

JOB REPORT

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Name of Project: Pollution Abatement in Regions M-4 through M-9.

Period Covered: September 1, 1959 to April 1, 1960. Job No. F-2

Bio-Assay of Sinclair Refinery's Effluent and Its Effect on Aquatic Life in Corpus Christi Harbor.

Abstract: Sinclair Refinery has several toxic pollutants entering Corpus Christi harbor through a cove dredged for mudshell barges. These pollutants are phenols, sulfides, and oil; however, only traces of oil were located at station 4. There is another industrial waste emptying into the same area that contains chlorine, which could possibly reduce the phenol content since application of chlorine has been satisfactorily used in post-dephenolization. Also, the agitation received in flowing down a wooden flume could reduce the phenol and sulfide content.

Objective: To determine the effects of Sinclair Refinery's industrial waste on aquatic life in Corpus Christi harbor.

Procedure: Samples were collected monthly at the following stations:
Station 1 - outfall prior to disposal in wooden flume;
Station 2 - outfall emptying from flume into cove;
Station 3 - 25 yards from flume;
Station 4 - mouth of cove into harbor.

The separator system operates on a fifteen minute disposal system. As the separator fills there is a trickle drainage of about 25 gallons per minute which is referred to as "the first wash". An automatic switch unloads the contents when the tank fills and this unloading is the "second wash", which is accomplished at a rate of about 300 gallons per minute. The purpose of the dumping of the second wash is to agitate the waste to remove the sulfides.

A sample of each was collected for every analysis. The sulfide samples were preserved with 2 ml. of zinc acetate/liter of sample and the phenols were preserved with 1 mg. copper sulfate/liter sample. The samples were chilled and an analysis was made within 24 hours.

Findings: The location of the disposal area and flushing by tidal effects has been described in the previous job. All physical features are the same except for the construction of the new high bridge. Future plans call for the elimination of the narrows at the old bascule bridge. Oil tankers during periods of high winds have had to retain ballast water in order to navigate the narrow channel. This ballast, which collects sulfur ions from the remains of sour crude oil, reacts to form the toxic sulfide, H_2S or HS . Ballast water is discharged into the Sinclair separator units. In order to be non-toxic sulfide content must be below 2.0 mg/l at the pH of the bay water (7.6). The elimination of the discharging of ballast would reduce the sulfide content of the waste water.

Phenols appear in the waste through decomposition of naphthenic acid from the catalytic cracker. Most of the phenols are washed from the cracked gasoline with caustic and reclaimed, but that which is not removed enters the disposal system.

The oil enters the wastes by spillage of slop oil and by failure of the separator to skim off all of the oil.

These three toxic pollutants are combined into one waste that empties into Corpus Christi harbor through a 36 inch underground tile pipe extending from the separator to the harbor. This empties into a 50 yard wooden flume that causes aeration by agitation before dumping the waste into a cove in the harbor. This cove was dredged as a loading dock for mudshell barges and is of no importance as a fishery habitat, and thus is classed as being of no biological value. The cove provides a period of retention for the waste before it enters the harbor and permits enough dilution to reduce the pollutants to a non-toxic level.

Samples taken at stations 1 and 2 (Table 1) had sufficient amounts of phenols sulfides, and oil to destroy aquatic life. The second wash was always more toxic since it was the full load.

Station 3 showed a decrease in phenols from 31.0 mg/l to less than 1.0 mg/l. The sulfide content dropped from 20.0 mg/l to 0.1 mg/l. The oil content was approximately the same. The phenols could have been reduced by two methods: (1) aeration by agitation down the wood flume and (2) dephenolization by a chlorine waste emptying into the same area of disposal by another industry. The sulfides were possibly reduced by oxidation with the air through agitation while flowing down the wooden flume.

There was no trace of phenols or sulfides at station 4. The oil content had decreased by about 50% from station 3 to station 4. The reduction was caused by spreading in a larger area and thus reducing the film thickness.

Dissolved oxygen was always low at station 3. The area is shallow and solar radiation increased the temperature above normal during the hot months. This plus a lack of wind action and an oxygen consuming waste is possibly the reason for the low readings.

Station 4 at the mouth of the cove had dissolved oxygen readings above the optimum 90% of the time (Table 1). The cove water was mixing with the harbor water and wave action stirred the water at this point. The water depth prevented extensive solar heating.

Forty-eight hour TLM (median tolerance limits) at station 2 and 4 varied from 5.3% to 100%. The low readings at station 2 were due largely to the high phenol content; since there were no phenols at station four the 48 hr. TLM was 100% on every occasion.

Comments: The water entering the harbor from the cove has proven to be safe for aquatic life. The toxic wastes of phenols and sulfides have been reduced to the extent they cause no physical or chemical effects on aquatic life in Corpus Christi harbor. Since the cove is of no biological value, it acts as a holding pond for the waste and provides enough retention time for the waste to become non-toxic. However, on occasions toxic amounts of oil have been found entering the harbor. Some precautionary measure should be taken to prevent waste oil from entering the harbor.

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Date Accepted: 27 September 1960

Table 1

Chemical Analysis of Sinclair Refinery's Effluent

Date	Station	Phenols (ppm)	Sulfides (ppm)	Oil (ppm)	Dissolved Oxygen (ppm)	pH	48 hr. TLM (%)
9-59	1	26.4	8.0	52.0	---	7.8	7.0
	2	24.0	.1	---	---	---	---
	3	1.0	0.0	45.0	3.3	7.6	---
	4	0.0	0.0	20.0	5.1	7.7	---
10-59	1	31.0	20.0	120.0	---	8.1	12.0
	2	30.4	1.2	---	---	---	---
	3	1.0	---	---	4.1	7.5	---
	4	---	---	---	5.5	7.6	100.0
11-59	1	18.1	9.0	36.0	---	8.3	15.0
	2	16.5	.3	---	---	---	14.0
	3	1.0	0.0	20.0	---	---	---
	4	---	0.0	5.0	---	---	---
12-59	1	20.0	11.0	---	---	7.9	9.5
	2	19.0	.2	---	---	---	---
	3	---	---	---	---	---	100.0
	4	---	---	---	---	---	100.0
1-60	1	12.5	6.0	16.0	---	8.0	11.2
	2	12.5	.0	---	---	---	---
	3	1.0	---	12.0	4.9	7.4	---
	4	0.0	---	10.0	5.8	7.5	100.0

Table 1.- Continued

Date	Station	Phenols (ppm)	Sulfides (ppm)	Oil (ppm)	Dissolved Oxygen (ppm)	pH	48 hr. Tlm (%)
2-60	1	16.8	14.0	-----	---	7.7	8.5
	2	15.3	.2	-----	---	---	---
	3	-----	00.0	-----	---	---	---
	4	-----	0.0	-----	---	---	---
3-60	1	17.1	6.0	41.0	---	8.5	5.3
	2	16.0	0.0	-----	---	---	---
	3	1.0	0.0	38.0	3.5	7.8	---
	4	0.0	0.0	30.0	5.1	7.9	100.0