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Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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MEMORANDUM

March 6, 1986

To: Gary Brugger and Kyle Cook

From: Marc Heffner

Subject: Richmond Beach Sewage Treatment Plant Class II Inspection
June 17-18, 1985

ABSTRACT

On June 17-18, 1985, the Water Quality Investigations Section conducted a Class II inspection at the METRO Richmond Beach sewage treatment plant (STP). The plant is a primary plant which usually produces an acceptable effluent with the exception of poor BOD_5 removals. Analysis of the BOD_5 removal problem was limited by holding-time problems at the Washington Department of Ecology (Ecology) laboratory that necessitated elimination of composite sample data from the report. Low dissolved oxygen (D.O.) concentrations in the clarifier and possible underestimation of the plant flow were noted. Both observations could be related to low BOD_5 removal efficiency. Due to the lost composite sample data, a repeat survey may be required.

INTRODUCTION

A Class II inspection was conducted on June 17-18, 1985, at the Richmond Beach STP (Figure 1). The 3 MGD primary plant is part of the METRO system. Facilities at the plant include a bar screen, aerated grit channel, two primary clarifiers in parallel, and chlorine injection system (Figure 2). Chlorine contact time is provided in the outfall line. Solids are sent from the primary clarifiers to an anaerobic digestor for reduction prior to disposal. The effluent discharge into Puget Sound is limited by NPDES permit WA-002961-1(M), and further discussed in Order #DE 85-180.

The plant generally operates within the effluent limits set in the Order with the exception of beinq unable to consistently meet the required 20 percent BOD_5 removal. The inspection was requested primarily to investigate the BOD_5 problem. Objectives included:

1. Collect samples to evaluate treatment efficiency.

2. Review laboratory procedures including sample splits for analysis by both the treatment plant and Ecology laboratories.

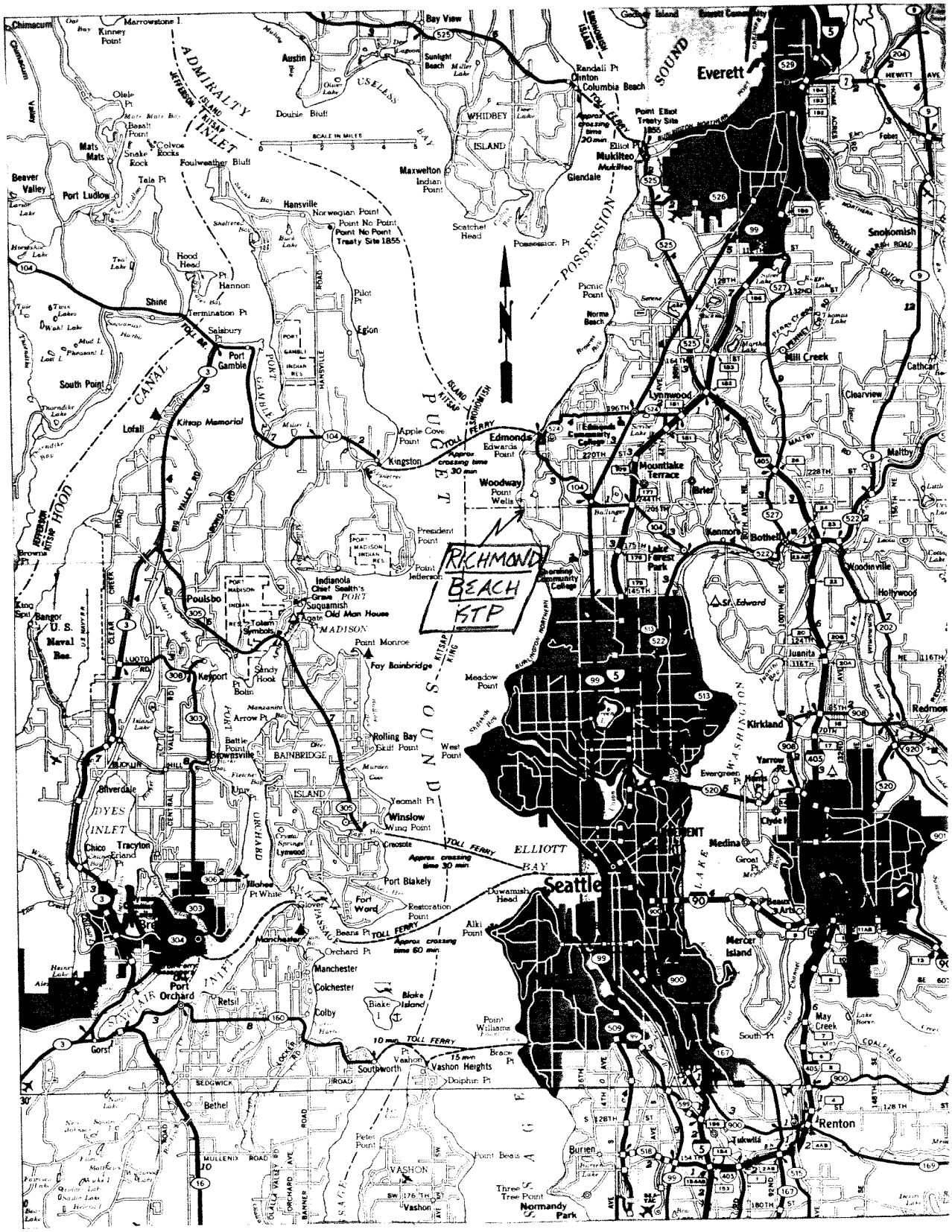
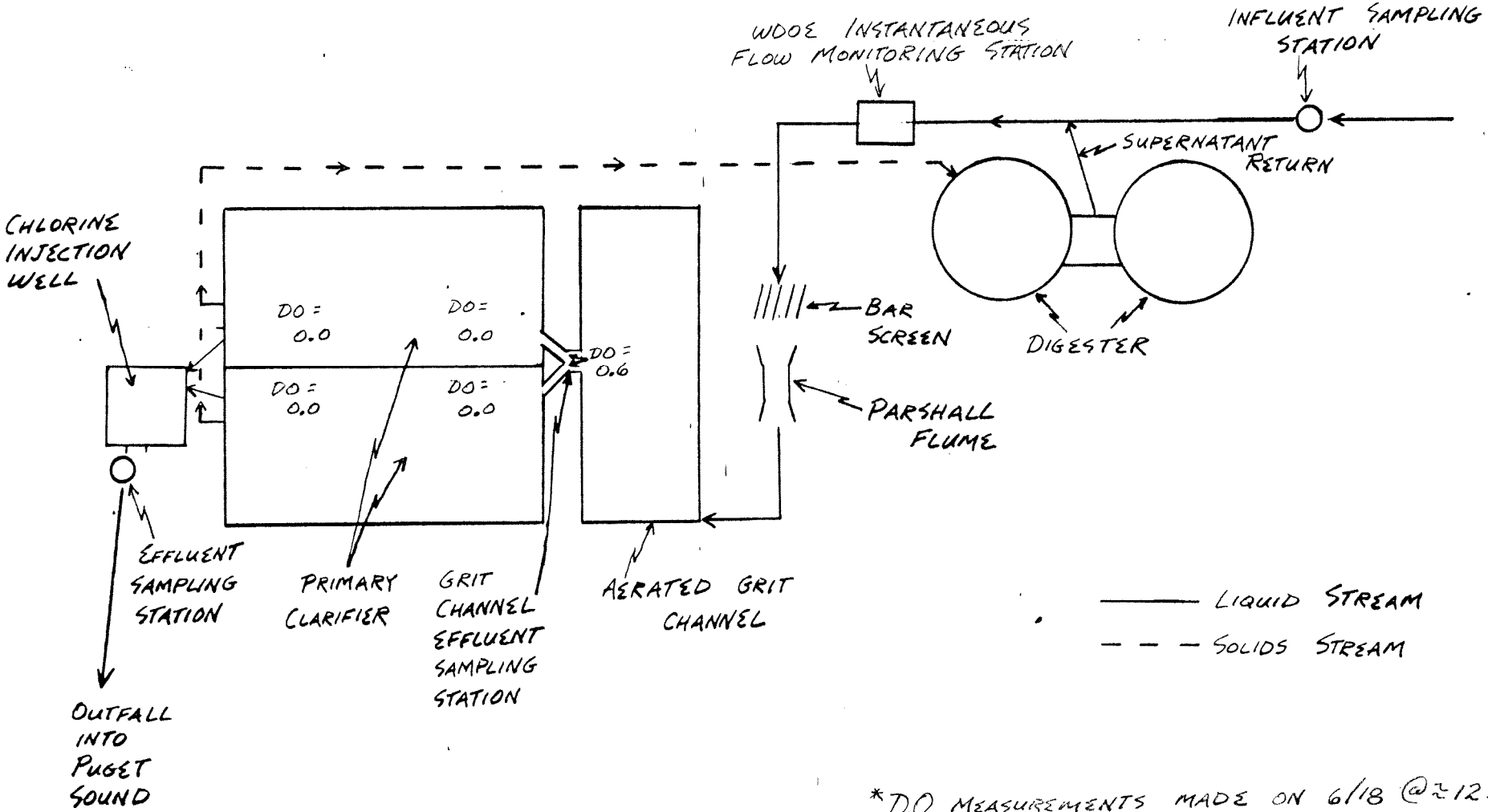


FIGURE 1 - STP LOCATION - RICHMOND BEACH, 6/85.



*D.O. MEASUREMENTS MADE ON 6/18 @ ≈ 1230, SAMPLES COLLECTED NEAR SURFACE FOR WINKLER ANALYSIS

FIGURE 2 - PLANT FLOW SCHEME AND DISSOLVED OXYGEN MEASUREMENTS* - RICHMOND BEACH, 6/85.

3. Investigate the low BOD_5 removal efficiency and identify possible cause(s).

The inspection was conducted by Brad Hopkins and Marc Heffner (Ecology, Water Quality Investigations Section) with the aid of James Harvey (METRO, Senior Process Analyst) and Gary Hansen (an operator at the plant).

Although prior arrangements were made, the Ecology laboratory was unable to complete analysis of several parameters within approved holding times. Included in the parameters for which holding time was exceeded were the BOD5 analyses. The laboratory problems were judged serious enough to warrant discarding the Ecology analytical results for all composite samples collected during the inspection. Without these results, the effort to meet the objectives of the inspection was severely restricted. This memo is designed to summarize the field work and sample collec ion scheme used during the inspection as well as make comments pertinent to the aspects of the inspection that were independent of composite sample analytical results.

PROCEDURES

Composite and grab samples were collected during the inspection. Samples collected and parameters analyzed are summarized on Table 1. Figure 2 notes composite sample stations.

Flows are routinely monitored by the plant flow meter which is operated in conjunction with a Parshall flume located just upstream of the aerated grit basin. Attempts to confirm meter accuracy were made by making instantaneous measurements using an Ecology Marsh McBernie magnetic flow meter in the influent channel upstream of the flume (Figure 2).

RESULTS AND DISCUSSION

As noted in the introduction, Ecology laboratory analytical problems with the composite samples collected during the inspection necessitated excluding composite sample data from the memorandum.

The Richmond Beach STP appeared to be a well-maintained facility. During the walk-through tour and discussion, operational strategies or techniques that could explain the BOD_5 percent removal problem were not observed. METRO has been investigating the problem, but to date has not isolated the cause(s). The sampling scheme for the inspection as noted on Table 1 was intended to provide data which, independent of plant operating personnel and data, might aid in isolating the BOD_5 percent removal problem. The loss of composite sample data severely limited the extent to which assistance could be offered. The discussion offers suggestions for improving plant operation to the extent possible with the limited database.

Table 1. Samples collected - Richmond Beach, June 1985.

Sample	Sampler	Laboratory	Date	Time	Field Analyses: Temperature	pH	Conductivity	Chlorine Residual	Dissolved Oxygen	Fecal Coliforms	Oil & Grease	Laboratory Analyses: COD	BOD_5	Soluble BOD_5	pH	Conductivity	Turbidity	Solids: TS	TNVS	TSS	TNVSS	Nutrients: NH_3-N	NO_2-N	NO_3-N	Dis-O-PO_4-P	Total PO_4-P	Alkalinity	Sludge Metals & Percent Solids
Composite Samples																												
Influent	Ecology	Ecology	6/17-18	1045-1045	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		METRO											X							X								
	METRO	Ecology	6/17-18	0800-0800								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		METRO											X							X								
Grit Chamber Effluent	Ecology	Ecology	6/17-18	1045-1045	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		METRO											X							X								
Final Effluent	Ecology	Ecology	6/17-18	1045-1045	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		METRO											X							X								
	METRO	Ecology	6/17-18	0800-0800								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		METRO											X							X								
Digester Supernatant	Ecology	Ecology	6/17	*								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Ecology Grab Samples																												
Influent			6/17	1030	X	X	X				X																	
				1400	X	X	X																					
				1525							X																	
			6/18	1040	X	X	X																					
Grit Channel Effluent			6/17	1050	X	X	X																					
				1410	X	X	X																					
			6/18	1050	X	X	X																					
				1230					X																			
Clarifier			6/18	1230					X																			
Final Effluent			6/17	1105	X	X	X	X		X	X																	
				1415	X	X	X																					
				1525						X	X																	
			6/18	1130	X	X	X	X		X**																		
Digested Sludge			6/18	1115																								X

*Composite sample made by combining equal volumes of flow collected at 1100 and 1400 hours on June 17.
**Grab sample collected for analysis by METRO also.

Grab sample results are summarized in Table 2. The Ecology chlorine residual concentration measurements were somewhat higher than the daily concentrations noted on the monitoring log at the plant. A chlorinated effluent sample was collected and diluted with distilled water so that the expected concentration would fall within the test ranges of both the Ecology and METRO chlorine detection kits. Total chlorine residual analysis of aliquots of the prepared sample yielded an Ecology result of 2.8 mg/L and a METRO result of 1.4 mg/L. The Richmond Beach test kit was later tested by METRO with the West Point STP titration method. Although no discrepancies were found, fresh chemicals were ordered for the Richmond Beach test kit to help assure accurate tests. A re-test of the kit is suggested during the next Ecology field visit at the plant

Flow measurements during the inspection are summarized in Table 3. The flow measurement system at Richmond Reach was somewhat unusual. The plant flow meter is operated in conjunction with a Parshall flume located just upstream of the aerated grit channel (Figure 2). Immediately upstream of the flume (within five to ten feet of the constricting approach) is a mechanically cleaned bar screen. Flow through the flume appeared turbulent; whereas well-distributed flow across the channel is necessary for accurate measurement (U.S. Department of the Interior, 1974). Instantaneous flow measurements were made upstream of the screen in an open channel (Figure 2) by Ecology using a Marsh-McBernie magnetic flow meter. The Ecology instantaneous measurements were 30 and 53 percent greater than the instantaneous flow measurements being made by the plant meter at the same time. Investigation by METRO of the flume accuracy when operated in close proximity to the bar screen is suggested.

Table 3. Flow measurements - Richmond Beach, June 1985.

		Instantaneous Flow (MGD)			
Date	Time	Plant Meter	Ecology Marsh-McBernie Meter	Totalizer	Flow Rate for Time Increment (MGD)
6/17	1100	1.86		83788	
	1240	1.56	2.03		
					1.72
	1525	1.46		84105	
					1.40
	1600	1.59		84139	
					1.39
6/18	1035	2.02		85215	
					1.78
	1325	1.52	2.32	85425	

Average flow rate for compositing period: 1.45 MGD

Table 2. Grab samples - Richmond Beach, June 1985.

Sample	Date	Time	pH (S.U.)	Conductivity (umhos/cm)	Temp. (°C)	Chlorine Residual (mg/L) Free	Chlorine Residual (mg/L) Total	Fecal Coliforms* (col/100 mi)	Oil and Grease (mg/L)
'Influent	6/17	1030	7.5	465	17.5				3
		1400	7.3	420	17.2				
		1525							84
	6/18	1040	7.8	475	17.4				
		Ecol. Comp.	7.3	430	13.8				
Grit	6/17	1050	7.4	575	17.4				
Channel		1410	7.3	550	17.6				
Effluent	6/18	1050	7.5	545	17.6				
		Ecol. Comp.	7.3	480	4.7				
Effluent	6/17	1105	7.1	500	17.2	0.6	4.5	6 est	<1
		1415	7.0	545	17.6				
		1525						6 est	<1
	6/18	1130	7.2	550	17.8	0.7	4.5	2 est	
						0.5**	3.5**		
		Ecol. Comp.	7.2	485	6.2				

*Held in conformance with METRO plant discharge rate/detention time curve prior to sample dechlorination. est = estimate.

**Chlorine residual at time of sample dechlorination. Because chlorine detention time is provided in the outfall line, fecal coliform samples are held a time period based on the known flow-rate-to-detention-time relationship prior to dechlorination.

Memo to Gary Brugger and Kyle Cook
Richmond Beach Sewage Treatment Piant Class II Inspection, June 17-18, 1985

Review of the April 1985 monthly report submitted by METRO to Ecology for Richmond Beach raised a question regarding plant solids removal. The solids removed by the plant (965 lbs/D of TSS removed) and the solids sent to the digester (1841 lbs/D of TS sent to digester) do not balance well (see Table 4 for calculations). This poor balance could result from a number of sources although underestimation of the plant flow and/or overestimation of the digester feed (flow and/or concentration) could be causes. METRO should investigate the imbalance and correct the source.

Table 4. Solids balance with METRO data* - Richmond Beach, June 1985.

Page Data From*	Parameter	Measurement*	Calculation
Solids to digester based on plant TSS removal data			
3	Influent TSS	156 mg/L	
4	Effluent TSS	67 mg/L	
	TSS Removal		89 mg/L
2	Plant Flow	1.3 MGD	
	TSS Removal		/965 lbs/D/
Solids to digester based on plant digester feed data			
6	Flow to Digester	5720 gpd	
6	TS	3.86%	
	TS to Digester		/1841 lbs/D/

*Average data from April 1985 monthly report submitted by METRO to Ecology for the Richmond Beach plant.

Results and station locations of the clarifier surface D.O. measurements are included on Figure 2. 0.0. concentrations in the clarifier were 0.0 mg/L at the time the samples were taken (June 18 at approximately 1230 hours). The piant was being operated with a minimal clarifier sludge blanket to minimize the chance of rising solids associated with denitrification. The 0.0 mg/L D.O. measurements suggest a high potential for denitification, thus minimizing the sludge blanket is a good practice that should be continued.

The 5.0. conditions in the clarifier may contribute to the poor BOD_5 removal at the plant, in part by affecting the character of the waste. Although some soluble BOD_5 work has been done at the plant, additional work may provide more insight into the low BOD_5 removal. Running soluble BOD_5 tests (influent and effluent) in addition to total BOD_5 tests for a two-month period when poor BOD_5 removal is a problem is suggested. Clarifier D.O. measurements (three times per day) made on days when samples for BOD_5 analysis are collected would provide good supporting data. Analysis of the data collected should give some insight into the BOD_5 removal that may be realistically expected at the plant.

Table 5 presents the results of the sludge metals analysis. The metals concentrations found in the Richmond Beach sludge generally fell well within the range of samples collected during previous Class II inspections at other primary plants in the state. The Cd (1.4 mg/Kg dry weight) and Zn (105 mg/Kg dry weight) concentrations were slightly less than the previously collected samples.

Table 5. Sludge metals concentrations - Richmond Beach, June 1985.

Metal	Richmond Beach Sludge† (mg/Kg dry wt)	Previous Inspection Data* Geometric Mean (mg/Kg dry wt)	Range (mg/Kg dry wt)	Number of Samples
Arsenic	2.3	--	--	--
Cadmium	1.4	8.0	1.8 - 61	25
Chromium	28	56	11 - 540	25
Copper	683	473	137 - 1300	25
Lead	285	307	64 - 1090	25
Nickel	30	52	14 - 130	19
Zinc	105	1310	180 - 2680	25

†Sludge solids = 4.1 percent.

*Summary of data collected during previous Class II inspections at primary plants.

Laboratory Procedures

Laboratory procedures were reviewed with the METRO staff. The "Laboratory Procedural Survey" with notes of the review is attached. Lab analysis for the Richmond Beach plant is set up so that NPDES analyses are done at the METRO West Point facility. Sampling and operational test analyses are done by the staff at Richmond Beach.

Lab procedures appeared to be generally good. Suggestions to improve procedures include:

1. Samples for BOD_5 analysis are routinely seeded and seed correction made by subtracting the oxygen depletion in the seeded blank from the oxygen depletion in the seeded test sample. Standard Methods (p. 529,d.) calls for a seed control to be set up to determine the BOD_5 of the seed (APHA, 1985). The seed D.O. depletion correction is then calculated using the seed control data and subtracted from the seeded test sample D.O. depletion to find the test sample D.O. depletion.

   The seed control correction method is preferred because in a seeded sample, the amount of seed used should result in a D.O. depletion of 0.6 to 1.0 mg/L. Thus, the seeded blank sample would then have an expected D.O. depletion in the 0.6 to 1.0 mg/L range. This range is below

the 2.0 mg/L minimum D.O. uptake required during the BOD_5 test to produce the most reliable results (p. 529,f) (APHA, 1985). Thus the seed control method of seed correction which is based on a more reliable BOD_5 test should be used.

The TSS test should be run using a Standard Methods approved filter paper (APHA, 1985). The Whatman GF/C filters noted as being used by METRO have an effective retention of 1.2 um as compared to an effective retention of 1.5 um for the approved Whatman 934 AH filter (Fisher, 1985). The smaller retention could result in an overestimate of solids concentrations by METRO. Because the retention is different, switching to the 934 AH or another approved filter is suggested.

Redrying and rechecking the weight of TSS samples to assure that the samples are dried completely is suggested. Quarterly rechecks as a quality control step are suggested.

Samples for fecal coliforrn analysis were collected simultaneously by Ecology and METRO during the inspection. The MPN test is used by METRO while the MF test is used by Ecology. Results of the split samples (Ecology - 2 est col/100 mL; Metro - 50 col/100 mL) were acceptably close when sampling and test variability are considered.

CONCLUSIONS AND RECOMMENDATIONS

The lack of acceptable laboratory analytical data for the composite samples limited the effectiveness of the inspection. Conclusions and recommendations based primarily on field analyses and observations include:

1. Ecology and Richmond Beach field chlorine residual test results did not compare closely. New chemicals were purchased for the Richmond Beach kit. Another comparison is suggested for the next Ecology field visit at Richmond Beach.

2. The positioning of the bar screen just upstream of the Parshall flume seemed to create turbulent flow conditions through the flume. Ecology instantaneous measurements upstream of the flume indicated a possible problem with the accuracy of the present flow-monitoring setup. Additional accuracy checks and any necessary flow-monitoring changes should be made by METRO.

3. The seeming discrepancy in diyester solids loading should be investigated by METRO.

4. Low D.O. concentrations (0.0 mg/L) were found in the clarifiers during the inspection. Waste character can be affected by such D.O. conditions, making treatment difficult. Including soluble BOD_5 tests and clarifier D.O. measurements in addition to the routine total BOD_5 tests for two months during a period of poor BOD_5 removal may provide better insight into potential removal efficiency.

5. Lab procedures were generally good. A few suggestions for improvement are made in the "Laboratory Procedures" portion of the report.

The inspection was incomplete due to the lack of composite sample data. If a more complete inspection is thought necessary, that request will be given high priority.

MH:cp

Attachments

REFERENCES

APHA-AWWA-WPCF, 1985. Standard Methods for the Examination of Water and Wastewater, 16th Ed.

Fisher, 1985, Fisher 1986. The Fisher Scientific Catalog.

U.S. Dept. of Interior, Bureau of Reclamation, 1974. Water Measurement Manual, 2nd Ed.

LABORATORY **PROCEDURAL** SURVEY

Discharger: RICHMOND BEACH STP

NPDES Permit Number: WA - 002961-1 (m)

Date: 6/17/85

Industrial/Municipal Representatives Present: JAMES HARVEY, GARY HANSEN

Agency Representatives Present: MARC HEFFNER

I. COMPOSITE SAMPLES

A. Collection and Handling

1. Are samples collected via automatic or manual compositing method? AUTOMATIC, Model? MANNING

   a. If automatic, are samples portable _____ or permanently installed PERMANENT?

   Comments/problems _____

2. What is the frequency of collecting composite samples? _____

   3x's/WK

3. Are composites collected at a location where homogeneous conditions exist?

   a. Influent? YES

   b. Final Effluent? YES

   c. Other (specify)? _____

4. What is the time span for compositing period? 0800-0800 (24 HRS)

   Sample aliquot? 200 mls per 60 minutes

5. Is composite sample flow or time proportional? TIME

6. Is final effluent composite collected from a chlorinated or non-chlorinated source? CHLORINATED

7. Are composites refrigerated during collection? YES

8. How long are samples held prior to analyses? SET- THE SAME MORNING COLLECTION IS COMPLETED

9. Under what condition are samples held prior to analyses?

   a. Refrigeration? YES

   b. Frozen? _____

   c. Other (specify)? _____

10. What is the approximate sample temperature at the time of analysis? ROOM TEMPERATURE

11. Are compositor bottles and sampling lines cleaned periodically? RINSE REGULARLY

   a. Frequency? 1X/WEEK WITH SOAP

   b. Method? _____

12. Does compositor have a flushing cycle? YES

   a. Before drawing sample? YES

   b. After drawing sample? YES

13. Is composite sample thoroughly mixed immediately prior to withdrawing sample? YES

Recommendations:

II. BIOCHEMICAL OXYGEN DEMAND CHECKLIST - TEST RUN @ WEST POINT

A. Technique

1. What analysis technique is utilized in determining BOD_5?

a. Standard Methods? YES Edition? 15TH (16TH ON ORDER)

b. EPA? _____

c. A.S.T.M.? _____

d. Other (specify)? _____

B. Seed Material

1. Is seed material used in determining BOD? YES

2. Where is seed material obtained? WEST POINT SETTLED EFFLUENT

3. How long is a batch of seed kept? ≈24 HRS

and under what conditions? (temperature, dark) _____

4. How is seed material prepared for use in the BOD test? _____

AERATE 1-2 HOURS, THEN INCUBATE

Recommendations:

C. Reagent Water

1. Reagent water utilized in preparing diultion water **is:**

   a. Distilled? _____

   b. Deionized? Yes

   c. Tap _____, chlorinated _____ non-chlorinated _____

   d. Other (specify)? _____

2. Is reagent water aged prior to use? _____

   How long? _____, under what conditions? _____

   _____

'Recommendations:

_____

_____

_____

_____

_____

D. Dilution Water

1. Are the four (4) nutrient buffers added to the reagent water? JUST BEFORE USE

   a. 1 mls of each nutrient buffer per LITER mls of reagent water

2. When is phosphate buffer added (in relation to setting up BOD test)? _____

3. How often is dilution water prepared? DAILY
   Maximum age of dilution water at the time test is set up.

   _____

4. Under what conditions is dilution water kept? _____

   REAGENT WATER IN INCUBATOR OVERNIGHT

5. What is temperature of dilution water at time of setup? ≈ 20° C

Recommendations:

E. Test Procedure

1. How often are BOD's being set up? 3x's/WK FOR RICHMOND BEACH

   What is maximum holding time of sample subsequent to end of composite period? COUPLE OF HOURS

2. If sample to be tested has been previously frozen, is it reseeded? _____ How? _____

3. Does sample to be tested contain residual chlorine? _____
   If yes, is sample

   a. Dechlorinated? YES

      How? THIOSULFATE

   b. Reseeded? _____

      How? _____

4. Is pH of sample between 6.5 and 8.5? YES

   If no, is sample pH adjusted and sample reseeded? _____

5. How is pH measured? METER

   a. Frequency of calibration? DAILY

   b. Buffers used? 7 (OLD METER @ RICHMOND BEACH, 2 POINT CALIBRATION NOT POSSIBLE)

6. Is final effluent sample toxic? NO

7. Is the five (5) day DO depletion of the dilution water (blank) determined? YES, normal range? <0.2

8. What is the range of initial (zero day) DO in dilution water blank? 8.8 - 9.0

9. How much seed is used in preparing the seeded dilution water? TABLE SET UP

10. Is five (5) day DO depletion of seeded blank determined? YES
If yes, is five (5) day DO depletion of seeded blank approximately 0.5 mg/l greater than that of the dilution water blank? RANGE .5-1.0

11. Is BOD of seed determined? BLANK ONLY

12. Does BOD calculation account for five (5) day DO depletion of

a. Seeded dilution water? YES

How? CORRECT WITH SEEDED BLANK DEPLETION

b. Dilution water blank? NO

How?

13. In calculating the five (5) day DO depletion of the sample dilution, is the initial (zero day) DO obtained from

a. Sample dilution? YES

b. Dilution water blank?

14. How is the BOD_5 calculated for a given sample dilution which has resulted in a five (5) day DO depletion of less than 2.0 ppm or has a residual (final) DO of less than 1.0 ppm?

SAMPLE REJECTED CRITERIA NOT MET

15. Is liter dilution method or bottle dilution method utilized in preparation of

a. Seeded dilution water? LITER METHOD

b. Sample dilutions? BOTTLE METHOD

16. Are samples and controls incubated for five (5) days at 20°C ± 1°C and in the dark? YES

17. How is i'ncubator temperature regulated? _____

_____

18. Is the incubator temperature gage checked for accuracy? _____

a. If yes, how? THERMOMETER IN WATER BATH

b. Frequency? _____

19. Is a log of recorded incubator temperatures maintained? YES

a. If yes, how often is the incubator temperature monitored/ checked? _____

20. By what method are dissolved oxygen concentrations determined?

Probe WHEATON Winkler _____ Other _____

a. If by probe:

1. What method of calibration is in use? WINKLER

_____

2. What is the frequency of calibration? DAILY

b. If by Winkler:

1. Is sodium thiosulfate or PAD used as titrant? _____

2. How is standardization of titrant accomplished? _____

_____

3. What is the frequency of standardization? _____

_____

Recommendations:

① MAKE SEED CORRECTION BASED ON DATA FROM A SEED CONTROL SAMPLE RATHER THAN SEEDED BLANK DATA.

F. Calculating Final Biochemical Oxygen Demand Values Washington State Department of Ecology

1. Correction Factors

a. Dilution factor:

$$= \frac{\text{total dilution volume (ml)}}{\text{volume of sample diluted (ml)}}$$

b. Seed correction:

$$- \frac{(\text{BOD of Seed})(\text{ml of seed in 1 liter dilution water})}{1000}$$

c. F factor ∿ a minor correction for the amount of seed in the seeded reagent Versus the amount of seed in the sample dilution:

$$F = \frac{[\text{total dilution volume (ml)}] - [\text{volume of sample diluted ml}]}{\text{Total dilution volume, ml}}$$

2. Final BOD Calculations

a. For seed reagent:

(seed reagent depletion-dilution water blank depletion) x D. F.

b. For seeded sample:

(sample dilution depletion-dilution water blank depletion-scf) x D.F.

c. For unseeded sample:

(sample dilution depletion-dilution water blank depletion) x D.F.

3. Industry/Municipality Final Calculations

Recommendations:

III. TOTAL SUSPENDED SOLIDS CHECKLIST

A. Technique

1. What analysis technique is utilized in determining total suspended solids?

   a. Standard Methods? Yes Edition _____

   b. EPA? _____

   c. A.S.T.M.? _____

   d. Other (specify)? _____

B. Test Procedure

1. What type of filter paper is utilized:

   a. Reeve Angel 934 AH? _____

   b. Gelman A/E? _____

   c. Other (specify)? WHATMAN GF/C

   d. Size? 47 mm

2. What type of filtering apparatus is used? _____

3. Are filter papers prewashed prior to analysis? Yes

   a. If yes, are filters then dried for a minimum of one hour Yes at 103°C-105°C Yes?

   b. Are filters allowed to cool in a dessicator prior to weighing? Yes

4. How are filters stored prior to use? OVERNIGHT

5. What is the average and minimum volume filtered? 50-150 mls

6. How is sample volume selected?

   a. Ease of filtration? _____

   b. Ease of calculation? _____

   c. Grams per unit surface area? _____

   d, Other (specify)? PRIOR KNOWLEDGE

7. What is the average filtering time (assume sample is from final effluent)? < 5 MINUTES

8. How does analyst proceed with the test when the filter clogs at partial filtration? PITCH & START OVER

9. If less than 50 milliliters can be filtered at a time, are duplicate or triplicate sampe volumes filtered? _____

10. Is sample measuring container; i.e., graduated cylinder, rinsed following sample filtration and the resulting washwater filtered with the sample? VOLUMETRIC PIPET RINSED

11. Is filter funnel washed down following sample filtration? YES

12. Following filtration, is filter dryed for one (1) hour, cooled in a desscator, and then reweighed? DRIED OVERNIGHT

13. Subsequent to initial reweighing of the filter, is the drying cycle repeated until a constant filter weight is obtained or until weight loss is less than 0.5 mg? No

14. Is a filter aid such as cellite used? _____

a. If yes, explain: _____

Recommendations:

① USE STANDARD METHODS APPROVED FILTER PAPER

② QUARTERLY REDRY SAMPLE TO FIXED WEIGHT AS A QUALITY ASSURANCE CHECK (ITEM 13).

C. Calculating Total Suspended Solids Values Washington State Department of Ecology

A. $mg/l\ TSS = \frac{A-B}{C} \times 10^6$

1. Where: A = final weight of filter and residue (grams)

B = initial weight of filter (grams)

C = Milliliters of sample filtered

2. Industry/Municipality Calculations

Recommendations:

SPLIT SAMPLE RESULTS:

Origin of Sample _____

Collection Date _____

BOD		TSS		EPA BOD Standard	
DOE	IND./MUN.	DOE	IND./MUN.	DOE	IND./MUN