	.13**	Unk.	1.3	Unk.	.31**	Unk.	.079	/5.1**/

* = Based on risk of 1 additional cancer per 10^6 exposures (consumption of seafood from contaminated waters) unless otherwise noted.
** = Value not confirmed
Unk. = Unknown
t = Based on toxicity

/ / = Indicates a ratio of greater than 1

Table 7 compares the priority pollutant concentrations detected in the sewer discharge to Lincoln Avenue drain to USEPA receiving water criteria. The ratio of sample concentration to criteria concentration provides a means of assessing the significance of concentrations detected. If the ratio is greater than 1, it indicates that the discharge concentration exceeds the receiving water criteria.

Table 8 compares the compounds detected in the sewer discharge to Lincoln Avenue drain during this survey with results of two previous USEPA sampling efforts. The June 3, 1980 data reports priority pollutants found at the mouth of the Lincoln Avenue drain. No other Lincoln drain samples were taken during this survey. The September 23, 1980 column identifies priority pollutants which were found at the mouth of Lincoln Avenue drain but were not identified in a sample taken immediately upstream of the discharge.

Table 8. Priority Pollutants in the Vicinity of Sewer Discharge to Lincoln Avenue drain.

Constituent	Present Study Sewer Discharge to Lincoln Ave. Drain May 5, 1981	EPA Study Lincoln Drain near Mouth June 3, 1980	EPA Study Lincoln Drain near Mouth Sept. 23, 1981
Chloroform	X	X	X
Methylene chloride	X	X	
1,1-dichloroethane	X		X
1,2-dichloroethane		X	X
1,1,1-trichloroethane	X	X	X
1,1,2,2-tetrachloroethane			X
1,2-trans-dichloroethylene	X		X
Trichloroethylene		X	X
Tetrachloroethylene	X	X	X
Benzene		X	
Chlorobenzene			X
1,2-dichlorobenzene			X
1,4-dichlorobenzene	X		
Napthalene	X		
Toluene	X	X	X
Pentachlorophenol	X		

There is a clear similarity in the types of compounds detected in each of the surveys, which indicates that the source of many of these compounds may be chronic.

Metals - The analytical results for trace metals indicate that the U.S. Oil effluent had very low metals concentrations. Metals concentrations

in both the effluent and the sewer discharge are within the range of metals concentrations found in Washington State streams and rivers. Metals loadings from U.S. Oil do not appear to be significant.

Other Constituents - Analyses of the samples collected did not indicate any other problems with U.S. Oil's effluent quality.

Sample Collection and Analysis

Sample Collection - The only deficiency noted at the time of the inspection was the lack of composite sample refrigeration.

Laboratory Analysis - Analytical procedures were reviewed by Industrial Section personnel and, therefore, are not included here. Table 5 summarizes the results of WDOE and U.S. Oil laboratory analyses of the U.S. Oil effluent composite sample. In general, agreement was adequate. There were some discrepancies in total chromium and ammonia results. Attention should be focused on these two constituents during future surveys to either avoid or explain these discrepancies.

CONCLUSIONS AND RECOMMENDATIONS

During this survey there was no indication that U.S. Oil's effluent had a significant impact on water quality in inner Commencement Bay. Priority pollutants were detected in the waters being discharged from the sewer to the Lincoln Avenue drain; however, the data strongly indicate that these pollutants were generated by sources other than U.S. Oil's treated effluent.

The treatment facility at U.S. Oil appeared to be operating well and U.S. Oil was meeting all current permit limitations.

BY:cp

Attachments