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MEMORANDUM

April 14, 1986

To: Tom Eaton

From: Marc Heffner

Subject: Port Angeles Sewage Treatment Plant Septage Concerns, March 1986

This memo is in response to your request for the Water Quality Investigations Section (WQIS) to suggest a self-monitoring program for the city of Port Angeles to estimate the impact of septage on the sewage treatment plant (STP).

BACKGROUND

A site visit was conducted on February 28, 1986. Terry Siebens, chief operator, provided the tour of the facilities and discussed laboratory procedures with me. The plant was still recovering from the recent clarifier problem that necessitated bypassing the clarifier for several weeks. During that time period the digestors were also taken out of service and cleaned.

All units were on line during the visit, but the digesters were still not operating efficiently. The operator's records showed a high volatile acids concentation and a low alkalinity concentration. His data suggest that the digesters are starting, but more time is necessary for the operation to stabilize. Prior to starting the digesters, the units were partially filled with warm water. Thus, digester supernatant presently returned to the plant is very dilute; having minimal negative impact on the system.

Until the digesters stabilize, only septage from inside the city limits is being accepted at the plant. A new manifest system is being developed by the city to enforce this requirement. The manifest includes information about the source and volume of the septage. Each load will be met by a city employee who will collect a sample. The sample will be analyzed for total suspended solids (TSS) and 5-day biochemical oxygen demand (BOD_5) at the STP and a higher billing rate levied if either concentration is greater than 400 mg/L.

The previous manifest system required the septic tank dumpers to file monthly reports that included how much sewage was coming from where. Information the operator compiled about the septage plus other pertinent data includes:

1. In a three-month period 391,000 gallons of septage from outside the city limits were sent to the STP.

2. In a three-month period 11,000 gallons of septage from inside the city limits were sent to the STP.

3. Random tests of six dumps during August 1985 were conducted. BOD_5 concentrations were greater than 1,000 mg/L, and TSS concentrations ranged from 19,500 to 30,400 mg/L (average 24,200 mg/L). Information suggests that BOD_5 concentrations in septage are approximately one-half the TSS concentration (EPA, 1984, p. 27). Thus an average BOD_5 concentration of 12,100 mg/L is estimated.

4. Based on Daily Monitoring Report (DMR) summaries, average plant influent for the July-August-September 1985 period were:

   Flow = 2.14 MGD
   BOD_5 = 130 mg/L = 2,330 lbs/day
   TSS = 190 mg/L = 3,390 lbs/day

Table 1 estimates the load attributable to septage at the Port Angeles STP. Roughly 25 percent of the BOD_5 and TSS loads appeared to be attributable to septage.

Table 1. Estimates of septage load on STP* - Port Angeles, March 1986.

	Plant Influent	Septage	
		Based on dumping 7 days per week	Based on dumping 5 days per week
BOD_5			
concentration (mg/L)	130	12,100	12,100
load (lbs/day)	2,330	444	616
percent of total load		19%	26%
TSS			
concentration (mg/L)	190	24,200	24,200
load (lbs/day)	3,390	888	1,231
percent of total load		26%	36%
Flow			
rate (MGD)	2.14	0.0044	0.0061
percent of total load		0.2%	0.3%

*See text for basis of estimates.

Effluent quality information based on the Ecology 1985 DMR tracking form is summarized on Table 2.

Table 2. Summary of effluent quality during 1985 - Port Angeles, March 1986.

	BOD_5		TSS		Flow
	(mg/L)	(lbs/day)	(mg/L)	(lbs/day)	(MGD)
NPDES permit monthly average limits	94	3,794	112	4,521	4.84
1985 range of monthly averages	48-74	870-2,344	22-122	777-2,675	2.1-4.0
Number of violations	0	0	1	0	0

Review of the 1985 DMR data indicates that the plant generally complied with monthly BOD_5 and TSS NPDES permit monthly limits. One TSS average concentration was the only BOD_5 or TSS violation noted. Because grab samples were collected during part of the year, quality of data is somewhat diminished. The margin of compliance nevertheless suggests that permit limits were being met.

The operator noted that key treatment problems associated with accepting septage have been:

1. The influx of grease associated with septage increases maintenance requirements. Increased clarifier skimmings resulting in increased hauling needs is a primary concern.

2. Periods of reduced effluent quality when septage loads pass through the plant have been visually observed. The periods of poor quality have not been of sufficient duration to cause NPDES permit violations when composite samples are collected.

3. The septage is presently dumped into a manhole out in the collection system. Alternative sites in the collection system have been tested as a dump site, but gas problems have been associated with these alternative sites.

LABORATORY REVIEW

Laboratory procedures were discussed with Terry Siebens. Terry has trained a new employee who now conducts laboratory testing The new employee was not on duty during the plant visit. Recommendations pertinent to Port Angeles laboratory procedures include:

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Sampling

1. Influent and effluent time-paced composites are collected. The compositors collect 200 mLs of sample every 30 minutes from 0800 to 1630 hours and 200 mLs of sample every 60 minutes from 1630 to 0800 hours. This system was devised to help compensate for reduced flows and a presumed decrease in concentrations during night-time until a flow-paced composite system is eventually in place. The system likely results in samples of higher concentration than the standard fixed-time method. Although unusual, the change in frequency scheme is thought to be acceptale.

   A suggested modification would be to change sampling intervals to 15 and 30 minutes to help assure that the relatively small slug loads of septage coming into the system are represented.

2. The composite samples are not being cooled during collection. It is recommended that the operator put ice around the composite sample jug in an effort to keep the sample at approximately 4°C during the sampling period. Sufficient sample for testing should be set out approximately one hour before testing begins to allow the sample to warm to room temperature.

3. The city is presently sampling all septage loads to the system. A hand composite of three or four samples of equal volume taken at different stages of the unloading process is suggested.

BOD_5

1. Excessive dissolved oxygen (D.O.) depletion or gain in the blank samples (0.7 - 1.0 mg/L) occasionally occurred, with more moderate drops occurring more frequently. Distilled water is aged one week in the incubator prior to use in the test. Increasing the aging time to two weeks may help solve this problem. Also assuring that all personnel involved with the test are interpreting the titration endpoint properly is necessary.

2. Distilled water for lab use is made in what appeared to be a copper still, suggesting potential copper toxicity. Use of the available demineralizer in conjunction with this still is suggested. Setting up replicate BOD_5 tests for several weeks with one set using distilled water made at the plant and another set using purchased distilled water is suggested as a means of determining the adequacy of the plant distilled water,

3. The pH of the sample to be tested should be checked and adjusted prior to setting up the BOD_5 test if 6.5 >pH or 8.0 <pH. Adjustment can be made with NaOH or H_2SO_4 if necessary (Ecology, 1983, p. 11, #5).

5. During periods of high infiltration/inflow (I/I), sample dilutions should be adjusted to assure a minimum of 2.0 mg/L of D.O. is consumed during the test and a minimum of 1.0 mg/L of D.O. is left in the bottle when the 5-day test is complete.

6 More dilute test dilutions for septage samples will be necessary to get actual BOD_5 concentrations.

TSS

1. The TSS test is presently being conducted using S & S #25 filters. Switching to a Standard Methods approved filter paper (Whatman grade 934AH, Gelman type A/E, or Millipore type AP40) is recommended (APHA, 1985).

2. Using desiccant with an indicator in the desiccator is suggested so the operator will know when the desiccant needs recharged or changed.

3, Quarterly quality assurance checks made by redrying and reweighing test filters after the initial solids test has been completed are suggested. This check, particularly for more thickly matted samples such as septage, helps asure that drying is complete.

MONITORING RECOMMENDATIONS

Monitoring recommendations for Port Angeles are designed to help the city identify the impact of septage on STP performance. Several factors increase the difficulty of establishing a good program to identify impacts of septage, thus increasing the number of samples necessary and corresponding analytical load. Two factors include:

1. Septage comes from domestic, restaurant, and other sources. Sufficient sampling to determine any differences and expected ranges for these classes are desirable.

2. Flow to the plant is influenced by I/I, suggesting a need to study how septage affects treatment by looking at both concentrations and loads at the plant.

The new manifest system being instituted appears to be a good start for recording the septage input to the STP. Expansion of the system to account for all contributions should be encouraged if the city resumes accepting septage hauled from outside city limits. By grouping the septage into several classes, approximate BOD_5 and TSS concentrations for each class can be established so the entire load can be estimated. Sampling all septage loads on days when plant monitoring will be done is suggested until a good background file is established.

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Flow quantities coming to the plant are variable because of I/I (for 1985 monthly average flows ranged from 2.1 to 4.0 MGD, and monthly maximum flows ranged from 2.5 to 10.6 MGD). The primary difficulty is associated with data interpretation and frequency of data collection. Collection of data at least two times per week is suggested so the study can be completed in a timely manner. A data set should include BOD_5 concentration, TSS concentration, and flow data for plant influent and effluent, and septage dumps during a 24-hour time period. Collection of grease data is also recommended. A record including grease volume removed (measured in the skimmer box) and septage load should be adequate.

Some anlaytical time savings may be realized by running COD tests routinely. The COD test can be run much faster than the BOD_5 test, and septage analytical requirements could be fairly high, depending on the amount of septage accepted. An attempt to establish a BOD_5:COD ratio so BOD_5 concentrations could be estimated using COD data may prove worthwhile.

Graphic interpretation of the data is suggested. Several series of graphs will probably be necessary in attempting to correlate flows, loads, and concentrations. Suggested formats are noted on Figure 1. After two months of data collection, the graphs should be thoroughly evaluated and the need for further data collection considered. The consistency of septage inputs should also be evaluated to determine if less frequent analysis of septage will be adequate to estimate septage loads at the plant.

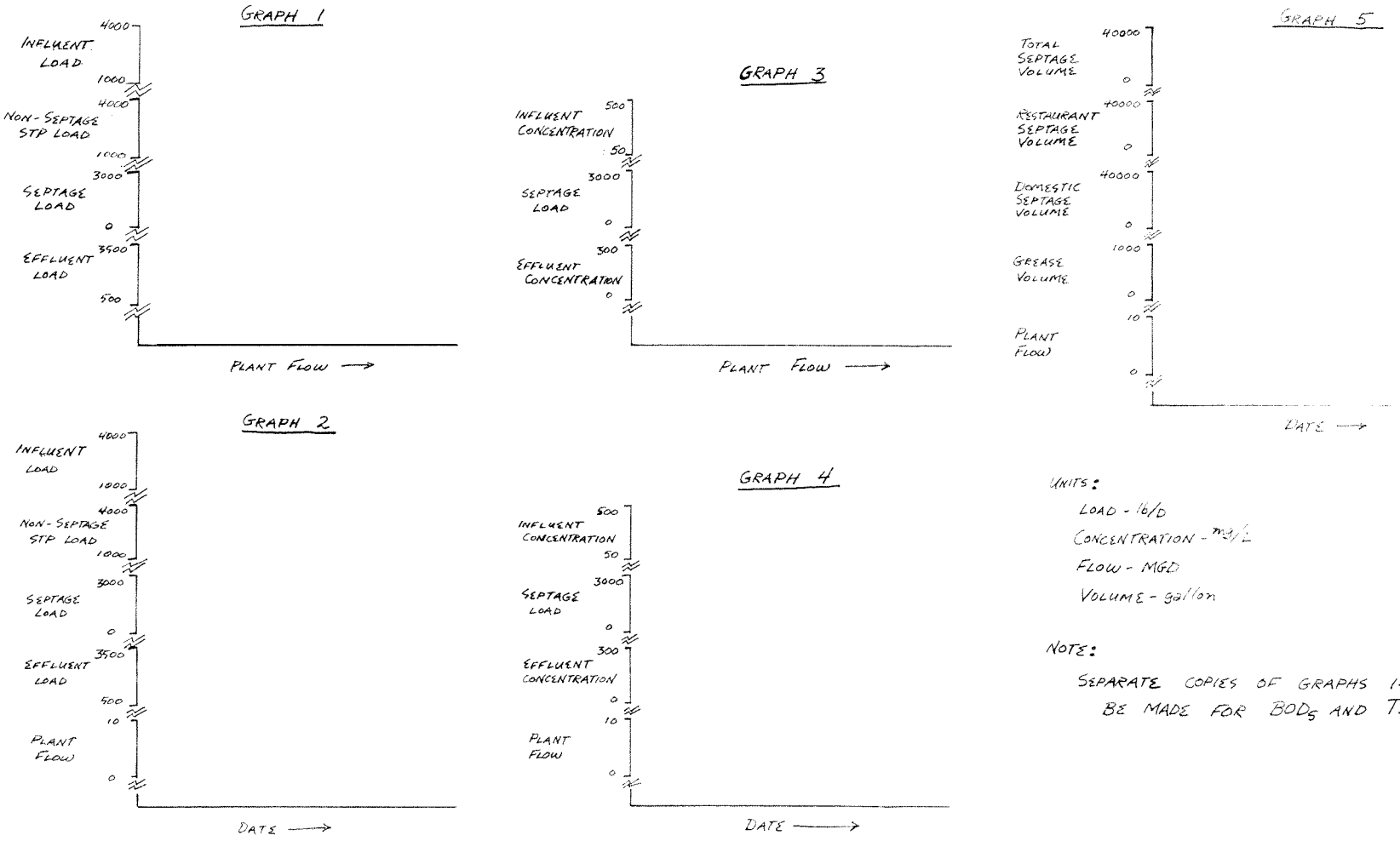
MH:cp

REFERENCES

APHA, AWWA, WPCF, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed.

Ecology, 1983. Laboratory Test Procedures for Biochemical Oxygen Demand of Water and Wastewater, DOE 77-24, August 1977, Revised February 1983.

EPA, 1984. Septage Treatment and Disposal Handbook, Technology Transfer, EPA-625/6-84-009.



UNITS:

LOAD - lb/D

CONCENTRATION - mg/L

FLOW - MGD

VOLUME - gallon

NOTE:

SEPARATE COPIES OF GRAPHS 1-4 SHOULD BE MADE FOR BOD_5 AND TSS DATA

FIGURE 1 - SUGGESTED GRAPHIC ANALYSIS FOR SEPTAGE STUDY - PORT ANGELES, 3/86.