Publication No. 79-e33

WA-37-1010

STATE OF WASHINGTON

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DEPARTMENT OF ECOLOGY

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M E M O R A N D U M
April 30, 1979

To: Al Newman

From: Bill Yake

Subject: Richland STP Class II Inspection

Introduction:

A Class II facility inspection was conducted on January 23-24, 1979 at the Richland Sewage Treatment Plant. Greg Cloud and Bill Yake (Ambient and Compliance Monitoring) and Al Newman (Central Regional Office) represented the Department of Ecology. Gerry Mashburn (Chief Plant Operator) and Pete Reiland (Chief Chemist) represented the city of Richland.

The Richland plant consists of two trickling filter plants run in parallel. Plant #2 processes about 70 percent of the total flow and, if overloaded, can shunt excess flow to Plant #1 above the primary clarifier. Each plant routes flow through a grit chamber, primary clarifier, and a single trickling filter. Plant #1 has two secondary clarifiers while Plant #2 has a single secondary clarifier. Effluent from each plant is chlorinated. Separate discharges from the two contact chambers are combined and discharged to a backwater canal which enters the Yakima River (Receiving Water Segment 18-31-01). This receiving water segment is identified in the 5-year Strategy as not meeting state and federal water quality goals due primarily to non-point sources. It is unknown whether this segment will attain these goals by 1985. This segment does not meet Class A water criteria for fecal coliforms, dissolved oxygen, pH, and turbidity and is prioritized 6th of 36 segments in this classification. It should be noted that the treatment plant discharges only about 1/2 mile above the Yakima's confluence with the Columbia River.

Findings and Conclusions:

Richland is anticipating the construction of a new treatment facility to be on line in 1984. In the interim, the city is operating under an order which allows BOD_5 and suspended solids discharges in excess of the standard 30/30 limitations. At the time of the inspection the facility was meeting the requirements of this order (see Tables 1 and 2). Effluent BOD_5 was, however, in excess of 30 mg/l.

The Richland plant has historically experienced problems in achieving satisfactory BOD_5 removal. Lately, this inefficiency has been noted in conjunction with a loss of surface growth in the trickling filters. Toxic influents are suspected but a specific toxin has not been isolated.

Influent, effluent, and sludge samples were analyzed for a range of trace metals. Results are given in Table 3 and compared with concentrations considered inhibitory to carbonaceous removal and nitrification. The only values which appear to be unusual are the copper concentrations. Effluent and sludge concentrations are higher than those encountered at other facilities throughout the state. Under normal conditions, secondary wastewater treatment will decrease trace metal concentrations in the treated wastewater. This removal is believed to be largely associated with the adsorbtion and chelation of metals by the facility's biomass[1] (whether activated sludge or fixed film growth). In secondary plants surveyed in previous Class II inspections, total copper concentrations have decreased by approximately 60 percent. It appears that composite samplers caught the end of a slug of high copper wastewaters. This slug was picked up in both effluent samplers, but largely missed by the influent samplers. If we assume 60 percent removal and an effluent averaging 0.40 mg Cu/l, then the influent must have averaged about 1.0 mg Cu/l. Because the total plant detention time is less than 24 hours, it is likely that the 0.40 mg Cu/l in the effluent is an underestimate of the peak Cu concentration. It is, therefore, likely that an influent concentration of greater than the 1.0 mg Cu/l identified as the threshold toxic concentration for carbonaceous removal[2] occurred during this episode. The high copper concentration in the sludge indicates that this was not an isolated instance. Although no loss of fixed film growth was noted during the inspection, the elevated copper concentrations are the prime toxic suspect based on the information presently available.

Laboratory procedures were, in general, excellent. Several suggestions for improved testing and reporting are noted in the "Review of Laboratory Procedures and Techniques."

This Class II inspection will probably not require a formal follow-up inspection. If, however, you could contact the Richland laboratory, see if our suggestions have been incorporated, and send us a quick note indicating their response, it would be very useful to us.

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[1] Neufeld, R. D., *et al.*, 1977. A kinetic model and equilibrium relationships for heavy metal accumulations, *JWPCF* 49 (489-497).

[2] Water Pollution Control Federation, 1977. Manual of Practice #8, Wastewater Treatment Plant Design, p. 227.

Review of Laboratory Procedures and Techniques:

Laboratory procedures were reviewed with Pete Reiland who is responsible for these analyses. Most analyses are carried out at the Richland city water laboratories. With several exceptions, split sample results agreed relatively well. Richland's influent BOD_5 results were 30-50 percent higher than DOE's results and Richland's Plant #1 effluent suspended solids result was about 3 times DOE's result. The variance in the suspended solids result is possibly due to Richland's filtration of an unrepresentative sample aliquot.

Richland's laboratory procedures appeared, in general, to be excellent. Several suggestions which would serve to improve the accuracy of the tests and standardize the reporting of results are noted below.

BOD_5 -

1. Incubator temperature is regulated by means of a thermometer built into the top of the incubator. We suggest the additional use of a thermometer placed in a water bath on the same shelf as the incubating sample dilutions.

2. If 5-day depletions are outside acceptable limits (less than 1.0 mg/l drop or less than 2.0 mg/l D.O. remaining after 5 days) results are not reported in accordance with DOE's "Laboratory Test Procedure for Biological Oxygen Demand of Water and Wastewater." BOD's should be reported as "less than" or "greater than" as outlined in this publication.

Suspended Solids -

1. The Richland laboratory was using a Whatman GFC filter. We suggest that the laboratory switch to either of the filters approved by Standard Methods (Gelman A/E or Reeves-Angel 934H).

2. Only 25 ml aliquots are filtered for influent samples. A minimum of 50 mls is required for a representative sample. We suggest either that the lab switch to larger diameter filters or process duplicate aliquots and sum volumes and weight changes prior to calculation.

BY:cp

24-Hour Composite Sampler Locations

Sampler	Date and Time Installed	Location
1. Plant #1 - Influent aliquot - 250 ml/30 min.	1/23/79 - 0900	Downstream from Comminutor
2. Plant #1 - Unchlor. Eff. aliquot - 250 ml/30 min.	1/23/79 - 0920	Outfall of Final Clarifier
3. Plant #1 - Chlor. Eff. aliquot - 250 ml/30 min.	1/23/79 - 0940	Outfall of Contact Chamber
4. Plant #2 - Unchlor. Eff. aliquot - 250 ml/30 min.	1/23/79 - 1000	Above gaging device, between final clarifier & contact chamber

Grab Samples

Date and Time	Analysis	Sample Location
1. 1/23-24/79 - 5 grabs composited	BOD, COD, Solids, nutrients, pH, Cond., Turb.	Plant #2 Influent, downstream of comminutor
2. 1/23-24/79 - 5 grabs composited	BOD, COD, Solids, nutrients, pH, Cond., Turb.	Plant #2 Chlorinated Effluent, at contact chamber outfall
3. 1/24/79 - 0800	Fecal Coliforms	Plant #1, Outfall of Contact Chamber
4. 1/24/79 - 1000	Fecal Coliforms	Plant #1, Outfall of Contact Chamber
5. 1/24/79 - 0745	Fecal Coliforms	Plant #2, Outfall of Contact Chamber
6. 1/24/79 - 1000	Fecal Coliforms	Plant #2, Outfall of Contact Chamber

Flow Measuring Device - Plant #1

1. Type - Parshall Flume
2. Dimensions - 12-inch throat

    a. Meets standard criteria - yes.
    b. Is within accepted 15% error limitations - yes.

Table 1

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

DOE Results

	Plant #1			Plant #2				
	Influent	Unchlor. Effluent	Chlor. Effluent	Influent	Unchlor. Effluent	Chlor. Effluent	Total Effluent	NPDES Permit Limitations Monthly Average
BOD (mg/l)	117	38	39	94	38	35	36.1	40
lbs/day	1180	383	394	2490	1010	928	1322	2000
TSS (mg/l)	140	16	16	92	21	13	13.9	40
lbs/day	1410	162	162	2440	557	345	507	2000
Total Plant Flow MGD			1.21			3.18	4.39	6.0
COD (mg/l)	352	120	120	416	120	112		
Fecal Coliforms (#'s/100 ml)			10 est. 83 est.			20 est. <10		
NH_3-N (mg/l)	22.0	19.8	19.6	18.0	19.0	18.0		
NO_2-N (mg/l)	<0.1	0.2	<0.1	<0.1	0.2	<0.1		
NO_3-N (mg/l)	1.0	1.2	1.6	1.8	2.2	2.4		
O-PO_4-P (mg/l)	5.0	5.6	5.6	4.2	4.8	4.8		
T-PO_4-P (mg/l)	7.2	7.2	7.0	7.2	6.5	6.7		
pH (S.U.)	7.3	7.7	7.4	8.1	7.7	7.7		
Spec. Cond. (µmhos/cm)	898	834	809	832	779	803		
Turb. (J.T.U.)	60	20	22	60	20	20		
Tot. Solids (mg/l)	626	477	450	604	439	464		
Tot. Non-Vol. Solids (mg/l)	416	393	353	386	339	341		
Tot. Sus. Sol. (mg/l)	140	16	16	92	21	13		
TNVSS	14	2	1	10	5	2		

Table 2

Richland STP Results

	Plant #1		Plant #2			
Parameter	Influent	Unchlor. Effluent	Influent	Unchlor. Effluent	Total Effluent	NPDES Permit Limitations
BOD (mg/l)	145	34	149	40	38.4	40
lbs/day	1463	343	3952	1061	1404	2000
TSS (mg/l)	130	51	111	18	27.1	40
lbs/day	1312	514	2943	477	991	2000
Total Plant Flow MGD		1.21		3.18	4.39	6.0

letal Concentrations

Municipal[1] Effluents o. Mean ± 1SD* (mg/l)	Carbonaceous[2] Threshold (mg/l)	Nitrification[2] Threshold (mg/l)	Richland Sludge mg/kg d.w.**	Sludges from[1] Secondary Plants Geo. Mean ± 1SD* mg/kg d.w.**
.009-.168	1.0	.005-0.5	3,100	230-1162
<.014	1.0-50	0.25	130	31-231
<.05	0.10	0.50	410	149-787
.033-.216	0.08-10.0	--	2,200	730-2664
<.05	1.0-2.5	0.25	32	24-62
<.012	10.0-100	--	13	6.2-16.6
--	--	--	13,200	--
--	--	--	172	--

ughout Washington State.

Wastewater treatment plant design, p. 227.