Segment No. 24-57-04

Publication No. 79-e41

STATE OF WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

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

MEMORANDUM
March 20, 1979

To: Phil Williams

From: Bill Yake

Subject: Spokane Industrial Park Class II Inspection

Introduction:

A Class II compliance inspection was conducted at the Spokane Industrial Park (SIP) on February 6, 1979. Mike Morhous, Bill Yake, and Phil Williams of DOE were present. The SIP was represented by Clayton Repp (Park Manager) and John Halpenstein (Treatment Plant Foreman). The SIP is served by an oxidation ditch which is designed to provide secondary waste water treatment. Influent flow passes through a grit chamber, comminutor, and rectangular weir to the oxidation ditch. The ditch has two brush aerators which are operated intermittently. The flow from the oxidation ditch passes to a clarifier. Underflow is returned to the ditch and the clarified flow passes to a chlorinator. A standpipe provides for solids wasting; however, it has never been operated and plant personnel do not know if it works. The chlorinated flow passes to two contact chambers and is discharged to the upper Spokane River (Segment 24-57-04). This water segment is defined in the Five-Year Strategy as meeting state and federal water quality goals. However, water quality in the upper Spokane River is receiving increased attention due to rapid urbanization in the Spokane Valley and proposed wastewater discharges from these developments.

Findings and Conclusions:

Samples collected during the inspection indicate that the STP is organically underloaded with an influent BOD_5 of 26 mg/l. Two pieces of evidence indicate that this is a chronic condition: 1) the DMR's report high (5-7 mg/l) dissolved oxygen concentrations even though the aeration brushes are operated approximately one out of every four hours; and 2) organic solids (biomass) concentrations in the ditch have never approached predicted levels although solids are not intentionally wasted from the system. DMR's for September and October 1978 report much higher influent BOD's but this is probably due to the poor sampling techniques employed at the plant. Weekly BOD_5 data are derived from grab samples taken at about 1030 every Wednesday morning. Influent BOD_5 is probably near its maximum at this time.

The plant was meeting all BOD_5 permit limitations during this inspection (Table 1). Due to low solids loadings, this plant was meeting TSS concentration and loading limitations; however, it was not providing 85 percent removal as required by the NPDES permit. Fecal coliform limitations were being met despite poor contact chamber design which does not promote plug flow (40:1 recommended length-width ratio) and allowed visable short circuiting. Operating personnel should determine a minimum total residual chlorine (TRC) concentration which will allow the plant to meet its fecal coliform limitations. If these limitations cannot be met with a TRC of 0.5 mg/l, the installation of contact chamber baffling should be considered. This will minimize the plant's chlorine contribution to the Spokane River and minimize chlorine costs for the plant.

In conjunction with this inspection, grab samples were taken for a number of parameters at three manholes at the SIP. The manholes accessed sewers serving Keytronics, Columbia Lighting, and Alumax, and are illustrated in Figure 1. It should be noted that the flow in the Alumax manhole was very low and that Alumax may not have been discharging at the time of collection. These samples were analyzed primarily for trace metals and other toxic substances including cyanides and phenols (Table 3). The treatment plant influent and effluent were sampled for the same parameters (Table 1). The concentrations of these substances which are potentially harmful to both SIP biomass and receiving water organisms are compared with values obtained at municipal plants throughout the state and threshold values for nitrification and carbonaceous removal inhibition[1] in Table 3. Copper, lead, and nickel concentrations at the SIP are much higher than those at typical municipal treatment plants. Copper, lead, and zinc concentrations are above those which may result in microbial inhibition. Results indicate that Keytronics is a major source of copper, lead, and nickel. The Alumax manhole sample had a high zinc concentration but flow at this manhole was low and it is not known if Alumax was discharging at the time samples were taken. Clayton Repp indicated that Keytronics is planning to put in a pretreatment system but the nature of this system was not known.

The possibility of routing domestic sewage to this STP to provide additional organic loading has been mentioned. The presence of substantial concentrations of certain toxics (primarily copper and lead) would require very careful analysis before this should be allowed. The operation of a model plant fed proportionate amounts of SIP and domestic wastewaters appears to be the only relatively certain way of predicting the treatment efficiency of such an arrangement. The wastewaters from the SIP

---

[1] Water Pollution Control Federation and American Society of Civil Engineers, 1977. Manual of Practice/8, *Wastewater Treatment Plant Design*, Lancaster Press, Inc., Lancaster, PA. 227 pp.

would appear to be more amenable to physical/chemical treatment than to secondary biological treatment. The plant's inability to decrease influent concentrations of any parameter other than BOD_5 and possibly fecal coliforms points to the inappropriateness of the present treatment scheme. It should also be noted that the low effluent BOD_5 concentrations reported may be more apparent than real. Influent and effluent COD's were identical (58 mg/l) and the low effluent BOD result may be a toxicity-related artifact. The large sample to dilution water ratio in the effluent BOD tests would tend to magnify any toxic effects.

Samples collected at the plant are analyzed by ABC Laboratories of Spokane. DO concentrations and total residual chlorine (TRC) are measured at the plant laboratory. Inadequacies were found in sampling and analytical techniques. These are described fully in the Laboratory Procedures portion of this memorandum.

Prior to the follow-up inspection by late April 1979, the following recommendations should be addressed by operating personnel:

1. TRC -
   a. The ortho-tolidine chlorine kits presently being used by the plant are not approved for residual chlorine analysis and should be replaced with an accepted method; i.e., DPD analysis.

   b. TRC samples should be taken from the discharge end of the contact chambers.

   c. Results from simultaneous TRC and fecal coliform samples should be analyzed and the chlorine feed reduced to a point where fecal coliform concentrations approach 200 colonies/100 ml.

2. BOD_5 and TSS sampling - Single-day composite samples should be collected for these analyses (see Laboratory Procedures).

3. Fecal Coliform - These samples should be collected from the discharge end of the contact chamber.

4. DO Meter - The DO meter should be calibrated no less often than weekly.

5. Sludge Wastage System - The sludge wastage system should be tested to see if it is operable.

6. BOD_5 Analysis - If chlorinated samples are to be collected, the plant operator should receive assurance from ABC Laboratories that these samples will be dechlorinated and reseeded. If this cannot be done, effluent samples should be collected prior to chlorination.

Review of Laboratory Procedures and Techniques

Samples collected at the treatment plant are analyzed by ABC Laboratories for suspended solids, BOD_5, and fecal coliform samples. Results of BOD_5 and TSS analyses from 24-hour composite splits collected during this inspection showed good agreement between ABC Laboratory and the DOE laboratory results. Treatment plant personnel collect samples and perform analyses for chlorine residual and DO on-site. Collection and on-site analytical techniques were generally inadequate. Recommendations for remedying observed problems are outlined below:

1. Total Residual Chlorine - The plant is using the orthotolidine method for TRC analysis. This method is not approved and should be replaced with an approved method (DPD or amperiometric titration) as soon as possible. These samples should be collected from the discharge end of the chlorine contact chambers.

2. Fecal Coliforms -

   a. During the inspection, plant personnel were observed collecting these samples from head end of the contact chamber. These samples should be collected from the discharge end of the contact chambers.

   b. To assure that the sample is being adequately dechlorinated, a portion of the sample could be poured to a test tube for TRC analysis.

   c. The plant operator should receive assurance from ABC Laboratories that non-ideal counts (outside the range of 20 to 60 colonies/filter) will be reported in accordance with "The Membrane Filter Procedures for the Fecal Coliform Test, DOE, 1977". This will eliminate the reporting of 0 or TNTC results.

3. Dissolved Oxygen - The DO meter appeared to be out of calibration at the time of the survey. This meter should be calibrated no less frequently than weekly. The air calibration technique is simple and could be performed on-site by the operator.

4. Suspended Solids and BOD_5 Sampling - Presently, BOD_5 samples are collected as a single grab at about 1030 every Wednesday morning. TSS samples are composited from grab samples taken every morning at about 1030. This sampling procedure is inadequate. Single-day composite samples should be collected for analyses. Ideally, these samples should be collected to assure that the samples results provide a good estimate of average daily concentrations. This would probably necessitate

the purchase of two composite samplers. A less desirable alternative would be collection and compositing of grab samples taken on an hourly basis during the work day. If this is done, a grab sample with a volume proportional to the plant flow since the last grab samples taken on the previous day should be collected early in the morning and composited with the other grab samples.

5. BOD_5 Analysis - If chlorinated samples are to be collected, the plant operator should receive assurance from ABC Laboratories that these samples will be dechlorinated and reseeded prior to analysis. If this cannot be done, effluent samples should be collected prior to chlorination.

BY:cp

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.	2/6/79 - 0945	Immed. downstream from comminutor
2. Chlorinated Eff. aliquot - 250 ml/30 min.	2/6/79 - 1000	In combined waste-streams downstream from contact chambers

Grab Samples

	Date and Time	Analysis	Sample Location
1.	2/6/79 - 1400	Grease and oils	Influent
2.	2/6/79 - 1400	Grease and oils	Chlorinated Effluent
3.	2/7/79 - 0840	Fecal Coliforms	Chlorinated Effluent
4.	2/7/79 - 0920	Fecal Coliforms	Chlorinated Effluent
5.	2/6/79 - 1050,1130,1330 2/7/79 - 0840,0915	Cyanide	Influent & Chlorinated Eff.
6.	2/6/79 - 1440	Grease & Oils, Metals, CN, pH, Cond.	Keytronics Manhole
7.	2/6/79 - 1450	Metals, Nutrients, pH, Cond., Turb.	Columbia Lighting Manhole
8.	2/7/79 - 1005	Metals, phenols, Grease & Oils	Alumax Manhole

Flow Measuring Device

1. Type - Contracted Rectangular Weir
2. Dimensions - 17-7/8 inch weir throat

a. Meets standard criteria /X/ Yes

/ / No Explain:

b. Accuracy check

	Actual Instan. Flow	Chart Recorder Reading	Recorder Accuracy (% of inst. flow)
1.	.783 MGD	.72 MGD	92%
2.			
3.			

/X/ is within accepted 15% error limitations

/ / is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
Total Chlorine Residual	2/6/79 - 1010	West Contact Chamber Eff.	0.55 mg/l
Total Chlorine Residual	2/6/79 - 1130	East Contact Chamber Eff.	0.80 mg/l
Total Chlorine Residual	2/7/79 - 0840	West Contact Chamber Eff.	1.8 mg/l
Total Chlorine Residual	2/7/79 - 0920	West Contact Chamber Eff.	1.5 mg/l

Table I

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

	DOE Composite Samples DOE Analysis		DOE Composite Samples ABC Laboratory Analysis		NPDES (Monthly average)
	Influent	Chlor. Eff.	Influent	Chlor. Eff.	
BOD_5 mg/l	26	Est. 4	25	4.2	30
lbs/day	140	22	135	23	188
TSS mg/l	27	29	27	22	30
lbs/day	145	156	145	119	188
Total Plant Flow MGD				.646	.750
COD (mg/l)	58	58			
Total Cyanide (mg/l)	.009[1]	.007[1]			
Fecal Coliforms (#/100 ml)		<10[2] <10[3]			200
Total Chlorine Res. (mg/l)		1.8[2] 1.5[3]			
O-PO_4-P (mg/l)	1.6	1.6			
T-PO_4-P (mg/l)	1.8	2.3			
NH_3-N (mg/l)	3.4	3.4			
NO_2-N (mg/l)	<.1	<.1			
NO_3-N (mg/l)	2.3	.9			
Total Solids (mg/l)	274	293			
T. Non-Vol. Solids (mg/l)	181	214			
T.S.S. (mg/l)	27	29			
TNVSS (mg/l)	9	10			
pH (S.U.)	7.6	7.9			
Turbidity (NTU's)	18	28			
Spec. Cond. (μmhos/cm)	402	430			
Fe (μg/l)	160	220			
Cu (μg/l)	3200	2900			
Cr (μg/l)	<20	<20			
Pb (μg/l)	160	190			
Cd (μg/l)	<10	<10			
Ni (μg/l)	300	300			
Mn (μg/l)	<20	<20			
Zn (μg/l)	150	150			
Mo (μg/l)	**	**			
Phenols (mg/l)	0.118	0.002			
Total Oils	Trace	Trace			

*Field Analysis "<" is "less than" and ">" is "greater than"
**Analyses Pending, will be forwarded.

[1] Grab Composite
[2] 0840
[3] 0915

Table II

Results of Grab from Manholes

	Columbia Lighting	Keytronics	Alumax				NPDES (Monthly Average)
pH (S.U.)	8.4	8.7	7.3				
Turbidity (NTU)	20	620	320				
Spec. Cond. (μmhos/cm)	374	520	399				
NH_3-N (mg/l)	0.09	--	--				
NO_2-N (mg/l)	0.01	--	--				
NO_3-N (mg/l)	1.0	--	--				
O-PO_4-P (mg/l)	8.6	--	--				
T-PO_4-P (mg/l)	10.5	--	--				
Total Cyanides (mg/l)	--	0.002	--				
Phenols (mg/l)	--	--	0.002				
Total Oils (mg/l)	--	Trace	Trace				
Fe (μg/l)	420	280	7200				
Cu (μg/l)	<10	24,000	30				
Cr (μg/l)	<20	<20	20				
Pb (μg/l)	<50	440	<50				
Zn (μg/l)	30	310	3600				
Cd (μg/l)	<10	<10	<10				
Ni (μg/l)	<50	500	<50				
Mn (μg/l)	30	30	60				
Mo (μg/l)	**	**	**				

* Field Analysis "<" is "less than" and ">" is "greater than"

** Analyses Pending, will be forwarded.

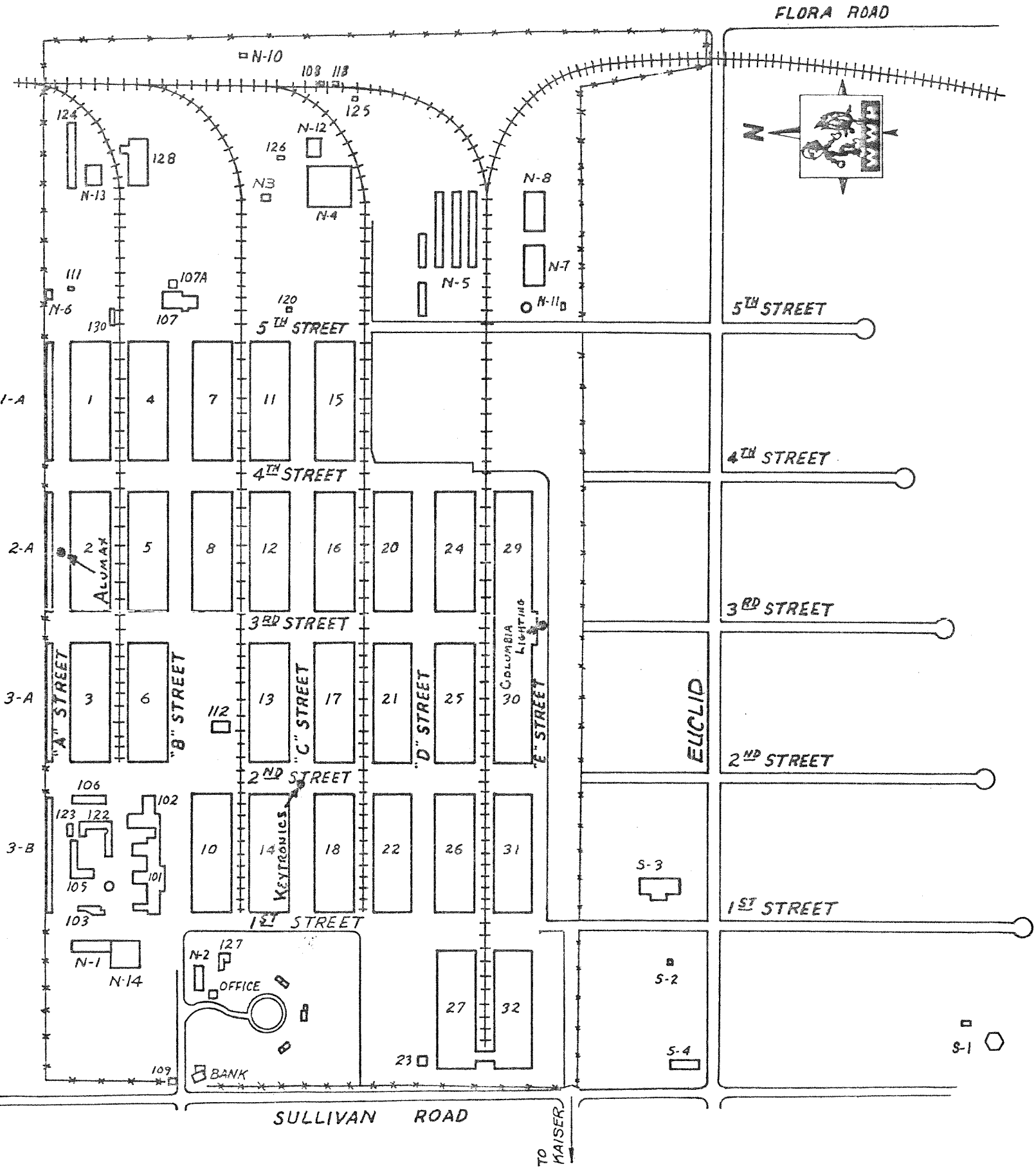

Figure 1 SPOKANE INDUSTRIAL PARK

Table III

Wastewater Toxics - Spokane Industrial Treatment Plant

	Municipal Influents[1] µg/l (Mean ± S.D.)	SIP Influent[2] µg/l	Municipal Effluents[3] µg/l (Mean ± S.D.)	SIP Effluent[4] µg/l	Carbonaceous[5] Threshold	Nitrification[6] Threshold
Cu	112 ± 102	3200	36 ± 23	2900	1,000	5-500
Cr	<31 ± 49	<20	<10	<20	1,000- 50,000	250
Cd	<12 ± 4	<10	<12 ± 5	<10	10,000-100,000	--
Pb	<60 ± 22	160	<50	190	100	500
Zn	268 ± 119	150	149 ± 131	150	80- 10,000	80- 500
Ni	<63 ± 25	300	<50	300	1,000- 2,500	250
Mn		<20		<20	10,000	--
Cyanide		9		7	100- 5,000	340
Phenol		118		23	200,000	4,000-10,000

[1]Data from 6 Washington Municipal Sewage Treatment Plant Influents.

[2]Data from Present Study.

[3]Data From 4 Washington Municipal Secondary Sewage Treatment Plant Effluents.

[4]Data from Present Study.

[5]Threshold Concentrations Inhibitory to Carbonaceous Removal in Activated Sludge Process (MOP/8, Wastewater Treatment Plant Design, 1977).

[6]Threshold Concentrations Inhibitory to Nitrification in Activated Sludge Process (MOP/8, Wastewater Treatment Plant Design, 1977).