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DEPARTMENT OF ECOLOGY
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M E M O R A N D U M
October 13, 1980

To: Doug Houck

From: Sharon Chase

Subject: Centralia STP Class II Inspection

Introduction

On August 5 and 6, 1980 a Class II inspection was performed at the Centralia sewage treatment plant (STP). Additional data were obtained on August 13, 1980. Data from a Class II inspection conducted on February 6 by the Southwest Regional Office were also used in compiling this report.

The Centralia Class II inspection was scheduled to coincide with a receiving water study on the Chehalis River and a Class II inspection on the Chehalis STP. The results from these studies will be issued in separate reports.

Personnel involved in the inspection included Sharon Chase, Bill Yake, and Will Abercrombie (Department of Ecology [DOE], Water and Wastewater Monitoring Section), and Mike Morhous (DOE, Southwest Regional Office). The plant operator, Everett Music, was unable to be present at the time of the inspection.

The Centralia STP is a secondary treatment plant with five rectangular primary clarifiers, two circular trickling filters, and two circular secondary clarifiers. The secondary clarifiers also serve as chlorine contact chambers. The plant's effluent is discharged to the Chehalis River (waterway segment number 10-23-13).

The National Pollution Discharge Elimination System (NPDES) waste discharge permit for the Centralia plant (number WA-002098-2) places limits on effluent biochemical oxygen demand (BOD), suspended solids (TSS), fecal coliforms, pH, chlorine residual, and flow. During this inspection period, the plant was not meeting permit limitations for TSS or chlorine residual.

General Description of Plant Conditions

Overall, the maintenance at the plant appeared to be quite good. The trickling filters showed no evidence of ponding and no filter flies were

seen. Two of the primary clarifiers and one of the secondary clarifiers were not in use at the time of the inspection. The primary clarifiers had been drained for cleaning and the secondary was being painted.

Flow is measured by three Parshall flumes, one at the influent above the comminutor which measures influent flow, and two in the channel that splits the flow between the two secondary clarifiers, which measured recirculation as well as the effluent from the primary clarifiers.

The walls of both the converging and diverging sections of the influent Parshall flume were bowed slightly. The location of the vertical scale was correct and the scale itself accurate. Table 1 compares the measured flow with the flow indicated by the flow measuring instruments at the influent and in the control room.

Table 1. Comparison of flow-measuring devices.

Measured	Wet Well		Script Chart		Needle Scale	
MGD	MGD	% Error	MGD	% Error	MGD	% Error
1.16	1.2	3.4%	1.4	20.7%	1.25	7.8%

Procedure at the Plant

On August 5, 1980 Sharon Chase and Mike Morhous placed three 24-hour composite samplers and took grab samples for temperature, pH, and conductivity. The compositors were removed and samples split with the plant's lab personnel on August 6. The plant's effluent compositor was not working properly August 5, so no sample was obtained from the plant's compositors. Fecal coliform and chlorine residual samples also were taken August 5.

Bill Yake returned to the plant August 12, reset two DOE compositors, and on August 13 obtained samples from these compositors and the plant's influent and effluent samplers. The DOE effluent sampler only ran for approximately five hours because of a low battery. Sludge samples also were collected on August 13. Table 2 summarizes the sample collection schedule, locations, and constituents analyzed.

Because the plant was understaffed at the time of the inspection, a full laboratory procedures review was not possible. However, we reviewed those laboratory procedures for which problems had been identified during the previous Class II inspection.

Table 2. Class II Field Review and Sample Collection 24-hour Composite Sampler Installations.

Composite Sampler	Sample Aliquot	Date and Time Installed	Location	Field Data* Collected
Influent	250 ml/30 min.	8/05/80 - 1130	Inf. channel below comminutor	pH, Temp., Cond.
Primary Clarifier Effluent	250 ml/30 min.	8/05/80 - 1135	Eff. channel	pH, Temp., Cond.
Final chlorinated Effluent	250 ml/30 min.	8/05/80 - 1115	Eff. channel	pH, Temp., Cond.
Influent	250 ml/30 min.	8/12/80 - 0940	Inf. channel below comminutor	
Final Chlorinated Effluent	250 ml/30 min.	8/12/80 - 0955	Eff. channel	

Grab Samples	Date and Time	Location	Field Data Collected
Fecal Coliform	8/05/80 - 0905	2nd Clarifier (Final Effluent)	Chlorine residual
Fecal Coliform	8/06/80 - 1110	2nd Clarifier (Final Effluent)	Chlorine residual
Fecal Coliform	8/06/80 - 0955	2nd Clarifier (Final Effluent)	Chlorine residual

*Parameters analyzed from grab samples taken when compositors were placed and from the composite sample when compositors were removed.

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Compliance with NPDES Permit

The Centralia plant was not in full compliance with its NPDES permit at the time of this inspection. The violations fell into two categories: failure to meet effluent limitations and; use of improper laboratory techniques or equipment. Table 3 compares DOE laboratory results with the NPDES permit limitations.

Table 3. Comparison of laboratory results from 24-hour composites with NPDES permit effluent limitations.

	Influent		Effluent		NPDES
	8/6/80	8/13/80	8/6/80	8/13/80	Permit
BOD (mg/l)	200	200	15	20	30
lbs/day	1,935	2,168	145	217	1,075
% Removal	--	--	93%	90%	85%
TSS (mg/l)	320	160	37	33	30
lbs/day	3,095	1,735	358	358	1,075
% Removal	--	--	88%	79%	85%
Fecal Coliforms (col/100 mls)			6 10 9		200
Chlorine Resid.			.5 .6 .6		**
August 6 - gage reading Mellon St. Bridge				48.3	
pH	7.3		7.1		6.0-9.0
Flow (MGD)	1.16	1.30	1.16	1.30	4.3 MGD

**No chlorine residual shall be detectable at any time the stream gage at the Mellon Street Bridge gage reads 150 feet of elevation or less.

During periods of low flow in the Chehalis River, the plant is not supposed to discharge any chlorine residual. The plant was in violation of this requirement at the time of the inspection and had been in violation, according to DMR's, since mid-April. The gage elevation has been considerably lower than 150 and chlorine residual averaged 1.4 mg/l in April and 1.5 mg/l in May.

Similarly, meeting the effluent limitations for TSS has been a chronic problem. The plant was violating its limitations on August 6 and August 13 as shown in Table 3. Daily monitoring reports submitted by the plant show compliance on only four occasions during the four-month period from March to June 1980.

In addition to these effluent violations, the Centralia STP was in violation of Section 3f. Test Procedures, within the schedule of compliance section of its permit. This section states "all sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless approved otherwise in writing by the Department conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants, contained in 40 CFR 136, as published in the Federal Register which currently references the following publications: 1) American Public Health Association, Standard Methods for the Examination of Water and Wastewater; 2) American Society for Testing and Materials ASTM Standards, Part 23, Water, Atmospheric Analysis and 3) Environmental Protection Agency, Water Quality Office Analytical Control Laboratory, Methods for Chemical Analysis of Water and Wastes." The plant has not been following correct analytical methods for BOD_5 and there has been some question on TSS as well.

In the course of our abbreviated laboratory procedural review, we were unable to find out what type of filter was being used for TSS. Laboratory personnel were unable to verify their contention that the filters being used were one of those approved in Standard Methods (Reeve Angel 934AH or Gelman Type A/E).

More critical was the error in analytical methods for the BOD_5 test. BOD effluent samples were not dechlorinated and reseeded as required in Standard Methods for samples collected from a chlorinated source. Effluent BOD samples can not be taken prior to chlorination because the secondary clarifiers also serve as chlorine contact chambers. Therefore, samples must be dechlorinated and reseeded for the BOD test. The laboratory personnel at Centralia were of the opinion that dechlorinating and reseeding the BOD's would not make any difference. They told us they had tried running BOD's both ways "a couple of times" and had found no difference in the results. An unsystematic comparison of this kind might give the impression that dechlorination made no difference; however, we could not have confidence in this conclusion knowing the effect chlorine has on bacteria. Chlorine is a very effective disinfectant. It is added to wastewater for the express purpose of destroying the bacteria in that water. Since the BOD test requires a healthy bacterial population, any chlorine residual in the sample must be removed and healthy bacterial introduced to the sample to replace those killed by the chlorine. Lab personnel at Centralia must begin dechlorinating and reseeding effluent BOD samples immediately.

The results of the sludge analysis are included in Table 4. No unusual values were reported.

Table 4. Metals in Centralia plant sludge (dry weight basis).

Percent Solids	9.4
Cadmium (mg/Kg)	7.0
Chromium	29.0
Copper	520.0
Iron	12,000.0
Mercury	7.2
Manganese	223.0
Nickel	27.0
Lead	404.0
Zinc	1,550.0

Table 5 shows the expected flow and BOD compared to the measured values for both of the Class II inspections.

Table 5. Expected versus measured flow and BOD.

		Expected (for pop. 11,000)	Measured
	Flow (MGD)	1.1	1.16
8/13	BOD (mg/l)	240	200
Class II	(lbs/day)	2,200	1,935
	Flow (MGD)	1.1	3.09
2/6	BOD (mg/l)	240	109
Class II	(lbs/day)	2,200	2,809

The Centralia plant has a serious infiltration and inflow problem, especially during the winter. If the infiltration and inflow problems were reduced, the plant influent would be stronger. The plant might then be able to achieve 85 percent removal for TSS.

Lab Procedural Survey

General

Some concern was expressed about the fact that the second secondary clarifier had been installed to work in parallel with the first

secondary clarifier rather than in series. The lab personnel did not believe that a parallel clarifier would improve TSS reduction. Parallel installation is the standard procedure, however. The efficiency of a clarifier is determined largely by the overflow rate. The lower the overflow rate the greater the amount of settling. A parallel clarifier reduces the overflow rate which theoretically results in greater treatment. If a second clarifier were installed to work sequentially, the overflow rate would be the same for both clarifiers. Both would be hydraulically overloaded and treatment efficiency would not be increased.

The equation for overflow rate is:

$$Vo = \frac{Q}{A}$$

Where Vo is the overflow rate in gal/day/sq. ft, Q is average daily flow in gal/day, and A is the total surface area of the clarifier basin in square feet. At Centralia STP, Vo is equal to 364 gal/day/sq. ft. with one of their single secondary clarifiers working. When both secondary clarifiers are operating, Vo = 182 gal/day/sq. ft. According to Criteria for Sewage Works Design (State of Washington, DOE), the design criteria is Vo = 800 maximum average and peak Vo = 2,400. The two clarifiers should be more than adequate for the flow at Centralia. Therefore, the problem with TSS at the plant is not due to inadequate settling capacity nor does it lie in the installation of the clarifiers. Further explanation of these processes can be found in Mark J. Hammer Water and Waste-water Technology, Wiley and Sons, N.Y. 1975, pp. 223 and 224 or Metcalf and Eddy Wastewater Engineering New York 1972, pp. 283-295. We do not know why the Centralia STP is having difficulty with suspended solids removal.

Sampling

No procedure exists for cleaning the automatic sampler lines. The TSS concentration as measured by the plant's influent sampler was much higher than that measured by DOE's sample on August 13. Microbial growth in the sample line may be the cause of this difference.

BOD

In addition to the problem of dechlorination and reseeding BOD's, it was suggested that the operator keep a thermometer in a water bath in the incubator on the same shelf as the BOD sample. We were also asked to clarify the proper calculating and reporting procedure for BOD_5 when a given sample dilution results in a five-day

dissolved oxygen (D.O.) depletion of less than 2.0 ppm or has a residual (final) D.O. of less than 1.0 ppm.

When the measured D.O. depletion of the diluted sample ($Do-D_5$) is less than 2.0, the BOD should be calculated and reported as "less than" the dilution factor times 2.

Example: Do = 9.0 and D_5 = 8.0 dilution factor = 100.
$Do-D_5$ = 1 which is less than 2. BOD is reported as less than 2 x 100 = BOD <200.

If the D_5 measured is less than 1.0 mg/l D.O., BOD is calculated and reported as "greater than" the dilution factor times (Do-1.0 mg/l).

Example: Do = 8.5, D_5 = .9. Dilution factor 10.
BOD = greater than (8.5-1.0) x 10 = >75.

TSS

Laboratory personnel reported filtering 30 mls for the analysis of TSS in the influent. This volume is considered to be too low and we recommended that a minimum of 50 mls be used. If a single 50 ml sample clogs the filter, they should run duplicates or triplicates of smaller volumes to increase the total volume analyzed to at least 50 mls.

Equipment

Plant laboratory personnel reported that they calibrated the pH meter once a week. We suggested that it be calibrated more frequently; ideally, before each use, but at least three times daily if the meter is in use throughout the day.

Conclusions and Recommendations

To comply with its NPDES permit, the Centralia plant must use its dechlorination facilities when the gage at the Mellon Street Bridge shows an elevation of less than 150 feet. The effluent BOD samples must be dechlorinated and reseeded. It should be noted that the BOD samples will need reseeding even when the plant is dechlorinating its effluent to meets its TCR limitation because the chlorine will have already reduced the bacteria population in the secondary clarifier. The confusion over what filter paper is being used for TSS should be cleared up. The lab should be using Reeve Angel 934AH or Gelman A/E filters.

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The lab personnel at Centralia attributed their TSS problems to volcanic ash. We do not think this is correct for two reasons: first, the plant's problems meeting 30 mg/l TSS limitation occurred before the May 18th eruption (in both March and April) and, second, a large percentage of the TSS was volatile solids. This high percentage of volatile solids indicates that the problem is largely due to organic solids. A volcanic ash problem would have resulted in a high percent of non-volatile solids. Table 6 shows the volatile and non-volatile solids and their percent contribution to total suspended solids.

Table 6. Volatile and non-volatile solids percent contribution.

	August 6, 1980		
	Influent	Effluent	Final Effluent
TSS	320	80	37
TNVSS	59	11	7
TVSS	261	69	30
% NVS	18%	14%	19%
% VS	82%	86%	81%

	August 13, 1980			
	Influent DOE	Influent City	Effluent DOE	Effluent City
TSS	160	360	33	34
TNVSS	36	53	8	7
TVSS	124	307	25	27
% NVS	23%	15%	24%	21%
% VS	77%	85%	76%	79%

We recommend that the city attempt to identify the cause of the settling problems and work to correct it. The Centralia STP laboratory personnel should follow the suggestions in the laboratory procedural section of this report.

A summary of all field and lab data can be found in Table 7.

SC:cp

Attachments

cc: Mike Morhous
Unit Files
Section Files
Central Files
Environmental Quality Supervisor

Table 7. Summary of field and laboratory data.

	(DOE) 8/6/80 Influent	(DOE) 8/6/80 Primary Effluent	(DOE) 8/6/80 Secondary Effluent		(City) 8/13/80 Influent	(City) 8/13/80 Effluent	(DOE) 8/13/80 Influent	(DOE) 8/13/80 Effluent	NPDES Permit Monthly Average
			Uninhib.	Inhib.					
Flow (MGD)	1.16								4.3
BOD_1			<4	<4					
BOD_4			13	9					
BOD_5	200	79	15	12	180	19	200	20	30 mg/l 1,075 lbs/day
BOD_7			16	12					
BOD_{12}			27	22					
BOD_{20}			110	54					
COD	300	170	100						
Fecal Coliform (Col/100 mls)			9[1]					6[1] 10[1]	400
Chlorine Resid.			.5[2]					.6[2] .6[2]	0 when gage <150 ft.
Temperature (°C)	19.4[2]	18.8[2]	19[2]						
Conductivity	563[2]	567[2]	504[2]						
pH	7.2[2]	7.2[2]	7.6[2]						6-9
TS	670	460	360						
TNVS	270	240	230						
TSS	320	80	37		360	34	160	33	30 mg/l 1,075 lbs/day
TNVSS	59	11	7		53	7	36	8	
Turb. (NTU)	80	23	11						
NO_3-N	<0.2	<0.2	6.4						
NO_2-N	<0.2	1.2	0.3						
NH_3-N	18	18	10						
O-PO_4-P	5.0	5.8	6.3						
T-PO_4-P	7.8	7.8	7.2						

[1] Estimated

[2] Field data - grab samples

"<" = "less than"