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ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

MEMORANDUM
November 4, 1985

To: Gary Bailey, Southwest Regional Office

From: Marc Heffner, Water Quality Investigations Section mwh

Subject: American Cyanamid Waste

This memo is intended to document the Water Quality Investigation Section (WQIS) effort in response to the Southwest Regional Office (SWRO) request for a Class II inspection at the American Cyanamid (AC) plant in Longview. The request was somewhat unusual in that the chief concern was related to operational problems at the Cowlitz Water Pollution Control (CWPC) plant which receives process wastewater discharged from the AC plant as a part of the influent load. Because the AC plant manufactures chemical flocculants used to separate solids from water and the CWPC operational problems were solids-related, it was suspected that AC discharge and CWPC operational problems might be related. A reconnisance trip to the AC plant and the CWPC plant was made in August 1984 by Gary Bailey and Marc Heffner.

A tour of the AC facility was given by Dennis Peters. The principal products at the AC plant are chemical flocculants to aid in separating water and solids. The waste stream sent to the CWPC plant primarily comes from clean-up of the reaction vessels in which the flocculants are made. Specific products for different applications are made in batches. Between batches a minor cleanup is required if a repeat of the same product is to be run. A major cleanup is required if a batch of a different product is to be run. The major cleanup requires three water rinses of approximately 12,000 gallons each, resulting in 35,000 to 40,000 gallons of wastewater generated during a 30- to 40-hour time period. The wastewater is routed to two 20,000 gallon holding tanks from which the wastewater is bled into the CWPC sewer system. Flow equalization and pH adjustment (if necessary) are the only treatment measures provided by AC. AC attempts to make arrangements with the CWPC plant when production problems or other occurrences require an atypical discharge to the CWPC plant.

A tour of the CWPC plant was given by Jerry Schultz. The CWPC plant is an activated sludge facility capable of handling a flow of approximately 10 MGD. Several operational problems were described by Jerry:

1. Sludge in the gravity thickener (used to thicken sludge prior to heat treatment) was becoming thicker than unit design had anticipated. Sludge scraper speeds in the thickener were approximately tripled to prevent sludge accumulation in the unit from damaging the scraper arm.

2. Excessive floating scum in basins with limited movement (wet wells, clarifiers, etc.) is an occasional problem requiring additional operator time for cleanup.

3. Excessive floating solids in the decant tank, following sludge heat treatment, is an occasional problem. The floating solids must be recirculated through the heat treatment process necessitating an additional energy input prior to disposal.

The cause(s) of these problems is unclear, but influent components known to alter solids behavior (such as flocculants) should be considered as a possible cause. Although several operational problems were pointed out, review of DMR's showed that the CWPC effluent TSS and BOD_5 concentrations were usually <15 mg/L; well below the NPDES permit limits of 30 mg/L.

The reconnisance trip information suggested that establishing or dismissing a relationship between AC waste and CWPC operational problems would be very difficult with Class II inspection data. Reasons include:

1. Variability of the AC waste. Waste strength would be somewhat related to the stage of the rinse process. Also, the various products made have potentially different influences on the CWPC plant influent. Thus the AC waste stream is not amenable to collection of a single sample (either grab or composite) from which generalized waste stream characteristics can be described.

2. Nature of the operational problems at CWPC. Chances of establishing a cause/effect relationship during a Class II inspection for the solids problem described would be very minimal. A study of longer duration would be necessary to increase the chances of finding a cause/effect relationship.

Therefore, rather than conducting a traditional Class II inspection, a limited study attempting to estimate the effects of AC waste on the CWPC plant was thought more appropriate.

A series of jar tests were performed in an attempt to estimate the effect. Influent from the LOTT STP in Olympia was used as the test sewage to avoid any double dosing effects that might result if CWPC sewage were used. The first jar test (trial 1) was set up on January 23, 1985, using a grab sample collected from the AC holding tank by Gary Bailey on January 22, 1985 (stored at 4°C prior to the test) and a grab sample of LOTT influent collected on January 23, 1985. The test was run in accordance with the procedure noted on Table 1 as adapted from Clark, et al. (1977).

Results of trial 1 are presented on Table 2. The "after settling" data indicate that increased TSS concentrations left in suspension correlated with increased doses of AC waste. Also, the TS concentrations "removed" seemed to increase to a point with increased doses of the AC waste. These results suggest that the AC waste may be having an effect on the sewage. Table 3 estimates the percent of the CWPC plant flow that is comprised of AC waste. The 3 and 10 mL categories in Table 2 approximate concentrations that could occur.

Although settling characteristics of the LOTT sewage seemed to change slightly when AC waste was added, the results were not clear-cut. While the TS removed increased with increased AC waste addition, the TSS removed decreased. This observation suggests that the "start" TSS concentration (a calculated value) failed to account for any changes in TS to TSS that may have occurred during flocculation. A retest to include measurements of post-flocculation solids content prior to setting and estimates of the settled solids volume and/or density was performed. The modified procedure is described in Table 4.

The modified procedure (Table 4) was used on April 2, 1985, for a retest of the AC waste collected January 22, 1985 (trial 2). The AC waste was stored at 4°C in the interim. Trial 2 results presented in Table 5 suggest that the AC waste had little, if any, effect on the sewage. Since the same waste seemed to have some effect during trial 1, the age of the AC waste is thought to be the most reasonable explanation for the minimal effect. It seems likely that because the product is present in the waste at a relatively low concentration, shelf life may be limited.

The procedure on Table 4 was used again on April 29, 1985, to test the AC waste collected April 17, 1985 (trial 3). The AC waste was stored at 4°C in the interim. Results of trial 3 are presented in Table 6. The April 17, 1985, AC waste sample had much lower TS and TSS concentrations than the January 22, 1985, sample (4/17/85: TS = 460 mg/L, TSS = 11 mg/L; 1/22/85: TS = 890 mg/L, TSS = 40 mg/L) and had a fishy odor that was not noticeable in the January 22, 1985, sample. Slight differences in the "after flocculation estimated" and "after flocculation measured" concentrations and slightly increased TSS "removed" concentrations with AC waste addition were observed. The differences are small in magnitude and could be either experimental variation or actual changes.

Differentiation of actual changes caused by the AC waste and experimental variation that may be occurring is difficult. Factors making experimental isolation of any effects the AC waste may be having on sewage include:

1. The jar test-solids measurement method used to estimate solids changes associated with different concentrations of the AC waste in sewage is not extremely sensitive.

2. The variability of the AC waste quality (as illustrated by the difference in the two samples collected by WDOE). Also, because the quantity discharged is variable and comprises a small percentage of the plant flow (Table 3), relating laboratory test results to field conditions would be difficult.

Test repetition and perhaps an improved test procedure would be necessary to define a range of effects, if any, the AC waste may have on sewage. The interpretation of any data collected would be difficult because the interpretation must address both the presumed positive impact of improving solids/water separation and thus aiding NPDES permit compliance by CWPC, and the presumed negative impact of unusual and/or increased solids coming into the CWPC plant as the dissolved flocculants coagulate and become part of the TSS load. The test repetition thought necessary is beyond the scope of a study or inspection that could be conducted by the WDOE WQIS.

In a July 23, 1985, conversation with Jerry Shultz, he noted that the increased rake speed in the gravity thickener was working adequately and the floating solids in the areas of limited flow and in the decant tank were occurring infrequently and seemed to be manageable. He believed that AC was making a conscientious effort to make CWPC personnel aware of any discharge abnormalities to minimize any adverse impacts their discharge might have on the CWPC plant. Based on the preliminary jar test experiments and the present operating conditions at the CWPC plant, an effort to isolate any effects of the AC waste on the CWPC would be technically difficult and of limited benefit at the present time. Should a study to accurately define any effects the AC waste may have on the CWPC plant become necessary, the amount of work involved would prohibit WQIS participation beyond a limited advisory/review role.

MH:cp

Attachments

REFERENCES

Clark, J.W., W. Viessman, Jr., and M.J. Hammer, 1977. Water Supply and Pollution Control, 3rd edition.

APHA-AWWA-WPCF, 1980. Standard Methods for the Examination of Water and Wastewater, 15th edition.

Table 1. Trial 1 jar test procedure* - American Cyanamid waste.

1. Place 1.5 L of LOTT influent† in each jar test vessel.

2. Add a measured volume of AC waste to each vessel.
   (volumes chosen: 0 mL, 3 mL, 10 mL, 30 mL, 90 mL, 180 mL)

3. Flash mix all samples for one minute at 100 rpm.

4. Flocculate samples for 20 minutes at 45 rpm; observe samples periodically for floc formation.

5. Stop agitation and rate the occurrence of floc in each sample.

6. Settle samples for 1.75 hours. Pour off decant for TSS and TS analyses.

*Adapted from Clark, *et al*., 1977.
†Sewage from the treatment plant located in Olympia.

Table 2. Trial 1 (1/23/85) jar test results - AC waste*.

Initial Measurements

Sample	TS (mg/L)	TSS (mg/L)
AC waste	890	40
LOTT influent	520	120

Jar Test Measurements

Sample (mLs AC waste added†)	Solids Concentration (mg/L) Start** TS	Start** TSS	After Settling TS	After Settling TSS	Removed*** TS (mg/L)	Removed*** TS (%)	Removed*** TSS (mg/L)	Removed*** TSS (%)	Flocculation Rating††	AC waste - Percent of Total Volume in Jar
0	520	120	440	52	80	15.4	68	56.7	0	0.00
3	521	120	430	60	91	17.5	60	50.0	<1	0.20
10	522	119	420	62	102	19.5	57	47.9	1	0.66
30	527	118	420	76	107	20.3	42	35.6	3	1.96
90	541	115	430	72	111	20.5	43	37.4	5	5.66
180	560	111	450	85	110	19.6	26	23.4	5	10.71

*AC waste collected 1/22/85
†AC waste added to 1.5 L of LOTT sewage
**Calculated based on volumes of AC and LOTT wastes combined
***Calculated: Start - After Settling = Removed
††Scoring system for visual observations:
0 = flocculation with no AC waste added
5 = maximum flocculation observed during trial

Table 3. Estimated percentages of AC flow in CWPC influent.

Date	CWPC Flow* (MGD)			Percent AC flow in CWPC influent based on 29,000 gpd AC flow**		
	Maximum	Minimum	Average	Maximum	Minimum	Average
9/84	6.6	4.6	5.3	0.44	0.63	0.55
8/84	6.9	4.6	5.5	0.42	0.63	0.53
7/84	8.2	6.1	6.9	0.35	0.48	0.42
6/84	10.9	6.7	8.4	0.27	0.43	0.35
5/84	11.1	8.1	9.7	0.26	0.36	0.30
4/84	12.7	6.3	8.4	0.23	0.46	0.35
3/84	12.5	6.7	9.3	0.23	0.43	0.31
2/84	13.0	6.8	9.7	0.22	0.43	0.30
1/84	22.4	7.5	10.9	0.13	0.39	0.27
12/83	11.8	6.6	9.2	0.25	0.44	0.32
11/83	19.1	7.2	11.9	0.15	0.40	0.24
10/83	6.9	5.1	5.6	0.42	0.57	0.52

*CWPC flows taken from CWPC NPDES monitoring reports.

**29,000 gpd flow is maximum industrial wastewater discharge listed on the 6/21/76 AC waste discharge permit application form.

Table 4. Trial 2 and 3 jar test procedure* - American Cyanamid waste.

1. Place 1.5 L of LOTT influent† in each jar test vessel.

2. Add a measured volume of AC waste to each vessel.
   (volumes chosen: 0 mL, 2 mL, 5 mL, 10 mL, 25 mL, 75 mL)

3. Flash mix all samples for one minute at 100 rpm.

4. Flocculate samples for 20 minutes at 45 rpm; observe samples periodically for floc formation.

5. Stop agitation. Pour off approximately 50 mL of sample (while still mixed) for TSS and TS analyses.

6. Pour 1 L of each mixed sample into an Imhoff cone. Rate the occurrence of floc in each sample.

7. Allow to settle for 45 minutes. Gently stir sides of cone with a glass rod, then allow to settle for 15 minutes.

8. Record volume of settled material.

9. Siphon approximately 500 mLs of sample from the center of the cone slightly above mid-depth for TSS and TS analyses.

*Steps 1 through 4 adapted from Clark, et al., 1977. Steps 5 - 9 adapted from APHA, 1980.

†Sewage from the treatment plant located in Olympia.

Table 5. Trial 2 (4/2/85) jar test results - AC waste*.

Initial Measurements

Sample	TS (mg/L)	TSS (mg/L)
AC waste	880	54
LOTT influent	400	92

Jar Test Measurements††

Sample (mLs AC waste added†)	Solids concentration (mg/L) After Flocculation Estimated TS	TSS	Measured TS	TSS	After Settling TS	TSS	Removed** TS	TSS	Settled Solids (mLs)	AC waste - Percent of Total Volume in Jar
0	400	92	400	80	360	38	40	42	4.5	0.00
2	401	92	270***	80	360	50	--	30	6	0.13
5	402	92	400	78	360	37	40	41	6	0.33
10	403	92	400	80	360	41	40	39	5.5	0.66
25	408	91	400	62	380	30	20	32	6	1.64
75	423	90	440	110***	370	22	70	88***	7.5	4.76

*AC waste collected 1/22/85
†AC waste added to 1.5 L of LOTT sewage
**Calculated value: After Flocculation (measured) - After Settling = Removed
***Error suspected
††Flocculation rating not done because visual differences were minimal

Table 6. Trial 3 (4/29/85) jar test results - AC waste*.

Initial Measurements

Sample	TS (mg/L)	TSS (mg/L)
AC waste	460	11
LOTT influent	560	73

Jar Test Measurements

Sample (mLs AC waste added†)	Solids concentration (mg/L)								Settled Solids (mLs)	Floc-culation Rating††	AC waste - Percent of Total Volume in Jar
	After Flocculation				After Settling		Removed**				
	Estimated		Measured								
	TS	TSS	TS	TSS	TS	TSS	TS	TSS			
0	560	73	550	74	510	45	40	29	5.5	0	0.00
2	560	73	570	82	490	49	80	33	5	0	0.13
5	560	73	540	86	500	48	40	38	5.25	0	0.33
10	559	73	540	80	500	44	40	36	5.25	1	0.66
25	558	72	550	77	500	80***	50	--	4.5	4	1.64
75	555	70	570	49***	480	53	90	--	4.5	5	4.76

*AC waste collected 4/17/85
†AC waste added to 1.5 L of LOTT sewage
**Calculated value: After Flocculation (measured) - After Settling = Removed
***Samples may have been switched
††Scoring system for visual observations:
0 = flocculation with no AC waste added
5 = maximum flocculation observed during trial