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DEPARTMENT OF ECOLOGY

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M E M O R A N D U M
April 19, 1979

To: Dave Wright

From: Bill Yake

Subject: Vashon Class II Inspection

Introduction:

A Class II facility inspection was conducted at the Vashon STP on March 20-21, 1979. Mike Morhous and Bill Yake of the Water and Wastewater Monitoring Section and Craig Baker of the Northwest Regional Office represented the Department of Ecology. Ron Teed, plant operator, was present throughout the inspection.

The treatment plant is an oxidation ditch of standard design. Influent gravity flow passes through a grit chamber, comminutor, and Parshall flume to a circular oxidation ditch which is equipped with a single brush aerator. Effluent from the aeration basin is routed to a secondary clarifier which is located inside the oxidation ditch. Clarified effluent is chlorinated, routed to a contact chamber, and discharged. Waste activated sludge is bled from the return activated sludge line to one of four drying beds.

The plant discharges to north Puget Sound (25-01-00), a receiving water segment which is not addressed in the Five-Year Strategy. It is, however, unlikely that this effluent has a significant impact on the receiving water under present operating conditions.

After completion of the present treatment facility, severe maintenance and operation problems were noted by Northwest Regional personnel (primarily Dave Wright). In addition, laboratory techniques were believed inadequate and data reporting (DMR's) was incomplete.

Findings and Conclusions:

At the time of this inspection the treatment facility was operating well and the plant equipment was generally in good repair. This is reflected by the analytical results (Table 2) which indicate that the plant is meeting all NPDES permit limitations.

Additional data (mixed liquor biomass concentrations, oxidation ditch dissolved oxygen concentrations, and waste activated sludge concentrations) are given in Table 1.

Table 1. Operating Parameters

Parameter	Influent	Oxidation Ditch	Waste Activated Sludge	Unchlor. Effluent	Chlor. Effluent
Dissolved O_2 (mg/l)	6.5	0.1 to 0.5[1] 0.6 to 1.0[2]		1.9	4.5
Sus. Solids (mg/l)		4540 4420	11,700		
Vol. Sus. Solids (mg/l)		3320 3320	8,850		
Food/Microorganism[3]					
lbs. BOD/lbs. MLSS·day		0.015[3]			
lbs. BOD/lbs. MLVSS·day		0.020[3]			

1) Immediately upstream of brush aerator.
2) Immediately downstream of brush aerator.
3) Based on biomass in aeration basin only.

The oxygen concentrations in the oxidation ditch are somewhat lower than recommended levels (0.5-2.0 mg/l). The F:M is also somewhat lower than recommended levels (0.03-0.10).[1] Nonetheless, the plant appears to be doing a very effective job of treating the wastewater and no substantial operating changes appear necessary.

Mr. Teed is presently operating the plant solely on the basis of a 30-minute settleability test. He has also indicated that the plant appeared to be operating particularly well on the day of inspection. To achieve and maintain the highest quality effluent, we suggest that MLSS and/or MLVSS tests be run periodically (probably daily). Mixed liquor solids concentrations should then be held at the level which results in the best quality effluent.

Effluent monitoring at the Vashon plant is not in compliance with the terms of the NPDES permit. At the time of the inspection, BOD_5 and

[1]Department of Ecology, 1978. *Criteria for Sewage Works Design.*

fecal coliform tests were not being performed and there were several substantial procedural errors in the suspended solids test. The primary reason for these deficiencies is that Mr. Teed has received little or no training in the required analytical tests. Before reliable effluent data can be generated at the Vashon plant, it is imperative that arrangements be made to provide Mr. Teed with the background necessary for performing these tests. Each of the tests (BOD_5, TSS, FC) were explained to Mr. Teed in some detail during the inspection; however, the actual in-lab experience provided by specific training courses appears to be the only method of insuring accurate data. In addition, the theoretical background provided by this training would allow Mr. Teed to better understand the waste treatment process and, specifically, operation of the Vashon plant. The "Laboratory Review" portion of this report outlines some of the difficulties encountered in laboratory procedures at the Vashon plant.

Prior to the follow-up inspection to be performed by the Northwest Region by early June 1979, we recommend the following:

1. Arrangements be made for Mr. Teed to obtain training in laboratory procedures (specifically BOD_5, suspended solids, and fecal coliforms). Mr. Teed should be developing his analyses during this period and laboratory techinques should be reviewed during the follow-up inspection.

2. MLSS and/or MLVSS tests should be run periodically (probably daily). These concentrations should be analyzed in conjunction with effluent BOD and suspended solids concentrations, to determine the optimum mixed liquor solids concentrations. Sludge wastage can then be keyed to maintain the optimum mixed liquor concentrations.

Review of Laboratory Procedures and Techniques:

At present, wastewater analyses performed at the Vashon Treatment Plant fall far short of NPDES discharge permit requirements. BOD_5 and fecal coliform tests are not performed and suspended solids analyses had not been reported prior to this inspection. The laboratory lacked some of the equipment required for these analyses; however, the main reason for the analytical deficiencies is the operator's lack of background in these procedures. The analytical techniques were reviewed with Mr. Teed to the extent possible during the day and a half available during this inspection, but we urge that every effort be made to encourage Mr. Teed to obtain the training in laboratory procedures necessary to accurately perform the required tests and report the values on daily monitoring reports (DMR's). Certain findings and recommendations are addressed below; however, we recommend that laboratory procedures be again reviewed once Mr. Teed has received training and is performing all tests on a routine basis.

Total Chlorine Residual -

1. Analysis was being performed using an orthotolidine test kit. This method is not accepted and a DPD test kit should be acquired and used for TRC analysis. We sent a DPD kit to Mr. Teed two weeks prior to the inspection and he became familiar with it. During the inspection Mr. Teed ordered a DPD test kit which should soon be in use at Vashon.

Suspended Solids -

1. Prior to our initial contact, Mr. Teed was using the MFC broth (fecal coliform media) pads as filters. He was sent a package of Reeves Angel 934AH filters prior to the inspection, used them, and has since ordered his own.

2. There is no drying oven at the plant. Mr. Teed is presently drying his filters on an adjustable hot plate. An oven capable of maintaining 103°C should be purchased and used for this analysis.

3. The dessicator was not being used. Filters should be placed in the dessicator prior to weighing both before and after the sample is filtered.

Biochemical Oxygen Demand -

1. Initial attempts to run BOD's had been foiled by low dissolved oxygen concentrations in the dilution water and high (about 2 mg/l) dissolved oxygen drops in the dilution water blank. We suggested that the source of dilution water be changed. Purchased distilled water at the plant had pieces of an unidentified fiberous material suspended in it. In addition, we suggested that dilution water be aerated prior to set-up.

Fecal Coliforms -

1. Fecal coliform tests have never been run at the plant. Initially Mr. Teed indicated that he felt that this analysis was unnecessary because although he had "seen coliforms in the influent", he had "never seen them in the effluent". We noted that these bacteria are not visible using a dissecting microscope, and would be difficult to see and impossible to identify even if a much more sophisticated microscope were used.

2. All of the equipment to perform this test is available at the Vashon plant laboratory. However, the MFC broth is outdated and should be replaced.

3. Training in the test is particularly critical.

pH -

1. Mr. Teed had no operator instrument manual for his pH meter and had been filling the pH probe with pH7 buffer. We located the correct filling solution and the probe was refilled; however, the meter still responded irratically. An operator's manual should be obtained and, if necessary, the meter should be serviced.

BY:cp

Class II Field Review and Sample Collection
24 Hour Composite Sampler Installations

Sampler	Date and Time Installed	Location
1. Influent aliquot - 250 ml/30 min.	3/20/79 - 1055	Immed. downstream from Parshall Flume
2. Unchlorinated Eff. aliquot - 250 ml/30 min.	3/20/79 - 1110	Effluent Weir Outfall
3. Chlorinated Eff. aliquot - 250 ml/30 min.	3/20/79 - 1045	Outfall End of Contact Chamber

Grab Samples

	Date and Time	Analysis	Sample Location
1.	3/21/79 - 1010	Fecal Coli, TCR	Chlorinated Effluent
2.	3/21/79 - 1015	Fecal Coli, TCR	Chlorinated Effluent
3.	3/21/79 - 1110	TSS, TNVSS	Oxidation Ditch
4.	3/21/79 - 1140	TSS, TNVSS	Oxidation Ditch
5.	3/21/79 - 1140	TSS, TNVSS, Trace Metals	Waste Activated Sludge
6.			

Flow Measuring Device

1. Type - Parshall Flume
2. Dimensions - 3 Inch Throat
   a. Meets standard criteria /X/ Yes
   /__/ No Explain:

b. Accuracy check

	Actual Instan. Flow	Recorder Reading	Recorder Accuracy (% of inst. flow)
1.	.081	.075	92.6%
2.	.219	.21	95.9%
3.			

/X/ is within accepted 15% error limitations

/__/ is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
pH, Sp. Cond., Temp., DO	3/20/79 - 1100	Influent	See Results
pH, Sp. Cond., Temp., DO	3/20/79 - 1115	Unchlorinated Eff.	See Results
pH, Sp. Cond., Temp., DO	3/20/79 - 1050	Chlorinated Effluent	See Results
Dissolved Oxygen	3/21/79 - 1115	Oxidation Ditch, Imm. downstream of Brushes	0.6 to 1.0 mg/l
Dissolved Oxygen	3/21/79 - 1120	Oxidation Ditch, Imm. upstream from Brushes	0.1 to 0.5 mg/l
Total Chl. Resid.	3/21/79 - 1010	Chlorinated Effluent	1.7 mg/l
Total Chl. Resid.	3/21/79 - 1110	Chlorinated Effluent	1.0 mg/l

Table 2

The following table is a comparison of laboratory results from 24 hour composite(s) together with NPDES permit effluent limitations. Additional results pertinent to this inspection have also been included.

	DOE Results			Vashon Results		
	Influent	Unchlor. Eff.	Chlor. Eff.	Influent	Unchlor. Eff.	NPDES (Monthl average
BOD_5 mg/l	160	13	2			30
lbs/day	100	8	1			50
TSS mg/l	142	16	14	116	10	30
lbs/day	89	10	9	72	6	50
Total Plant Flow MGD					.075	.265
COD (mg/l)	320	57	46			
NH_3-N (mg/l)	15.2	<0.1	1.0			
NO_2-N (mg/l)	19.2	<0.1	<0.1			
NO_3-N (mg/l)	19.2	<0.1	<0.1			
O-PO_4-P (mg/l)	3.6	4.8	4.8			
T-PO_4-P (mg/l)	6.1	5.4	4.9			
Fecal Coli. (no/100 ml)			<10[1] <10[2]			200
Chlorine Res. (mg/l)			1.7[1] 1.0[2]			
pH (SU's)	7.6 7.1* 7.5**	7.4 7.2* 7.3**	7.4 7.1* 7.3**			
Spec. Cond. (µmhos/cm)	346 470* 420**	352 430* 465**	365 440* 468**			
Turbidity (JTU's)	60	8	7			
Total Solids (mg/l)	382	230	237			
TNVS (mg/l)	195	180	170			
TSS (mg/l)	142	16	14			
TSNVS (mg/l)	20	2	3			
Diss. O_2 (mg/l)	6.5*	1.9*	4.5*			
Temp. (°C)	10.2*	10.2*	10.2*			

* Field Analysis-grab "<" is "less than" and ">" is "greater than"
** Field Analysis-composite
1 Grab 3/21-1010
2 Grab 3/21-1110

Table 3

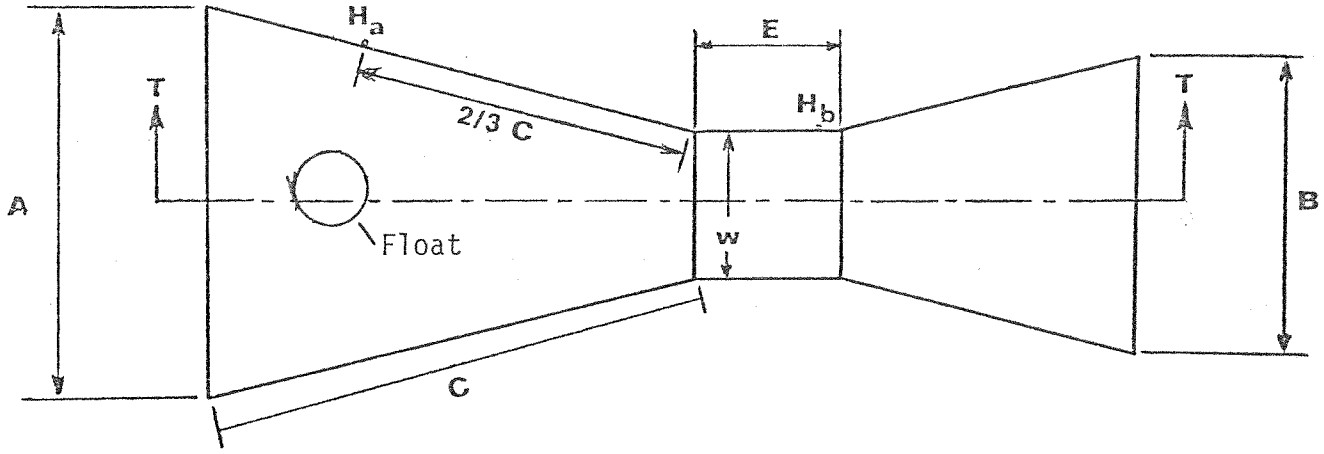
Trace Metal Analyses - Waste Activated Sludge

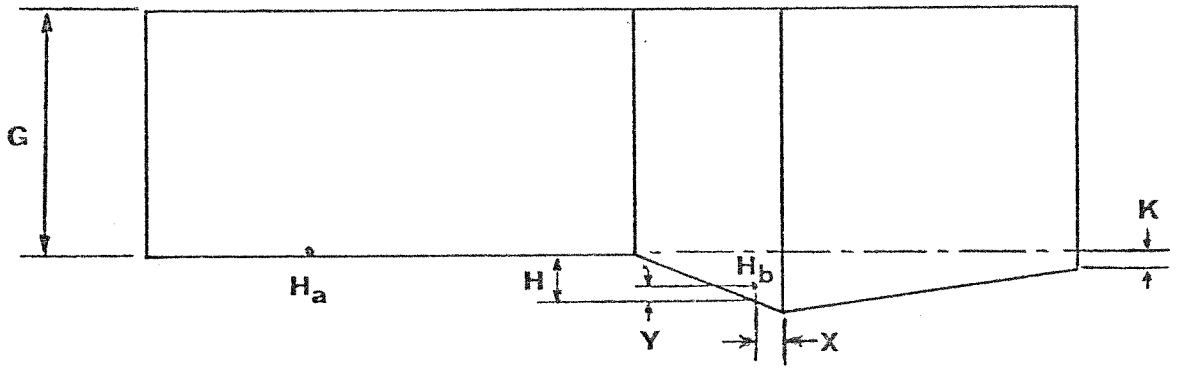
	Metal Concentration (mg/kg dry weight)
Lead	160
Zinc	1740
Cadmium	5
Copper	370
Nickel	<26
Chromium	68

% Solids - 2.4%

PARSHALL FLUME:

Dimensions & Flow





Code	Spec's	Measured
A		
B		
C	18-3/8"	18"
2/3 C	12-1/4"	12"
E	6"	6"
G	15"	27.5"
H		
K	1"	1-1/8"
W	3"	3"
X		
Y		

Time	H_a	H_b	Theoretical Flow	Recorded Flow
	3 1/8"		.081	.075
	6"		.219	.21