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STATE OF WASHINGTON
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Governor

DEPARTMENT OF ECOLOGY
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MEMORANDUM
January 18, 1979

To: Claude Sappington

From: Bill Yake

Subject: Tekoa
Class II Inspection

Introduction:

A Class II inspection was conducted at the Tekoa STP on December 19 and 20, 1978. DOE was represented by Bill Yake (Water and Wastewater Monitoring) and Claude Sappington (Eastern Regional Office). Silas Hair (Tekoa STP operator) was present to describe plant operation and laboratory techniques.

The facility is a secondary (modified activated sludge) treatment plant with several unusual characteristics. No primary settling is provided and the chlorine contact chamber is a modified, circular clarifier. Incoming sewage is pumped to the headworks from a wet well. It passes through a bar screen and comminuter to a covered aeration basin. Aeration basin effluent is passed to a clarifier. Clarified effluent is then piped through a magnetic flow meter, chlorine is added flow proportionally. The flow then passes to a circular clarifier which serves as a contact chamber. The plant discharges to upper Hangman (Latah) Creek which is identified on the Five-Year Strategy as a surface water segment which is not meeting state and federal water quality goals, primarily due to non-point sources (dry land farming). Standard parameters exceeding goals are fecal coliforms, pH, and turbidity. It is not known if the goals will be obtained by implementing best management practices. Based on frequency of violations, this stream is 15th in priority of 36 stream segments in this category.

Findings and Conclusions:

Although this plant is of non-standard design, it appears to be doing a remarkable job of removing BOD and suspended solids. Effluent concentrations for these parameters are perhaps the lowest recorded in any municipal treatment plant in the state and during the inspection, the plant was discharging only 5 to 10 percent of its BOD and TSS permit limitations. Although the use of a converted clarifier as a chlorine contact chamber does not provide true plug flow and thus sacrifices some efficiency, the use of a flow paced chlorinator and the long nominal detention time (about 2 hours) appear to provide adequate disinfection with comparatively low total residual chlorine concentrations (approximately 0.5 mg/l). Difficulties in maintaining adequate disinfection at low chlorine residuals may be experienced if plant flows increase and contact time is decreased by increased flows.

In addition to removing high percentages of BOD and suspended solids, the plant also produces a highly nitrified effluent. Another unusual characteristic of the effluent is the high concentration of dissolved oxygen (6 - 8 mg O_2/l). Initially we felt that these values reported on the DMR's may have reflected false highs resulting from using the Winkler method to detect D.O. in a chlorinated effluent. Therefore, an IBC probe and meter were used to analyze the oxygen concentrations throughout the process. The following results were obtained:

	Dissolved Oxygen
Aeration Basin Effluent	0.5 mg/l
Secondary Clarifier Effluent	1.8 mg/l
Chlorine Contact Chamber	5.2 mg/l
Final Effluent	6.2 mg/l

The source of this oxygen is unknown, but the increase appears to be legitimate and to occur primarily in the contact chamber/clarifier.

The plant probably has little direct adverse effect on dissolved oxygen in Hangman Creek. The main effects on the creek are likely nutrient enrichment and the secondary effects associated with stream eutrophication (increased pH's, diurnal dissolved oxygen swings, and aquatic weed growth).

As with many small-town systems, there is evidence of infiltration and/or inflow. The design average capacity of the plant is 100,000 gpd with a maximum of 300,000 gpd. Dry weather flow (August) is about 100,000 gpd, but the flow during the inspection was 198,000 gpd and this appears to be typical of non-summer months. Influent BOD loading was close to the expected 0.20 lbs/capita/day. Infiltration/inflow appears to be more of a threat to causing flows in excess of design capacity than population growth.

Laboratory procedures were reviewed and recommendations are outlined in the "Review of Laboratory Procedures and Techniques". Values reported on DMR's to date appear to be relatively accurate but refinements are suggested.

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	12/19/78 - 1130	Influent wet well
2. Unchlorinated Effluent aliquot - 250 ml/30 min	12/19/78 - 1030	Secondary clarifier launder
3. Chlorinated Effluent aliquot - 250 ml/30 min	12/19/78 - 1045	Outfall of chlorine contact chamber (converted clarifier)

Grab Samples

	Date and Time	Analysis	Sample Location
1.	12/20/78 - 0940	Fecal Coli., Chlorine Residual	Chlorinated Effluent
2.	12/20/78 - 1150	Fecal Coli., Chlorine Residual	Chlorinated Effluent
3.			
4.			
5.			
6.			

Flow Measuring Device

1. Type Magnetic Flow Meter, In-line
2. Dimensions

a. Meets standard criteria ☐ Yes
☐ No Explain:
In-line meter, could not be calibrated

b. Accuracy check

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

☐ is within accepted 15% error limitations
☐ is in need of calibration

Field Data

Parameter	Date and Time	Sample Location	Result
Temp., pH, conductivity	12/19/78 - 1130	Influent	See Results
Temp., pH, conductivity	12/19/78 - 1110	Unchlorinated Effluent	See Results
Temp., pH, conductivity	12/19/78 - 1115	Chlorinated Effluent	See Results

Review of Laboratory Procedures and Techniques

The laboratory analyses are performed in a consciencious manner and Wes Meyers (east side roving operator) has worked closely with Mr. Hair (Tekoa operator) to provide necessary training. Agreement between split sample results was generally good; there are, however, some refinements in techniques which should be implemented to bring analyses into line with Standard Methods and DOE guidelines. These refinements are outlined below. Additional information is available on the attached "Laboratory Procedural Survey".

BOD_5:

1. Effluent BOD tests are being performed on chlorinated effluent. Samples are dechlorinated, but not reseeded. It is suggested that either unchlorinated samples (samples taken from the secondary clarifier outfall before chlorination) be analyzed or that dechlorinated, reseeded final effluent samples be analyzed in accordance with "Laboratory Test Procedure for BOD of Water and Wastewater", DOE, 1977.

2. Dissolved oxygen decreases in the effluent sample dilutions are generally less than the 2.0 mg/l minimum specified in the above reference. Sample volumes should be increased until at least a 2.0 mg/l drop is recorded. If drops are less than 2.0 mg/l, then values reported on the DMR's should reflect this by reporting the value as less than (<) the BOD value calculated for a 2 mg/l drop at that dilution.

3. A water bath thermometer should be placed in the incubator on the same shelf as the test bottles and this temperature recorded and used to control the temperature setting on the incubator.

Suspended Solids:

1. Rather than analyzing a single morning grab sample for suspended solids, aliquots of the grab composite taken for BOD analysis should be used for suspended solids analysis.

2. Millipore filters are being used for suspended solids. These filters are not approved by Standard Methods, EPA, or DOE for this analysis. When the present supply is exhausted, they should be replaced with approved filters (Reeves Angel 930AH or Gelman A/E).

3. Filters should be washed with distilled water, dried, dessicated and weighed prior to use.

Chlorine Residual:

1. The DPD method is used and this analysis is being performed correctly.

Fecal Coliform:

1. Samples are not dechlorinated prior to analysis. This should be done by placing 1 ml of 1 percent sodium thiosulfate per 4 oz. volume of sample to each sample bottle prior to autoclaving.

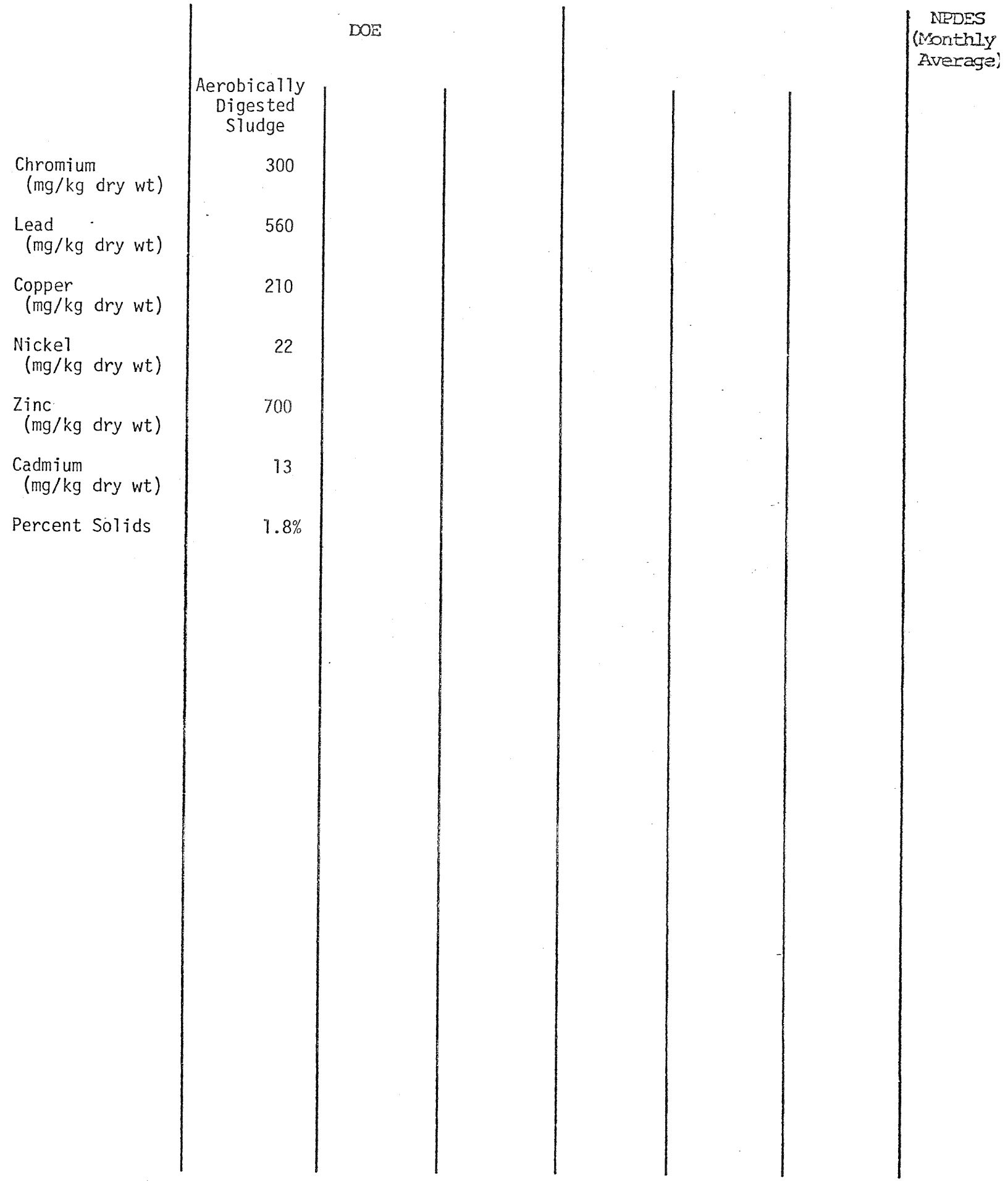
2. The filtering apparatus is rinsed with distilled water after the sample is filtered. Sterile phosphate buffer (see "The Membrane Filter Procedure for the Fecal Coliform Test, DOE, 1977) should be used instead of distilled water to prevent stressing or killing organisms retained by the filter.

3. If fecal coliform counts are outside the ideal 20 to 60 plate counts, they should be reported as specified in the above reference. Counts should not be reported as 0 or TNTC, but reported as less than (<) or greater than (>) as specified in the same reference.

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 Laboratory Results			Tekoa Laboratory Results			NPDES (Monthly average)
	Influent	Unchlori-nated Eff.	Chlorinated Effluent	Influent	Unchlori-nated Eff.	Chlorinated Effluent	
BOD_5 mg/l	84	6	6	115	8	3 3/	30
lbs/day	139	9.9	9.9	190	13.2	5.0	112
TSS mg/l	52	5	2	64	--	6	30
lbs/day	86	8.3	3.3	106		9.9	112
Total Plant Flow MGD	--	0.198	--	--	0.198	--	
Fecal Coliform (Colonies/100 ml)			280 est. 1/ 160 2/				200
Total Chlorine Res. (mg/l)			0.4 mg/l 1/* 0.4 mg/l 2/*				
NH_3-N (mg/l)	7.0	1.4	0.72				
NO_2-N (mg/l)	0.2	0.2	0.1				
NO_3-N (mg/l)	2.5	7.2	7.1				
$T-PO_4$-P (mg/l)	3.6	3.8	2.4				
$D-PO_4$-P (mg/l)	4.2	4.1	3.0				
pH (S.U.)	7.5* 7.3**	7.2* 7.4**	7.4* 7.7**				6.5-8.5
Specific Conductivity (umhos/cm)	477 530* 497**	427 500* 500**	431 495* 540**				
Total Solids (mg/l)	378	315	312				
Total Non. Vol. Solids (mg/l)	260	227	230				
Total Sus. Solids (mg/l)	52	5	2				
NVSS (mg/l)	14	3	2				
Temperature (°C)	10.4°C*	10.0°C*	9.4°C*				

* Field Analysis grab "<" is "less than" and ">" is "greater than"
** Field Analysis - Composite
1) Grab 12/20/78, 0940
2) Grab 12/20/78, 1150
3) Unseeded



* Field Analysis

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