ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

Report on

Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana

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Dallas, Texas
January 1972

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GLOSSARY OF TERMS

BOD - Biochemical Oxygen Demand

COD - Chemical Oxygen Demand

TOC - Total Organic Carbon

OSI - Organic Sediment Index

Org N - Organic Nitrogen

NH_3N - Ammonia Nitrogen

cfs - Flow rate given in cubic feet per second

gpm - Flow rate given in gallons per minute

mgd - Flow rate given in million gallons per day

mg/l - Concentration given in milligrams per liter

INTRODUCTION

DESCRIPTION OF AREA

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

In the southwestern corner of Louisiana -- in the Calcasieu River Basin -- is the State's second largest industrialized area. Industries on the lower portion of the Calcasieu River are principally involved in the production of chemicals, petrochemicals, and petroleum products. Also of interest to this study area are several firms on the upper portions of the River that are processing tall oil and producing Kraft paper.

All of these industries are discharging waste waters into the Calcasieu River or its tributaries - Bayou d'Inde, Bayou Verdine, Houston River, Mill Creek, and Palmetto Creek [Figure 1]. The Rivers and Harbors Act of 1899,[1/] the Water Quality Act of 1965, and the Water Quality Improvement Act of 1970[2/] are applicable to the Calcasieu River and its tributaries. [Water quality regulations established pursuant to the provisions of these Acts are presented in Appendix A.]

The Division of Field Investigations-Denver Center (DFI-DC), Environmental Protection Agency (EPA), at the request of the Director, Water Quality Office, Region VI, EPA, undertook a study of the Calcasieu River Basin in March-April 1971. Specific objectives of the study were to:

1. Compile an up-to-date inventory of industrial waste sources discharging to the Calcasieu River and its tributaries.
2. Ascertain a) types of treatment presently provided and b) the quality and quantity of each industrial waste discharge.
3. Evaluate the individual and collective impacts of wastewater discharges on the beneficial water uses of the Calcasieu River and its tributaries.

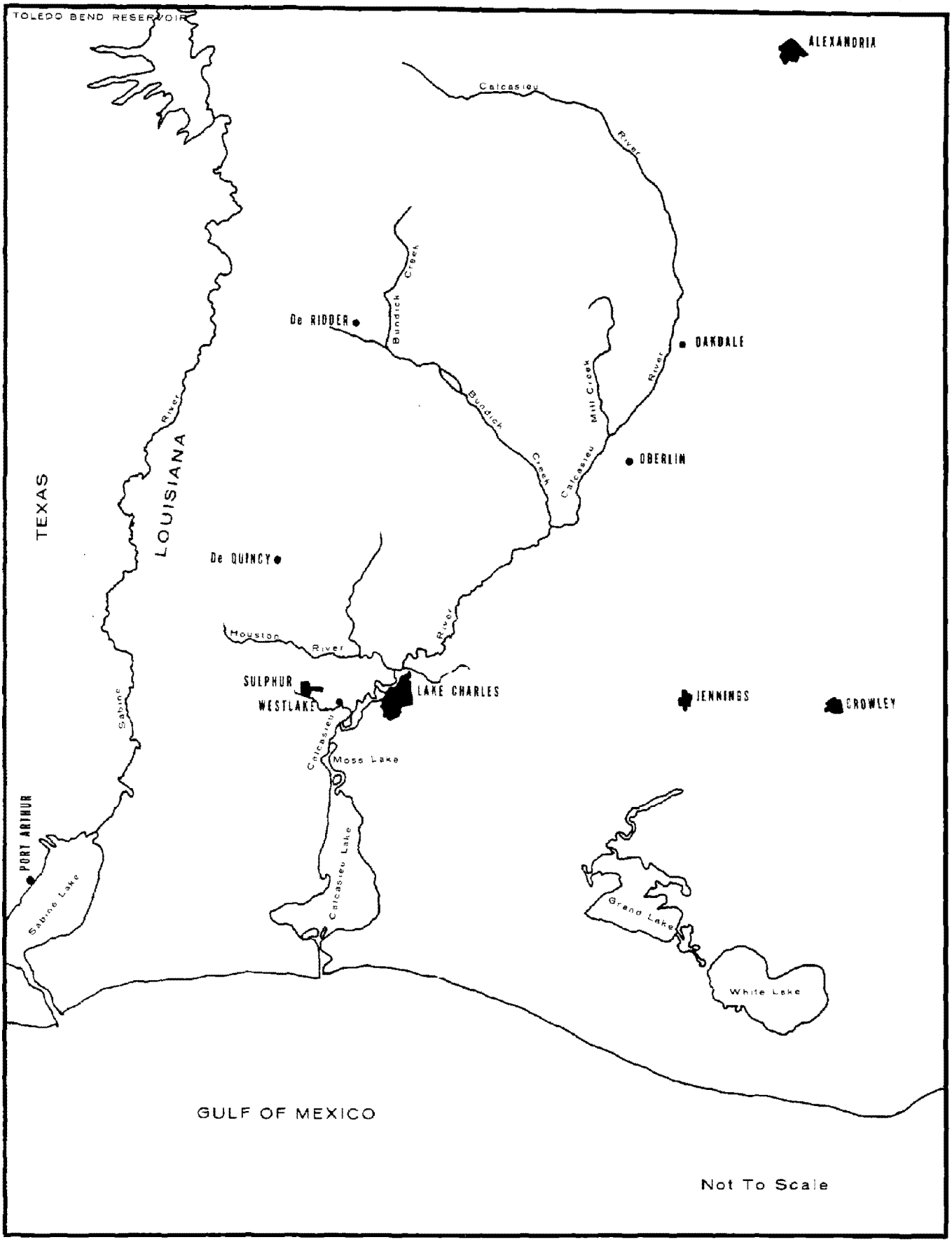

Figure 1. Location Map - Calcasieu River Drainage

4. Determine abatement proceedings necessary or warranted under the Rivers and Harbors Act of 1899, the Water Quality Act of 1965, and/or other applicable local, State and Federal laws.

In the case of each industry surveyed, a team of DFI-DC staff members called upon company officials, explained the investigative program and the basis for it, and negotiated the details for examining the effluents from each firm. Further, each industry representative received a letter detailing EPA's authority in the work and indicating that the investigative program was being conducted to provide the basis for:

(1) Evaluation of Corps of Engineers permits as required under the Rivers and Harbors Act of 1899;

(2) Determination of present water quality conditions in the Calcasieu River and its tributaries;

(3) Evaluation of the individual and collective impacts of wastewater discharges on the beneficial water uses of the Calcasieu River and its tributaries;

(4) Determination of water pollution control needs within the area;

(5) Abatement proceedings as necessary or warranted under the Rivers and Harbors Act of 1899, the Water Quality Act of 1965, and/or other applicable local, State, and Federal laws.

Industrial and municipal waste treatment and disposal practices in the Lake Charles, Louisiana area were then evaluated by a team of DFI-DC engineers, scientists, and technical support personnel. The evaluations were conducted during March and April, 1971. A second survey of effluents from the plants of Cities Service Oil Company and of Continental Oil Company was made in early November 1971.

In addition, because of prior indications that aquatic life in the Lake Charles area contains significant concentrations of mercury, DFI-DC conducted an ancillary sampling program in the Calcasieu River Basin to determine, quantitatively, the presence of mercury.

This report summarizes information pertaining to raw materials, processes, waste loads, and treatment needs (if any) at each of the industries and recommends actions necessary to protect the quality of the receiving waters. Specific information for each significant industrial waste source is summarized in a separate section. Complete custodial records [Appendix B], for each sample taken during the course of this investigation, are on file at the Division of Field Investigations-Denver Center, Office of Enforcement, EPA (Denver, Colorado).

Assistance and support in the conduct of this investigation was provided by the following EPA entities:

Division of Field Investigations-Cincinnati Center

Analytical Quality Control Laboratory, Cincinnati, Ohio

Enforcement Office, Region VI, Dallas, Texas

Southeast Water Laboratory, Athens, Georgia.

The assistance of personnel of the Lake Charles Office, Louisiana Wildlife and Fisheries Commission, is gratefully acknowledged.

DESCRIPTION OF AREA

The total drainage area of the Calcasieu River and its tributaries is about 4,000 square miles; measures approximately 55 by 120 miles; and includes portions of eight parishes with a total population of about 230,000. The Lower Calcasieu River refers to the area from the salt water barrier

(located just north of the city of Lake Charles) downstream to the Gulf of Mexico. The Upper Calcasieu River refers to the fresh water portion of the watershed extending upstream of the salt water barrier to the basin headwaters.

The River is navigable from its mouth to Moss Bluff, Louisiana (about ten miles upstream of Westlake).[3/] Barges and ships navigate a channel that has been dredged from the Gulf of Mexico northward along the west side of Calcasieu Lake to Devils Elbow, thereafter following the natural river channel, except for two cutoffs, to the Port of Lake Charles.

Thundersqualls and tropical storms with high wind velocities occasionally pass through the area. Prevailing winds are from the north during the months of November through January and from the south during the remainder of the year. Frosts occur during the period from late November through February. Average temperatures range from the low 50's (in January) to the 80's (in July).

The lower Calcasieu River, Lake Calcasieu, Bayou d'Inde, Bayou Verdine, and Indian Marais are affected by lunar tides. Passage of a cold front or high winds may cause wind-dominated tides that produce flooding of low-lying areas, tributary streams, and bayous. Hence, flow mixing patterns may be highly irregular.

Brackish inland lakes and marshes that border the main River channel and the adjacent shallow offshore area support a large commercial and sport fishery. The area is an excellent spawning and rearing ground for shrimp, crabs, and various estuarine fish.

In addition to furnishing a location for the propagation of aquatic life, the waters of the Calcasieu River system support other beneficial uses, including municipal and industrial water supplies, recreation, irrigation, and navigation.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Conclusions

During the survey an industrial waste inventory was compiled. It included information on the types of materials produced and raw materials used at each plant, as well as the process additives, water supplies, and wastewater treatment procedures. Composite samples, generally covering 24-hour periods, were obtained from each industrial waste outfall and were analyzed for constituents appropriate to the industry evaluated. Grab samples for oil and grease analysis were obtained where appropriate. Survival and palatability studies were conducted in receiving waters, and sediments were examined for organic content.

The Calcasieu River Basin is logically divided into two areas for assessing the effects on water quality of the sources inventoried during this survey. The Upper Calcasieu River is the fresh water portion of the watershed extending upstream of a salt water barrier. [The industries and sampling locations in this part of the basin are illustrated in Figure 2.] The Lower Calcasieu River encompases the saltwater portion of the watershed. [The sampling locations for this area are depicted in Figure 3, located inside back cover.] The major portion of industrial activity (most of which is directly or indirectly related to the production of petroleum and petrochemicals) is located in the Lower Calcasieu River area. [An industrial location map of this area is illustrated in Figure 4, located inside back cover.]

Evaluation of data indicates that the following two groups of industries are in violation of Section 407, Rivers and Harbors Act of 1899 (33 USC:401-413):

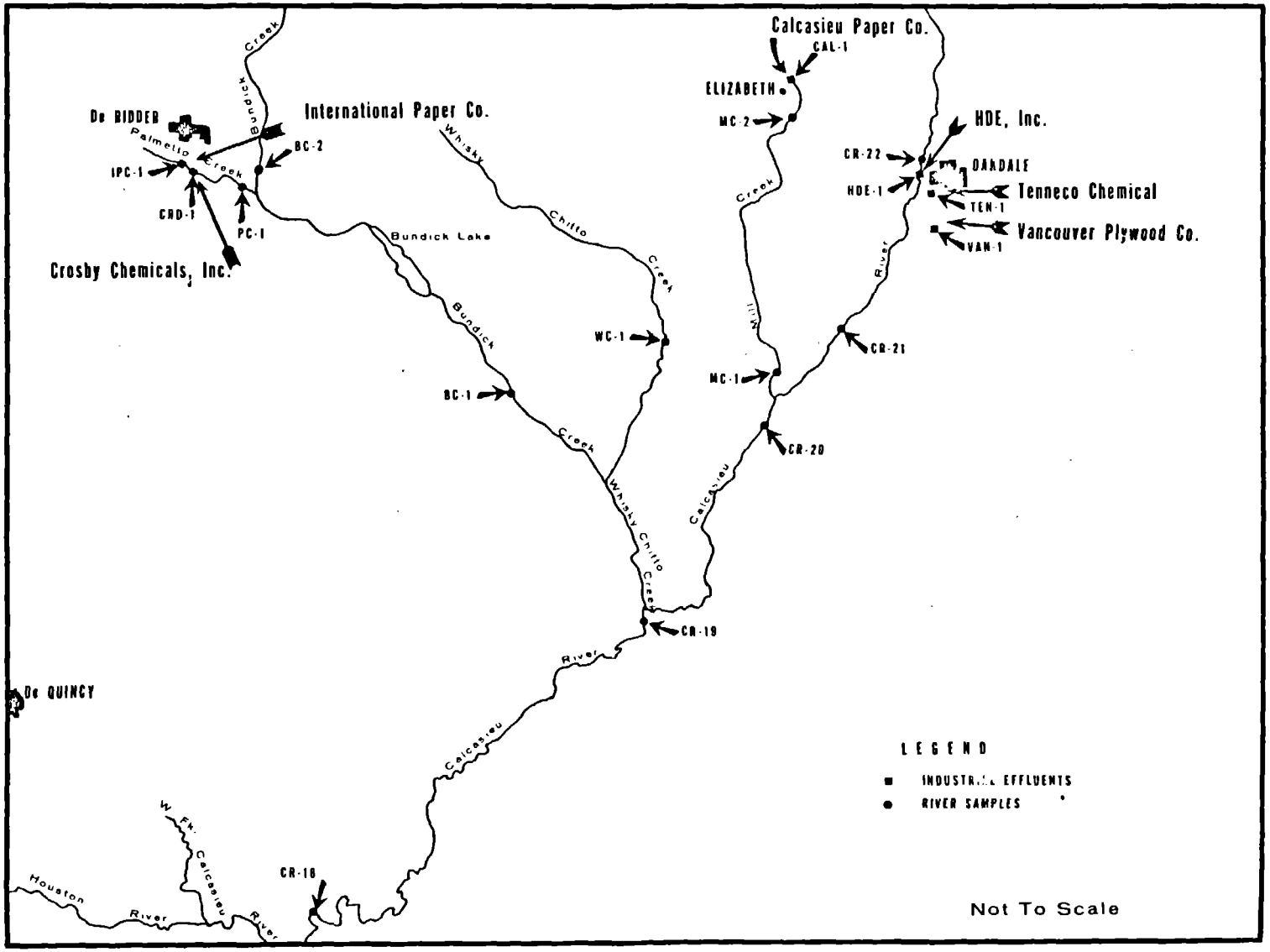

Figure 2. Sampling Locations - Upper Calcasieu River, La.
(APRIL 1971)

Group 1

Cities Service Oil Company refinery;

PPG Industries, Incorporated;

Crosby Chemicals, Incorporated;

Olin Corporation; and

Continental Oil Company refinery.

And:

Group 2

Cities Service Oil Company - Butyl plant;

Cities Service Oil Company - lube and wax plant;

Cities Service Oil Company - petrochemical plant;

Firestone Rubber Company;

W. R. Grace and Company Davison Chemical Division;

Hercules, Incorporated;

Calcasieu Paper Company;

Continental Oil Company - petrochemical plant; and

Continental Oil Company - VCM plant.

The industries in these two groups are generally discharging carbonaceous materials, suspended solids, and oil and grease, to the Calcasieu River or tributary thereof, thus causing violations of Section 407 of the Act. In addition, except for Crosby Chemicals, the first group and Cities Service Oil Company Petrochemical Plant were in violation of Section 407 of the Act for the discharge of heavy metals, heat, nitrogenous materials, and complex organics.

Evaluation of the data indicates that the 14 industries of the preceding two groupings in combination discharge daily at least 82,000 lbs. of COD; 597,000 lbs. of TOC; 601,000 lbs. of suspended solids; and $22,4 \times 10^{12}$ calories of heat. [A summary of the analytical results obtained, by industry, is presented in Appendix G.]

Six industries discharge complex organic derivatives of petroleum, some of which are known to be toxic to aquatic life and/or humans. Survival studies, conducted in situ in receiving waters near these discharges, demonstrated the toxic nature of the effluents from the following industries: Cities Service Oil Company refinery and Butyl plant; Firestone Rubber Company; W. R. Grace and Company, Davison Chemical Division; Hercules, Incorporated; Olin Corporation; and PPG Industries, Incorporated.

Analyses of bottom sediments showed that industrial waste solids are being deposited in the Calcasieu River, a navigable stream, and in the streams and bayous that are tributaries thereto.

[Present and proposed waste water treatment facilities for each industry are tabulated in Table 1.] Industries in the first grouping have no indication of plans to initiate or improve treatment of the wastes that they presently discharge. Industries in the second grouping are either engaged in the construction of new facilities for waste treatment or are developing suitable treatment measures.

Recommendations

Specific recommendations for each significant source of pollution are presented in the individual report sections. These recommendations are summarized in the following paragraphs.

TABLE 1

SUMMARY OF PRESENT AND PROPOSED WASTEWATER TREATMENT
FOR INDUSTRIAL DISCHARGES IN THE
LAKE CHARLES, LOUISIANA, AREA

Name of Industry	Present Treatment	Adequate	Violation of Refuse Act	Proposed Treatment	Scheduled Completion	Adequate	Violation of Refuse Act
Calcasieu Paper Company[a]	Black water - oxidation ponds. White water and cooling water - none.	No	Yes	New facilities are to be constructed and effluent recirculated. Type of treatment to be constructed is unknown.	Unknown	Unknown	Unknown
Cities Service Oil Company							
-Butyl Plant[b]	Oily wastes to refinery treatment facilities. Cooling tower blowdown receive chromate treatment. Once-through cooling water and process water, no treatment.	No	Yes	Experimenting with new treatment processes.	Unknown	Unknown	Unknown
-Lube and wax plant (Cit-Con)	Oxidation pond with oil skimmer	No	Yes	Oxidation pond	Apr. 1, 1972	Unknown	Unknown
-Petrochemical and ethylene propylene plants	Neutralization, oil separation, aerated lagoons	No	Yes	Extended aeration	Dec. 31, 1972	Unknown	Unknown
-refinery[c]	28-Acre oxidation pond followed by a pond that was dredged in Indian Marais. Condensor cooling water receives no treatment.	No	Yes	Cooling tower to reduce flow to oxidation pond by 130 mgd. Deep well disposal of "sour water"	Dec. 31, 1972 Sept. 1, 1971	No No	Yes -
Continental Oil Company							
-Continental Carbon Company	Settling pond	Yes	No				
-Lake Charles Petrochemical Plant	Chromate reduction, acid neutralization, oil separation, filtration	No	Yes	Aerated lagoon	Dec. 31, 1971	Unknown	Unknown
-Lake Charles Refinery[d]	Oil separation, activated sludge, clarifier, oxidation pond; settling ponds for cooling water and coker discharge.	Unknown	Yes	Need to connect all wastewater discharges to the new treatment facilities.	Unknown	Unknown	Unknown
-VCM Plant	Neutralization, oil separation	No	Yes	Extended aeration Sludge facilities Caustic recovery system Chromate recovery Activated carbon filter	Nov., 1971 Dec., 1972 Aug., 1971 Dec., 1973 Unknown	Yes	No

TABLE 1 (CONTINUED)

SUMMARY OF PRESENT AND PROPOSED WASTEWATER TREATMENT
FOR INDUSTRIAL DISCHARGES IN THE
LAKE CHARLES, LOUISIANA, AREA

Name of Industry	Present Treatment	Adequate	Violation of Refuse Act	Proposed Treatment	Scheduled Completion	Adequate	Violation of Refuse Act
Crosby Chemicals, Incorporated	Settling pond, dilution water	No	Yes	None scheduled in the next five years.		No	Yes
Firestone Rubber Company[e/]	Gravity separation and filtration through excelsior pads.	No	Yes	API, alum and polyelectrolyte, air flotation, biological treatment, aerated lagoons.	Sep. 1, 1971	Unknown	Unknown
W. R. Grace and Company Davison Chemical Division	None	No	Yes	Clarification and pH control.	Jan. 1, 1972	Unknown	Unknown
Hercules, Incorporated	API, six oxidation ponds	No	Yes	Biological treatment followed by the six oxidation ponds.	Jan. 1, 1972	Unknown	Unknown
Olin Corporation	Nine discharges to Calcasieu River without treatment. One discharge from a large tailings pond.	No	Yes	No information provided by Company officials.	-	No	Yes
PPG Industries, Incorporated[f/]	Mercury reduction "oxidation ditch"	No	Yes	None scheduled in the next five years.	-	No	Yes

a/ Presently discharge is to Mill Creek; it affects water quality of the Calcasieu River.
b/ When suitable treatment of the waste source is obtained, the treated wastewater will be used for cooling tower makeup water.
c/ Deep well disposal of wastes is not an acceptable treatment for "sour water."
d/ This new treatment facility was recently put into operation and had not stabilized; therefore, it was not providing adequate treatment at the time of the survey.
e/ The Company has an EPA Research and Development Grant for the development of this new industrial wastewater treatment facility.
f/ The Company uses Bayou Verdine and a 2.5-mile ditch to treat wastewater.

It is recommended that appropriate abatement proceedings be initiated against those industries cited in Group 1 for discharging to a navigable stream or tributary thereof those materials that place them in violation of the Refuse Act of 1899. In addition, the refinery of Cities Service Oil Company has constructed a deep well for disposal of "sour water" from the catalytic cracking operations. Since "sour water" is treatable by ammonia stripping and sulfide recovery, there is no justification for deep well injection. It is recommended that legal steps be taken to prevent deep well disposal by the Cities Service Oil Company refinery.

Recommendations contingent upon timely implementation of proposed treatment improvements are made for those industries given in Group 2. For these industries recommendations are that adequacy of treatment be reevaluated after facilities are placed in operation, and if the water quality is found to be inadequate, appropriate abatement proceedings be initiated.

The recommendation is made for all industries surveyed that the discharge permit, to be issued by the Corps of Engineers, limit discharges of those materials now in violation of the Refuse Act of 1899 to levels consistent with the best available treatment and water quality standards for the Calcasieu River.

During the period of these studies, waste treatment and disposal practices at seven additional industries could not be evaluated owing, in most cases, to the seasonal nature of the operations. It is recommended that the waste discharges from these industries be evaluated during the period of operation.

Limited sampling of tributary streams and municipal effluents failed to identify sources of mercury that pollute much of the Calcasieu River Basin, including tributaries that are unaffected by the industrial wastes evaluated. This limited sampling did not shed new light on the source(s) of mercury. It is recommended that additional studies be carried out in the Upper and Lower Calcasieu River Basin in order to identify the mercury sources.

CALCASIEU PAPER COMPANY PLANT
ELIZABETH, LOUISIANA

BACKGROUND INFORMATION

General

The Calcasieu Paper Company (a Kraft process mill) and the Iron Kraft Bag Company (adjacent to the mill) are divisions of Unijax Corporation, West Bay annex, Jacksonville, Florida. Both firms contribute significantly to the economy of the area. There is no bleaching of pulp at the paper company, where the capacity is 350 tons per day. The raw materials used are wood, salt, coke, lime, caustic soda, and sodium sulfate. (The product is converted to wrapping paper and bags by the adjacent bag company.)

About 850 persons are employed at the two plants. The mill operates continuously. During the visit of EPA personnel, this plant was not operating at full capacity. Two engineers, one chemist, and a laboratory technician are assigned full-time to water pollution control at the Kraft process mill.

Water Supply

Seven wells, each rated at 900 gpm, provide a total of 9 mgd of water. This water is used for processing, cooling, boiler feed, fire control, and sanitary purposes.

Existing Waste Treatment

Major sources of wastewater are the white water from the paper machines and the black liquor (spent cooking liquor) from the pulp process. White water and cooling water blowdown are released, without treatment, to Mill Creek, which flows for 14 miles through West Bay Wildlife Management Area before discharging to the Upper Calcasieu River. The black liquor is treated in the oxidation ponds that overflow to Mill Creek. During an EPA

tour of the mill (April 2, 1971) black liquor was being discharged, along with the the white water, directly to Mill Creek. Company officials stated that this was not a routine occurrence, but was due to a breakdown in the pulp process. The resulting effluent was black in appearance and ranged in temperature from 36° to 42°C.

Chronology of Contacts

On April 2, 1971, M. R. Helton and R. D. Harp of EPA's DFI-DC met with J. E. Mailhaus, the Calcasieu Paper Company plant manager, to collect information on wastewater disposal practices at the plant. E. D. Anthony, Jr., enforcement programs specialist, Region VI, EPA, Dallas, Texas, had arranged for the meeting on March 31.

Subsequent to the April 2 meeting (about a week later) the Plant Manager was contacted by DFI-DC representatives and a request was made to sample the plant discharges. Mr. Mailhaus was informed that effluent sampling was in conjunction with a water quality survey of the Calcasieu River Basin.

Mr. Mailhaus objected to the planned sampling regime that included sampling of the plant effluent at the outfall, at the Company's property fence. He asserted that the waste receives additional treatment while flowing in Mill Creek and claimed it was the Company's right to use the stream for treatment purposes. The investigating team explained to Mr. Mailhaus that the Refuse Act applies to waste discharges at the point of discharge to the naturally occurring waterways that are classified as navigable or as tributaries to navigable streams. Permission was granted to sample at the point of discharge (MC-2). Mill Creek was also sampled near the mouth (MC-1).

SAMPLING PROGRAM AND RESULTS

Samples (125 ml. aliquots) were composited every two hours, for a 24-hour period, commencing at 6:25 a.m., April 19. A grab sample for oil and grease analysis was taken at 8:25 a.m., April 19. Eight days later, water quality and sediment samples were collected from Mill Creek and from the Calcasieu River upstream and downstream from the mouth of Mill Creek. [Descriptions of the sampling stations and their locations are shown in Table 1-1 and Figure 1-1, respectively. Analytical results from the sampling program are listed in Table 1-2.]

During the sampling period, the Calcasieu Paper Company was discharging 8.7 mgd, carrying a load of 10,900 lbs of TOC; 36,700 lbs of COD; 26,200 lbs of suspended solids; and 290 lbs of oil and grease. Samples collected at MC-1 and at the CR-20 and CR-21 stations indicated that the wastes carried by Mill Creek increased the TOC and suspended solids concentrations in the Calcasieu River from 11 mg/l to 15 mg/l, and from 18 mg/l to 49 mg/l (35 percent and 170 percent, respectively).

Bottom sediments from MC-2 near the point of discharge contained 25 percent volatile materials, while the sediments from MC-1 near the mouth of Mill Creek contained 3.8 percent volatiles [Table E-1, Appendix E]. The differential confirms that substantial decomposition of discharged solids from the Calcasieu Paper Company takes place in Mill Creek.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission recently approved the discharge levels of certain materials based on data submitted them by Calcasieu Paper Company. A summary of the information from the Commission is as follows:

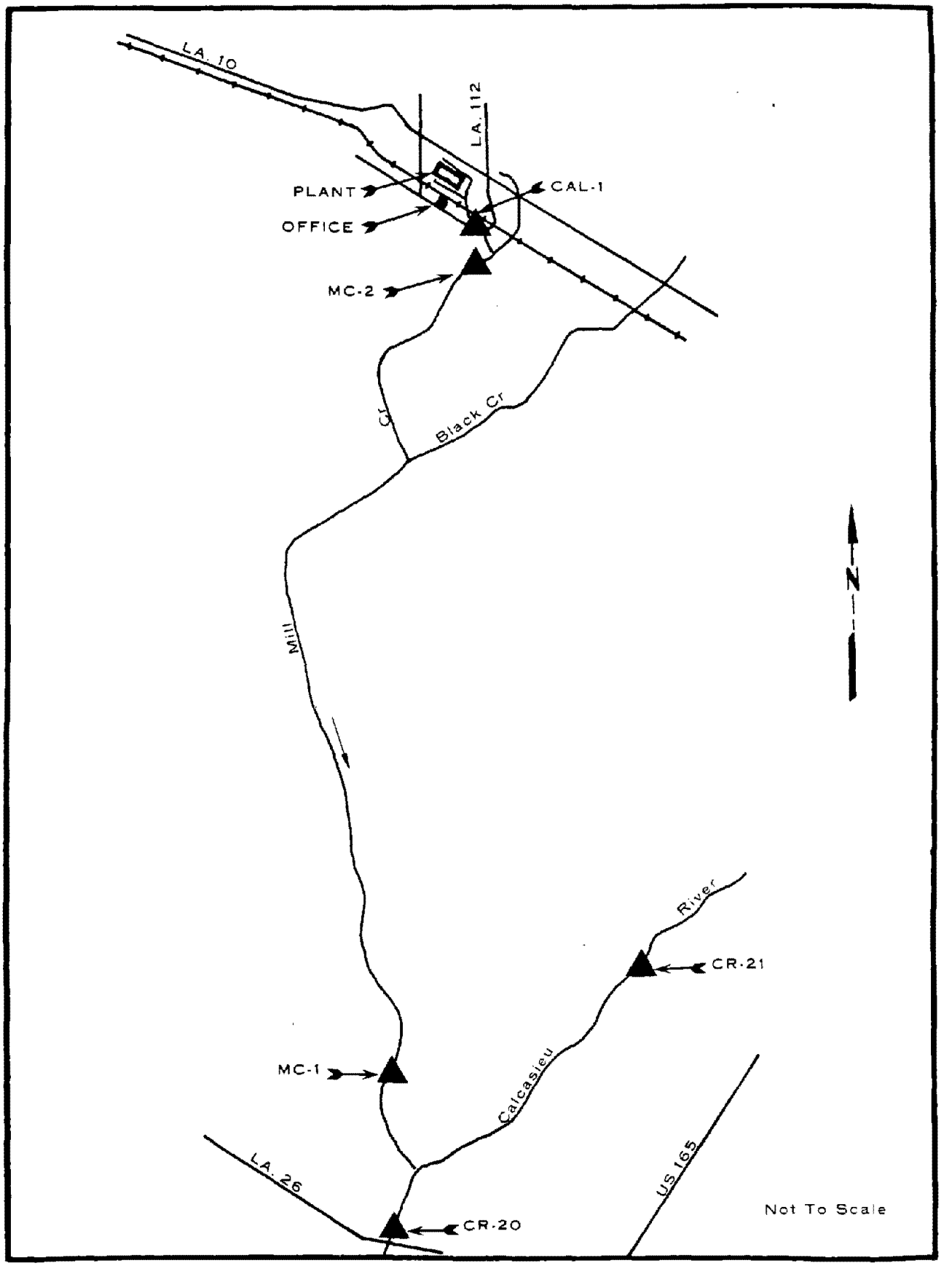

Figure 1-1. Effluent & Receiving Water Sampling Locations for Calcasieu Paper Company

TABLE 1-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CAL-1	Sample taken 20 yards downstream from the point where the "Front Ditch" and "Back Ditch" combine at the headwaters of Mill Creek. Mill Creek is a tributary to the Calcasieu River.
CR-20	Calcasieu River at Highway 26 bridge (USGS 135) downstream from the mouth of Mill Creek.
CR-21	Calcasieu River at bridge in Sec 15, T4 and R4W upstream from the mouth of Mill Creek.
MC-1	Mill Creek near mouth at USGS 134.5.
MC-2	Mill Creek south of Elizabeth, Louisiana.

TABLE 1-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	COD[b/] mg/l	COD[b/] lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
CAL-1	8.71	7.2-11.2	320-5,000	750	36-42	150	10,900	504	36,700	918	66,800	360	26,200
CR-20		6.5- 7.3		117	23	15				182		49	
CR-21		7.4- 8.0		75.5	20-22	11				116		18	
MC-1		6.4- 6.6		2,000	22	48		200		451			
MC-2		7.6- 9.3		12,800	36-37	390		560		1,810			

Sta	Oil & Grease mg/l	Oil & Grease lbs/day	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Copper mg/l	Lead[c/] mg/l	Aluminum mg/l
CAL-1	4	290	<0.05	0.10	7	<0.1			
CR-20			<0.05	<0.02		<0.1	<0.02	<0.1	1.5
CR-21			<0.05	<0.02		<0.1	<0.02	<0.1	2.4
MC-1						<0.1			
MC-2						<0.1			

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ No interference from calcium detected.

I-5

Date of Application:	August 20, 1970
Quantity of Discharge:	11 cfs
Temperature:	Equivalent to stream temperature
Turbidity:	80
True Color:	135
Organic Materials:	8,883 lbs/day, equivalent to 150 ppm
Inorganic Materials:	11,843 lbs/day, equivalent to 200 ppm

No toxic materials were listed in the application. Discharge is to the Upper Calcasieu River.

PROPOSED WASTE TREATMENT

According to Company officials, a new waste treatment facility has been designed and is scheduled to be completed within the next year. The major portion of the present wastewater flow will be recirculated. The proposed system is designed to reduce BOD to 25 mg/l, suspended solids to 25 mg/l, and color to 100 APHA units. The "treatment" afforded by Mill Creek will, according to Company estimates, reduce the BOD at the mouth of Mill Creek by an additional 75 percent. Company officials contend, further, that the constituents in the wastewater will be reduced correspondingly by treatment in Mill Creek, thus causing a negligible effect on the Upper Calcasieu River.

CONCLUSIONS

It is concluded that:

1. Because Mill Creek flows, for its entire length downstream from the point of discharge, through the West Bay Wildlife Management Area, using the stream as a treatment facility is unacceptable;

2. Whereas the Calcasieu Paper Company has indicated intent to claim use of Mill Creek as part of the treatment process subsequent to the installation of new treatment facilities, use of a tributary to a navi-

gable stream for waste treatment or disposal is a violation of the Refuse Act and, in the case of Mill Creek, constitutes a violation of Louisiana law;

3. Present treatment allows for the daily discharge to a tributary of a navigable stream of 10,900 lbs of carbonaceous materials; 26,200 lbs, suspended solids; and 290 lbs of oil and grease, thus constituting violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, monitor progress toward initiation of suitable treatment by July 1, 1972, and evaluate the effectiveness of treatment by January 1, 1973, to ascertain that effluent quality at the point of discharge is adequate for release into a wildlife refuge.

2. The Office of Enforcement, EPA, notify the Louisiana Stream Control Commission that:

a) The Calcasieu Paper Company claims the right to use Mill Creek for waste treatment, is presently doing so, and intends to continue the practice subsequent to construction of new treatment facilities and that,

b) Mill Creek is the property of the State of Louisiana, by virtue of LSA - R.S. 9:51 Section 1101, and the statute gives specific guidance in the control of pollution "... injurious to ....aquatic life or wild or domestic animals or fowls."

3. If the implementation of this treatment program is not carried out according to schedule, or if treatment is not adequate, consideration be

given to initiating appropriate abatement actions against the Company.

4. The discharge permit, to be issued by the Corps of Engineers, limit discharges of BOD, COD, TOC, suspended solids, color, and toxic materials to levels consistent with applicable water quality standards and best available treatment.

THE CITIES SERVICE OIL COMPANY FACILITIES
LAKE CHARLES, LOUISIANA

GENERAL INFORMATION

In conjunction with other chemical plants and petroleum refineries, the Cities Services Oil Company is a substantial contributor to the economy in the Lower Calcasieu River area. Company operations are involved in the production of petroleum products, petrochemicals, and butyl rubber.

The Cities Service Oil Company (P. O. Box 1562, Lake Charles, Louisiana 70601) has four industrial plants located in the Lake Charles area:

(1) Cities Service Oil Company Butyl Rubber;

(2) Cities Service Oil Company Refinery;

(3) Cities Service Oil Company Lube and Wax; and

(4) Cities Service Oil Company Petrochemical and Ethylene Propylene.

On March 25, 1971, W. C. Blackman, Jr., M. R. Helton, and J. L. Hatheway, DFI-DC, EPA, met with T. W. Kirby, assistant superintendent for laboratories, at the Cities Service Oil Company, in order to obtain information for a waste source inventory. T. P. Harrison, Enforcement Office, EPA, Region VI, had made arrangements for the meeting. A tour of the four plants was conducted during the March 25 visit. (Mr. Kirby would not permit the investigators to take photographs within the plant property).

Subsequent contact was made with Mr. Kirby on April 15, by R. D. Harp and Mr. Hatheway, both of DFI-DC, to plan the industrial waste sampling program being conducted in conjunction with a water quality survey of the Calcasieu River Basin.

Permission to sample all effluent discharges was granted by Mr. Kirby; however, permission to sample process wastes prior to treatment was not granted.

Pertinent information and results of the investigation of waste treatment and disposal practices at each Cities Service facility are discussed below.

BACKGROUND INFORMATION

Facility Description

The Butyl rubber plant operates continuously. Eighty-seven people are employed in the rubber production operation. The rated plant capacity is 84 million lbs per year of Butyl rubber, the plant's primary product. By-products, such as isobutylene, isoprene, and methyl chloride, are recycled into the production process. The raw materials that are employed include isobutylene, isoprene, zinc stearate, aluminum chloride, and natural gas.

Water Supply

Water, for process and cooling purposes, is obtained from one 1,000 gpm (1.44 mgd) well. Boiler feed water is supplied from steam condensate in the refinery feed.

Existing Waste Treatment

Oily wastewaters from the Butyl plant are discharged to the oxidation pond at the Cities Service Oil Company refinery. Once-through cooling water, other wastewater, and blowdown from a cooling tower are discharged to the Lower Calcasieu River without treatment.

The effluent, from a commercial chromate recovery process, is -- according to Company information -- essentially free of chromate, although it may contain zinc on the order of 2-3 mg/l as zinc stearate.

SAMPLING PROGRAM AND RESULTS

Aliquots (125 ml) of the effluent were composited every two hours for 24 hours, commencing at 7:35 a.m., April 21, 1971. Samples were taken

from the outfall ditch near the Lower Calcasieu River [Figure 2-1]. A grab sample was collected, at 3:40 p.m., April 17, for oil and grease analysis. Shrimp survival studies were conducted in the Lower Calcasieu River in the vicinity of this discharge. Water and sediment samples were collected in the Lower River upstream and downstream from the point of industrial discharge. [The sampling points are described in Table 2-1, their locations shown in Figure 2-1.]

[Analyses of the effluent and stream samples are listed in Table 2-2.] During the 24-hour sampling period, pollutant loads discharged included 6 lbs of chromium; 2,470 lbs, COD; 410 lbs, TOC; 2,160 lbs, suspended solids; and 100 lbs of oil and grease.

Survival studies using white shrimp were conducted (following methods outlined in Appendix C) in situ at industrial site stations CR-2.1 and 4.2 and at the Control Stations (CR-11.2 and 1) [Figure 2-1]. Total mortality, within 24 hours [Appendix D], of the shrimp at CR-4.1 and 4.2, precluded taste and odor studies. After a similar 24-hour exposure period, shrimp mortalities at the Control Stations were 10 and 20 percent, respectively [Appendix D]. Although it is not known which constituents or combinations of constituents in the River caused total mortality at stations CR-4.1 and CR-4, it is clear that the stream quality at this location is toxic to native shrimp.

Control Stations, CR-1 and CR-11.2 [Table 2-1], are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other

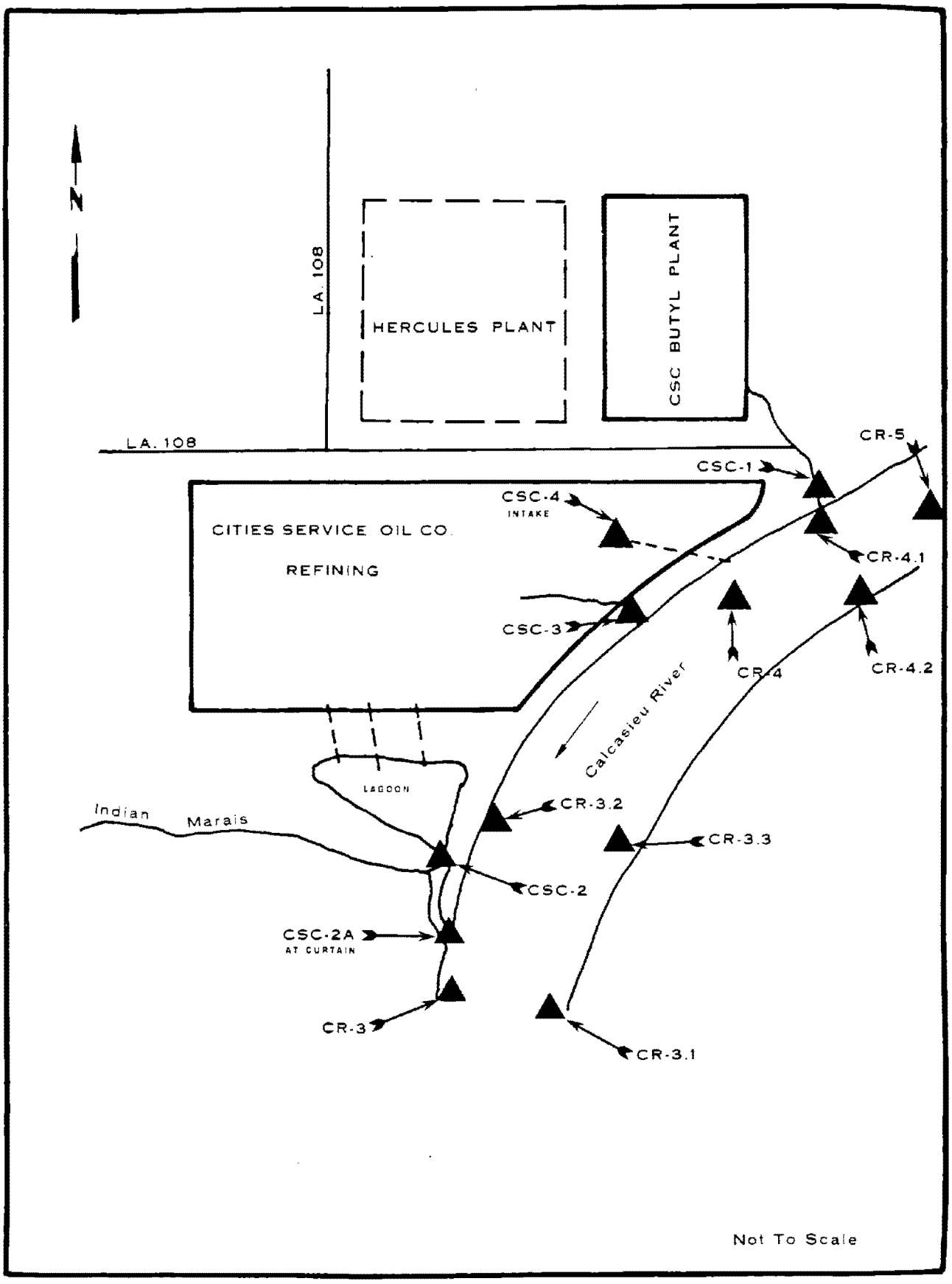

Figure 2-1. Effluent & Receiving Water Sampling Locations for Cities Service Oil Co. - Butyl Plant & Refinery

TABLE 2-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CSC-1	Samples collected from the drainage ditch at a point just before it empties into the Lower Calcasieu River (ditch parallels the north fence of the Cities Service refinery plant).
CR-1	Lower Calcasieu River near Calcasieu Landing (upstream of intracoastal waterway) near Channel Marker 92 (Control Station).
CR-4	Lower Calcasieu River upstream of Cities Service refinery effluent and downstream from the Butyl rubber plant effluent.
CR-4.1	Lower Calcasieu River, northwest shore, at discharge of the Butyl rubber plant.
CR-4.2	Lower Calcasieu River, opposite the Butyl rubber plant.
CR-5	Lower Calcasieu River near Channel Marker 108.
CR-11.2	Lower Calcasieu River, south shore, south of Clooney Island just west of Lake Charles (Control Station).

TABLE 2-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow	pH	Conductivity µmhos/cm		Temp °C	TOC		COD[b/]		Solids total		Solids susp		Oil & Grease	
	mgd	range	range	comp	range	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
CSC-1	1.70	7.2-9.8	1,000-3,500	2,300	22-30.5	29	410	170	2,470	1,480	21,000	152	2,160	7	100
CR-4		7.1-8.3		13,000	24-24	9.4, 12[c/]				8,610		14			
CR-5		6.8-8.6		13,400	23-24	9.4, 13[c/]				8,980		16			

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Copper mg/l	Lead mg/l
CSC-1	<0.05	0.40	6	<0.1	<0.02	<0.1
CR-4						
CR-5						

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ Two composites taken (morning and afternoon).

stations. Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station CR-1.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) the discharge levels of certain materials based on data submitted by the Cities Service Oil Company for its Butyl plant. A summary of the information from the Commission files is as follows:

Quantity of Discharge:	0.9 cfs
Temperature:	65-87°F.
Turbidity:	25-60 JTU
True Color:	20-30
Organic Materials (oil):	17 lbs/day - 3 ppm
Inorganic Materials:	4300 lbs/day - 900 ppm
Toxic Materials:	
Chromium	0 lbs/day - 0 ppm
Zinc	4 lbs/day - 1 ppm
Mercury	0 lbs/day - 0 ppm
Dissolved Oxygen:	50% Saturation

PROPOSED WASTE TREATMENT

The Company's laboratory personnel are presently experimenting with new treatment processes; no schedule for upgrading treatment has been made known. The intent, according to Mr. Kirby, is to reuse treated wastewater as cooling make-up water in the Butyl plant.

CONCLUSIONS

It is concluded that:

1. The present discharges of heavy metals, carbonaceous materials, suspended solids, and oil and grease, constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. The stream near the effluent discharge is toxic to native shrimp.

3. Even though an effort is being made to develop and implement a suitable treatment and reuse scheme, no implementation schedule was made known to the EPA investigators.

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, in cooperation with appropriate State and local authorities, monitor progress toward implementation of suitable treatment processes at The Cities Service Oil Company Butyl Rubber plant.

2. If a schedule for implementation of suitable treatment is not in effect by June 1, 1972, consideration be given to initiating appropriate abatement actions against the Company for the discharge of chromium; carbonaceous materials; suspended solids; and oil and grease to the Calcasieu River, a navigable stream.

3. When a suitable schedule is implemented, the Office of Enforcement, EPA, monitor progress toward completion, and take appropriate action at any time that the Company falls behind the schedule.

4. The Corps of Engineers permit, to be issued, limit concentrations of BOD; COD; TOC; of suspended solids; oil and grease; heavy metals; and complex organics to levels consistent with best available treatment and with the water quality standards for the Lower Calcasieu River.

BACKGROUND INFORMATION

Facility Description

The plant operates continuously. The production work force includes approximately 1000 employees.

The refinery produces propane; propylene; *o*-xylene and other aromatic chemicals; aviation gas; motor gas; jet fuel; kerosene; diesel fuel; furnace oil; carbon black feed; residual fuel; coke; and feed stocks for lubes, waxes, and petrochemicals.

Crude oils, light hydrocarbons (to butane), diethylglycol, and pyrrolidine are the raw materials used in the operation. Others, used in the process, include sodium hydroxide, calcium chloride, corrosion inhibitors, oxidation inhibitors, and tetraethyl lead.

Water Supply

Water for the refinery is obtained from the Calcasieu River for noncontact cooling (360 mgd). Seven wells, each rated at 1,000 gpm (1.44 mgd), provide process water, cooling water, and boiler feed.

Analyses of the river intake water [Table 2-3] indicate that it contained 0.2 μg/l mercury; 0.1 mg/l lead; 9 mg/l TOC; and 31 mg/l suspended solids on the day of sampling.

Existing Waste Treatment

Once-through cooling water from the power plant as well as oily wastes from the refinery and the Butyl rubber plant are treated in a 28-acre oxidation lagoon. It discharges to a second pond that was dredged in Indian Marais. The second pond's outlet, to the Lower Calcasieu River

TABLE 2-3

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS
FROM FIRST SAMPLING PROGRAM[a]

Sta	Flow[b] mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm comp	Temp °C range	TOC mg/l	TOC lbs/day	COD[c] mg/l	COD[c] lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	Oil & Grease mg/l	Oil & Grease lbs/day
CSC-2	290	7.3-8.2	14,000-18,000	13,600	32-37	15	36,300			9,220	22.3×10^6	38	92,000	5	12,100
CSC-2A	290	7.3-8.3	14,500-17,000	13,000	32-34	230	557,000	520	1.26×10^6	9,850	23.9×10^6	220	533,000		
CSC-3	58	7.0-7.9	13,000-16,000	12,800	33-36	13	6,300			8,710	4.2×10^6	27	13,000		
CSC-4	400	7.1-7.8	15,000-20,000	13,600	23-25	9	30,000			9,760	32.6×10^6	31	103,500		
CR-3		7.1-8.0		14,850	25-25	9.8, 13[d]				9,580		9			
CR-4		7.1-8.3		13,000	24-24	9.4, 12[d]				8,610		14			

II-10

TABLE 2-3 (continued)

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS
FROM FIRST SAMPLING PROGRAM

Sta	Cadmium	Chromium		Mercury		Copper		Lead		Aluminum	NH_3 as N	
	mg/l	mg/l	lbs/day	µg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	mg/l	lbs/day
CSC-2	<0.05	0.02	48	0.2	0.4843	0.04	97	0.2[e]	485		10.1	24,500
CSC-2A	<0.05	0.14	340	1.0	2.422	0.11	266	4.0[e]	9,690			
CSC-3	<0.05	<0.01		0.3	0.1443	0.04	19	0.2[e]	95			
CSC-4	<0.05	<0.01		0.2	0.6680	<0.02		0.1[e]	335			
CR-3	<0.05	<0.02		4.6		<0.02		<0.1		<0,5		
CR-4												

a/ Analytical procedures are outlined in Appendix F.
b/ Flow data, provided by T. W. Kirby, compare with information collected from Louisiana Stream Control Commission files.
c/ COD analyses were performed when TOC values exceeded 20 mg/l.
d/ Two composites taken (morning and afternoon).
e/ No interference from calcium detected.

II-11

(Station CSC-2A), is equipped with a steel curtain that extends approximately three feet below the water surface. This curtain functions as a skimmer to prevent the discharge of floating oil and is hinged to a catwalk so that it can pivot with the direction of flow of the water. When there is barge traffic on the River, the curtain is observed to pivot with flows moving from the waterway upstream into the second pond. Flow through this system is approximately 288 mgd [Figure 2-1].

Condenser cooling water is discharged without treatment directly to the Lower Calcasieu River. This discharge amounts to approximately 57.6 mgd.

FIRST SAMPLING PROGRAM AND RESULTS

Aliquots (250 ml) were composited every four hours, commencing at 7:55 a.m., April 21, at four sampling stations in the refinery [Figure 2-1]. [Description of these stations and of the stream stations sampled is provided in Table 2-4.] A grab sample for oil and grease analysis was obtained at CSC-2 at 3:15 p.m., April 17. On April 21, at 11:00 a.m. another grab sample was taken, at Station CSC-2, for organic analysis. [Analytical results and field measurements recorded are listed in Table 2-3.]

Analysis of the upper pond effluent was carried out to determine complex organics [Table 2-5]. Normal aliphatic hydrocarbons identified in the effluent sample represent a portion of the oil and grease discharged by the Company refinery. High concentrations of phenolic compounds were also observed in the effluent. In these concentrations (as discharged from the refinery), the compounds are toxic to aquatic life and may have a detrimental effect on the receiving waters.

TABLE 2-4

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description
CSC-2	Effluent from the refinery lagoon at the outlet structure, approximately 1,000 ft from the Lower Calcasieu River.
CSC-2A	Samples collected at the point where the effluent from the refinery enters the Lower Calcasieu River.
CSC-2B	Samples collected at mid-depth at center of second pond dredged from Indian Marais.
CSC-2C	Effluent from two small ponds, which are part of the refinery's treatment, that are located on the south side of Indian Marais. Effluent enters Indian Marais just upstream of second pond.
CSC-3	Samples collected from the power plant effluent before it enters the Lower Calcasieu River (Dock C). Flow is approximately 40,000 gpm.
CSC-4	Cooling water supply to the refinery (approximately 200,000 gpm). Samples collected at the forebay of the pump house, (source Lower Calcasieu River).
CR-1	Lower Calcasieu River near Calcasieu Landing (upstream of intracoastal waterway), near channel marker 92 (Control Station).
CR-3	Lower Calcasieu River at Channel Marker 106, downstream from the main effluent of the Company refinery.
CR-3.1	Lower Calcasieu River, east shore opposite the main refinery discharge.
CR-3.2	Lower Calcasieu River, west shore at industrial discharge of the refinery.
CR-3.3	Lower Calcasieu River, east shore, and opposite Cities Service main refinery discharge.
CR-4	Lower Calcasieu River upstream of Cities Service refinery effluent and downstream from the Company Butyl rubber plant effluent.
CR-11.2	Lower Calcasieu River, south shore, south of Clooney Island just west of Lake Charles (Control Station).

TABLE 2-5

RESULTS OF ORGANIC ANALYSIS

Compound Identified	Concentration (mg/l)	Load lb/day
Dodecane	0.031	79
Heptadecane	0.022	53
Hexadecane	0.026	66
Nonadecane	0.013	33
2-Methylnaphthalene	0.013	33
o-Cresol	0.120	300
Octadecane	0.017	43
Pentadecane	0.030	76
Phenol	0.200	510
Tetradecane	0.039	99
Tridecane	0.042	107
Undecane	0.027	69
1-Methylnaphthalene	0.005	12

At the time sampling was being planned, the DFI-DC investigating team indicated to officials of the Company that, since the second pond had been dredged from a natural tributary (Indian Marais) and is subject to tidal action, the discharge from the first pond (CSC-2) should be considered to be the point of discharge and, therefore, the point to be sampled. These officials claimed that the second pond constitutes a segment of the treatment process, and that the flow past the curtain into the Lower Calcasieu River (CSC-2A) should be sampled. Since the dispute could not be resolved, it was finally agreed that both points would be sampled -- the dispute to be resolved after consultation with respective legal staffs.

Substantial differences in quality were found to exist between the two sampling points [Table 2-4]. Calculated loads discharged, during the 24-hour period, at CSC-2 included 36,300 lbs of TOC; 92,000 lbs, suspended solids; 12,100 lbs, oil and grease; 48 lbs, chromium; 0.48 lbs, mercury; 97 lbs, copper; 485 lbs of lead; and 1.7×10^{12} calories of heat. Calculated loads discharged at CSC-2A, during the 24-hour sampling period, included 1,260,000 lbs of COD; 557,000 lbs, TOC; 533,000 lbs, suspended solids; 340 lbs, chromium; 2.42 lbs, mercury; 266 lbs, copper; and 9,690 lbs of lead.

Because the curtain caused the materials to be discharged at depths of at least 6 feet in the Lower River, oil and grease were not measured at CSC-2A; however, oil rises in widely dispersed patches well downstream from the curtain. Thus, it was not possible to obtain a representative sample with the equipment at hand.

The cause of the differences in the concentrations at the two points is not clear. Possible causes include unknown discharge(s) to the second

pond; unobserved discharges from Indian Marais; tidal action causing buildup in the lower ponds or scouring of bottom materials by flood tides passing beneath the curtain; and the elimination of interfering substances within the lower pond. The possibility of sampling error is discounted because various parts of the analyses and standards were carefully rechecked. Moreover, concentrations of TOC, suspended solids, lead, and mercury were at least five times greater at CSC-2A than at CSC-2. Also, all concentrations measured were higher to some degree at the outlet from the second pond. If analytical or sampling errors were involved, such a pattern would not have prevailed.

Based upon the contention by Company officials that Station CSC-2A is most representative of the discharge by the refinery, the net loads discharged during the 24-hour sampling period were calculated by adding loads from stations CSC-2A and CSC-3, and by subtracting the intake loads at CSC-4. (Flows used in calculating the loads were furnished by Company officials.) The loads thus calculated include 533,000 lbs of TOC; 443,000 lbs of suspended solids; 340 lbs, chromium; 1.9 lbs, mercury; 285 lbs, copper; and 9,400 lbs of lead. As indicated earlier, discharges of oil and grease were not determined at CSC-2A. The load discharged at CSC-2 during the 24-hour sampling period was 12,000 lbs. The discharges also added 12×10^{12} calories heat.

Survival studies, employing white shrimp, were conducted in situ at industrial sites Stations CR-3, 3.1, 3.2, 3.3, 4.1, and 4.2 and at 11.2 and 1 [Figure 2-1] following methods outlined in Appendix C. A 100 percent shrimp mortality [Appendix D] at all industrial site stations within a

24-hour exposure period, precluding taste and odor studies. Shrimp at Control Stations CR-11.2 and CR-1 [Figure 2-1] had 24-hour mortalities of 10 and 20 percent, respectively [Appendix D].

A sediment sample, collected below the main discharge (station CR-3.2), was composed of black soft sediment having a strong petrochemical odor [Table E-1, Appendix E]. Almost 20 percent of the sample was volatile materials. An OSI value of 2.8 indicates an organic sludge undergoing decay and decomposition. The sediment also contained 5.4 µg/g of mercury.

SECOND SAMPLING PROGRAM AND RESULTS

This section summarizes the results of the second sampling program of Cities Service Oil Company refinery.

As noted in the section titled "First Sampling Program and Results", discrepancies connotating differences in quality were perceived between two sampling points, CSC-2 and CSC-2A [Table 2-3]. Because of these discrepancies a second survey was conducted on October 22 and 23, 1971.

On October 21, 1971, T. P. Harrison, Enforcement Office, EPA, Region VI contacted officials of Cities Service Oil Company refinery to make arrangements for the re-sampling program. On October 22, 1971, J. L. Hatheway, L. R. Walz, and H. W. Boyle contacted Stan Gilliard of the refinery to outline and make arrangements for the second survey. Mr. Gilliard was cooperative and agreed to the re-sampling survey as well as to the addition of station CSC-2B. He also informed Mr. Hatheway that effective September 19, 1971, the refinery began discharging "sour water"* at a rate of 325 gpm to a deep well.

* "Sour water" is a trade term that identifies a process waste which contains high concentrations of hydrogen sulfide, ammonia, and phenols.

Aliquots (125 ml) were composited every two hours commencing at 12:15 p.m., on October 22, 1971, at six sampling stations in the refinery [Figure 2-1]. [Description of these stations is provided in Table 2-4.] At stations CSC-2A and CSC-2B the samples were collected at a point below the steel curtain and at mid-depth, respectively. The samples collected from the lower pond (CSC-2B) consisted of a composite of two grab samples.

On October 23, grab samples for oil and grease analysis were obtained at stations CSC-2A and CSC-2 at 10:30 and 10:40 a.m., respectively. At the request of Cities Service Oil Company personnel, all collected samples were divided and a portion given to them; the remainder was forwarded to EPA laboratories for analysis. [Analytical results and field measurements of the second sampling program are listed in Table 2-6.]

During the 24-hour period, waste loads discharged from the refinery were calculated by adding loads from stations CSC-2A and CSC-3, and subtracting the intake loads at CSC-4. Flows used in calculating the loads were furnished by Company officials and compare with information in Louisiana Stream Control Commission files. The daily loads calculated include 25,000 lbs of COD; 3000 lbs, suspended solids; 16 lbs, chromium; 134 lbs, copper; 167 lbs, lead; 12,000 lbs of oil and grease, and 11 X 10^{12} calories of heat.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) the discharge levels of certain materials based on data submitted by the Cities Service Oil Company for its refinery. A summary of the information from the Commission files is as follows:

TABLE 2-6

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS
FROM SECOND SAMPLING PROGRAM[a]

Station	Flow[b] mgd	Conductivity µmhos/cm range	Temp °C range	TOC mg/l	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
CSC-2	290	18,000-21,000	35-38	<5	190	459,000			50	121,000
CSC-2A	290	18,500-22,000	31-35	<5	140	339,000	14,500	35.1×10^6	40	97,000
CSC-2B	290	22,000	35	<5	120	291,000	14,700	35.6×10^6	40	97,000
CSC-2C				89	520		14,300		160	
CSC-3	58	16,000-22,000	35-39	<5	110	53,000	14,000	6.78×10^6	80	39,000
CSC-4	400	18,000-23,000	25-26	<5	110	367,000	14,300	47.7×10^6	40	133,000

TABLE 2-6 (continued)

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS
FROM SECOND SAMPLING PROGRAM

Station	Oil and Grease		Cadmium		Chromium		Copper		Lead[c]	
	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
CSC-2	9	22,000	<0.01		0.03	73	0.10	242	0.19	459
CSC-2A	5	12,000	<0.01		0.03	73	0.16	387	0.14	338
CSC-2B			<0.01		0.03	73	0.14	339	0.08	194
CSC-2C			0.02		0.44		0.33		0.63	
CSC-3			0.02	10	0.02	10	0.10	48	0.06	29
CSC-4	<1		0.01	33	0.02	67	0.09	301	0.06	200

a/ Analytical procedures are outlined in Appendix F.
b/ Flow data, provided by T. W. Kirby, compare with information collected from Louisiana Stream Control Commission files.
c/ No interference from calcium detected.

Quantity of Discharge:	535 cfs
Temperature:	68-102°F
Turbidity:	25-60 JTU
True Color:	60
Organic Materials (Oil):	17,300 lbs/day - 6 ppm
Organic Materials (BOD):	98,400 lbs/day - 34 ppm
Inorganic Materials:*	100,000 lbs/day - 37 ppm
Toxic Materials:	
Chromate	80 lbs/day - 0.03 ppm
Phenol	1,205 lbs/day - 0.45 ppm
Zinc	117 lbs/day - 0.13 ppm
Mercury	0 lbs/day - 0 ppm.

PROPOSED WASTE TREATMENT

Towers are being constructed at the Cities Service Oil Company refinery that will permit recirculation of cooling water. Operation of the cooling facilities will reduce flow through the ponds by approximately 130 mgd.

As noted earlier, EPA investigators were not permitted to sample the process wastes entering the pond system. As a result, the present treatment capability could not be determined. Since the detention time will remain short, reduction of the flow through the system by 130 mgd cannot be expected to increase materially the treatment efficiency. The proposed additional wastewater treatment consists principally of in-plant process control and primary treatment for the residual.

At the time of the first EPA investigation, sour water was included with the wastes treated in the pond system. A deep well system (4,900 ft) had been constructed and was being used for disposal of sour water at the time of the second investigation. The Cities Service Oil Company refinery has been issued a permit by the mineral division of the Louisiana Department of Conservation to operate this disposal well. The quantity and quality of

* Incoming River water would contain as much as 53,000,000 lbs/day of dissolved solids, to which the above would be added.

the sour water produced is not known but the disposal well is rated at 800 pgm (1.15 mgd).

CONCLUSIONS

From the data obtained during the second sampling program, October 22 and 23, 1971, the discharged waste loads, as measured at stations CSC-2 and CSC-2A, are comparable. Waste loads at both these stations are very comparable to those measured at station CSC-2 during the first sampling program. The reason for the discrepancy between measured waste loads at CSC-2 and CSC-2A during the first survey is not readily apparent. Operation of the disposal well appears to have contributed to the reduction of waste loads discharged to the River. So, it is concluded that:

1. The waste loads determined at stations CSC-2 and CSC-2A in the second survey confirm the waste load measurement at station CSC-2 in the first survey.

2. The refinery discharges carbonaceous materials; suspended solids; chromium; mercury; copper; lead; phenols; and heat to the Lower Calcasieu River, in violation of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

3. Observations of receiving waters, the discharge of oil and grease at station CSC-2A (12,000 lbs/day), and the character of the bottom deposits in the Lower Calcasieu River in the vicinity of the refinery substantiate that oil and grease in objectionable quantities are being discharged by the refinery into the River.

4. River water near the refinery discharge is toxic to shrimp, one of the native forms of aquatic life found in the Lower Calcasieu River.

5. Cooling facilities, which will reduce flow through the pond system, are under construction. The pond system will continue to be used for treating the remaining waste streams and constitutes primary treatment even though ponding is no suitable treatment for refinery wastes.

6. Operation of the disposal well, if continued, may result in reductions in the amounts of ammonia and sulfides and other substances now discharged to the pond system. (Such disposal is contrary to EPA policy guidelines and previous regulatory practice.)

RECOMMENDATIONS

It is recommended that:

1. Consideration be given to initiating appropriate abatement actions against the Lake Charles Refinery of the Cities Service Oil Company for discharges of carbonaceous materials; suspended solids; chromium; mercury; copper; lead; phenols; and heat to the Calcasieu River.

2. The appropriate Federal District Court be requested to enjoin the Cities Service Oil Company from use of the disposal well because such practice is contrary to the public interest and may endanger public water supplies.

3. The Corps of Engineers permit, to be issued to this refinery, limit the discharge of BOD; COD; TOC; suspended solids; oil and grease; heavy metals; complex organics; and heat to levels consistent with best available treatment and with the water quality standards for the Lower Calcasieu River.

BACKGROUND INFORMATION

Facility Description

Ownership of this plant is divided as follows: approximately two-thirds by Cities Service Oil Company and one-third by Continental Oil Company, thus the name Cit-Con.

This lube and wax plant operates continuously. Of the 454 persons employed at the plant three are involved in water pollution control activities. Finished products are liquid paraffin wax; vacuum gas oil; wax slabs; finished neutral oil; finished light intermediate neutral oil; finished heavy oil; soft wax by-product; finished bright stock; and amorphous wax.

The primary raw material is topped crude. Rated plant capacity is 30,000 barrels per day of feed, of which 9,500 barrels are lube stock.

Water Supply

Water for use in this plant is obtained from a series of four wells, each of which is rated at 1,000 pgm (1.44 mgd). Approximately 1,000 gpm (1.44 mgd) are used for non-contact cooling and 2,000 gpm (2.88 mgd) for process water. Water is also used to slurry fine clay employed as a decoloring agent, to disposal pits.

Existing Waste Treatment

Wastewater discharges from this industry are treated in a large oxidation pond where gravity separation and skimming of oil and grease are provided. The wastewater flow is approximately 3.32 mgd, of which 0.43 mgd is cooling water. The oxidation pond has a retention time of about 70 days. Effluents from this pond and the clay pits discharge to an open channel that

subsequently enters Bayou d'Inde [Figure 2-2].

DISCUSSION OF SAMPLING PROGRAM AND RESULTS

Aliquots (125 ml) of the plant effluent were collected every two hours and composited over a 24-hour period commencing at 7:15 a.m. April 21. [Description of sampling stations is provided in Table 2-7.] The plant effluent samples were taken at a railroad bridge (CSC-6), located approximately 500 feet downstream of the oxidation pond [Figure 2-2]. At this sampling point the effluent from the clay slurry pits was thoroughly mixed with the pond effluent. A grab sample was collected, at 4:40 p.m. April 17, for oil and grease analysis. [Results of the effluent sampling are shown in Table 2-8.]

During the 24-hour period of sampling the lube and wax plant discharged 410 lbs of TOC; 60 lbs, NH_3-N; 630 lbs, suspended solids; and 190 lbs of oil and grease.

Shrimp survival studies were conducted in Bayou d'Inde at station CR-6.1 [Figure 2-2] and at Control Stations following methods outlined in Appendix C. Sediment samples were collected upstream of the lube and wax plant and at Station CR-6.2 [Appendix E].

Survival studies with shrimp indicate that total mortality occurred within six hours [Appendix D]. The lack of oxygen in the water or the toxicity from either industrial wastes or noxious gases (released from the sludge-covered bottom) was considered as cause of death. The 100 percent mortality precluded taste and odor tests. During this time span, at CR-11.2 and CR-1, shrimp mortalities were 10 and 20 percent, respectively.

A-85A

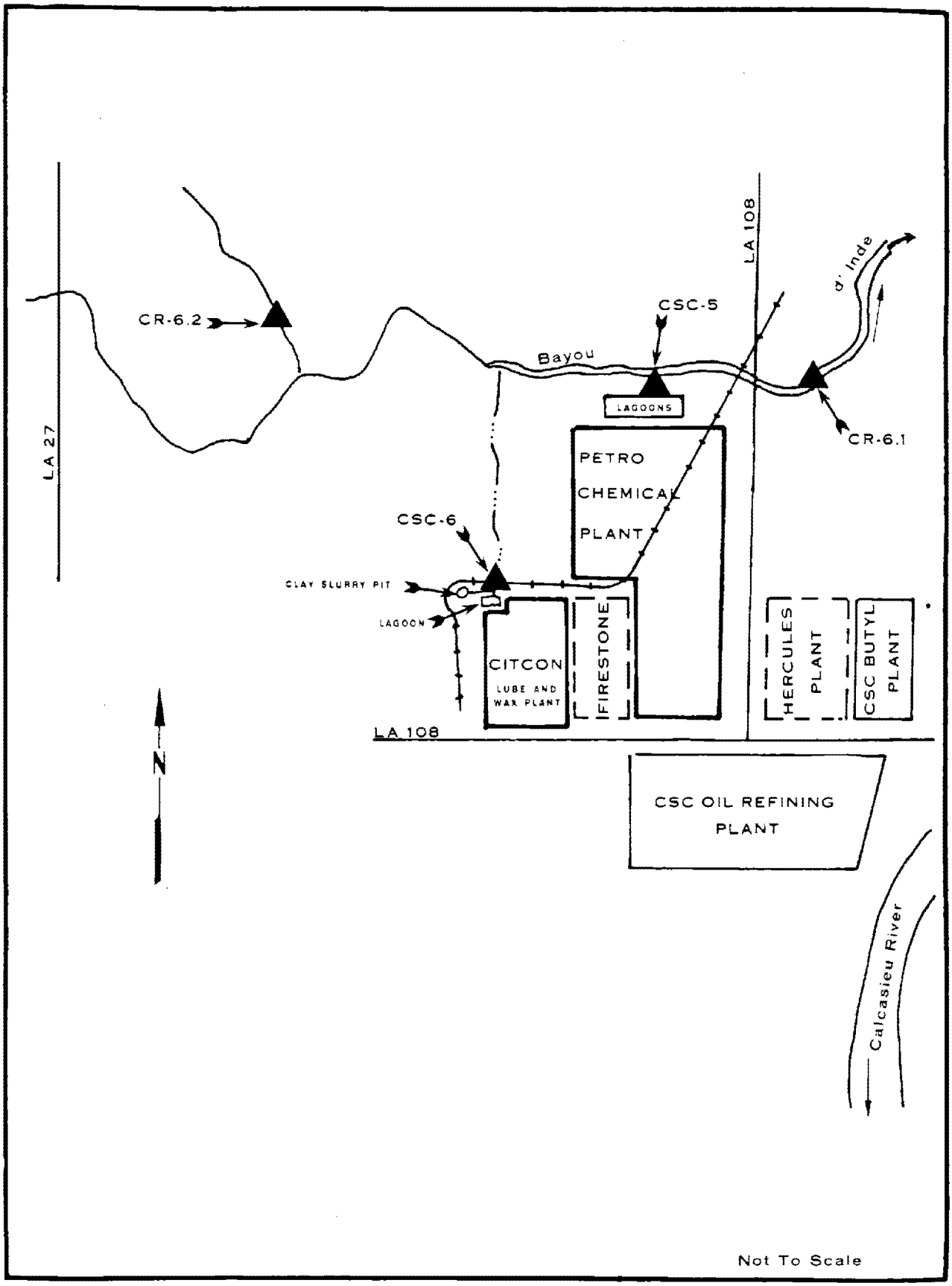

Figure 2-2. Effluent & Receiving Water Sampling Locations for Cities Service Oil Co. - Lube & Wax Plant (CIT-CON) & Petrochemical Plant

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TABLE 2-7

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CSC-6	Effluent from oxidation pond of lube and wax plant, collected at railroad bridge approximately 500 feet downstream from pond.
CR-1	Lower Calcasieu River near Calcasieu Landing (above intracoastal waterway) near channel marker 92 (Control Station).
CR-6.1	Bayou d'Inde downstream from Cit-Con, and Cities Service petrochemical plant.
CR-6.2	Bayou d'Inde upstream of Cit-Con, and Cities Service petrochemical plant.
CR-11.2	Lower Calcasieu River, south shore, south of Clooney Island just west of Lake Charles (Control Station).

TABLE 2-8

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

		pH	Conductivity µmhos/cm		Temp °C	TOC		Solids total		Solids susp		NH_3 as N	
Sta	Flow	range	range	composite	range	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
CSC-6	2.91	7.2-8.6	460-540	510	26-29	17	410	361	8,800	26	630	2.35	60

	Oil & Grease		Cadmium	Chromium		Mercury	Lead	Copper
Sta	mg/l	lbs/day	mg/l	mg/l	lbs/day	µg/l	mg/l	mg/l
CSC-6	8	190	<0.05	0.07	2	<0.1	<0.1	<0.02

a/ Analytical procedures are outlined in Appendix F.

Sediment analyses from CR-6.1 indicated a 20 percent volatile material and an OSI value of 3.4 [Table E-1, Appendix E]. This value indicates a highly organic bottom deposit that is undergoing decomposition and stabilization. Upstream of the lube and wax plant discharge the sediment was composed of decaying material, vegetation, leaves, etc. At this location the OSI was only slightly lower (3.1); likewise, the volatile material (19 percent) was lower.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) the discharge levels of certain materials based on data submitted by the Cities Service Oil Company for its lube and wax plant. A summary of the information from the Commission files is as follows:

Quantity of Discharge:	5.1 cfs*
Temperature:	65-87°F
Turbidity:	36 JTU
True Color:	30
Organic Materials (BOD):	2870 lbs/day - 104 ppm
Phenol	825 lbs/day - 30 ppm
Organic Materials (oil):	5,520 lbs/day - 200 ppm
Toxic Materials	
Chromium	12 lbs/day - 0.42 ppm
Zinc	4 lbs/day - 0.16 ppm

* Approximately 87 percent of the 5.1 cfs is discharged to the Cities Service refinery sewers and thence to the Lower Calcasieu River; 0.7 cfs goes directly to Bayou d'Inde.

PROPOSED WASTE TREATMENT

A larger oxidation pond is being constructed for this plant. The cost for new facilities was estimated at $1.5 million. (The plant was under construction at the time of sampling.) They are scheduled to be in operation by the latter part of 1971.

CONCLUSIONS

It is concluded that:

1. The daily discharged loads of 410 pounds of carbonaceous material; 630 pounds of suspended solids; and 190 pounds of oil and grease are violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. Construction of new facilities for treatment of the lube and wax plant liquid wastes is underway.

3. Results of survival tests with shrimp were inconclusive because effects of other, nearby discharges could not be separated from those of the lube and wax plant discharges.

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, monitor progress toward completion and operational status of the treatment facility, now under construction.

2. If suitable treatment is not operational by June 1, 1972, consideration be given to initiating appropriate abatement actions against the Company for the discharge of carbonaceous materials; nitrogenous materials; suspended solids; and oil and grease.

3. If the new treatment facilities are in operation by June 1, 1972, the discharge from the lube and wax plant be reevaluated and, if the quality does not meet applicable criteria, appropriate abatement actions be initiated.

4. The Corps of Engineers permit, to be issued, limit concentrations of BOD; COD; TOC; suspended solids; oil and grease; and complex organics, to levels consistent with best available treatment and applicable water quality standards.

BACKGROUND INFORMATION

Facility Description

The materials produced at the Cities Service Petrochemical and Ethylene-Propylene plant are propylene; ethylene; butadiene; butane and dimer; ethylene glycol; ethylene oxide; polyglycols; and ammonia.

The plant operates continuously. Of the 498 persons employed in production, three - an engineer, a chemist, and an equipment operator - are involved in water pollution control.

Rated annual capacities of the facility are 900 million lbs of ethylene; 500 million lbs, propylene; 220 million lbs, polyethylene; six million lbs, ethylene oxide; and 22 million gal. of ethylene glycol.

The raw materials employed include raw gas; ethane; by-products from the Cities Service Oil Company refinery identified only as C_2 stream and C_3 mix; propane; butadiene; nitrogen; hydroformer gas; platformer gas; caustic soda; and sulfuric acid.

Water Supply

Water is obtained from seven wells, each of which is rated at 1,000 gpm (1.44 mgd). This water is used for cooling water makeup, boiler feed, and process water. Approximately 223 mgd of cooling water is recirculated through the cooling systems. The condensate from the cooling water is sold to a neighboring industry.

Existing Waste Treatment

The wastewater discharge from this industry is approximately 3 mgd. Treatment consists of neutralization; oil separation (gravity); and three

aerated lagoons -- totalling five acres, which are operated in series. The effluent from the lagoons is discharged to Bayou d'Inde.

SAMPLING PROGRAM AND RESULTS

Aliquots (250 ml) of the treated waste were collected every four hours and composited over a 24-hour period commencing at 8:40 a.m. on April 21. A grab sample was collected for oil and grease analysis at 4:15 p.m. on April 17. A grab sample for special organic analyses was collected at 11:45 a.m. on April 21. Samples of the effluent from the petrochemical plant's third lagoon, were collected at the overflow structure prior to discharge in Bayou d'Inde (CSC-5). [Its location is shown in Figure 2-2. Analytical results for station CSC-5 are tabulated in Table 2-9.]

The organic compounds [Table 2-10] represent the major constituents in the effluent sample. Other compounds were observed in lesser concentrations, but were not positively identified. The results demonstrate that a wide variety of aromatic chemicals are discharged by the Company's petrochemical plant. The specific toxicity of these compounds has not been determined. However, discharge of these compounds undoubtedly has a detrimental effect on the receiving water.

Net loads discharged by the petrochemical plant during the 24-hour sampling period included 59 lbs of chromium; 20,200 lbs, COD; 5,900 lbs, TOC; 180 lbs, ammonia; 2,600 lbs, suspended solids; and 165 lbs of oil and grease.

Shrimp survival tests and sediment analyses for the stations in Bayou d'Inde are discussed under the section covering waste treatment and disposal at Cities Service Oil Company lube and wax plant.

TABLE 2-9

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow	pH range	Conductivity µmhos/cm range	Temp °C range	TOC mg/l	TOC lbs/day	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	NH_3 as N mg/l	NH_3 as N lbs/day
CSC-5	3.95	9.2-9.7	1,000-1,600	26-28	180	5,900	612	20,200	868	28,600	78	2,600	5.35	180

Sta	Oil & Grease mg/l	Oil & Grease lbs/day	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day	Lead mg/l	Copper mg/l	Copper lbs/day
CSC-5	5	165	<0.05	1.8	59	0.8	0.0264	<0.1	0.09	3

a/ Analytical procedures are outlined in Appendix F.

TABLE 2-10

RESULTS OF ORGANIC ANALYSIS

Compound Identified	Concentration (mg/l)	Load lb/day
2-Methylnaphthlene	0.030	1.1
1-Methylnaphthalene	0.025	0.9
2,6-Dimethylnaphthalene	0.015	0.5
Indan	0.007	0.3
Indene	0.026	0.9
m-Xylene	0.008	0.3
1-Methylindene	0.002	0.1
3-Methylindene	0.003	0.1
Naphthalene	0.053	1.9
o-Methylstyrene	0.001	0.05
m-Methylstyrene	0.02	0.8
p-Xylene	0.002	0.1
o-Xylene	0.006	0.2
Phenol	0.060	2.1
Styrene	0.031	1.1

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission did not have in its files, any information on the industrial waste discharge from the Cities Service Oil Company petrochemical plant.

PROPOSED WASTE TREATMENT

The Cities Service Oil Company is presently constructing a new kind of "extended aeration" facility in order to treat wastewaters from the petrochemical plant. This new facility, to cost approximately $3 million and scheduled to be placed in operation during 1972, should reduce the loads of COD, TOC, and suspended solids now being discharged to Bayou d'Inde.

CONCLUSIONS

It is concluded that:

1. Present discharges of chromium; carbonaceous materials; nitrogenous materials; suspended solids; complex organics; and oil and grease constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. Treatment facilities, now under construction, should reduce quantities of carbonaceous and nitrogenous materials discharged to the Lower Calcasieu River and may also reduce quantities of complex organics and suspended solids discharged. (No evidence exists, nor has any claim been made, to the effect that the new treatment will eliminate discharges of heavy metals and oil and grease.)

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, monitor progress toward completion of new facilities for treatment of the liquid wastes generated by the plant, and that it further conduct follow-up monitoring of actions taken to reduce discharges of chromium and oil and grease.

2. If the new treatment facilities now under construction are not operational by June 20, 1973, consideration be given to initiating appropriate abatement actions against the Company for discharges of carbonaceous and nitrogenous materials, suspended solids, and complex organics.

3. If the new treatment facilities are on-line by June 30, 1973, the treatment provided be reevaluated, and abatement measures, as needed, be initiated.

4. The Corps of Engineers permit, to be issued this industry, limit discharges of BOD; COD; TOC; heavy metals; suspended solids; complex organics; and oil and grease to levels consistent with best available treatment and water quality standards for the Lower Calcasieu River.

THE CONTINENTAL OIL COMPANY FACILITIES
LAKE CHARLES, LOUISIANA

GENERAL INFORMATION

In conjunction with other chemical plants and petroleum refineries, the Continental Oil Company is a substantial industrial contributor to the economy in the Lower Calcasieu River area. The Company's facilities are involved primarily in the production of organic chemicals, carbon black, and oil refinery products.

Continental operates four facilities in the Lake Charles area: (1) Continental Carbon Company; (2) Continental Oil Company - Lake Charles Petrochemical; (3) Continental Oil Company - Lake Charles Refinery; and (4) Continental Oil Company - Lake Charles VCM Plant [Figure 3-1]. Although these plants are in proximity to each other, all are under separate management.

Initial Contact

Representatives of EPA's DFI-DC staff visited these industries during the period March 24-31, 1971, to obtain information for an industrial waste inventory. Company officials contacted at that time were very cooperative, provided the information requested, and conducted tours of their respective plants. Subsequent to these meetings, Refinery and VCM plant officials were contacted, on April 15, to discuss sampling of plant effluents. Officials of the carbon Company and Lake Charles Petrochemical were contacted on April 16. They were informed that the industrial waste source sampling was in conjunction with a survey of the Calcasieu River Basin being conducted by EPA.

Permission was granted to sample all the effluent discharges. No restrictions were placed on the sampling of process wastes prior to treatment.

III-12

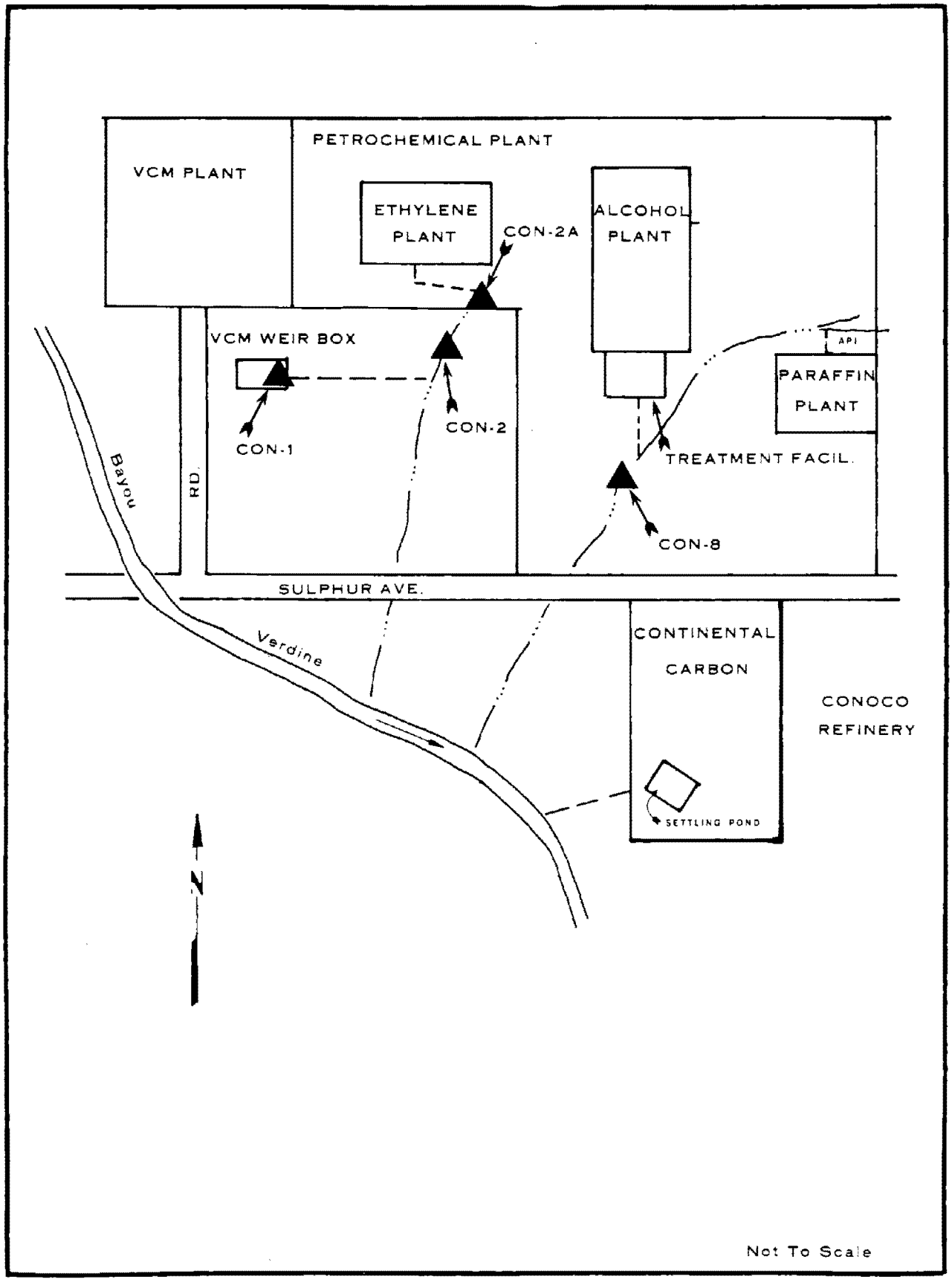

Figure 3-1. Effluent Sampling Locations for Continental Oil Co. VCM Plant, Petrochemical Plant, & Carbon Plant

Aliquots (125 ml) were collected of each of the industrial discharges and composited over a 24-hour period. These composite samples were analyzed for TOC; COD; total and suspended solids; and selected heavy metals. All of the industrial waste effluents from Continental Oil Company discharge to Bayou Verdine.

Responsible Company officials contacted, information on plant operations, etc., and the results of each sampling program are discussed in the following report.

BACKGROUND INFORMATION

Facility Description

The plant is owned by the Continental Oil Company (80 percent) and the Witco Chemical Corporation (20 percent). The plant's rated capacity per day is 250,000 to 300,000 lbs of carbon black. The raw materials used in the process include coke and gas oil. This plant operates continuously and employs seventy-one persons.

Water Supply

Water is purchased from Continental Oil Company, which borders Continental Carbon Company on two sides. Water is used for washdown (quenching), drinking, and pelletizing of the product.

Existing Waste Treatment

A settling pond is employed to collect the small carbon fines. The pond effluent is discharged to Bayou Verdine [Figure 3-1]. Banks of Bayou Verdine downstream of Continental Carbon have a flat gray-to-black color, attributable to the discharge from the settling pond. According to the Continental Carbon Company Manager, Louis Herst, constant agitation of carbon fines by the wind causes the material to be blown about the plant site. Some of these fines find their way into the Bayou. The Manager stated that during the period 1968 to 1971, the Company converted the air pollution control system from wet scrubbers to bag houses. He indicated that this change had reduced the water pollution problems caused by the carbon fines.

Chronology of Contacts

Mr. Herst was contacted by Mr. Helton of the DFI-DC staff, on

March 31, 1971, to obtain inventory information. R. D. Harp and J. L. Hatheway, also of DFI-DC, met with Mr. Herst on April 16, to plan the industrial sampling program.

SAMPLING PROGRAM AND RESULTS

Effluent sampling commenced at 9:00 a.m., April 20. Aliquots (125 ml) were composited every two hours for 24 hours. Samples were collected from the Continental Carbon plant settling pond effluent (Con-7) which is discharged to Bayou Verdine. [Analytical results and recorded field measurements are listed in Table 3-1.]

Loads discharged during the 24-hour sampling period included 50 lbs of COD; 10 lbs, TOC; and 10 lbs of suspended solids.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission had, in its files, no information on the industrial discharge from the Continental Carbon Company.

PROPOSED WASTE TREATMENT

No new treatment facilities are proposed for the next five years.

CONCLUSION

It is concluded that:

1. The pollutant loads discharged by Continental Carbon are of no serious consequence to the receiving waters.

RECOMMENDATIONS

It is recommended that:

1. No abatement proceedings be initiated at this time;

TABLE 3-1

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
CON-7	0.032	7.4-8.0	500-825	570	22-30	43	10	180	50	440	120	36	10

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day
CON-7	<0.05	0.03	0.01	0.1	0.00003

a/ Analytical procedures are outlined in Appendix F.

2. The discharge permit, to be issued by the Corps of Engineers, limit discharges of BOD; COD; TOC; heavy metals; complex organics; suspended solids; and oil and grease, to levels consistent with best available treatment and the water quality standards for the Lower Calcasieu River.

BACKGROUND INFORMATION

Facility Description

Headquarters for this plant (P. O. Box 37, Westlake, Louisiana 70669) is the office of the Petrochemical Sales Division, Continental Oil Company, 80 Park Plaza East, Saddlebrook, New Jersey 07662. This plant operates continuously and employs 320 persons in its production operation. Twelve individuals (a superintendent; an engineer; a chemist; a foreman; four equipment operators; and four maintenance men) are employed in the water pollution control program.

The annual, rated capacities of this petrochemical facility are 150 million lbs of industrial alcohol; 550 million lbs, ethylene; 98 million lbs, methyl chloride; 200 million lbs, normal paraffins; and 50 million lbs of ethoxylates.

The raw materials used are: ethylene; aluminum; hydrogen; "raffinate"; sulfuric acid; ethylene oxide; acetic acid; caustic soda; phosphoric acid; hydrochloric acid; kerosene; ethane; propane; and methanol.

Water Supply

Water is obtained from five wells (700 ft deep), each rated at 1,500 gpm (2.16 mgd). It is used for process, boiler feed, and non-contact cooling.

Existing Waste Treatment

There are three wastewater discharges from this industry. These originate in the alcohol plant, paraffin plant, and the ethylene plant [Figure 3.1].

Effluents from the alcohol and paraffin plants discharge to a drainage ditch that subsequently enters Bayou Verdine. The ethylene plant effluent (cooling water) discharges to a second drainage ditch that also collects the VCM plant discharge before entering Bayou Verdine.

Present treatment of the waste discharges consists of the following:

1. Wastewater passes through an API separator, at the paraffin plant;
2. Caustic wastes are treated in a neutralization basin and oily wastes pass through an API separator -- both waste streams passing through a settling basin prior to discharge, at the alcohol plant; (The Company representative stated that total chromate removal is obtained in the system.)
3. Cooling water receives no treatment prior to discharge, at the ethylene plant.

Chronology of Contacts

On March 29, J. L. Hatheway of the Division of Field Investigations-Denver Center, EPA, met with Gary D. Johnson, environmental engineer at the Lake Charles Petrochemical plant, to obtain inventory information. R. D. Harp and Mr. Hatheway, DFI-DC, contacted Mr. Johnson on April 16, to plan the first industrial sampling program. J. V. Rouse, DFI-DC, contacted J. D. Minott, a senior process engineer at Continental's Lake Charles VCM plant -- in the absence of Mr. Johnson, at the beginning (November 1) of the second industrial sampling program. Mr. Minott was cooperative, consented to the resampling of the Petrochemical Plant effluent, and requested samples, duplicate to those collected by EPA, for the Company.

FIRST SAMPLING PROGRAM AND RESULTS

Aliquots (125 ml) were collected at two-hour intervals, beginning at 6:45 a.m., April 20, and continued for 24 hours. Grab samples for oil and grease analysis were collected at Station CON-2 at 2:30 p.m., April 17, and at 6:45 a.m., April 20. One grab sample for oil and grease analysis was collected at CON-8, at 9:30 a.m., April 29. A grab sample for specific organic analyses was taken at station CON-8 at 9:30 a.m. on April 29. [See Table 3-3. In Table 3-2 is a description of the sampling stations for the petrochemical plant. In Table 3-4 is a summary of analytical results and field measurements.]

Four alcohols [Table 3-3] comprise the major extractable organics in this effluent. However, numerous other materials were observed in lower concentration, but were not identified. Although these alcohols probably have little toxic effect on the receiving environment, they do exert a considerable oxygen demand, and in the concentrations observed, may represent an economic loss to the Company.

At the request of Mr. Johnson, an additional 24-hour composite sample of the ethylene plant effluent was collected at CON-2A.*/ A TOC value of 620 mg/l was measured at Station CON-2, but at CON-2A the TOC value was only 8 mg/l. The Company official contended that both tidal action and the discharge from the vinyl chloride monomer (VCM) plant interfered with the sample obtained at CON-2. This contention was not borne out by the pH, TOC, and total solids values observed at CON-2. No waste

*/ *This station is located within the Company property at the point of discharge to the drainage ditch. Access to the ethylene plant was initially denied to the investigators because of the latent dangers associated with not being familiar with the processing and production of petrochemicals.*

TABLE 3-2

DESCRIPTION OF EFFLUENT SAMPLING POINTS

Station Number	Description and Remarks
CON-2	The cooling water effluent from the ethylene plant; samples collected from a ditch to Bayou Verdine at a point 500 ft outside the south property fence. (This is 100 ft upstream of Station No. CON-1.)
CON-2A	The cooling water effluent from the ethylene plant; samples collected at the point of discharge from a 42-in reinforced concrete pipe to a drainage ditch to Bayou Verdine. Sampled April 23-24, 1971.
CON-8	Samples collected from a drainage ditch crossing the plant property at the weir. The flow is primarily made up of wastewater from the API separator at the paraffin plant. Wastewater from the alcohol plant, and discharges from the oily water sewers of the ethylene plant.

TABLE 3-3

RESULTS OF ORGANIC ANALYSIS

Compounds Indentified	Concentrations (mg/l)	Load lbs/day
n-Butanol	16	90
n-Decanol	2.5	15
n-Hexanol	65	375
n-Octanol	19	110

TABLE 3-4

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	Oil & Grease mg/l	Oil & Grease lbs/day
CON-2	1.33	5.6-7.2	560-1,150	750	30-34	620	6,890	570	6,330	32	355	2-5[b/]	22-56
CON-2A	1.30	7.1-7.9	900-1,600	1,140	24-36	8	90	827	8,980	36	390		
CON-8	0.72	4.1-6.7	2,500-5,000	4,000	30-36	130	780	2,650	15,900	34	200	7	40

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day	Copper mg/l	Lead mg/l	Lead lbs/day
CON-2	<0.05	<0.01		<0.1		<0.02	<0.1	
CON-2A	<0.05	<0.1		0.2	0.0022	<0.02	<0.1	
CON-8	<0.05	0.30	2	0.2	0.0018	<0.02	0.2[c/]	1.2

a/ Analytical procedures are outlined in Appendix F.
b/ Two separate grab samples.
c/ No interference from calcium detected.

streams enter the drainage ditch between CON-2 and CON-2A.

Calculations, based upon analytical data obtained from CON-2 and CON-8, indicate net discharge loads during the 24-hour sampling period, of 7,670 lbs of TOC; 560 lbs, suspended solids; and 60 to 95 lbs of oil and grease.

SECOND SAMPLING PROGRAM AND RESULTS

In order to resolve the disparities noted earlier between results for CON-2 and CON-2A a second survey was conducted on November 1, 2, and 3, 1971.

Effluent sampling commenced at 6:30 a.m., November 1. Aliquots (125 ml) were composited every two hours for 24 hours and continued for 48 hours, yielding two separate-daily-composited samples. Each of the daily composite samples was thoroughly mixed in its container and divided, with a portion given to the Company and the remainder forwarded to EPA laboratories for analysis. [Analytical results and field measurements of the second sampling program are listed in Table 3-5.] Results of the second sampling program indicate little difference between the waste loads measured at CON-2 and CON-2A.

Waste loads discharged from the Lake Charles Petrochemical Plant were calculated by summing the discharge loads from either CON-2 or CON-2A with those from CON-8. These calculations indicated daily discharge levels of 780 lbs of TOC, 310 to 590 lbs of suspended solids, and 40-95 lbs of oil and grease.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970)

TABLE 3-5

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS FROM SECOND SAMPLING PROGRAM[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm	Temp °C range	TOC mg/l	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
CON-2[a/]	1.33	7.7-8.1	850-1,750	31-35	<5	16	180	640	7,100	10	110
CON-2[b/]	1.33	7.6-8.8	850-2,100	30-36	<5	20	220	700	7,800	15	170
CON-2A[a/]	1.30	7.3-7.9	850-900	33-37	<5	22	240	620	6,700	20	220
CON-2A[a/]	1.30	7.5-8.8	800-1,700	33-37	<5	20	220	690	7,500	20	220

a/ Analytical procedures are outlined in Appendix F.
b/ Composite sample collected November 1 and 2.
c/ Composite sample collected November 2 and 3.

the discharge levels of certain materials based on data submitted by Continental Oil Company's Lake Charles Petrochemical Plant. A summary of the information from the Commission files is as follows:

Date of Application:	August 28, 1970
Quantity of Discharge:	1.7 cfs
Temperature:	80°F
Turbidity:	100 BTU's
True Color:	15
Organic Material:	15,150 lbs/day equivalent to 1,652 ppm COD
Inorganic Material:	Equivalent to 23,900 lbs/day equivalent to 26,007 ppm total dissolved solids
Toxic Materials:	
Phenols	4.8 lbs/day, equivalent to 0.5 ppm
Sulfide	7.5 lbs/day, equivalent to 0.8 ppm
Chromate	2.9 lbs/day, equivalent to 0.3 ppm

PROPOSED WASTE TREATMENT

In order to provide additional treatment to the wastes from the petrochemical plant a new aerated lagoon is under construction. The new system is expected to provide satisfactory removal of the TOC, COD, and suspended solids. The new treatment facility may bring about further reduction of oil and grease.

CONCLUSIONS

It is concluded that:

1. From the results of two surveys there appears to be no significant difference between the waste loads measured at Station CON-2 or CON-2A. (The data collected at Station CON-2 during the first survey may have reflected an inplant "spill", but is generally not representative of the waste loads discharged.)

2. Of the measured waste loads that are discharged by petrochemical plant operations, the major portion originates at the paraffin and alcohol

plants (CON-8), for which treatment measures are proposed.

3. Discharges of carbonaceous materials, suspended solids, and grease and oil from the entire petrochemical plant operations constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

4. The new facilities for the treatment of these wastes now under construction can be expected to reduce present pollutant loads to acceptable levels.

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, monitor progress toward completion of the facilities now under construction.

2. If the facilities now under construction are not operative by March 1, 1972, consideration be given to initiating appropriate abatement proceedings against the Company for discharging carbonaceous materials, suspended solids, and oil and grease to Bayou Verdine, a tributary to a navigable stream.

3. If the facilities are in operation by March 1, 1972, the nature of the discharge from the plant be reevaluated.

4. The Corps of Engineers permit, to be issued to Continental Oil Company Lake Charles Petrochemical Plant, limit discharges of BOD; COD; TOC; complex organics; heavy metals; suspended solids; and oil and grease to levels consistent with best available treatment and applicable water quality standards.

BACKGROUND INFORMATION

Facility Description

The refinery (P. O. Box 37, Westlake, Louisiana 70669) is a subdivision of the Continental Oil Company, Refinery Headquarters, Houston, Texas. It operates continuously and employs 475 persons. Eight employees (six full-time and two part-time) are involved in pollution control efforts.

Finished products from this plant are propane; butane; LPG; gasoline; kerosene; diesel fuel; heating oil; No. 6 fuel oil; and coke.

The rated plant capacity is 71,000 barrels per day. The production rate is to be increased to 81,000 barrels per day by January 1972.

The primary raw material is crude oil. Other materials added in the various processes include isobutane and polyvinylchloride. Also, the operation uses various metals that are of concern from the standpoint of water pollution. These include chromates, zinc, copper, and tetraethyl and tetramethyl lead.

Water Supply

The plant obtains water from six wells, each of which is rated at a capacity of 2,000 gpm (2.88 mgd). These wells pump from the 200, 500, and 700-ft strata. Two reserve wells are not used routinely.

Existing Waste Treatment

Original wastewater treatment and disposal facilities included an API trap, a settling pond, and separate wastewater collection system. The Company began a water pollution abatement program in 1967. A corrugated plate interceptor (CPI) has been installed that is reputed to give higher

oil recoveries than the API separators. An activated sludge unit and an aerated lagoon follow the CPI.

Discharges to Bayou Verdine which result from the refinery are:

(1) Effluent from the aerated lagoon;

(2) The effluent from a "firewater pond" that receives cooling water blowdown;

(3) Effluent from the coker area;

(4) The cooling water discharge;

(5) At least two intermittent discharges of small amounts of unidentified liquid wastes.

At the time of the survey, the activated sludge unit was operating. However, difficulties in maintaining an activated sludge were evident. The activated sludge unit is designed with a retention time of 24 hours, but owing to leaks in the aeration basin, it had been necessary to shut down the unit and drain the basin several times in order to repair the leaks. Consequently, the system had not stabilized and was not, according to Company officials, providing effective treatment.

At the present time the activated sludge-aerated lagoon system does not treat the effluents either from the "firewater pond", the coker area, or the cooling water. The receiving water at the point where discharges enter the Bayou appeared gray-black in color. According to Company officials, this color is caused by carbon fines from the Continental Carbon Company [Figure 3-1]. The banks of the channel were caked with what appeared to be carbon fines [see p. 3-4]. The DFI-DC investigating team observed black fines from the coker blowing about the area and into Bayou Verdine.

Chronology of Contacts

On March 24, 1971, Company representatives Steve Carson and Bill Cayan were contacted by J. L. Hatheway and M. R. Helton, Division of Field Investitations-Denver Center, EPA, for inventory information. R. D. Harp and Mr. Hatheway, DFI-DC, met with these officials, on April 15, to plan the industrial sampling program.

SAMPLING PROGRAM AND RESULTS

Sampling of the refinery discharges commenced at 7:30 a.m., April 20. [In Figure 3-2 sampling locations are shown; their description is found in Table 3-6.] Grab samples for oil and grease analysis were collected at CON-6A and CON-7A, on April 17 at 11:25 a.m. and 1:50 p.m., respectively, and at all other locations starting at 7:50 a.m., April 20. A grab sample for organic analysis was also collected at Station CON-3 at 8:15 a.m., April 20. [See Table 3-7.]

Samples at CON-6A and CON-7A contained high concentrations of oil and grease. On April 20, it was observed that at CON-6A there was no flow and at CON-7A the flow contained no visible oil and grease. [Analytical results and field measurements are summarized in Table 3-8.]

All the organic compounds identified [Table 3-7] in the refinery effluent are normal aliphatic hydrocarbons that represent a portion of the oil and grease discharged by the refinery.

During the 24-hour sampling period, the refinery discharged 48 lbs of chromium; 2,400 lbs, TOC; 490 lbs, ammonia as nitrogen; 8,600 lbs, suspended solids; and 1,400 lbs of oil and grease to Bayou Verdine.

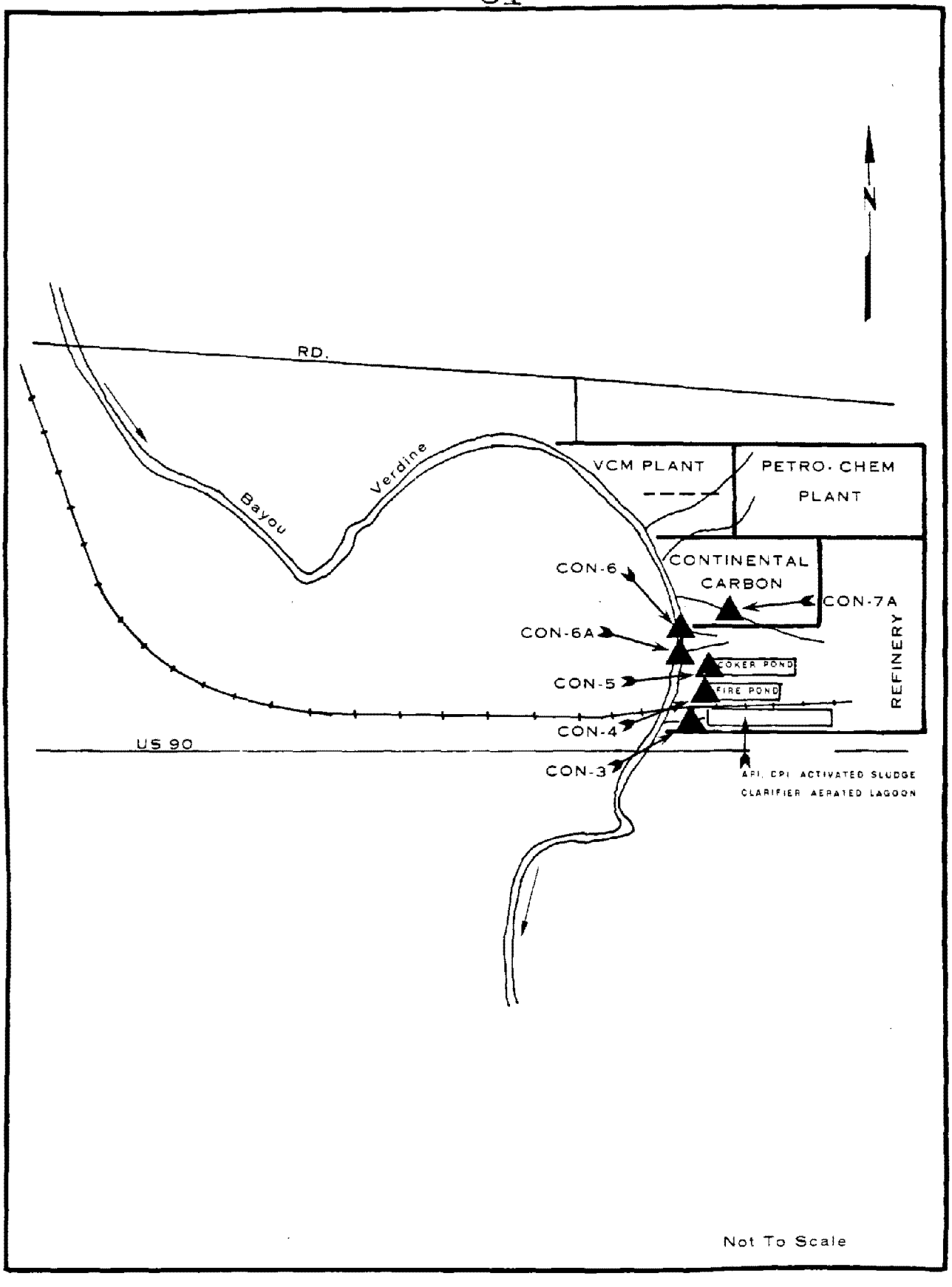

Figure 3-2. Effluent Sampling Locations for Continental Oil Co. Conoco Refinery

TABLE 3-6

DESCRIPTION OF EFFLUENT SAMPLING POINTS

Station Number	Description and Remarks
CON-3	Effluent from the refinery's aerated lagoon that receives the majority of process wastes of the refinery. Effluent is discharged directly into Bayou Verdine.
CON-4	Effluent, from the "fire-pond", discharged directly into Bayou Verdine.
CON-5	Effluent is from the triangular pond that receives the cooling water from the calcined coke shaker plus miscellaneous streams from the coking area. Effluent is discharged directly into Bayou Verdine.
CON-6	Cooling water effluent from the refinery to Bayou Verdine.
CON-6A	Discharge from the coker area sampled for oil and grease on April 17, 1971. No flow on April 20-21. Discharge goes to Bayou Verdine.
CON-7A	Sample collected, April 17, 1971, for oil and grease analysis, from a drainage ditch that commences at the refinery, flows across Continental Carbon property and discharges into Bayou Verdine. No samples was collected on April 20, 1971.

TABLE 3-7

RESULTS OF ORGANIC ANALYSIS

Compounds Identified	Concentrations (mg/l)	Load lbs/day
Dodecane	0.22	2.2
Eicosane	0.30	2.9
Heneicosane	0.19	1.8
Heptadecane	0.34	3.3
Hexadecane	0.43	4.0
Nonadecane	0.31	3.0
Octadecane	0.33	3.2
Pentadecane	0.49	4.8
Tetradecane	0.58	5.6
Tridecane	0.39	3.8
Undecane	0.05	0.4

TABLE 3-8

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	COD[b/] mg/l	COD[b/] lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	Oil & Grease mg/l	Oil & Grease lbs/day	NH_3 as N mg/l	NH_3 as N lbs/day
CON-3	1.12	7.4-8.6	3,400-5,000	3,900	23-28	210	1,960	676	6,320	2,340	21,900	182	1,700	130	1,215	52.1	490
CON-4	5.43	6.9-8.5	400-650	450	40-45	5	230			315	14,300	132	5,990	4	180		
CON-5	1.74	6.8-8.2	540-750	600	32-40	10	145			460	6,680	49	710	1	15		
CON-6	0.984	3.3-8.9	1,150-4,000	1,700	34-42	7	60			1,130	9,290	30	250	3	25		
CON-6A														190			
CON-7A														100			

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day	Copper mg/l	Copper lbs/day	Lead mg/l	Lead lbs/day
CON-3	<0.05	0.17	1.6	0.9	0.0084	0.03	0.3	<0.1	
CON-4	<0.05	0.16	7	0.1	0.0045	<0.02		<0.1	
CON-5	<0.05	0.41	6	0.3	0.0044	<0.02		<0.1	
CON-6	<0.05	4.0	33	0.1	0.0008	0.08	0.7	0.1[c/]	1

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ No interference from calcium detected.

It should be noted that the new activated sludge facility had not been in operation for a sufficient period of time to achieve effective treatment. When fully operational, the system in combination with the aerated lagoon may reduce the TOC and suspended solids to satisfactory levels. It is doubtful that the oil and grease will be reduced to a satisfactory level.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) the discharge levels of certain materials based on data submitted by Continental Oil Company - Lake Charles Refinery. A summary of the information from the Commission files is as follows:

Date of Application:	August 19, 1970
Quantity of Discharge:	18 cfs
Temperature:	110°F Maximum
Turbidity:	160 ppm
True Color:	Clear to slightly yellow or slightly gray
Organic Material:	1850 lbs/day, equivalent to 19 ppm
Inorganic Material:	53,400 lbs/day, equivalent to 350 ppm suspended solids or dissolved solids
Toxic Material:	
Phenols	4 ppm maximum - 390 lbs/day maximum
Hydrogen Sulfide (H_2S)	6 ppm maximum equivalent to 585 lbs/day maximum

PROPOSED WASTE TREATMENT

New waste treatment facilities have been constructed and placed in operation. All discharge points still must be connected to these facilities. No plans presently exist for treatment of oil and grease or heavy metals.

CONCLUSIONS

It is concluded that:

1. Present discharges of chromium; carbonaceous materials; nitrogenous

materials; suspended solids; complex organics; and oil and grease constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. With new treatment facilities having recently been placed in operation, they may reduce the discharges of carbonaceous and nitrogenous materials, suspended solids, and complex organics. (There is no evidence at hand and no claim by the Company that the treatment will reduce either present discharges of heavy metals or of oil and grease.)

3. Effluents, from the "firewater pond" and the coker as well as the cooling water discharge, that carry substantial loads of suspended solids, heavy metals, and oil and grease continue to be discharged to Bayou Verdine without adequate treatment. (At least two small intermittent discharges of unidentified liquid wastes also flow directly to Bayou Verdine.)

RECOMMENDATIONS

It is recommended that:

1. Consideration be given to initiating appropriate proceedings against the Continental Oil Company - Lake Charles Refinery (Westlake, Louisiana) for the daily discharge of 48 pounds of chromium; 2,400 pounds of carbonaceous materials; 490 pounds of nitrogenous materials; 8,600 pounds of suspended solids; 1,400 pounds of oil and grease; and a variety of aromatic hydrocarbons to Bayou Verdine, a tributary to a navigable stream.

2. The Corps of Engineers permits, to be issued, limit concentrations of BOD; COD; TOC; complex organics; heavy metals; suspended solids; and oil and grease to levels consistent with best available treatment and applicable water quality standards.

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BACKGROUND INFORMATION

Facility Description

The VCM Plant (P. O. Box 605, Westlake, Louisiana 70669) operates under the direction of the Petrochemical Sales Division, Continental Oil Company, 80 Park Plaza East, Saddlebrook, New Jersey 07662. This facility operates continuously and employs 80 production workers. The plant assigns four persons (a senior engineer; a lab technician; an equipment operator; and an unskilled laborer) to service on the water pollution control program.

The primary product is vinylchloride monomer (Stauffer Process). By-products of this process are 1, 2-dichlorethane and ethylene dichloride. The plant is rated at 600 million pounds of vinylchloride and 960 million pounds of ethylene dichloride per year.

The principal raw materials used are ethylene and chlorine - the latter purchased locally. Process additives include chromates, phosphates, commercial dispersants, sulphuric acid, and zinc.

Water Supply

Water is obtained from wells that supply about 600 gpm, of which about 100 gpm is used as process water and 400 gpm for non-contact cooling.

Existing Waste Treatment

The treatment provided consists of steam distillation, clam shell neutralization and settling pits for light and heavy oil separation. The effluent is discharged by a single outfall to a drainage ditch [Figure 3-1] that subsequently enters Bayou Verdine.

Chronology of Contacts

On March 29, J. L. Hatheway, of EPA's DFI-DC staff, met with R. H. Gerlock, chief process engineer, J. D. Minott, a senior process engineer, and Plant Manager L. N. Vernon, for the purpose of obtaining inventory information. R. D. Harp, also of DFI-DC, and Mr. Hatheway met with these officials, on April 15, to plan the industrial waste sampling program. J. V. Rouse, DFI-DC, contacted Mr. Minott at the beginning (November 1) of the second industrial sampling program. He was cooperative, consented to the resampling of the VCM plant effluent, and requested, on behalf of the Company, samples duplicate to those collected by EPA.

FIRST SAMPLING PROGRAM AND RESULTS

Aliquots (125 ml) of the effluent were taken at 2-hour intervals, for 24 hours, beginning at 6:05 a.m., April 20. The effluent from the VCM Plant (CON-1) was sampled at the single oufall leaving the weir box (Figure 3-1) and flowing into the drainage ditch coming from the ethylene plant and subsequently entering Bayou Verdine. A grab sample was taken at the time composite sampling was initiated, and analyzed for oil and grease. [Analyses of the samples are shown in Table 3-9.]

During the 24-hour sampling period, this industry discharged 12 lbs of chromium; 55 lbs, TOC; 320 lbs, suspended solids; and 9 lbs of oil and grease.

SECOND SAMPLING PROGRAM AND RESULTS

As noted in a previous section - one that describes waste discharges from the Lake Charles Petrochemical plant, a second survey was initiated

TABLE 3-9

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS FROM FIRST SAMPLING PROGRAM[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
CON-1	0.547	3.5	11,000-17,000	13,000	28-30	12	55	8,930	40,800	71	320

Sta	Oil & Grease mg/l	Oil & Grease lbs/day	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Lead[b/] mg/l	Lead[b/] lbs/day	Copper mg/l	Copper lbs/day
CON-1	2	9	<0.05	2.6	12	<0.1	0.2	0.9	0.09	0.4

a/ Analytical procedures are outlined in Appendix F.
b/ No interference from calcium detected.

November 1, 2, and 3, 1971, in order to resolve differences in waste loads that were measured between stations which should have given comparable values. Of the possible reasons given for these differences in waste loads, one was the contention by Company officials, that the discharge from the VCM plant interfered with samples collected at CON-2. Hence, during the second survey the effluent from the VCM plant (CON-1) was also resampled.

Effluent sampling commenced at 6:30 a.m., November 1. Aliquots (125 ml) ere composited every two hours for 24 hours, and continued for 48 hours, yielding two separate-daily-composited samples. Each of the daily composite samples was mixed and then divided, with a portion given to the Company and the remainder forwarded to EPA laboratories for analysis. [Analytical results and field measurements of the second sampling program are listed in Table 3-10.]

Waste loads discharged from the VCM plant indicated daily levels of at least 1,350 lbs of TOC; 5,200 lbs, COD; 140 lbs, suspended solids; and 17 lbs of oil and grease. The discharge level of carbonaceous material is appreciably higher than levels measured during the first survey [Table 3-9].

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission had no information on the industrial discharge from the VCM plant.

PROPOSED WASTE TREATMENT

An extended aeration treatment facility is under construction and is scheduled to be completed in November 1971. This new system will have 12

TABLE 3-10

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS FROM SECOND SAMPLING PROGRAM[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm	Temp °C range	TOC mg/l	TOC lbs/day	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	Oil & Grease mg/l	Oil & Grease lbs/day
CON-1[b/]	0.19	1.4-4.0	26,500-55,000	31-34	850	1,350	3,300	5,200	21,700	34,400	90	140	11	17
CON-1[c/]	0.25	2.2-3.2	22,000-26,000	30-35	740	1,550	2,800	5,800	17,500	36,400	80	170		

a/ Analytical procedures are outlined in Appendix F.
b/ Composite sample collected November 1 and 2.
c/ Composite sample collected November 2 and 3.

days' retention at the present wastewater production rate. At the time of the second sampling program during the first part of November, construction of this facility had not been completed. Sludge handling facilities are scheduled to be constructed in 1972.

A caustic recovery system, also under construction, was scheduled to be in operation in August 1971. Chromate recovery is being considered and will be constructed in 1973 if required by the State.

Currently, sums of from $100,000 to $250,000 are programmed for an activated carbon filter for tertiary treatment as part of this water pollution control program.

The proposed new wastewater treatment facilities should provide adequate reduction of the pollutant loads now being discharged except for chromate.

CONCLUSIONS

It is concluded that:

1. Present discharge levels of carbonaceous materials and chromium, by the Continental Oil Company's Lake Charles VCM plant, constitute a violation of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. With additional treatment facilities under construction, they should bring about further reduction of all pollutant loads except chromium.

RECOMMENDATIONS

It is recommended that:

1. The Company be informed of the discharge of heavy metals (chromium) to Bayou Verdine, a tributary of a navigable stream, and that appropriate

measures be taken to eliminate this discharge.

2. The Office of Enforcement, EPA, monitor progress toward completion of the facilities now under construction.

3. If the facilities now under construction are not operative by December 31, 1971, appropriate abatement actions be initiated against the Company.

4. If the facilities are in operation by December 31, 1971, the nature of the discharge from the plant be reevaluated.

CROSBY CHEMICALS, INCORPORATED, PLANT
DE RIDDER, LOUISIANA

BACKGROUND INFORMATION

General

Crosby Chemicals, Incorporated, located between timber production areas and a seaport, contributes significantly to the economy of the Upper Calcasieu River basin area.

The firm's Louisiana Division is located in De Ridder, Louisiana. This industry produces fatty acid and rosin from crude tall oil. The rosin is further processed to yield "paper sizing," polymerized rosin, metal resinates, and asper gums. Crosby Chemicals [Figure 4-1] operates continuously and employs 60 persons in the production facility.

Water Supply

Water is obtained from six wells. Five of these wells are 120 feet deep and are rated at 500 gpm (0.72 mgd); the sixth well is 1,500 feet deep and is rated at 1,000 gpm (1.44 mgd).

Existing Waste Treatment

The one wastewater discharge from the plant flows through an open channel to Palmetto Creek, a tributary to the Calcasieu River [Figure 4-1]. Process wastewater and excess cooling water, totaling 9.6 mgd, are treated in five earthen ponds that are arranged in series. One thousand gpm (1.44 mgd) of "aerated" well water is added to the effluent from the last pond to further reduce the BOD and suspended solids levels prior to being discharged into Palmetto Creek. Cooling water is recirculated to a spray pond.

Chronology of Contacts

On March 31, 1971, J. L. Hatheway, of the Division of Field

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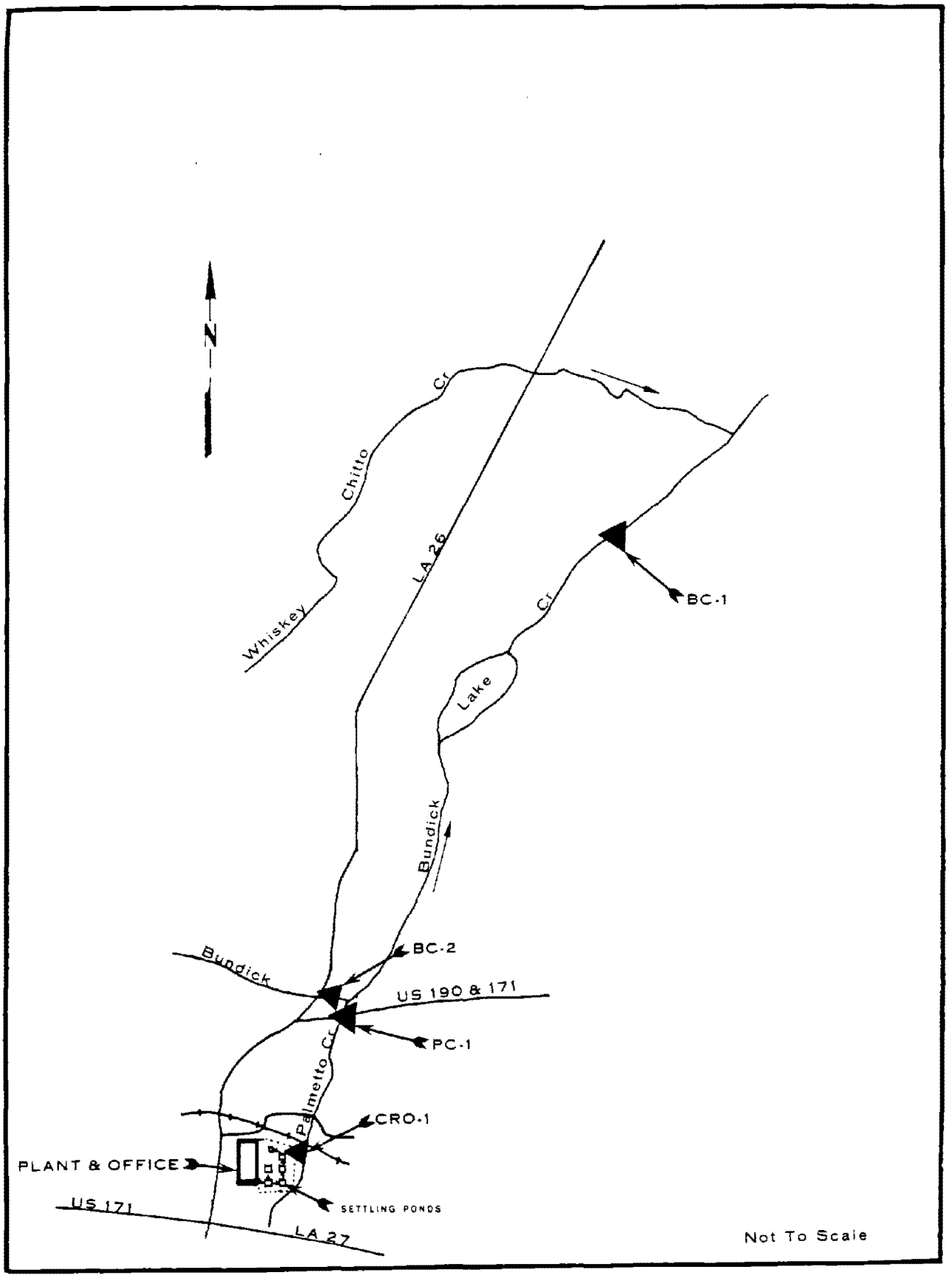

Figure 4-1 Effluent & Receiving Water Sampling Locations for Crosby Chemicals, Incorporated

Investigations-Denver Center, met with G. K. Bienvenu, plant manager for Crosby Chemicals. The meeting had been arranged by E. D. Anthony, Jr., enforcement programs specialist, Region VI Office. Mr. Bienvenu answered most of the questions that were posed by the EPA investigator.

An appointment was made to talk to Mr. Bienvenu on April 14 in order to discuss sampling of the discharge from Crosby Chemicals. However, when the EPA representatives arrived, Mr. Bienvenu was unavailable. An appointment was made to see Mr. Robert Crosby, Company president, at 8:00 a.m., April 15, but when the EPA representatives arrived, they learned that Mr. Crosby was not present and could not be seen until late afternoon. He was available the next day, was apprised of the waste source evaluations and water quality investigations being conducted in the Basin, and consented to the sampling of the effluent from Crosby Chemicals.

SAMPLING PROGRAM AND RESULTS

Wastewater effluent samples were collected downstream from the point of discharge from the last pond (CRO-1). Water samples were collected from Palmetto and Bundick Creeks (stations PC-1, BC-1, BC-2). Sediment samples were collected in Palmetto Creek also. [In Table 4-1 is a description of the stations where the effluent, Palmetto Creek, and Bundick Creek were sampled.]

Effluent samples (125 ml aliquots) were composited every hour over a 24-hour period, commencing at 8:25 a.m., April 27. On April 19, one effluent grab sample was collected for oil and grease analysis. Grab samples were collected from the stream stations. [Analytical results are shown in Table 4-2.]

TABLE 4-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CRO-1	Samples collected at a point where the effluent from the last treatment pond enters the ditch to Palmetto Creek, approximately 1/8 mile downstream from the point where 1,000 gpm of dilution water is added.
BC-1	Bundick Creek near Dry Creek (USGS 150).
BC-2	Bundick Creek at Highway 26 bridge near De Ridder, Louisiana.
PC-1	Palmetto Creek at Highway 171-190 bridge near De Ridder, Louisiana.

TABLE 4-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm Composite	Temp °C range	TOC mg/l	TOC lb/day	COD[b/] mg/l	COD[b/] lb/day	Solids total mg/l	Solids total lb/day	Solids susp mg/l
CRO-1	6.26	6.4-7.3	180	23-25	38	1,990	160	8,360	184	9,600	
BC-1		6.7-7.3	78	22-22	11				74		12
BC-2		6.8-7.2	148	21-22	11				108		16
PC-1		6.6-7.4	134	23-24	22		136				142

Sta	Oil & Grease mg/l	Oil & Grease lb/day	Cadmium mg/l	Chromium mg/l	Mercury µg/l	Lead[c/] mg/l
CRO-1	42	2,200	<0.05	<0.02	<0.1	
BC-1			<0.05		<0.1	<0.1
BC-2					<0.1	
PC-1			<0.05		<0.1	<0.1

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ No interference from calcium detected.

Examination of the data indicates that, during the period of sampling, Crosby Chemicals discharged daily loads of 8,360 lbs of COD; 1,990 lbs, TOC; and 2,200 lbs of oil and grease to Palmetto Creek, a tributary to a navigable stream.

The materials discharged from this industry discolor Palmetto Creek for several miles downstream from the discharge point. According to the Company plant manager, this discoloration is attributable to fatty acid particles.

A sample of bottom muds was collected in Palmetto Creek downstream from the Crosby Chemicals plant discharge. The sample consisted primarily of sandy material with very little volatiles (1.9 percent) and a very low OSI value, 0.06. Both of these figures indicate insignificant build-up of organic materials in the receiving stream [Table E-1, Appendix E]. Mercury, at a low concentration of 0.4 µg/g, was also found in this sediment sample.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) the discharge levels of certain materials based on data submitted by Crosby Chemicals, Incorporated. A summary of the information from the Commission files is as follows:

Date of Application:	March 9, 1971
Quantity of Discharge:	90,000 gal/hour
Temperature:	23°C
Turbidity:	Slightly milky, colorless
True Color:	None
Organic Material:	1953 lbs/day equivalent to 108.6 ppm
Inorganic Material:	1965 lbs/day equivalent to 109.2 ppm

PROPOSED WASTE TREATMENT

According to company officials, no additional treatment facilities are planned for construction during the next five years.

CONCLUSIONS

It is concluded that:

1. The present discharges, by Crosby Chemical Company, of carbonaceous materials and of oil and grease to Palmetto Creek, a tributary to a navigable stream, constitute a violation of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. According to Company officials, no plans exist for implementing adequate treatment.

RECOMMENDATIONS

It is recommended that:

1. The Crosby Chemical Company be advised that the Company has until March 1, 1972 to develop plans for providing statisfactory treatment for its present discharges of carbonaceous materials and oil and grease, and has until December 31, 1972, to place necessary treatment facilities in operation.

2. If the new treatment facilities are not in operation by December 31, 1972, appropriate abatement proceedings be initiated against the Company.

3. If new treatment facilities are in operation by December 31, 1972, effluent quality be examined; if the quality be found to be inadequate, appropriate abatement proceedings be initiated against the Company.

4. The Corps of Engineers permits, for this industry specify limitations on BOD, COD, TOC, oil and grease, and suspended solids.

FIRESTONE RUBBER COMPANY PLANT
LAKE CHARLES, LOUISIANA

BACKGROUND INFORMATION

General

In conjunction with other chemical plants and petroleum refineries, the Firestone plant provides much of the support of the economy in the Lower Calcasieu River area. The Firestone operation is involved primarily in the production of synthetic rubber.

Facility Description

Synthetic rubber is manufactured at this plant which operates continuously and employs about 900 production persons. The facility furnishes 80 percent of the raw synthetic rubber for Firestone's operation [headquartered at Akron, Ohio] in the United States. Production at the Lake Charles plant is rated at 315,000 tons per year of synthetic rubber. It is baled and shipped by rail or truck to the other Firestone facilities.

The original facilities were constructed during the years 1942-43, with the original production process of synthetic rubber being by the emulsion method. In 1948, cold rubber processing was introduced here. A solution-type process using an organic solvent was implemented in 1969.

The raw synthetic rubber material is approximately 75 percent butadiene and 25 percent styrene; minor amounts of sulfuric acid, sodium chloride, and carbon black are added during the process.

According to the Company plant engineer (at Lake Charles) mercury is used here for seals in the domestic waste treatment system. He estimated losses from the seals at between 26 and 30 lbs per year of mercury. Eight employees spend either full time or significant portions of their time in water pollution control activities at this plant.

Water Supply

Water, obtained from a series of wells -- each being approximately 500 feet deep, is softened and demineralized before use in the plant. Chromate corrosion inhibitors and sulfuric acid are added to the makeup water for the cooling towers.

Existing Waste Treatment

Present treatment of the process wastewater, in order to remove the rubber crumb lost in the production process, consists of gravity separation followed by filtration through an excelsior fiber pad. From the data [listed in Table 5-1] provided by the Company Plant Engineer, the quantity and quality of wastewater discharge can be ascertained. The heated wastewater is discharged from one outfall into an open channel and thence to Bayou d'Inde [Figure 5-1].

Chronology of Contacts

On March 24, 1971, W. C. Blackman, J. L. Hatheway, and M. R. Helton of the Division of Field Investigations-Denver Center, EPA, visited the Firestone Rubber Company Lake Charles plant to initiate an industrial waste inventory. G. R. McBride, plant engineer, provided the information requested and conducted a tour of the facility. The meeting had been arranged by T. P. Harrison II, enforcement officer, Region VI, EPA, prior to the day of the visit.

Throughout the interview, Mr. McBride and his assistants cooperated fully with the DFI-DC investigators. Permission to take photographs was not granted; however, a member of his staff accompanied the investigators and provided Polaroid pictures of production and treatment facilities as

TABLE 5-1

QUALITY OF WASTEWATER PRESENTLY DISCHARGED AND EXPECTED FUTURE WASTEWATER DISCHARGE[a/]

Parameter	Present Effluent Quality	Estimated Quality of Future Effluent[b/]
Flow (mgd)	2.9	3.4
BOD (mg/l)	71	7
Dissolved oxygen (mg/l)	-	5
Suspended solids (mg/l)	144	<10
Oil and grease (extraction) (mg/l)	30	Zero
Chromium (total) (mg/l)	0.11	Zero
Phenols (mg/l)	0.30	Zero
Chlorides (mg/l)	701	<701
Sulfates (mg/l)	514	514

a/ Data provided by the Firestone Rubber Company, Lake Charles, Louisiana.
b/ Following construction of new primary and secondary treatment facility (95 percent removal, suspended solids, and 90 percent removal, BOD).

V-32

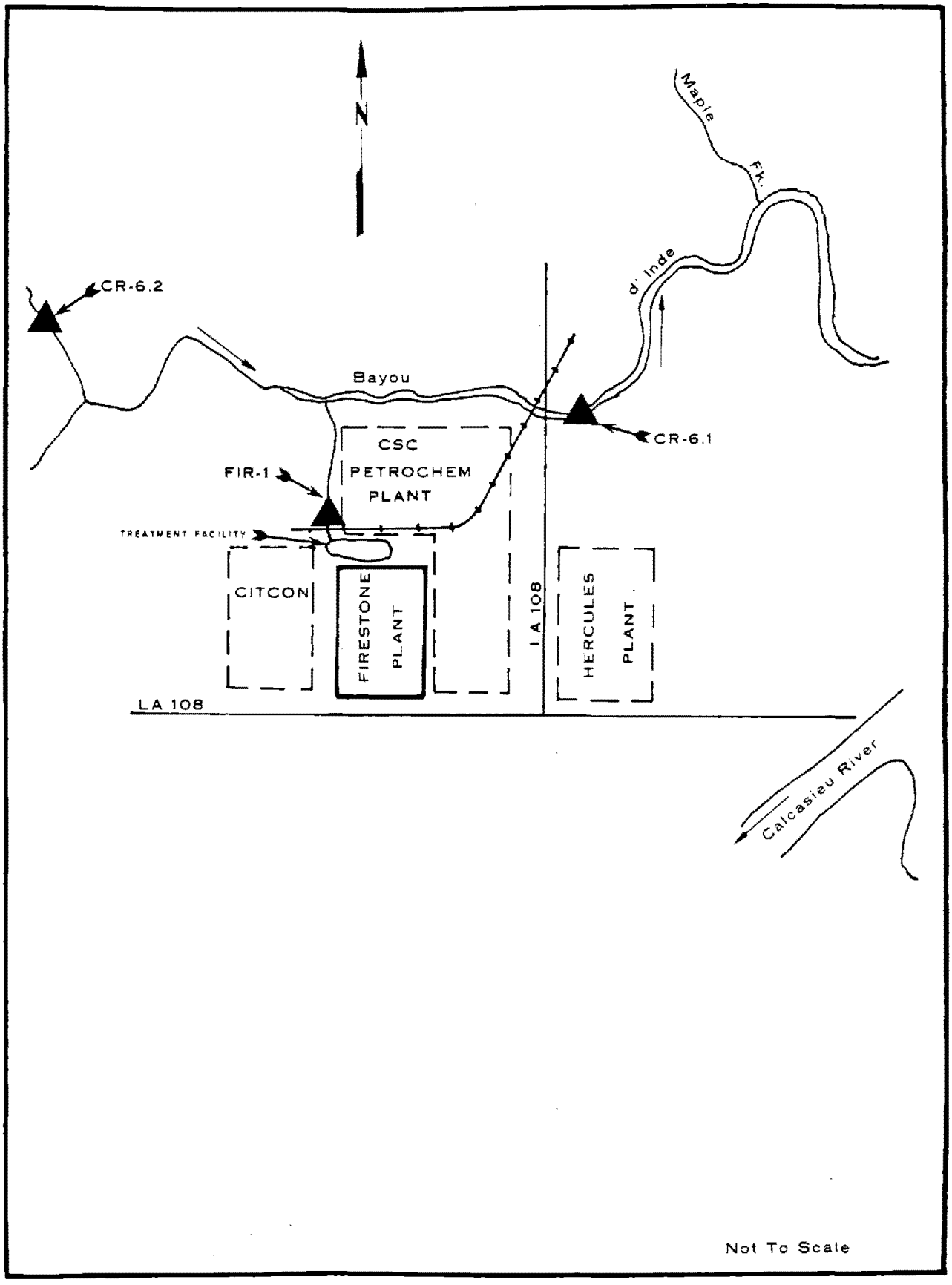

Figure 5-1. Effluent & Receiving Water Sampling Locations for Firestone Rubber Company

requested. Mr. McBride provided a layout drawing of the facility as well as analyses of process wastewater and makeup cooling tower water.

On April 15, 1971, R. D. Harp and Mr. Hatheway (of the DFI-DC staff) met with Mr. McBride and other Company officials to inform them that waste source evaluations and water quality investigations were to be conducted by EPA in the Calcasieu River Basin. He consented to the sampling of Firestone Company effluent.

SAMPLING PROGRAM AND RESULTS

The effluent (Station FIR-1) was sampled from the railroad bridge crossing a drainage ditch that discharges to Bayou d'Inde [Figure 5-1]. Shrimp survival and palatability studies were conducted in Bayou d'Inde at a point downstream of the Company discharge. Sediment samples were collected from Bayou d'Inde upstream and downstream of the discharges. [In Table 5-2 is a description of the stations where the effluent and Bayou d'Inde were sampled.]

Samples (125 ml aliquots) were composited every two hours for 24 hours commencing at 7:00 a.m., April 21. One effluent grab sample, collected at 10:32 a.m. April 17, was analyzed for oil and grease. Additional grab samples were collected on April 21 for organic analyses. [Analytical results of the effluent sampling are shown in Table 5-4.]

The compounds listed [Table 5-3] comprise the major extractable organic materials in the Firestone discharge. Other compounds, present in lesser amounts, were not identified. At present, the effect of these, in the relatively low concentrations observed, on the receiving water is unknown.

TABLE 5-2

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS FOR FIRESTONE RUBBER COMPANY

Station Number	Description and Remarks
FIR-1	Samples collected at the railroad bridge, outside the Firestone property, from the drainage ditch that empties into Bayou d'Inde.
CR-1	Lower Calcasieu River near Calcasieu Landing (above intracoastal waterway) near Channel Marker 92 (Control station).
CR-6.1	Bayou d'Inde downstream from Firestone, Cit-Con, and Cities Service petrochemical plant.
CR-6.2	Bayou d'Inde upstream from Firestone, Cit-Con, and Cities Service petrochemical plant.
CR-11.2	Lower Calcasieu River, south shore, south of Clooney Island, just west of Lake Charles (Control station).

TABLE 5-3

ORGANIC SAMPLING RESULTS

Compounds Identified	Concentration (mg/l)	Load (lb/day)
Styrene	0.0026	1.3
Furfural	0.0017	0.9
4-Carbon Cyclohexane Isomer	0.0030	1.5
4-Carbon Cyclohexane Isomer	0.0011	0.6
4-Carbon Cyclohexane Isomer	0.0060	3.1
4-Carbon Cyclohexane Isomer	0.0033	1.7
1-Methylnaphthalene	0.0017	0.9

TABLE 5-4

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS
FOR FIRESTONE RUBBER COMPANY[a]

Sta	Flow	Temp °C	Conductivity µmhos/cm		pH	TOC		COD		Solids total		Solids susp		Oil & Grease	
	mgd	range	range	composite	range	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
FIR-1	5.75	32-39	3,000-7,500	5,000	6.5-8.8	52	2,500	168	8,070	3,210	154,000	76	3,650	17	815

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day	Copper mg/l	Lead mg/l	Lead lbs/day
FIR-1	<0.05	0.20	10	0.6	0.0288	<0.02	0.2[b]	10

a/ Analytical procedures are outlined in Appendix F.
b/ No interference from calcium detected.

During the sampling period, the daily Firestone industrial waste discharge to Bayou d'Inde contained 8,070 lbs of COD; 2,500 lbs, TOC; 3,650 lbs, suspended solids; and 815 lbs of oil and grease [Table 5-4].

Survival studies with shrimp were made at Station CR-6.1 and at the control stations following methods outlined in Appendix C. These studies indicated that total mortality occurred at this station in Bayou d'Inde within six hours (Appendix D). Toxicity resulting from industrial wastes, noxious sludge gases, the lack of oxygen, -- either alone or a combination -- is contributary to the cause of the mortalities. The 100 percent mortality precluded taste and odor tests with shrimp. (No shrimp mortalities occurred at the Control Stations (CR-1 and CR-11.2) during this six-hour time span.)

Control Stations, CR-1 and CR-11.2 [Table 1], are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other stations. Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station 1.

Bottom sediment samples collected from Bayou d'Inde, at a point below the discharges from the Firestone plant, contained 20 percent volatile material and had an OSI value of 3.4 [Table E-1, Appendix E]. (Neighboring industrial sources also downstream from the discharges may be contributory to the problem.) These figures indicate a highly organic bottom deposit undergoing decomposition and stabilization. Upstream of the plant discharges, bottom sediments are composed of decaying matted vegetation,

leaves, etc.; and the OSI value is slightly lower, at 3.1; the volatiles 19 percent.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

Information obtained from the Louisiana Stream Control Commission indicates that present treatment at Firestone consists of solids removal, neutralization, filtration, and aeration. By March 1971, these facilities were scheduled to be replaced by primary and secondary clarification and aeration. During this investigation the aerators were not in use. Further, no specific levels of waste materials in the industrial effluent from Firestone Rubber Company were available to EPA representatives.

PROPOSED WASTE TREATMENT

The Company has been awarded an EPA Research and Development Grant ($390,000) for the development of a new industrial wastewater treatment system. The purpose of the research is to develop a system using alum and a polyelectrolyte, air flotation followed by biological treatment, and aerated lagoons to treat approximately 5.8 mgd. An API oil separator will precede the new treatment system.

At the time of this inspection, in offering data [presented in Table 1], Company officials disclosed that these are the expected results of the proposed system, to be on line in early June 1971. If the anticipated level of treatment is achieved, abatement of these pollution sources should be adequate to protect the present uses of the receiving waters.

CONCLUSIONS

It is concluded that:

1. Present discharge of carbonaceous materials, suspended solids, and oil and grease by the Lake Charles Plant of the Firestone Rubber Company constitutes a violation of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. The Company appears to be making suitable progress toward installation of improved treatment facilities.

3. The Company should be permitted a reasonable allowance of time to complete the planned facilities and to attain routine operation thereof.

RECOMMENDATIONS

It is recommended that:

1. Progress toward implementation of planned treatment procedures be monitored by the Office of Enforcement, EPA.

2. If the new treatment facilities are not in operation by December 31, 1971, appropriate abatement proceedings be initiated against the Company.

3. If new treatment facilities are in operation by December 31, 1971, effluent quality be examined; if the quality is found to be inadequate, appropriate abatement proceedings be initiated.

4. The permit, to be issued to the Lake Charles Plant of the Firestone Rubber Company, limit discharges of BOD, COD, TOC, oil and grease, heavy metals, and total hydrocarbons, consistent with best available treatment and with the water quality standards for the Lower Calcasieu River.

DAVISON CHEMICAL DIVISION
W. R. GRACE AND COMPANY
LAKE CHARLES, LOUISIANA

BACKGROUND INFORMATION

General

In conjunction with other chemical plants and all the major petroleum refineries, the Davison Chemical plant makes a significant contribution to the economy in the Lower Calcasieu River area. This W. R. Grace operation is involved primarily in the production of catalysts.

The Davison Chemical Division manufactures synthetic cracking catalysts to supply the needs of various petrochemical complexes operating in the Lake Charles area. This plant operates continuously. One hundred fifty employees are involved in production and another fifty carry out management and administrative duties. The director of environmental matters for W. R. Grace declined to answer EPA's question regarding the rated plant capacity.

The basic raw materials used in the production of catalysts at this facility are silica and aluminum. Intermediate compounds are sodium silicate, aluminum hydrate, aluminum sulfate, and ammonia. Various clays are also added in the process. The final step is a spray wash and drying. It is at this point that a portion of the product is lost and eventually finds its way into the Davison industrial waste discharge.

Water Supply

Water is obtained from two wells, each rated at 1,250 gpm (1.8 mgd). Uses of this water are for process, boiler feed, sanitary service, and non-contact cooling.

Existing Waste Treatment

Untreated process waste is discharged from a single outfall to an unnamed bayou that flows to the Calcasieu River [Figure 6-1].

The plant is currently operating under a permit from the Louisiana Stream Control Commission.

Chronology of Contacts

On March 26, 1971, J. L. Hatheway and M. R. Helton of the Division of Field Investigations-Denver Center, EPA, met with Henry E. Craven, Plant Manager, and Fred Henke, Director of Environmental Matters, in order to initiate an industrial waste inventory at this plant. The meeting had been arranged by E. D. Anthony, Jr., enforcement programs specialist, Region VI Office, EPA, Dallas, Texas, on March 25, 1971.

Mr. Henke commented that none of the local employees devote significant time to water pollution control. There are, however, two employees at the corporate home office [P.O. Box 2117, Baltimore, Maryland] who are assigned principal duties in water pollution and/or air pollution control for all operating subdivisions. These employees were present and accompanied the EPA investigators on the initial tour of the plant. Mr. Henke and the others present indicated that no heavy metals are used in any of the processes, and added that heavy metals cannot be permitted to be present in the finished product. The Company representatives were cooperative, attempted to answer all the questions posed by the investigating team, and conducted the team on a tour of the plant.

On April 16, 1971, R. D. Harp, R. L. King, and Mr. Hatheway (all

DFI-DC representatives) met with Mr. Henke to discuss the industrial wastewater sampling program. He consented to the sampling of the effluent from this W. R. Grace facility.

SAMPLING PROGRAM AND RESULTS

Wastewater effluent samples [as illustrated in Figure 6-1] were collected from the discharge channel at a point about 200 feet outside the southeast corner of the property (WRG-1). Shrimp survival studies were conducted on the Lower Calcasieu River upstream and downstream from the W. R. Grace discharge. Sediment samples were collected from the River at the point of the discharge (station CR-2). [In Table 6-1 is a description of the stations where the effluent and the Lower Calcasieu River were sampled.]

Effluent samples (125 ml aliquots) were composited every two hours, for 24 hours, beginning at 6:15 a.m., April 23. [The results of the sampling are shown in Table 6-2.]

During the period of the sampling, Grace's Davison Chemical Division discharged each day loads of at least 910 lbs of aluminum; 3,870 lbs, COD; 290 lbs, TOC; and 11,700 lbs of suspended solids into the Lower River.

Survival studies were made with shrimp at Station CR-2, CR-2.1 and at the Control Stations following methods outlined in Appendix C. These studies indicated that total shrimp mortality occurred within 6 hours [Appendix C]. Near the east bank of the Lower River, opposite the discharge point (CR-2.1), a total shrimp mortality occurred within two hours. Total mortality during the 6-hour test precluded taste and odor evaluation. (At Control Stations CR-1 and CR-11.2 there were no mortalities during this time span.)

VI-3F

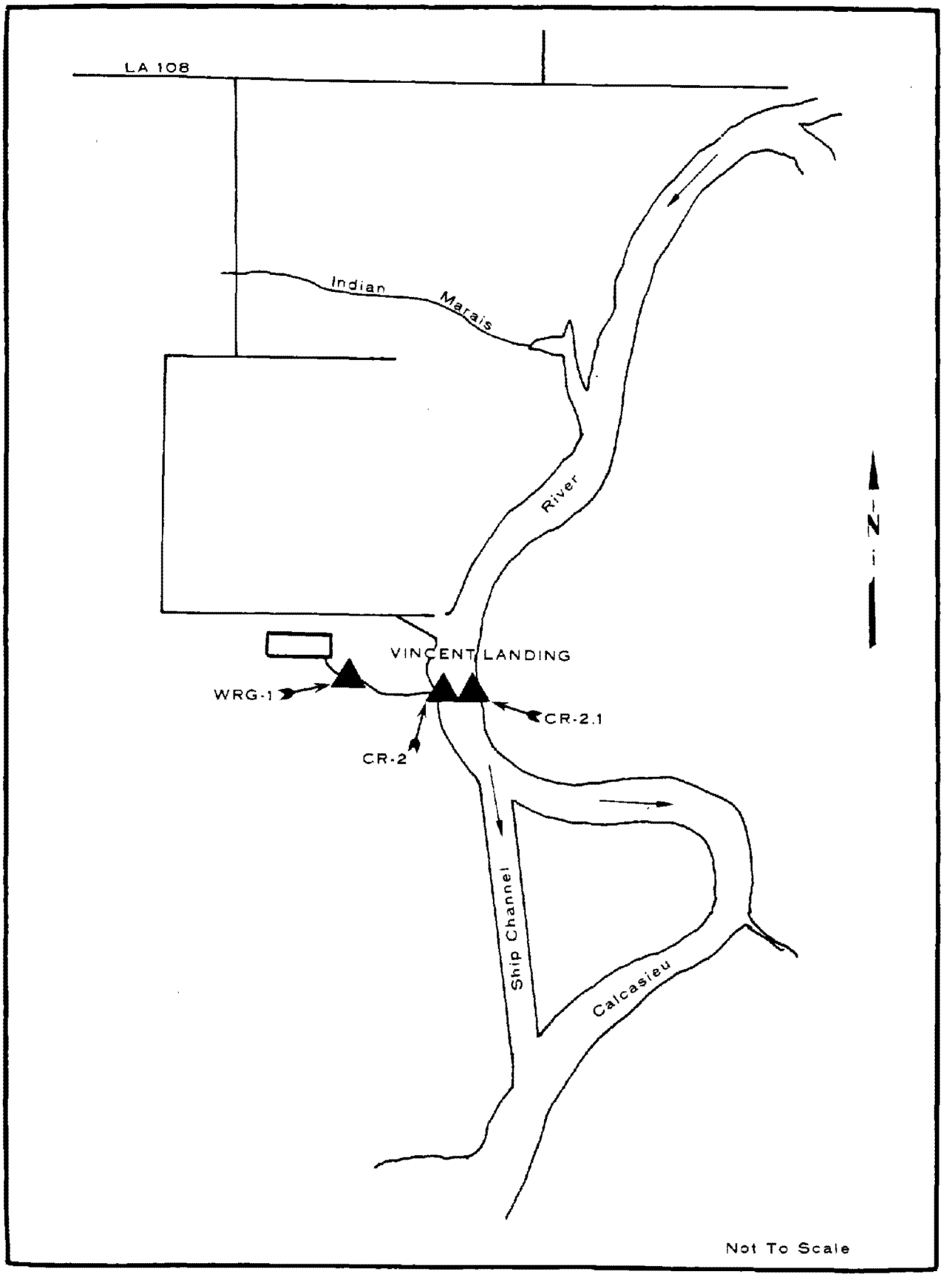

Figure 6-1. Effluent & Receiving Water Sampling Locations for W. R. Grace & Company

TABLE 6-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
WRG-1	Samples collected of the effluent from the drainage ditch at a point about 200 ft outside the southeast corner of the property. The ditch drains into the Lower Calcasieu River through an unnamed Bayou.
CR-1	Calcasieu River near Calcasieu Landing (upstream from intracoastal waterway) near Channel Marker 92 (control station).
CR-2	Lower Calcasieu River near Vincent's Landing, at the discharge from W. R. Grace and Company.
CR-2.1	Lower Calcasieu River, next to the east bank, opposite W. R. Grace and Company discharge.
CR-11.2	Calcasieu River, south shore, south of Clooney Island just west of Lake Charles (control station).

TABLE 6-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm composite	Temp °C range	TOC mg/l	TOC lbs/day	COD mg/l	COD lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
WRG-1	1.81	4.1-8.6	19,500-40,000	28,000	37-42	19	290	256	3,870	22,900	346,000	772	11,700
CR-2		7.6-8.9		14,500	23-26	9.1, 11[b/]				8,950		16	

Sta	Cadmium mg/l	Chromium mg/l	Mercury µg/l	Mercury lbs/day	Aluminum mg/l	Aluminum lbs/day	Copper mg/l	Lead mg/l
WRG-1	<0.05	<0.01	0.8	0.0121	60	910		
CR-2	<0.05	<0.02	3.2		<0.5		<0.02	<0.1

a/ Analytical procedures are outlined in Appendix F.
b/ Two samples taken (morning and afternoon).

VI-5

Control Stations, CR-1 and CR-11.2 [Table 1], are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other stations. Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station 1.

A sample of the bottom sediments, taken downstream from the industrial discharge of W. R. Grace and Company, was composed of grayish-white particulate material. A low OSI value, 0.25, indicates that the waste material discharged is primarily of inorganic character [Table E-1, Appendix E].

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission extended (December 16, 1970) the discharge permit of W. R. Grace and Company. A summary of information from the Commission files as to allowable levels of materials discharged is as follows:

Date of Application:	August 13, 1970
Quantity of Discharge:	3.09 cfs
Temperature:	Ambient
Turbidity:	50 to 800 ppm
True Color:	None
Inorganic Materials:	332,000 lbs/day equivalent to 19,500 ppm discharged to the Calcasieu River.

PROPOSED WASTE TREATMENT

Construction of a new wastewater treatment facility is underway with an estimated completion date of December 1972. This new facility consists of clarification and pH control. If properly designed and operated, this

facility should provide adequate treatment to protect the quality of the receiving waters.

CONCLUSIONS

It is concluded that:

1. Present discharge of carbonaceous materials, aluminum, and suspended solids, by the Lake Charles Plant of W. R. Grace and Company (Davison Chemical Division) constitutes a violation of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. The Company appears to be making suitable progress toward installation of treatment facilities.

3. The Company should be permitted a reasonable allowance of time to complete the planned facilities and to attain routine operation thereof.

RECOMMENDATIONS

It is recommended that:

1. Progress toward implementation of planned treatment be monitored by the Office of Enforcement, EPA;

2. If new treatment facilities are not in operation by January 1, 1973, appropriate abatement actions be initiated against the Company.

3. If new treatment facilities are in operation by January 1, 1973, effluent quality be examined; if the quality is found to be inadequate, appropriate abatement actions be initiated against the Company.

4. The permit, to be issued to W. R. Grace and Company, limiting discharges of BOD, COD, TOC, heavy metals, and aluminum be consistent with best available treatment and the water quality standards for the Lower Calcasieu River.

HERCULES, INCORPORATED
LAKE CHARLES, LOUISIANA

BACKGROUND INFORMATION

General

In conjunction with other chemical plants and all the major petroleum refineries in the area, the Hercules plant is a substantial contributor to the economy in the Lower Calcasieu River Basin. The Hercules operation is involved primarily in the production of organic chemicals.

The plant operates continuously to produce 500 million lbs of polyolefins, polyethylene, and polypropylene per year. Six hundred persons are employed at this facility.

The materials used in the process are eythlene, propylene, isopropanol, methanol, aluminum alkyl, titanium chloride, surfactants, caustic soda, sulfuric acid, an unidentified plastic stabilizer, kerosene hydrocarbons, and chromate corrosion inhibitors.

Water Supply

Water is obtained from three wells that are about 500 feet deep. The wells supply a total of about 3,000 gpm (4.32 mgd). Process water is demineralized and is used for purification of the product.

Existing Waste Treatment

Present treatment of water-contact process wastes takes place in six ponds that can be operated in series or in parallel [Figure 7-1]. Aluminum and titanium are removed by pH adjustment and subsequent precipitation in the ponds. Isopropanol is stripped, by steam, from the product. Then, the steam is distilled in order to recover the alcohol for recycling. (Company officials claim that 94 to 96 percent recovery of isopropanol is achieved

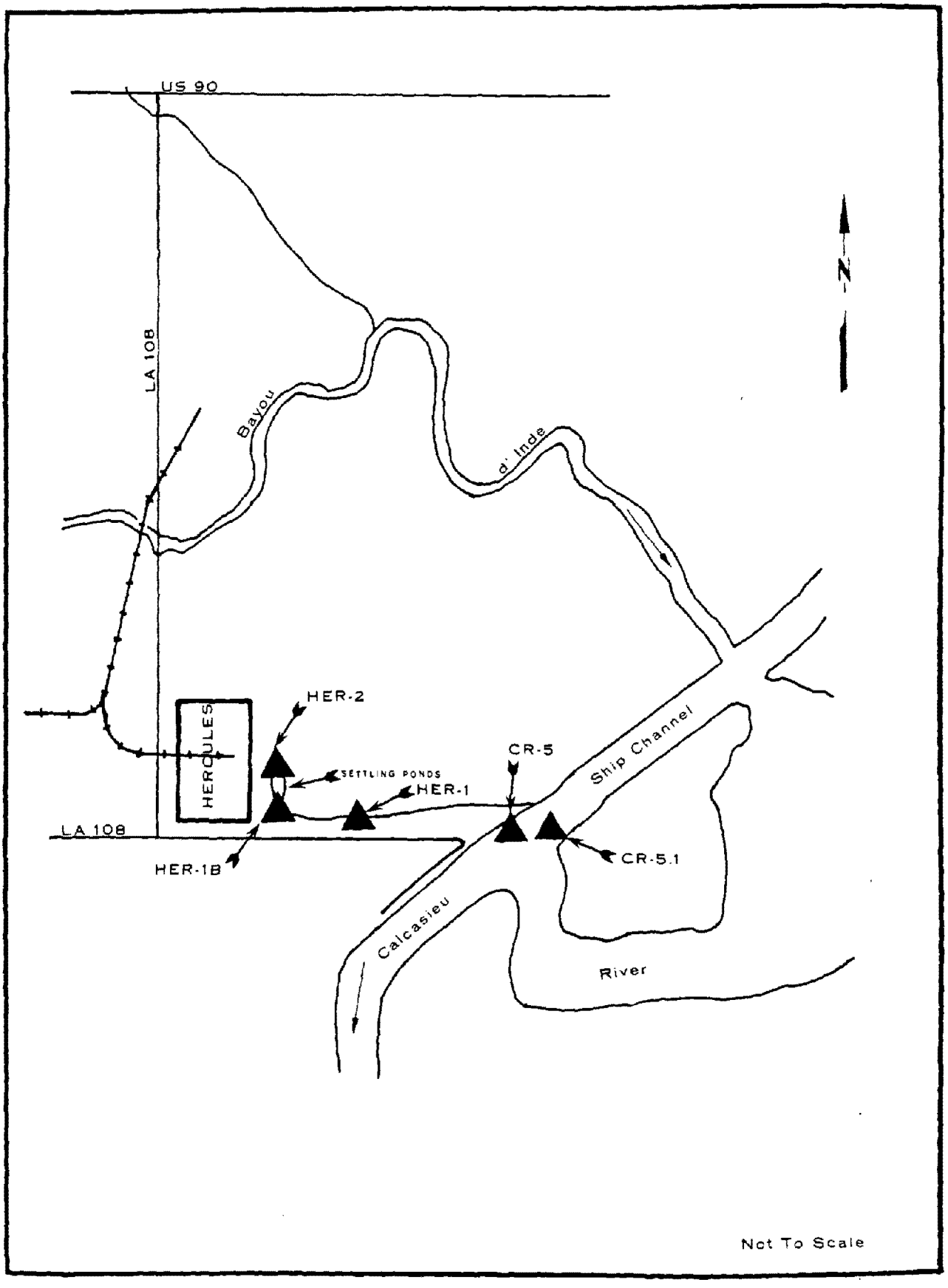

Figure 7-1. Effluent & Receiving Water Sampling Locations for Hercules, Incorporated

by this system.) The alcohol lost in the process is mixed with the wastewater discharged to the ponds.

A seventh pond, known as the "firewater pond", receives wastes from the railroad car unloading area. This wastewater receives treatment in an API separator prior to discharge to the "firewater pond". Various flow patterns are possible within the pond area. At the time of the survey, a separate discharge, from the "firewater pond" to the outfall ditch, was in operation. The combined wastewater streams flow through a rated section that is equipped with a water level recorder, and are then discharged to the Lower Calcasieu River through an outfall ditch.

Chronology of Contacts

On April 1, 1971, R. D. Harp and M. R. Helton of the DFI-DC staff visited the Lake Charles facility of Hercules, Incorporated, in order to determine the basic processes in the plant and the associated water pollution control facilities. D. J. Kielman, manager of environmental affairs for Hercules, provided the information requested and conducted a tour of the facilities. The meeting had been arranged on March 29, by E. D. Anthony, Jr., enforcement programs specialist, EPA, Region VI.

Throughout the interview Mr. Kielman was cooperative and provided analytical data, drawings of the treatment facilites, and a general location plan.

On April 19, J. V. Rouse (also of EPA's DFI-DC staff) and Mr. Harp met with Mr. Kielman to discuss the industrial wastewater sampling program. He was informed that waste source evaluations and water quality investigations were being conducted in the Calcasieu River Basin by DFI-DC. Mr. Kielman consented to the sampling of the Hercules effluent.

SAMPLING PROGRAM AND RESULTS

Wastewater effluent samples were collected from the outfall ditch (HER-1) at a point just outside of the southeast corner of the property fence. [In Table 7-1 is a description of the Lower Calcasieu River sampling stations, and in Table 7-2 are the effluent data furnished by Hercules.]

Water samples (125 ml aliquots) were composited every two hours over a 24-hour period commencing at 6:45 a.m., April 23. One effluent grab sample (HER-2) was collected at 2:15 p.m., April 19, for oil and grease analysis. Additional grab samples (HER-1B) were collected at 6:45 a.m., April 23, for specific organic analysis [Table 3]. Survival studies with shrimp were conducted on the Lower Calcasieu River downstream from the Hercules discharge. Sediment samples were also obtained from the same area.

Shrimp survival studies were made with white shrimp at CR-5 and CR-5.1 -- as well as at CR-11.2 and CR-1 -- following methods outlined in Appendix C, in order to determine palatabilities and mortality rates. These studies showed mortalities of 40 to 100 percent, respectively, at the end of a 24-hour period [Appendix D]. The mortality rate, at CR-5, continued at 10 to 20 percent for each additional 24-hour period until, at the end of 72 hours, 70 percent of the shrimp had died. The Control Stations CR-1 and CR-11.2 had mortalities of 20 percent during this 72-hour period. Shrimp showed no significant off-flavor or off-odor.

Control Stations, CR-1 and CR-11.2 [Table 7-1], are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other stations.

TABLE 7-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
Her-1	Samples collected from the drainage ditch just outside the southeast corner of the property fence. Ditch empties into the Lower Calcasieu River.
HER-1B	Grab sample for organic chemical analyses taken of the effluent from the last treatment pond.
HER-2	Grab sample for organic chemical analyses of the influent to the waste treatment ponds.
CR-1	Calcasieu River near Calcasieu Landing (upstream from intracoastal waterway) near Channel Marker 92 (Control Station).
CR-5	Lower Calcasieu River, near Channel Marker 108, downstream from Hercules effluent.
CR-5.1	Lower Calcasieu River, at Channel Marker 108, opposite shore from Hercules Incorporated discharge.
CR-11.2	Calcasieu River, south shore, south of Clooney Island just west of Lake Charles (Control Station).

TABLE 7-2

HERCULES EFFLUENT[a/]

Sodium	885	mg/l	Chromate	1.06	mg/l[b/]
Chloride	400	mg/l	Total dissolved inorganics	2,702	mg/l
Sulfate	1,490	mg/l	Dissolved oxygen	7	mg/l
Calcium	19	mg/l			
Aluminum	4	mg/l			
Titanium	3	mg/l			

a/ Data supplied by manager for environmental affairs,
b/ According to Company officials, recent improvements in treatment have reduced the chromate concentration in the effluent to 0.38 mg/l.

Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station 1.

TABLE 7-3

RESULTS OF ORGANIC ANALYSIS

Station	Parameter	Concentration (mg/l)	Load lbs/day
HER-1B	Decane	0.03	0.6
	Undecane	0.02	0.4

Both decane and undecane are aliphatic hydrocarbons that can be measured as oil and grease. These two compounds were the major extractable organics in the Hercules effluent. At the low concentrations encountered, the hydrocarbons should have little effect on the receiving water.

Evaluation of analytical data and field measurements [Table 7-4] indicates that, during the period of the survey, Hercules, Incorporated, discharged daily loads of 3.5 lbs of chromium; 5,800 lbs, COD; 1,100 lbs, TOC; 760 lbs, suspended solids; and 18 lbs of oil and grease.

Bottom sediment samples collected in the Lower Calcasieu River downstream from the Hercules discharge were primarily composed of fine sand. Approximately one percent of the sample was volatile and the OSI value was 0.01, thus confirming the inorganic nature of the settleable solids discharged by the Company [Table E-1, Appendix E].

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (December 16, 1970) discharge levels of certain materials based on data submitted by Hercules,

TABLE 7-4

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm Composite	Temp °C range	TOC mg/l	TOC lbs/day	COD[b/] mg/l	COD[b/] lbs/day	Solids Total mg/l	Solids Total lbs/day	Solids Susp mg/l	Solids Susp lbs/day
HER-1	2.12	6.9-7.2	2,400-3,200	1,960	23-30.5	62	1,100	332	5,880	1,290	22,800	43	760
CR-5		6.8-8.3		13,400	23-24	9.4, 13[c/]				8,980		16	

Sta	Oil & Grease mg/l	Oil & Grease lbs/day	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day
HER-1	1	18	<0.05	0.20	3.5	0.7	0.0124
CR-5							

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ Composite samples taken (morning and afternoon).

Incorporated. A summary of the information from the Commission files is as follows:

Date of Application:	August 19, 1970
Quantity of Discharge:	2.3 cfs
Temperature:	Ambient
Turbidity:	Approximately 100 ppm
True Color:	Less than 20 by the Hazen method
Organic Material:	8,000 lbs/day
Inorganic Materia;:	30,000 lbs/day
Toxic Material:	
Zinc Chromate	2 lbs/day discharged to Lower Calcasieu River

PROPOSED WASTE TREATMENT

Hercules, Incorporated, is constructing a new biological treatment facility that will be in operation by January 1, 1972. This new facility is designed to remove 85 percent of the organic chemicals before the effluent enters the settling ponds.

CONCLUSIONS

It is concluded that:

1. Present discharges of chromium, carbonaceous materials, and suspended solids constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC 401-413).

2. Survival studies with shrimp indicate that the stream near the Hercules facility contains toxic materials.

3. The Company is on schedule with the construction of upgraded treatment facilities.

RECOMMENDATIONS

It is recommended that:

1. The Office of Enforcement, EPA, monitor progress toward construction completion and start-up of the treatment facilities;

2. If the new treatment facilities are not in operation by April 1, 1972, consideration be given to initiating appropriate abatement actions against Hercules, Incorporated, for the discharge of chromium, carbonaceous materials, and suspended solids, to the Lower Calcasieu River, a navigable stream;

3. If the new treatment facilities are in operation by April 1, 1972, the effluent quality be examined and, if found to be inadequate, appropriate abatement proceedings be initiated;

4. The permit to be issued Hercules, Incorporated, limit discharges of BOD; COD; TOC; oil and grease; heavy metals; and total hydrocarbons to be consistent with best available treatment and the water quality standards for the Lower Calcasieu River.

OLIN CORPORATION
LAKE CHARLES, LOUISIANA

BACKGROUND INFORMATION

General

In conjunction with other chemical plants and all the major petroleum refineries, the Olin Corporation plant is a substantial contributor to the economy in the Lower Calcasieu River area. The operation is primarily involved in the production of heavy chemicals.

Olin operates this facility continuously. Between 100 and 500 persons are employed in the production operation. The major products are soda ash, ammonia, sodium nitrate, hydrazines, urea, and nitric acid. The Solvay process is used in the production of soda ash (technical grade sodium carbonate, anhydrous). The rated, daily plant capacity is 1,000 tons of soda ash; 1,400 tons, ammonia; 300 tons, sodium nitrate; 250 tons, nitric acid; 8,000 lbs, hydrazine; and 450 tons of urea.

Water Supply

Water is obtained from the Lower River for use in non-contact cooling. (No information regarding the quality of water withdrawn from the River was provided by the Company.) Water for boiler feed, domestic use, and for additional non-contact cooling, plus process water, is supplied by 13 wells, each of which is rated at 1,100 gpm (1.58 mgd).

Existing Waste Treatment

All wastewater effluents are discharged back to the River. (Company officials would not disclose either the type of treatment provided to the wastes prior to their discharge or the process from which each discharge was derived.) Nine of the ten discharges from the Olin facility are to a barge slip [Figure 8-1]. Discharge from the large tailings pond is to the River.

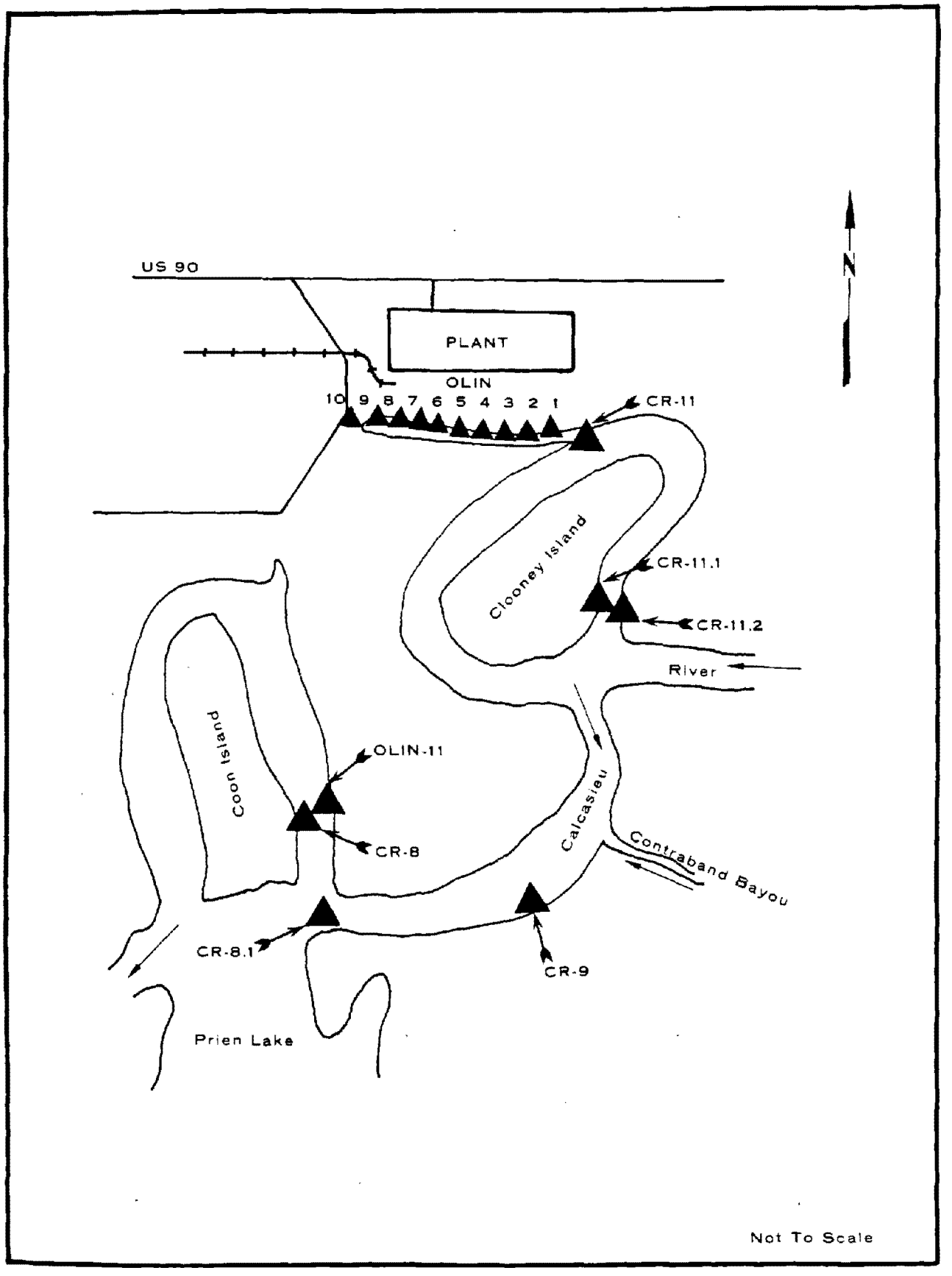

Figure 8-1. Effluent & Receiving Water Sampling Locations for Olin Corporation

Chronology of Contacts

On March 26, 1971 E. D. Anthony, Jr., enforcement programs specialist, Region VI Office, EPA, contacted L. P. Schell, technical manager of the Agricultural Division of Olin Corporation, in order to arrange a meeting with DFI-DC representatives. On March 29, M. R. Helton, of the DFI-DC staff, met with Mr. Schell. It was pointed out that, at the request of the Region VI Office, information was being collected on industrial discharges in the Lake Charles area. Mr. Schell indicated that he was not at liberty to release information. Further, he was neither cooperative nor responsive to inquiries regarding processes, raw materials, treatment of wastes, etc. Although Mr. Schell consented to conduct the EPA representative on a tour of the process area, he avoided any discussion of waste discharges -- to the extent that he would not even admit that the Olin Corporation owned a 525-acre tailings pond.

On April 16, R. D. Harp, of the DFI-DC staff contacted Mr. Schell to request permission to sample the wastewaters discharged by the Olin plant. He was provided a copy of an introductory letter, signed by the DFI-DC director, indicating the purposes of the survey.

On April 29, 1971, Mr. Schell contacted Mr. Harp to inform him that the plant effluent could be sampled. The next day (April 21) the plant was visited in order to select sampling locations. Company officials requested that they be furnished copies of the analytical results of the sampling. Mr. Harp indicated that their request should be directed to the Dallas Regional Office, EPA. Copies of the field measurement results were provided the Company immediately after the sampling was completed.

SAMPLING PROGRAM AND RESULTS

Samples were collected from the ten discharges and the water supply intake. [See Table 8-1 for a description of effluent and receiving water sampling points.] Effluent samples (125 ml aliquots) were collected every two hours and composited over a 24-hour period (except at station Olin 11, which was sampled every six hours) commencing at 8:20 a.m., April 22, 1971. Intake water (Olin 1) is apparently used for a once-through, non-contact cooling. Also, the Olin 9 discharge is assumed to be primarily cooling water.

Survival and palatability studies were conducted with white shrimp. The shrimp were exposed to the River water near discharges following methods outlined in Appendix C. [Results of these studies are shown in Appendix D.] Within six hours, shrimp placed in the River at the mouth of the Company barge canal (CR-11) acquired significant off-flavor. At the end of a 24-hour period, total shrimp mortality had occurred at this station. Similar tests conducted at Control Stations showed no significant off-flavor or off-odor and shrimp had a mortality range from 10 to 20 percent (80 to 90 percent survival).

Control Stations, CR-1 and CR-11.2 [Table 1], are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other stations. Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station 1.

Shrimp placed in the River for 6 hours near the Olin tailings pond discharge (CR-8) acquired no significant off-odor or off-flavor. A 40

TABLE 8-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
OLIN-1	Water supply intake, located north of Clooney Island and approximately 1,000 ft east of the Olin Slip entrance.
OLIN-2	Samples of the effluent from the nitrogen area collected from a 48-in. reinforced concrete pipe discharging to the Olin Slip, upstream of the Slip entrance.
OLIN-3	Samples of the water treatment effluent collected from a 2-ft concrete open rectrangular channel that is located approximately 600 ft from the Olin Slip entrance.
OLIN-4	Samples collected from a 2-ft concrete open rectangular channel located approximately 1,400 ft from the Olin Slip entrance and west of the alkali warehouse.
OLIN-5	Samples collected from a 30-in. diameter cast iron pipe located approximately 200 ft from the alkali warehouse and 1,600 ft from the Olin Slip entrance.
OLIN-6	Samples collected from a 24-in. diameter cast iron pipe located approximately 250 ft west of the alkali warehouse and 1,700 ft west of the entrance to the Olin Slip.
OLIN-7	Samples collected from a rectangular channel located approximately 300 ft west of the alkali warehouse and 1,700 ft west of the entrance to the Olin Slip.
OLIN-8	Samples collected from a 24-in. diameter reinforced concrete pipe located approximately at the same elevation as the west edge of the powerhouse and 2,000 ft west of the entrance to the Olin Slip.
OLIN-9	Samples collected from a pipe located west of OLIN-8. This constituted the major discharge (quantity) to the Olin Slip.
OLIN-10	Samples of the effluent from the hydrazine area collected from a pipe located at the west end of the Olin Slip.

TABLE 8-1 (Continued)

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
OLIN-11	Samples of the effluent collected from the Olin tailings pond discharging to the Lower Calcasieu River east of Coon Island. The discharge point is located approximately 2,000 ft north of Channel Marker #111.
CR-8	Lower Calcasieu River, east shore of Coon Island near the discharge from Olin tailings pond.
CR-8.1	Lower Calcasieu River, near Prien Lake at buoy 110.
CR-9	Lower Calcasieu River near Channel Marker 112, midway between Coon Island and Contraband Bayou.
CR-11	Lower Calcasieu River at mouth of Olin barge slip, northwest of Clooney Island.
CR-11.1	Lower Calcasieu River, north shore, south of Clooney Island.
CR-11.2	Lower Calcasieu River, south shore, south of Clooney Island, just west of Lake Charles (Control Station).
CR-1	Lower Calcasieu River near Calcasieu Landing (upstream of the intracoastal waterway) near Channel Marker 92 (Control Station).

percent shrimp mortality was recorded at this station at the end of a 24-hour survival study. The kill continued at a mortality rate of 10 to 20 percent for each additional 24-hour exposure to the River water [Appendix D]. The result was a 70 percent mortality at CR-8 at the end of a 72-hour test period. Control Stations had a mortality of 20 percent during this period. The live shrimp were left in situ until the termination of the 4-day test. High mortalities at all including Control Stations precluded the use of the 96-hour data for bioassay or taste and odor comparisons. Toxic materials contained in the Company discharges apparently contributed to shrimp mortalities at CR-8 and CR-11.

Waste loads discharged during the sampling period, not including constituents contained in the cooling water (Olin-9), were at least: 2,000 lbs of TOC; 5,200 lbs, NH_3N; 1,000 lbs, Org N; 12,300 lbs, suspended solids; 145 lbs, chromium; and 4 lbs of cadmium. [See Table 8-2.] Temperature of the effluents varied from 10° to 50°C. Total addition of heat to the receiving waters from all discharges was 1.2×10^{12} calories.

Bottom sediment samples [Table E-1, Appendix E] were taken at the mouth of the Olin Barge Slip and near the discharge from the Company tailings pond across from Coon Island. In the Slip (35 ft depth) sediments consisted of a soft mud that emitted a petrochemical odor. These sediments contained 22 percent volatile materials. However, the Organic Sediment Index (OSI) was only 1.2, indicating slowly decomposing materials. It was not possible to determine whether these materials are deposited from Company discharges or from barge leakage. Bottom sediments near the tailings pond discharge exhibited a low OSI value 0.24 and only 7.9 percent volatile

TABLE 8-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm comp	Temp °C range	TOC mg/l	TOC lbs/day	COD[b/] mg/l	COD[b/] lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day
OLIN-1		7.1-8.8	4,250-16,000	7,900	10-25	9				5,160		23	
OLIN-2	4.10	7.0-8.5	1,200-4,250	2,300	25-38	23	790	114	3,900	1,190	40,700	44	1,510
OLIN-3	0.81	7.1-10.3	1,000-15,000	4,300	40->50	1	7			2,620	17,700	99	670
OLIN-4	0.389	7.8-12.2	4,000-22,500	11,600	19-30	3	10			8,370	27,200	77	250
OLIN-5	6,358	7.2-10.6	6,500-15,000	7,200	18-32	8	425			4,540	241,000	122	6,480
OLIN-6	2.31	7.0-9.7	6,500-15,000	8,800	26-43	11	210			5,890	113,600	28	540
OLIN-7	0.036	7.4-10.0	1,000-40,000	5,700	23-42	5	2			3,750	1,130	115	35
OLIN-8	0.267	6.6-10.2	1,300-20,500	2,000	22-40	2	4			1,030	2,300	13	30
OLIN-9	15.16	7.0-9.0	6,000-15,000	8,600	15-34	10	1,270			5,580	706,400	33	4,180
OLIN-10	0.362	4.0-11.5	1,300-2,900	1,340	10-28	5	15			1,450	4,400	31	95
OLIN-11	3.19	5.9-9.0	>40,000	74,000	24-25	21	560			73,900	1,970,000	102	2,720
CR-8		7.5-8.2		8,500	22.5-24	9.4, 11[c/]				5,350		14	
CR-9		7.4-8.0		12,600	20-23	8.5, 8.8[c/]				8,420		8	
CR-11		7.6-8.5		11,000	24-25	9.5, 17[c/]				7,300		6	

VIII-7

TABLE 8-2 (Continued)

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS

Sta	Org N		NH_3-N		Cadmium		Chromium		Mercury		Copper		Lead	Nickel	Aluminum
	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	µg/l	lbs/day	mg/l	lbs/day	mg/l	mg/l	mg/l
OLIN-1	7.00		3.44		<0.05		0.04		<0.1		<0.02		0.1	<0.2	<0.5
OLIN-2	11.50	394	75.6	2,590	<0.05		4.0	140	0.2	0.0069	<0.02		<0.1	<0.2	<0.5
OLIN-3	6.44	40	21.6	145	<0.05		<0.01		0.4	0.0027	<0.02		<0.1	<0.2	<0.5
OLIN-4	4.76	15	438	1,420	<0.05		<0.01		2.7	0.0088	0.08	0.3	<0.1	<0.2	<0.5
OLIN-5	7.28	390	12.7	675	<0.05		0.02	1.1	3.9	0.2071	<0.02		<0.1	<0.2	<0.5
OLIN-6	8.12	160	13.6	260	<0.05		0.02	0.4	0.1	0.0019	<0.02		<0.1	<0.2	<0.5
OLIN-7	48.2	15	156	45	<0.05		0.02	0.01	0.2	0.0001	<0.02		<0.1	<0.2	<0.5
OLIN-8	6.16	15	2.1	5	<0.05		<0.01		0.1	0.0002	<0.02		<0.1	<0.2	<0.5
OLIN-9	10.1	1,280	6.3	800	<0.05		0.04	5	0.1	0.0127	<0.02		<0.1	<0.2	<0.5
OLIN-10	6.16	20	5.18	16	<0.05		<0.01		0.6	0.0018	<0.02		<0.02	<0.2	<0.5
OLIN-11			3.22	85	0.15	4	0.10	3	0.1	0.0027	0.17	4.5	d/	d/	<0.5
CR-8															
CR-9															
CR-11					<0.05		0.05		2.7		<0.02		<0.1		<0.5

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were performed when TOC values exceeded 20 mg/l.
c/ Two composites taken (morning and afternoon).
d/ Interference by standard atomic absorption procedure, completion of data dependent on development of an alternate method of analysis.

material, thus indicating that the solids discharged are primarily inorganic in nature.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

Olin Corporation submitted an application [August 24, 1970] to the Louisiana Stream Control Commission for approval of waste discharge levels of certain materials. The total quantity of flow discharged through eleven sources was to be 29.83 cfs with an inorganic load of 2,847,210 lbs/day. The Commission reviewed the application and returned the data to the Company for submission of more information. [A summary of the present information pertaining to waste discharges on file with the Louisiana stream Control Commission is contained in Table 8-3.]

PROPOSED WASTE TREATMENT

There was no information provided by Company officials on a proposed treatment program at this industry.

CONCLUSIONS

It is concluded that:

1. Discharges to the Lower Calcasieu River, of chromium, cadmium, nitrogenous materials, carbonaceous materials, suspended solids, and heat, by the Company plant constitute violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. Survival studies with shrimp indicate that the stream near the Olin facility contains toxic materials.

3. At no time during the course of the investigation was there any indication that the Company plans to initiate or improve treatment of the liquid wastes which are presently being discharged.

TABLE 8-3

OLIN CORPORATION DISCHARGE COMPOSITION LEVELS SUBMITTED TO
LOUISIANA STREAM CONTROL COMMISSION

Sewer	Quantity of Discharge, cfs	Temperature °F	Turbidity, ppm SiO_2	True Color Units	Inorganic Material		Toxic Materials			
							CrO_4		NH_3	
					lbs/day	ppm	lbs/day	ppm	lbs/day	ppm
1	No information available on this discharge									
2	2.0	93	41	93	2,850	2,652	176	16	336	31
3	0.8	149	10	12	48,500	10,226				
4	0.82	95	46	9	20,540	4,647				
5	0.11	95	98	9	200	337	7	12		
6	1.74	107	3	9						
7	1.34	107	500	5	1,300	180				
8	0.45	93	4	7						
9	13.6	96	2	9						
9B	0.17	83	19	3	60	67				
10	0.17	83	19	3	60	67				
11*	8.5	ambient	9	6	2,772,000	60,000			600	13

Note: All of the above permits except for Sewer #11 indicated no treatment with direct discharge of effluent to the Lower Calcasieu River via a privately owned boat slip.

* Sewer #11 discharges to a 525-acre treatment pond and then to the Lower Calcasieu River.

RECOMMENDATIONS

It is recommended that:

1. Appropriate proceedings be initiated immediately against the Olin Corporation to abate the present daily discharge to the Calcasieu River, a navigable stream, of 2,000 pounds of carbonaceous material; 7,500 pounds, nitrogenous materials; 12,300 pounds, suspended solids; 4 pounds, cadmium; 145 pounds of chromium; and 1.2×10^{12} calories of heat.

2. The discharge permit to be issued by the Corps of Engineers limit discharges of BOD, COD, TOC, suspended solids, heavy metals, and heat, to levels consistent with applicable water quality standards and best available treatment.

LAKE CHARLES FACILITY
OF
PPG INDUSTRIES, INCORPORATED

BACKGROUND INFORMATION

General

In conjunction with other chemical plants and petroleum refineries on the Lower Calcasieu River, PPG Industries, Incorporated contributes significantly in supporting the economy of the area. The PPG operation is involved primarily in the production of heavy chemicals (both organic and inorganic).

PPG Industries, a subdivision of the parent corporation, PPG Industries, Incorporated, of Pittsburgh, Pennsylvania, is located in the Lake Charles-Westlake-Sulphur area of Louisiana.

The core area of the plant was built in 1942, with additions made in 1955. A sulfide plant expansion was completed in 1970. Various process changes were made in the period 1960 to 1970. This facility produces chlorine, caustic soda, aliphatics, chlorinated hydrocarbons, silica pigments, sodium chlorate, and hydrochloric acid. The raw materials used in the process are salt (sodium chloride) and ethylene. In addition, significant amounts of mercury are used in the production of chlorine by mercury cell process. The rated daily capacities of the chlorine and caustic plants are 1,500 tons of chlorine and 1,650 tons of sodium hydroxide. Approximately nine employees are involved, to a significant extent, in water pollution control at this facility.

Water Supply

Water is obtained from the Lower Calcasieu River for non-contact cooling (290-300 mgd) and from 12 wells for process, sanitary service, and some additional non-contact cooling water. The wells have a rated capacity of 750 to 2,000 gpm (1.05 to 2.88 mgd).

Existing Waste Treatment

Five outfalls discharge liquid wastes from PPG operations to an open channel that is approximately 50 feet wide and two and one-half miles long [Figure 9-1]. Company officials refer to the channel as the "oxidation ditch". The once-through cooling water from the electrical power generating plant is discharged to a ditch along with wastes from the silica pigment plant, the organics plant, the caustic plant, and a mercury reduction cell. Total flow in the "ditch", according to Company officials, is about 290 mgd.

Wastewater from the silica pigment plant flows through an open channel to the "ditch". The bottom of this channel consists of a chalkish white sandy material. Company officials maintain that this material is natural sand, not sediment from discharge.

A mercury reduction cell was recently constructed and placed in operation. The effluent from the cell is discharged into the "ditch".

The "oxidation ditch" flows through a tidal area to Bayou d'Inde and was observed several times during the survey to be flooded until the "ditch" was indistinguishable. This tidal condition markedly reduces any effectiveness, as a treatment facility, that the "ditch" might otherwise exert.

Three additional waste streams from the anhydrous caustic operation, the sodium chlorate plant, and the chlorate recovery system, discharge directly to Bayou Verdine. These discharges receive no treatment prior to discharge. Once-through cooling water from a second power plant is also discharged to Bayou Verdine.

Chronology of Contacts

On March 26, 1971, J. L. Hatheway and M. R. Helton of the Division of

IV-72

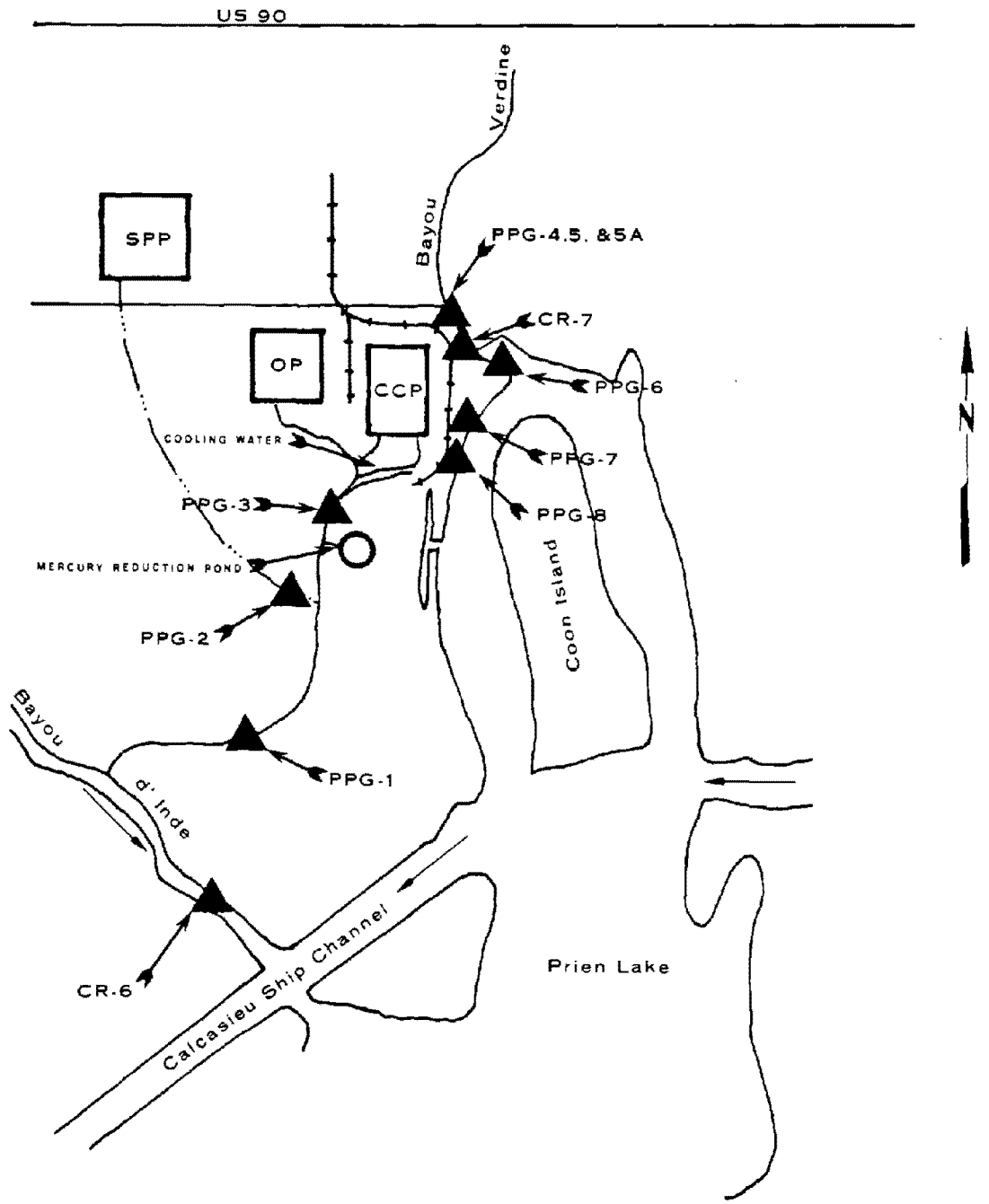

Figure 9-1. Effluent & Receiving Water Sampling Locations for PPG Industries Incorporated

Field Investigations-Denver Center, EPA, met with W. B. Graybill, Plant Manager, and Pete Burns, environmental control specialist for PPG Industries, to initiate an industrial waste inventory of this plant. E. D. Anthony, Jr., enforcement programs specialist, EPA Region VI, had made arrangements on March 23 with Mr. Burns for the meeting. He and Mr. Graybill provided the information requested and conducted a tour of the plant area.

Throughout the interview, Mr. Burns was cooperative and provided answers to all questions posed by the investigating team. However, the DFI-DC investigators were not permitted to take photographs within the plant property.

On April 15, 1971, R. D. Harp and Mr. Hatheway met with Mr. Burns to discuss the EPA industrial wastewater sampling program in the Lake Charles area, specifically the waste source evaluations and water quality investigations that were being conducted in the Calcasieu River Basin.

Mr. Burns consented to the sampling of PPG Industries effluents.

SAMPLING PROGRAM AND RESULTS

Wastewater samples were collected from all nine discharges within the PPG Industries complex. Survival studies employing native, white shrimp were conducted on Bayou d'Inde and Bayou Verdine downstream of the effluents. Sediment samples were also collected from Bayou Verdine and Bayou d'Inde downstream from the effluents as well as from the "oxidation ditch" upstream from Bayou d'Inde. [In Table 9-1 is a description of the stations where effluent and streams were sampled.]

Aliquots (750 ml) from the "oxidation ditch" were composited every four hours for a 24-hour period, commencing at 6:20 a.m., April 26. Composites, consisting of 125 ml aliquots, were taken from the other effluents

TABLE 9-1

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
PPG-1	Samples collected from the effluent canal at a bridge on Mobil Road #2 just downstream of I-210 Bridge (flow est., 300 mgd).
PPG-2	Samples collected of the effluent from the pigment plant at the point where the flow drains through a culvert under Mobil Oil Company service road.
PPG-3	Samples collected from the effluent canal downstream from the point where the organics plant and caustic plant discharges join and upstream from the point where the cooling water discharge enters.
PPG-3A	Samples collected of the effluent from the organics plant at the culvert under the Mobil Oil Company service road.
PPG-4	Samples collected from a 72-inch sewer that discharges wastewater from the anhydrous caustic plant and cooling water from the chlorine and chlorate recovery systems into Bayou Verdine.
PPG-5	Samples collected from the north 54-inch sewer that discharges wastewater from the sodium chlorate and caustic plants into Bayou Verdine.
PPG-5A	Samples collected from the south 54-inch sewer that discharges wastewater from the sodium chlorate and caustic plants into Bayou Verdine.
PPG-6	Samples collected of the cooling water effluent from power Plant A as it discharges into the Barge Slip at the mouth of Bayou Verdine.
PPG-7	Samples collected of the cooling water intake (power Plant A) at a hose bib. Source, Lower Calcasieu River.
PPG-8	Samples collected of the cooling water intake (power Plant B) at a hose bib. Source, Lower Calcasieu River.
CR-1	Lower Calcasieu River near Calcasieu Landing (upstream from the intracoastal waterway) near Channel Marker 92 (Control station).
CR-6	Bayou d'Inde at a gas line crossing about 1,000 yards southeast of PPG discharge canal.

TABLE 9-1 (Continued)

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CR-7	Bayou Verdine northwest of Coon Island.
CR-11.2	Calcasieu River, south shore, south of Clooney Island, just west of Lake Charles (Control station).

during the same period. One effluent grab sample was collected at Stations PPG-4 and 7, at 5:30 a.m. and 8:50 a.m., respectively, on April 19 for oil and grease analysis. [Results of this sampling are shown in Table 9-2.] An additional grab sample was collected for specific organics analyses from Station PPG-3A at 6:50 a.m. April 26 [Table 9-3].

TABLE 9-3

RESULTS OF ORGANIC ANALYSIS

Compounds Identified	Concentration (mg/l)	Load lb/day
1, 1, 2, 2-Tetrachloroethane	2.2	95
1, 1, 2-Trichloroethane	5.4	240

These two polychlorinated ethanes were the major extractable organics present in the effluent sample. Other compounds were present in lower concentration, but were not identified. These compounds are fat soluble and are likely to accumulate in the environment much as other chlorinated hydrocarbons, i.e., chlorinated pesticides, and polychlorinated biphenyls do. Because food chain magnification can increase the concentration of these compounds to what may be toxic levels, their discharge must be considered as hazardous to the receiving waters, i.e., an aquatic environment.

Calculations based upon analytical data for stations PPG-1, 4, 5, 5A, and 6, minus stations PPG 7 and 8, indicate that this industry discharged, during the period of the study, net loads of at least 0.50 lbs of mercury; 600 lbs, TOC; 31,000 lbs of suspended solids; and 9.2×10^{12} of heat [Table 9-3].

Survival studies made with shrimp at stations CR-6, CR-7, and at the Control Stations, followed methods outlined in Appendix C. The first shrimp

TABLE 9-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm comp	Temp °C range	TOC mg/l	TOC lbs/day	Solids total mg/l	Solids total lbs/day	Solids susp mg/l	Solids susp lbs/day	Oil & Grease mg/l	Oil & Grease lbs/day
PPG-1	290[b/]	6.2-7.6	10,000-13,000	11,000	30-32	13	31,500	7,070	17,120,000	32	77,500		
PPG-2	2.22		7,500-19,500	8,600	39-42	18	330	7,030	130,090	887	16,400		
PPG-3	74.1	6.3-7.2	10,200-14,500	10,450	32-34	12	7,430	6,800	4,207,000	22	13,600		
PPG-4	1.3	7.1-9.8	600->80,000	16,000	26-30	6.2	70	9,700	105,300	138	1,500	1	11
PPG-5	}	6.8-8.9	9,000-15,000	11,400	31-34	10	}	7,760	}	32	}		
	}5.9[c/]						}490		}364,000[d/]		}14,500[d/]		
PPG-5A	}	6.8-11.3	10,000-17,000	10,800	35-40	10	}	7,220	}	428	}		
PPG-6	0.743	7.2-8.1	6,000- 9,000	1,150	28-30	5.4	35	4,620	28,700	17	105		
PPG-7	}	6.8-7.5	5,600-14,500	10,800	24-26	16	}	7,060	}	31		1	
	}300[b,c/]						}32,600[e/]		}6,750,000				
PPG-8	}	6.5-8.0	10,000-14,000	9,500	24-26	11	}	6,350	}	19			
CR-6		7.4-7.8		10,100	24-26	10, 9.9[f/]		6,430		14			
CR-7		6.2-6.8		10,200	35-36	5.4, 7.6[f/]		6,550		34			

a/ Analytical procedures are outlined in Appendix F.
b/ Flow estimated by Company officials.
c/ Summation of the two indicated stations.
d/ Based on estimated flow of each discharge.
e/ Based on average concentration.
f/ Two composite samples taken (morning and afternoon).

TABLE 9-2 (Continued)

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS

Sta	Cadmium mg/l	Chromium mg/l	Chromium lbs/day	Mercury µg/l	Mercury lbs/day	Copper mg/l	Copper lbs/day	Lead mg/l	Aluminum mg/l
PPG-1	<0.05	<0.01		0.4	0.9700	0.02	48	<0.1	
PPG-2	<0.05	0.09	2	<0.1					
PPG-3	<0.05	0.10	62	1.0	0.6187				
PPG-4	<0.05	<0.02		<0.1					
PPG-5	<0.05	<0.02		0.1	}				
					}				
					}0.0080[e/]				
					}				
PPG-5A	<0.05	<0.02		0.2	}				
PPG-6	<0.05	<0.02		0.2					
PPG-7	<0.05	<0.02		0.2	}	<0.02		<0.1	
					}				
					}0.4800				
					}				
PPG-8	<0.05	<0.02		0.2	}	<0.02		<0.1	
CR-6	<0.05	<0.02		3.4		0.02		<0.1	0.6
CR-7	<0.05	<0.02		1.5		0.02		<0.1	<0.5

mortalities occurred within 20 minutes; a 100 percent mortality occurred within six hours [Appendix D]. Floating sludge, gas bubbles, and an odor similar to hydrogen sulfide characterized Bayou d'Inde during the biological survey. These conditions deteriorated as barge traffic stirred decomposing sludge from the Bayou bottom. Shrimp placed in the Bayou water were immediately in distress. Mortalities were probably caused by sulfide toxicity, but other toxic substances discharged from other industrial sources and/or PPG Industries or low dissolved oxygen levels may have caused the shrimp kill. Total mortality during the 6-hour test precluded taste and odor or extended survival studies. No shrimp mortalities occurred at Control Stations CR-1 and CR-11.2 during this 6-hour study.

These stations [Table 9-1] are located in the Lower Calcasieu River so as to have the least possible contamination from industrial wastes. Station CR-1 is located downstream from industrial discharges and closer to the Gulf of Mexico than are all the other stations. Station CR-11.2 is located upstream of most industrial discharges and has water with lower salinity levels than has Station 1.

Shrimp displayed shock as they were placed into submerged baskets in the 35.5°C River water near the industrial discharge from PPG Industries. After a 30-minute exposure, a 40 percent shrimp mortality was recorded as the stream temperature rose to 38°C [Appendix D]. Within 6 hours a 100 percent mortality occurred. The dead shrimp had a pinkish discoloration. The heated industrial discharges appeared to cause the distress and subsequent mortality to shrimp at this River location.

Bottom sediment samples were collected in the PPG wastewater canal and

in Bayou d'Inde at a point about 1,000 yards downstream from the mouth of the canal. The sediment in the canal was found to be composed primarily of sand, clay, and perhaps stable sludge with an OSI value of only 0.2. However, in Bayou d'Inde downstream from the canal, the bottom sediments were composed of soft black mud with a chemical odor. The OSI value was found to be 6.6, indicative of an actively decomposing sludge [Table E-1, Appendix E].

A bottom sediment sample, collected near the mouth of Bayou Verdine, was composed of soft brown mud having a chemical odor. Although 13 percent of the sample was volatile at 600°C, the OSI value was relatively low, 0.3.

Sediment samples were analyzed for mercury content. In the PPG Industries canal, sediments contained 0.3 µg/g mercury. However, sediments in Bayou d'Inde contained high levels of mercury. Downstream from the canal, the concentration was 6.0 µg/g mercury; upstream, the level was 2.0 µg/g; and farther upstream, above all major industrial discharges, the concentration was 1.7 µg/g mercury. At the mouth of Bayou Verdine, the mercury concentration was 1.7 µg/g in the bottom sediment.

DATA REPORTED TO LOUISIANA STREAM CONTROL COMMISSION

The Louisiana Stream Control Commission approved (October 29, 1969 and August 13, 1970) discharge levels of certain materials based on data submitted by PPG Industries, Incorporated. [A summary of the information from the Commission files is tabulated in Table 9-4.] The total discharge for these three sewers is 297.027 mgd, which is equivalent to 460 cfs.

Further, PPG Industries has filed a permit application with the Corps of Engineers requesting permission to discharge mercury to a navigable water.

TABLE 9-4

PPG INDUSTRIES DISCHARGE LEVELS APPROVED
BY LOUISIANA STREAM CONTROL COMMISSION

Parameter	Sewer #1 (PPG-1)	Sewer #2 (PPG-6)	Sewer #3 (PPG-4, 5, 5A)
Flow discharged, mgd	288.985	0.926	7.116
Water body receiving discharge	Bayou d'Inde	Bayou Verdine	Bayou Verdine
Organic material, lbs/day	2,411,582	7,725,000	59,379,000
Inorganic materials, lbs/day			
$CaCl_2$	68,826 lbs/day equivalent to 28.5 ppm.		
$CACO_3$	17,302 lbs/day equivalent to 7.2 ppm.		
Cr_4	73 lbs/day equivalent to 0.03 ppm.		
Hg	34 lbs/day equivalent to 0.014 ppm.		
NaCl	1,380,417 lbs/day equivalent to 572.3 ppm.	279 lbs/day equivalent to 36.1 ppm.	59,613 lbs/day equivalent to 1003.9 ppm.
$NaCO_3$	16,518 lbs/day equivalent to 6.9 ppm.		
Na_2SO_4	91,416 lbs/day equivalent to 37.9 ppm.	27 lbs/day equivalent to 3.5 ppm.	
PO_4	113 lbs/day equivalent to 0.05 ppm.		
SIO_2	19,328 lbs/day equivalent to 8.0 ppm.		
Organics	10,146 lbs/day equivalent to 4.2 ppm.		
Carbon	2,160 lbs/day equivalent to 0.90 ppm.		288 lbs/day equivalent to 3.8 ppm.
Asbestos	1,080 lbs/day equivalent to 0.45 ppm.		

PROPOSED WASTE TREATMENT

Company officials indicated that no additional treatment facilities are proposed for the next five years.

CONCLUSIONS

It is concluded that:

1. Present practices permit the discharge of mercury, carbonaceous materials, suspended solids, aromatic hydrocarbons, and heat, constituting violations of Section 407, Rivers and Harbors Act of 1899 (33 USC: 401-413).

2. No additional treatment facilities to correct present conditions are planned by the Company.

RECOMMENDATIONS

It is recommended that:

1. Consideration be given to initiating appropriate abatement proceedings against the Lake Charles facility of PPG Industries for discharging inadequately treated industrial wastes containing net daily loads of 0.50 pounds of mercury; 600 pounds of carbonaceous materials; 3,100 pounds of suspended solids; 9.2×10^{12} calories of heat; 95 pounds of tetrachloroethane; and 240 pounds of trichloroethane, to the Calcasieu River, a navigable stream.

2. The discharge permit, to be issued by the Corps of Engineers, limit discharges of heavy metals, BOD, COD, TOC, complex organics, suspended solids, and heat, to levels consistent with best available treatment and the water quality standards for the Lower Calcasieu River.

MISCELLANEOUS INDUSTRIES IN THE CALCASIEU RIVER DRAINAGE

BACKGROUND INFORMATION

General

During the period March 22 through April 13, 1971, investigators from DFI-DC, EPA, evaluated wastewater treatment and disposal practices of industries in the Lake Charles, Louisiana area. Findings and recommendations pertaining to the industries that were discharging significant amounts of liquid wastes have been presented in individual sections of this report. The discussion in this section covers industries that were either not operating or were discharging negligible amounts of waste at the time of the investigations [Table 10-1].

These firms are:

1) Gulf Coast Aluminum Corporation;

2) Gulf Menhaden Company;

3) Gulf States Utilities - Roy S. Nelson Power Station;

4) HDE, Incorporated;

5) International Paper Wood Preserving Division - De Ridder Plant;

6) Louisiana Menhaden Company;

7) Ocean Protein, Incorporated;

8) Tenneco Chemicals, Incorporated - Newport Division;

9) Vancouver Plywood Company, Incorporated - Oakdale Plywood Plant.

Officials of Gulf States Utilities; HDE; International Paper; Tenneco Chemicals, Incorporated; and Vancouver Plywood Company were contacted in order to discuss the industrial wastewater sampling program that DFI-DC was carrying out in the Calcasieu River Basin. Officials of these companies were interviewed in a manner similar to that with officials of the larger

TABLE 10-1

INVENTORY OF MISCELLANEOUS INDUSTRIES IN THE CALCASIEU RIVER DRAINAGE

Name, Address and Contact of Industry	Raw Materials	Products	Present Treatment	Remarks
Gulf Coast Aluminum Corporation Lake Charles, Louisiana C. L. Keigley	green petroleum coke Al_2O_3	carbon electrodes aluminum	coagulation - sedimentation	This industry is currently under construction. Little wastewater discharge at time of survey. No samples taken.
Gulf Menhaden Co. Cameron, Louisiana W. Saltzman, Plant Manager	Menhaden fish	oil feed fertilizer	none	Not in operation during the time of the survey.
Gulf States Utilities Roy S. Nelson Power Station Lake Charles, Louisiana Pat Brady and Cliff Chambers	natural gas oil standby	electricity	holding pond	
HDE, Incorporated Oakdale, Louisiana Bill Corbin	logs	hardwood lumber furniture	none	No wastewater treatment required on this discharge.
International Paper Wood Preserving Division De Ridder Plant De Ridder, Louisiana Mr. Burchfield, Plant Manager	wood creosote pentachlorophenol	wood preservation	oxidation ponds to holding ponds	Company is considering construction of additional treatment facilities. No discharge during the time of the survey. Discharge is during periods of high flow in the receiving stream.

X-2

TABLE 10-1 (Continued)

INVENTORY OF MISCELLANEOUS INDUSTRIES IN THE CALCASIEU RIVER DRAINAGE

Name, Address, and Contact of Industry	Raw Materials	Products	Present Treatment	Remarks
Louisiana Menhaden Company Lake Charles, Louisiana H. C. Dickens, Plant Manager	Menhaden fish	oil meal scrap solubles	complete retention	Not in operation during the time of the survey.
Ocean Protein, Incorporated Cameron, Louisiana Mr. Dassinger, Plant Manager	Menhaden fish	feed meal	none	Not in operation during the time of the survey.
Terneco Chemicals, Incorporated Newport Division Oakdale, Louisiana E. G. Fleming, Plant Manager	crude tall oil crude sulfate - turpentine	rosin vegetable fats turpines	oxidation pond	The oxidation pond is large enough to store wastewater for one year. There was no discharge at the time of the survey. Company discharges wastewater from oxidation pond during periods of high flow in the receiving stream. Company is planning construction of a new wastewater treatment facility in the near future.
Vancouver Plywood Company, Incorporated Oakdale Plywood Plant Oakdale, Louisiana Bill Corbin	logs glue resin	soft plywood	Complete retention of all wastewaters, except a small amount of non-contact cooling water.	

industries whose discharges have been described in previous sections.

The three Menhaden plants (Gulf Menhaden Company, Louisiana Menhaden, and Ocean Protein, Incorporated) and Gulf Coast Aluminum were not in operation during this survey. (It would be appropriate to conduct a sampling program at these plants when they are in operation. The normal operating period is from May through October; however, it varies from year to year.) Louisiana Menhaden and Ocean Protein, Incorporated, have no domestic or industrial wastewater treatment facilities at present.

Gulf Coast Aluminum is a new industry and had, at the time of the EPA investigation, been in operation for only two months. Owing to operational difficulties the plant had not been able to maintain production. The major portion of the plant's industrial wastewater is expected to originate in the process air scrubbing in the aluminum reduction operation. This wastewater, containing calcium fluoride and aluminum particles, will pass through settling ponds prior to discharge to the Lower Calcasieu River.

Discussion

Sampling of effluents included single grab samples and 24-hour composites. [These sample results are summarized in Table 10-2.]

Survival studies were conducted on the Lower Calcasieu River near the discharge from Gulf Coast Aluminum Corporation. Sediment samples from the Lower River, downstream from the Gulf Coast Aluminum discharge, were also collected. [In Table 10-3 is a description of the effluent and sampling stations.]

During the time of the survey, International Paper's Wood Preserving Division and Tenneco Chemicals, Incorporated, were not discharging wastewater. These two industries store water in holding ponds during low stream

TABLE 10-2

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS[a/]

Sta	Date	Type	Flow mgd	pH range	Conductivity µmhos/cm range	Conductivity µmhos/cm comp	Temp °C range	TOC mg/l	COD[b/] mg/l	Solids mg/l total	Solids mg/l susp	Oil & Grease mg/l
CR-1	4/25	Grab						8.8, 11[c/]		11,200	17	
TEN-1	4/15	Grab		7.4		2,000	18.5	430	1,300	1,720	132	177
IPC-1	4/19	Grab		7.0-7.4	90-165	230	20-27	130	460	599	188	26
HDE-1	4/19-4/20	[d/] Composite- 2 hr. interval				136		31	100	212	78	
VAN-1	4/19-4/20	Composite- 2 hr. interval		7.0-8.2	180-280	250	20-24	13		252	54	
GSU-1	4/22-4/23	Composite- 6 hr. interval		7.1-7.3	580-850	450	22-24			320	24	
GSU-2	4/22-4/23	Composite- 6 hr. interval	4.31	7.1-7.2	1,200-1,700	1,480	28-32			914	24	

a/ Analytical procedures are outlined in Appendix F.
b/ COD analyses were made when TOC values exceeded 20 mg/l.
c/ Two composite samples taken (morning and afternoon).
d/ All composites are 24 hours.

X-5

TABLE 10-2 (Continued)

SUMMARY OF ANALYTICAL RESULTS AND FIELD MEASUREMENTS

Sta	Cadmium mg/l	Chromium mg/l	Mercury µg/l	Copper mg/l	Lead mg/l
CR-1	<0.05		3.9		<0.1
TEN-1					
IPC-1	<0.05	<0.01	0.1	0.04	0.1
HDE-1	<0.05	<0.01	<0.1		
VAN-1	<0.05	<0.01	<0.1		
GSU-1	<0.05	<0.01	0.4	0.07	<0.1
GSU-2	<0.05	<0.01	0.6	0.21	<0.1

TABLE 10-3

DESCRIPTION OF EFFLUENT AND RECEIVING WATER SAMPLING POINTS

Station Number	Description and Remarks
CR-1	Calcasieu River near Calcasieu Landing (above intracoastal waterway) near Channel Marker 92.
CR-1.1	Devil's Elbow Coral (Gulf Aluminum Channel), at Channel Marker 4.
CR-1.2	Devil's Elbow Canal at the industrial discharge canal of Gulf Coast Aluminum.
TEN-1	Sample collected at the treatment pond effluent weir bos of Tenneco Chemicals, Incorporated at Oakland, Louisiana. Wastewater is discharged only during periods of high water flow in the Calcasieu River. There was no discharge during the survey.
IPC-1	Samples collected from a point near the outfall of the last treatment pond of Internation Paper Company, De Ridder, Louisiana. These ponds discharge only during periods of high water flow within Palmetto Creek (a tributary to Bundick Creek). There was no discharge from these ponds during the survey.
HDE-1	Samples from HDE, Incorporated, Oakdale, Louisiana, Collected near a pump house adjacent to their old wood burning yard, prior to entering the Calcasieu River. Unable to measure flow due to insufficient quantity of wastewater.
VAN-1	Samples collected of cooling water effluent at a bridge approximately one-half mile south of the Oakdale Plywood plant of Vancouver Plywood Company. Unable to measure flow due to insufficient quantity of water.
GSU-1	Cooling water supply from the Houston River of Gulf States Utilities. Samples collected at the intake pump.
GSU-2	Cooling water effluent to the Houston River of Gulf States Utilities.

flow periods and make discharges at a given rate during high flow periods. Grab samples were collected from the holding ponds for the purpose of obtaining estimates of the quality of the effluent that is released during high flow into the receiving waters (Palmetto Creek and Upper Calcasieu River, respectively). The analytical results indicate that the effluents stored in the holding ponds contain large quantities of oil and grease, solids, and COD.

Wastewater discharges from HDE and the Vancouver Plywood Company were negligible, containing only small amounts of pollutant materials.

Gulf States Utilities uses water from the Houston River for once-through cooling. The plant returns this water to the River through a large settling pond.

Shrimp placed in the canal adjacent to Gulf Coast Aluminum (Station CR-1.2), after six hours had acquired no significant off-odor or off-flavor [Appendix D].

Survival bioassays, also conducted in the canal (Stations CR-1.2 and CR-1.1) adjacent to the aluminum company, showed no significant mortality after 24 hours when compared to shrimp located at the Control Stations (CR-11.2 and CR-1). Longer term bioassay results were not obtained because baskets of shrimp at these two canal stations (CR-1.2 and CR-1.1) were damaged or lost between the 24- and 48-hour examinations.

RECOMMENDATIONS

It is recommended that: Officals of the Louisiana Wildlife and Fisheries Commission be requested to notify the Office of Enforcement, EPA, when the Calcasieu River Basin area facilities of International Paper

Company, Tenneco Chemicals, Incorporated, and Gulf Coast Aluminum Corporation resume operation and/or begin discharging industrial effluents so that waste treatment and disposal practices by these industries may be evaluated by the Division of Field Investigations-Denver Center.

ANCILLARY SAMPLING FOR MERCURY

GENERAL INFORMATION

Earlier investigations in the Lake Charles area, by various State and Federal agencies, have shown that fish and other aquatic life contain high concentrations of mercury. As a result of these earlier investigations, pressure was brought to bear upon local industries to eliminate discharges of mercury. PPG Industries recently installed a mercury treatment cell that reduces daily discharge loads of mercury from 14.4 to 0.50 lbs.

More recent studies indicate that aquatic life in both the Upper and Lower Calcasieu River continues to contain significant concentrations of mercury in flesh and viscera.

Because of this fact, ancillary sampling of streams, bottom deposits, and sewage treatment plant effluents, was carried out at the time of the industrial waste treatment evaluations in order to identify sources of the mercury.

Seven municipal wastewater treatment facilities were investigated. Contacts with a superintendent or chief operator were made at each plant. These officials were advised that the information was being gathered in conjunction with a water quality survey of the Calcasieu River Basin.

Four of the plants (Lake Charles A, Lake Charles B and C, Westlake, and Sulphur Southside) were sampled over a 24-hour period, commencing on April 27, primarily to determine the existence of any mercury discharges. Aliquots based upon flow were composited at 6-hour intervals. These four plants represent about 95 percent of the sewage flow in the Lake Charles area. [The information collected at each plant is recorded in Table 11-1.]

Both water and sediment were collected in the receiving waters below the Lake Charles and Westlake wastewater treatment plants.

TABLE 11-1

MUNICIPAL WASTE SOURCES IN THE LAKE CHARLES, LOUISIANA AREA

Treatment Facility	Sampling Location	Receiving Water	Type of Treatment	Pop. Served	Design Flow MGD	Flow MGD	Cond Range µmhos/cm	Temp °C range	Total Solids lbs/day	Susp Solids lbs/day	Mercury lbs/day
Lake Charles Plant A LCWTF-A	At Parshall flume just after final clarifiers	Calcasieu River	Conventional Activated	55,000	6.0	4.5	1,000-1,250	24-25	31,800	340	0.026
Lake Charles Plants B and C LCWTF-B&C	Just after chlorine contact chamber at weir	Contraband Bayou	Conventional Activated Sludge (Plant B) High Rate Activated Sludge (Plant C)	25,000	6.2	3.0	840-1,700	24-25	28,500	1,400	0.010
Sulphur South Side Plant SSWFF	At end of 24" outfall line	Drainage to Bayou d'Inde	Trickling Filter	10,000	(est.) 1.0	(est.) 1.0	600-1,200	23-24.5	3,700	280	0.008
Westlake WWTF	Effluent from chlorine contact chamber	Bagdad Bayou	Trickling Filter	4,000	(est.) 0.7	(est.) 0.8	650-1,800	22-24.5	3,700	300	0.003
Greenwich Terrace Lake Charles	None	Kayauchbee Creek to English Bayou	Trickling Filter	2,000	(est.) 0.200						
Maplewood	None	Maple Fork to Bayou d'Inde	Conventional Activated Sludge	500	Unknown	Unknown					
Sulphur Rosepark Subdivision	None	Bayou d'Inde	Trickling Filter	5,000	Unknown	Unknown					

SAMPLING PROGRAM AND RESULTS

The total mercury discharged by the four plants was approximately 0.05 lbs per day, with 50 percent of this amount being discharged by Lake Charles Plant A. [Results of the effluent sampling at the four plants are contained in Table 11-1. Mercury concentrations in the water and sediment samples taken from the receiving waters, along with other constituents, are recorded in Table 11-2.]

Sediment samples from Contraband Bayou, downstream from Lake Charles Plants B and C, gave evidence of gross degradation. The black, soft mud, containing 31 percent volatile material, produced the highest OSI value (13) recorded in the Lake Charles area and can be characterized only as a very actively decomposing sludge. The mercury concentration in this sludge was 2.6 µg/g (dry weight basis).

Bottom mud from the Calcasieu River, downstream from the discharge from Plant A (Station CR-15), contained much less volatile material (17 percent) than in Contraband Bayou. Since the River is a much larger body of water than is the Bayou, sludge discharged by Plant A would naturally be dispersed over a larger area. The OSI value of 1.9 was considerably lower than the OSI value from the mud in Contraband Bayou and represents more moderate quantities of decaying sludge. The mercury content of this sludge was 1.7 µg/g.

About one mile upstream, the Westlake treatment plant discharges to Bagdad Bayou. The sludge at the mouth of this bayou had an OSI value of 0.56, with an organic carbon and organic nitrogen content of 3.55 percent and 0.16 percent, respectively. These numbers are indicative of a sludge

TABLE 11-2

SUMMARY OF THE ANALYTICAL RESULTS AND FIELD MEASUREMENTS
AT SELECTED STATIONS BELOW MUNICIPAL WASTEWATER DISCHARGES

Sta No	Description	Type Sample	pH[a] range	Cond[a] µmhos/cm range	Temp[a] °C range	TOC[a] mg/l	Org C %	Org N %	OSI	Volatile %	Solids mg/l Total	Solids mg/l Susp	Metals Mercury
CR-10	Contraband Bayou, just downstream from Lake Charles wastewater treatment plant (B & C) discharge	water (4/25/71)	6.9-7.5	7,500-7,600	24-25	12.5					4.700	18	
		sediment					7.46	1.79	13	34			2.6 µg/g
CR-14	Bagdad Bayou, near mouth downstream from the Westlake wastewater treatment plant	water	7.1-8.8	3,500-4,200	22-23.5	8.5-11					2,010	20	
		sediment					3.55	0.16	0.56	10			14. µg/g
CR-15	Lower Calcasieu River downstream from the discharge from Lake Charles wastewater treatment Plant A	water	7.4-7.9	6,300-8,700	21-23	11					58.70	13	3.7 µg/g
		sediment					4.45	0.42	1.9	17			1.7 µg/g

a/ Two samples collected on April 25, 1971.

that is mostly stabilized or is exerting a slow oxygen demand. The mercury content of the sludge was 1.4 µg/g.

Mercury concentrations in the sludge deposits downstream from the treatment plants were significantly higher than those in sludge from most other areas of the Calcasieu River Basin. It is hypothesized that, since most elemental mercury entering a sewage treatment plant is settled in the clarifiers, the mercury concentrations observed in bottom sediments near plant outfalls may be indicative of intermittent discharges of sludge. The findings of only minor amounts of mercury in municipal plant effluents are consistent with this hypothesis.

CONCLUSIONS

It is concluded that:

It is not possible, based upon the findings of these investigations, to draw positive conclusions regarding mercury sources in the Calcasieu River Basin. Facts that bear upon this matter include:

a) The dispersion of industrial waste discharges, throughout the Lower Calcasieu River, by tides;

b) The seasonal migration of fish past the saltwater barrier;

c) The inconclusive results of mercury sampling in sewage treatment plant effluents; and

d) The lack of conclusive information regarding mercury sources in the Calcasieu River and tributaries.

RECOMMENDATIONS

It is recommended that:

1) Arrangements be concluded between the Enforcement Officer, Region VI, EPA, the Bureau of Sport Fisheries and Wildlife, the Food and Drug Administration, and the Louisiana Wildlife and Fisheries Commission, to monitor mercury concentations in fish samples from the Calcasieu River Basin.

2) If, after sufficient time has passed, i.e., to ameliorate the effects of earlier mercury discharges, presently observed symptoms of mercury pollution persist, a comprehensive survey of the Calcasieu River drainage area be conducted to identify the source(s) of mercury.

3) EPA Air Quality personnel examine industrial stack gases in the Lake Charles area to evaluate the possibility of the fallout of mercury upon the Calcasieu watershed being a significant mercury contributor to the waters of the Calcasieu River.

REFERENCES

1/ Rivers and Harbors Act of 1899, 33 U.S.C. 401-413, Section 407 referred to as Refuse Act of 1899.

2/ Federal Water Pollution Control Act, 33 U.S.C. 466 et seq, as amended by the Federal Water Pollution Control Act Amendments of 1961-(PL 87-88), the Water Quality Act of 1965-(PL 89-234), the Clean Water Restoration Act of 1966-(PL 89-753), and the Water Quality Improvement Act of 1970-(PL 91-224).

3/ U. S. Department of Commerce, Environmental Science Service Administration Coast and Geodectic Survey, *Atlantic Coast Sixth (1967) Edition* 163-165.

APPENDICES

APPENDIX A

APPLICABLE WATER QUALITY REGULATIONS

General

The Calcasieu River is a navigable waterway in law and in fact.[1/] Large ocean-going vessels travel up the Calcasieu River to Westlake, Louisiana. The remainder of the Calcasieu River upstream of Westlake is also used for navigation. Similarly, the lower portion of the Calcasieu River complex can be classified as a coastal water in that tidal influences are felt for significant distances upstream of the point where the Calcasieu joins the Gulf of Mexico. In compliance with the Federal Water Pollution Control Act, as amended, the State of Louisiana established water quality standards for interstate streams, coastal waters, and streams discharging into coastal waters. These standards were approved by the Secretary of the Interior. The Calcasieu River is also subject to the provisions of Section 407 of the 1899 Rivers and Harbors Act (the Refuse Act), and the oil discharge regulations established pursuant to the Water Quality Improvement Act of 1970.

Water Quality Standards

The State of Louisiana divided the Calcasieu River from the Gulf of Mexico to its origin into three distinct zones for the purpose of establishing water quality standards: (1) Zone 1, the Calcasieu River from its origin to the Salt Water Barrier; (2) Zone 2, the Calcasieu River from the Salt Water Barrier to the upper end of Moss Lake; and (3) Zone 3, that portion of the Calcasieu River from the upper end of Moss Lake to the Gulf of Mexico. Louisiana State Water Quality Standards for the Calcasieu River

describe a series of present uses of that river. They are industrial supply, primarily cooling water in the Lake Charles area; propagation of aquatic life for commercial fishing, including shellfish; irrigation water for considerable acreage of river; recreational use, including water contact sports; navigational use from the Lake Charles area to the Gulf of Mexico; and finally, carriage of municipal and industrial wastes.

Conditionally, the State indicated that they expected changes in the usage of this water with the progression of time. Primarily, these changes will take the form of municipal water supply in the upper reaches, carriage of treated municipal and industrial wastes in the lower area, and increased use for industrial supply.

No water quality standards have been established for the following tributaries: Bayou d'Inde, Bayou Verdine, Contraband Bayou, English Bayou, Houston River, Mill Creek and Palmetto Creek, all intrastate waters. The Standards established for the Calcasieu River follow.

Zone 1 - The River from Its Origin to the Salt Water Barrier

General criteria were established in Zone 1 by the Louisiana State Stream Control Commission in 1968. These criteria state that no discharge to Zone 1 shall result in conditions in the stream that will adversely affect the public health or use of the water (i.e. municipal and industrial supplies, recreation, propagation of aquatic life, etc.).

Specific criteria are as follows:

pH	From 6.0 to 8.5
Dissolved Oxygen	Not less than 50 percent saturation at existing water temperature.

Temperature	Not to be raised more than 3°C above normal ambient water temperature nor to exceed an absolute maximum of 36°C.
Oil and Grease	No oil slicks of free or floating oil are present in sufficient quantities to interfere with the designated uses nor shall emulsified oils be present in the same quantity.
Toxic Materials	None present in quantities that alone or in combination will be toxic to animals or plant life, but in all cases the level shall not exceed a $TLM_{48/10}$.
No foaming or frothing materials	
Coliform Density	1600/100 ml, calculated as the most probable number, as a monthly mean. However, 10 percent of the samples may exceed the previous number up to 5420/100 ml in any one month.
Other Materials	Limits on other substances not heretofore specified shall be in accordance with recommendations set by the Louisiana Stream Control Commission and/or by the Louisiana State Board of Health for municipal raw water sources.

Zone 2 - The Calcasieu River from the Salt Water Barrier to the Upper End of Moss Lake

General criteria for this zone indicate that, at present, the water is suitable for propagation of aquatic life, recreation, navigation, and low grade industrial supply when necessary adaptations are made by industry. No discharge is to be permitted that will result in stream conditions that will adversely affect public health, propagation and harvesting of aquatic life, recreation and navigation, or impose additional burdens of adaptation on industrial use.

Specific criteria for Zone 2 are shown in the following table:

pH	6.0 to 8.5
Dissolved Oxygen	Not less than 50 percent saturation at the existing temperature.
Temperature	Not to be raised more than 3°C above normal ambient water temperature nor to exceed an absolute maximum of 36°C.
Oil and Grease	There shall be no slicks of free or floating oil present in sufficient quantities to interfere with the designated uses nor shall emulsified oils be present in the same quantity.
Toxic Materials	None present in quantities that alone or in combination will be toxic to animals or plant life, but in all cases the level shall not exceed a $TLM_{48/10}$.
No foaming or frothing materials	
Coliforms	The monthly median for coliform density shall not exceed 542/100 ml (MPN) nor shall this count exceed 1750/100 ml in more than 10 percent of the samples in any one month.

Zone 3 - The Calcasieu River from the Upper End of Moss Lake to the Gulf of Mexico

The general criteria for this zone indicate that during periods of low flow the high mineral content of the water approaches that of the marine water itself. This mineral content is caused by tidal intrusion. Therefore, no discharge shall produce conditions in the stream adversely affecting public health or the use of waters for propagation and harvesting of aquatic life, recreation, or navigation.

Specific criteria for this zone are as follows:

pH	From 6.0 to 8.5
Dissolved Oxygen	Not less than 60 percent saturation at existing water temperature.
Temperature	Not to be raised more than 3°C above normal ambient water temperature nor to exceed an absolute maximum of 36°C.
Oil and Grease	No oil slicks of free or floating oil are present in sufficient quantities to interfere with the designated uses nor shall emulsified oils be present in the same quantity.
Toxic Materials	None present in quantities that alone or in combination will be toxic to animals or plant life, but in all cases a level shall not exceed a $TLM_{48/10}$.
No foaming or frothing materials	
Coliforms	The monthly median shall not exceed 70/100 ml nor shall this count exceed 230/100 ml in more than 10 percent of the samples in any one month.

The Rivers and Harbors Act of 1899 (Refuse Act)

The Rivers and Harbors Act of 1899 prohibits the discharge of industrial wastes to navigable waters without a permit from the U. S. Army Corps of Engineers. Section 407 of the Act (referred to as the Refuse Act) makes it unlawful to discharge from any "... manufacturing establishment, or mill or any kind, any refuse matter of any kind or description whatever, other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water from which the same shall float or be

washed into such navigable water ..." provided that a discharge may be permitted under certain conditions specified by the Corps of Engineers.

Executive Order No. 11574, Administration of the Refuse Act Permit Program, signed by President Nixon on December 23, 1970, tightens enforcement of the Refuse Act of 1899 by requiring that all sources of industrial wastes discharging to navigable waters or their tributaries must apply to the Corps of Engineers for permits to continue such discharges. All sources of industrial wastes investigated during this study will thus need to apply for such permits.

Water Quality Improvement Act of 1970

On September 11, 1970, Federal regulations regarding the discharge of oil to navigable waters were established pursuant to the provisions of Section 11(b)(3) of the Federal Water Pollution Control Act, as amended by the Water Quality Improvement Act of 1970. This legislation required the President to publish, in the Federal Register, rules regarding the allowable discharge of oil to navigable water from any source. Subsequently, the President published rules which specifically stated:

(1) That discharges of oil shall not occur in amounts which violate applicable water quality standards, or;

(2) That discharges of oil shall not occur in amounts to cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

APPENDIX B

CUSTODY OF SAMPLES

Special procedures were employed during the field investigations of waste sources in the Calcasieu River Basin to insure that a chain of custody was documented for water quality samples potentially useful as evidence for enforcement actions. This documentation was designed to maintain a record of the collection and source of each sample, as well as of the personnel involved in the handling, preparation, and disposition of each.

A unique "custody" number was assigned to each of the Company's waste effluent samples collected. This number was recorded on the sample tag, the corresponding "custody" information sheet, and on the laboratory receipt log.

As each sample was collected, a labeled tag was attached to each bottle or container. The tray information recorded on the tag included the "custody" number; the sampling station number and description; the time and date of collection; the types of analyses to be performed on the sample by the laboratory; the types of preservatives added [see Appendix C, Analytical Procedures]; and the personnel collecting the sample and performing the sample preservation. Sample containers were placed in plastic bags and the bags sealed with paper tape bearing the initials of the individual packaging the sample. The intact seal and bag guaranteed the integrity of the sample during shipment.

A special "custody" information sheet was prepared for each "custody" number assigned. In addition to information being recorded on the sample

tag, the information sheet recorded the laboratory to which the sample was sent, the time and method of shipment, and the carrier. Federal Government bills-of-lading provided additional records of the shipments made.

Upon arrival of each shipment at its destination, laboratory personnel recorded the time and date of receipt; the number and type of samples received; and the analyses to be performed. This documentation procedure maintained a "custody" record for the field-to-the-laboratory transit. Each analytical laboratory involved (Division of Field Investigations-Denver Center; Division of Field Investigations-Cincinnati Center; Analytical Quality Control Laboratory, Cincinnati, Ohio; and the Southeast Water Laboratory, Athens, Georgia) then maintained custody of each sample, using procedures and records standard for the specific laboratory.

This special "custody" documentation was employed for industrial waste effluent samples only. No "custody" numbers were assigned for water and sediment samples collected from streams. Normal documentation procedures including tagging of samples, as discussed above, and logging of field measurements were followed.

APPENDIX C

STUDY METHODS

Common white, or lake, shrimp (*Penaeus setiferus*), sized from 90-110 mm,* were used for survival and palatability studies in the Lower Calcasieu River. Shrimp were captured by bottom seining at 5-minute intervals in Lake Calcasieu near Turner's Bay. The catch was released from the seining net into a holding tub. These test shrimp were transferred, with extreme care, employing a nylon dipnet, or by hand, from the tub to an aerated acclimation tank filled with clean water from Lake Prein. Shrimp exposure out of the water was kept to a minimum.

After a 24-hour acclimation period in the tank, less than ten percent of the shrimp were found in distress or dead because of the previous day's netting and handling. These were culled from the tank. Live, healthy shrimp were taken from the holding tank, decapitated, wrapped in foil, and frozen with dry ice for use as a taste and odor reference sample. The remaining live, healthy shrimp were used for survival and palatability tests.

At selected stations, wire, minnow baskets were attached to floats and suspended at 1-foot depths in the River. Cloth net bags, measuring 12 by 24 inches and having a mesh opening of one-quarter inch, were placed inside the baskets. Live shrimp were carefully transferred from the holding tank to cloth net bags inside the wire baskets. This basket apparatus permitted free circulation of River water through the cages, retained the test shrimp, and reduced predation by crabs.

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* Determined by measuring from the tip of the rostrum to the end of the telson.

Flavor and Odor Evaluation (Field and Laboratory Procedures)

Baskets, each containing six shrimp, were placed at control stations and near the Company's effluents in the Lower Calcasieu River and its tributaries. After a 6-hour River exposure near the Company's discharge, the shrimp were retrieved and examined. Survivors were decapitated, wrapped, in foil, and frozen with dry ice. These frozen shrimp were shipped to the Department of Food Science and Technology at Oregon State University, Corvallis, Oregon, for flavor and odor evaluations by a panel of experienced judges.

Odor Test -- At the Oregon State University facility, the wrapped, frozen shrimp were transferred from the shipping container to a -10°F freezer. Later, the shrimp were removed from the freezer and placed at 40°F. until defrosted, then cooked in eight ounces of unsalted boiling water for five minutes. The cooked shrimp were quickly peeled and then tightly wrapped with plastic film. The cooking water was poured into 100 ml beakers and the beaker then tightly covered with aluminum foil. Each respective sample of shrimp and cooking water was placed on a plate coded with a 3-digit random number.

The reference sample* was divided into four portions, two of which were placed on coded plates and the other two on plates marked "Ref." These shrimp were then alloted to two groups and placed on opposite counters for odor testing, with the first sample in each group being a "Ref" sample. Half of the judges smelled one group first and then smelled the other,

* Shrimp that were kept in aerated Lake Prien water and not exposed to River water near industrial discharges.

with a 3- to 5-minute wait between groups. The judges were asked to sniff both the shrimp and the cooking water and score the intensity of "off-odor" as related to the reference sample. Re-sniffing the reference sample was allowed. Thirty minutes after the first odor test was completed, the plates were recoded with new 3-digit random numbers, the order changed, and a second test conducted by the same ten judges.

Flavor Test -- Each shrimp was cut into four pieces and each respective sample mixed, then served in paper cups coded with 3-digit random numbers. The coded cups were randomly placed on two serving trays, each of which contained a labeled and a coded "Ref" sample. The trays were served in balanced order to the judges seated in individual testing booths lighted with yellow-orange light. The judges were asked to score the degree of "off-flavor" and the overall desirability of the samples on a 7-point scale. (0=extreme "off-flavor" and 7=no "off-flavor.") Because the sample size varied from one to six shrimp, only five judges were served on the flavor panel. Because there was only one shrimp in four of the 96-hour exposure samples, only two judges received these samples.

Survival Tests

Baskets, each containing ten shrimp, were placed at "flavor evaluation test" stations and elsewhere. These shrimp were used as test animals for 96-hour survival studies. At the termination of each 24-hour exposure period, mortalities were recorded and the surface water near each basket was tested for pH, temperature, and salinity.

Shrimp that survived the 96-hour exposure were tested for flavor in the manner described above.

APPENDIX D

TABLE D-1

PALATABILITY OF WHITE SHRIMP FOLLOWING A 6-HOUR EXPOSURE
IN THE LOWER CALCASIEU RIVER, LOUISIANA
(April 20, 1971)

Station	Nearest Industrial Discharge	Off-Odor	Off-Flavor	Over-all Desirability
Reference	-	5.57	5.60	5.30
CR-11.2	Control Station	5.72	4.40	3.70
CR-11	Olin Barge Canal	2.85	2.50	2.20
CR-8	Olin Tailings Pond	5.35	5.40	5.50
CR-7	PPG Industries, Incorporated	-	-	0.0[a]
CR-6.1	Cities Service Firestone Cit-Con	-	-	0.0[a]
CR-6	PPG Industries, Incorporated	-	-	0.0[a]
CR-5	Hercules	5.05	4.30	3.20
CR-3	Cities Service	-	-	0.0[a]
CR-2	W. R. Grace Davison Chemical Division	-	-	0.0[a]
CR-1.2	Gulf Coast Aluminum	5.62	4.90	4.70
CR-1	Control Station	5.60	5.20	5.10
Total Judgments		20	5	5
LSD (05)[b]		0.82	1.47	1.71

a/ Dead shrimp were considered unpalatable and were not tested for flavor or odor.

b/ LSD (05) refers to the least significant difference at the 5 percent level. Data from above stations were examined by analysis of variance.

TABLE D-2

PALATABILITY OF WHITE SHRIMP FOLLOWING A 96-HOUR EXPOSURE IN THE LOWER CALCASIEU RIVER, LOUISIANA (April 20-24, 1971)

Station	Nearest Industrial Discharge	Off-Odor	Off-Flavor	Over-all Desirability
Reference	-	5.62	5.30	4.50
CR-11.2	Control Station	4.50	5.10	4.80
CR-11.1	Control Station	5.82	5.75	5.75[a]
CR-11	Olin Barge Canal	-	-	0.0[c]
CR-8.1	Olin Tailings Pond	-	-	-[b]
CR-8	Olin Tailings Pond	5.55	4.50	3.25[a]
CR-7	PPG	-	-	0.0[c]
CR-6.1	Cities Service Firestone Cit-Con	-	-	0.0[c]
CR-6	PPG	-	-	0.0[c]
CR-5.1	Hercules	-	-	0.0[c]
CR-5	Hercules	5.27	2.50	1.75[a]
CR-4.2	Cities Service	-	-	0.0[c]
CR-4.1	Cities Service	-	-	0.0[c]
CR-3.3	Cities Service	-	-	0.0[c]
CR-3.2	Cities Service	-	-	0.0[c]
CR-3.1	Cities Service	-	-	0.0[c]
CR-3	Cities Service	-	-	0.0[c]
CR-2.1	W. R. Grace	-	-	0.0[c]
CR-2	W. R. Grace	-	-	0.0[c]
CR-1.2	Gulf Coast Aluminum	-	-	-[b]
CR-1.1	Gulf Coast Aluminum	5.72	3.50	2.25[a]
CR-1	Control Station	6.02	5.40	5.20
Total Judgments		20	5	5
LSD (05)[d]		0.77	1.20	1.75

a/ Only one shrimp tested.
b/ Cages were lost or damaged before 96 hours had passed.
c/ Dead shrimp were considered unpalatable and were not tested for flavor or odor.
d/ LSD (05) refers to the least significant difference at the 5 percent level. Data were examined by analysis of variance.

TABLE D-3

RESULTS OF THE WHITE SHRIMP 96-HOUR SURVIVAL STUDIES TESTS
CONDUCTED IN THE LOWER CALCASIEU RIVER, LOUISIANA
(April 20-24, 1971)

Station	Nearest Industrial Discharge	In Situ Bioassay			
		Exposure Time	Alive	Dead	Percent Survival
CR-11.2	Control Station	Initial	10	0	100
		24-hour	9	1	90
		48-hour	8	2	80
		72-hour	8	2	80
		96-hour	5	5	50
CR-11.1	Control Station	Initial	10	0	100
		24-hour	8	2	80
		48-hour[a/]			
CR-11	Olin Corporation Barge Canal	Initial	10	0	100
		24-hour	0	10	0
CR-8.1	Olin Corporation Tailings Pond	Initial	10	0	100
		24-hour[a/]			
CR-8	Olin Corporation Tailings Pond	Initial	10	0	100
		24-hour	6	4	60
		48-hour	5	5	50
		72-hour	3	7	30
		96-hour	1	9	10
CR-7	PPG	Initial	10	0	100
		24-hour	0	10	0
CR-6.1	Cities Service, Firestone, and Cit-Con	Initial	10	10	0
		24-hour	0	10	0

a/ Cage with shrimp lost or damaged.

TABLE D-3 (Continued)

RESULTS OF THE WHITE SHRIMP 96-HOUR SURVIVAL STUDIES TESTS
CONDUCTED IN THE LOWER CALCASIEU RIVER, LOUISIANA
(April 20-24, 1971)

Station	Nearest Industrial Discharge	In Situ Bioassay			
		Exposure Time	Alive	Dead	Percent Survival
CR-6	PPG Industries, Inc.	Initial	10	0	100
		24-hour	0	10	0
CR-5.1	Hercules Company	Initial	10	0	100
		24-hour	0	10	0
CR-5	Hercules Company	Initial	10	0	100
		24-hour	6	4	60
		48-hour	4	6	40
		72-hour	3	7	30
		96-hour	1	9	10
CR-4.2	Cities Service	Initial	10	0	100
		24-hour	0	10	0
CR-4.1	Cities Service (Butyl Rubber Plant)	Initial	10	0	100
		24-hour	0	10	0
CR-3.3	Cities SErvice (refinery)	Initial	10	0	100
		24-hour	0	10	0
CR-3.2	Cities Service (refinery)	Initial	10	0	100
		24-hour	0	10	0
CR-3.1	Cities Service (refinery)	Initial	10	0	100
		24-hour	0	10	0
CR-3	Cities Service (refinery)	Initial	10	0	100
		24-hour	0	10	0

TABLE D-3 (Continued)

RESULTS OF THE WHITE SHRIMP 96-HOUR SURVIVAL STUDIES TESTS
CONDUCTED IN THE LOWER CALCASIEU RIVER, LOUISIANA
(April 20-24, 1971)

Station	Nearest Industrial Discharge	In Situ Bioassay			
		Exposure Time	Alive	Dead	Percent Survival
CR-2.1	W. R. Grace Davison Chemical Division	Initial	10	0	100
		24-hour	0	10	0
CR-2	W. R. Grace Davison Chemical Division	Initial	10	0	100
		24-hour	0	10	0
CR-1.2	Gulf Coast Aluminum Company	Initial	10	0	100
		24-hour	8	2	80
		48-hour[a/]			
CR-1.1	Gulf Coast Aluminum Company	Initial	10	0	100
		24-hour	8	2	80
		48-hour[a/]			
CR-1	Control Station	Initial	10	0	100
		24-hour	8	2	80
		48-hour	8	2	80
		72-hour	8	2	80
		96-hour	5	5	50

APPENDIX E

TABLE E-1

ANALYTICAL RESULTS OF BOTTOM SEDIMENT SAMPLES-CALCASIEU RIVER, LOUISIANA
(April, 1971)

Station[a] Number	1971 Date	Time	Water Depth ft	Type[b] of bottom	Odor[b] of bottom	Volatiles %	Org Carbon %	Nitrogen %	OSI	Sediment Type	Mercury[c] µg/g
CR-1	4/22	1145	2.0	soft mud	none	7.6	2.76	0.189	0.52	II	<0.2
CR-1.2	4/22	1225	4.0	soft mud	petro-chemical	5.0	2.52	0.06	0.15	I	<0.2
CR-2	4/22	1310	3.0	greyish-white sediment	none	7.7	1.20	0.209	0.25	I	0.9
CR-3.2	4/22	1330	30.0	black soft sediment	petro-chemical	19	8.88	0.318	2.8	III	5.4
CR-5	4/22	1115	1.0	fine sand		0.7	0.19	0.029	0.01	I	0.1
CR-6	4/22	1420	12.0	soft mud	chemical	7.9	1.96	3.41	6.6	IV	6.0
CR-6.1	4/22	1350	15.0	soft mud	H_2S	20	9.03	0.375	3.4	III	2.0
CR-6.2	4/24	1700		black muck	septic	19	7.41	0.423	3.1	III	1.7
CR-7	4/22	1440	4.0	soft brown sediment	chemical	13.0	3.61	0.082	0.30	I	1.3

TABLE E-1 (Continued)

ANALYTICAL RESULTS OF BOTTOM SEDIMENT SAMPLES-CALCASIEU RIVER, LOUISIANA
(April, 1971)

Station[a] Number	1971 Date	Time	Water Depth ft	Type[b] of bottom	Odor[b] of bottom	Volatiles %	Org Carbon %	Nitrogen %	OSI	Sediment Type	Mercury[c] µg/g
CR-8	4/22	1100	1.5	soft mud	H_2S	7.9	1.98	0.123	0.24	I	0.5
CR-10	4/22	1630	6.0	soft mud	organic	34	7.46	1.79	13	IV	2.6
CR-11	4/22	1510	35.0	soft mud	slight petro-chemical	22.0	4.92	0.249	1.2	III	0.7
CR-14	4/25					10	3.55	0.158	0.56	II	1.4
CR-15	4/25					17	4.45	0.419	1.9	III	1.7
CR-18	4/25					13	3.99	0.343	1.4	III	0.9
MC-1	4/27					3.8	1.08	3.78	4.1	III	0.2
MC-2	4/27					25					<0.1
PC-1	4/27					1.9	0.89	0.064	0.06	I	0.4

a/ All samples collected with an Ekman Dredge. For description of stations see Table E-2.
b/ General appearance and odor at time of collections.
c/ Results based on dry weight. Samples were dried at 35°C for two days.

TABLE E-2

DESCRIPTION OF SEDIMENT SAMPLING POINTS - CALCASIEU RIVER, LOUISIANA

Station	Station Description
CR-1	Lower Calcasieu River, near Calcasieu Landing (upstream of intracoastal waterway) near Channel Marker 92.
CR-1.2	Devils Elbow Canal at the industrial discharge canal of Gulf Coast Aluminum.
CR-2	Lower Calcasieu River, near Vincents Landing (at the discharge from W. R. Grace and Company).
CR-3.2	Lower Calcasieu River, west shore at industrial discharge of Cities Service refinery.
CR-5	Lower Calcasieu River near Channel Marker 108 (downstream of Hercules effluent).
CR-6	Bayou d'Inde at a gas line crossing approximately 1,000 yards southeast of PPG discharge canal.
CR-6.1	Bayou d'Inde, downstream from Firestone, Cit-Con, and from Cities Service petrochemical plant.
CR-6.2	Bayou d'Inde, upstream of Firestone, Cit-Con, and of Cities Service petrochemical plant.
CR-7	Bayou Verdine, northwest of Coon Island.
CR-8	Lower Calcasieu River, east shore of Coon Island, near the discharge from Olin tailings pond.
CR-10	Contraband Bayou, downstream from Lake Charles wastewater treatment facility (Plant A and B) discharge.
CR-11	Lower Calcasieu River at mouth of Olin barge slip, northwest of Clooney Island.
CR-14	Near mouth of Bagdad Bayou at highway bridge.
CR-15	Lower Calcasieu River at Ryan Street downstream from Lake Charles wastewater treatment facility (Plant A) effluent.
CR-18	Lower Calcasieu River at Highway 171 bridge.
MC-1	Mill Creek, near mouth at USGS 134.5 (Upper Calcasieu River).
MC-2	Mill Creek south of and downstream from Elizabeth, Louisiana (Upper Calcasieu River).
PC-1	Palmetto Creek at Highway 171-190 bridge, near De Ridder, Louisiana (Upper Calcasieu River).

APPENDIX F

ANALYTICAL PROCEDURES

Grab, or 24-hour composite, samples of water, industrial waste, and bottom sediments were collected in the Lake Charles area by DFI-DC personnel. Samples were preserved when collected as outlined in the Federal Water Quality Administration's Manual for the Chemical Analysis of Water and Wastes.[1/]

One-liter grab samples were collected in glass containers from each Company's effluent suspected of containing oil and grease. The samples were preserved with 2 ml concentrated H_2SO_4/l and shipped on ice to the Division of Field Investigation-Denver Center. Within 24 hours after collection, the samples were tested for oil and grease, according to the procedure outlined in Standard Methods for the Examination of Water and Waste Water[2/] - *with the exception that n-hexane was used as the extraction solvent instead of petroleum ether.* Because only single grab samples were taken from each effluent, the results may not be representative of the composite daily discharge.

Twenty-four-hour composite samples were collected at each of the Company's effluents. One liter of the sample was preserved with 2 ml concentrated H_2SO_4 for total organic carbon (TOC), chemical oxygen demand (COD), ammonia nitrogen (NH_3-N), and organic nitrogen (org.-N) analyses. One liter was preserved with 5 ml concentrated HNO_3 for metals analyses and one liter was left untreated for total and suspended solids analyses.

Water and effluent samples specified for metals analyses were shipped,

air-freight, to the Division of Field Investigations-Cincinnati Center. These samples were analyzed for cadmium (Cd), copper (Cu), Lead (Pb), chromium (Cr), zinc (Zn), aluminum (Al), and nickel (Ni) by atomic absorption spectrophotometry. All samples were analyzed for total mercury (Hg) according to the flameless AA procedure of Hatch and Ott.[3/]

Other samples were shipped, air-freight, to the Analytical Quality Control (AQC) Laboratory in Cincinnati where they were analyzed, by DFI-DC personnel, according to procedures described in the FWQA Manual.[1/]

These samples were tested for TOC by injection of homogenized 100 µl aliquots into a Beckman Model 915 Carbon Analyzer after having been purged with nitrogen gas for five to ten minutes. Injections were made in duplicate and triplicate; the average peak height was taken for comparison to a standard curve. In general, reproducibility was within five percent. Industrial waste samples with more than 20 mg/l TOC were also analyzed for COD. These determinations were made according to the procedure for "high level COD", (i.e., digestion with 0.25N $K_2Cr_2O_7$). For this analysis sufficient mercuric sulfate was added to each sample to tie up the chloride ions -- as determined by titration with mercuric nitrate. In general, each sample was tested only once, although one duplicate analysis was reproducible within eight percent. Both NH_3-N and org.-N were determined using the micro-Kjeldahl apparatus. Consequently, all reagent concentrations were scaled down to one-tenth of the level of the regular Kjeldahl procedure. Several duplicate analyses were performed with reproducibilities of four and six percent.

Total and suspended solids were determined on the unpreserved samples.

The residues were dried at 105°C.

Bottom sediment samples were collected with an Eckman Grab Sampler at selected sites along the Calcasieu River and in the vicinity of waste discharges. The muds were packed in Whirlpack bags, frozen, and shipped air-freight to the AQC Laboratory in Cincinnati.

Samples, when thawed, were air-dried at 35°C for two days under a stream of clean, dry air. The percent volatiles were calculated from the weight loss after heating the dried sample at 600°C for one hour. The percent carbon and organic nitrogen were determined by the procedures outlined by Ballinger and McKee.[4/] The organic sediment index (OSI) was calculated as the product of the percent carbon and percent organic nitrogen.

Mercury in the dried sediments was determined by an adaptation of the "wet digestion/flameless AA procedure" for mercury in fish developed by Uthe, et al.[5/] Standard additions using mercuric chloride or methyl mercuric chloride were made on each sample; recoveries ranged from 87 to 122 percent throughout the 20 samples.

One-liter grab samples were collected from the Company's effluents for organic characterization. Immediately after collection, the samples were frozen and shipped, air mail-special delivery, to the Southeast Water Laboratory, Athens, Georgia. The samples were thawed, then extracted with chloroform. Chloroform extracts were concentrated to one ml or less and injected into a Perkin Elmer Model 900 gas chromatograph. Conditions were adjusted to obtain the best resolved chromatogram by using open tabular columns of Carbowax 20 M or SE-30. Once the conditions were selected, the

column effluent was directed into a Perkin Elmer-Hitachi Mass Spectrometer, Model RMU-7. Mass scans were made of all major peaks. Identity of the extract components was confirmed by injecting known compounds under the same conditions and comparing both the retention time and the mass spectrum.

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APPENDIX G

SUMMARY OF ANALYTICAL RESULTS FOR INDUSTRIAL DISCHARGES IN THE CALCASIEU RIVER BASIN, LOUISIANA

Industry	Station Number	COD		TOC		NH_3 as N		Total Solids		Suspended Solids		Oil & Grease	
		mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
Calcasieu Paper Company	CAL-1	504	36,700	150	10,900			918	66,800	360	26,200	4	290
Cities Service Oil Company													
-Butyl plant	CSC-1	174	2,470	29	410			1,480	21,000	152	2,160	7	100
-refinery	CSC-2			15	36,300	10.1	24,500	9,220	22,300,000	38	92,000	5	12,100
	CSC-2A	520	1.26×10^6	230	557,000			9,850	23,900,000	220	533,000		
	CSC-3			13	6,300			8,710	4,200,000	27	13,000		
	CSC-4[b]			9	30,000			9,760	32,600,000	31	103,500		
-petrochemical plant	CSC-5	612	20,200	180	5,900	5.35	180	868	28,600	78	2,600	5	165
-lube and wax plant (Cit-Con)	CSC-6			17	410	2.35	60	361	8,800	26	630	8	190
Continental Oil Company													
-VCM plant	CON-1			12	55			8,930	40,800	71	320	2	9
-petrochemical plant	CON-2			620	6,890			570	6,330	32	355	2.5[c]	22.56
	CON-2A			8	90			827	8,980	36	390		
	CON-8			130	780			2,650	15,900	34	200	7	40
-refinery	CON-3	676	6,320	210	1,960	52.1	490	2,340	21,900	182	1,700	130	1,215
	CON-4			5	230			315	14,300	132	5,990	4	180
	CON-5			10	145			460	6,680	49	710	1	15
	CON-6			7	60			1,130	9,290	30	250	3	25
	CON-6A											190	
	CON-7A											103	
Continental Carbon Company	CON-7	180	50	43	10			440	120	36	10		
Crosby Chemicals Incorporated	CRO-1	160	8,360	38	1,990			184	9,600			42	2,200
Firestone Rubber Company	FIR-1	168	8,070	52	2,500			3,210	154,000	76	3,650	17	815
W. R. Grace and Company													
-Davison Chemical Division	WRG-1	256	3,870	19	290			22,900	346,000	772	11,700		
Hercules, Incorporated	HER-1	332	5,880	62	1,100			1,290	22,800	43	760	1	18

APPENDIX G (Continued)

SUMMARY OF ANALYTICAL RESULTS FOR INDUSTRIAL DISCHARGES IN THE CALCASIEU RIVER BASIN, LOUISIANA

Industry	Station Number	TOC		NH_3 as N		Organic Nitrogen		Total Solids		Suspended Solids		Oil & Grease	
		mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
Olin Corporation	OLIN-1[b]	9		3.44		7.00		5,160		23			
	OLIN-2[d]	23	790	75.6	2,590	11.5	394	1,190	40,700	44	1,510		
	OLIN-3	1	7	21.6	145	6.44	40	2,620	17,700	99	670		
	OLIN-4	3	10	438	1,420	4.76	15	8,370	27,200	77	250		
	OLIN-5	8	425	12.7	675	7.28	390	4,540	241,000	122	6,480		
	OLIN-6	11	210	13.6	260	8.12	160	5,890	113,600	28	540		
	OLIN-7	5	2	156	45	48.2	15	3,750	1,130	115	35		
	OLIN-8	2	4	2.10	5	6.16	15	1,030	2,300	13	30		
	OLIN-9	10	1,270	6.30	800	10.1	1,280	5,580	706,400	33	4,180		
	OLIN-10	5	15	5.18	16	6.16	20	1,450	4,400	31	95		
	OLIN-11	21	560	3.22	85			73,900	1,970,000	102	2,720		
PPG Industries, Incorporated	PPG-1	13	31,500					7,070	17,120,000	32	77,500		
	PPG-2	18	330					7,030	130,000	887	16,400		
	PPG-3	12	7,430					6,800	4,207,000	22	13,600		
	PPG-4	6.2	70					9,700	105,300	138	1,500	1	11
	PPG-5	10	}490					7,760	}364,000[f]	32	}14,500[f]		
	PPG-5A	10						7,220		428			
	PPG-6	5.4	35					4,620	28,700	17	105		
	PPG-7[b]	16	}32,600[f]					7,060	}16,750,000	31	}62,800[f]		
	PPG-8[b]	11						6,350		19			

APPENDIX G (Continued)

SUMMARY OF ANALYTICAL RESULTS FOR INDUSTRIAL DISCHARGES IN THE CALCASIEU RIVER BASIN, LOUISIANA

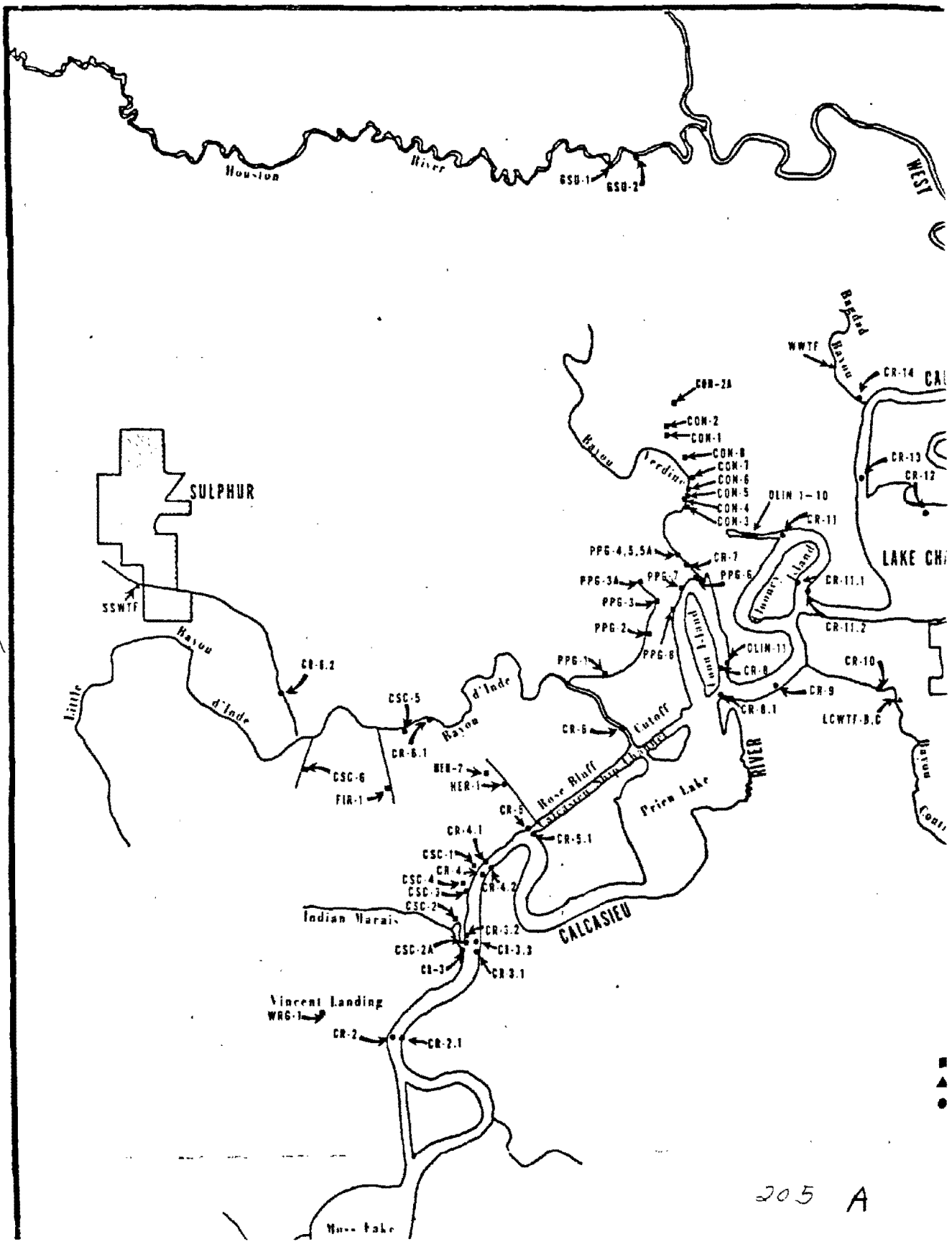
Industry	Station Number	Chromium		Cadmium		Mercury		Copper		Lead	
		mg/l	lbs/day	mg/l	lbs/day	µg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
Calcasieu Paper Company	CAL-1	0.10	7	<0.05		<0.1					
Cities Service Oil Company											
-Butyl plant	CSC-1	0.40	6	<0.05		<0.1		<0.02		<0.1	
-refinery	CSC-2	0.02	48	<0.05		0.2	0.4343	0.04	97	0.2[a/]	485
	CSC-2A	0.14	340	<0.05		1.0	2.422	0.11	266	4.0[a/]	9,690
	CSC-3	<0.01		<0.05		0.3	0.1443	0.04	19	0.2[a/]	95
	CSC-4	<0.01		<0.05		0.2	0.6680	<0.02		0.1[a/]	335
-petrochemical plant	CSC-5	1.8	59	<0.05		0.8	0.0264	0.09	3	<0.1	
-lube and wax plant (Cit-Con)	CSC-6	0.07	2	<0.05		<0.1		<0.02		<0.1	
Continental Oil Company											
-VCM plant	CON-1	2.6	12	<0.05		<0.1		0.09	0.4	0.2[a/]	0.9
-petrochemical plant	CON-2	<0.01		<0.05		<0.1		<0.02		<0.1	
	CON-2A	<0.01		<0.05		0.2	0.0022	<0.02		<0.1	
	CON-8	0.30	2	<0.05		0.3	0.0018	<0.02		0.2[a/]	1.2
-refinery	CON-3	0.17	1.6	<0.05		0.9	0.0084	0.03	0.3	<0.1	
	CON-4	0.16	7	<0.05		0.1	0.0045	<0.02		<0.1	
	CON-5	0.41	6	<0.05		0.3	0.0044	<0.02		<0.1	
	CON-6	4.0	33	<0.05		0.1	0.0008	0.08	0.7	0.1[a/]	1
	CON-6A										
	CON-7A										
Continental Carbon Company	CON-7	0.03	0.01	<0.05		0.1	0.00003				
Crosby Chemicals Incorporated	CRO-1	<0.02		<0.05		<0.1					
Firestone Rubber Company	FIR-1	0.20	10	<0.05		0.6	0.0288	<0.02		0.2[a/]	10
W. R. Grace and Company -Davison Chemical Division	WRG-1[g/]	<0.01		<0.05		0.8	0.0121				
Hercules, Incorporated	HER-1	0.2	3.5	<0.05		0.7	0.0124				

APPENDIX G (Continued)

SUMMARY OF ANALYTICAL RESULTS FOR INDUSTRIAL DISCHARGES IN THE CALCASIEU RIVER BASIN, LOUISIANA

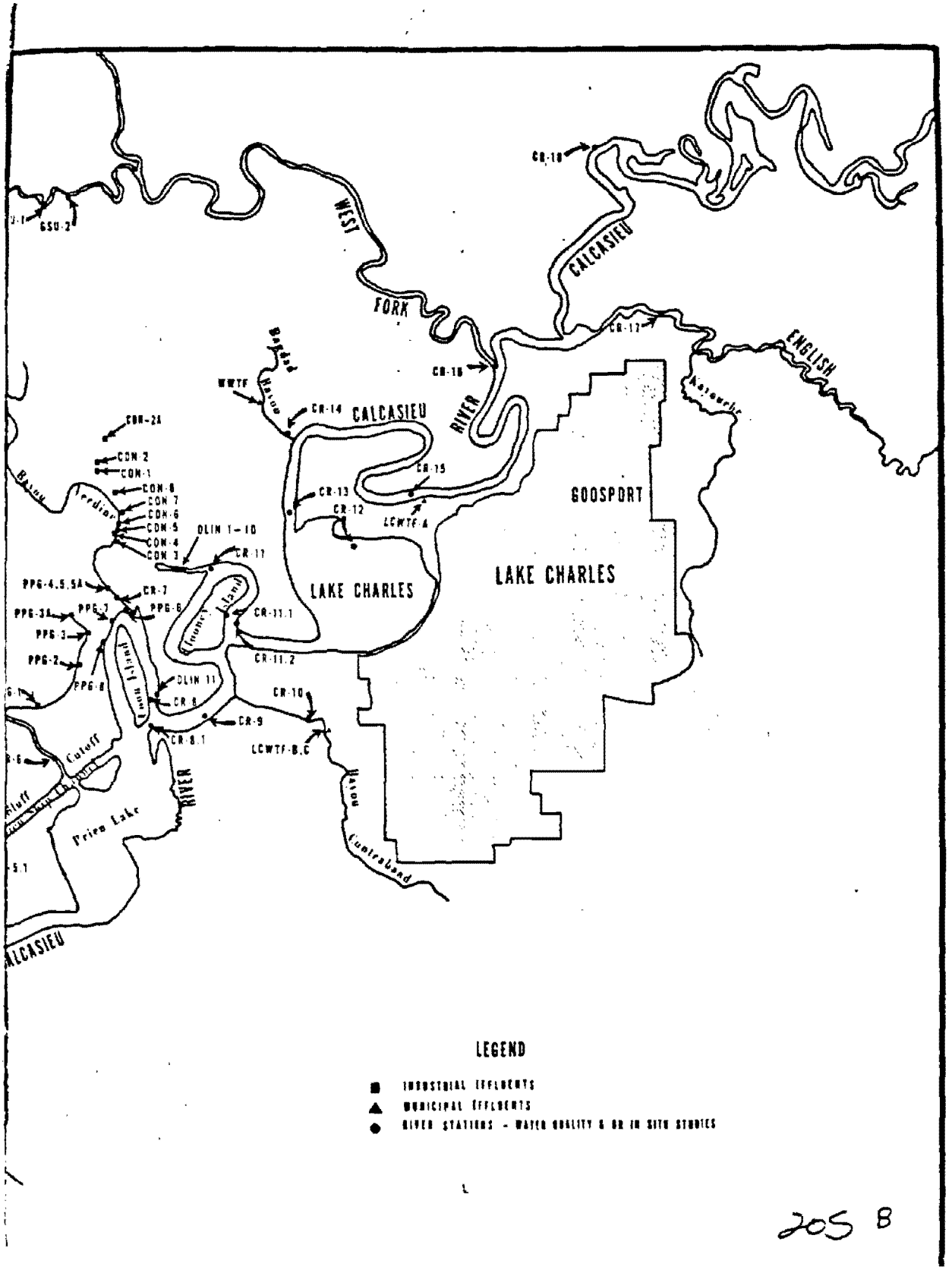
Industry	Station	Chromium		Cadmium		Mercury		Copper		Lead		Nickel	Aluminum
	Station	mg/l	lbs/day	mg/l	lbs/day	µg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	mg/l
Olin Corporation	OLIN-1[b]	0.04		<0.05		<0.1		<0.02		0.1		<0.2	<0.5
	OLIN-2[d]	4.0	140	<0.05		0.2	0.0069	<0.02		<0.1		<0.2	<0.5
	OLIN-3	<0.01		<0.05		0.4	0.0027	<0.02		<0.1		<0.2	<0.5
	OLIN-4	<0.01		<0.05		2.7	0.0088	0.08	0.3	<0.1		<0.2	<0.5
	OLIN-5	0.02	1.1	<0.05		3.9	0.2071	<0.02		<0.1		<0.2	<0.5
	OLIN-6	0.02	0.4	<0.05		0.1	0.0019	<0.02		<0.1		<0.2	<0.5
	OLIN-7	0.02	0.01	<0.05		0.2	0.0001	<0.02		<0.1		<0.2	<0.5
	OLIN-8	<0.01		<0.05		0.1	0.0002	<0.02		<0.1		<0.2	<0.5
	OLIN-9	0.04	5	<0.05		0.1	0.0127	<0.02		<0.1		<0.2	<0.5
	OLIN-10	<0.01		<0.05		0.6	0.0018	<0.02		<0.02		<0.2	<0.5
	OLIN-11	0.10	3	0.15	4	0.1	0.0027	0.17	4.5	[a]		[a]	<0.5
PPG Industries, Incorporated	PPG-1	<0.01		<0.05		0.4	0.9700	0.02	48	<0.1			
	PPG-2	0.09	2	<0.05		<0.1							
	PPG-3	0.10	62	<0.05		1.0	0.6187						
	PPG-4	<0.02		<0.05		<0.1							
	PPG-5	<0.02		<0.05		0.1	} 0.0080						
	PPG-5A	<0.02		<0.05		0.2							
	PPG-6	<0.02		<0.05		0.2	0.0012						
	PPG-7[b]	<0.02		<0.05		0.2	} 0.4800	<0.02		<0.1			
	PPG-8[b]	<0.02		<0.05		0.2		<0.02		<0.1			

a/ No interference from calcium detected.
b/ Intake from Calcasieu River.
c/ Samples collected on two different days.
d/ COD measurement of 114 mg/l or 3900 lbs/day.
e/ Interference by standard atomic absorption procedure, completion of data dependent on the development of an alternate method of analysis.
f/ Based on estimated flow and/or average concentration.
g/ Aluminum measurement of 60 mg/l or 910 lbs/day.


Houston River
GSB-1
GSB-2
WEST
Bayou Verdine
CON-2A
CON-2
CON-1
CON-8
CON-7
CON-6
CON-5
CON-4
CON-3
OLIN 1-10
CR-11
WWTF
Bayou
CR-14
CR-13
CR-12
LAKE CH
PPG-4,5,5A
CR-7
PPG-3A
PPG-7
PPG-6
PPG-3
PPG-2
PPG-1
PPG-8
January Island
CR-11.1
CR-11.2
OLIN-11
CR-8
CR-8.1
CR-9
CR-10
LCWTF-B,C
SULPHUR
SSWTF
Bayou d'Inde
Little
CR-6.2
CSC-5
CR-6.1
CSC-6
FIR-1
HER-2
HER-1
Rose Bluff
CR-5
CR-5.1
CR-6
Cutoff
Prien Lake
RIVER
CR-4.1
CSC-1
CR-4
CSC-4
CSC-3
CR-4.2
CSC-2
Indian Marais
CR-3.2
CSC-2A
CR-3.3
CR-3
CR-3.1
CALCASIEU
Vincent Landing
WRG-1
CR-2
CR-2.1
Haven Coul
Moss Lake

205

205 A


WEST FORK
CALCASIEU RIVER
ENGLISH
GSU-2
CR-18
CR-17
CR-16
CR-14
CALCASIEU
WWTF
CON-2A
CON-2
CON-1
CON-8
CON-7
CON-6
CON-5
CON-4
CON-3
DLIN 1-10
CR-11
CR-13
CR-12
CR-15
LCWTF-A
GOOSPORT
LAKE CHARLES
LAKE CHARLES
PPG-4,5,5A
PPG-3A
PPG-3
PPG-2
PPG-1
PPG-7
PPG-6
PPG-8
CR-7
CR-11.1
CR-11.2
DLIN 11
CR-8
CR-9
CR-8.1
CR-10
LCWTF-B,C
Cutoff
Prien Lake
MAIN
Intracoastal
CALCASIEU
LEGEND
INDUSTRIAL EFFLUENTS
MUNICIPAL EFFLUENTS
RIVER STATIONS - WATER QUALITY & DO IN SITU STUDIES

205 B

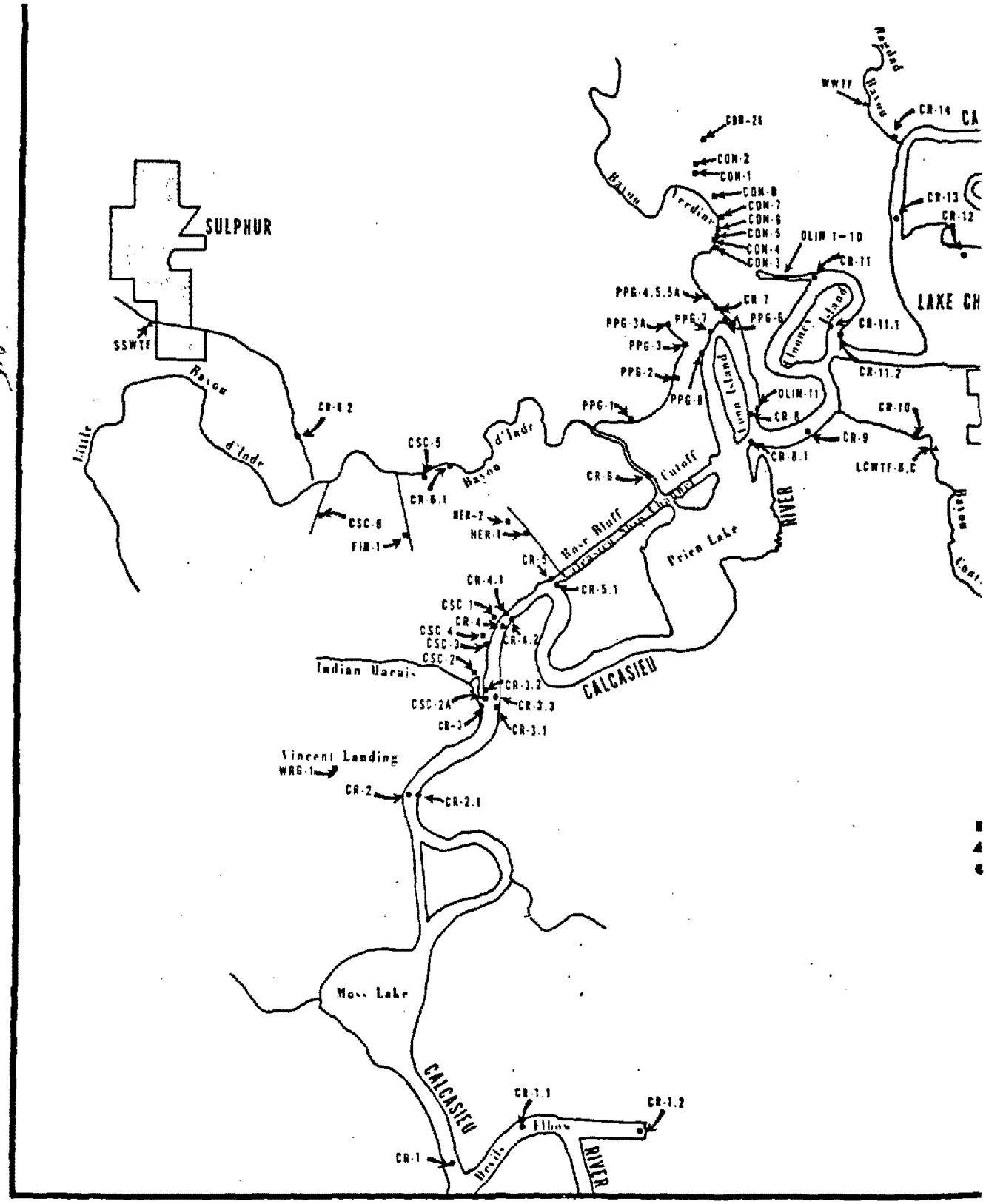
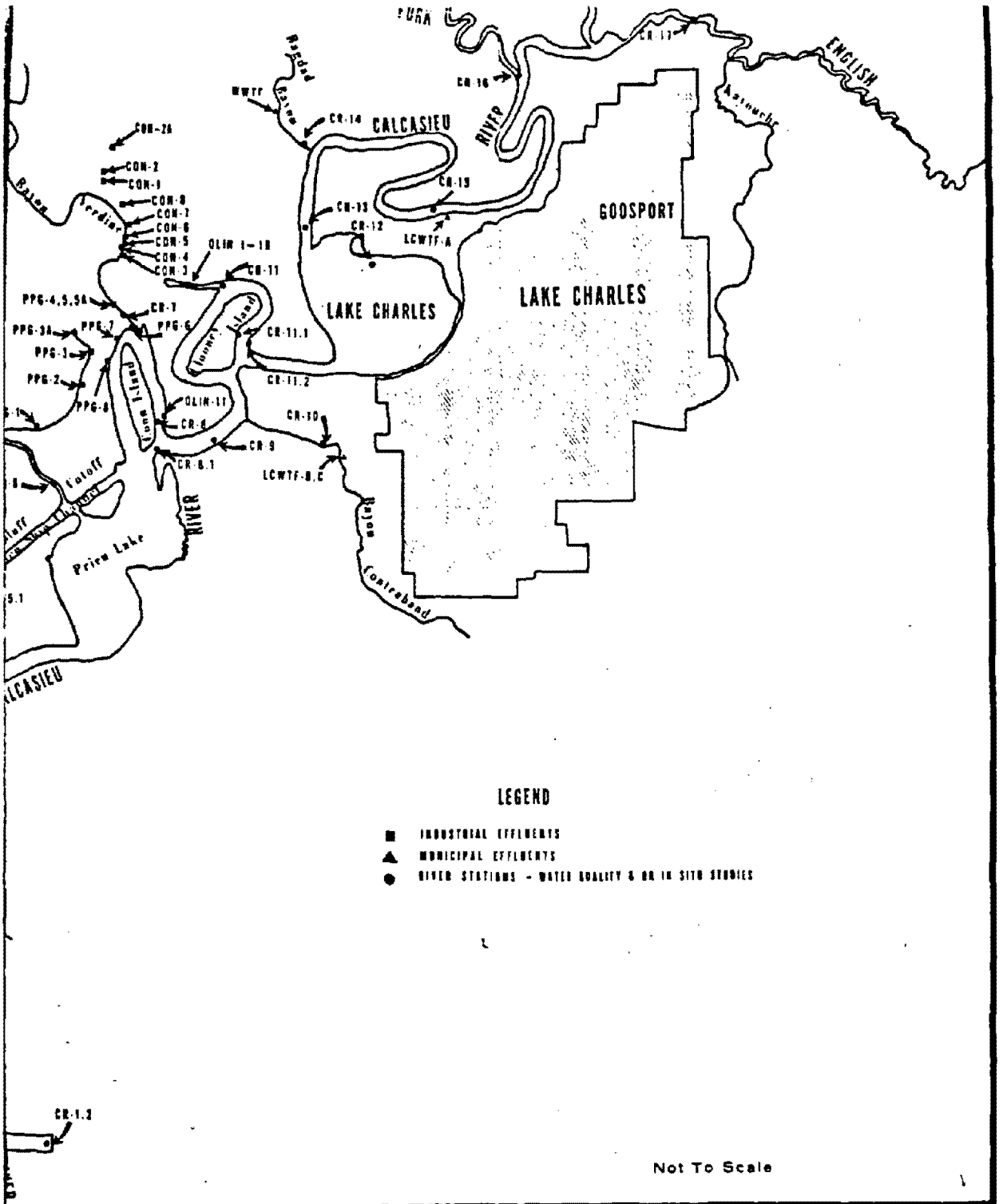


Figure 3. Sampling Locations - Lower Calcasieu Rive

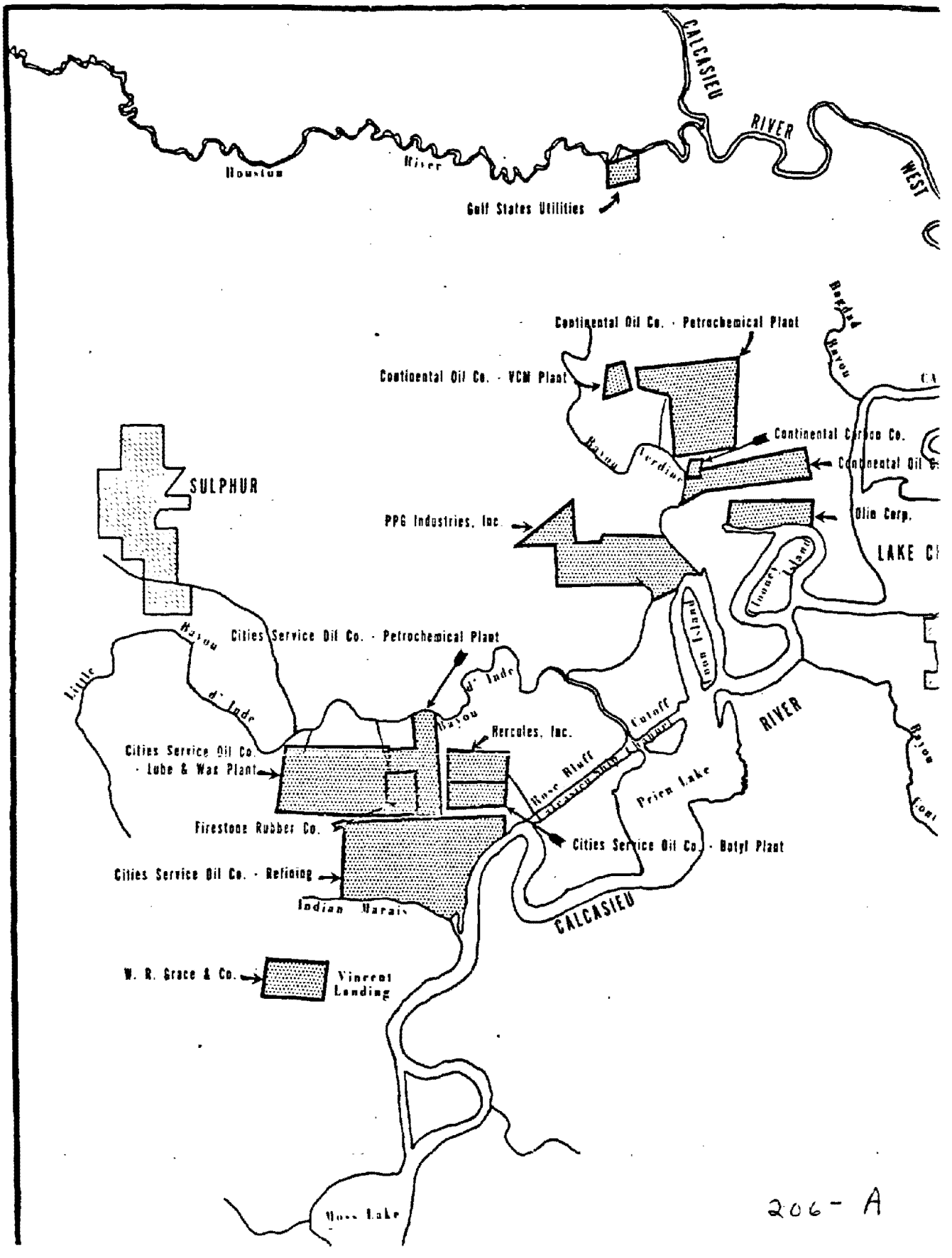
April 1971



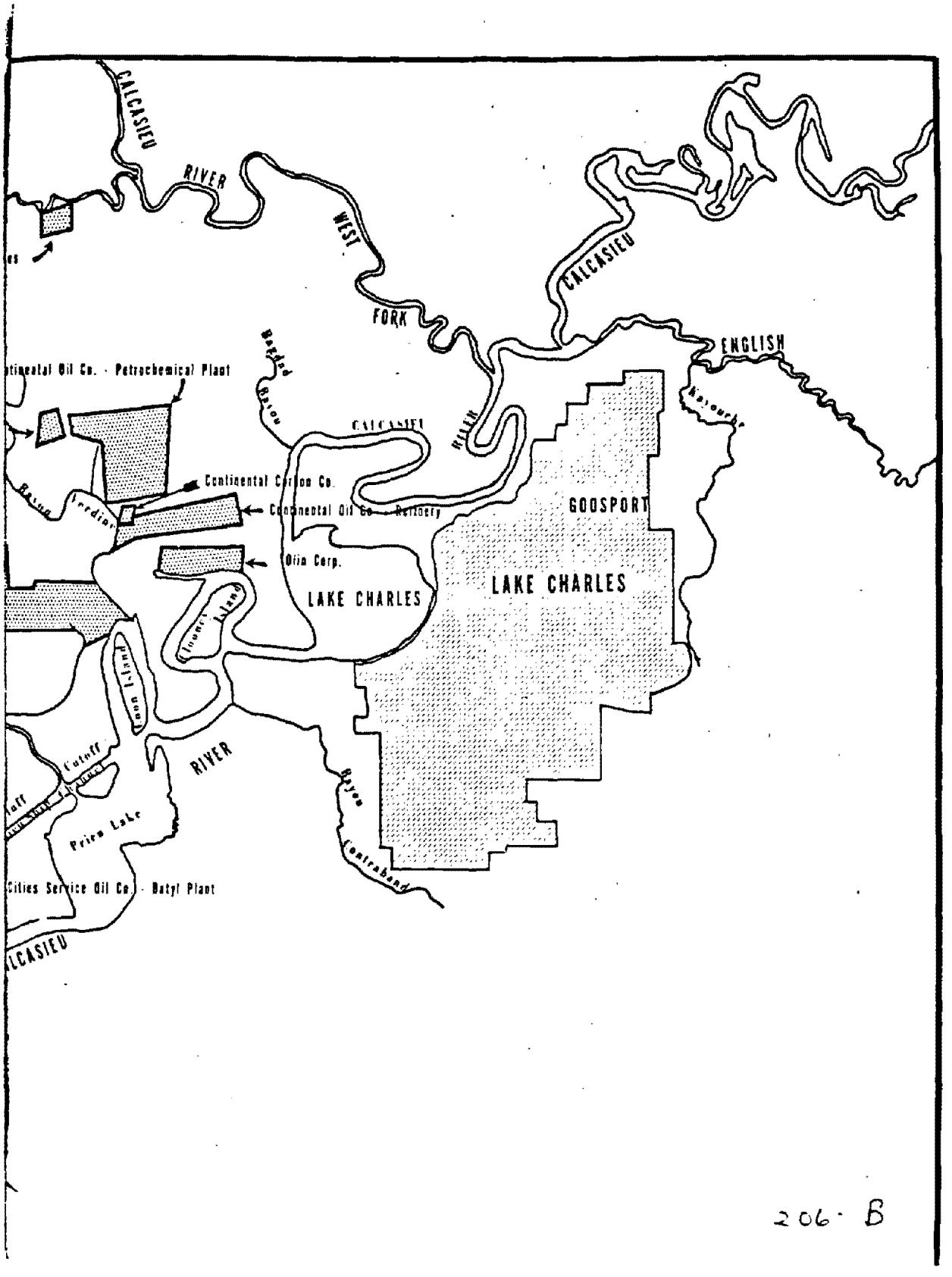
Sampling Locations - Lower Calcasieu River, La.

April 1971

205 D


CALCASIEU
RIVER
Houston
River
Gulf States Utilities
Continental Oil Co. - Petrochemical Plant
Continental Oil Co. - VCM Plant
Continental Carbon Co.
Continental Oil Co.
SULPHUR
PPG Industries, Inc.
Olin Corp.
LAKE CH
Cities Service Oil Co. - Petrochemical Plant
Bayou
Little
d' Inde
Hercules, Inc.
Cutoff
Cities Service Oil Co.
- Lube & Wax Plant
Rose Bluff
Price Lake
RIVER
Firestone Rubber Co.
Cities Service Oil Co. - Butyl Plant
Cities Service Oil Co. - Refining
Indian Marais
CALCASIEU
W. R. Grace & Co.
Vincent
Landing
Moss Lake

206 - A


CALCASIEU
RIVER
WEST
FORK
CALCASIEU
ENGLISH
Petrochemical Plant
Continental Carbon Co.
Continental Oil Co. - Refinery
Olin Corp.
LAKE CHARLES
GOOSPORT
LAKE CHARLES
Cutoff
RIVER
Price Lake
Cities Service Oil Co. - Butyl Plant
CALCASIEU

206-B

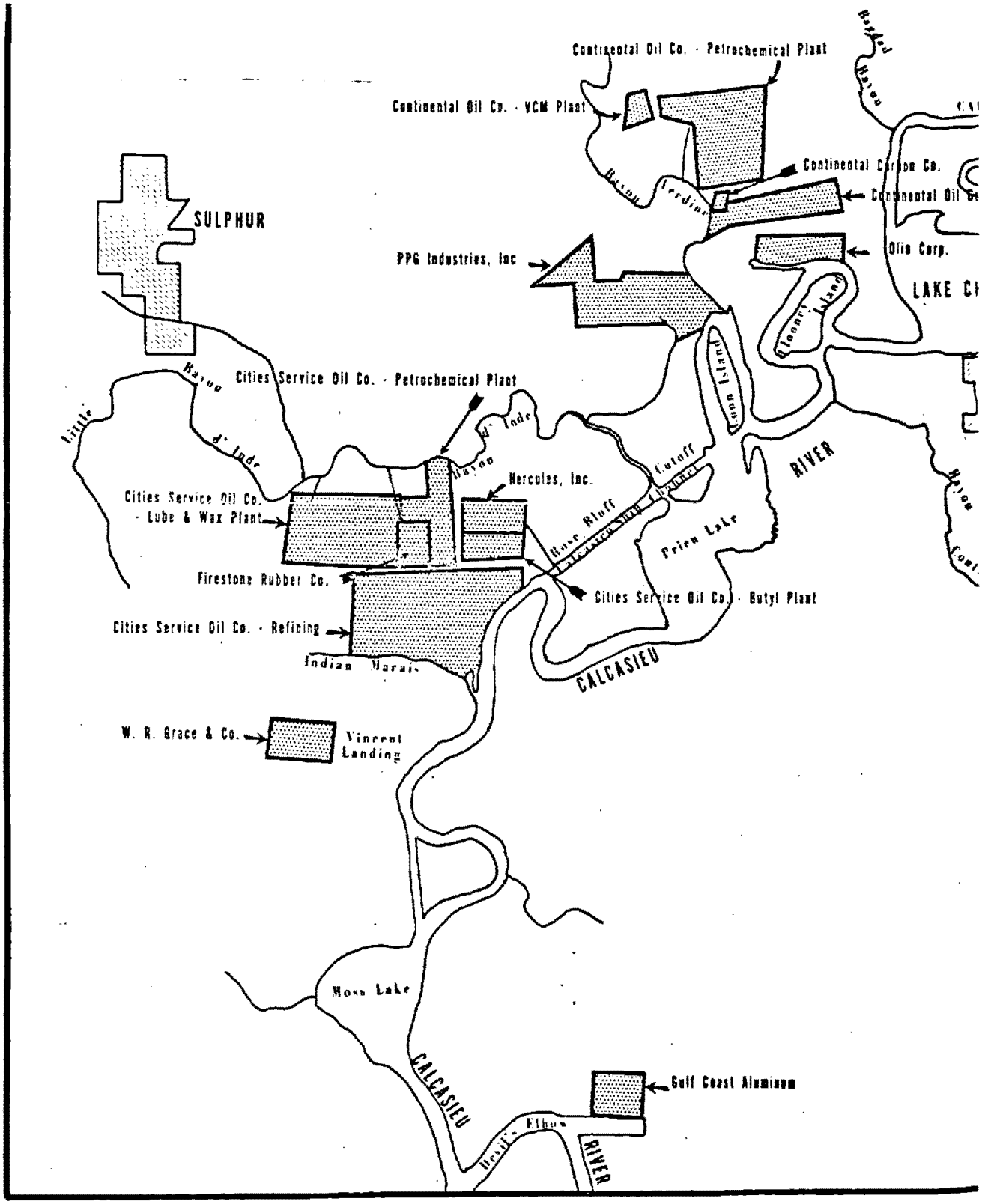
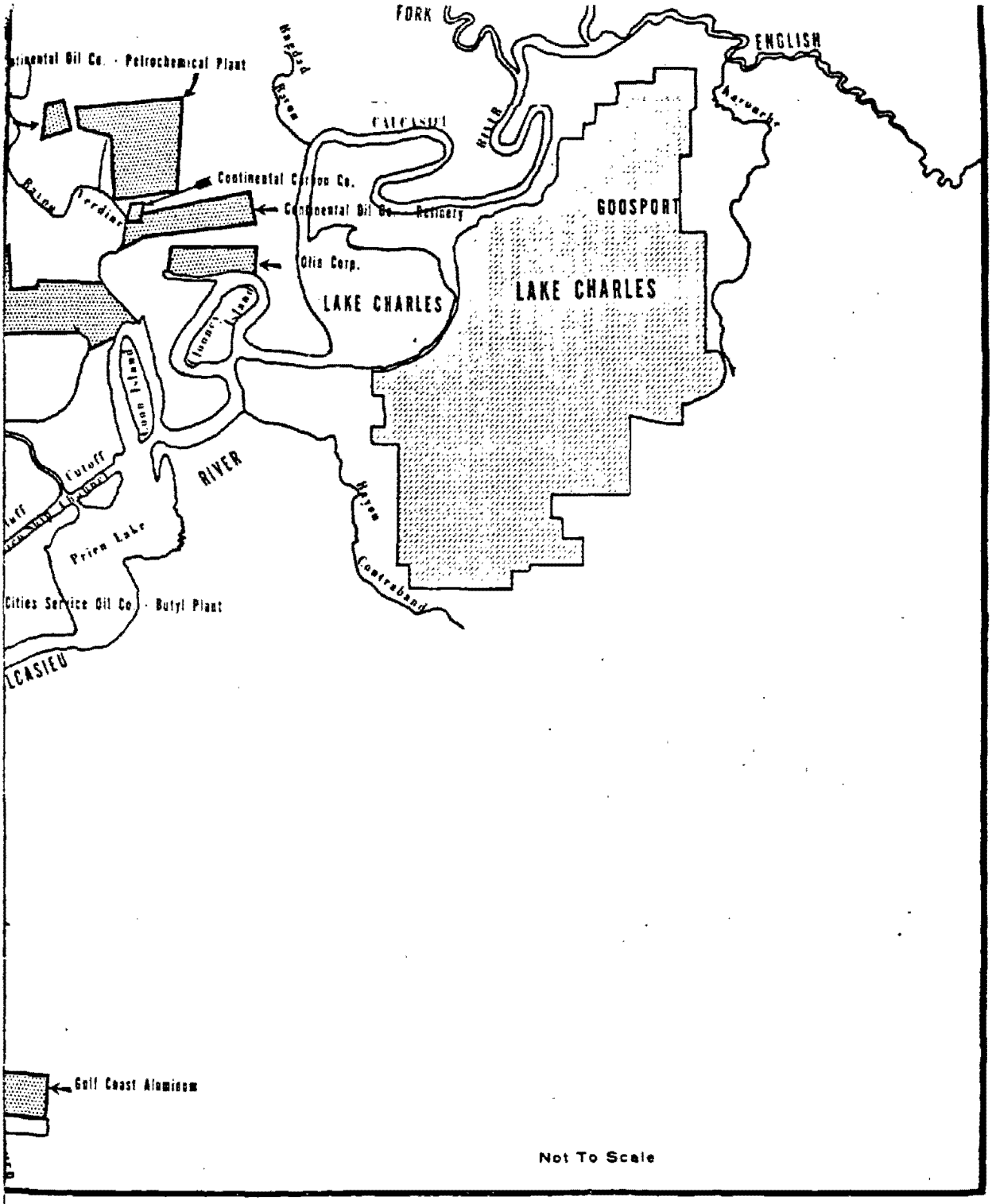


Figure 4. Industrial Locations–Lower Calcasieu R
(April 1971)

206

206-C



dustrial Locations–Lower Calcasieu River, La.

206 (April 1971)

206-D