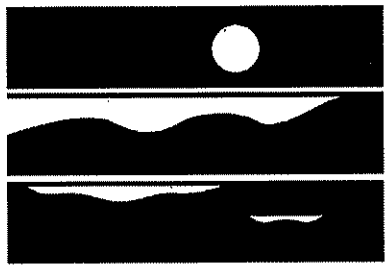

City of Aberdeen
Wastewater Treatment Plant
Class II Inspection, March 17-19, 1997

September 1997

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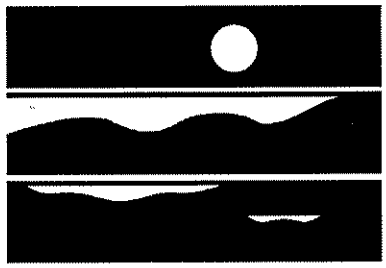

City of Aberdeen
Wastewater Treatment Plant
Class II Inspection, March 17-19, 1997

by
Steven Golding

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

September 1997

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Abstract

An announced Class II inspection was conducted at the Aberdeen Wastewater Treatment Plant on March 17-19, 1997. Extreme wet-weather conditions prevailed during the inspection and the plant was hydraulically overloaded, exceeding design peak loading. The plant was being operated at maximum capacity during the inspection, with flow rate limited by discharge pump capacity. The conventional parameters of 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) showed that there was little or no removal through the plant during the inspection.

The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for BOD_5 and TSS concentrations, and pH. As a result of dilution from infiltration and inflow, the influent also met these limits. Weekly average loading limits for BOD_5 and TSS in the 24-hour composite effluent sample were each exceeded by a factor of greater than 2. Removal of BOD_5 and TSS during the 24-hour inspection was 4.2% and -12.5% respectively, as compared with monthly average permitted minimum removals of 85%. Fecal coliform counts exceeded the permitted monthly average but were within the weekly permitted average. This indicates that despite hydraulic overloading during maximum flow conditions, effective disinfection was achieved. Aberdeen's reported results for the entire month of March show compliance with BOD_5, TSS, and flow monthly and weekly permit limits.

Copper, lead, silver, and zinc were detected in the effluent sample. A reasonable potential was found for copper to violate water quality standards. All metals in the sludge sample were found in concentrations lower than EPA sludge application limits and ceiling concentrations for land application of municipal sludge.

Summary

Extreme wet-weather conditions prevailed during the inspection and the plant was hydraulically overloaded as a result of infiltration and inflow. The plant exceeded design peak loading.

Flume Configuration and Flow Measurements

The plant flow meter indicated an instantaneous flow 2% lower than the summed flow value determined from Ecology measurements of depth in the Parshall flumes. This indicates good agreement between the ultrasonic flow meter and flow calculated from measured depths.

The effluent totalizer reading from 0800 March 18 to 0800 March 19 indicated an average flow of 16.6 MGD. The 16.6 MGD measured flow is believed to have been in error as a result of flow backing up into the effluent flumes as a result of high flows. Plant personnel report that the pump discharge rate for the effluent pumps is approximately 15 MGD (Wilppone; Cook, 1997). To allow for any error to be conservative, flow during the inspection was taken to be 16.6 MGD determined by actual flow measurement.

NPDES Permit Compliance/General Chemistry

The plant was being operated at maximum capacity during the inspection, with flow rate limited by discharge pump capacity. Flow was nearly double the permitted monthly average flow of 8.75 MGD. The conventional parameters of 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) showed that there was little or no removal through the plant during the inspection.

The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for BOD_5 and TSS concentrations, and pH (Table 3). As a result of dilution from infiltration and inflow, the influent also met these limits. The plant was hydraulically overloaded during the inspection as a result of infiltration and inflow accompanying the heavy rainfall. As a result of the hydraulic overloading, weekly average loading limits for BOD_5 and TSS in the 24-hour composite effluent sample were each exceeded by a factor of greater than 2. Removal of BOD_5 and TSS during the inspection was 4.2% and -12.5% respectively, as compared with monthly average permitted minimum removals of 85%. Aberdeen's reported average results for the entire month of March show compliance with monthly and weekly BOD_5, TSS, and flow permit limits.

Fecal coliform counts exceeded the permitted monthly average but were within the weekly permitted average, indicating the achievement of effective disinfection for a plant experiencing hydraulic overloading and maximum flows.

Plant Operation

During the inspection, secondary clarifier loading exceeded both the design peak loading and the typical plant design loading indicated by Metcalf and Eddy.

Split Sample Results

There was good agreement in BOD_5 results between Ecology and Aberdeen sampling as well as analysis. Effluent TSS results from both Ecology and Aberdeen sampling and analysis showed good agreement. Aberdeen influent TSS analyses found consistently lower concentrations than did the Ecology analyses. Visual observation of the influent supports Ecology results, since the influent appeared considerably more turbid than does a typical municipal wastewater having a TSS of about 8 or 10 mg/L, the influent TSS values reported by Aberdeen. It is recommended that Aberdeen review its procedures for analyzing TSS and correct any problems that may be found.

Priority Pollutant Metals

Copper, lead, silver, and zinc were detected in the effluent sample. A reasonable potential was found for copper to violate water quality standards.

Sludge

The total and fecal coliform counts were each >15,500,000/100g-dry (>2,400,000/100g-wet). The fecal coliform count exceeds 1,000/g-dry (100,000/100g-dry) maximum limit for Class A sewage sludge in accordance with EPA regulations. It could not be determined whether the count was within the Class B sewage sludge limit.

Eleven priority pollutant metals were detected in the sludge sample. Zinc was found in the highest concentration (659 mg/Kg-dry). All metals were found in concentrations lower than EPA sludge application limits and ceiling concentrations for land application of municipal sludge (Table 6).

Recommendations

- Inflow and infiltration to the Aberdeen sewer system should be reduced.
- The Aberdeen WWTP should be inspected again when it is operating under a normal flow regime, rather than the extreme high flow conditions encountered during the inspection.
- Aberdeen should review its procedures for analyzing TSS and correct any problems that may be found.
- Aberdeen should monitor copper in the WWTP effluent and report results to Ecology.

Introduction

An announced Class II inspection was conducted at the City of Aberdeen (Aberdeen) Wastewater Treatment Plant (WWTP) on March 17-19, 1997. Conducting the inspection were Steven Golding and Guy Hoyle-Dodson of the Washington State Department of Ecology. Assisting from the Aberdeen staff were Plant Supervisor Arne Wilppone and Lab Technician Les Cook.

The Aberdeen WWTP is a large facility (8.75 MGD permitted monthly average) located near the North Channel of the Chehalis River (Figure 1). The plant serves the cities of Aberdeen and Cosmopolis. The cities have no known industrial contributors. However, there are a number of commercial contributors. The proposed Stafford Creek Correctional Center, to be located on the south side of Grays Harbor, approximately five miles south of Aberdeen, would contribute to the Aberdeen WWTP. The plant was completed in 1981, with subsequent modifications in sludge treatment and the addition of dechlorination equipment (Figure 2). The facility is regulated under NPDES Permit No. WA-003719-2. Discharge is into Grays Harbor Estuary. The estuary is a sensitive water body containing commercial shellfish beds and is near critical shorebird habitat.

Wastewater treatment consists of primary sedimentation, mechanical aeration, secondary clarification, chlorine disinfection, and sulfur dioxide dechlorination. Treated effluent is discharged into the mouth of the Chehalis River at Grays Harbor Estuary through a submerged outfall with a multiport diffuser. Sludge handling consists of gravity thickening, anaerobic digestion, and dewatering with a plate and frame press. The biosolids are disposed of in a sanitary landfill.

Infiltration and inflow have been an ongoing problem for the facility. Self reporting discharge monitoring reports (DMRs) show a base flow of between 2.8 and 3.0 MGD for the months of June, July, and August 1996. Three months of the twelve months between April 1996 and March 1997 were reported to have average flows of greater than double the base flow. Maximum flows during five of the months exceeded 13 MGD.

Extreme wet-weather conditions prevailed during the inspection. A heavy rain event began in the Olympic Peninsula on March 17, 1997 with light rain the day Ecology was setting up sampling equipment at Aberdeen in preparation for the inspection. The rain continued and intensified during the inspection on March 18. Aberdeen personnel reported 3.03 inches of rain from 8:00 AM on March 17 to 8:00 AM on March 18 and 4.59 additional inches of rainfall accumulating in the WWTP rain gauge between 8:00 AM on March 18 and 8:00 AM on March 19. Rainfall was heaviest in the Olympic Peninsula north of Aberdeen, with 13.25 inches of rain recorded at Lake Wynoochee for the 36-hour period between 2000 on March 17 and 0800 on March 19 (Tacoma Public Utilities, 1997). By the morning of March 19, there was widespread flooding in the Chehalis River valley. Flooding of the Wynoochee River west of Montesano caused

State Highway 12 to be closed on the morning of March 19, leaving Aberdeen virtually cut off from the remainder of the state by road travel for most of the day.

Objectives of the inspection included:

- Evaluate NPDES permit compliance
- Evaluate sampling and laboratory procedures with split samples
- Compare effluent sample results with state and federal water quality criteria

Procedures

Composite samples were collected by Ecology at influent (Inf), primary effluent (Prim), and effluent (Eff) locations. Grab samples were collected by Ecology at (Inf), aeration (Aer), (Eff), and sludge (Sludge) locations (Figure 2). Ecology conducted field measurements on influent and effluent samples as well as on the mixed liquor in the aeration basins. Aberdeen collected composite samples of influent (Inf-A) and effluent (Eff-A).

A more detailed description of sampling procedures appears in Appendix A. Sampling station descriptions appear in Table 1. The sampling schedule, parameters analyzed, and sample splits are included in Appendix B. Ecology analytical methods and laboratories performing the analyses are summarized in Appendix C. Ecology field and laboratory QA/QC are summarized in Appendix D. Quality Assurance cleaning procedures are included in Appendix E. A glossary appears in Appendix F.

Results and Discussion

Flume Configuration and Flow Measurements

Aberdeen determines effluent flow from wastewater depth as measured by ultrasonic flow meters, combining the flow measurements from its two Parshall flumes. Each of the two flumes measures flow from one of the plant's two final clarifiers. The two 12-inch flumes were found to be level. Ecology took instantaneous readings of flow depths in the two flumes at 1330 on March 18 and found a depth of 25.9 inches in each of the two flumes. This corresponds to a flow of 8.35 MGD for each flume, or a combined flow of 16.70 MGD. The instantaneous flow at the same time was found to be 8.22 MGD for the west flume and 8.14 MGD for the east flume, or a combined flow of 16.36. This is 2% lower than the summed flow value determined from the depth measurements, indicating good agreement between the ultrasonic flow meter and flow calculated from measured depths.

The effluent totalizer reading from 0800 March 18 to 0800 March 19 indicated an average flow of 16.6 MGD. The 16.6 MGD flow measurement is believed to have been in error as a result of flow backing up into the effluent flumes as a result of high flows.

At 0815 on March 18, the flow was backed up to the downstream end of the throats of the flumes. The flow continued to back up through the end of the inspection on March 19. When flow is impeded downstream from a flume, inflated flow measurements can result. Plant personnel report that the pump discharge rate for the effluent pumps is approximately 15 MGD (Wilppone; Cook, 1997). Although the flows determined in the Parshall flumes may be inflated, flow determinations by pump capacity are inexact. To allow for any error to be on the side of a conservative determination of pollutant loading, as well as to correspond with flow meter readings as reported to Ecology by Aberdeen, flow during the inspection was taken to be 16.6 MGD determined by actual flow measurement.

NPDES Permit Compliance/General Chemistry

The plant was being operated at maximum capacity during the inspection, with flow rate limited by discharge pump capacity. Flow was nearly double the permitted monthly average flow of 8.75 MGD. The conventional parameters of 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) showed that there was little or no removal through the plant during the inspection (Table 2).

The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for BOD_5 and TSS concentrations, and pH (Table 3). It is interesting to note that as a result of dilution from infiltration and inflow, the influent also met these limits. The plant

was hydraulically overloaded during the inspection as a result of infiltration and inflow accompanying the heavy rainfall. As a result of the hydraulic overloading, weekly average loading limits for BOD_5 and TSS in the 24-hour composite effluent sample were each exceeded by a factor of greater than 2.

Removal of BOD_5 and TSS during the inspection was 4.2% and -12.5% respectively, as compared with monthly average permitted minimum removals of 85%. These percent removals are based on Ecology analyses of Ecology samples, except for influent BOD_5, which is based on the Aberdeen analysis of the Ecology sample. The Aberdeen number was used because the Ecology result was indeterminate as a result of dilutions during the test that were not appropriate for the low BOD_5 concentrations found in the influent. Negative removal across the WWTP can be explained as the result of imprecision of the test results or as a result of sludge in the clarifiers being washed through the plant. In comparing the composite sample with monthly and weekly averages, it should be noted that the composite sample was limited to 24 hours and was taken near the peak of the rain event.

For the entire month of March, Aberdeen reported an average 60 mg/L BOD_5 influent concentration and an average 9 mg/L BOD_5 effluent concentration for a removal of 85%. Average TSS concentrations for the month of March were reported to be 73 mg/L influent and 7 mg/L effluent, for a removal of 90%. Average flow for the month of March was reported to be 6.9 MGD. Aberdeen self-reporting data indicate compliance with monthly and weekly average permit limits for BOD_5, TSS, and flow.

Fecal coliform counts during the inspection exceeded the permitted monthly average but were within the weekly permitted average. This indicates the achievement of effective disinfection for a plant experiencing hydraulic overloading and maximum flows.

Plant Operation

Hydraulic overloading typically has its greatest impact on plant operation on secondary clarifier operation. The Aberdeen plant is designed for a secondary clarifier peak loading of 1,164 gpd/ft^2 (URS). This is within the 1,000 - 1,200 gpd/ft^2 range that Metcalf and Eddy (1991) indicates for typical peak loading. If the peak flow was taken to be 16.6 MGD during the inspection, the corresponding loading is 1,486 gpd/ft^2. This exceeds both the design peak loading and the typical design loading indicated by Metcalf and Eddy. If the peak flow is taken to be the 15 MGD estimated pump flow, the corresponding load is 1,343 gpd/ft^2. This is also above the design loading and the typical design loading given by Metcalf and Eddy. This indicates that the secondary clarifiers were overloaded and could be expected to be providing insufficient settling of solids during the high flow conditions of the inspection.

Split Sample Results

Samples were split to determine the comparability of Ecology and permittee laboratory results and sampling methods (Table 4). Ecology influent BOD_5 values in Table 2 are replaced with Manchester Laboratory estimated values in the table below, for the purpose of split sample comparisons. The Ecology estimates cannot be used for comparison with limits in the Aberdeen NPDES permit. As stated earlier, Aberdeen influent BOD_5 results have been used to calculate percent BOD_5 removal.

	BOD_5 (mg/L)			
Analysis by:	Ecology Influent (Inf-E)	Aberdeen Influent (Inf-A)	Ecology Effluent (Eff-E)	Aberdeen Effluent (Eff-A)
Ecology	21 (est.)	33 (est.)	23	30
Aberdeen	24	21	22	24

These split sample results show good agreement in BOD_5 between Ecology and Aberdeen sampling as well as analysis. Effluent TSS results from both Ecology and Aberdeen sampling and analysis showed good agreement (Table 4). The influent TSS results shown in Table 4 indicate that Aberdeen influent TSS analyses found consistently lower concentrations than did the Ecology analyses. Visual observation of the influent supports Ecology results, since the influent appeared considerably more turbid than does a typical municipal wastewater having a TSS of about 8 or 10 mg/L, the influent TSS values reported by Aberdeen. It is recommended that Aberdeen review its procedures for analyzing TSS and correct any problems that may be found.

Priority Pollutant Metals

Copper, lead, silver, and zinc were detected in the effluent sample. Based on a dilution factor at the acute mixing zone boundary of 13:1 and a dilution factor at the chronic mixing zone boundary of 17:1 (CH2M Hill, 1996), and a probability of achieving water quality standards of 95%, TSDCALC6 indicates a reasonable potential for copper to violate water quality standards. The effluent copper concentration was 24 µg/L. The state marine water quality standards for copper are 2.4µg/L acute and 2.4µg/L chronic. The maximum copper concentrations at the edge of the acute and chronic mixing zones were calculated to be 9.50 µg/L and 7.26 µg/L respectively. Aberdeen should monitor copper in the WWTP effluent and report results to Ecology.

Sludge

Sludge handling consists of gravity thickening, anaerobic digestion, and dewatering with a plate and frame press. The biosolids are disposed of in a sanitary landfill.

The dried sludge sample contained 15.5% solids and 9.5% volatile solids. The total and fecal coliform counts were each >15,500,000/100g-dry (>2,400,000/100g-wet - Table 2). The fecal coliform count exceeds 1,000/g-dry (100,000/100g-dry) maximum limit for Class A sewage sludge in accordance with EPA regulations (EPA, 1993). Class A sewage sludge is suitable for use on agricultural lands without time restrictions to harvesting. Because the fecal coliform count was reported not as equal to a value, but instead greater than 15,500,000/100g-dry, it could not be determined whether the count was within the Class B sewage sludge limit of 200,000,000/100g-dry. Class B sewage sludge may be applied to agricultural lands with certain restrictions.

Eleven priority pollutant metals were detected in the sludge sample. Zinc was found in the highest concentration (659 mg/Kg-dry). All metals were found in concentrations lower than EPA sludge application limits and ceiling concentrations for land application of municipal sludge (Table 6).

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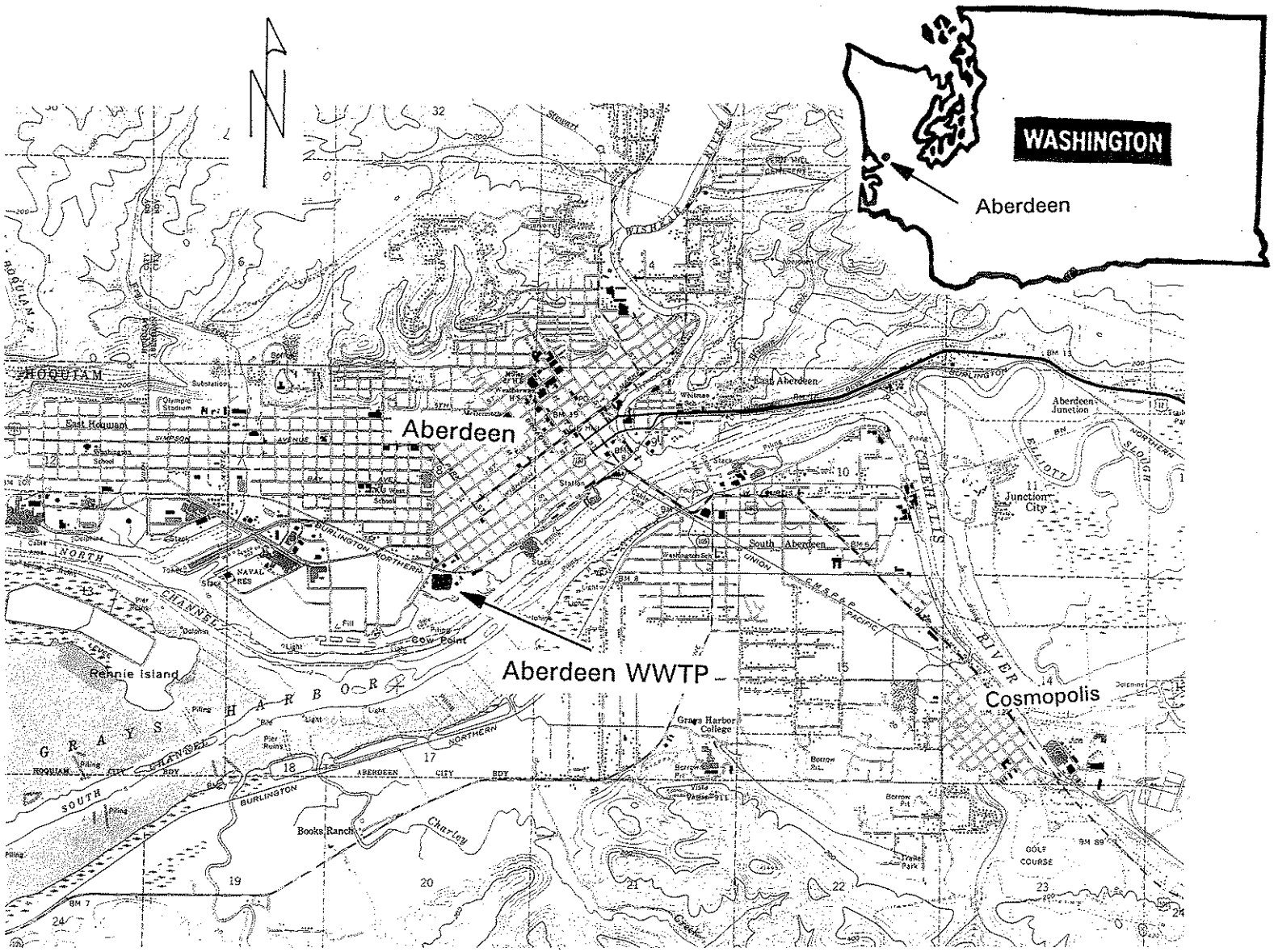

Figure 1 - Location Map - Aberdeen, March 1997.

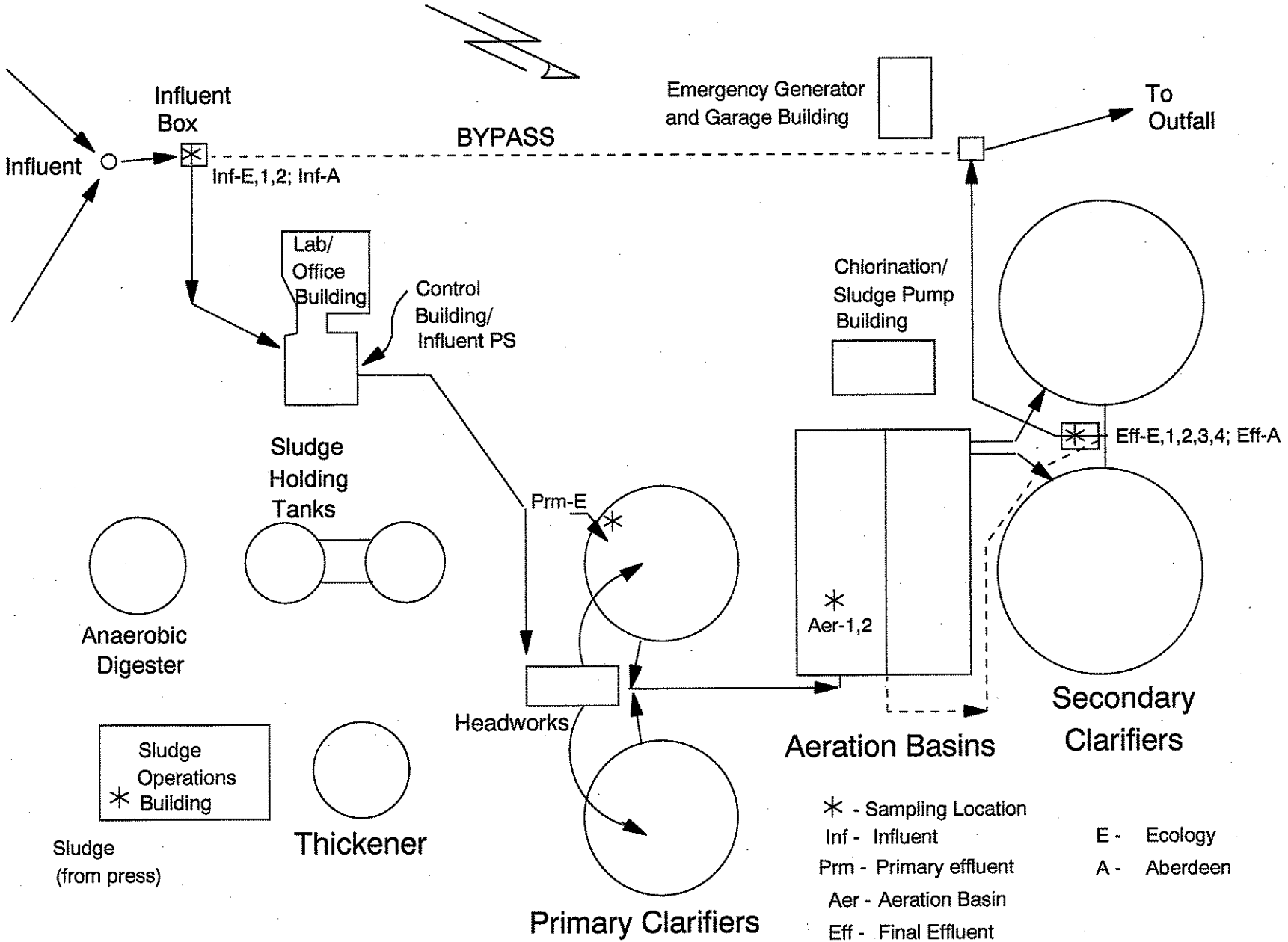

Figure 2 - Flow Schematic - City of Aberdeen, March 1997.

Table 1 - Sampling Station Descriptions - Aberdeen, March 1997.

Ecology influent grab and composite samples (Inf-1,2; Inf-E)

Influent grab samples were collected from the influent box, using a beaker mounted on a pole. The influent composite sample was taken with an intake hose suspended in the entrance to the exit pipe from the influent box.

Aberdeen influent composite samples

The influent composite sample was with an intake hose suspended in the entrance to the exit pipe from the influent box.

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

Effluent grab samples were taken as a grab composite, half from each of the two effluent channels leading to the two Parshall flumes. The effluent composite sample was taken with an intake hose suspended in the box downstream of the Parshall flumes. The flow was turbulent and well mixed in the box.

Aberdeen effluent grab and composite samples

Effluent grab samples were taken as a grab composite, half from each of the two effluent channels leading to the two Parshall flumes. The effluent composite sample was taken with an intake hose suspended in the box downstream of the Parshall flumes. The flow was turbulent and well mixed in the box.

Ecology primary effluent composite sample (Prim-E)

The primary effluent composite sample was taken with an intake hose suspended in the channel outside of the outer launder weir of the west primary clarifier.

Ecology aeration basin grab samples (Aer-1, 2)

The aeration basin (mixed liquor) sample was taken from the walkway of the south aeration basin, halfway between the aerator and the side wall, in a well-mixed region.

Ecology sludge sample (Sludge)

Sludge was collected as a grab-composite sample from the sludge drying shed. The sludge sampled was ready to be trucked off-site.

Table 2 - General Chemistry Results - City of Aberdeen, March 1997.

Location:	Inf-1	Inf-2	Inf-E	Inf-A	Prm-E	Aer-1	Aer-2	Eff-1	Eff-2
Type:	grab	grab	comp	comp	comp	grab	grab	grab	grab
Date:	3/18	3/18	3/18-19	3/18-19	3/18-19	3/18	3/18	3/18	3/18
Time:	1015	1450	0950	1035	1045	0920	1420	0840	1355
Lab Log #:	128080	128081	128082	128083	128084	128085	128086	128087	128088
GENERAL CHEMISTRY									
Conductivity (umhos/cm)	118	109	96.4	101	111			111	136
Alkalinity (mg/L CaCO3)			28.3	26.7	33.4				
Hardness (mg/L CaCO3)			23.7	24.9					
TS (mg/L)			112	152	187	1400	1300		
TNVS (mg/L)			56	77	67	454	428		
TSS (mg/L)	41	30	24	44	34	1360	1240	17	54
TNVSS (mg/L)			7	11	10	360	360		
% Solids									
% Volatile Solids									
OXYGEN DEMAND PARAMETERS									
BOD5 (mg/L)			40U	50U	40U				
TOC (water mg/L)	11.6	13.8	9.1	8.5	10.4			5.5	8.6
TOC (soil - %C dry)									
NUTRIENTS									
NH3-N (mg/L)	1.24	0.795	0.853	1.20				0.021	2.64
NO2+NO3-N (mg/L)	0.640	0.585	0.635	1.17				2.13	3.15
Total-P (mg/L)	0.782	0.619	0.534	0.887				0.559	1.32
MISCELLANEOUS									
F.Coliform MF (#/100mL)								250	360
Fecal Coliform (#/100g wet)									
Total Coliform (#/100g wet)									
Cyanide total (mg/L)								0.010U	
Cyanide wk & dis (mg/L)								0.010U	
FIELD OBSERVATIONS									
Temperature (C)	8.9	9.1				9.1	10.4	9.2	10.0
Temp-cooled (C)			4.6	11.0	5.4				
pH	7.1	7.2	7.4	6.8	6.8	7.0	6.6	6.8	6.6
Conductivity (umhos/cm)	129.2	107.4	100.6	102.6	114.5	133.9	141.5	111.6	148.8
Chlorine (mg/L)									
Free								<0.1	<0.1
Total								<0.1	<0.1

Table 2 - (cont'd) - City of Aberdeen, March 1997.

Location	Eff-E	Eff-A	Sludge
Type:	comp	comp	grab
Date:	3/18-19	3/18-19	3/18
Time:	1010	1020	0950
Lab Log #:	128089	128090	128093
GENERAL CHEMISTRY			
Conductivity (umhos/cm)	99.6	101	
Alkalinity (mg/L CaCO3)	14.5	13.4	
Hardness (mg/L CaCO3)	25.1	25.5	
TS (mg/L)	130	118	
TNVS (mg/L)	63	65	
TSS (mg/L)	27	37	
TNVSS (mg/L)	7	10	
% Solids			15.5
% Volatile Solids			9.5
OXYGEN DEMAND PARAMETERS			
BOD5 (mg/L)	23	30	
TOC (water mg/L)	7.7	7.4	
TOC (soil - %C dry)			28.9
NUTRIENTS			
NH3-N (mg/L)	0.289	0.346	
NO2+NO3-N (mg/L)	2.36	2.58	
Total-P (mg/L)	0.804	0.956	
MISCELLANEOUS			
F.Coliform MF (#/100mL)			
Fecal Coliform (#/100g-wet)			2,400,000 G
Total Coliform (#/100g-wet)			2,400,000 G
Cyanide total (mg/L)			
Cyanide wk & dis (mg/L)			
FIELD OBSERVATIONS			
Temperature (C)			
Temp.cooled (C)	3.6	10.0	
pH	7.8	6.2	
Conductivity (umhos/cm)	106.1	104.2	
Chlorine (mg/L)			
Free			
Total			

E - Ecology sample
A - Aberdeen sample

Inf - influent
Prm - primary clarifier effluent
Aer - aeration basin mixed liquor
Eff - effluent
Sludge - sludge

U - The analyte was not detected at or above the reported result

G - The true value is greater than the reported result.

Table 3 - NPDES Permit Limits and Inspection Results - Aberdeen, March 1997

	NPDES Limits		Inspection Results	
Parameter	Monthly Average	Weekly Average	Composite Samples	Grab Samples
BOD5	30 mg/L 977 lbs/day 85% removal	45 mg/L 1,465 lbs/day	23 mg/L 3,184 lbs/day 4.2% removal	
TSS	30 mg/L 1,073 lbs/day 85% removal	45 mg/L 1,610 lbs/day	27 mg/L 3,738 lbs/day -12.5% removal	
Fecal Coliform	200/100 mL	400/100 mL		250/100 mL 360/100 mL
pH	6.0 to 9.0 (continuous)			6.8;6.6
Flow	8.75 MGD	--	16.6 MGD*	

* totalizer reading from 0800 on 03-18-97 to 0800 on 03-19-97.

Table 4 - Split Sample Results Comparison - Aberdeen, March 1997.

	Location:	Inf-E	Inf-A	Eff-E	Eff-A
	Type:	comp	comp	comp	comp
	Date:	3/18-19	3/18-19	3/18-19	3/18-19
	Time:	0800-0800	0800-0800	0800-0800	0800-0800
	Lab Log #:	128082	128083	128089	128090
	Sampled by:	Ecology	Aberdeen	Ecology	Aberdeen
Parameter	Analysis by:				
TSS (mg/L)					
	Ecology	24	44	27	37
	Aberdeen	8	10	26	27
BOD5 (mg/L)					
	Ecology	40U; 21 est.	50U; 33 est.	23	30
	Aberdeen	24	21	22	24

Inf - influent sample
Eff - effluent sample

E - Ecology sample
A - Aberdeen sample
comp - composite sample

U - less than the reported result.

Table 5 - Comparison of Metals Detected to Water Quality Criteria - Aberdeen, March 1997.

Location:	Eff-E	Trnsblk	EPA/Ecology Water Quality Criteria	
Type:	comp	grab		
Date:	3/18-19	3/17	Acute	Chronic
Time:	0800-0800	1400	Marine	Marine
Lab Log#:	128089	128094		
	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Metals (total recoverable)				
Antimony	30 U	30 U		
Arsenic	1.5 U	1.5 U	69	36
Beryllium	1 U	1 U		
Cadmium	0.2 U	**1.3**	42.0	9.3
Chromium	5 U	5 U		
Hexavalent			1,100	50
Trivalent			10,300	
Copper	**24**	4 U	2.4	2.4
Lead	**3.4**	1.0 U	210	8.1
Mercury (total)	0.05 U	0.05 U	1.8	0.025
Nickel	10 U	10 U	74	8.2
Selenium	1.5 U	1.5 U	290	71
Silver	**1.5 J**	0.5 UJ	1.9	
Thallium	1.5 U	1.5 U	2,130 *	
Zinc	**40.7**	**5.6**	90	81

Eff - Effluent
E - Ecology sample
Trnsblk - transfer blank

Bold -detected value

U - The analyte was not detected at or above the reported result.
J - estimated value
UJ - undetected at estimated detection level

Table 6 - Sludge Metals and Comparison with EPA Criteria for Land Application - Aberdeen, March 1997.

Location:	Sludge		
Type:	grab	EPA Sludge	
Date:	10/18	Application Limits	EPA Ceiling
Time:	1400	(monthly avg.)	Concentrations
Lab Log #:	118171		
	mg/Kg-dry	mg/Kg-dry	mg/Kg-dry
Metals (total)			
Antimony	4 UJ		
Arsenic	3.1 J	41	75
Beryllium	0.23		
Cadmium	2.2	39	85
Chromium	19.2	1200	3000
Copper	653	1500	4300
Lead	170	300	840
Mercury	1.72 J	17	57
Nickel	15.6	420	420
Selenium	2.2 J	36	100
Silver	52.9 J		
Thallium	0.3 UJ		
Zinc	659	2800	7500

Sludge - sludge sample
Compost - compost sample

grab - grab sample

U - The analyte was not detected at or above the reported result.
J - The analyte was positively identified. The associated numerical result is an estimate.
UJ - The analyte was undetected at estimated detection level.

Appendices

Appendix A - Sampling Procedures - Aberdeen, March 1997.

Ecology Isco composite samplers were set up to collect equal volumes of sample every 30 minutes for 24 hours. The samples were then divided into subsamples for analysis. The compositors were iced to preserve samples.

The composite influent and effluent samplers operated by Aberdeen were set to collect equal volumes of sample every hour for 24 hours. The samples were kept refrigerated during sampling.

Ecology influent and effluent composite samples and Aberdeen influent and effluent composite samples were split for both Ecology and Aberdeen laboratory analysis. Sampler configurations and locations are summarized in Figure 2 and Table 1.

Appendix B - Sampling Schedule - City of Aberdeen, March 1997.

Location:	Inf-1	Inf-2	Inf-E	Inf-A	Prm-E	Aer-1	Aer-2	Eff-1	Eff-2
Type:	grab	grab	comp	comp	comp	grab	grab	grab	grab
Date:	3/18	3/18	3/18-19	3/18-19	3/18-19	3/18	3/18	3/18	3/18
Time:	1015	1450	0950	1035	1045	0920	1420	0840	1355
Lab Log #:	128080	128081	128082	128083	128084	128085	128086	128087	128088
GENERAL CHEMISTRY									
Conductivity	E	E	E	E	E			E	E
Alkalinity			E	E	E				
Hardness			E	E					
TS			E	E	E	E	E		
TNVS			E	E	E	E	E		
TSS	E	E	EA	EA	E	E	E	E	E
TNVSS			E	E	E	E	E		
% Solids									
% Volatile Solids									
OXYGEN DEMAND PARAMETERS									
BOD5			EA	EA	E				
TOC	E	E	E	E	E			E	E
TOC									
NUTRIENTS									
NH3-N	E	E	E	E				E	E
NO2+NO3-N	E	E	E	E				E	E
Total-P	E	E	E	E				E	E
MISCELLANEOUS									
F.Coliform MF								E	E
Fecal Coliform									
Total Coliform									
Cyanide total								E	
Cyanide wk & dis								E	
FIELD OBSERVATIONS									
Temperature	E	E				E	E	E	E
Temp-cooled			E	E	E				
pH	E	E	E	E	E	E	E	E	E
Conductivity	E	E	E	E	E	E	E	E	E
Chlorine									
Free								E	E
Total								E	E

Appendix B - (cont'd) - City of Aberdeen, March 1997.

Location	Eff-E	Eff-A	Sludge
Type:	comp	comp	grab
Date:	3/18-19	3/18-19	3/18
Time:	1010	1020	0950
Lab Log #:	128089	128090	128093
GENERAL CHEMISTRY			
Conductivity	E	E	
Alkalinity	E	E	
Hardness	E	E	
TS	E	E	
TNVS	E	E	
TSS	EA	EA	
TNVSS	E	E	
% Solids			E
% Volatile Solids			E
OXYGEN DEMAND PARAMETERS			
BOD5	EA	EA	
TOC	E	E	
TOC			E
NUTRIENTS			
NH3-N	E	E	
NO2+NO3-N	E	E	
Total-P	E	E	
MISCELLANEOUS			
F.Coliform MF			
Fecal Coliform			E
Total Coliform			E
Cyanide total			
Cyanide wk & dis			
FIELD OBSERVATIONS			
Temperature			
Temp-cooled	E	E	
pH	E	E	
Conductivity	E	E	
Chlorine			
Free			
Total			

Inf - influent
Prm - primary clarifier effluent
Aer - aeration basin mixed liquor
Eff - effluent
Sludge - sludge
Trnsblk - transfer blank

U - The analyte was not detected at or above the reported result

G - The true value is greater than the reported result.

- E - Ecology sample
- A - Aberdeen sample

E - Ecology analysis
A - Aberdeen analysis

Appendix C - Ecology Analytical Methods - Aberdeen, March 1997.

Laboratory Analysis	Method Used for Ecology Analysis	Laboratory Performing Analysis
Conductivity	EPA, Revised 1983: 120.1	Manchester Laboratory
Alkalinity	EPA, Revised 1983: 310.1	Manchester Laboratory
Hardness	EPA, Revised 1983: 130.2	Manchester Laboratory
TS	EPA, Revised 1983: 160.3	Manchester Laboratory
TNVS	EPA, Revised 1983: 160.3	Manchester Laboratory
TSS	EPA, Revised 1983: 160.2	Manchester Laboratory
TNVSS	EPA, Revised 1983: 160.2	Manchester Laboratory
% Solids	APHA, 1992: 2540G.	Manchester Laboratory
% Volatile Solids	EPA, Revised 1983: 160.4	Manchester Laboratory
BOD5	EPA, Revised 1983: 405.1	Manchester Laboratory
TOC (water)	EPA, Revised 1983: 415.1	Manchester Laboratory
TOC (soil/sed)	EPA, Revised 1983: 415.1	Manchester Laboratory
NH3-N	EPA, Revised 1983: 350.1	Manchester Laboratory
NO2+NO3-N	EPA, Revised 1983: 353.2	Manchester Laboratory
NO2-N	EPA, Revised 1983: 353.2	Manchester Laboratory
Total-P	EPA, Revised 1983: 365.3	Manchester Laboratory
F-Coliform MF	APHA, 1992: 9222D.	Manchester Laboratory
F-Coliform (soil/sed)	APHA, 1992: 9221A.	Manchester Laboratory
T-Coliform (soil/sed)	APHA, 1992: 9221A.	Manchester Laboratory
PP Metals	EPA, Revised 1983: 200-299	Manchester Laboratory

METHOD BIBLIOGRAPHY

APHA-AWWA-WPCF, 1992. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

EPA, Revised 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 (Rev. March, 1983).

Appendix D - Quality Assurance/Quality Control (QA/QC) - Aberdeen, March 1997.

SAMPLING QA/QC

Ecology quality assurance procedures for sampling included cleaning of the sampling equipment for priority pollutant metals analyses prior to the inspection to prevent sample contamination (Appendix E). Chain-of-custody procedures were followed to assure the security of the samples (Ecology, 1994).

LABORATORY QA/QC

General Chemistry Analysis

The data generated by the analysis of the samples can be used noting the qualifications given to the data. The duplicates for TS and TNVS sample 97128090 have been qualified as estimates. The MPN results for sample 97128093 have been qualified as estimates. BOD samples 97128082-84 have been qualified as estimates.

The results of the duplicate analysis of samples were used to evaluate the precision on this sample set. The Relative Percent Differences (RPD) were within their acceptance windows of +/- 20% and +/- 40% for microbiology except for TS and TNVS sample 97128090. Only the duplicates have been qualified as estimates. The sample was re-analyzed, over holding time, to determine if the sample or duplicate result was accurate. The results of the re-analysis produced data results that were close to the sample result. Therefore, the sample result has not been qualified.

Priority Pollutant Metals Analysis

Data quality for the effluent sample analysis is generally good with the exception that recovery of silver spikes and silver from the LCS sample are low. Also cadmium contamination was detected in the transfer blank. No other significant quality assurance issues are noted with the data.

Data quality for the sludge sample analysis is reduced by low and erratic recoveries of a number of elements owing to the difficult matrix. There is essentially no recovery of antimony from the spiked samples and the LCS sample. Recovery of thallium is slightly low from the LCS sample and essentially nonexistent from the spiked sample. Recovery of silver from the LCS sample is low and spiked sample recovery erratic. Mercury data as well shows poor precision. Recovery of arsenic and selenium is acceptable from the LCS sample, but is low from the sludge sample. No other significant quality assurance issues are noted with the data.

LABORATORY AUDIT

The Aberdeen laboratory was accredited on July 1, 1992 and renewed most recently on September 7, 1996. It expires on September 6, 1997.

Appendix E - Priority Pollutant Metals Cleaning Procedures - Aberdeen, March 1997.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent (phosphate-free)
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse one time with distilled/deionized water
5. Rinse with 10% HNO_3 solution
6. Rinse three times with distilled/deionized water
7. Seal with aluminum foil

Appendix F - Glossary of Terms - Aberdeen, March 1997.

A - Aberdeen
BOD_5 - five day biochemical oxygen demand
comp - composite sample
E - Department of Ecology
Eff - effluent
EPA - United States Environmental Protection Agency
F-coli - fecal coliform bacteria
g - gram
gpm - gallons per minute
grab - grab sample
Inf - influent
MF - membrane filter
mg - milligram
mg/L - milligram per liter
NPDES - National Pollutant Discharge Elimination System
pH - $-\log_{10}$ (hydrogen ion concentration)
Prm - primary clarifier effluent
QA - quality assurance
QC - quality control
TNVS - total nonvolatile solids
TNVSS - total nonvolatile suspended solids
TOC - total organic carbon
TS - total solids
TSS - total suspended solids
"U" or "<" - The analyte was not detected at or above the reported result; or less than
WWTP - wastewater treatment plant