Water Body WA-10-0020
Segment No. 05-10-01

LILYBLAD CLASS II INSPECTION REPORT
December 29-30, 1988

by
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ABSTRACT

A Class II inspection was conducted at Lilyblad Petroleum, Inc. (Lilyblad) on December 29-30, 1988. Lilyblad is a bulk distributor of petroleum products located in Tacoma. An effluent priority pollutant scan found VOA fraction compounds present in relatively high concentrations. A rainbow trout bioassay resulted in 100 percent mortality in the Lilyblad effluent sample, possibly due to metals toxicity. The discharge was in compliance with NPDES pH limits, but in violation of NPDES oil and grease limits. Additional NPDES permit parameters are recommended.

INTRODUCTION

A Class II inspection was conducted at Lilyblad Petroleum, Inc. (Lilyblad) on December 29-30, 1988. Lilyblad, a bulk distributor of petroleum products, is located in Tacoma. On-site activities include oil recycling, solvent recovery/recycling, and hazardous waste storage/transportation (TSD #WAD027543032). Stormwater discharge from the site is regulated by NPDES Permit No. WA-003867-9. The discharge is into the Blair Waterway via a Port of Tacoma storm sewer and the Lincoln Avenue Ditch (Figure 1). The permit does not allow process wastewater discharge.

Lilyblad treats the stormwater prior to discharge (Figure 1). On-site treatment units include two oil/water separators and a biotower. A third oil/water separator is located off the Lilyblad site, just upstream of the area drain discharge into the Port of Tacoma storm sewer. The storm sewer discharges behind a containment dam designed to help catch spills in the storm sewer drainage area. Flows are not measured.

The inspection was conducted by Carlos Ruiz and Keith Seiders of the Ecology Compliance Monitoring Section. Objectives of the survey included:

1. Assess compliance with effluent permit conditions and address the location of the final effluent sampling station.

2. Characterize the facility effluent.

3. Assess the toxic effect of effluent using biological indicators.

PROCEDURES

Ecology composite and grab samples were collected. Sampling stations, moving downstream, included (Figure 1):

- Influent - the main influent into the first oil/water separator. Three other inlet pipes with little or no flow were observed.

- Effluent - the effluent stream leaving the second stage of the larger on-site oil/water separator. Flow had passed through the biotower and all on-site oil/water separators. This sample represents the flow off the Lilyblad site and is presently designated as the NPDES permit monitoring site.

- Sepa-3 - the discharge from oil/water separator 3 located just upstream of the area drain discharge into the storm sewer. This station is located off the Lilyblad site and may include other flows in addition to the Lilyblad effluent. The station had previously been used as the NPDES permit monitoring site.

- Manhole - the flow in the storm sewer including the Lilyblad discharge along with all discharges upstream of Lilyblad.

- Dam-Eff - The discharge from the containment dam into the Lincoln Avenue Ditch.

Ecology Isco composite samplers were set up to collect effluent and Sepa-3 samples. The compositors collected approximately 300 mLs of sample every 30 minutes for 24 hours. Samples collected, sampling times, and parameters analyzed are included in Table 1.

Field QA/QC techniques included cleaning equipment for priority pollutant sampling prior to the inspection and collection of transfer blank samples on-site (Table 2).

All samples were placed on ice and sent to the Ecology Manchester Laboratory. Analytical techniques and the laboratory performing the analysis are summarized in Table 3.

RESULTS AND DISCUSSION

Tacoma rainfall data, collected from 1600-1600 hours, showed inspection stormwater runoff resulted from rainfall of 0.55 inch on 12/29 and 1.20 inches on 12/30 (NOAA, 1988a). During the previous four days a total of 0.01 inch fell and 1.5 inches fell during the week of December 18-24. Hourly data from the Sea-Tac Airport weather station indicates precipitation occurred between 0800 on 12/29 and 0600 on 12/30 (NOAA, 1988b).

Chemistry Results

Chemical concentrations were generally higher in the 12/29 grab samples than in the 12/30 grab samples for both general chemistry (Table 4) and priority pollutant (Table 5) parameters. The rainfall data suggest that this may be related to the first flush caused by the storm. The priority pollutant data show both the majority of compounds found and the compounds found in the highest concentrations, were from the VOA fraction. Acetone, 2-Butanone, 4-Methyl-2-Pentanone, Methylene Chloride, and Total Xylenes were found in the highest concentrations. Most parameters decreased in concentration going downstream. The exception was the BNA fraction, particularly the PAHs and phthalates, which appeared in slightly higher concentrations in the Sepa-3 composite sample than in the effluent composite sample.

Loadings cannot be calculated because flows were/are not measured. Thus, differentiation between dilution and removal is difficult. Table 6 looks at several parameters to help speculate whether dilution or contaminant removal was occurring. Differences in effluent and Sepa-3 grab sample conductivity and temperature data and composite sample conductivity data suggests additional sources were entering the system. At least, in part, dilution by additional sources rather than contaminant removal appears to be occurring. The higher BNA concentration in the Sepa-3 composite sample than in the effluent composite sample also suggests additional inputs into the area drain between the two stations. Requiring collection of flow data is highly recommended, so treatment efficiency and loads being discharged can be calculated. Until flow data are available to demonstrate there are no additional inputs between the effluent and Sepa-3 stations, the effluent station should be used for NPDES monitoring.

The December 29th influent and effluent grab sample conductivity and temperature data suggests influents other than the main influent sampled may have an effect on the influent stream. A sample representing all influent streams or samples of all the influent streams would be necessary to evaluate the treatment efficiency of the oil/water separator - biotower treatment system.

NPDES Permit Comparison

The Lilyblad NPDES permit regulates only two parameters; oil and grease, and pH (Table7). Inspection effluent grab samples were in violation of the oil and grease limit (not >15 mg/L) and in compliance with the pH limit (not <6.5 or >8.5).

Addition of flow measurement and volatile organics (VOAs) as parameters for NPDES permit monitoring appears appropriate based on inspection observations.

Bioassay Results

Effluent sample bioassay results indicate rainbow trout (*Oncorhynchus mykiss*) was the most sensitive species tested (Table 8). The trout experienced 100 percent mortality in the effluent sample. No significant mortality was observed in the mysid (*Mysidopsis bahia*) test. Microtox exhibited a measurable effect, but the EC50s were relatively high indicating fairly low toxicity.

Effluent total metal copper, lead, and zinc concentrations exceeded acute toxicity total recoverable metal criteria suggesting metals as a possible cause of the observed trout mortality (Table 5). Organisms are more sensitive to metals when hardness concentrations are low, as was the case in the effluent sample (30 mg/L as $CaCO_3$). Although the volatile organic concentrations were fairly high, the toxicity criteria suggest they were far below acutely toxic concentrations. Including hardness and total recoverable copper, lead, and zinc as NPDES permit parameters may be appropriate.

The Dam-Eff sample exhibited very low toxicity to Microtox.

CONCLUSIONS AND RECOMMENDATIONS

The effluent station appeared most appropriate for NPDES permit monitoring. Data suggest that additional inputs may be occurring between the effluent and Sepa-3 stations. Flow monitoring to demonstrate that there are no additional inputs should be required prior to allowing permit sampling at a site other than the effluent station.

The effluent priority pollutant scan found several VOA fraction compounds present in relatively high concentrations. Acetone, 2-Butanone, 4-Methyl-2-Pentanone, Methylene Chloride, and Total Xylenes were present in the highest concentrations.

A rainbow trout bioassay in the Lilyblad effluent resulted in 100 percent mortality. Metals (copper, lead, and/or zinc) are thought to be a possible cause.

The discharge was in compliance with NPDES pH limits, but in violation of NPDES oil and grease limits. Recommended additional NPDES permit parameters include:

- The VOA fraction of the priority pollutant scan.
- Measurement of effluent flow rates so loads can be calculated.
- Copper, lead, zinc, and total hardness.

REFERENCES

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Ecology, 1981. Static Acute Fish Toxicity Test, DOE 80-12, revised July 1981.

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EPA, 1980. Level 1 Biological Testing Assessment and Data Formatting, EPA 600/7-80-79, April 1980.

EPA, 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA/600/4-85/013.

EPA, 1986. Quality Criteria for Water, EPA 440/5-86-001, May 1, 1986.

NOAA, 1988a. Climatological Data - Washington - December 1988, Volume 92, Number 12.

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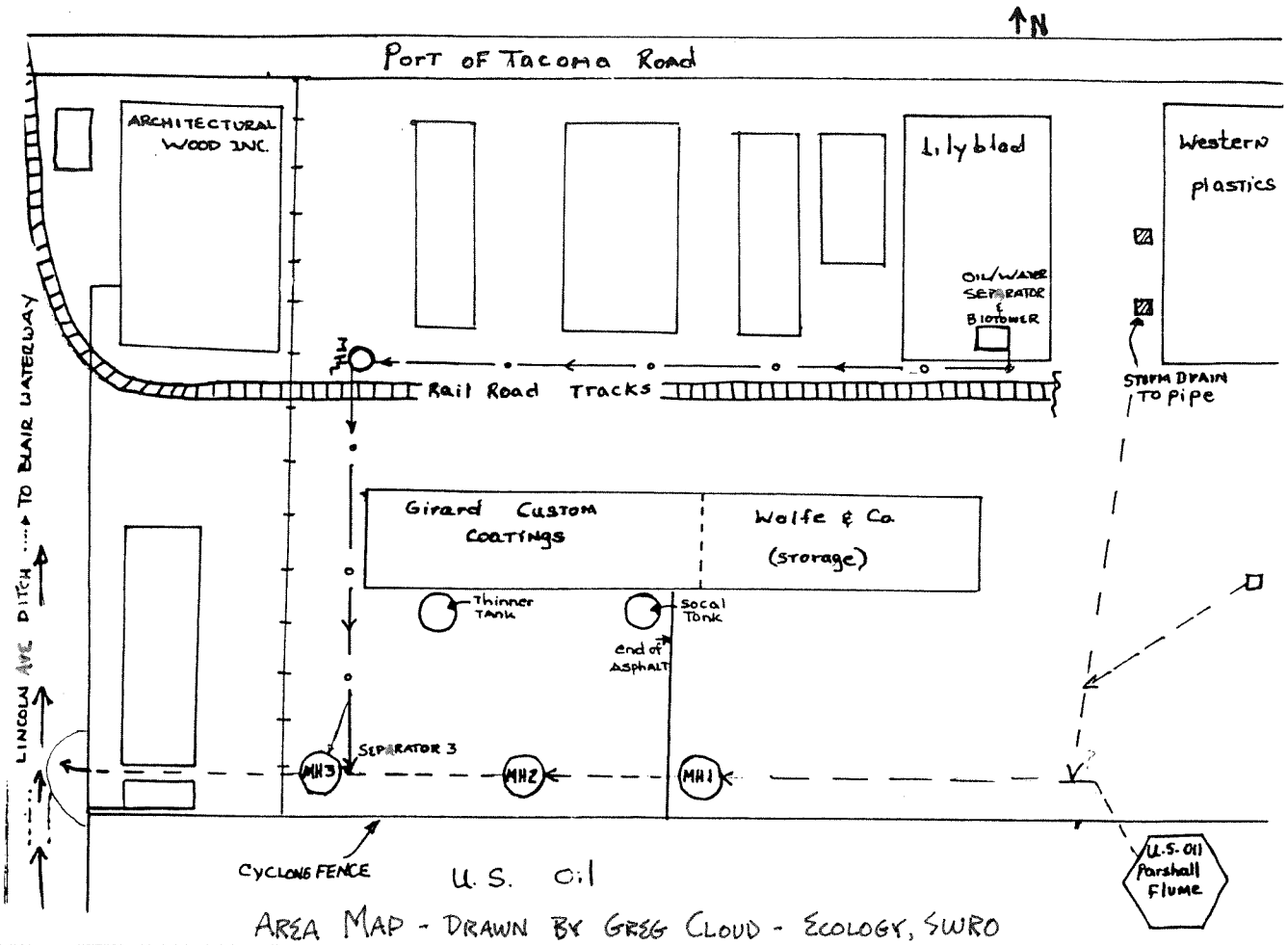
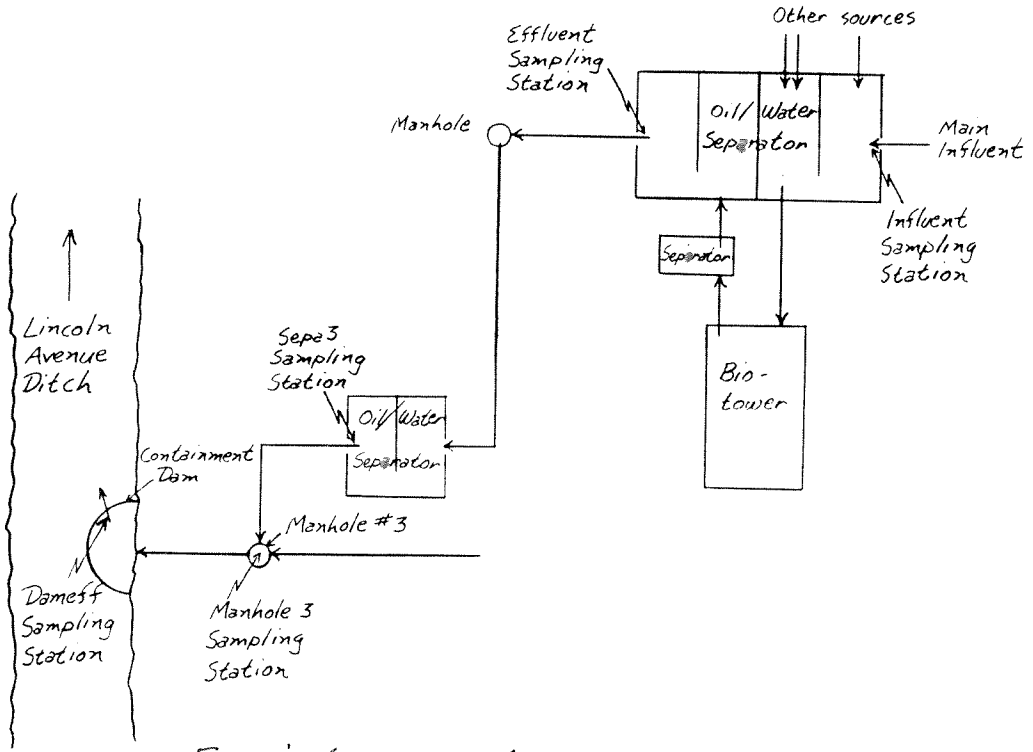
Verschueren, K., 1983. Handbook of Environmental Data on Organic Chemicals, second edition.



Area Map - Drawn By Greg Cloud - Ecology, SWRO



Flow & Sampling Schematic

Figure 1 - Area Map and Flow Schematic - Lilyblad, December 1988

Table 1 - Ecology Sampling Schedule - Lilyblad, December 1988.

Station:	Influent	Effluent	Effluent	Effluent	Sepa-3	Sepa-3	Sepa-3	Manhole	Dam-Eff	Dam-Eff	Blank
Date:	12/29	12/29	12/30	12/29-30	12/29	12/30	12/29-30	12/30	12/29	12/30	12/29
Time:	1304	1330	1030	1210-1210	1420	1100	1235-1235	1120	1445	1150	1150
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Composite	Grab	Grab	Grab	Grab
Lab Log #:	538205	538206	538207	538214	538208	538209	538213	538210	538211	538212	538215
Field Analyses											
Temperature	X	X	X	X	X	X	X	X	X	X	
pH	X	X	X	X	X	X	X	X	X	X	
Conductivity	X	X	X	X	X	X	X	X	X	X	
Laboratory Analyses											
Conductivity	X	X	X	X	X	X	X	X	X	X	
COD	X	X	X	X	X	X	X	X	X	X	
TOC	X	X	X	X	X	X	X	X	X	X	
TOX	X	X	X	X	X	X		X	X	X	
Oil & Grease		X	X		X	X		X	X	X	
Phenols	X	X	X	X	X	X	X	X	X	X	X
Cyanide				X							X
BNA				X			X				X
Pesticide/PCB				X			X				X
VOA	X	X	X		X	X		X	X	X	X
PP Metals				X			X			X	X
Trout				X *							
Microtox			X	X *						X	
Mysid Shrimp				X *							

* - Bioassay samples were collected as grab composites. Equal volumes were collected at 1330 on 12/29 and at 1030 on 12/30.

Table 2 - Priority Pollutant Cleaning and Field Transfer Blank Procedures - Lilyblad, December 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 parameters to be analyzed from 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 parameters to be analyzed from composite samples (BNA, Pesticide/PCB, metals, cyanide, and phenols).

Table 3 - Analytical Methods - Lilyblad, December 1988.

Laboratory Analyses	Method Used for Ecology Analysis (Ecology, 1988 & 89)	Laboratory Performing Analysis
Conductivity	EPA #120.1	Ecology
COD	EPA #410.1	Ecology
TOC	EPA #415.1	Ecology
Oil and Grease	EPA #413.1	Ecology
Cyanide	EPA #335.3	Ecology
Phenols	EPA #420.1	Ecology
TOX	EPA #9020	Ecology
VOA	EPA #624	ARI
BNA	EPA #625	ARI
Pest/PCB	EPA #608	ARI
Metals	EPA #200 series	ARI
Salmonid (Trout)	Ecology, 1981	Ecology
Microtox	Beckman, 1982	ECOVA
Mysid	EPA, 1985	EVS
Field Analyses		
pH	APHA, 1985: #423	
Conductivity	APHA, 1985: #205	
Temperature	APHA, 1985: #212	

ARI - Analytical Resources Incorporated
EVS - EVS Consultants, Inc.

Table 4 - General Chemistry Results - Lilyblad, December 1988.

Station:	Influent	Effluent	Effluent	Effluent	Sepa-3	Sepa-3	Sepa-3	Manhole	Dam-Eff	Dam-Eff	Blank
Date:	12/29	12/29	12/30	12/29-30	12/29	12/30	12/29-30	12/30	12/29	12/30	12/29
Time:	1304	1330	1030	1210-1210	1420	1100	1235-1235	1120	1445	1150	1150
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Composite	Grab	Grab	Grab	Grab
Lab Log #:	538205	538206	538207	538214	538208	538209	538213	538210	538211	538212	538215
Field Analyses											
Temperature (C)	7.0	9.3	12.0	3.1	7.6	9.5	2.2	10.2	11.2	9.4	
pH (S.U.)	6.8	7.2	7.3	6.9	6.7	6.7	6.9	6.8	7.3	6.5	
Conductivity (umhos/cm)	138	107	75	59	66	235	87	250	702	250	
Laboratory Analyses											
Conductivity (umhos/cm)	90	100	64	64	60	240	96	281	700	269	
COD (mg/L)	210	210	100	110	110	24	62	20	78	25	
TOC (mg/L)	58	46	16	26	21	16	16	13	22	13	
TOX (ug/L)	300	190	140	110	70	60		60	30	40	
Oil & Grease (mg/L)		32	23		7	1U		3	12	1U	
Phenols (ug/L)	84	56	22	26	18	8	10	2	6	2	2U
Cyanide (ug/L)				8							5U

Table 5 - Priority Pollutants Detected(1) - Lilyblad, December 1988.

Station:	Influent	Effluent	Effluent	Sepa-3	Sepa-3	Manhole	Dam-Eff	Dam-Eff	Field Blank	Freshwater Toxicity Criteria (EPA, 1986)		Toxicity Data *** LC_{50} (ug/L)
Date:	12/29	12/29	12/30	12/29	12/30	12/30	12/29	12/30	12/29			
Time:	1304	1330	1030	1420	1100	1120	1445	1150	1150			
Type:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	(ug/L)	(ug/L)	(Verschueren
Lab Log #:	538205	538206	538207	538208	538209	538210	538211	538212	538215	Acute	Chronic	1983)
--VOA Compounds (ug/L)--												
Vinyl Chloride	5.5 U	5.5 U	5.5 U	5.5 U	2.0 U	1.3 M	1.1 U	1.5	1.1 U			
Methylene Chloride	570 B	520 B	260 B	130 B	59	8.4	10 B	12 B	1.8 B			
Acetone	30000	16000	510	8700	32	36	280	56	0.6 U			5000000
1,1-Dichloroethane	12	7.9	7.4	3.5 J	2.9	1.5	0.6 M	1.2	1.1 U			
1,2-Dichloroethene (Cis)	4.9 J	2.1 J	6.0 U	6.0 U	0.8 U **	1.5 **	1.2 U	0.8 J	1.2 U	11600*	++*	
Chloroform	4.5 U	4.5 U	4.5 U	4.5 U	1.1 U	6.9	1.3	4.3	0.9 U	28900*	1240*	
2-Butanone	21000	15000	68	4600	6.2 U	6.2 U	1.0 U	1.6	1.0 U			1690000
1,1,1-Trichloroethane	32	12	7.0	4.0 M	2.4	1.8	5.3	1.6	1.0 U			
Trichloroethene	4.0 U	2.2 J	4.0 U	4.0 U	0.6 U	0.6 U	0.8 U	0.8 U	0.8 U	45000*	21900*	
Benzene	7.2 B	3.7 B	2.0 U	2.0 U	1.0 U	1.0 U	0.4 U	0.4 U	0.4 U	5300*		
4-Methyl-2-Pentanone	2700	3800	170	1300	8.8	14	1.8 U	23	1.8 U			460000
Tetrachloroethene	6.0	3.5	0.6 M	0.5 M	0.5 U	0.8	0.3 J	0.4 J	0.6 U	5280*	840*	
Toluene	67	3.4 BM	3.0 U	3.0 U	0.8 U	0.8 U	0.6 U	0.6 M	1.8	17500*		
Total Xylenes	5800	330	140	96	38 M	12	1.5 U	15	1.6 M			11000
Station:			Effluent		SEPA-3			Dam-Eff	Field Blank			
Date:			12/29-30		12/29-30			12/30	12/29			
Time:			1210 - 1210		1235 - 1235			1150	1150			
Type:			Composite		Composite			Grab	Grab			
Lab Log #:			538214		538213			538212	538215			
Cyanide (ug/L)			8						5 U	22	5.2	
--BNA Compounds (ug/L)--												
1,2-Dichlorobenzene			1 J		2				1 U	1120*	763* +**	
2-Methylphenol			9		9				1 U			
4-Methylphenol			1 U		2 M				1 U			
2,4-Dimethylphenol			5		2 U				2 U	2120*		
Benzoic Acid			10 U		22				10 U			180000
bis(2-Chloroethoxy)Methane			1 U		9 M				1 U			
Acenaphthene			1 J		1				1 U	1700*	520*	
Dibenzofuran			1 J		2				1 U			
Fluorene			1 J		3				1 U			
Phenanthrene			1 J		5				1 U			
Di-n-Butylphthalate			1 U		1				1 U			
Fluoranthene			1 U		2				1 U	3980*		
Pyrene			1 U		1				1 U			
Butylbenxylphthalate			1 U		1				1 U			
bis(2-Ethylhexyl)Phthalate			3		13				1			
--Priority Pollutant Metals (ug/L)--												
Arsenic (TR)			1.0 U		1.9			2.6	1.0 U	(850*)360++	(48*)190++	
Chromium (T)			5 U		5			5 U	5 U	(16)650+*	(11)77+*	
Copper (T)			13		16			10	2 U	5.7+	4.2+	
Lead (T)			20.5		17.5			7.4	1.0 U	18+	0.7+	
Zinc (T)			298		191			103	14	42+	38+	

U - Indicates compound was analyzed for but not detected at the given detection limit.
J - Indicates an estimated value when result is less than the specified detection limit.
B - Indicates 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.
* - Insufficient data available to develop criteria. LOEL - Lowest observed effect concentration listed.
** - Total 1,2-Dichloroethene.
*** - lowest concentration presented by Verschueren (1983) for a species of fish.
+ - calculated using a hardness of 30 mg/L as measured during the trout effluent bioassay.
++ - (Penta)Tri.
+* - (Hex)Tri. Tri concentrations are based on a hardness of 30 mg/L
++* - criteria for dichloroethenes.
+** - criteria for dichlorobenzenes.
(T) - total metal analysis.
(TR) - total recoverable metal analysis.
(1) - complete analytical results are included in the Appendix.

Table 6 - Selected Parameter Review - Lilyblad, December 1988.

Station:	Influent	Effluent	Sepa-3	Dam-Eff	Effluent	Sepa-3	Manhole	Dam-Eff
Date:	12/29	12/29	12/29	12/29	12/30	12/30	12/30	12/30
Time:	1304	1330	1420	1445	1030	1100	1120	1150
Type:	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Lab Log #:	538205	538206	538208	538211	538207	538209	538210	538212
Field Analyses								
Temperature (C)	7.0	9.3	7.6	11.2	12.0	9.5	10.2	9.4
Conductivity (umhos/cm)	138	107	66	702	75	235	250	250
Laboratory Analyses								
Conductivity (umhos/cm)	90	100	60	700	64	240	281	269
TOX (ug/L)	300	190	70	30	140	60	60	40
Oil & Grease (mg/L)		32	7	12	23	1 U	3	1 U
Phenols (ug/L)	84	56	18	6	22	8	2	2
----------VOA Compounds (ug/L)----------								
Acetone	30000	16000	8700	280	510	32	36	56
2-Butanone	21000	15000	4600	1.0 U	68	6.2 U	6.2 U	1.6
4-Methyl-2-Pentanone	2700	3800	1300	1.8 U	170	8.8	14	23
Methylene Chloride	570 B	520 B	130 B	10 B	260 B	59	8.4	12 B
Total Xylenes	5800	330	96	1.5 U	140	38 M	12	15
1,1,1-Trichloroethane	32	12	4.0 M	5.3	7.0	2.4	1.8	1.6
Tetrachloroethene	6.0	3.5	0.5 M	0.3 J	0.6 M	0.5 U	0.8	0.4 J
Toluene	67	3.4 BM	3.0 U	0.6 U	3.0 U	0.8 U	0.8 U	0.6 M

U - Indicates compound was analyzed for but not detected at the given detection limit.
J - Indicates an estimated value when result is less than the specified detection limit.
B - Indicates 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.

Table 7 - Comparison of Inspection Results to NPDES Permit Limits - Lilyblad, December 1988.

Parameter	NPDES Permit Limit	Inspection Results *
pH (S.U.)	Not <6.5 or >8.5	7.2; 7.3
Oil & Grease (mg/L)	Not >15	32; 23

* effluent sample results

Table 8 - Bioassay Results - Lilyblad, December 1988.

Microtox

Sample	Lab Log #	15 minute test EC50	Ranking *
Effluent (Grab)	538207	40.1%	moderate
Effluent (Comp)	538214	83.4%	low
Dam-Eff (Grab)	538212	Data not suitable for reduction **	

EC50 - concentration effecting 50% of the test organisms
* - relative ranking to aid in prioritizing the need for further toxicity investigation (EPA 1980)
** - low toxicity of the sample did not allow the EC50 to be calculated

Rainbow Trout (Oncorhynchus mykiss)

Sample	Lab Log #	Number Tested	Number Killed	Percent Mortality
Control		30	0	0%
Effluent (Comp) *	538214	30	30	100%

* - test run in 100% effluent. Sample was aerated to maintain adequate DO.

Mysid (Mysidopsis bahia)

Sample	Lab Log #	Percent Sample	Number Tested	Number Killed	Percent Mortality
Control			30	0	0%
Effluent (Comp)	538214	1%	30	0	0%
		3%	30	0	0%
		10%	30	0	0%
		30%	30	0	0%
		100%	30	2	7%
			LC50 is greater than 100%		

LC50 - concentration lethal to 50% of the test organisms

APPENDIX

Appendix - Priority Pollutant Results - Lilyblad, December 1988.

Station:	Influent	Effluent	Effluent	Sepa-3	Sepa-3	Manhole	Dam-Eff	Dam-Eff	Field Blank
Lab Log #:	538205	538206	538207	538208	538209	538210	538211	538212	538215
Date:	12/29	12/29	12/30	12/29	12/30	12/30	12/29	12/30	12/29
----------VOA Compounds (ug/L)----------									
Chloromethane	10 U	15 U	15 U	15 U	3.8 U	3.8 U	2.9 U	2.9 U	2.9 U
Bromomethane	4.5 U	4.5 U	4.5 U	4.5 U	3.1 U	3.1 U	0.9 U	0.9 U	0.9 U
Vinyl Chloride	5.5 U	5.5 U	5.5 U	5.5 U	2.0 U	1.3 M	1.1 U	1.5	1.1 U
Chloroethane	4.5 U	4.5 U	4.5 U	4.5 U	3.3 U	3.3 U	0.9 U	0.9 U	0.9 U
Methylene Chloride	570 B	520 B	260 B	130 B	59	8.4	10 B	12 B	1.8 B
Acetone	30000	16000	510	8700	32	36	280	56	0.6 U
Carbon Disulfide	10 U	10 U	10 U	10 U	1.2 U	1.2 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethene	6.5 U	6.5 U	6.5 U	6.5 U	0.7 U	0.7 U	1.3 U	1.3 U	1.3 U
1,1-Dichloroethane	12	7.9	7.4	3.5 J	2.9	1.5	0.6 M	1.2	1.1 U
1,2-Dichloroethene (Trans)	5.5 U	5.5 U	5.5 U	5.5 U			1.1 U	1.1 U	1.1 U
1,2-Dichloroethene (Cis)	4.9 J	2.1 J	6.0 U	6.0 U	0.8 U **	1.5 **	1.2 U	0.8 J	1.2 U
Chloroform	4.5 U	4.5 U	4.5 U	4.5 U	1.1 U	6.9	1.3	4.3	0.9 U
1,2-Dichloroethane	3.0 U	3.0 U	3.0 U	3.0 U	0.5 U	0.5 U	0.6 U	0.6 U	0.6 U
2-Butanone	21000	15000	68	4600	6.2 U	6.2 U	1.0 U	1.6	1.0 U
1,1,1-Trichloroethane	32	12	7.0	4.0 M	2.4	1.8	5.3	1.6	1.0 U
Carbon Tetrachloride	2.5 U	2.5 U	2.5 U	2.5 U	0.9 U	0.9 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	8.5 U	8.5 U	8.5 U	8.5 U	3.1 U	3.1 U	1.7 U	1.7 U	1.7 U
Bromodichloromethane	1.0 U	1.0 U	1.0 U	1.0 U	0.7 U	0.7 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	3.0 U	3.0 U	3.0 U	3.0 U	0.7 U	0.7 U	0.6 U	0.6 U	0.6 U
Cis-1,3-Dichloropropene	2.5 U	2.5 U	2.5 U	2.5 U	1.8 U	1.8 U	0.5 U	0.5 U	0.5 U
Trichloroethene	4.0 U	2.2 J	4.0 U	4.0 U	0.6 U	0.6 U	0.8 U	0.8 U	0.8 U
Dibromochloromethane	4.5 U	4.5 U	4.5 U	4.5 U	0.7 U	0.7 U	0.9 U	0.9 U	0.9 U
1,1,2-Trichloroethane	1.5 U	1.5 U	1.5 U	1.5 U	0.7 U	0.7 U	0.3 U	0.3 U	0.3 U
Benzene	7.2 B	3.7 B	2.0 U	2.0 U	1.0 U	1.0 U	0.4 U	0.4 U	0.4 U
Trans-1,3-Dichloropropene	3.0 U	3.0 U	3.0 U	3.0 U	1.9 U	1.9 U	0.6 U	0.6 U	0.6 U
2-Chloroethylvinylether	7.5 U	7.5 U	7.5 U	7.5 U	2.7 U	2.7 U	1.5 U	1.5 U	1.5 U
Bromoform	1.5 U	1.5 U	1.5 U	1.5 U	2.5 U	2.5 U	0.3 U	0.3 U	0.3 U
4-Methyl-2-Pentanone	2700	3800	170	1300	8.8	14	1.8 U	23	1.8 U
2-Hexanone	6.5 U	6.5 U	6.5 U	6.5 U	3.2 U	3.2 U	1.3 U	1.3 U	1.3 U
Tetrachloroethene	6.0	3.5	0.6 M	0.5 M	0.5 U	0.8	0.3 J	0.4 J	0.6 U
1,1,2,2-Tetrachloroethane	3.0 U	3.0 U	3.0 U	3.0 U	2.7 U	2.7 U	0.6 U	0.6 U	0.6 U
Toluene	67	3.4 BM	3.0 U	3.0 U	0.8 U	0.8 U	0.6 U	0.6 M	1.8
Chlorobenzene	3.0 U	3.0 U	3.0 U	3.0 U	0.9 U	0.9 U	0.6 U	0.6 U	0.6 U
Ethylbenzene	5.0 U	5.0 U	5.0 U	5.0 U	0.8 U	0.8 U	1.0 U	1.0 U	1.0 U
Styrene	2.5 U	2.5 U	2.5 U	2.5 U	1.1 U	1.1 U	0.5 U	0.5 U	0.5 U
Total Xylenes	5800	330	140	96	38 M	12	1.5 U	15	1.6 M

Appendix (Continued) - Lilyblad, December 1988.

Station:	Effluent	Sepa-3	Field Blank
Lab Log #:	538214	538213	538215
Date:	12/29-30	12/29-30	12/29
----------BNA Compounds (ug/L)----------			
Phenol	1 U	1 U	1 U
bis(2-Chloroethyl)Ether	1 U	1 U	1 U
2-Chlorophenol	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U
Benzyl Alcohol	5 U	5 U	5 U
1,2-Dichlorobenzene	1 J	2	1 U
2-Methylphenol	9	9	1 U
bis(2-chloroisopropyl)ether	1 U	1 U	1 U
4-Methylphenol	1 U	2 M	1 U
N-Nitroso-Di-n-Propylamine	1 U	1 U	1 U
Hexachloroethane	2 U	2 U	2 U
Nitrobenzene	1 U	1 U	1 U
Isophorone	1 U	1 U	1 U
2-Nitrophenol	5 U	5 U	5 U
2,4-Dimethylphenol	5	2 U	2 U
Benzoic Acid	10 U	22	10 U
bis(2-Chloroethoxy)Methane	1 U	9 M	1 U
2,4-Dichlorophenol	3 U	3 U	3 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U
Naphthalene	1 U	1 U	1 U
4-Chloroaniline	3 U	3 U	3 U
Hexachlorobutadiene	2 U	2 U	2 U
4-Chloro-3-Methylphenol	2 U	2 U	2 U
2-Methylnaphthalene	1 U	1 U	1 U
Hexachlorocyclopentadiene	5 U	5 U	5 U
2,4,6-Trichlorophenol	5 U	5 U	5 U
2,4,5-Trichlorophenol	5 U	5 U	5 U
2-Chloronaphthalene	1 U	1 U	1 U
2-Nitroaniline	5 U	5 U	5 U
Dimethyl Phthalate	1 U	1 U	1 U
Acenaphthylene	1 U	1 U	1 U
3-Nitroaniline	5 U	5 U	5 U
Acenaphthene	1 J	1	1 U
2,4-Dinitrophenol	10 U	10 U	10 U
4-Nitrophenol	5 U	5 U	5 U
Dibenzofuran	1 J	2	1 U
2,4-Dinitrotoluene	5 U	5 U	5 U
2,6-Dinitrotoluene	5 U	5 U	5 U
Diethylphthalate	1 U	1 U	1 U
4-Chlorophenyl-phenylether	1 U	1 U	1 U
Fluorene	1 J	3	1 U
4-Nitroaniline	5 U	5 U	5 U
4,6-Dinitro-2-Methylphenol	10 U	10 U	10 U
N-Nitrosodiphenylamine	1 U	1 U	1 U
4-Bromophenyl-phenylether	1 U	1 U	1 U
Hexachlorobenzene	1 U	1 U	1 U
Pentachlorophenol	5 U	5 U	5 U
Phenanthrene	1 J	5	1 U

Appendix (Continued) - Lilyblad, December 1988.

Station:	Effluent	Sepa-3	Field Blank
Lab Log #:	538214	538213	538215
Date:	12/29-30	12/29-30	12/29
----------BNA Compounds (ug/L)----------			
Anthracene	1 U	1 U	1 U
Di-n-Butylphthalate	1 U	1	1 U
Fluoranthene	1 U	2	1 U
Pyrene	1 U	1	1 U
Butylbenxylphthalate	1 U	1	1 U
3,3'-Dichlorobenzidine	5 U	5 U	5 U
Benzo(a)Anthracene	1 U	1 U	1 U
bis(2-Ethylhexyl)Phthalate	3	13	1
Chrysene	1 U	1 U	1 U
Di-n-Octyl Phthalate	1 U	1 U	1 U
Benzo(b)Fluoranthene	1 U	1 U	1 U
Benzo(k)Fluoranthene	1 U	1 U	1 U
Benzo(a)Pyrene	1 U	1 U	1 U
Indeno(1,2,3-cd)Pyrene	1 U	1 U	1 U
Dibenz(a,h)Anthracene	1 U	1 U	1 U
Benzo(ghi)Perylene	1 U	1 U	1 U
---------- Pesticides/PCBs (ug/L) ----------			
Apha-BHC	0.03 U	0.03 U	0.03 U
Beta-BHC	0.03 U	0.03 U	0.03 U
Delta-BHC	0.03 U	0.03 U	0.03 U
Gamma-BHC (Lindane)	0.03 U	0.03 U	0.03 U
Heptachlor	0.03 U	0.03 U	0.03 U
Aldrin	0.03 U	0.03 U	0.03 U
Heptachlor Epoxide	0.03 U	0.03 U	0.03 U
Endosulfan I	0.09 U	0.09 U	0.09 U
Dieldrin	0.06 U	0.06 U	0.06 U
4,4'-DDE	0.06 U	0.06 U	0.06 U
Endrin	0.06 U	0.06 U	0.06 U
Endosulfan II	0.06 U	0.06 U	0.06 U
4,4'-DDD	0.06 U	0.06 U	0.06 U
Endosulfan Sulfate	0.06 U	0.06 U	0.06 U
4,4'-DDT	0.06 U	0.06 U	0.06 U
Methoxychlor	0.12 U	0.12 U	0.12 U
Endrin Ketone	0.06 U	0.06 U	0.06 U
alpha-Chlordane	0.06 U	0.06 U	0.06 U
gamma-Chlordane	0.06 U	0.06 U	0.06 U
Toxaphene	3.0 U	3.0 U	3.0 U
Aroclor-1016	0.06 U	0.06 U	0.06 U
Aroclor-1221			
Aroclor-1232			
Aroclor-1242	0.06 U	0.06 U	0.06 U
Aroclor-1248	0.06 U	0.06 U	0.06 U
Aroclor-1254	0.06 U	0.06 U	0.06 U
Aroclor-1260	0.06 U	0.06 U	0.06 U
Cyanide (ug/L)	8		5 U

Appendix (Continued) - Lilyblad, December 1988.

Station:	Effluent	Sepa-3	Dam-Eff	Field Blank
Lab Log #:	538214	538213	538212	538215
Date:	12/29-30	12/29-30	12/30	12/29
---------- Priority Pollutant Metals (ug/L) ----------				
Antimony (TR)	1.0 U	1.0 U	1.0 U	1.0 U
Arsenic (TR)	1.0 U	1.9	2.6	1.0 U
Beryllium (T)	1 U	1 U	1 U	1 U
Cadmium (T)	2 U	2 U	2 U	2 U
Chromium (T)	5 U	5	5 U	5 U
Copper (T)	13	16	10	2 U
Lead (T)	20.5	17.5	7.4	1.0 U
Mercury (T)	0.1 U	0.1 U	0.1 U	0.1 U
Nickel (T)	10 U	10 U	10 U	10 U
Selenium (TR)	1.0 U	1.0 U	.0 U	1.0 U
Silver (T)	3 U	3 U	3 U	3 U
Thallium (T)	1.0 U	1.0 U	1.0 U	1.0 U
Zinc (T)	298	191	103	14

U - Indicates compound was analyzed for but not detected at the given detection limit.
J - Indicates an estimated value when result is less than the specified detection limit.
B - Indicates 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.
K - Indicates that quantitative value falls above the limit of the calibration curve, and dilution should be run.
** - Total 1,2-Dichloroethene.
(T) - Total metal analysis
(TR) - Total recoverable metal analysis

ANALYTICAL
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INCORPORATED

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, Wa 98109-5187
(206) 621-6490

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ARI Job No: 2456

Client: WDOE
Project: Lillyblad of Tacoma

Sample No: 538208

COMPOUND	SPIKE ADDED (µg/L)	SAMPLE CONCENTRATION (µg/L)	MS CONCENTRATION (µg/L)	MS % REC	QC LIMITS REC
1,1-Dichloroethene	2500	0.0	2400	96.0	61-145
Trichloroethene	2500	0.0	2300	92.0	71-120
Benzene	2500	0.0	2400	96.0	76-127
Toluene	2500	0.0	2600	104	76-125
Chlorobenzene	2500	0.0	2200	88.0	75-130

COMPOUND	SPIKE ADDED (µg/L)	MSD CONCENTRATION (µg/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC
1,1-Dichloroethene	2500	2300	92.0	4.3	14	61-145
Trichloroethene	2500	2300	92.0	0.0	14	71-120
Benzene	2500	2300	92.0	4.3	11	76-127
Toluene	2500	2600	104	0.0	13	76-125
Chlorobenzene	2500	2000	80.0	9.5	13	75-130

RPD: 0 out of 5 outside limits
Spike Recovery: 0 out of 10 outside limits

Asterisked values outside QC Limits

Comments:

FORM III VOA-1

ANALYTICAL
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Analytical
Chemists &
Consultants

333 Ninth Ave. Nor
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WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ARI Job No: 2456

Client: WDOE
Project: Lillyblad of Tacoma

Sample No: 538214

COMPOUND	SPIKE ADDED (µg/L)	Sample Concentration (µg/L)	MS Concentration (µg/L)	MS % REC	QC LIMITS REC
Phenol	100	0.0	44	44	12-89
2-Chlorophenol	100	0.0	90	90	27-123
1,4-Dichlorobenzene	50	0.0	40	80	36-97
N-Nitroso-Di-n-Propylamine	50	0.0	45	90	41-116
1,2,4-Trichlorobenzene	50	0.0	43	86	39-98
4-Chloro-3-Methylphenol	100	0.0	104	104	23-97
Acenaphthene	50	1.0	42	82	46-118
4-Nitrophenol	100	0.0	46	46	10-80
2,4-Dinitrotoluene	50	0.0	48	96	24-96
Pentachlorophenol	100	0.0	120	120	9-103
Pyrene	50	0.0	42	84	26-127

COMPOUND	SPIKE ADDED (µg/L)	MSD Concentration (µg/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC
Phenol	100	46	46	-4	42	12-89
2-Chlorophenol	100	94	94	-5	40	27-123
1,4-Dichlorobenzene	50	43	85	-6	28	36-97
N-Nitroso-Di-n-Propylamine	50	48	96	-6	38	41-116
1,2,4-Trichlorobenzene	50	44	88	-3	28	39-98
4-Chloro-3-Methylphenol	100	103	103	1	42	23-97
Acenaphthene	50	45	88	-7	31	46-118
4-Nitrophenol	100	47	47	-2	50	10-80
2,4-Dinitrotoluene	50	52	104	-9	38	24-96
Pentachlorophenol	100	118	118	1	50	9-103
Pyrene	50	43	87	-4	31	26-127

RPD: 0 out of 11 outside limits
Spike Recovery: 0 out of 22 outside limits
Asterisked values outside QC Limits

Comments:

FORM III SV-1

ANALYTICAL RESOURCES INCORPORATED
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Seattle, Wa 98109-5187
(206) 621-6490

PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYTICAL RESOURCES, INC.

PROJECT: LILLYBLAD OF TACOMA

QC REPORT NO: 2456-WD0E
MATRIX: Water
VTSR: 01/03/89

Volume Extracted: 1 Liter
Conc/Dilution: 1:10
Date Analyzed: 01/12/89

CLIENT SAMPLE NO: 538214
ARI LAB ID: 2456 J

COMPOUND	CONC. SPIKE ADDED (µg/L)	SAMPLE RESULT	MS CONC.	% REC.	MSD CONC.	% REC.	% RPD	QC Limits RPD	QC Limits REC
Lindane	0.200	0	.114	**57**	.132	**66**	15	15	56-123
Heptachlor	0.200	0	.124	**62**	.143	**72**	15	20	40-131
Aldrin	0.200	0	.134	**67**	.154	**77**	14	22	40-120
Dieldrin	0.500	0	.310	**62**	.361	**72**	15	18	52-126
Endrin	0.500	0	.347	**69**	.400	**80**	15	21	56-121
4,4'-DDT	0.500	0	.400	**80**	.480	**96**	18	27	38-127

DATA RELEASE AUTHORIZED:

DATA PREPARED: MAOC - M.L. (01/31/89)

COMMENTS:
Higher recoveries in MSD also reflected in higher MSD surrogate recovery.