Segment 09-17-02

Publication No. 79-e19

WA-17-0050

STATE OF
WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

MEMORANDUM

May 21, 1979

To: Ron Robinson

From: Mike Morhous

Subject: Sequim STP Class II Inspection

Introduction

The above-referenced inspection was conducted on March 6-7, 1979. Those persons in attendance were Russ Robertson and Dan Schmidt, plant operators in training and Mike Morhous, DOE, Water and Wastewater Monitoring Section. The Sequim Sewage Treatment Plant (STP) is a secondary treatment (oxidation ditch) facility which provides activated sludge (extended aeration) treatment. The final effluent is discharged to Sequim Bay (Segment 09-17-02). Sequim Bay is presently meeting Marine Class AA water quality standards, according to DOE's Five-Year Water Quality Strategy, September 1977. The City of Sequim is in the process of upgrading the facility in order to comply with secondary effluent limitations as described in the NPDES Waste Discharge Permit, #WA-002234-9, S2, Final Effluent Limitations.

Findings and Conclusions

At the time of this inspection, the STP's chlorinated effluent was meeting interim effluent limitations (NPDES, S1.) for TSS and pH, although the TSS concentration was borderline. The chlorinated effluent was out of compliance with BOD_5 and fecal coliform limitations (Table I).

It was apparent that the chlorinator was malfunctioning when the coliform samples were collected on March 7. The chlorinator registered an injection loading of 10 lbs per day; however, at the sampling station (composite station #3, see Field Review Sheet) a total residual chlorine concentration could not be detected. On the previous day, total residual chlorine concentrations of 0.2 ppm and 0.5 ppm (Field Review Sheet) were measured and the chlorinator was registering approximately 10 lbs/day. Subsequent to the inspection, Mr. Robertson explained the facility chlorinator had been rebuilt and was on line together with a second rebuilt chlorinator. It should be noted that the STP does not have a chlorine contact chamber. The secondary effluent is chlorinated as it passes into the discharge line to Sequim Bay. An open channel chlorine contact chamber should possibly be considered for incorporation with upgrading of the facility. This structure would ensure adequate retention of the effluent for disinfection purposes and provide an improved sampling station for monitoring the quality of effluent disinfection and possible chlorinated (final) effluent compositing in the future.

At the present time, there is no explanation for the approximate 60 percent reduction in organics (TSS and BOD_5) between DOE's unchlorinated and chlorinated composites (composite stations #2 and #3, Field Review Sheet). There is roughly 200 yards of discharge pipe between the two sampling points with no known points where retention or settling out could occur.

The plant's flow measuring device is a 6-inch Parshall flume located at the headworks immediately below the comminutor. The structure was measured and compared to standard construction criteria (Table II). Two discrepancies were found, including a throat width of 5.5 inches. An accuracy check was conducted by comparing the recorded (script chart) flow with a calculated (6-inch throat formula) instantaneous flow and using a correction factor for the 5.5-inch actual throat width. The accuracy of the flume/recorder was within the acceptable error limit of 15 percent. See Table II for details.

Laboratory procedures including sampling methodology were reviewed with Mr. Robertson and Mr. Schmidt. Several discrepancies were observed. However, there is still no explanation for the substantial differences in analytical (BOD_5 and TSS) results. The findings and recommendations are provided in the "Review of Laboratory Procedures" section of this memo.

It has been previously noted by DOE personnel that the Sequim STP is organically overloaded, particularly during the summer months. At the time of this inspection, the influent composite showed the organic loading to be 107 percent of the design (550 lbs/day) loading. In conjunction with the organic overloading problem, the sludge wasting routine also appears to adversely affect the efficiency of the plant. Sludge is wasted approximately once a month. The sludge is pumped from the secondary clarifier to a tank truck. Disposal of the sludge is normally accomplished by field application. Sludge is generally wasted for two to three consecutive days. During the sludge wasting process, the return sludge to the aeration basin (oxidation ditch) is shut down. On occasions the sludge return may be shut down for four to five days (See Sequim STP Fact Sheet). An extended termination (1/2 day or longer) of return sludge to aeration basin has a two-fold impact on the treatment process. First, it reduces the biomass in the aeration basin by approximately 50 percent to 75 percent (as determined from DMR-Mixed Liquor Suspended Solids [MLSS] data). These reductions result in an aeration basin biomass (MLSS) concentration which is considerably lower than typical minimum design criteria (2,000 mg/l). Second, extended shutdowns appear to result in the starvation of the biomass and anoxic conditions in the secondary clarifier. The overall impact on plant efficiency during these shutdowns is that of subjecting the total biomass to stress and shock. On the afternoon of March 6, bulking sludge was observed in the clarifier. This situation is probably due to overloaded and anoxic conditions in the clarifier. The escape of organics resulting from bulking conditions in clarifier contributes to the difficulty in meeting effluent limitations for BOD_5 and TSS.

Bearing in mind that the plant is, at times, operating under an organic overload, it is suggested that consideration be given to the following operational procedures which should improve (1) efficiency of the existing plant, (2) the quality of the final effluent.

1. Use a constant sludge age as control for plant operation. Normally the sludge age of an extended aeration system is between 10 and 30 days. However, experimentation will be necessary to determine what constant sludge age will provide the best treatment in this plant. In addition to maintaining an accurate log of the volumes of sludge wasted, monitoring the biomass (MLSS) of the wasted sludge will also be necessary.

2. Development of a sludge wasting schedule more consistent with secondary treatment. Sludge wasting should be scheduled to provide more frequent sludge wasting with smaller volumes of sludge wasted at any one time. The limiting factor for sludge wasting frequency and volume would be the experimentally determined optimum constant sludge age. The reactivation of existing sludge drying beds may help to accomplish an increased frequency of sludge wasting since smaller sludge volumes would be involved.

3. Cease the practice of extended or prolonged elimination of return sludge to the oxidation ditch. Sludge wasting procedures should not result in a substantial reduction of the biomass in the oxidation ditch.

4. Increase the average flow rate of return sludge to the oxidation ditch. Increasing the oxidation ditch biomass may encourage additional organic degradation in the ditch and may reduce anoxic conditions in the clarifier.

5. As an interim measure to facility upgrading, a second brush aerator may have an advantageous application toward improving the oxidation ditch treatment process.

In addition, Mr. Robertson and Mr. Schmidt should be provided the opportunity and training necessary to become certified plant operators. This would increase their understanding of proper plant operation and improve their laboratory skills.

In summary, it is requested that the following suggestions be given due consideration with regard to their application toward improving the efficiency of the existing facility:

1. Incorporation of an open channel chlorine contact chamber for improved disinfection and monitoring purposes.

2. Improve the efficiency of the existing secondary treatment process by:

    a. using a constant sludge age as a control of plant operations;

    b. develop a sludge wasting schedule more applicable to the activitated sludge treatment process;

    c. preclude extended retention of return sludge in the secondary clarifier prior to wasting;

    d. increase the average flow rate of return sludge to the oxidation ditch; and

    e. possible addition of a second brush aerator in the oxidation ditch.

3. Provide the training necessary to enable the two operators in training to become certified plant operators.

In conjunction with the regional follow-up inspection (mid-July, 1979), the following recommendations should be reviewed with the operator(s) to insure that corrective action has been implemented:

Sampling Procedures

1. Utilize automatic composite samplers on a full-time basis and increase sample aliquot to a minimum of 100 mls per hour.

2. Provide ice in composite samplers during sampling period.

3. Collect final effluent sample from launder ring discharge pipe.

Biochemical Oxygen Demand - Five Day

1. Improve accuracy sample dilution technique and completely phase out the Hatch Manometer procedure for reporting purposes on DMR's.

2. Obtain the necessary reagents for checking normality and standardization of sodium thiosulfate.

3. During preparation of dilution water, add the four nutrient reagents to a full one liter volume of distilled water.

4. Stabilize temperature of collected samples to room temperature before proceeding with BOD test.

5. Report BOD$_5$ values on DMR's for the day the sample was collected.

6. Check accuracy of incubator temperature gage using a water bath and thermometer placed on same shelf as BOD bottles.

Total Suspended Solids

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

2. Filter a total minimum of 50 mls of sample using duplicate or triplicate sample volumes as necessary.

3. If difficulty in filtering sample volume should arise, start over with a new, prewashed, dried, and weighed Gooch crucible and filter paper.

4. Provide post washdown after sample volume has been filtered.

5. To obtain final weight, repeated drying process until a constant weight is obtained or weight loss is less than 0.5 mg.

6. When stock of Whatman GF/C filter papers is gone, order either Reeve Angel 934AH or Gelman A/E filter papers.

7. Suggest a larger diameter filter funnel and filter for MLSS analyses.

Fecal Coliform

1. Report FC values as colonies per 100 mls and use prescribed methods for reporting plate counts outside the 20 to 60 colonies range.

In addition, and to be included in the follow-up review:

1. Split composite sample(s) between STP and DOE lab for further comparative BOD$_5$ and TSS results.

2. Check total residual chlorine of final effluent and collect one or two fecal coliform samples to check operation of rebuilt chlorinators. (USE STP sampling point for both chlorine monitoring and FC sample collection.)

Review of Laboratory Procedures and Techniques

Laboratory and sampling procedures were reviewed with Mr. Robertson and Mr. Schmidt on March 6, 1979. Both operators are conscientious in their work, but appear to lack fundamental theory of treatment plant operation and laboratory analyses.

Although discrepancies were noted in sampling procedures and analytical tests, there is no specific explanation for the poor correlation of the comparative BOD_5 and TSS results in Table I. In view of this situation and the data in the plant's daily monitoring reports (DMR's) (November 1978 through February 1979), the accuracy of the effluent data (BOD_5, TSS, and fecal coliform) appears questionable. There is a poor correlation between the respective BOD_5 and TSS values reported. In addition, the fecal coliform results were consistently reported as less than 10. The fecal coliform problem relates to the method used for reporting test results and will be explained later in this section.

In view of the problem with analytical accuracy, it is recommended the subsequent composite(s) be split between DOE and the STP during the follow-up inspection for additional comparative BOD_5 and TSS results. It also appears that additional training for both operators and treatment plant certification of one or both operators would help to improve the accuracy of laboratory analyses.

The following areas were reviewed during this inspection.

Sampling Procedures

The STP uses both automatic (Isco) composite samplers and manual grabs for permit parameter analyses. The automatic samplers are adjusted to collect a 40 ml per hour aliquot. It was expressed during this review that due to previous weather conditions (hard freezes) and clarifier bulking problems, the manual grab procedure was being used. The latter procedure consists of collecting one grab sample from each sampling point (influent and unchlorinated effluent) and conducting permit parameter analyses on the single grab sample. A major portion of this problem is the operator's inability to manually collect an 8- or 24-hour composite due to the short period of time spent at the plant each day. The STP is only manned part-time as opposed to a full 8-hour shift.

The influent sampling point is located below the comminutor and provides homogeneous sample conditions. The final effluent, however, is collected from the middle (quiescent portion) of the secondary clarifier.

Recommendations

1. Utilize automatic composite samplers on a full-time basis. Manual composites should only be used as a backup in the event of an automatic sampler failure.

2. Increase the automatic sampler aliquot to a minimum of 100 mls per hour or use an aliquot which will completely fill compositing jug at the end of the 24-hour sampling period.

3. Provide ice in composite sampler to maintain a sample temperature of approximately 4°C during the compositing period.

4. In the event manual composites become necessary, samples should be collected hourly for a minimum of 8 hours and preferably on an hourly schedule extending from mid-morning of the first day to mid-morning of the second day.

5. Collect final effluent sample from launder ring discharge pipe for a more representative effluent sample.

Biochemical Oxygen Demand - Five Day

The STP runs BOD_5's on the influent and unchlorinated final effluent and therefore does not incorporate dechlorination or reseeding procedures with the test. The STP implements two separate methods when conducting BOD tests: (1) Standard Methods - Sample dilution; and (2) Hach Manometer. Predominantly the sample dilution BOD_5 results are reported on the DMR. However, the Hach BOD_5 results are reported when there appears to be a discrepancy with the standard BOD_5 test. It should be noted that the Hach procedure is not an acceptable method for determining BOD_5. The Sequim STP fact sheet shows a correlation between the two test procedures. The Hach BOD_5 results are consistently lower than the respective standard BOD_5 results.

The STP uses the Winkler Azide Modification procedure for determining initial and final dissolved oxygen (DO) values. Incorporated with this test is the use of manufactured sodium thiosulfate at the prescribed .025 normality. It was noted, however, that the normality is never checked for accuracy or deterioration.

At this time, there is no specific explanation for the poor correlation of BOD_5 results from the composite samples split with the STP. However, when the BOD_5 results were being compared, the STP reported the final effluent BOD_5 as 400 mg/l. It was later discovered that the actual BOD_5 result was 40 mg/l, as shown in Table I. The use of the wrong "percent dilution" in the calculation was the apparent error. DOE's "Lab Procedures for BOD" manual was given to the operators to help explain the procedures discussed and for future reference.

Recommendations

1. If the STP determines it necessary to report a Hach BOD_5 result on the DMR, it should be made clear on the DMR that the Hach Manometer was used.

The operators should be cognizant of the fact that Hach Manometer is not recognized as an acceptable procedure for the BOD_5 test by either Standard Methods or the Environmental Protection Agency (EPA). More impetus should be given toward improving the accuracy of the sample dilution method and use of the Hach Manometer phased out completely.

2. Obtain the required reagents for checking the normality of the sodium thiosulfate and standardization when needed as per Standard Methods, 14th Edition or DOE's BOD manual. The normality should be checked every two weeks.

3. When preparing the dilution water, the prescribed volumes of the four reagents should be added to a full 1 liter volume of distilled water, not 996 mls of distilled water.

4. Stabilize temperature of collected samples to room temperature (approximately 20°C) before proceeding with the BOD test.

5. Report BOD_5 values on DMR for the day the samples are collected as opposed to the day test is completed. It was also suggested that a thermometer be placed in a beaker of water and the beaker set in the incubator on the same shelf as the BOD bottles to monitor water temperature inside the incubator and to check the accuracy of the outside temperature gage.

Total Suspended Solids

The STP analyzes TSS using a Gooch cruicible and both Reeve Angel 934AH and Whatman GF/C glass fiber filter papers. Approximately 30 mls of influent sample is filtered in approximately 2-5 minutes. The same volume of final effluent sample is filtered in usually less than a minute.

As a check for the optimum volume of sample to be filtered during this analysis, the following guideline was recommended. An optimum sample volume should reduce the initial filtration rate by approximately 50 to 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 the analysis to determine the sample volume required. In no case should the total volume filtered be less than 50 mls. Duplicate or triplicate filtrations become necessary when the filterable sample volume is less than 50 mls.

The STP's TSS results did not compare satisfactorily with DOE's results. However, no major discrepancies were found that would explain the poor comparison.

The STP uses the Gooch cruicible unit to analyze MLSS (oxidation ditch biomass) and has a difficult time filtering the sample. It was suggested that a larger diameter filtering unit be obtained for this analysis.

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 as necessary.
3. In the event there is difficulty in filtering the sample due to excessive solids or plugging of filter, the test should be started over with a new crucible and filter (prewashed, dried, and weighed).
4. After sample has been filtered, rinse the crucible and filter with approximately 20 mls of distilled water and filter the rinse water. This will remove any trapped dissolved solids.
5. After sample has been filtered, dried in the oven, cooled in the dessicator, and weighed, the drying cycle should be repeated until a constant weight is attained or until weight is less than 0.5 mg.
6. When Whatman GF/C filter paper stock is depleted, order either Reeve Angel 934AH or Gelman A/E filter papers.
7. Suggest a larger diameter filter funnel and filters for Mixed Liquor Suspended Solids (MLSS) analysis.

Fecal Coliform

The STP uses the membrane filter technique for FC analyses. The M-FC broth used is Gelman Ampoule media. The STP obtains its stock phosphate buffer solution from the Pt. Angeles STP and prepares their own working solution for rinsedowns.

A 10 percent solution of sodium thiosulfate solution is added to the sample bottle prior to autoclaving for dechlorination purposes when collecting samples.

Three separate sample volumes are filtered for each test. However, tests results were being reported as actually number of colonies on one filter pad. If the number of colonies was less than 10, then the results were reported as less than 10. It was explained that the results are to be reported as colonies per 100 mls. DOE's "Fecal Coliform Test Procedure," February 1977 was given to the operators to help explain procedures, calculations, and for future reference.

Recommendations

1. Report FC values as colonies per 100 mls and use the DOE Fecal Coliform Procedure manual for determining how to report number outside the optimum 20 to 60 colonies range.

pH

The STP uses a Corning Model #5 pH meter. The meter is calibrated daily using #7 buffer only.

Recommendations

1. Obtain #4 and #10 buffer solutions to ensure an accurate and complete calibration of the meter.

Total Residual Chlorine

The STP has an acceptable DPD chlorine test kit for monitoring TRC.

MM:cp

Attachments

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.	3/6/79 @ 0900	Headworks, below comminutor
2. Unchlor. Effluent aliquot - 250 ml/30 min.	3/6/79 @ 0915	Secondary clarifier effluent

3. Chlor. Effluent - a manual composite was collected from the second manhole on the discharge line located adjacent to the dirt road leading to the STP.
aliquots: 3/6 @ 0930 - 300 mls; @ 1220 - 300 mls; @ 1515 - 300 mls;
3/7 @ 0825 - 300 mls; @ 0930 - 300 mls

Grab Samples

	Date and Time	Analysis	Sample Location
1.	3/7/79 @ 0825	Fecal Coliform	Same as Sampler #3
2.	3/7/79 @ 0930	Fecal Coliform	Same as Sampler #3
3.	3/7/79 @ 1000	Heavy Metals	Secondary Clarifier (See Table III)
4.			
5.			
6.			

Flow Measuring Device

1. Type - Parshall flume (six-inch throat width)
2. Dimensions - (See Table II)

a. Meets standard criteria ☐ Yes

☐ No Explain:

Generally, the Parshall flume meets standard criteria. However, the 2/3C measurement was in error by 6.5% and the throat width measurement was in error by 8.3%. See Table II

b. Accuracy check

	Actual Instan. Flow	Recorder Reading	Recorder Accuracy (% of inst. flow)
1.	See Table II		
2.			
3.			

☒ is within accepted 15% error limitations

☐ is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
Total Resid. Chl.	3/6/79 @ 0930	Composite Station #3	.2 ppm
Total Resid. Chl.	3/6/79 @ 1515	Composite Station #3	.5 ppm
Temp., pH, Cond.	3/7/79 @ 0825	Composite Station #3	10°C, 7.0, 490 µmhos/cm
Temp., pH, Cond.	3/7/79 @ 0850	Composite Station #2	10.6°C, 6.9, 500 µmhos/cm
Temp., pH, Cond.	3/7/79 @ 0855	Composite Station #1	11°C, 8.1, 650 µmhos/cm
Total Resid. Chl.	3/7/79 @ 0825	Composite Station #3	None detected
Total Resid. Chl.	3/7/79 @ 0930	Composite Station #3	None detected

Table I

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

	DOE			Sequim STP		NPDES (Monthly average
	Influent	Unchl. Eff.	Chl. Eff.	Influent	Unchl. Eff	
OD$_5$ mg/l	220	150	60	320/170[1/]	40/50[1/]	30
lbs/day	587	400	160	854/454	107/133	143
SS mg/l	152	80	30	260	146	30
lbs/day	406	214	80	694	390	143
otal Plant Flow GD				.32		Not to exceed .654
Fecal Coliform colonies/100 mls						200
@ 0825			>250,000			
@ 0930			140,000 (est.)			
Total Residual Chlorine ppm						
@ 0825			N.D.			
@ 0930			N.D.			
pH (stand. units)	7.9	7.3	7.2			6.0 to 9.0
Sp. Cond. µmhos/cm	667	512	499			
COD (mg/l)	640	140	99			
NO_3-N (filt.) mg/l	<.1	1.4	3.0			
NO_2-N (filt.) mg/l	<.1	0.4	0.4			
NH_3-N (unfilt) mg/l	25.0	10.0	8.5			
O-PO_4-P (filt) mg/l	5.4	15.0	14.0			
Total Phos.-P (unfilt.)	10.0	16.0	14.0			
Total Solids (mg/l)	506	358	316			
Total Non Vol. Solids (mg/l)	249	254	235			
Total Sus. Non Vol. Solids (mg/l)	22	24	8			

* Field Analysis
DPD Chlorine Kit

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

[1/] Dilution Result/Hach Result

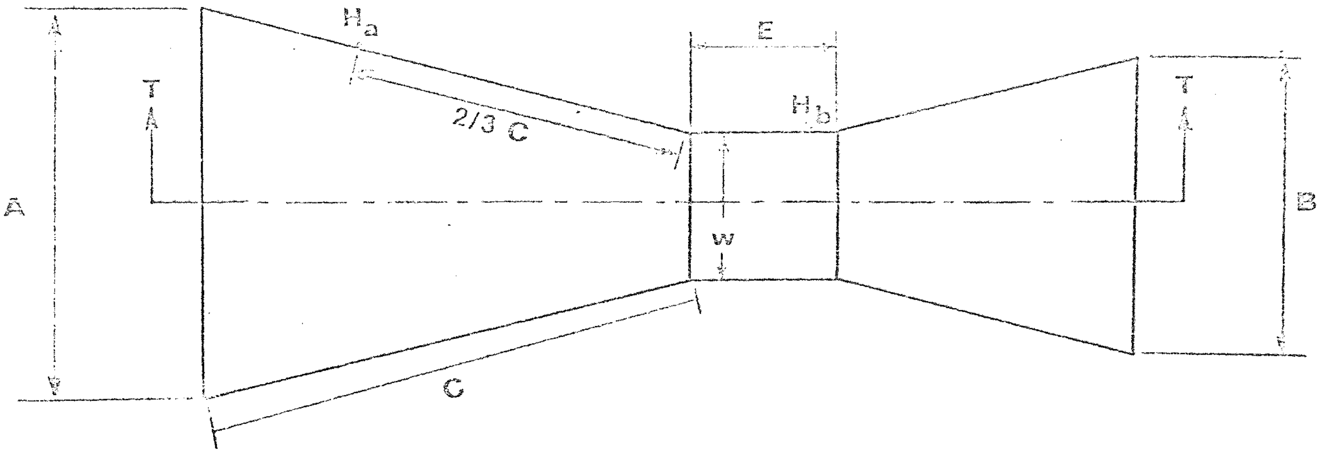
N.D. = None Detected

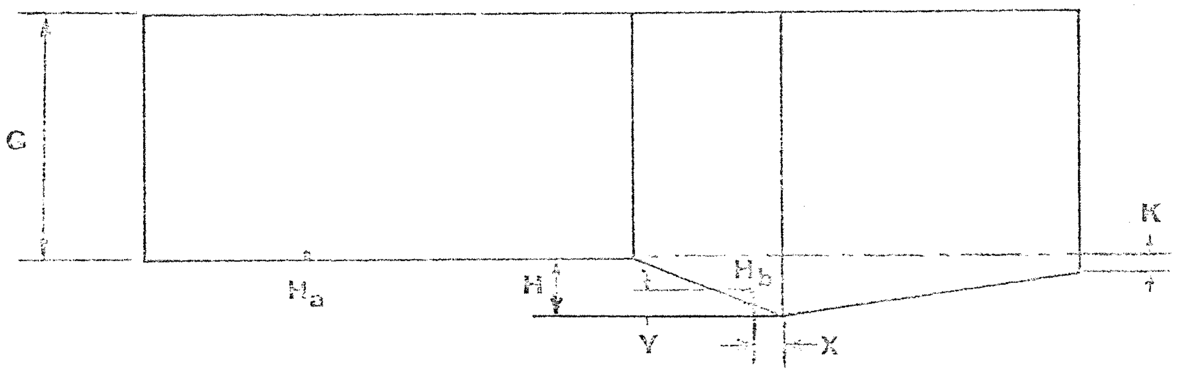
Table II

Sequim STP
3/6/79

PARSHALL FLUME:

Dimensions & Flow





Code	Spec's	Measured
A	15.5"	16"
B	15.5"	16"
C	24.44"	24.5"
2/3 C	16.31	15.25 1/
E	12"	12"
G	24"	24"
H	4.5"	4.5"
K	3"	3"
W	6"	5.5"
X		
Y		

Time	H_a	H_b	Corrected 2/ Theoretical Flow	Script Chart Recorded Flow	Percent Error
1340	.48'		.39 MGD	.43 MGD	10%
1350	.44'		.33 MGD	.37 MGD	12%

1/ 2/3C was measured to the center line of the head height gage and not to the submerged (Ha) orifice, although these two measurements should be identical.

2/ Theoretical flow was calculated for a throat width of 5.5" ($\frac{5.5}{6}$ correction factor)

Table III

Heavy Metal Analyses - Waste Activated Sludge

	Metal Concentration (mg/kg dry weight)
Lead	370
Zinc	1,360
Cadmium	3
Copper	370
Nickel	29
Chromium	34

Percent Solids -- 3.6

Sequim STP
Fact Sheet

Sequim B.O.D. HACH & Winkler Methods

	HACH			Winkler		
Date	Inf.	Eff.	Red.	Inf.	Eff.	Red.
1-23-79	185	20	89%	290	140	51%
1-31-79	190	10	94%	260	140	46%
2-7-79	170	10	94%	170	80	52%
2-14-79	180	5	97%	190	10	94%
2-21-79	165	10	93%	150	20	86%
2-28-79	250	50		280	160	42%
3-7-79	170	50	70%	320	400	
3-14-79	195	15	92%	Error made in testing		
3-21-79	90	5	94%	280	210	25%
157 ml. per sample bottle				1% dilution		

Sludge Wasted for February and March

2-19-79	Return was closed but was unable to waste sludge.
2-20-79	Return still closed, unable to haul.
2-21-79	Return still closed, unable to haul.
2-22-79	5 loads of sludge hauled-4,000 gallons - opened return.
3-5-79	Return is closed, unable to haul.
3-6-79	Return is closed, unable to haul.
3-7-79	Return is closed, unable to haul.
3-8-79	Return is closed, unable to haul.
3-12-79 to 3-16-79	Return closed but couldn't haul.
3-17-79 to 3-23-79	Hauled 55 loads - 44,000 gallons.
3-18-79	Opened return.

M.L.S.S. & S.V.I. March 1979

	M.L.S.S.	S.V.I.		M.L.S.S.	S.V.I.		M.L.S.S.	S.V.I.
1.	4940	197	14.	4705	207	27.	446	448-50 ml
2.	3205	304	15.	4635	210	28.	1442	242-50 ml
3.	4875	200	16.	2000	425	29.	1850	216
4.	4980	195	17.	-	-	30.	2085	191
5.	2140	397	18.	-	-	31.	1960	229
6.	800	375	19.	335	522			
7.	510	392	20.	310	564			
8.	-	-	21.	170	588			
9.	4675	208	22.	-	-			
10.	-	-	23.	-	-			
11.	4220	231	24.	-	-			
12.	1770	480	25.	-	-			
13.	4555	214	26.	-	-			

Everything else is 20 ml. sample except for the 27th and 28th which are 50 ml.

LABORATORY PROCEDURAL SURVEY

Discharger: Sequim STP

NPDES Permit Number: WA-002234-9

Date: 3/6/79

municipal ~~Industry~~ Representatives present: Russ Robertson, Dan Schmidt > operators in training

Agency Representatives present: Mike Morhous

I.) BIOCHEMICAL OXYGEN DEMAND CHECKLIST

What analysis technique is utilized in determining biochemical oxygen demand? 1/

1. Standard Methods ✓
2. EPA ____
3. NCASI ____
4. Other Hach Manometer

A.) SAMPLE COLLECTION AND PREPARATION

1. Are samples collected at a point where homogeneous conditions exist? Inf. - Yes, Eff (unchl.) is collected from the quiescen portion of clarifier. Recommend collection from launder ring discharge pipe.
2. Are samples collected via composite or grab? utilizes both methods
3. Automatic ~~What is~~ compositing period? 24 hrs How often does compositor draw a sample? 40 mls/hr Manual composite usually consist of a single grab sample. Recommend using auto. sampler. full time and increasing the sample aliquot.
4. Is composite sample flow proportional? NO Recom: utilizing auto. samplers full time for a representative 24 hour composite sample
5. Are composites refrigerated during collection? NO recommend icin composite during sampling period.
6. Are BOD samples frozen prior to analysis? NO

   If Yes: a.) For how long? ____

   b.) Are samples reseeded before set-up? _
7. How long are samples held prior to analysis? analyses are initiate immediately following completion of composite or collection of grab sam
8. Under what condition are samples held prior to analysis?

   N/A

1/ runs both procedures for each BOD_5 test and reports the results from the one that gives the best ~~results~~ (lowest) results

9. What is the approximate sample water temperature at time of set-up? Not checked, temperature should be checked and stabilized at approx 20°C (room temperature)

10. Are compositor bottles and sampling lines cleaned periodically? Yes, after each use

11. Does compositor go through a flush cycle before drawing sample? Yes

12. Are composite container contents mixed thoroughly before sample is withdrawn? Yes

B.) SEED MATERIAL - Does not pertain, Final Eff sample is unchlorinated

1. Is seed material used in determining BOD?

2. Where is seed material obtained?

3. Is seed from an unchlorinated effluent?

4. How long is a batch of seed kept?

5. Under what conditions is seed kept? (temperature, dark)

C.) DILUTION WATER

1. Reagent water utilized in preparing dilution water is:

distilled, deionized, tap, other distilled

If tap, is it chlorinated or unchlorinated? N/A

2. Is reagent water aged prior to use? Yes

3. How long is it aged, and under what conditions? 7-10 days at room temperature

4. When is the phosphate buffer added (in relation to sample set-up)? Morning of analysis setup

5. Are the four (4) nutrient buffers added to the reagent water in prescribed volumes? Yes 1ml/liter [1]

6. How often is dilution water made up? (Maximum age of dilution water at time of set-up.) before each test

[1] nutrient buffers are actually added 996 mls of distilled water.
Rec: buffers should be added to a full 1 liter volume

7. How often are BOD's being set up? ONCE a WEEK

8. Under what conditions is reagent water kept? glass container with a black cover

9. Under what conditions is dilution water kept? dilution water is not stored

10. What is dilution water temperature at time of set-up? room temp approx. 20°C

D.) TEST PROCEDURE

1. Does sample to be tested contain residual chlorine? No - N/A

If yes, is sample dechlorinated and reseeded? ______

2. Is sample pH 6.5-8.5? YES

If no, is sample pH adjusted and reseeded? ______

3. How is pH measured? Corning Model 5 pH meter

Probe calibration frequency: daily with #7 buffer only
Recom: using #4 & #10 buffers in conjunction with #7 during calibrati

4. Is effluent sample toxic? No

5. Is ~~BOD~~ DO depletion of dilution water determined? YES

6. Is seed BOD determined? No, not used

7. Is BOD of seeded blank determined? N/A

If yes, is 5-day dissolved oxygen depletion of seeded blank near 0.5 mg/l beyond that of dilution water blank? ______

8. Is zero day D.O. obtained from sample dilution or from dilution water prior to sample addition?

Runs initial DO on both blank and sample dilution

9. What is the range of zero day D.O. in dilution water blank?

6 - 8 mg/l

10. How much seed is used in preparing seeded dilution water?

N/A

11. Is liter dilution method or bottle dilution method utilized in the preparation of: NEXT PagE

a.) Seeded dilution water: N/A

b.) Sample dilutions: liter dilution

12. Are samples and controls incubated for 5 days at 20°C? YES, approx. when checked temp. of incubator was 19.2°C according to outside temp. gage

13. How is incubator temperature range regulated and kept track of? thermostatic heater + control panel temp. gage

Recom: thermometer in beaker of water placed on same shelf as BOD bottles. Adjust temp accordingly

14. By what method are dissolved oxygen concentrations determined?

Probe ____ Winkler ✓ Other ____

If by probe: What method of calibration is in use? ____

What is frequency of calibration: ____

If by Winkler: Is [✓ sodium thiosulfate] or PAO used as titrant?

How is standardization of titrant accomplished? Is not standardized. Uses manufacture .025N sod. thio. and assumes manufactured Normality is correct.

~~What is the frequency of standardization?~~

Recom: acquiring the necessary reagents to check and adjust normality when nesessary. Frequency - weekly or bi monthly

15. What is the observed dissolved oxygen depletion in the dilution water blank? ,02-,04 usually

BIOCHEMICAL OXYGEN DEMAND
METHODS FOR CALCULATING FINAL VALUES

1.) WASHINGTON STATE DEPARTMENT OF ECOLOGY

A.) CORRECTION FACTORS

1. Dilution factor:

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

2. Seed correction:

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

3. F factor ~ a minor correction for the amount of seed in the seeded reagent versus the amount of seed in the sample dilution:

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

B.) FINAL BOD CALCULATIONS:

For seed reagent:

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

For seeded sample:

(sample dilution depletion-dilution water blank depletion-scf) x DF

For unseeded sample:

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

2.) ~~INDUSTRY~~ Municipality

$$\frac{D_1 - D_2}{\%\ \text{dilution}} = 5\text{day BOD}$$

II.) TOTAL SUSPENDED SOLIDS CHECKLIST

What analysis technique is utilized in determining total suspended solids?

a. Standard Methods ✓

b. EPA

c. NCASI

d. Industry

A.) Sample Collection

1. Are TSS samples representative of the discharge in question, i.e., taken from a homogeneous segment of the effluent? ______

same as response to I.) A.) 1.

2. How long are samples held prior to analysis? analysis is initiated immediately upon completion of composite period or collection of grab sample.

3. Is composite container well mixed when sample is withdrawn? YES

4. Under what conditions are samples held prior to analysis? N/A

______

B.) Test Procedure

1. What type of filter is utilized:

[✓ Reeve Angel 934 AH] uses both
Gelman Type A/E
Other Whatman GF/C Size 2.4 cm

2. What type of filter support is used?

Gooch crucible ✓, Millipore filter suction base ____,
Other ____

3. Are filters washed prior to adding sample? YES

a. If yes: are filters then dried for a minimum of one hour YES at 103-105°C YES.

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

4. How are filters stored prior to use? in dessicator

5. What is the average and minimum volume filtered?

Inf - 30 mls Eff - 30 mls

6. How is sample volume selected?

a. ease of filtration ✓

b. ease of calculation ____

c. grams per unit surface area ____

d. other ____

7. What is the average filtering time (assume sample is from final effluent)? Inf - 2-5 mins. Eff - less than a min.

8. How does analyst proceed with the test when the filter clogs at partial filtration? doesn't have that problem. It was explaine

that should this situation occure, should start over with new crucible + filterpaper (prewashed)

9. If less than 50 milliliters can be filtered at a time, are duplicate or triplicate filtrations performed? ____

10. Is filter funnel washed following sample filtration? NO

recom: post filtration washdown

11. Following filtration, is filter dryed for 1 hour, cooled in a dessicator and then reweighed?

YES - final wt. is measured once only, should be reweighed until weight stabilizes (Standard Methods 14th Edition)

12. Is a filter aid such as cellite used? NO

√ Gooch crucible is also used for MLSS analysis. Suggest a larger filtering apparatus + filter papers for MLSS analyses.

TOTAL SUSPENDED SOLIDS
METHODS OF CALCULATION

1.) WASHINGTON STATE DEPARTMENT OF ECOLOGY

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

Where:
A = final weight of filter & residue (grams)
B = initial weight of filter (grams)
C = milliliters of sample filtered

2.) ~~INDUSTRY~~ Manicipality

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

SPLIT SAMPLE RESULTS: See Table I for results

Origin of Sample ____________________
Collection Date ____________ ____________

BOD		TSS		EPA BOD Standard	
DOE	IND.	DOE	IND.	DOE	IND.
___	___	___	___	___	___

Gave STP copies of DoE's BOD_5 and Fecal Coliform procedure manual