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STATE OF WASHINGTON
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DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

Segment No. 02-03-04

MEMORANDUM

To: John Glynn

From: Mike Morhous

Re: Anacortes STP
Class II Inspection

Date: December 8, 1978

Introduction

On August 29-30, 1978 the above-referenced inspection was conducted by Gerald McDonald and myself. The Anacortes STP is a primary wastewater treatment facility presently in the process of upgrading to secondary or best practical treatment. The final effluent is discharges into Guemes Channel. Those persons in attendance during this inspection were John Glynn, DOE N.W. Regional Office; Chet Smith, Plant Operator; and, Don Weiland, Trainee.

Findings and Conclusions

At the time of this inspection, the Anacortes STP was in compliance with all NPDES permit limitations except fecal coliforms. The combined fecal coliform values shown in Table I equal a geometric mean of 1000 colonies per 100 mls. It is difficult to explain this situation because the respective chlorine residuals (1.2 ppm and 1.0 ppm) were not abnormally low. Visual observation of the chlorine contact chamber was impossible because of its underground location. The most probable reasons for the lack of adequate disinfection are: 1) poor mixing of injected chlorine and wastewater; and/or, 2) short-circuiting of flow in the contact chamber.

During the inspection it was noted that the STP has no means of monitoring the amount of chlorine remaining in the chlorine tank. There also is no warning system to indicate when the tank is empty. The STP is not manned at night, on weekends, or holidays. Subsequently, should the chlorine tank run dry, the situation is not corrected until the next work day. Corrective action should be initiated to preclude the possibility of discharging an unchlorinated final effluent to the receiving water.

The STP's 24-hour composites consist of grab samples collected at the influent and final (unchlorinated) effluent during the 8-hour work day. The influent sample is collected at the headworks below the comminutors. The final effluent sample is collected from the quiescent portion of the primary clarifier inside the scum ring. As shown in Table 1, the STP's

sampling location in the clarifier was not truly representative of the clarifier's final discharge (DOE sampler location). Although this may be due in part to the 8-hour collection period, the sampling point is not presently at the best location. Subsequent sample collections should be oriented to the clarifier's combined effluent flow before discharge to the chlorine contact chamber.

The STP's flow measuring device is a Sparling propeller flowmeter situated at the head end of the chlorine contact chamber. The accuracy of the flowmeter/recorder was checked by comparing the recorded flow with the calculated instantaneous flow. The flow was calculated from a combined contract/suppressed broad-crested rectangular weir located at the chlorine contact chamber outfall. The flowmeter/recorder checked out extremely well by recording 98.5 percent of the instantaneous flow.

Laboratory procedures were reviewed and appeared generally adequate; however, a few discrepancies were observed. These findings are provided in the Review of Laboratory Procedures section of this memo.

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

Sampler	Date and Time Installed 1/	Location
1. Influent aliquot - 250 mls/30 min.	8/29 @ 0920	Headworks below comminutors
2. Unchlorinated Effluent aliquot - 250 mls/30 min	8/29 @ 0940	Combined clarifier effluent
3. Chlorinated Effluent aliquot - 250 ml/30 min.	8/29 @ 0930	Chlorine contact chamber outfall

NOTE: In addition, the STP collected their regular final effluent (unchlorinated) manual grab composite for comparative purposes

Grab Samples

	Date and Time	Analysis	Sample Location
1.	8/29 @ 1400	Heavy Metals	Primary Digester
2.	8/30 @ 0915	Fecal Coliform	Chlorinated Effluent
3.	8/30 @ 1000	Fecal Coliform	Chlorinated Effluent
4.			
5.			
6.			

Flow Measuring Device

1. Type Propeller Flowmeter
2. Dimensions N/A

a. Meets standard criteria

☐ Yes

☐ No Explain:

N/A

b. Accuracy check

	Actual Instan. Flow	Recorder Reading	Recorder Accuracy (% of inst. flow)
1.	.68 MGD	.69 MGD	98.5%
2.			
3.			

☒ is within accepted 15% error limitations

☐ is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
temp.,pH,sp.cond.	8/29 @1520	Same as Sampler #1	19.7°C, 7.1, 675 umhos/cm
temp.,pH,sp.cond.	8/29 @1525	Same as Sampler #2	19.7°C, 6.9, 1360 umhos/cm
temp.,pH,sp.cond.	8/29 @1530	Same as Sampler #3	19.7°C, 6.9, 1290 umhos/cm
chlorine residual	8/29 @1025	Same as Sampler #3	1.2 ppm
chlorine residual	8/30 @0915	Same as Sampler #3	1.2 ppm
chlorine residual	8/30 @1000	Same as Sampler #3	1.0 ppm

1/Partial 24-hr. composite, jug half full. Sampler hose became plugged with solids during the night.

Review of Laboratory Procedures and Techniques

Laboratory procedures were reviewed with Chet Smith and Don Weiland. General laboratory procedures appeared acceptable although discrepancies were observed in certain techniques used during the tests reviewed.

Total Residual Chlorine

The STP was using the orthotolidine colormetric method for total residual chlorine. However, they indicated that a DPD chlorine test kit was on order.

Fecal Coliform

The STP uses the membrane filter techinque for the fecal coliform analysis. General test procedures appeared adequate. However, a discrepancy was observed with regard to the rinse water used. The STP was using distilled water instead of the required phosphate buffer rinse water. The use of distilled water for rinsedowns creates a high stress and mortality rate of the fecal coliforms. This would, in turn, result in lower FC colony counts. In comparison to DOE's FC results, Table I, the STP's previous DMR values are quite low. This could be the result of the rinse water used in the test. The STP is in the process of acquiring the potassium phosphate needed for preparation of the buffer rinse water.

It was also noticed that the STP was calculating the FC monthly average using an arithmetic mean instead of the required geometric mean. It was recommended that the geometric mean be implemented in calculating subsequent monthly averages. It was also suggested that a blank be run at the beginning and end of the test procedure as a quality check of sterilization and disinfection techniques and thoroughness of rinsedowns between sample filtering.

A copy of DOE's Membrane Filter Procedure for the Fecal Coliform Test, February, 1977, together with a graph for determining the geometric mean of coliform values was sent to Don Weiland subsequent to this inspection.

Recommendations

1. The use of the prescribed phosphate buffer rinse water.

2. The use of the geometric mean procedure for determining monthly averages.

3. The use of blanks during the test as a quality check of individual technique.

BOD_5

The STP runs 5-day BOD's on the plant influent and final unchlorinated effluent. Therefore, dechlorination and reseeding procedures are not necessary. The measurement of dissolved oxygen during the BOD_5 tests is accomplished with a membrane electrode DO meter. The DO meter is calibrated using the air calibration techinque as described in the operation manual. BOD procedures appeared to be in order. The basic mechanics of calculating BODs from the raw lab data also appeared to be understood by the plant personnel. However, one discrepancy was observed relating to the use of invalid dissolved oxygen depletions to calculate 5-day BODs. It was explained that an invalid DO depletion is a DO value which, at the end of the 5-day incubation period, does not drop at least 2.0 ppm from the initial DO value or does not have at least 1.0 ppm DO remaining after incubation. An invalid DO depletion can only be used to estimate the actual BOD_5. The estimated value would be expressed as either a "greater than, >" or "less than, <" BOD_5. It was further explained that these estimate BODs cannot be averaged with valid BOD_5 results when calculating the final BOD_5.

During the comparison of the split composite results with Don Weiland, there was still some confusion regarding DO depletions. Don indicated the following BOD_5 results; 1) Inf. - 189 mg/l, 2) Unchl. Eff. - 189 mg/l. I reviewed Don's raw lab data and explained to Don which DO depletions should have been used to calculate the BODs. Utilizing the STP's raw data, the actual BOD_5 results were; 1) Inf. - >400 mg/l, 2) Unchl. Eff. - 228 mg/l, which more reasonably compare with DOE's results, Table I. However, it may be advantageous to split an additional sample with the STP. A copy of DOE's "Laboratory Procedures for Biochemical Oxygen Demand, August 1977" was mailed to the STP subsequent to this inspection.

Recommendations

1. When calculating BODs, use those dissolved oxygen depletions in which the DO has dropped at least 2.0 ppm and has at least 1.0 ppm remaining at the end of the 5-day incubation period.

2. In the event none of the sample dilutions are valid, use the appropriate calculation (DOE Lab. Proced. for BOD_5, Pg. 20, 5 f or g) and report the BOD_5 value accordingly.

Total Suspended Solids

The STP uses the Gooch crucible filtering apparatus and Whatman GF/C glass fiber filter papers. TSS procedures appeared to be in order. It was suggested that when the STP was ready to reorder filter papers that they order one of the following; 1) Reeve Angel 934 AH, 2) Gelman A/E.

It was also suggested that as a check for the optimum volume of sample to be filtered during this analysis, the following guideline should be used. The sample volume should be sufficient to reduce the initial filtration rate by approximately 50-60 percent at the end of the sample filtering period. Sample volumes should be adjusted accordingly. This may necessitate filtering a portion of the sample, prior to analysis, to determine the sample volume required. In no instance should the total sample volume filtered be less than 50 mls. Duplicate or triplicate filtrations become necessary when the filterable sample volume is less than 50 mls.

Recommendations

1. Utilize the sample filtration rate as a guide to the optimum volume of sample to be filtered during the test.

2. Filter a minimum of 50 mls of sample, utilizing duplicate or triplicate samples if necessary.

3. When reordering filter papers, order either the Reeve Angel 934 AH or the Gelman A/E filter papers.

MM:cp

Table I

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				Anacortes STP		
	Inf.	Unchl. Eff.	Chl. Eff.	Unchl. Eff. 1/	Inf.	Unchl Eff.	NPDES 3/ (Monthly average)
BOD_5 mg/l	445	302	288	235	189 2/	189 2/	
lbs/day			1489	1215	977	977	2500
TSS mg/l	360	108	118	108	410	143	
lbs/day			610	558		739	1250
Total Plant Flow MGD						.62	Not to exceed 2.2
Fecal Coliform colonies/100 mls							700
@ 0915			2100				
@ 1000			490				
*Total Residual chlorine ppm							
@ 0915			1.2				
@ 1000			1.0				
pH	7.5	7.3	7.1	7.5			6.0-9.0
sp. conductivity umhos/cm	162	144	154	124			
COD	980	510	510	440			
NO_3-N (filtered) mg/l	ND	ND	ND	ND			
NO_2-N (filtered) mg/l	ND	ND	ND	ND			
NH_3-N (unfiltered) mg/l	23	28	29	27			
O-PO_4-P (unfiltered) mg/l	8.8	8.7	9.2	8.0			
Total Phos.-P (filtered) mg/l	11.5	9.2	11.0	9.5			
Total Solids mg/l	1250	846	902	690			
Total Non. Vol. Solids mg/l	801	652	687	516			
Total Susp. Non. Vol. Solids mg/l	100	10	10	4			

* Field Analysis DPD Field Kit

"<" is "less than" and ">" is "greater than", "ND" is "none detected"

1/STP manual grab composite, analyzed by DOE only.

2/Explanation provided in Review of Lab. Procedures.

3/Permit limitations in accordance with DOE Order, Docket No. DE 77-330

Table II
Heavy Metals Results

	Primary Digester Sludge	DOE					
% Solids	4.2						
Lead mg/Kg dry wt.	530						
Zinc mg/Kg dry wt.	1380						
Cadmium mg/Kg dry wt.	7						
Copper mg/Kg dry wt.	450						
Chromium mg/Kg dry wt.	60						
Nickel mg/Kg dry wt.	39						

"<" is "less than" and ">" is "greater than"