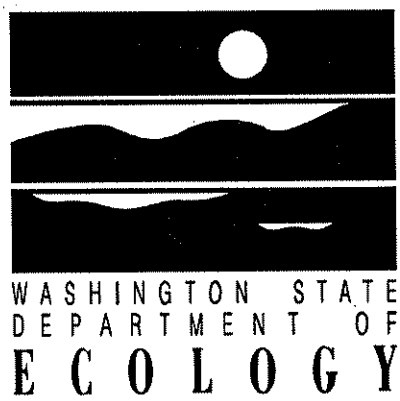

METRO RENTON
WASTEWATER TREATMENT PLANT
CLASS II INSPECTION, JANUARY 24-26, 1994

February 1995

Water Body No. WA-PS-0240

Publication No. 95-305
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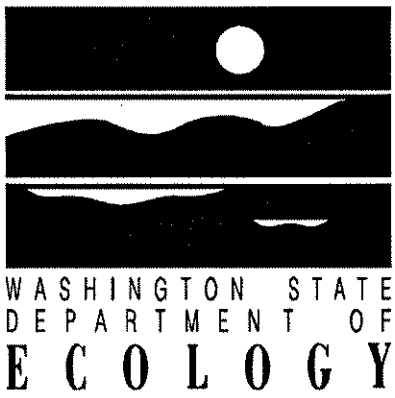

METRO Renton Wastewater Treatment Plant Class II Inspection, January 24-26, 1994

by
Steven Golding

Environmental Investigations and Laboratory Services Program
Olympia, Washington 98504-7710

February 1995

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Table of Contents

List of Figures and Tables

Abstract

A Class II inspection was conducted at the METRO Renton Wastewater Treatment Plant on January 24-26, 1994. The plant was performing well during the inspection with effective removal of the conventional parameters BOD_5 and TSS. The effluent met all permit limits.

Bioassays showed toxicity to four of the five species tested. The rainbow trout results did not meet the whole effluent toxicity performance standard. An effluent ammonia concentration of 19.5 mg/L may be responsible for the toxicity found in the effluent. Split sample general chemistry results showed close agreement between Ecology and METRO for both sampling and analysis.

Of the five priority pollutant metals detected in the effluent samples, only copper (16 µg/L est.) exceeded EPA marine water quality criteria, exceeding the acute criterion by a factor of six. The effluent copper concentration was lower than theoretical water quality based limits based on calculated dilution factors. All priority pollutant metals found in the sludge sample were in concentrations below EPA sludge limits and ceiling concentrations for land application. A fecal coliform count for the sludge sample exceeded the EPA Class A pathogen limitation.

Summary

Wastewater

Flow Measurements

Because the facility's flow measuring device was inaccessible, flow measurements were not verified by Ecology.

NPDES Permit Compliance / General Chemistry

Influent and effluent data indicate effective removal of the conventional parameters BOD_5 (96% removal) and TSS (95% removal). **The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for all parameters.**

The waste water treatment plant (WWTP) was not being operated in a nitrifying mode and no significant nitrification was occurring. The effluent ammonia concentration was 19.5 mg/L.

Split Sample Results

Split sample results showed close agreement between Ecology and METRO for both sampling and analysis. Determinations of total chlorine concentration near the outfall by Ecology (<0.04 mg/L) and METRO (0.07 mg/L) varied somewhat.

Priority Pollutant Scans

Twenty-three VOA compounds were detected in the influent samples collected. Other than acetone (105 µg/L), all other influent VOA compounds were found in low concentrations (23.8 µg/L - est. or lower). Eight BNA compounds were detected in the influent; benzoic acid was found in the highest concentration (41 µg/L).

Nine VOA compounds were detected in effluent. All were at concentrations of 2.9 µg/L or lower. All VOA compounds were at concentrations well below the EPA water quality criteria (EPA, 1986). Bis(2-ethylhexyl)pthalate was the only BNA compound found in the effluent, at a concentration approximately one-half of the EPA acute and chronic marine water quality criteria.

No pesticides or PCB compounds were detected in influent or effluent samples.

Six priority pollutant metals were detected in the influent sample. Zinc (114 µg/L) and copper (107 µg/L) were found in the highest concentrations.

Of the five priority pollutant metals detected in the effluent samples, only copper (16 µg/L est.) exceeded EPA marine water quality criteria, exceeding the acute criterion by a factor of six. The effluent copper concentration was lower than the daily maximum water quality based limit for copper (365 µg/L) and monthly average limit (139 µg/L) based on calculated dilution factors as reported in the permit fact sheet.

Bioassays

The effluent sample for bioassays was taken from the effluent vault just upstream of the outfall. The effluent showed toxicity to four of the five species tested. No toxic effects were observed in *Daphnia magna*. **The rainbow trout results did not meet the whole effluent toxicity performance standard**. The survival for rainbow trout at 100% effluent was 50%.

Ammonia at a concentration of 19.5 mg/L may be responsible for the toxicity found in the effluent. An upward drift in pH during bioassay testing has been known to increase the concentrations of the toxic unionized form of ammonia. The range for pH during the rainbow trout bioassay test was 7.5 to 8.0. This is considered to be a normal range for the standard EPA test that was employed. Effluent ammonia concentration was considerably lower than water quality based limits based on dilution factors for the twin diffusers. Although it is not likely that chlorine was a major cause of toxicity in the bioassay tests, it is possible that chlorine was present in the effluent sample in toxic concentrations.

Sludge

Twenty-three VOA compounds were found in the sludge sample. Other than acetone, 2-butanone (MEK - 1560 µg/Kg-dr) was found in the highest concentration. Nine BNA compounds were found in the sludge sample. Bis(2-ethylhexyl)phthalate was found in the highest concentration (72,000 µg/Kg-dr est.).

No pesticide or PCB compounds were detected in the sludge sample.

Eleven priority pollutant metals were detected in the sludge sample. **All metals found were in concentrations below EPA sludge application limits and ceiling concentrations for land application of municipal sludge**.

A fecal coliform count of 1,700,000/100g corresponding to 89,500/g dry-wt was found in the sludge sample. **This exceeds the 1000/g dry-wt Class A pathogen limitation for the land application of municipal sewage sludge by a factor of 90**. For sludges that do not meet the Class A pathogen limitation there are alternative provisions set forth for land application (EPA, 1993).

Recommendations

- The effluent flow meter should be regularly checked per manufacturer's recommendations, and meter accuracy should be assured.

- Rainbow trout bioassay results did not meet the whole effluent toxicity performance standard. Further bioassay testing should be conducted in compliance with WAC 173-205, Whole Effluent Toxicity Testing and Limits.

- Consideration may need to be given to achieving reduction of effluent ammonia in order to comply with WAC 173-205, Whole Effluent Testing and Limits.

- Additional analyses of sludge fecal coliform should be conducted and causes of high fecal coliform counts considered.

Introduction

A Class II inspection was conducted at the METRO Renton Wastewater Treatment Plant (WWTP) January 24-26, 1994. Conducting the inspection were Ed Abbasi of Ecology's Northwest Regional Office in Bellevue, and Steven Golding of Ecology's Toxics Investigations Section in Olympia. Assisting from the METRO staff were Richard Finger, Superintendent of Process Control; and Barbara Strutynski, Chief Process Analyst.

Facility Description

The plant, located in the City of Renton, approximately one mile west of downtown, is a secondary treatment facility discharging to Puget Sound (Figure 1). The plant service area includes Algona, Auburn, Bellevue, Bryn Mawr, Cedar River, Eastgate, Issaquah, Kent, Kirkland, Mercer Island, NE Lake Washington, Pacific, Renton, Tukwila, Sammamish Plateau, Black Diamond, Soos Creek, Val Vue, and Water District 107.

There are approximately 60 industrial users discharging in excess of 2.5 MGD of wastewater to the facility. Average dry weather flow is 61 MGD. Maximum monthly flow is 91 MGD. The current facility was constructed in 1965. The plant was expanded most recently in 1988. A further expansion is in the planning stage (Finger, 1994).

The facility includes headworks, eight primary sedimentation tanks, three aeration tanks, sixteen secondary sedimentation tanks, seven chlorinators, two chlorine contact channels, four dissolved air flotation thickeners, four anaerobic digesters, and eight belt filter presses (Figure 2).

The discharge to Puget Sound is through a 12-mile-long outfall line with a diffuser system located approximately 10,000 feet from shore and at a depth of approximately 625 feet. An outfall to the Green River is permitted for emergency and maintenance use only.

The current NPDES permit #WA-002958-1 was issued on March 31, 1993 and expires on March 31, 1997.

Objectives

Objectives of the inspection included:

1. Verify compliance with NPDES permit parameters.

2. Determine WWTP performance.

3. Assess permittee's self-monitoring, splitting samples with the permittee to determine the comparability of sampling methods and laboratory results.

4. Characterize wastewater toxicity with priority pollutant scans and bioassays.

Procedures

Composite samples were taken at influent (Inf-E), primary sedimentation tank effluent (Sed-E), and effluent (Eff-E) locations. Ecology Isco composite samplers were set up to collect equal volumes of sample every 30 minutes for 24 hours. Samples of effluent taken at two times comprised the grab-composite samples for bioassay tests. Influent, primary sedimentation tank effluent, aeration basin, and final effluent grab samples were also taken. Sampler configurations and locations are summarized in Figure 2 and Table 1. A glossary of terms appears in Appendix H.

METRO also collected grab and composite samples of influent, primary sedimentation tank effluent, and final effluent. The METRO samplers were set to collect subsamples on a flow proportional basis. All composite samples were split for both Ecology and METRO laboratory analysis. A more detailed description of Ecology and METRO sampling procedures appears in Appendix A. The sampling schedule, parameters analyzed, and sample splits are included in Appendix B.

Samples for Ecology analysis were kept on ice and delivered to Manchester Laboratory the day following the date of collection, maintaining field chain-of-custody tracking on all samples. A summary of analytical methods, references, and the laboratory conducting the analysis is given in Appendix C. For a discussion of QA/QC, see Appendix D. Priority pollutant cleaning procedures appear in Appendix E.

Results and Discussion

Wastewater

Flow Measurements

Flow is measured by a propeller meter inside the effluent discharge pipe. There is no provision for measuring influent flow. In the absence of an accessible flow measuring device flow measurements were not verified by Ecology. **The effluent flow meter should be checked regularly per manufacturer's recommendations and meter accuracy should be assured**. METRO measured a flow of 63.9 MGD during the 24-hour period from 7 a.m. January 25, 1994 to 7 a.m. January 26, 1994.

NPDES Permit Compliance / General Chemistry

Influent and effluent data indicate effective removal of the conventional parameters BOD_5 (96% removal) and TSS (95% removal). Low counts of fecal coliform in the effluent also indicate effective treatment (Table 2). **The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for all parameters**: 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, cadmium, total chromium, copper, lead, mercury, nickel, zinc, oil and grease, and chlorine (Table 3).

The effluent ammonia concentration (19.5 mg/L) was lower than the total ammonia permit limit of 24 mg/L for the Green River discharge - Outfall 002, which is authorized under emergency conditions. The facility was not discharging to the Green River at the time of the inspection. There is no permit limit for ammonia discharged to Puget Sound - Outfall 001.

Removal of TSS through the primary sedimentation tanks was 62%. This compares with the 50% to 70% which should be removed in an efficiently designed and operated sedimentation tank (Metcalf and Eddy, 1991). Removal of BOD_5 through the primary sedimentation tanks was 38%. This compares with the 25% to 40% that should be removed.

Because effluent ammonia concentrations have not been exceeding permit limits, the WWTP has not been operated in the nitrification mode (Abbasi, 1995). A comparison of influent and effluent NH_3 and $NO_3 + NO_2$-N concentrations indicate that **no significant nitrification was occurring at the time of the inspection**. The effluent ammonia concentration (19.5 mg/L) was essentially the same as ammonia influent concentration (17.2 mg/L). Effluent $NO_3 + NO_2$-N concentration (0.059 mg/L) was only slightly higher than $NO_3 + NO_2$-N influent concentration (0.016 mg/L). If nitrification had occurred NH_3

in the effluent would have substantially diminished from that in the influent and NO_3 + NO_2-N would have substantially increased. Consistent with a lack of nitrification, alkalinity did not decrease substantially.

Cyanide (weak and dissociable method) effluent concentrations (<0.004; 0.010 mg/L - Table 2) were below Ecology's acute marine water criterion (1.0 mg/L - WAC 173-201A-040).

Split Sample Results

Samples were split to determine the comparability of Ecology and permittee laboratory results and sampling methods. Ecology and METRO laboratory analyses of BOD_5, TSS, VSS, fecal coliform, COD, alkalinity, hardness, and total-P were in close agreement. Results from Ecology and METRO samplers were also in close agreement (Table 4).

Chlorine was the only parameter for which Ecology and METRO determinations were not in close agreement. At the vault near the outfall, Ecology's field DPD color method indicated a total chlorine residual of less than 0.04 mg/L. METRO's continuously reading chlorine meter found 0.07 mg/L total residual chlorine. The meter employs a Clark type membrane probe. METRO cleans the probe and calibrates the meter twice per week. Meter accuracy is such that readings can vary by several hundredths of a mg/L (Stratton, 1994). The METRO laboratory performs a chlorine analysis of effluent chlorine from the vault twice per month. Analysis of a sample taken on February 1, 1994 found a chlorine concentration of 0.07 mg/L.

Priority Pollutant Scans

Twenty three VOA compounds were detected in the influent samples collected (Table 5). Acetone was the VOA compound found in the highest concentration in the influent (105 µg/L). Because acetone is used for laboratory cleaning, the concentration found may not be representative of the influent. All other influent VOA compounds were found in low concentrations (23.8 µg/L - est. or lower).

Eight BNA compounds were detected in the influent. Benzoic acid was the BNA compound found in the highest concentration in the influent (41 µg/L). All other BNA compounds in the influent were found in low concentrations (18 µg/L -est. or lower).

Ten organic compounds were detected in the effluent samples collected. All were at concentrations of 2.9 µg/L or lower. All VOA compounds were at concentrations well below the EPA water quality criteria (EPA, 1986). Bis(2-ethylhexyl)pthalate was the only BNA compound found in the effluent, at a concentration approximately one half of the EPA acute and chronic marine water quality criteria for total phthalate esters.

No pesticides or PCB compounds were detected in influent or effluent samples.

Six metals were detected in the influent sample. Zinc (114 µg/L) and copper (107 µg/L) were found in the highest concentrations.

Of the five priority pollutant metals detected in the effluent samples, only copper (16 µg/L est.) exceeded the EPA acute or chronic marine water quality criteria, exceeding the acute criterion by a factor of 6. Dilution from the twin 500 foot long twin diffusers provides a calculated daily maximum water quality based limit for copper of 365 µg/L and a monthly average limit of 139 µg/L. These calculated limits appear in the permit fact sheet and are based on acute and chronic criteria for copper of 2.5 µg/L. The effluent copper concentration (16 µg/L) was much lower than these limits.

Complete priority pollutant scan results with detection limits are included in Appendix F.

A number of VOA Tentatively Identified Compounds (TICs) were found in the influent samples at concentrations up to 10.5 µg/L est. Of the two VOA TICs in the effluent samples, unknown hydrocarbons were found in concentrations up to 7.1 µg/L. BNA TICs were not reported. TICs are summarized in Appendix G.

Bioassays

METRO effluent flows through a 12-mile long 8-foot diameter transfer line, then through two 6-foot diameter outfall lines to the diffuser. The effluent sample for bioassays was taken from the effluent vault just upstream of the two outfall lines. Dechlorination upstream of the vault occurs in the transfer line. Detention time through the line was calculated to be 9.0 hours at the 63.85 MGD measured during the inspection. Ecology found no chlorine residual (<0.04 mg/L) in the effluent at the vault. METRO measured 0.07 mg/L total residual chlorine there. Effluent was not dechlorinated in the laboratory prior to conducting bioassays.

The effluent showed toxicity to four of the five species tested (Table 6). No toxic effects were observed in *Daphnia magna*. Toxicity was shown in all other bioassay tests conducted. Microtox results indicate the presence of a relatively fast-acting toxicant and recovery by the organisms within the time period of the test (Stinson, 1994).

Ceriodaphnia dubia had a reproduction NOEC of 25% effluent and a survival NOEC of 50% effluent. Survival at 100% effluent was 0%. Fathead minnow had an NOEC of 50% effluent for both weight and survival. Survival at 100% effluent was 0%.

Rainbow trout had an NOEC for survival of 50%. Survival at 100% effluent was 50%. **The rainbow trout results did not meet the whole effluent toxicity performance**

standard which specifies that for acute toxicity, no individual test result show less than sixty-five percent survival in 100% effluent (WAC 173-205-020).

An ACEC (acute critical effluent concentration) of 0.68% can be derived from the chronic dilution factor of 146 and the CCEC (chronic critical effluent concentration) of 0.32% can be derived from the dilution factor of 308 that appears in the permit fact sheet. All acute and chronic NOECs were greater than the ACEC of 0.68% and the CCEC of 0.32% respectively.

Ammonia at a concentration of 19.5 mg/L may be responsible for the toxicity found in the effluent. A number of *Daphnia* species have been found to have 48-hour LC50s in the range of 0.53 to 4.94 mg/L NH_3. Fathead minnows have been found to have LC50s from 0.73 to 3.4 mg/L NH_3. Rainbow trout have been found to have 96-hour LC50s ranging from 0.16 to 1.1 mg/L NH_3 (EPA, 1984). While there are a number of variables that limit the ability to compare test results, a concentration of 19.5 mg/L NH_3 could be expected to be acutely toxic to the bioassay organisms.

Based on dilution calculations for the twin 500 foot long diffusers, the daily maximum water quality based limit for total NH_3 would be 465 mg/L. The monthly average water quality based limit for total NH_3 would be 178 mg/L. These limits are based on an acute criterion of 6.2 mg/L and a chronic criterion of 0.92 mg/L and calculations of dilution factors as reported in the permit fact sheet. The 19.5 mg/L ammonia concentration from the 24-hour composite sample during the inspection is considerably lower than these limits. Because these theoretical limits were considerably higher than possible effluent concentrations they were not incorporated into the permit (Abbasi, 1995).

METRO has expressed concern in the past that pH excursions during rainbow trout bioassay tests may cause increases in the amount of toxicity shown as a result of increased ammonium ion concentration as pH rises (Abbasi, 1994). The range for pH during the rainbow trout bioassay test was 7.5 to 8.0. This is considered to be a normal range for the standard EPA test that was employed (Stinson, 1994).

Summary of pH ranges for METRO Renton bioassay tests at 100% effluent:

Daphnia magna	7.07 - 8.29
Ceriodaphnia	7.0 - 8.6
Fathead minnow (chronic)	7.0 - 8.1
Rainbow trout	7.5 - 8.0

While it appears unlikely that chlorine was the primary toxicant, it is possible that chlorine was present in the effluent sample in toxic concentrations. LC50s of 40 µg/L to 110 µg/L total residual chlorine have been reported for rainbow trout. LC50s of 82 µg/L to 130 µg/L have been reported for fathead minnow (EPA, 1985). A total chlorine residual of up to 0.07 mg/L (70 µg/L) measured in the effluent vault is in the range of LC50s for rainbow trout and fathead minnow. Because Ecology did not find effluent total residual chlorine at a detection limit of 0.04 mg/L and actual total chlorine residual during bioassay testing could be expected to be reduced somewhat from the concentration measured at the effluent vault, it appears that chlorine was not likely a major cause of toxicity in the bioassay tests.

Sludge

Primary and waste secondary sludges are co-thickened in dissolved air flotation thickeners. The thickened sludge is fed to anaerobic digesters. Digested sludge is thickened with belt filter presses. The thickened sludge is then transported by truck for land application. General chemistry parameters of the sludge sample from the filter presses are shown in Table 2.

Priority Pollutant Organics

Twenty-three VOA compounds were found in the sludge sample (Table 7). Acetone was found in the highest concentration (2140 µg/Kg-dr est.). Because acetone is used in laboratory cleaning of equipment, the concentration found may not be representative.

2-butanone (MEK - 1560 µg/Kg-dr) and 1,4-dichlorobenzene (1040 µg/Kg-dr) were found in the next highest concentrations. All other VOA compounds were found in concentrations of 299 µg/Kg or lower.

Nine BNA compounds were found in the sludge sample. Bis(2-ethylhexyl)phthalate was found in the highest concentration (72,000 µg/Kg-dr est.). Phenol was found in the next highest concentration (12,000 µg/Kg-dr est.). All other BNA compounds were found in concentrations of 1,900 µg/Kg-dr est. or lower.

A number of VOA Tentatively Identified Compounds (TICs) were found in the sludge sample at concentrations up to 12,330 µg/Kg-dr est.

Pesticides/PCBs

No pesticide or PCB compounds were detected in the sludge sample.

Metals

Eleven priority pollutant metals were detected in the sludge sample. Copper was found in the highest concentration (870 µg/Kg-dr). Zinc was found in the next highest concentration (770 µg/Kg-dr). All other metals found were in concentrations of 63.8 µg/Kg-dr or lower. **All metals found were in concentrations below EPA sludge application limits and ceiling concentrations for land application of municipal sludge** (Table 7).

Fecal Coliform

A fecal coliform count of 1,700,000/100g was found in the sludge sample. This corresponds to 89,500/g dry-wt at 19% solids. **This exceeds the 1000/g dry-wt Class A pathogen limitation for the land application of municipal sewage sludge by a factor of 90**. For sludges that do not meet the Class A pathogen limitation there are alternative provisions set forth for land application (EPA, 1993).

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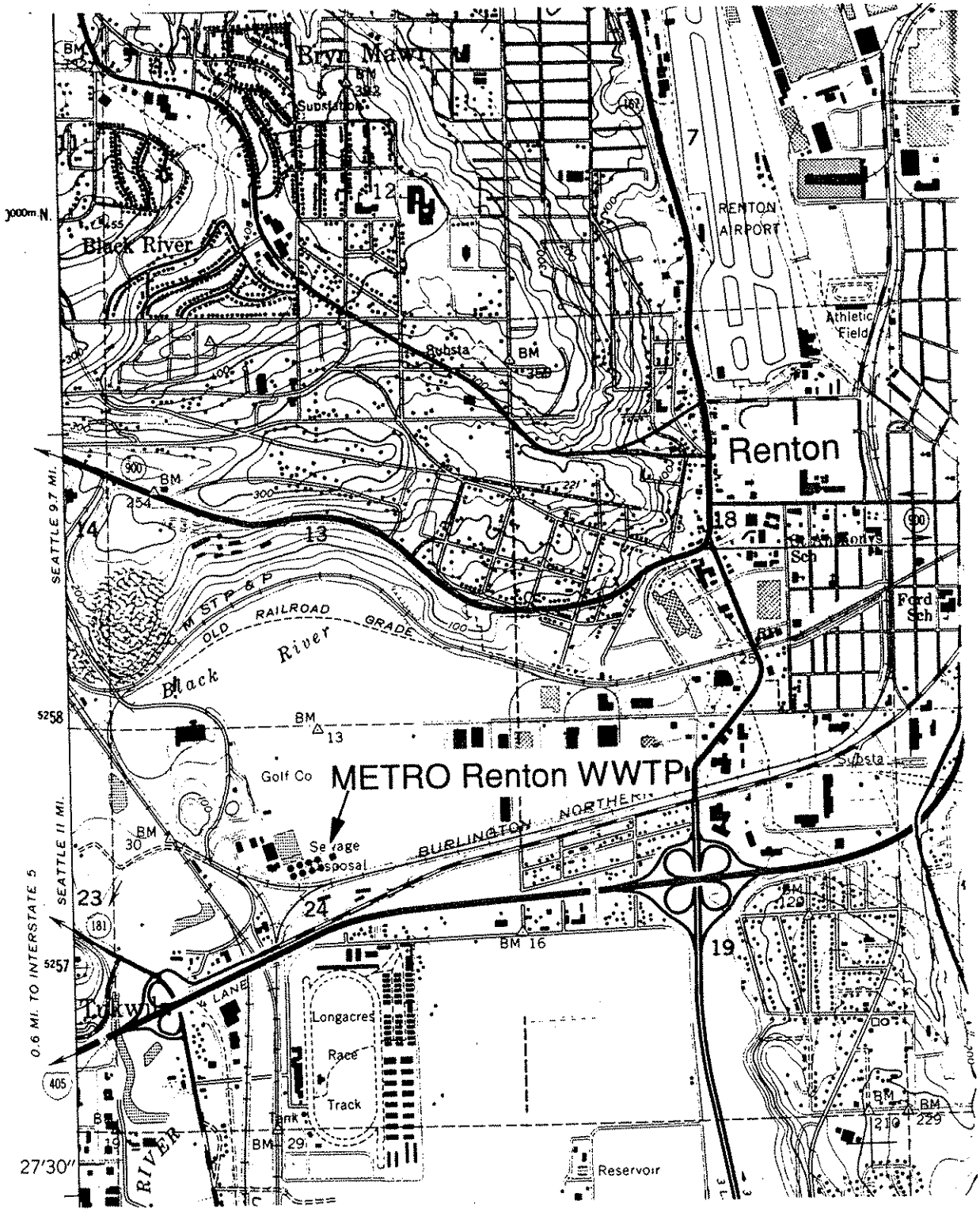

Figure 1 – Location Map – METRO Renton, January 1994.

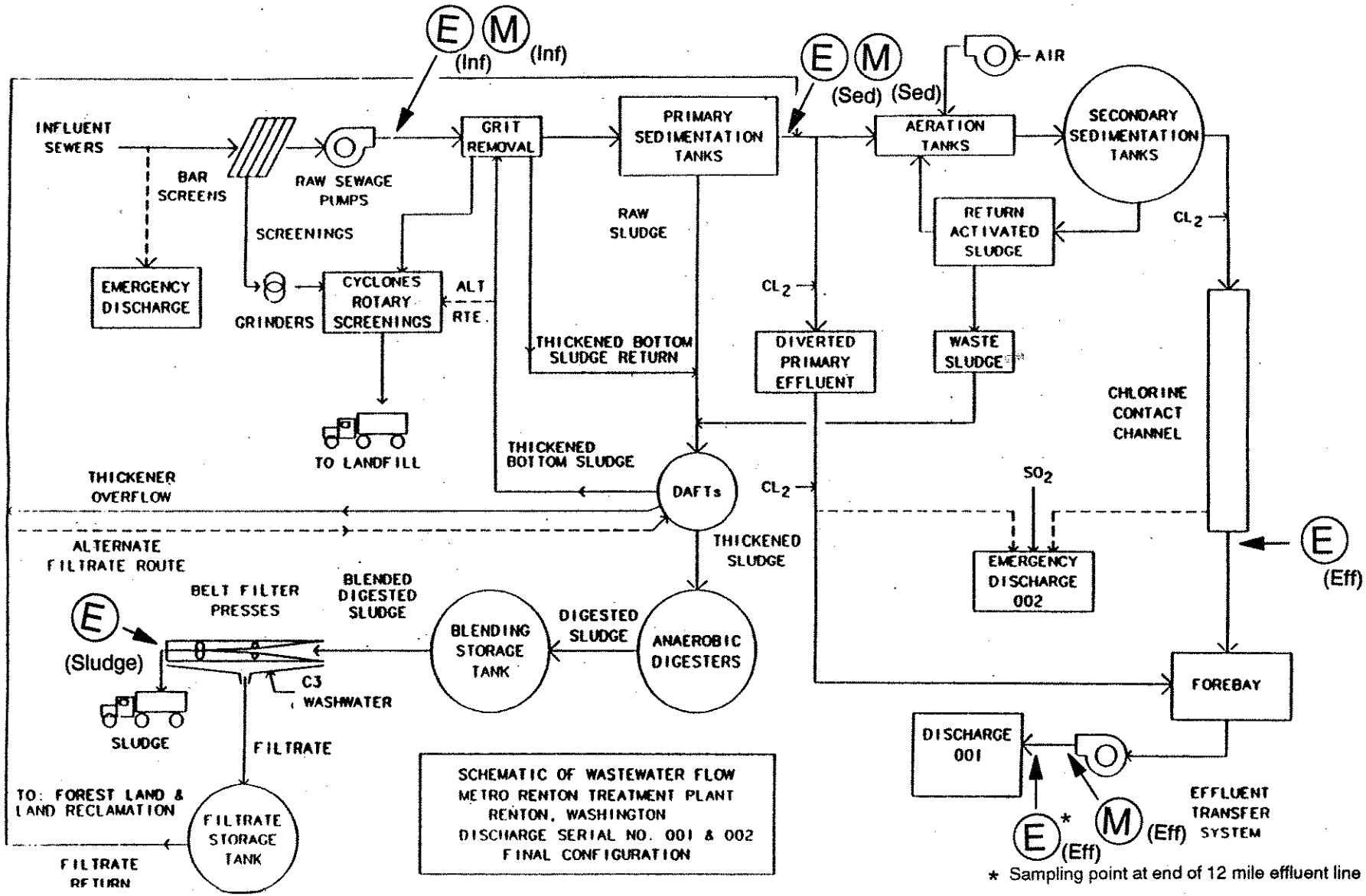

Figure 2 – Flow Schematic – METRO Renton, January 1994.

Table 1 - Sampling Station Descriptions - METRO Renton, January 1994.

Ecology and METRO Renton influent grab and composite samples (Inf-1, Inf-2, Inf-E, Inf-M)

Influent samples were collected from the pump discharge channel ("division channel") in a well mixed location 10 feet downstream of the influent pump discharge. The sampling location is upstream of all return flows including filtrate. (Several years ago filtrate was included in the influent sample.) Ecology and METRO compositor intakes were located two feet from the channel wall, one foot below the surface. The channel depth was approximately four feet.

Ecology and METRO Renton primary sedimentation tank grab and composite samples (Sed-1, Sed-2, Sed-E, Sed-M)

Primary sedimentation tank effluent samples were taken from the effluent channel dowstream of the primary sedimentation tanks. Ecology and METRO Renton compositor intakes were located in the middle of the channel in a well-mixed area one foot below the surface.

Ecology mixed liquor samples (Aer-1 and Aer-2)

Mixed liquor was collected as grab composite samples consisting of grab samples from each of the three aeration basins. The grabs were collected from sampling taps in the below ground gallery.

Ecology final effluent grab and composite samples (Eff-1, Eff-2, Eff-E)

Final effluent samples were taken just downstream of the overflow weir from the center of the chlorination channel. The compositor intake was placed two feet below the surface. Channel depth was greater than eight feet.

METRO Renton final effluent composite sample (Eff-M)

The METRO Renton compositor intake is located in the outfall line as the line leaves the WWTP.

Ecology outfall sample (Eff-GC, Eff-3, Eff-4)

Final effluent samples were taken from the effluent vault just upstream of the outfall, for samples in which chlorine removal or microbial population changes could occur during transport through the 12 mile long effluent line.

Ecology and METRO Renton sludge sample (Sludge)

Both Ecology and METRO Renton sampled sludge from the belt filter presses as a composite from the two belts.

Table 2 – General Chemistry Results – METRO Renton, January 1994.

Parameter	Location:	Inf–1	Inf–2	Inf–E	Inf–M	Sed–1	Sed–2	Sed–E	Sed–M	Aer–1	Aer–2	Eff–1	Eff–2
	Type:	grab	grab	comp	comp	grab	grab	comp	comp	grab–comp	grab–comp	grab	grab
	Date:	1/25	1/25	1/25–26	1/25–26	1/25	1/25	1/25–26	1/25–26	1/25	1/25	1/25	1/25
	Time:	1120	1450	0700–0700	0700–0700	1145	1550	0700–0700	0700–0700	1210	1430	0925	1630
	Lab Log #:	048230	048231	048232	048233	048234	048235	048236	048245	048246	048247	048237	048238
GENERAL CHEMISTRY													
Conductivity (umhos/cm)		551	581	542	516	512	564	540				573	555
Alkalinity (mg/L CaCO3)				175	167			173					
Hardness (mg/L CaCO3)													
TS (mg/L)				731	511			416	567	1780	1870		
TNVS (mg/L)				238	229			218	163	504	509		
TSS (mg/L)		244	267	253	243	83	90	95	104	1460	1440	9	8
TNVSS (mg/L)				47	43			15	17	270J	278J		
% Solids													
% Volatile Solids													
BOD5 (mg/L)				237	192			147	141				
COD (mg/L)				479	454			326					
TOC (water mg/L)		82.9	103	105	95.3	65.5	74.7	69.5	64.7			17.3	18.6
TOC (soil/sed %C)													
NH3–N (mg/L)				17.2	13.8			17.4					
NO2+NO3–N (mg/L)				0.016	1.20			0.012					
Total–P (mg/L)				5.65	5.41			4.43					
Oil and Grease (mg/L)												2	
F–Coliform MF (#/100mL)													
Fecal Coliform (sludge /100g)													
Total Coliform (sludge /100g)													
Cyanide total (mg/L)		0.006	0.020									<0.004	0.014
Cyanide (wk & dis mg/L)		0.005	<0.004									<0.004	0.010
FIELD OBSERVATIONS													
Temperature (C)		14.1	13.0			13.9	13.6			15.4		14.0	13.2
Temp–cooled (C)				2.0	*			2.5	*				
pH		6.8	6.9	6.7	7.0	7.1	7.2	6.8	6.9	7.1		7.3	7.1
Conductivity (umhos/cm)		557	596	583	544	526	587	577		579		595	580
Chlorine (mg/L)													
Free			<0.1									0.8	1.0
Total			<0.1									0.8	1.5
Sulfide (mg/L)			<0.1									0.0	0.0

Inf – influent
Sed – primary sedimentation tank effluent
Aer – aeration tank
Eff – final effluent
Sludge – sludge from belt filter presses

grab – grab sample
comp – composite sample
grab–comp – grab–composite sample

E – Ecology sample
M – METRO sample
J – The numerical result is an estimate.
LAC – laboratory accident

* – sample was removed before chilled temperature could be measured.
** – grab–composite sample taken as two grabs at1040 and 1410 on 1/26

Table 2 – (cont'd) – METRO Renton, January 1994.

Parameter	Location:	Eff–3	Eff–4	Eff–E	Eff–M	Eff–GC	Sludge
	Type:	grab	grab	comp	comp	grab–comp	grab
	Date:	1/26	1/26	1/25–26	1/25–26	1/25	1/25
	Time:	1040	1410	0700–0700	0700–0700	**	1415
	Lab Log #:	048242	048243	048239	048240	048241	048244
GENERAL CHEMISTRY							
Conductivity (umhos/cm)				567	559		
Alkalinity (mg/L CaCO3)				180	171	185	
Hardness (mg/L CaCO3)				80	85	78	
TS (mg/L)				291	296		
TNVS (mg/L)				202	207		
TSS (mg/L)				12	11	10	
TNVSS (mg/L)				LAC	2		
% Solids							19
% Volatile Solids							64
BOD5 (mg/L)				9	12		
COD (mg/L)				42.3	44.6		
TOC (water mg/L)				19.2	18.6		
TOC (soil/sed %C)							36.1J
NH3–N (mg/L)				19.5	18.9		
NO2+NO3–N (mg/L)				0.059	1.01		
Total–P (mg/L)				2.51	2.50		
Oil and Grease (mg/L)							
F–Coliform MF (#/100mL)		3	5				
Fecal Coliform (sludge /100g)							1,700,000
Total Coliform (sludge /100g)							16,000,000
Cyanide total (mg/L)							
Cyanide (wk & dis mg/L)							
FIELD OBSERVATIONS							
Temperature (C)				2.4	*		
Temp–cooled (C)				6.9	7.3		
pH				614	585		
Conductivity (umhos/cm)							
Chlorine (mg/L)							
Free		<0.04					
Total		<0.04					
Sulfide (mg/L)							

Inf – influent
Sed – primary sedimentation tank effluent
Aer – aeration tank
Eff – final effluent
Sludge – sludge from belt filter presses

grab – grab sample
comp – composite sample
grab–comp – grab–composite sample

E – Ecology sample
M – METRO sample
J – The numerical result is an estimate.
LAC – laboratory accident

* – sample was removed before chilled temperature could be measured.
** – grab–composite sample taken as two grabs at1040 and 1410 on 1/26

Table 3 – NPDES Permit Limits and Inspection Results – METRO Renton, January 1994.

	NPDES Limits*		Inspection Results	
Parameter	Monthly Average	Weekly Average	Composite Samples	Grab Samples
BOD5 (mg/L)	30	45	9	
lbs/day	22,768	34,152	4,793	
	85 % removal		96 % removal	
TSS (mg/L)	30	45	12	9; 8
lbs/day	22,768	34,152	6,390	
	85 % removal		95 % removal	
Fecal Coliform (#/100mL)	200	400		3; 5
pH	6.0 to 9.0 (continuous)			7.3, 7.1
	Daily Maximum	Monthly Average		
Cadmium (mg/L)	0.007	0.005	0.00015 (est.)	
lbs/day	5.3	3.8	0.080 (est.)	
Chromium Total (mg/L)	0.12	N/A	<0.005	
lbs/day	91	N/A	<2.66	
Copper (mg/L)	0.20	0.11	0.016 (est.)	
lbs/day	152	83	8.52 (est.)	
Lead (mg/L)	0.09	0.05	<0.0010 (est.)	
lbs/day	68.3	37.9	<0.53 (est.)	
Mercury (mg/L)	0.013	0.003	<0.000050	
lbs/day	10	2.3	<0.03	
Nickel (mg/L)	0.08	0.04	<0.010	
lbs/day	60.7	30.4	<5.33	
Zinc (mg/L)	0.15	0.05	0.037 (est.)	
lbs/day	113.8	37.9	19.7 (est.)	
Oil & Grease (mg/L)	15	10		2
	No visible sheen at any time			
Total Chlorine (mg/L)	1.9	0.725		<0.04
lbs/day	1442	550		<21.3
Flow	--	--	63.852 MGD**	

* limits apply to Puget Sound – Outfall 001

** 24 hour effluent flow measured by METRO Renton.

Table 4 – Split Sample Results Comparison – METRO Renton, January 1994.

Location:	Inf–E	Inf–M	Clar–E	Clar–M	Eff–E	Eff–M	Eff–3*	Eff–4*	Eff*
Type:	comp	comp	comp	comp	comp	comp	grab	grab	grab
Date:	1/25–26	1/25–26	1/25–26	1/25–26	1/25–26	1/25–26	1/25	1/25	2/1
Time:	0700–0700	0700–0700	0700–0700	0700–0700	0700–0700	0700–0700	1040	1410	1030
Lab Log #:	048232	048233	048236	048245	048239	048240	048242	048243	
Sampled by	Ecology	METRO	Ecology	METRO	Ecology	METRO	Ecology	Ecology	METRO
Parameter	Analysis by:								
BOD5 (mg/L)	Ecology	237	192	147	141	9	12		
	METRO	200	180	127	121	7	11		
TSS (mg/L)	Ecology	253	243	95	104	12	11		
	METRO	248	248	81	78	10	7		
VSS (mg/L)	Ecology	206	200	70	87	–	9		
	METRO	230	216	70	71	9	7		
F–coli (#/100mL)	Ecology							3; 5	
	METRO								3
Total Cl2 Residual (mg/L)	Ecology							<0.04	
	METRO							0.07	0.07
COD (mg/L)	Ecology	479	454	326	–	42	45		
	METRO	445	431	275	252	46	53		
Alkalinity (mg/L)	Ecology	175	167	173	–	180	171		
	METRO	160	155	–	–	175	165		
Hardness (mg/L)	Ecology	–	–	–	–	80	85		
	METRO	83	83	83	83	78	79		
Total–P (mg/L)	Ecology	5.7	5.4	4.4	–	2.5	2.5		
	METRO	6.0	5.7	4.4	4.5	2.6	2.6		

E – Ecology sample
M – Metro sample
Inf – influent
Clar – primary clarifier effluent
Eff – final effluent
grab – grab sample
comp – composite sample
* – at outfall structure just upstream of diffuser

Table 5 – Comparison of Organic Compounds and Metals Detected to Toxicity Criteria – METRO Renton, January 1994.

group	Location: / Type: / Date: / Time: / Lab Log#: / VOA Compounds	Inf–1 grab 1/25 1120 048230 µg/L	Inf–2 grab 1/25 1450 048231 µg/L	Eff–1 grab 1/25 0925 048237 µg/L	Eff–2 grab 1/25 1630 048238 µg/L	EPA/Ecology Water Quality Criteria Summary: Acute Marine (µg/L)	Chronic Marine (µg/L)
	Acetone	105	105				
a	Chloroform	3.5	4.7	2.4	2.2	12,000 *(a)	6,400 *(a)
c	1,1,1–Trichloroethane	0.42 J	1.2	0.10 J		31,200 *	
	Vinyl Chloride	0.32 J	0.32 J				
	Carbon Disulfide	1.4	3.1	0.093 J			
a	Bromodichloromethane	0.13 J	0.16 J	0.12 J	0.12 J	12,000 *(a)	6,400 *(a)
	2–Butanone (MEK)		23.8 J				
	Trichloroethene	1.1	1.6	0.11 J	0.15 J	2,000 *	
n	Naphthalene		2.9			2,350 *	
	o–Xylene	0.73 J	2.9				
	1,2,4–Trimethylbenzene	4.4					
	Isopropylbenzene	0.22 J	0.092 J				
	p–Isopropyltoluene	4.6	1.4				
	Ethylbenzene	0.34 J	1.6			430 *	
	Styrene		2.9				
	Propylbenzene	0.57 J	0.10 J				
h	1,4–Dichlorobenzene	2.4	1.7	1.2	2.9	1,970 *(h)	
	m–Xylene	1.5 J	7.3				
	1,3,5–Trimethylbenzene	2.3	0.39 J				
	Toluene	9.9 J	2.8 J	0.38 J	0.31 J	6,300 *	5,000 *
	Tetrachloroethene	1.7	4.1	0.24 J	0.29 J	10,200 *	450 *
b	cis–1,2–Dichloroethene	5.1	4.5	0.35 J	0.58 J	224,000 *(b)	
	Total Xylenes	2.2 J	10.2				

	Location: / Type: / Date: / Time: / Lab Log#: / BNA Compounds	Inf–E comp 1/25–26 0700–0700 048232 µg/L	Eff–E comp 1/25–26 0700–0700 048239 µg/L	EPA/Ecology Water Quality Criteria Summary: Acute Marine (µg/L)	Chronic Marine (µg/L)
	Phenol	3 J		5,800 *	
	Benzyl Alcohol	18 J			
	4–Methylphenol	15			
	Benzoic Acid	41			
i	Diethyl Phthalate	4.8		2.944 *(i)	3.4 *(i)
i	Di–n–Butyl Phthalate	8.3		2.944 *(i)	3.4 *(i)
i	Butylbenzyl Phthalate	3.1		2.944 *(i)	3.4 *(i)
i	Bis(2–Ethylhexyl)Phthalate		1.4	2.944 *(i)	3.4 *(i)

Pesticide/PCB Compounds

(none detected)

Table 5 – (cont'd) – METRO Renton, January 1994.

Location:	Inf–E	Eff–E	Eff–M	EPA/Ecology Water Quality Criteria Summary	
Type:	comp	comp	comp		
Date:	1/25–26	1/25–26	1/25–26	Acute	Chronic
Time:	0700–0700	0700–0700	0700–0700	Marine	Marine
Lab Log#:	048232	048239	48240		
Metals	µg/L	µg/L	µg/L	(µg/L)	(µg/L)
Antimony					
Arsenic	1.8 J	1.6 J		2,319*	13*
Pentavalent				69	36
Trivalent					
Beryllium					
Cadmium	0.75 J	0.15 J	0.15 J	37.2	8.0
Chromium					
Hexavalent				1,100	50
Trivalent				10,300*	
Copper	107	16 P	20 P	2.5	
Lead	9.3 J			151	5.8
Mercury	0.33 P			2.1	0.025
Nickel				71	7.9
Selenium				300	
Silver		0.90 J	0.86 J	1.2	
Thallium				2,130*	
Zinc	114	37 P	36 P	85	77

NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISCUSSION.

J The analyte was positively identified. The associated numerical result is an estimate.

P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

* Insufficient data to develop criteria. .Value presented is the LOEL – Lowest Observed Effect Level.

Inf – influent sample
Eff– effluent sample
E – Ecology sample
M – METRO sample
grab – grab sample
comp – composite sample

[ ] – acute or chronic criteria exceeded

a Total Halomethanes
b Total Dichloroethenes
h Total Dichlorobenzenes
i Total Phthalate Esters

Table 6 – Effluent Bioassay Results – METRO Renton, January 1994.

Microtox — EC50 (% Effluent)

Sample	Sample No.	5 minutes	15 minutes	30 minutes
Eff-GC	048241	55.4**	84.8**	114.9**

** – extrapolated EC50

Daphnia magna – 48-hour survival test
(Daphnia magna)
Sample No. 048241

Sample Concentration	# Tested*	Percent Survival
0% Effluent	20	100
6.25% effluent	20	100
12.5% effluent	20	100
25% effluent	20	100
50% effluent	20	100
100% effluent	20	100

NOEC = 100% effluent
LC50 > 100% effluent

* four replicates per concentration, five organisms per replicate

Ceriodaphnia dubia – 6-day survival/reproduction test
(Ceriodaphnia dubia)
Sample No. 168144

Sample Conc.	# Tested*	# Young Produced/Adult	Percent Survival
0% effluent	10	19.9	100
6.25% effluent	10	19.8	100
12.5% effluent	10	21.1	100
25% effluent	10	18.3	100
50% effluent	10	12.8	100
100% effluent	10	0.0	0

Reproduction
NOEC = 25% Effluent

Survival
NOEC = 50% Effluent
LC50 = 71% Effluent

* Ten replicates per concentration, one organism per replicate

Table 6 – (cont'd) – METRO Renton, January 1994.

Fathead Minnow – 7 day survival and growth test
(Pimephales promelas)
Sample No. 048241

Sample Conc.	# Tested*	Percent Survival	Average Dry Weight (mg)
Control	40	97.5	0.33
6.25% Effluent	40	97.5	0.36
12.5% Effluent	40	92.5	0.32
25% Effluent	40	97.5	0.33
50% Effluent	40	67.5	0.29
100% Effluent	40	0.0	

NOEC for Weight = 50%
NOEC for Survival = 50% effluent
LC50 = 54% effluent

* four replicates per concentration, ten organisms per replicate

Rainbow Trout – 96 hour survival test
(Oncorhynchus mykiss)
Sample No. 048241

Sample Conc.	Number Tested*	Percent Survival
Control	30	100
6.25% Effluent	30	97
12.5% Effluent	30	100
25% Effluent	30	100
50% Effluent	30	100
100% Effluent	30	50

NOEC for Survival = 50% effluent
LC50 = 100% effluent

* three replicates per concentration, ten organisms per replicate

Table 7 – Sludge VOA, BNA/Pesticide Compounds and Metals Detected – METRO Renton, January 1994.

Location:	Sludge
Type:	grab
Date:	1/25
Time:	1415
Lab Log#:	048244

VOA Compounds	µg/Kg-dr	
Acetone	2140	EJ
Chloroform	2.6	J
Benzene	6.6	J
Carbon Disulfide	172	
2-Butanone (MEK)	1560	
Naphthalene	73.7	
o-Xylene	38.2	J
1,2-Dichlorobenzene	13.2	J
1,2,4-Trimethylbenzene	299	
Isopropylbenzene	32.6	J
Ethylbenzene	45.4	J
Styrene	3.8	J
Butylbenzene	82.2	
1,4-Dichlorobenzene	1040	
1,3,5-Trimethylbenzene	114	
Toluene	69.2	
Chlorobenzene	78.2	
Tetrachloroethene	1.0	J
sec-Butylbenzene	50.1	J
cis-1,2-Dichloroethene	3.9	J
1,3-Dichlorobenzene	989	
Total Xylenes	82	J
m p-Xylene	43.8	J

	Sludge
	grab
	1/25
	1415
	048244

BNA Compounds	µg/Kg-dr	
Phenol	12,000	J
1,4-Dichlorobenzene	1,900	J
4-Methylphenol	1,200	J
Naphthalene	380	J
2-Methylnaphthalene	1,200	J
Phenanthrene	880	J
Fluoranthene	570	J
Pyrene	770	J
Bis(2-Ethylhexyl)Phthalate	72,000	J

Pesticide/PCB Compounds

(none detected)

Metals	mg/Kg-dr		EPA Sludge Application Limits mg/Kg-dr	EPA Ceiling Concentrations mg/Kg-dr
Arsenic	4.26	N	41	75
Beryllium	0.19	P		
Cadmium	6.77	N	39	85
Chromium	50.4	N	1200	3000
Copper	870		1500	4300
Lead	80.8	N	300	840
Mercury	0.16	N	17	57
Nickel	25.1		420	420
Selenium	5.53	N	36	100
Silver	63.8			
Zinc	770		2800	7500

Sludge - sludge sample
grab - grab sample

E - The reported result is an estimate because of the presence of interference.
J - The analyte was positively identified. The associated numerical result is an estimate.
N - The spike sample recovery is not within control limits.
P - The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

Appendices

Appendix A - Sampling Procedures - METRO Renton - January 1994.

All METRO composite samples are collected for a 24-hour period from 7 a.m. to 7 a.m. Samples are collected on a flow-proportioned basis. Return flows and process streams are sampled as well as influent and effluent. Sample collection bottles are refrigerated during collection. METRO reports that all samplers are cleaned at least once per week.

The effluent sampling line (in the plant outfall line) is cleaned periodically by rinsing for one half hour. METRO reported that the line had not been cleaned for a few months.

All Ecology Isco samplers were set up to collect equal volumes of sample every 30 minutes for 24 hours. All samplers were set to collect samples from 7 a.m. to 7 a.m. to coincide with METRO sampler collection times. All composite samplers were iced to keep samples cool. Grab samples were collected with priority pollutant cleaned sampling equipment (see Appendix E). Sampler configurations and locations are summarized in Figure 2 and Table 1.

Sludge is sampled as a grab sample, composited from the two belts carrying dried sludge from the eight belt filter presses. Ecology grab sludge samples were collected with priority pollutant cleaned equipment and containers.

Appendix B – Sampling Schedule – METRO Renton, January 1994.

Parameter	Location:	Inf–1	Inf–2	Inf–E	Inf–M	Sed–1	Sed–2	Sed–E	Sed–M	Aer–1	Aer–2	Eff–1	Eff–2
	Type:	grab	grab	comp	comp	grab	grab	comp	comp	grab	grab	grab	grab
	Date:	1/25	1/25	1/25–26	1/25–26	1/25	1/25	1/25–26	1/25–26	1/25	1/25	1/25	1/25
	Time:	1120	1450	00–0700	00–0700	1145	1550	0700–0700	0700–0700	1210	1430	0925	1630
	Lab Log #:	048230	048231	048232	048233	048234	048235	048236	048245	048246	048247	048237	048238
GENERAL CHEMISTRY													
Conductivity (umhos/cm)		E	E	E	E	E	E	E				E	E
Alkalinity (mg/L CaCO3)				EM	EM			E					
Hardness (mg/L CaCO3)				M	M			M	M				
TS (mg/L)				E	E			E	E	E	E		
TNVS (mg/L)				E	E			E	E	E	E		
TSS (mg/L)		E	E	EM	EM	E	E	EM	EM	E	E	E	E
TNVSS (mg/L)				E	E			E	E	E	E		
% Solids													
% Volatile Solids													
BOD5 (mg/L)				EM	EM			EM	EM				
COD (mg/L)				EM	EM			EM	M				
TOC (water mg/L)		E	E	E	E	E	E	E	E			E	E
TOC (soil/sed %C)													
NH3–N (mg/L)				E	E			E					
NO2+NO3–N (mg/L)				E	E			E					
Total–P (mg/L)				EM	EM			EM	M				
Oil and Grease (mg/L)												E	
F–Coliform MF (#/100mL)													
Fecal Coliform (sediment)													
Total Coliform (sediment)													
Cyanide total (mg/L)		E	E									E	E
Cyanide (wk & dis mg/L)		E	E									E	E
FIELD OBSERVATIONS													
Temperature (C)		E	E			E	E			E		E	E
Temp–cooled (C)*+				E	E			E	E				
pH		E	E	E	E	E	E	E	E	E		E	E
Conductivity (umhos/cm)		E	E	E	E	E	E	E		E		E	E
Chlorine (mg/L)													
Free			E									E	E
Total			E									E	E
Sulfide (mg/L)			E									E	E

Inf – influent
Clar – from primary clarifier
Sed – primary sedimentation tank effluent
Eff – final effluent
Sludge – sludge from belt filter presses

E – Ecology analysis
M – METRO analysis

grab – grab sample
comp – composite sample
grab–comp – grab–composite sample
* – grab–composite consists of two grab samples taken 1/25

Appendix B – (cont'd) – METRO Renton, January 1994.

Parameter	Location:	Eff–3	Eff–4	Eff–E	Eff–M	Eff–GC	Sludge
	Type:	grab	grab	comp	comp	grab–comp	grab
	Date:	1/26	1/26	1/25–26	1/25–26	1/25	1/25
	Time:	1040	1410	0700–0700	0700–0700	*	1415
	Lab Log #:	048242	048243	048239	048240	048241	048244
GENERAL CHEMISTRY							
Conductivity (umhos/cm)				E	E		
Alkalinity (mg/L CaCO3)				EM	EM	E	
Hardness (mg/L CaCO3)				EM	EM	E	
TS (mg/L)				E	E		
TNVS (mg/L)				E	E		
TSS (mg/L)				EM	EM	E	
TNVSS (mg/L)				E	E		
% Solids							E
% Volatile Solids							E
BOD5 (mg/L)				EM	EM		
COD (mg/L)				EM	EM		
TOC (water mg/L)				E	E		
TOC (soil/sed %C)							E
NH3–N (mg/L)				E	E		
NO2+NO3–N (mg/L)				E	E		
Total–P (mg/L)				EM	EM		
Oil and Grease (mg/L)							
F–Coliform MF (#/100mL)		E	E				
Fecal Coliform (sediment)							E
Total Coliform (sediment)							E
Cyanide total (mg/L)							
Cyanide (wk & dis mg/L)							
FIELD OBSERVATIONS							
Temperature (C)							
Temp–cooled (C)*+				E	E		
pH				E	E		
Conductivity (umhos/cm)				E	E		
Chlorine (mg/L)		EM	EM				
Free						E	
Total						E	
Sulfide (mg/L)							

Inf – influent
Clar – from primary clarifier
Sed – primary sedimentation tank effluent
Eff – final effluent
Sludge – sludge from belt filter presses

E – Ecology analysis
M – METRO analysis

grab – grab sample
comp – composite sample
grab–comp – grab–composite sample
* – grab–composite consists of two grab samples taken 1/25

Appendix C – Ecology Analytical Methods – METRO Renton, January 1994.

Laboratory Analysis	Method Used for Ecology Analysis	Laboratory Performing Analysis
Conductivity	EPA, Revised 1983: 120.1	Ecology Manchester Laboratory
Alkalinity	EPA, Revised 1983: 310.1	Ecology Manchester Laboratory
Hardness	EPA, Revised 1983: 130.2	Ecology Manchester Laboratory
TS	EPA, Revised 1983: 160.3	Ecology Manchester Laboratory
TNVS	EPA, Revised 1983: 160.3	Ecology Manchester Laboratory
TSS	EPA, Revised 1983: 160.2	Ecology Manchester Laboratory
TNVSS	EPA, Revised 1983: 160.2	Ecology Manchester Laboratory
% Solids	APHA, 1989: 2540G.	Ecology Manchester Laboratory
% Volatile Solids	EPA, Revised 1983: 160.4	Ecology Manchester Laboratory
BOD5	EPA, Revised 1983: 405.1	Ecology Manchester Laboratory
COD	EPA, Revised 1983: 410.1	Analytical Resources, Inc.
TOC (water)	EPA, Revised 1983: 415.1	Ecology Manchester Laboratory
TOC (soil/sed)	EPA, Revised 1983: 415.1	Analytical Resources, Inc.
NH3–N	EPA, Revised 1983: 350.1	Ecology Manchester Laboratory
NO2+NO3–N	EPA, Revised 1983: 353.2	Ecology Manchester Laboratory
Total–P	EPA, Revised 1983: 365.3	Ecology Manchester Laboratory
Oil and Grease (water)	EPA, Revised 1983: 413.1	Ecology Manchester Laboratory
F–Coliform MF	APHA, 1992: 9222D.	Ecology Manchester Laboratory
F–Coliform (soil/sed)	APHA, 1989: 9221A.	Ecology Manchester Laboratory
T–Coliform (soil/sed)	APHA, 1989: 9221A.	Ecology Manchester Laboratory
Cyanide total	EPA, Revised 1983: 335.2	Analytical Resources, Inc.
Cyanide (wk & dis)	APHA, 1992: 4500–CNI.	Analytical Resources, Inc.
VOC (water)	EPA, 1986: 8260	Ecology Manchester Laboratory
VOC (soil/sed)	EPA, 1986: 8240	Ecology Manchester Laboratory
BNAs (water)	EPA, 1986: 8270	Analytica Resources, Inc.
BNAs (soil/sed)	EPA, 1986: 8270	Analytica Resources, Inc.
Pest/PCB (water)	EPA, 1986: 8080	Analytical Resources Inc.
Pest/PCB (soil/sed)	EPA, 1986: 8080	Analytical Resources Inc.
PP Metals	EPA, Revised 1983: 200–299	Ecology Manchester Laboratory
Salmonid (acute 100%)	EPA, 1991.	Parametrix, Inc.
Microtox (acute)	Beckman, 1982.	Ecology Manchester Laboratory
Daphnia magna (acute)	EPA, 1991.	Ecology Manchester Laboratory
Ceriodaphnia (chronic)	EPA, 1989: 1002.0	Parametrix, Inc.
Fathead Minnow (chronic)	EPA, 1989.	Parametrix, Inc.

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Appendix D - Quality Assurance/Quality Control (QA/QC) - METRO Renton, 1994.

SAMPLING QA/QC

Ecology quality assurance procedures for sampling included priority pollutant cleaning the sampling equipment prior to the inspection to prevent sample contamination (Appendix E).

Chain of custody procedures were followed to assure the security of the samples (Huntamer and Hyre, 1991).

LABORATORY QA/QC

Analysis

Most Ecology laboratory data met Ecology QA/QC guidelines and are considered to be reliable. Those data that did not meet the guidelines are appropriately qualified on the data tables. Problems with specific tests are discussed in the following paragraphs.

General Chemistry Analysis

TOC matrix spike recoveries for sample 048244 exceeded the QC limits of 75% and 125%. This was most likely due to the dilutions necessary to obtain a result within the calibration range. The TOC result for this sample has been qualified with a "J" to indicate a possible high bias. Other general chemistry results were acceptable.

VOA Analysis

Low levels of the common laboratory solvents acetone and methylene chloride were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Surrogate recoveries and holding times were within acceptable limits. Matrix spikes were acceptable for QC limits for all compounds except 2-butanone and 2-hexanone. These two compounds were not recovered in the matrix spike and results are qualified with a REJ (rejected). The one exception was in sample 048230 where 2-butanone was detected in the sample and qualified with a J (estimate).

BNA Analysis

Samples were analyzed within recommended holding times with the exception of sample 048244 which was re-extracted thirty-four days past the recommended holding time of fourteen days. The result is qualified with a J. Method blanks, GC/MS tuning and calibration, blank spikes, and surrogates were acceptable.

Metals Analysis

Holding times, instrument calibration, procedural blanks, and precision data were acceptable. All spike recoveries were within acceptance limits with the exception of the elements

analyzed by GFAA. An apparent spiking error associated with the QA samples caused one spike to be high and precision to be out of control. The affected results are qualified with a J.

LABORATORY AUDIT

The PTPC laboratory was accredited by Ecology on July 1, 1992. The accreditation was renewed on September 1, 1994.

Appendix E - Priority Pollutant Cleaning Procedures - METRO Renton, January 1994.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO3 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

Appendix F – VOA, BNA, Pesticide/PCB and Metals Scan Results – METRO Renton, January 1994.

Location:	Inf–1	Inf–2	Eff–1	Eff–2	Sludge
Type:	grab	grab	grab	grab	grab
Date:	1/25	1/25	1/25	1/25	1/25
Time:	1120	1450	0925	1630	1415
Lab Log#:	048230	048231	048237	048238	048244
VOA Compounds	µg/L	µg/L	µg/L	µg/L	µg/kg–dr
Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Acetone	105	105	5.5 UJ	6.8 UJ	2140 EJ
Chloroform	3.5	4.7	2.4	2.2	2.6 J
Benzene	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	6.6 J
1,1,1–Trichloroethane	0.42 J	1.2	0.10 J	1.0 U	50.1 U
Bromomethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Chloromethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Dibromomethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Bromochloromethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Chloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Vinyl Chloride	0.32 J	0.32 J	1.0 U	1.0 U	50.1 U
Methylene Chloride	5.1 UJ	3.6 UJ	3.5 UJ	1.8 UJ	50.1 UJ
Carbon Disulfide	1.4	3.1	0.093 J	1.0 U	172
Bromoform	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	50.1 U
Bromodichloromethane	0.13 J	0.16 J	0.12 J	0.12 J	50.1 U
1,1–Dichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,1–Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Trichlorofluoromethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Dichlorodifluoromethane	1.0 U	1.0 U	1.0 U	1.0 U	25.0 U
1,2–Dichloropropane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
2–Butanone (MEK)	REJ	23.8 J	REJ	REJ	1560
1,1,2–Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Trichloroethene	1.1	1.6	0.11 J	0.15 J	50.1 U
1,1,2,2–Tetrachloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,2,3–Trichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Hexachlorobutadiene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Naphthalene	1.2 UJ	2.9	2.0 U	2.0 U	73.7
o–Xylene	0.73 J	2.9	1.0 U	1.0 U	38.2 J
2–Chlorotoluene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,2–Dichlorobenzene	1.0 UJ	1.0 UJ	1.0 U	1.0 U	13.2 J
1,2,4–Trimethylbenzene	4.4	1.1	1.0 U	1.0 U	299
1,2–Dibromo–3–Chloropropane (DB	2.0 U	2.0 U	2.0 U	2.0 U	50.1 U
1,2,3–Trichloropropane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
tert–Butylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Isopropylbenzene	0.22 J	0.092 J	1.0 U	1.0 U	32.6 J
p–Isopropyltoluene	4.6	1.4	1.0 U	1.0 U	50.1 U
Ethylbenzene	0.34 J	1.6	1.0 U	1.0 U	46.4 J
Styrene	1.0 U	2.9	1.0 U	1.0 U	3.8 J
Propylbenzene	0.57 J	0.10 J	1.0 U	1.0 U	50.1 U
Butylbenzene	1.0 U	1.0 UJ	1.0 U	1.0 U	82.2
4–Chlorotoluene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,4–Dichlorobenzene	2.4	1.7	1.2	2.9	1040
1,2–Dibromoethane (EDB)	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,2–Dichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
4–Methyl–2–Pentanone (MIBK)	20.0 U	20.0 U	20.0 U	20.0 U	50.1 U
m–Xylene	1.5 J	7.3	2.0 U	2.0 U	
1,3,5–Trimethylbenzene	2.3	0.39 J	1.0 U	1.0 U	114

Appendix F – (cont'd) – METRO Renton, January 1994.

Location:	Inf–1	Inf–2	Eff–1	Eff–2	Sludge
Type:	grab	grab	grab	grab	grab
Date:	1/25	1/25	1/25	1/25	1/25
Time:	1120	1450	0925	1630	1415
Lab Log#:	048230	048231	048237	048238	048244
VOA Compounds (cont'd)	µg/L	µg/L	µg/L	µg/L	µg/kg–dr
Bromobenzene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Toluene	9.9 J	2.3 J	0.38 J	0.31 J	69.2
Chlorobenzene	1.0 U	1.0 U	1.0 UJ	1.0 U	78.2
1,2,4–Trichlorobenzene	2.0 U	2.0 U	2.0 U	2.0 U	50.1 U
Dibromochloromethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Tetrachloroethene	1.7	4.1	0.24 J	0.29 J	1.0 J
sec–Butylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 J
1,3–Dichloropropane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
cis–1,2–Dichloroethene	5.1	4.5	0.35 J	0.58 J	3.9 J
trans–1,2–Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,3–Dichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	989
1,1–Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
2–Hexanone	REJ	REJ	REJ	REJ	50.1 U
2,2–Dichloropropane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
1,1,1,2–Tetrachloroethane	1.0 U	1.0 U	1.0 U	1.0 U	50.1 U
Total Xylenes	2.2 J	10.2	3.0 U	3.0 U	82 J
m&p–Xylene					43.8 J
cis–1,3–Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U	53.1 U
trans–1,3–Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U	47.1 U

Appendix F – (cont'd) – METRO Renton, January 1994.

Location:	Inf-E	Eff-E	Sludge
Type:	comp	comp	grab
Date:	1/25-26	1/25-26	1/25
Time:	0700-0700	0700-0700	1415
Lab Log#:	048232	048239	048244
BNA Compounds	µg/L	µg/L	µg/kg-dr
Phenol	3 J	2.0 U	12,000 J
Bis(2-Chloroethyl)Ether	2.0 U	1.0 U	310 UJ
2-Chlorophenol	2.0 U	1.0 U	310 UJ
1,3-Dichlorobenzene	2.0 U	1.0 U	310 UJ
1,4-Dichlorobenzene	2.0 U	1.0 U	1,900 J
Benzyl Alcohol	18 J	5.0 UJ	1,500 UJ
1,2-Dichlorobenzene	2.0 U	1.0 U	310 UJ
2-Methylphenol	2.0 U	1.0 U	310 UJ
2,2-Oxybis (1-Chloropropane)	2.0 U	1.0 U	310 UJ
4-Methylphenol	15	1.0 U	1,200 J
N-Nitroso-di-n-Propylamine	2.0 U	1.0 U	310 UJ
Hexachloroethane	4.0 U	2.0 U	620 UJ
Nitrobenzene	2.0 U	1.0 U	310 UJ
Isophorone	2.0 U	1.0 U	310 UJ
2-Nitrophenol	10 U	5.0 U	1,500 UJ
2,4-Dimethylphenol	4.0 U	2.0 U	620 UJ
Benzoic Acid	41	10 U	3,100 UJ
Bis(2-Chloroethoxy)Methane	2.0 U	1.0 U	310 UJ
2,4-Dichlorophenol	6.0 U	3.0 U	920 UJ
1,2,4-Trichlorobenzene	2.0 U	1.0 U	310 UJ
Naphthalene	2.0 U	1.0 U	380 J
4-Chloroaniline	6.0 U	3.0 U	920 UJ
Hexachlorobutadiene	4.0 U	2.0 U	620 UJ
4-Chloro-3-Methylphenol	4.0 U	2.0 U	620 UJ
2-Methylnaphthalene	2.0 U	1.0 U	1,200 J
Hexachlorocyclopentadiene	10 UJ	5.0 UJ	1,500 UJ
2,4,6-Trichlorophenol	10 U	5.0 U	1,500 UJ
2,4,5-Trichlorophenol	10 U	5.0 U	1,500 UJ
2-Chloronaphthalene	2.0 U	1.0 U	310 UJ
2-Nitroaniline	10 U	5.0 U	1,500 UJ
Dimethyl Phthalate	2.0 U	1.0 U	310 UJ
Acenaphthylene	2.0 U	1.0 U	310 UJ
3-Nitroaniline	10 UJ	5.0 UJ	1500 UJ
Acenaphthene	2.0 U	1.0 U	310 UJ
2,4-Dinitrophenol	20 U	10 U	3,100 UJ
4-Nitrophenol	10 UJ	5.0 UJ	1,500 UJ
Dibenzofuran	2.0 U	1.0 U	310 UJ
2,6-Dinitrotoluene	10 U	5.0 U	1,500 UJ
2,4-Dinitrotoluene	10 U	5.0 U	1,500 UJ
Diethyl Phthalate	4.8	1.0 U	310 UJ
4-Chlorophenyl Phenylether	2.0 U	1.0 U	310 UJ
Fluorene	2.0 U	1.0 U	310 UJ
4-Nitroaniline	10 U	5.0 U	1,500 UJ
4,6-Dinitro-2-Methylphenol	20 U	10 U	3,100 UJ
N-Nitrosodiphenylamine	2.0 U	1.0 U	310 UJ
4-Bromophenyl Phenylether	2.0 U	1.0 U	310 UJ
Hexachlorobenzene	2.0 U	1.0 U	310 UJ
Pentachlorophenol	10 U	5.0 U	1,500 UJ
Phenanthrene	2.0 U	1.0 U	880 J

Appendix F – (cont'd) – METRO Renton, January 1994.

Location:	Inf–E	Eff–E	Sludge
Type:	comp	comp	grab
Date:	1/25–26	1/25–26	1/25
Time:	0700–0700	0700–0700	1415
Lab Log#:	048232	048239	048244
BNA Compounds (cont'd)	µg/L	µg/L	µg/kg–dr
Carbazole	2.0 U	1.0 U	310 UJ
Anthracene	2.0 U	1.0 U	310 UJ
Di–n–Butyl Phthalate	8.3	1.0 U	310 UJ
Fluoranthene	2.0 U	1.0 U	570 J
Pyrene	2.0 U	1.0 U	770 J
Butylbenzyl Phthalate	3.1	1.0 U	310 UJ
3,3'–Dichlorobenzidine	10 U	5.0 U	1,500 UJ
Benzo(a)Anthracene	2.0 U	1.0 U	310 UJ
Bis(2–Ethylhexyl)Phthalate	15	1.4	72,000 J
Chrysene	2.0 U	1.0 U	310 U
Di–n–Octyl Phthalate	2.0 U	1.0 U	310 U
Benzo(b)Fluoranthene	2.0 U	1.0 U	310 U
Benzo(k)Fluoranthene	2.0 U	1.0 U	310 U
Benzo(a)Pyrene	2.0 U	1.0 U	310 U
Indeno(1,2,3–cd)Pyrene	2.0 U	1.0 U	310 U
Dibenzo(a,h)Anthracene	2.0 U	1.0 U	310 U
Benzo(g,h,i)Perylene	2.0 U	1.0 U	310 U

Appendix F – (cont'd) – METRO Renton, January 1994.

Location:	Inf-E		Eff-E		Sludge	
Type:	comp		comp		grab	
Date:	1/25-26		1/25-26		1/25	
Time:	0700-0700		0700-0700		1415	
Lab Log#:	048232		048239		048244	
Pesticide/PCB Compounds	µg/L		µg/L		µg/kg-dr	
alpha-BHC	0.050	U	0.050	U	18	UJ
beta-BHC	0.050	U	0.050	U	18	UJ
delta-BHC	0.090	U	0.050	U	70	UJ
gamma-BHC (Lindane)	0.050	U	0.050	U	18	UJ
Heptachlor	0.050	U	0.050	U	24	UJ
Aldrin	0.050	UJ	0.050	U	18	U
Heptachlor Epoxide	0.050	UJ	0.050	U	18	U
Endosulfan I	0.050	UJ	0.050	U	18	U
Dieldrin	0.10	UJ	0.10	U	35	U
4,4'-DDE	0.10	UJ	0.10	U	35	U
Endrin	0.10	UJ	0.10	U	35	U
Endosulfan II	0.10	UJ	0.10	U	35	U
4,4'-DDD	0.10	UJ	0.10	U	35	U
Endosulfan Sulfate	0.10	UJ	0.10	U	35	U
4,4'-DDT	0.10	UJ	0.10	U	35	U
Methoxychlor	0.50	UJ	0.50	U	180	U
Endrin ketone	0.10	UJ	0.10	U	35	U
Endrin aldehyde	0.10	UJ	0.10	U	35	U
alpha-Chlordane	0.050	UJ	0.050	U	38	U
gamma-Chlordane	0.050	UJ	0.050	U	45	U
Toxaphene	5.0	UJ	5.0	U	1800	U
Aroclor-1016	1.0	UJ	1.0	U	350	U
Aroclor-1221	2.0	UJ	2.0	U	710	U
Aroclor-1232	1.0	UJ	1.0	U	350	U
Aroclor-1242	1.0	UJ	1.0	U	350	U
Aroclor-1248	1.0	UJ	1.0	U	350	U
Aroclor-1254	1.0	UJ	1.0	U	350	U
Aroclor-1260	1.0	UJ	1.0	U	350	U

Appendix F – (cont'd) – METRO Renton, January 1994.

Location:				
Type:	Inf–E	Eff–E	Eff–M	Sludge
Date:	comp	comp	comp	grab
Time:	1/25–26	1/25–26	1/25–26	1/25
Lab Log#:	0700–0700	0700–0700	0700–0700	1415
	048232	048239	48240	048244
Metals	µg/L	µg/L	µg/L	µg/kg–dr
Antimony	30 U	30 U	30 U	3 UJ
Arsenic	1.8 J	1.6 J	1.5 UJ	4.26 N
Beryllium	1 U	1 U	1 U	0.19 P
Cadmium	0.75 J	0.15 J	0.15 J	6.77 N
Chromium	5 U	5 U	5 U	50.4 N
Hexavalent				
Trivalent				
Copper	107	16 P	20 P	870
Lead	9.3 J	1.0 UN	1.0 UN	80.8 N
Mercury	0.33 P	0.05 U	0.05 U	0.16 N
Nickel	10 U	10 U	10 U	25.1
Selenium	2.0 UJ	2.0 UJ	2.0 UJ	5.53 N
Silver	0.5 UJ	0.90 J	0.86 J	63.8
Thallium	2.5 UJ	2.5 UJ	2.5 UJ	0.5 UN
Zinc	114	37 P	36 P	770

E – Ecology sample
M – METRO sample
Inf – influent sample
Eff – effluent sample
Sludge – sludge sample
grab – grab sample
comp – composite sample

U – The analyte was not detected at or above the reported result.
UJ – The analyte was not detected at or above the reported estimated result.
J – The analyte was positively identified. The associated numerical result is an estimate.
B – Analyte was found in the analytical method blank, indicating the sample may have been contaminated.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
N – The spike sample recovery is not within control limits.
UN – The analyte was not detected at or above the reported result. The spike sample recovery is not within control limits.

[ ] – detected analyte

Appendix G – VOA Scan Tentatively Identified Compounds (TICs) – METRO Renton, January 1994.

VOA Scan TIC data are presented on the laboratory report sheets that follow. Locations corresponding to the Lab Log# and data qualifiers are summarized on this page. If sheets are not included for a station, no TICs were detected.

Location:	Inf-1	Inf-2	Eff-2	Sludge
Type:	grab	grab	grab	grab
Date:	1/25	1/25	1/25	1/25
Time:	1120	1450	1630	1415
Lab Log#:	048230	048231	048238	048244

NJ – The analyte has been tentatively identified. The associated numerical result is an estimated quantity.

Inf – influent
Eff – effluent
grab – grab sample

Laboratory: Ecology, Manchester

Sample No: 94 048230 Description: INF-1

Begin Date: 94/01/25

Tent Ident - VOA Sca	Water-Total Result	Units
Isopropylbenzene (Cume+	5.9NJ*	ug/l
7-OXABICYCLO[2.2.1]HEP+	2.6NJ*	ug/l
BENZENE, 1-ETHYL-2-MET+	5.0NJ*	ug/l
BENZENE, 1-ETHYL-4-MET+	8.9NJ*	ug/l

Laboratory: Ecology, Manchester

Sample No: 94 048231 Description: INF-2

Tent Ident - VOA Sca	Water-Total Result	Units
7-OXABICYCLO[2.2.1]HEP+	2.3NJ*	ug/l
CINEOLE (VAN)	5.7NJ*	ug/l
Benzene, 1,2,3,4-Tetra+	6.7NJ*	ug/l
BENZENE, 1,2,3,5-TETRA+	8.3NJ*	ug/l
DISULFIDE, DIMETHYL	5.0NJ*	ug/l
BENZENE, (1-METHYL-1-P+	10.4NJ*	ug/l
1H-INDENE, 2,3-DIHYDRO+	6.2NJ*	ug/l
BENZENE, 1-ETHYL-3,5-D+	10.5NJ*	ug/l

Laboratory: Ecology, Manchester

Sample No: 94 048238 Description: EFF-2

Tent Ident - VOA Sca	Water-Total Result	Units
UNKNOWN HYDROCARBONS	7.1NJ*	ug/l
UNKNOWN CHOLESTANE-TYP+	4.0NJ*	ug/l

Laboratory: Ecology, Manchester

Sample No: 94 048244 Description: SLUDGE

Tent Ident - VOA Sca	Sediment Result	Units
METHANE, THIOBIS	154NJ*	ug/kg
OCTANE (DOT)	17NJ*	ug/kg
BENZENE, 1,2,3,5-TETRA+	12330NJ*	ug/kg
CYCLOTETRASILOXANE, OC+	412NJ*	ug/kg
DISULFIDE, DIMETHYL	43NJ*	ug/kg
NUMEROUS UNKNOWN HYDRO+	11364NJ*	ug/kg
D-LIMONENE	1848NJ*	ug/kg

Appendix H - Glossary of Terms - METRO Renton, January 1994.

ACEC - acute critical effluent concentration
Aer - aeration basin
BOD - biochemical oxygen demand
BNA - base-neutral acids (semivolatile organics)
CCEC - chronic critical effluent concentration
COD - chemical oxygen demand
comp - composite sample
E - Department of Ecology
Eff - effluent
EPA - United States Environmental Protection Agency
g - gram
GC - grab composite
grab - grab sample
grab-comp - grab-composite sample
Inf - influent
LC50 - concentration which is lethal to 50% of the test organisms
M - METRO Renton
MF - membrane filter
mg - milligram
mg/L - milligram per liter
NOEC - no observable effect concentration
NPDES - National Pollutant Discharge Elimination System
pH - hydrogen ion concentration
QA - quality assurance
QC - quality control
Sed - primary sedimentation tank effluent
Sludge - sludge sample from belt filter press
TIC - tentatively identified compound
TNVS - total nonvolatile solids
TNVSS - total nonvolatile suspended solids
TOC - total organic carbon
TS - total solids
TSS - total suspended solids
μg - microgram
VOA - volatile organic acid