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WILSONVILLE WASTEWATER SAMPLING PROGRAM

Final Report

Work Performed Under Contract No. AC05-78OR03054

International Coal Refining Company
Allentown, Pennsylvania

Technical Information Center
Office of Scientific and Technical Information
United States Department of Energy

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FINAL REPORT

WILSONVILLE WASTEWATER SAMPLING PROGRAM

Prepared by

INTERNATIONAL COAL REFINING COMPANY
P. O. Box 2752
Allentown, Pennsylvania 18001

for the

UNITED STATES DEPARTMENT OF ENERGY
Office of Solvent-Refined Coal Products
under Contract DE-AC05-78-OR-03054

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TABLE OF CONTENTS

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LIST OF ABBREVIATIONS

BOD	Biochemical Oxygen Demand (five-day) in mg/l
TOC	Total Organic Carbon in mg/l
COD	Chemical Oxygen Demand in mg/l
TKN	Total Kjeldahl Nitrogen
D.O.	Dissolved Oxygen in mg/l
gpd	Gallons per day
gpm	Gallons per minute
MG	Million gallons
MGD	Million gallons per day
l	Liter
m	Milligram
mg/l	Milligram per liter of solution
ml	Milliters
G	Grams
ppm	Parts per million
ul	Microliter
ug	Microgram
ug/l	Microgram per liter of solution
lb/hr	Pounds per hour
lb/month	Pounds per month
hr.	Hour
min.	Minute
TDS	Total Dissolved Solids in mg/l
TSS	Total Suspended Solids in mg/l
VSS	Volatile Suspended Solids in mg/l
MLSS	Mixed Liquor Suspended Solids in mg/l
MLVSS	Mixed Liquor Volatile Suspended Solids in mg/l
mg/l/hr	Milligrams per liter of solution per hour
RPM	Revolution per minute
psig	Pounds per square inch gauge
D.I.	Deionized
Temp.	Temperature
°C	Degrees celsius
°F	Degree fahrenheit
SRT	Solids retention time in days
HRT	Hydraulic retention time in-days
Inf	Influent
Eff	Effluent
GC	Gas chromatograph
GC/MS	Gas chromatograph/mass spectrometer
AA	Atomic adsorption spectrophotometer
SRC	Solvent refined coal
HTU	Hydrotreater Unit
CSD	Critical solvent deashing
CWS	Waste caustic sump
LWS	Liquid waste sump

LIST OF ABBREVIATIONS (Continued)

ACS	American Chemical Society
EPA	U.S. Environmental Protection Agency
ASTM	American Society of Testing and Materials
ESD	Catalytic Environmental Systems Division
HNO_3	Nitric acid
H_2SO_4	Sulfuric acid
HCl	Hydrochloric acid
NaOH	Sodium hydroxide (caustic)
$Ca(OH)_2$	Calcium hydroxide (lime)
$Pb(NO_3)_2$	Lead nitrate
Na_2CO_3	Sodium carbonate
NH_3-N	Ammonia (as nitrogen)
NO_3-N	Nitrate (as nitrogen)
NO_2-N	Nitrite (as nitrogen)
H_2S	Hydrogen sulfide (sulfide)
CN	Cyanide
SCN	Thio cyanate

Abstract

As part of its contract to design, build and operate the SRC-1 Demonstration Plant in cooperation with the U.S. Department of Energy (DOE), International Coal Refining Company (ICRC) was required to collect and evaluate data related to wastewater streams and wastewater treatment procedures at the SRC-1 Pilot Plant facility. The pilot plant is located at Wilsonville, Alabama and is operated by Catalytic, Inc. under the direction of Southern Company Services. The plant is funded in part by the Electric Power Research Institute and the DOE.

ICRC contracted with Catalytic, Inc. to conduct wastewater sampling. Tasks 1 through 5 included sampling and analysis of various wastewater sources and points of different steps in the biological treatment facility at the plant. The sampling program ran from May 1 to July 31, 1982. Also included in the sampling program was the generation and analysis of leachate from SRC product using standard laboratory leaching procedures. For Task 6, available plant wastewater data covering the period from February 1978 to December 1981 was analyzed to gain information that might be useful for a demonstration plant design basis.

This report contains a tabulation of the analytical data, a summary tabulation of the historical operating data that was evaluated and comments concerning the data. The procedures used during the sampling program are also documented.

Introduction

Tasks 1-5

A periodic sampling of the Wilsonville process water discharge streams under various operating conditions was performed to attain a better understanding of the range of contaminant concentrations encountered at Wilsonville, and to be expected at the SRC-I Demonstration Plant. In addition, a periodic sampling of certain points in the biological treatment system was performed to provide information on nitrification, denitrification, organic removal, and suspended solids removal.

The sampling program was keyed to the pilot plant operating schedule, taking advantage of material balance sampling periods at different steady state conditions. Sampling of the wastewater treatment system continued during two periods of operation downtime in order to determine any changes that occur during an operating-downtime-operating cycle. This information should be beneficial to the demonstration plant design, since shutdowns are sometimes accompanied by shock loads to the wastewater treatment system. The general sample matrix consisted of weekly composites of the "process samples" (composites of grab samples taken 4-5 days per week). "Treatment plant samples" were daily grab samples (generally 5 days per week). Chlorides samples were weekly composites. This general matrix was altered as requested by ICRC during the course of the program and is reflected in the data tables.

In addition to the general sampling, there were 2 sets of grab samples during the two pilot plant runs (239 and 240) for trace organics, trace metals and other inorganics as specified. Also, a single sample of SRC product from Run 236 was leached by various methods and analyzed by GC/MS for specified trace organics.

Task 6

Wilsonville treatment plant operating data and SRC "sour water" analysis from February of 1978 to December 1981 were compared to pilot plant operating data from quarterly reports covering the same period. The hydrotreater unit (HTU) was not in operation until May of 1981. Separate historic data on HTU sour water was not available. The data was looked at for variability and correlation to process operations. The biological treatment data was also evaluated to determine if any design or operating parameters could be derived for demonstration plant use.

This report does not describe either the pilot plant SRC-I process or the wastewater treatment plant process operation to any great detail. The design and operation of these units has been described elsewhere (References 1 thru 5 below). There are flow diagrams for specific reference, but the report assumes familiarity with the SRC-I process including hydrotreating and the wastewater treatment plant.

1. Sapp, J.B., Wastewater Treatment at The Wilsonville, Alabama Advanced Coal Liquefaction Pilot Plant, presented at the Summer National AICHE meeting at Cleveland, Ohio, 1 September 1982.

2. Watt, J.C., and Wroniewicz, V.S., Converting Coal Creates Contaminants, Pollution Engineering, 13, 7, pp. 27-30, July, 1981.

3. Watt, J.C., and Wroniewicz, V.S., Treatment of Wastes Originating From a Coal Conversion Pilot Plant, proceedings of the 7th Annual Industrial Pollution Conference, pp. 235-253, Philadelphia, PA, June 5-7, 1979.

4. Watt, J.C., and Boykin, R.G., Start-up and Operation of an Advanced Wastewater Treatment System for a Coal Conversion Pilot Plant, proceedings of the Industrial Waste Symposium sponsored by the Water Pollution Control Federation, October 6, 1981, Detroit, Michigan.

5. All Quarterly Technical Progress Reports, Operation of the Wilsonville Advanced Coal Liquefaction R & D Facility, Wilsonville, Alabama.

Background information

This section documents the background information concerning the sampling and analysis of the wastewater samples collected as part of this study. "Biological treatment plant" samples were to be taken daily. The "raw waste" sample and the "process samples" were to be run on weekly composites. The Wilsonville pilot plant sampled and preserved each sample site daily (generally 5 days per week). Samples were shipped daily to Catalytic Environmental Systems Division Laboratory in Marcus Hook, PA.

The sampling was initiated on 29 April 1982 and ran to 30 July 1982. Adjustments to the sampling schedule and to the original analytical schedule were made during the program according to ICRC requests. Additional sampling and analysis, primarily of phenolics, around the hydrotreater unit (HTU) was also done at ICRC request. In addition to the daily routine sampling and analysis, two sets of samples were taken to be analyzed for certain specified trace metals, inorganics and organics.

Description of Sample Points & Flow Measurements

(Refer to Figures 1 thru 5, and Tables 13, 14, 15 in the Appendix). Documented below are the sample designations, sample descriptions and sample point locations. Major process streams were sampled in the SRC process and in the hydrotreater (HTU) in addition to those samples taken around the wastewater treatment plant (WTU). Sanitary wastes are collected and treated separately in a package biological extended aeration system. Utility blowdowns etc. and process area run-off are treated in the WTU.

SRC Plant

1. V-105: SRC process sour water. This tank is a low pressure separator following the dissolver. The flow is measured and the sample taken from the overflow line running down the water phase side of the vessel through a sample cooler. The sour water flows continuously to a measuring pot where the volume is periodically recorded and discharged to sewer.

2. K-111: Vacuum Column (T-102) Vacuum Jet Condensate. The steam condensate and any column overheads dissolved in the water. There is no capability for routine flow measurement. Valves were installed to block off the vacuum jet down leg in order to take a sample by diverting the hot wastewater through a sample cooler. This procedure affected the vacuum in the system, and was only done for as long as needed to obtain each daily sample. It did not allow routine flow measurement. However, flow was measured twice during the study when the effect on the process was not critical. This number compared favorably with the theoretical steam usage (390 lb/hr) calculated by the plant engineers. Steam pressure was recorded but the pressure is kept well over that required by the vacuum jets and therefore was not indicative of flow. Flow should have been reasonably constant however, as the vacuum in the column is kept constant.

The other major waste stream in the process which was not sampled was the blowdown from the caustic scrubber. This scrubber removes acid gases and ammonia from the process gas streams. The pilot plant opted for the scrubber in lieu of a sulfur recovery unit. The scrubber is a major source of sulfide as well as organic and inorganic ammonia pollutants. However it is not indicative of a larger scale operation where the process gases would be treated in a sulfur recovery unit. The scrubber waste stream is combined with the other major process wastes in the "Raw Waste" sample.

Critical Solvent Deashing (CSD) Unit

There were no sample points in the CSD unit. There is minimal flow of wastewater from that process and only minor quantities of pollutants.

Hydrotreater (HTU)

1. V-1080: HTU process sour water

This vessel is a final separator on the overheads following the hydrogenation reactor. The water is primarily injected water taken from the vacuum jet condensate in the reactor bottoms recovery system. (See V-1070). V-1070 condensate is used as process contact water and then separated. It is let down through a measuring pot. Flow was derived from the plant records of the calibrated flow indicator on the pump that returns the condensate to the system (pump P-1230).

2. V-1070: Vacuum System Condensate
The condensate is let down in a hotwell where a nominal 70 to 80 lbs/hr (using pump P-1230) is returned to the process and becomes the bulk of the sour water (V-1080). The remainder goes directly to the sewer. There is no capability to measure this flow routinely. However, it was measured several times during the study and also compared to the theoretical value, based on steam consumption (290 lb/hr). This flow was somewhat variable, but there are several separate vessels and operations on the vacuum system.

3. Caustic Scrubber Blowdown: Continuous blowdown from T-1059 recycle gas scrubber. This is the scrubber on the recycle gases. It was sampled at the discharge to sewer and flow was derived from the caustic make-up pump flow rates. The raw sample is 20 percent caustic and can contain near saturation levels of H_2S. For safety reasons this sample was routinely diluted by 1 X 10 before handling. It was not felt that this would adversely affect the analysis or levels of detection required for collection of data for this program. All results are reported on a raw sample basis.

Wastewater Treatment Plant (WTU)

1. Raw Waste: Combined raw process waste. This flow comes from the Waste Caustic Sump (WCS) in the process area. The sample was collected as it was going to the pretreatment tank after a surge tank and a separator where phase separation of organics and flow

equalization is achieved. Combined raw process waste is the bulk of the pollutant load going to the treatment plant but does not include the "Liquid Waste Sump" (LWS) where most of the run-off utility blowdowns, etc. are collected. The LWS stream is generally low strength (less than 25 ppm TOC) but is a considerable portion of the hydraulic load.

2. Bioreactor Influent: Equalized pretreated combined wastewater going to biological treatment. Flow through the treatment plant is measured at the final effluent discharge to Yellow Leaf Creek. The sanitary discharge is separate.

3. 1st Bioreactor Effluent: Overflow of the first stage settling tank.

4. 2nd Bioreactor Effluent: Clarifier overflow from the second stage going to sand filtration.

Field Sampling, Preservation, and Analysis

Catalytic's ESD personnel went to Wilsonville to initate the sampling program. Sample sites were verified, sampling procedures were reviewed, facilities for storage and preservation were set up and approved. Other logistics for documentation, preparation of samples for shipping and transportation arrangements were worked out. Sampling was begun while personnel from Catalytic's ESD were still on site and necessary adjustments were made to the program and procedures. Sample perservation requirements were consolidated where possible to avoid complexity. Daily samples of each of the designated sample sites were obtained on the evening shift. They were analyzed for pH and sulfide by Wilsonville personnel, who then stored them in a refrigerator at less than 40°F. The following morning the samples were packed in an insulated container and shipped air freight directly to Philadelphia, where they arrived at approximately 3:30 PM and were held for pick-up by Catalytic. The samples were picked-up that afternoon or the following morning. In either case, the hold time was no longer than 48 hours, which meets EPA specification. Any required compositing was performed at the Catalytic laboratory.

Listed below are the finalized instructions for the routine samples.

General Instructions For Sampling, Sample Preservation And Analysis

I. Daily Bottle-Pack

Each pack contains enough bottles for sampling on one day. The following bottles are included in each daily bottle-pack:

Bottle Size		Quality
16 oz. (500 ml)		4
32 oz. (1000 ml)		6
8 oz. (250 ml)		17
	Total	27

Also included in each pack are three cold-brick freezer pillows. These must be frozen overnight before use in the bottle packs for keeping the bottles cool during shipment to Marcus-Hook. All bottles should be rinsed with two small portions of samples before filling to about 90 percent of bottle volume.

II. Unpreserved Samples - "A Samples"

If the label states "No Preservatives", simply fill the bottle with the sample. Write on the label the Sample No., date sampled, time sampled, and collector's name. Place the bottle in a refrigerator until packed for shipment.

III. HNO_3 - Preserved Samples - "A Samples"

If the label states "Add HNO_3 to pH 4.0", place the sample in a designated beaker and carefully add enough concentrated nitric acid to lower the pH below 4.0. Stir the sample during acid addition. Use pH indicating paper. Record the volume required on the label and in the red Sample Log Book. Refrigerate until packed for shipment.

Caution: Be certain to use a fume hood, or similar precaution, while adding acid. Toxic gases such as hydrogen sulfide could be evolved.

IV. H_2SO_4 - Preserved Samples - "B Samples"

If the label states "Add conc. H_2SO_4 to pH 2", proceed as described in Section III using concentrate and sulfuric acid. Take the necessary precautions, record volumes, and refrigerate the samples after treating.

The "biofeed", "1st bio eff", and "2nd bio eff", samples should not be transferred to a beaker, but the acid addition should be directly to the sample bottle. Mix and test with pH paper, record volumes and refrigerate.

V. Cyanide - Thiocyanate Samples with Pb $(NO_3)_2$ and $Ca(OH)_2$ "C Samples"

1. 500-ml samples: Add Pb $(NO_3)_2$ powder (ACS Reagent Grade) with a small (0.2g) measuring scoop to approximately 500 ml of sample (see note on sample preservation) in a beaker while stirring. After each addition, check for sulfide with a lead acetate test strip moistened with pH 4 acetate buffer (15th Ed. Standard Methods, Method 408B(e), p. 283). After the sample tests negative for sulfide, add about 0.1g excess Pb $(NO_3)_2$ (1/2 scoop).

   Next, add $Ca(OH)_2$ powder while stirring and adjust the pH to 12-12.5. Allow the sample to settle. This should occur fairly rapidly (do not allow long contact of sample with precipitate). Filter the sample by decanting the top liquid through a Whatman No. 40 paper filter on a Buchner funnel into a clean suction flask. Place the bottle in a refrigerator until packed for shipment.

2a. 250-ml Samples (except V-105 and C. S. Blowdown):

Perform preservation as in IV.1 above, except that $Pb(NO_3)_2$ should be added in excess at about 0.05g per sample (1/4 scoop).

2b. 250-ml Samples from V-105 and C. S. Blowdown:

First, collect 25-ml sample with a graduated cylinder. Pour this volume into a 250-ml graduated cylinder and add distilled water to the 250-ml mark.

Next, pour the diluted sample into a beaker containing a stirring bar. Add $Pb(NO_3)_2$ powder with a small scoop (note that about 2.8g may be required because of the high sulfide levels - a portion of $Pb(NO_3)_2$ may be weighed out on a top-loading balance to add most of the Pb requirement in one dose). After each addition, check for sulfide with a lead acetate test strip moistened with pH 4 acetate buffer (15th Ed. Standard Methods, Method 408B(e), p. 283). After the sample tests negative for sulfide, add about 0.05g $Pb(NO_3)_2$ in excess (1/4 scoop). Next, add $Ca(OH)_2$ powder to adjust the pH to 12-12.5 while stirring the sample. Allow the sample to settle, then filter through a No. 40 filter paper by decanting the top liquid through the filter on a Buchner funnel. (Avoid long contact times between the sample and precipitate.) Fill out the bottle label and place the bottle in refrigerator until packed for shipment.

VI. Sample Documentation

1. Each sample collected must be assigned a unique number by the collector. If possible, these numbers should run consecutively for samples collected in this wastewater sampling program.

2. The collector's name and the sample number must be written on the label, along with the date and time of sampling. The place of collection and preservation type are pre-printed on the label. Use a waterproof ink for marking bottle labels. If any liquid preservatives have been added to the samples, record the volume of added preservative on the label.

3. A red field log book has been supplied for recording sampling information in the appropriate columns as follows:

Date Logged In	- Use for date sample collected
by:	- Use for sampler's initial
Date Received:	- Leave blank
By:	- Leave blank
Lab Control No.:	- Use for Wilsonville Samples
Client & Job No.:	- Leave blank
Billing Basis:	- Leave blank
Sample Description:	- Fill in with description on bottle, such as "K-111" or "1st Bio. Effl."
Analysis Inventory:	- Fill in with data from those parameters being run at Wilsonville Laboratory. Photocopies of these papers can then be sent to Marcus Hook for inclusion of data on Summary Sheets. Use one of the columns to record the volume of added preservative (H_2SO_4 or HNO_3), dilutions, and quantities of dry preservatives.

VII. Laboratory Notebook

A project notebook is supplied for use by the analyst for documenting pH and sulfide analyses. This book has been checked out from the Catalytic Laboratory in Marcus Hook and will become part of the project record in Marcus Hook after the sampling period has ended. Sign and date all page entries made in this book. The book should show reagent preparation for the sulfide analysis and calculation necessary for obtaining the final data on sulfides from the raw data collected on the spectrophotometer. For pH determinations, a pH Meter Standarization sheet is supplied to simplify documentation of pH meter standardizations with commercial buffers. These sheets should be taped into the laboratory notebook.

VIII. Analytical Laboratory Analysis Request Form for Field Samples

Please fill in the "Sample Description" column with the sample numbers assigned to each bottle, adjacent to the sample collection sites information. Do not write in the "Laboratory Number" column of these sheets.

The Request Form acts as a sample inventory sheet for the collector (tells which bottles are to be filled at each site), and is a shipping list for the laboratory. It should be filled out and packed in its envelope, between the inner styrofoam box top and the outer cardboard.

IX. Analysis

1. Sulfides and pHs should be run on each sample. Caution should be taken not to cross-contaminate different samples. Data and dilutions required for analysis should be recorded in the red Sample Log Book.

2. Alkalinity measurement is required on the raw waste. This should be done on a separate sample taken from the pre-mix tank. The quantity and concentration of acid required to lower the pH to 7.0 and then to 4.3 should be recorded in the red Sample Log Book next to the Raw Waste - "A" sample for that day.

Daily Routine For Sample Collection Preservation And Analysis

1. Put name, date, and time on sample label before sampling.

2. Fill sample bottles about 90 percent full.

3. Dilute C.S. Blowdown sample:
   One sample bottle will be filled for the hydrotreater C.S. Blowdown (the "A" sample). Take 100 mls of this sample and dilute to a liter; (Discard the remaining sample). Thoroughly rinse the "A" sample bottle. Make sure the dilution is well mixed and transfer the diluted sample to the 3 sample bottles designated for "C.S. Blowdown". Record the dilution on the label if it is not already and in the red Sample Log Book. Discard any unused diluted sample.

4. Analyze sulfides and pH. Take care not to contaminate effluent samples with equipment or glassware that has been in contact with the more concentrated raw waste and process samples. Record the dilutions required for the sulfide analysis and a reference for future samples.

   One alkalinity is required each day on the raw waste. A separate sample from the premix tank may be taken (with the sulfides oxidized so that H_2S will not come off when acid is added). Record the mls of acid required to lower a 50 ml sample to pH 7.0. Then add additional acid to the sample in order to lower the pH to 4.3. Record that volume. Record the volumes in the red Sample Log Book next to the "Raw Waste" sample that was taken that day.

5. Take the samples, sample container, Analytical Request Form, and red log book to the hydrotreater Control Room. Refrigerate all of the "B" and "C" samples and the "A" samples of the bio feed and the two bioeffluents. Take the remaining 6 "A" samples and the red Sample Log Book to the CSD lab.

6. Sample preservation (see Note on last page).

"A" 7. Transfer each sample in turn to its designated beaker and add concentrated HNO_3 (nitric acid) with stirring, under the hood, to bring the pH to 4.0 using pH paper. Return each treated sample to its sample bottle. (It is not necessary to rinse out these sample bottles). Record the volume added on the label and in the red Sample Log Book. Thoroughly rinse each beaker twice with tap water and once with D.I. water and drain well.

8. Return the "A" samples to the refrigerator and get all 9 "B" samples.

"B" 9. Acidify the biofeed and two bioeffluent "B" samples by adding conc. H_2SO_4 directly to the bottle. Mix and check with pH paper to less than or equal to pH 2.0. 1/2 ml (1/2 dropper full) to each effluent and 1 ml (1 dropper full to the Biofeed).

"B" 10. For the 6 remaining "B" samples, use the designated beakers and treat as described in Item 7 above, using conc. H_2SO_4 instead of HNO_3 to pH less than or equal to 2.0 Record volumes and refrigerate samples.

"C" 11. Get all 9 "C" samples from refrigerator. Dilute the V-105 sample and the C.S. Blowdown sample (which is already diluted 1.10) by diluting 25 mls up to 250 mls in a graduate and pour into their designated beakers. In turn, put the other 5 process samples and the raw waste sample in their beakers and treat as described below.

Note: After each "C" sample bottle is emptied, before it is refilled, rinse twice with tap water, add a scoop of lead nitrate, add some water, mix, and rinse twice again.

"C" 12. For the 5 process samples and the raw waste, take each sample in turn and add the estimated quantity of Pb $(NO_3)_2$ (based on previous day's sample. Mix and check with lead-acetate strip. If the sample still tests positive for sulfide (the test strip turns black), add an additional scoop of lead nitrate and stir. Check with the test strip after each addition until it is negative. Then add sufficient $Ca(OH)_2$ (lime) to bring the pH to 12.0 or above as indicated by pH paper. Decant the supernatant through a filter (Whatman #40), and return the sample to the original sample bottle that has been rinsed as specified in Item 11 above. Record quantities in red log book.

"C" 13. For the Biofeed, add one scoop $Pb(NO_3)_2$ and 3 scoops $CaO(H)_2$. Filter and return to the sample bottle.

"C" 14. Add 1 scoop of $Ca(OH)_2$ to each bioeffluent directly to the bottle. No $Pb(NO_3)_2$ should be added.

15. Make sure all caps are on all bottles tightly. Lay them on their side in the refrigerator in the Hydrotreater Control Room. Make sure the "Analytical Request Form" is with them.

NOTE ON SAMPLE PRESERVATION:

(1) Before beginning, six separate 500 ml beakers should be permanently marked with the following designations; V-105, K-111, V-1070, V-1080, C.S. Blowdown, and Raw Waste. Each beaker should be used for that sample site for all the preservation.

In addition, one similarly designated and marked beaker will be required to treat the biofeed for sulfide removal if sulfide is present. Normally, no sulfide will be detected in the effluents. For those samples where no sulfide is detected, no beaker will be necessary. The pH of the sample being treated for cyanide preservation will be raised by adding $Ca(OH)_2$ directly to the bottle. (No $PB(NO_3)_2$ addition is required if there is no sulfide present.)

(2) Quantities of fixative reagents required for addition should be deduced from previous day's work. A summary table may be helpful for this purpose. Using these quantities as estimates (starting points), check to see if they are correct, adjust accordingly and record the actual addition quantities required.

Two sets of samples for sampling priority pollutant and trace inorganic analysis were taken. Separate sample containers were prepared and shipped to Wilsonville. Again Catalytic's ESD personnel were on site to coordinate and supervise the taking of the initial sample set. All samples were grab samples. Blanks containing fixative reagents were returned also. Where applicable, the general instructions for the routine daily sampling were applied with the following special instructions:

Instructions for Cleaning Beakers and Acidifying Samples with HNO_3

1. Use one liter or larger beakers, preferably new ones, a different one for each of the 6 different sample sites requiring acidification.

2. Before using, rinse with 1:1 HCl, then rinse with 1:1 HNO_3, rinse once with tap water then twice with "nanopure" D.I. water.

3. In order to acidify the volume of sample required (3 liters of sample for each site), each beaker will have to be reused several times. Do not rinse the beaker for that sample site between each aliquot. Acidify the contents of one of the liter bottles for the site, return the sample to the same bottle. Do not rinse the bottle or the beaker. Using the same beaker acidify the remaining liter bottle for that sample site in the same manner.

4. Measure accurately and record the quantity of acid (HNO_3) added to each bottle; on that bottle and in the log book.

5. Acidify only the 1 liter bottles that are indicated. No vials are to be acidified.

Priority Pollutant Sampling Instructions for Diluting The Caustic Scrubber For Blowdown Sample

1. One amber bottle will be filled with straight raw sample at the time of sampling. The remaining bottles will be held and filled with diluted sample generated from that bottle.

2. Sufficient quantity will be prepared to fill all the vials and one liter bottles as indicated. (approximately 3.2 liters)

3. Use oxygen-free water from the cartridge for dilution. Use the same glassware that has been used for making these dilutions. Rinse throughly with O_2 free water before beginning. Also return 500 mls of O_2 free water in a separate sample bottle to use as a blank.

4. Mix with as little agitation/aeration as possible, then fill the vials first (1 X 10 Dilution).

   Note: no sulfide analysis is required on these samples.

5. Once the sample has been diluted and put in the sample bottles, treat them as whole samples, as indicated on the sampling chart.

Analytical Procedures

Boron

Boron was determined in unfiltered samples by Method 404A (Curcumin Method) in Standard Methods (1). After dissolution of the colored residue in absolute isopropanol or 95 percent ethanol and dilution to 25 mls the samples were centrifuged at 1000 rpm for 5 min. if suspended matter was present. The clarified solutions were then read on a spectrophotometer for estimation of boron. Interferences were found in the caustic scrubber sample, even after dilution to 1/50 of the original sample. Hence, no results were reported for this sample. Low recovery values for some of the raw waste and K-111 samples were found. However, no boron was detected in these samples and the detection limits reflect the recovery values. Recoveries of other samples were found to be close to 100 percent for the dilutions used in the analysis. (One raw waste sample (3447) was 80 percent.) Boron was determined on samples preserved with nitric acid.

Chloride

Chloride was determined after filtration (glass fiber) and preliminary digestion by the Method of Luthy (2) using Method 408C (Potentiometric Method) in Standard Methods (1). The titration with silver nitrate was performed using an Orion Model 94-16 silver ion/sulfide ion activity electrode to indicate the end-point. Chloride was determined on samples which were not preserved.

Fluoride

Fluoride was determined in unfiltered samples after Bellack distillation, using an Orion Model 94-09 fluoride electrode and Orion #94-09-09A total ionic strength adjustment buffer (with EDTA) to measure fluoride in the distillates. These methods are documented in EPA (3) Methods 340.1 and 340.2. Samples for fluoride were not preserved and were collected in amber glass bottles used for priority pollutant analyses.

Alkalinity

Total alkalinity was determined in unpreserved samples by constructing three titration curves with treatment system feed, primary effluent, and secondary effluent samples from Wilsonville. The end-point pH values were found to be 4.25 (feed), 4.50 (primary effluent), and 4.60 (secondary effluent). Subsequent alkalinity titrations were made to these end-points, using standardized sulfuric acid near 0.1 N (feed) or 0.02 N (effluent), with a combination pH electrode and pH meter as documented in EPA (3) Method 310.1.

Chemical Oxygen Demand (COD)

COD was determined on unfiltered samples by EPA (3) Method 410.4, using test-tube digestion in an oven with subsequent colorimetric analysis on a Spectronic 710 spectrophotometer or Spectronic 20 spectrophotometer. The COD analysis was performed on samples preserved with sulfuric acid.

Thiocyanate

Thiocyanate was determined on samples preserved by addition of lead and lime. The samples were filtered through paper, then were diluted into four 50-ml volumetric flasks per sample. Raw waste and the feed to the biological treatment system were diluted 10 ml/50ml, while all other wastewaters were diluted 40 ml/50 ml. To one of the four volumetric flasks in each set was added nitric acid only, to act as a color blank, while the other flasks were treated with a color reagent containing iron and nitric acid, as specified in Standard Methods (1), Method 412-K. One of the flasks in each set was spiked with 2 mg/l and another with 4 mg/l of thiocyanate from a 100 mg/l standard solution. The concentration of thiocyanate in the unspiked sample was found by the method of standard additions, using readings made on a Spectronic 710 or Spectronic 20 spectrophotometer, after subtraction of the color blank reading from that of each of the other sample dilutions in each set.

Cyanide

Total cyanide was determined on samples which had been preserved with lead nitrate and lime to pH 12. The samples were distilled according to EPA (3) Method 335.2, and the distillates were treated with approximately 0.2 g cadmium carbonate to precipitate sulfide, according to the procedure proposed by Barton et al. (4). Initial analyses were performed with the silver nitrate titration procedure for analysis of the distillate. However, the sample concentrations were found to be too low for the method, and the pyridine-barbituric acid procedure given in EPA (3) Method 335.2 was used for the rest of the program.

Ammonia

Ammonia-N analyses were performed on unfiltered samples preserved with sulfuric acid using EPA (3) Method 350.2. This method employed distillation and titrimetric analysis of the ammonia trapped in boric acid, using 0.02N sulfuric acid.

Total Kjeldahl Nitrogen (TKN)

TKN was analyzed, on unfiltered samples preserved with sulfuric acid, using EPA (3) Method 351.3. As in the ammonia analysis, the boric acid solutions of distilled ammonia were titrated with 0.02N sulfuric acid.

Total Organic Carbon (TOC)

TOC was determined on unfiltered, unpreserved samples after pretreatment with approximately 0.4g lead nitrate/30 ml sample and centrifugation, to remove sulfides. The sample vials were centrifuged 10 minutes at 1000 RPM and the supernates were then diluted for analysis and acidified to pH less than 2 with concentrated hydrochloric acid. TOC concentrations were determined by injection of 25-30 ul of sample into the sample boat of a Dohrman DC-50 TOC Analyzer.

Biochemical Oxygen Demand (BOD)

BOD was determined on unfiltered unpreserved samples, using Method 507 in Standard Methods (1). Nitrification Inhibitor (2-chloro-b-(trichloro methyl pyridine)) was used for all determinations. Feed was derived from Wilsonville primary effluent.

Phenolics (Colorimetric)

Phenolics were determined on unfiltered samples preserved with sulfuric acid. The samples were distilled and analyzed without solvent extraction, using the 4-aminoantipyrene colorimetric procedure in EPA (3) Method 420.1.

Nitrite-N

Nitrite-nitrogen was determined on filtered primary and secondary effluent samples which were unpreserved, by analyzing them the day they arrived in the laboratory. The EPA (3) Method 353.3 was used. Poor recoveries were found unless the samples were diluted prior to analysis. The samples were diluted 10/100, then diluted again 25/100 with ammonium chloride buffer for colorimetric analysis on a Spectronic 710 or Spectronic 20 Spectrophotometer.

Nitrate-N

Nitrate-nitrogen was determined on filtered primary and secondary effluent samples which were preserved with sulfuric acid. The cadmium reduction method, EPA (3) Method 353.3, was used to determine (nitrate nitrite)-N, and nitrate-N was found by subtraction of the nitrite-N concentration. Bio-reactor Feed samples could not be run with this procedure, as interferences destroyed the efficiency of the cadmium columns for nitrate reduction. The effluent samples were diluted by 2/100, then 10/25 before final dilution by 25/100 with ammonium chloride buffer for colorimetric analysis and Spectronic 710 or Spectronic 20 Spectrophotometer.

Total Dissolved Solids (TDS)

TDS was found by filtration of unpreserved samples and evaporation of the filtrates in an oven set at 180°C, according to EPA (3) Method 160.1.

Total Suspended Solids (TSS) and Volatile Suspended Solids (VSS)

TSS and VSS analyses were performed on unpreserved samples, according to Methods 208.D and 208.E in Standard Methods (1).

Metals

All metals analyses were performed on unfiltered samples which were preserved with nitric acid to a pH of 2 or less. The samples were digested with the following procedures, to obtain an estimate of the "total" metal in the samples.

a. For antimony: Digested according to the EPA (3) nitric acid digestion procedure in the Metals section, paragraph 4.1.3. The digested samples were diluted to volume with 2.5 percent HCl + 0.5 percent HNO_3 in water for analysis.
b. For mercury: Digested according to EPA (3) Method 245.1 (Manual Cold Vapor Technique).
c. For arsenic and selenium: Digested according to EPA (3) Method 206.2. The digested samples were treated with nickel nitrate to give a final concentration of 0.1 percent nickel nitrate in the solutions taken for analysis.
d. For all other metals: Digested according to the EPA (3) nitric acid digestion procedure in the metals section, paragraph 4.1.3. The digested samples were diluted to volume with 0.5 percent HNO_3 in water for analysis.

The digested solutions were analyzed by one of three atomic absorption techniques:

a. For mercury: Analyzed by the Manual Cold Vapor Technique, EPA (3) Method 245.1, with an Instrumentation Laboratories Model 457 Atomic Absorption (AA) Spectrophotometer.

b. For arsenic and selenium: Analyzed by injection of 25 ml of sample into a graphite tube of an Instrumentation Laboratories Model 655 furnace which was mounted on an IL Model 457 AA Spectrophotometer.

c. For all other metals: Analyzed by aspiration of sample into either an air-acetylene or nitrous oxide-acetylene flame on an IL 457 AA Spectrophotometer.

Benzene, Toluene, and Ethylbenzene (Volatile Aromatics)

These volatile organic compounds were extracted from unpreserved, unfiltered samples which were collected in headspace-free septum bottles or screw-top septum vials from two steady-state runs and refrigerated until analyzed. The extraction and quantitation procedure was a micro extraction approach used during the EPA Effluent Guidelines Verification program (5), as described in Method Code #7, and by Rhoades and Nulton (6).

In the micro-extraction procedure, 30g of salt (sodium chloride) were added to a 100-ml volumetric flask and 90 ml of sample or sample dilution were added to the flask. This solution was then spiked with 50 ul of internal standard solution (850 mg/l cumene in methanol) and an added 50-ul spike of a methanolic solution of benzene-toluene-ethylbenzene mixture. A second flask was set up in the same manner, without the added benzene-toluene-ethylbenzene spike mixture. One ml of pesticide-grade pentane was added to each flask and the flasks were shaken for 2 minutes. All sample transfers and extractions were conducted in a walk-in cold storage room. Sample dilutions were prepared in the same cold room, with graduated cylinders for measurement of sample aliquots and cold, purified water for dilution of these aliquots to 90 ml.

After mixing, the upper solvent layer was sampled by taking one ul for gas chromatographic (GC) analyses on a Hewlett-Packard 5880 instrument filled with a fused-silica capillary column (27.3 in. long, 0.335 mm ID, 1 micron DB-5 film thickness). One ul of pentane was co-injected with the sample as solvent flush of the needle, and the injection was made in the splitless mode. Other chromatographic conditions were:

Carrier Gas Hydrogen at 32.5 cm/sec. flow

Auxiliary Detector Gas: Nitrogen at 30 ml/min.

Inlet Purge Flow: Hydrogen at 60 ml/min.

Purge Activation Time: 30 sec.

Oven Temperature: 34°C (0.6/min)
10°C/min. to 150°C
Hold at 150°C to elute compounds of interest.

Detector: Flame Ionization

Detector Temperature: 150°C

Injector, Temperature: 2 mm ID Fused Silica Liner, 150°C

Septum Purge: 4 ml/min. Hydrogen

Peak identities were confirmed by comparing relative retention times (to cumene) of sample peaks to those of standard compounds. Quantitation was performed by calculating the relative area of each peak, references to the area of the internal standard (cumene) peak in the unspiked sample, then by multiplying each relative area by a response factor computed as follows:

$$\text{Response Factor for Compound A} = \frac{\text{ug/l of added compound}}{\text{Rel. area (spiked sample)-Rel. area (un-spiked sample)}}$$

By performing these calculations, each sample was calibrated by its change in relative area as a result of a known spike addition. Distilled water showed the following extraction efficiencies for the aromatic compounds from 90 ml water (and salt) into 1 ml pentane:

Compound	Computed Percent Extracted *
Benzene	84
Toluene	85
Ethylbenzene	84
Cumene	68

* Cold-room temperature of water and solvent

Phenolic Compounds

The following compounds were determined on composite V-1080 sample #3489, composite V-1070 sample #3490, and on several samples taken during two different steady-state runs: phenol, o-cresol, p-cresol, m-cresol, 2,6-dimethyl phenol, 2,4-dimethyl phenol, 2,5-dimethyl phenol, and p-ethyl phenol. The samples were not preserved and were analyzed unfiltered by EPA Effluent Guidelines Verification Procedure Code #19 (5), as described by Rhoades and Nulton (6).

Before analysis by microextraction, 125 ml of sample or sample dilution was made basic (pH 12 or above) with 6 N NaOH. The sample was extracted three times with 20 ml of methylene chloride each time in a 250 ml separatory funnel, and the methylene chloride extracts were discarded. The solution was then extracted with 20 ml hexane and the hexane was discarded. A few ml's were drained out of the separatory funnel, then an 85 ml portion was measured out and made acidic (pH 2 or less) with 1 + 1 sulfuric acid/water. This solution was poured into a 100 ml volumetric flask containing 30 g of sodium chloride. Micro-extraction was performed by shaking (2 min. spiked and unspiked solutions with 1 ml diisopropyl ether (peroxide-free). All samples were dosed with 25 ul of 2,4-dibromophenol (13,140 mg/l in 2-propanol).

Gas chromatography was performed on the same capillary column used for volatile aromatics, with 1 ul injection with 1 ul of diisopropyl ether in the splitless mode. Other conditions were as follows:

Carrier Gas: Hydrogen at 32 cm/sec. flow at 30°C
Auxiliary Detector Gas: Nitrogen at 30 ml/min.
Inlet Purge Flow: 60 ml/min Hydrogen.
Purge Activation Time: 40 sec.
Oven Temperature: 48°C (1.0/min)
4°C/min. to 100°C (0 min)
2°C/min to 200°C (5 min. hold)
Septum Purge: 4.4 ml/min. Hydrogen
Detector: Flame Ionization
Detector Temperature: 150°C
Injector, Temperature: 2 mm ID Fused Silica Liner, 150°C

Because m- and p-cresol were not separated on the capillary column, these compounds were quantitated together, using p-cresol spikes, Similarly, 2,4-and 2,5-dimethyl phenol were not separated on the capillary and were quantitated together using 3,4-dimethyl phenol spikes. Peak identities were confirmed by comparing relative retention times (to 2,4-dibromophenol) of samples and standards. These peak identities were also checked by running some of the samples on a packed column of SP=1000 (0.1 %) on 80/100 mesh carbopack at 200°C, with nitrogen carrier at 20 ml/min. This column was found to be able to separate m- and p-cresols, but not 2,4- and 2,5-dimethyl phenols.

Peak quantitation was performed as described earlier for benzene, toluene, and ethyl benzene microextractions. A test with distilled water spiked with phenols showed the following extraction efficiencies for extraction from 85 ml water (+ salts) into 1 ml diisopropyl ether).

Compound	Computed Percent Extracted *
Phenol	62
o-cresol	92
p-cresol	90
2,6-dimethyl phenol	97
2,4-dimethyl phenol	101
p-ethyl phenol	101
2,4-dibromo phenol	104

Polynuclear Aromatic Compounds

Those compounds identified by GC/MS were naphthalene, pyrene, fluoranthene and phenanthrene. The extraction and quantitation procedure was a micro-extraction approach described in EPA Effluent Guidelines Verification Procedure Code #21 (5) and in Rhoades and Nulton (6). In addition a clean-up procedure was employed to eliminate much of the potential interferences from non-aromatic carbon compounds.

Each sample was measured out in duplicate 90-ml portions or dilutions which were added to 30 g sodium chloride in 100 ml volumetric flasks. A 100 ml portion of p-terphenyl in methanol was added as an internal standard, and a 100 ml spike solution of the aromatic compounds in methanol was added to one flask in each pair of flasks proposed for each sample. One ml of hexane was added to each flask and each was shaken for two minutes. The entire hexane extract was removed to a small vial with a pasteur pipet, and the extract was diluted to two ml with hexane.

The diluted extract was placed onto a silica gel column and cleaned up according to the procedure described in the Federal Register (7) EPA Method for polynuclear aromatics. The final column eluate was concentrated to apprimately 2 ml with a micron-Kuderna-Danish concentration tube in a 50°C water bath. One ul of this concentrate was injected onto the DB-5 capillary column used for volatile aromatics and phenolics, using a cool on-column injector inlet. The chromatographic conditions were:

Carrier Gas: Hydrogen at 51 cm/sec. flow at 60°C
Auxiliary Detector Gas: Nitrogen at 30 ml/min.
Inlet Purge Flow: 24 cc/min Hydrogen.
Purge Activation Time: No interruption in purge flow used
Septum Purge: 4.6 ml/min. Hydrogen
Oven Temperature: 60°C (1 min)
30°C/min. to 120°C (0 min)
5°C/min to 325°C
Hold as needed at 325°C
Detector: Flame Ionization
Detector Temperature: 350°C
Injector Temperature: 40-60°C (cold on-column syringe injector)

Peak identification and quantitation were performed as described above for benzene, toluene, and ethyl benzene micro-extractions. A test with distilled water spiked with polynuclear aromatics showed the following extraction efficiencies from 90 ml water (+ salt) into 1 ml hexane:

Compound	Computed Percent Extracted *
Naphthalene	95
Phenanthrene	102
Fluormethene	104
Pyrene	104
p-terphenyl	103

It was necessary for one of the raw waste samples to run a slower temperature program to separate the many peaks around napththalene. This program was:

60°C (1 min)

30°C/min to 120°C (hold 5 min)

5°C/min to 325°C

Hold as needed at 325°C

SAMPLE PRESERVATION FOR WILSONVILLE ANALYSES

	Preservation Method	Analyses Method
1.	Refrigerate, 4°C	GC/MS Organics
		GC Organics
		Alkalinity
		Chloride
		BOD
		Fluoride
		TOC
		Nitrite-N
		TDS
		TSS/VSS
2.	H_2SO_4 to pH 2,	Ammonia-N
	Refrigerate, 4°C	TKN
		COD
		Phenolics
		(Nitrate, Nitrite)-N
3.	Lead Nitrate +	Cyanide
	Lime to pH 12	Thiocyanate
	Refrigerate, 4°C	
4.	HNO_3 to pH 2	Trace Metals
	Refrigerate, 4°C	Boron

References - Analytical Section

1. Standard Methods for the Examination of Water and Wastewater, 15th Ed., APHA, AWWA, WPCF, pp 247-260 (1981).

2. Luthy, R.G., "Manual of Methods Preservation and Analysis of Coal Gasification Wastewaters," Tech. Rep. No. FE-2496-16, U.S. Dept. of Energy (1978).

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, U.S. EPA, Cincinnati, OH (1979).

4. Barton, P.A., Hammer, C.A., and Kennedy, D.C., "Analysis of Cyanides in Coke Plant Wastewater Effluents", JWPCF, 50, 234-239 (1978).

5. Analytical Methods for the Verification Phase of the BAT Review, Ed. W. F. Cowen and J. L. Simons, Report to U.S. EPA, Contract No. 68-01-5011, September (1980).

6. Rhoads, J.W., and Nulton, C.R., "Priority Pollutant Analyses of Industrial Wastewater Using a Micro-extraction Approach"; J. Environ. Science and Health, Environ. Science and Engineering, A-15, p. 467 (1980).

7. Federal Register, 44 pp. 69514 - 69517 (December 3, 1979).

Pilot Plant Operation

The pilot plant operation was fairly routine during the period of the testing. There were some start-up problems, power failures, and short term operational down times during the process runs. However, the frequency and duration of these disruptions during the sampling program was not atypical of the pilot plant operation.

Runs 239 and 240 were included in the sampling period. The down time for plant shut-down/turnaround between Runs 239 and 240 and between Runs 240 and 241 and the start-up of Run 241 were monitored through the wastewater treatment plant. Daily tabulation of operating parameters are shown in Tables 13 and 14 in the Appendix. Also shown are cross references with flow diagrams (Figures 1 and 2 in the Appendix).

The general operating conditions for the two runs were as follows:

Run No. 239
Date: 4/23/82 to 5/24/82
Coal Type: Illinois No. 6
Coal Feed Rate: 420 lb/hr
Dissolver Pressure: 2000 psig
Dissolver Temperature: 785°F
Separator Temperature: 700°F
Na_2CO_3: 0

Run 239 was a "low severity" run.

Run No. 240
Date: 5/31/82 to 7/20/82
Coal Type: Illinois No. 6 Burning Star Mine
Coal Feed Rate: 380 lb/hr
Dissolver Pressure: 2100 psig
Dissolver Temperature: 840°F
Separator Temperature: 740°F
Na_2CO_3: 0

Run 240 was a "demonstration plant" simulation run.

The CSD operation is not tabulated. There is an insignificant quantity of wastewater from that operation, and inclusion of CSD operating data might unnecessarily complicate future release of this report.

Wastewater Treatment Plant Operation

The design and operation of the waste treatment plant has been discussed in detail elsewhere (References in the "INTRODUCTION"). General process flow diagrams are shown in Figures 3, 4, & 5 in the Appendix for reference. Daily operating parameters are listed in Tables 15 and 17 in the Appendix.

The operation was stable during the sampling period. Carbon additions and hydrogen peroxide addition are intermittent on an "as needed" basis. Hydrogen peroxide is added to the pretreatment tank(s); activated carbon is added directly to each aeration basin. The biological treatment plant was operating at the following average conditions during the program:.

	Range	Mean
Combined		
Hydraulic Residence Time (HRT) days	2.3-4.9	3.2
Solids Residence Time (SRT) days	-	60.0
First Stage		
Dissolved Oxygen uptake rate (mg/l/hr)	6-34	21
Mixed liquor suspended solids (mg/l)	3290-6880	4830
Temperature °F	75-88	81°
pH	7.0-7.9	-
Second Stage		
Dissolved Oxygen uptake rate (mg/l/hr)	1-23	7
Mixed liquor suspended solids (mg/l)	1965-3975	2845
Temperature °F	73-88	82
pH	7.1-8.0	-

Data Tabulation

The analytical results as well as other operating parameters that were collected from the pilot plant during the study are tabulated in the Appendix. Although the scope of this project did not include any extensive data evaluation (statistical analysis, plotting for correlations, etc.), there is a brief discussion and observations (unquantified) concerning the data at each site, and its relationship to the process parameters and the other samples.

There were places in the tabulations where either data is missing or data is presented that was not on the schedule. Each of these is not discussed separately. Generally these irregularities are due to insufficient sample (caused by "repeats", excessive quality control or sampling difficulties) or in some cases extreme interference that made results questionable. Some irregularities are due to the extensive scope (in number of samples and number of analyses) and the rather complex matrix of sampling, compositing and analysis that changed several times during the study. Other irregularities are due to lapses in sample accounting.

Biological Treatment Plant

The data for the biological system is tabulated in Tables 1, 2, 3, 10, 15 in the Appendix (Reference also Figures 3, 4 and 5). A mathematical and statistical analysis of this data, including flow rates, is required to say anything meaningful about correlations. Conversion of these parameters to a pounds basis would provide a more meaningful analysis. Bio-reactor effluent data would also have to be compared to operating parameters (Table 17).

In general, the data are indicative of a stable plant operation. There is nitrification occuring in the first bio-reactor based on the ammonia removals and nitrate production. Note also that the feed pH is high to counteract the system's natural formation of inorganic acids. There is significant additional removal in the second stage bio-reactor, particularly of BOD and COD in addition to enhanced phenol removal. Significant cyanide and thiocyanate levels are not present in the feed, but the thiocyanates are not completely removed. There appears to be little or no second stage removal of that parameter.

The total dissolved solids (TDS) appear somewhat variable from day to day for a system with large hydraulic capacity such as this. However, there are sources with high dissolved solids concentrations in the plant. No adverse effects on the bio-system are readily apparent due either to the concentration levels or the variability of the TDS.

Note also that the effluent suspended solids (TSS) concentration is indicative of the clarifier overflow. The effluent then passes through a multimedia filter prior to discharge.

Process Wastewaters

In addition to the five process wastewaters the analytical results of the "Raw Waste" are included in this section (refer to Tables 4 thru 10 in the Appendix). Raw waste is the combined process wastewaters that were sampled separately plus the SRC caustic scrubber blowdown and a few minor contributers that were not sampled separately.

The most variable parameter is sulfide. It can vary considerably from day to day for all of the sample sites. The variability does not seem to correlate with any of the process parameters; however the hydrotreater uses the addition of methyl sulfide to the reactor. This usage is not recorded, but occurs primarily during start-up.

The following discussions concern the parameters other than sulfide.

Raw Waste (Tables 4, 10, 13, 14, 15)

The high pH of the raw waste is due to the caustic scrubber blowdown. Most of the sulfides are from that source as well. Concentrations of most of the pollutants in the raw waste are not particularly variable for a combined plant wastewater. Although some of the variability is dampened in the sample compositing, the concentration levels are consistent even during pilot plant process changes and down times. The flow does vary however, and does decrease when the plant is down (see Table 15). Ammonia is the only parameter that shows consistent (though slight) drop in concentration during process shut-down (Tables 4 and 13). TOC, BOD and phenol values show no particular correlation to each other. TSS is variable, most of the TSS is volatile (organic).

V-105 (Tables 5, 10, 13)

TKN and COD were inadvertantly run on the first sample set and reported on the table. Thiocyanate levels are highest in this sample site, and Thiocyanate is present in a high ratio to cyanide. Most parameters are relatively consistent. The increase in the chloride during June roughly corresponds to the change from Run 239 to 240 which actually had a lower feed coal rate, although the temperature and pressures were higher. The V-105 average flow also increased slightly over that same period.

K-111 (Tables 6, 10, 13)

There is relatively little variablity in most parameters. The significant pollutants are organic, (TOC, COD, Phenol). There is a high BOD:COD ratio indicating significant biodegradability of the organics (mostly phenolics based on the relatively high phenol:TOC ratio). T-102 vacuum tower operation was checked where any variability was evident with no readily apparent correlation.

V-1080 (Tables 7, 10, 14)

No significant variability is apparent other than the last two phenol values in Table 7 which are an order of magnitude lower than the others. Attempts to correlate some of the lower ammonia and phenol values evident in Table 7 to any process variable did not yield any readily apparent correlations. Thiocyanate is somewhat variable, but is generally low.

V-1070 (Tables 8, 10, 14)

Caustic Scrubber Blowdown (Tables 9, 10, 14) Two composites 7/11 - 7/13 and 6/13 - 6/16 have very low BOD, ammonia and phenol values. Both of those time periods were just prior to the HTU unit shut-down. Cyanides and thiocyanate values are consistently low.

SRC Leachate

A sample of SRC from a "Demonstration Plant" run was taken by Wilsonville personnel and shipped to Marcus Hook Laboratory, where it was leached using three standard leaching procedures: the EPA-EP Leachate procedure and ASTM procedures A & B (Reference below). The sample was HTU SRC from Run 236-5 taken 22 February 1982.

Leachates were analyzed for the parameters listed in Table 16 in the Appendix. Total organic carbon (TOC) was not measured where the leaching acid was an organic acid.

Some oil and grease (freon extractables) were found in the EP Leachate and ASTM "A", however none of the trace organics that were looked for were detected in those leachates. Although less of the heavier organics (oil and grease) were leached into the ASTM "B" leachate, benzene was detected. However, we would expect to find toluene and/or ethyl benzene in conjunction with this level of benzene. It is possible that the benzene detected was an artifact of the laboratory.

ASTM Method A and B Leachates

1. 1979 Annual Book of ASTM Standards (Water), Part 31, ASTM, Philadelphia, PA., pp 1258-1261 (1979).

EP Leachate

1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, U.S. EPA Office of Water and Waste Management, Washington, DC, pp 7.0-1 - 7.1-11 (1980).

Review Of Historical Data

Combined raw wastewater and wastewater treatment information, accumulated for the period of February 1979 to June 1981 was evaluated with the ultimate goal of developing design criteria for the demonstration plant and to observe any particular relationship between wastewater characteristics and pilot plant operating conditions. Material balance sour water (V-105) analytical data from February 1979 to December 1981 was evaluated to characterize this major process wastewater in relationship to the process operation. The primary process wastewater is the water portion of the solvent decanter (V-105). The wastewater is termed sour wastewater by virtue of the high hydrogen sulfide concentration. The other major source of raw wastewater at the pilot facility is the caustic scrubber blowdown which removes the acid gases and ammonia from the recycle gases. The combined process wastewaters go into the caustic waste sump (CWS) where they are pumped to pretreatment to remove residual separable organics, oxidize the sulfides and provide neutralization and equalization prior to being fed to the biological system.

Wastewater Characterization

At the Wilsonville Pilot Plant the principle objective is to evaluate and optimize the operation of the SRC process. A series of continuous process "runs" have been performed to accomplish this task. The following operating parameters are routinely monitored.

1. Dissolver volume
2. Dissolver pressure
3. Coal feed rate
4. Feed gas rate (to preheater & bypass)
5. Dissolver solids withdrawal rate
6. Dissolver product cooler bypass

In addition, the coal type is another operating variable. The operating parameters remained constant during a run. The parameters or a portion of these parameters were then changed for subsequent runs. After steady state conditions are reached, material balances are derived. Samples of the sour wastewater (V-105) were taken as part of the material balance sampling. These samples are indicative of the sour water generated during a particular run. To date, the liquid waste characterization efforts have focused on analysis of the combined sour water stream (V-105), as the primary source of wastewater.

Material balances from February 1979 to December 1981 for V-105 were compiled. The wastewater samples were analyzed for TOC, COD, ammonia, sulfide, and phenol. In an effort to characterize this sour wastewater (V-105) the material balance analyses were evaluated on a run by run basis and by various operating parameters. Wastewater analyses data and operating conditions are summarized on Tables A-1 and A-2. These include data from run 133-B to 235-AB.

Figures B-1 thru B-5 are normal probability plots which were developed for TOC, COD, NH_3-N, sulfide and phenols. Figures B-1 and B-5 indicate that the TOC and phenol plots did not yield a straight line at the extremities and thus were not normally distributed. COD, ammonia and sulfide yielded "fairly" normal distribution. The results of this analysis are summarized below.

Parameters	Time Period	50 Percentile	90 Percentile
TOC	2/79 to 12/81	N/A	N/A
COD	2/79 to 12/81	65,000 mg/l	85,000 mg/l
NH_3-N	2/80 to 12/81	14,600 mg/l	20,000 mg/l
Sulfide	2/80 to 12/81	13,500 mg/l	19,500 mg/l
Phenol	2/80 to 12/81	N/A	N/A

Real sets of data for wastewater characteristics are not normally distributed in that they are skewed (i.e. the average is greater than the mode or the median and the proportion of this data that is more than two standard deviations greater than the mean is so by more than 2.5%).

Distribution of data displaying these characteristics can be converted graphically to normal distribution by taking their logarithm, resulting in a log-normal distribution. If a plot on linear probability paper shows an upward curvature together with no points less than zero and several points greater than twice the mean, the data is probably log-normal.

The probability plots suggested that any further probability analysis be done as a log-normal distribution. The percentiles (a non linear scale) were converted to probits (a linear scale) to allow a linear regression analysis. The equation for the resulting line is shown in Tables A-3 to A-9. Refer to Tables A-3 to A-7 and Figures B-6 thru B-15. The following table presents the results of these log-normal probability plots.

Parameters	Time Period	50% (mg/l)	90% (mg/l)	r *
TOC	2/79 to 12/81	13,100	37,900	0.95
COD	2/79 to 12/81	53,000	76,000	
NH_3-N	2/80 to 12/81	10,400	17,100	0.97
Sulfide	2/80 to 12/81	7,200	14,200	0.95
Phenol	2/80 to 12/81	2,590	4,170	0.97

In addition to the preceeding concentration analysis, a mass basis (lb/hr) was also evaluated. The mass probabilities were determined for a limited amount of material balance data. The wastewater rate was based on the percent moisture in the coal. These analyses were log-normally distributed and yield the following results.

Parameters	Time Period	50% lb/hr	90% lb/hr	r*
TOC	2/79 to 7/81	0.22	0.87	0.99
COD	2/79 to 7/81	1.01	2.23	0.98
NH_3-N	2/80 to 7/81	0.19	0.42	0.99
Sulfide	2/80 to 7/81	0.12	0.36	
Phenol	2/80 to 7/81	0.06	0.10	0.98

Log-normal probability analyses were performed to determine the relationship between various parameters (i.e. COD to TOC and NH_3-N to sulfides). The results are as follows:

Parameters	50 Percent	90 Percent	r*
COD/TOC	3.65	6.06	0.99
NH_3-N/Sulfide	1.49	2.30	0.85

This data analysis appears on Figures B-16 and B-17 and Tables A-8 and A-9.

* Correlation Coefficent - (complete correlation = 1.0)

V-105 Wastewater Characteristics vs Coal Types

During the time period investigated (February 1979 to December 1981) only two different types of coal were utilized at the pilot plant, Indiana V and Kentucky #9. However, the Kentucky #9 was mined from four different seams, Pyro, Lafayette, Fies and Dotiki.

Based on the material balance runs, (Table A-1), V-105 wastewater characteristics were developed for the different coal types. These are summarized on Table A-10.

There does not appear to be any strong correlation between coal types, percent sulfur, percent moisture, and wastewater characteristics. With the exception of the Fies seam, there is limited data to draw any strong correlation between differences in the mean values of the parameters. With the limited number of data points for the other coal types any higher or lower "than normal" data points could strongly influence the mean.

The average sulfur contents of the mass balance runs of each of the respective coals were approximately 3 percent ranging from a low of 2.86 percent for Lafayette to 3.18 percent for Fies. Similarly, COD's ranged from 52,000 to 67,000 mg/l for Fies and Pyro respectively.

Lafayette coal did yield higher TOC contents than the remaining coals, 46,371 mg/l versus 25,100 mg/l for Old Ben #1 the next highest value. Phenol values were fairly constant, ranging from the lowest average concentration of 2679 mg/l for Lafayette to approximately 3500 mg/l for Pyro and Old Ben #1.

Biological Treatment Plant Operation

Daily logs of the wastewater treatment plant for April 1979 to June 1981 were reviewed and the monthly averages are summarized on Table A-11 and A-12. The sample points were the equalized pretreated feed to the biosystem, the final effluent after multi-media filtration, and the mixed liquor in each basin. The overall averages for the time period are listed below:

Flow	20,210	gpd
BOD inf	674	mg/l
BOD eff	7	mg/l
Removal Efficiency	99.0	%
COD inf.	1,333	mg/l
COD eff.	109.9	mg/l
Removal Efficiency	91.8	%
Phenol inf.	65.8	mg/l
Phenol eff.	0.049	mg/l
Removal Efficiency	99.9	%
Dissolved Oxygen Uptake (Basin A)	15.2	mg/l/hr
Dissolved Oxygen Uptake (Basin B)	5.3	mg/l/hr
Mixed Liquor Suspended Solids (Basin A)	4,167	mg/l
Mixed Liquor Suspended Solids (Basin B)	2,420	mg/l
Hydraulic Retention Time (combined)	3.7	days
BOD F/M Applied/Combined MLSS	0.06	$days^{-1}$
COD F/M Applied/Combined MLSS	0.10	$days^{-1}$
Sludge Production	0.3 lb MLSS / lb COD removal	
Carbon Addition (combined)	150	lb/month
TSS inf.	7.2	mg/l
TSS eff.	7.7	mg/l

The data indicates that the treatment facility is effectively treating the wastes generated at the Wilsonville pilot plant. BOD removals are averaging 667 mg/l/day or 99 percent, COD removal 1233 mg/l/day or 91.8 percent and phenol removal is greater than 99.9 percent.

The treatment plant operates a two stage activated sludge system with an overall hydraulic detention time of 3.7 days. The total aeration volume is 75,000 gallons, split equally between two basins. Basin A has an average mixed liquor volatile solids concentration of 4167 mg/l and Basin B 2420 mg/l. The dissolved oxygen uptake for Basin A was 15.2 mg/l/hr and 5.3 mg/l/hr for Basin B. As can be expected, the majority of biological activity and thus organics removal is occuring in Basin A. The exact amount of organics removal in each basin cannot be determined since samples were only taken at the head of the treatment plant and at the discharge of Basin B. An intermediate sample between the two basins would be required for the purpose of establishing biological kinetics in each basin. The overall F/M in the system is 0.06 day^{-1} based on BOD removal. Table A-13 summarizes the sludge wasting on a monthly basis.

Part of the treatment operation is the addition of powdered activated carbon to the aeration basins. Carbon is added to the basins on a batch basis once or twice a month on an "as needed" basis to handle spills, high influent phenol concentrations etc. On an average, 150 lb/month of carbon were added to the system.

Suspended solids in the feed are relatively low, averaging above 7.2 mg/l. There is solids settling in the organics separators and in the equalization storage tank. The suspended solids concentration in the effluent is approximately the same average as the feed at 7.7 mg/l.

The correlation of treatment plant operations to pilot plant operation is inhibited by the large hydraulic capacity of the treatment plant which result in long lag times through the system and the dilution of daily wastewaters.

Conclusions

1. Log-normal statistical analysis of data from V-105 wastewater (SRC sour water) yields the following wastewater characteristics (50 percentile values). This relates to a nominal coal throughput of 6 tons/day.

TOC	13,100 mg/l	0.22 lb/hr
COD	53,000 mg/l	1.01 lb/hr
NH_3-N	10,400 mg/l	0.19 lb/hr
Sulfide	7,200 mg/l	0.12 lb/hr
Phenol	2,590 mg/l	0.06 lb/hr

2. The following relationships between parameters exist (50 percentile):

COD/TOC	3.65
NH_3-N/Sulfide	1.49

3. There does not appear to be any strong correlation between coal type and wastewater characteristics. No strong correlation between V-105 wastewater and process variables is evident.

4. The unit operations used at the pilot plant treatment facility are effective in treating wastes generated by the SRC-1 process. To June 1981:

   a. BOD removal has averaged 99 percent.
   b. COD removal 91.8 percent.
   c. Phenol removal 99.9 percent.

5. The operating data from the wastewater treatment plant does not provide any kinetic or similar design data for use in optimizing the size of the unit operations for scale-up.

Conclusions And Recommendations

1. Using standard leaching test measures, SRC product does not produce a leachate containing trace organic compounds (priority pollutants and other similar compounds).

2. The historical wastewater data available from Wilsonville does not provide any strong correlation between the process wastewater and process variables nor does it provide design data for scale-up because the plant is never sufficiently loaded to provide data points for determining kinetic correlations.

3. The data does provide a good basis for determining design raw wasteloads and variabilities of the SRC sour water for some of the major pollutants: COD, TOC, phenolics, sulfide and ammonia. The data also provides substantial evidence that most of the major pollutants can be consistently removed to very low levels (very high treatment efficiencies) using conventional waste treatment.

4. The data collected during the sampling period of this report appears to substantiate the conclusions of 2 and 3 above. However statistical analysis should be applied to this daily data in order to determine if any correlations do exist.

5. Various levels of organic priority pollutants occur in the process wastewater and the combined wastewater going to waste treatment. Removal of these pollutants is very effective. However, further study might pursue whether any of these pollutants remain in the wasted sludge.

6. Low levels of Boron, Mercury, Selenium and Zinc were found in the effluent from treatment. The main sources of Boron, Mercury and Selenium appear to be the SRC sour water (V-105). Zinc was found in V-105 but it may also be present from galvanized piping in the wastewater treatment area.

APPENDIX

TABLES AND FIGURES IN APPENDIX OF FINAL REPORT: WILSONVILLE WASTEWATER SAMPLING PROGRAM

TABLE 1
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
FEED TO BIO-REACTORS

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity $Ca(CO_3)$ mg/l	TDS mg/l	NO_2-N mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2866	4/28		202	48	29	1130	4740	2.6	575	30	35	1271	40	2.6	ND(1.0)	
2886	4/29		280	92	45	2020	8640	7.7	865	38	49	1784	72	ND(8.8)	3.8	
2924	5/2	10.3	142	38	25	1300	5310	9.7	570	68	67.8	1320	40	ND(2.2)	2.0	ND(0.01)
2951	5/3	10.1	280	54	27	1630	8835		930	57	76.2	1553	93	ND(2.2)	4.3	ND(0.01)
2978	5/4	9.8	170	70	22	1230	8165		525	37	43.1	1022	55	ND(2.2)	1.2	3.5
3007	5/5	10.3	285	66	30	2234	6995	1.42	1000	155	109	1800	92	4.4	4.0	0.2
3040	5/6	10.3	241	75	18	1823	7022		940	121	110	1658	76	2.2	3.4	2
3066	5/9	10.1	220	47	22	1119	5220	1.12	625	65	71	1410	53	1.1	2.3	2
3084	5/10	9.9	150	37	20	956	5130		495	52	64	750	50	ND(1.1)	1.8	2
3115	5/11	10.0	185	74	16	1459	5935	ND(0.5)	750	109	115	1280	64	ND(1.1)	4.0	2
3144	5/12	10.4	235	108	50	1283	6995	0.54	1170	170	169	2000	75	ND(1.1)	5.3	2
3171	5/13	10.2	193	72	54	1169	5000	0.54	540	86	83	865	42	ND(1.0)	1.9	ND(0.01)
3198	5/17	10.4	160	24	17	1119	3920	2.3	580	71	84	1083	40	ND(1.0)	1.0	ND(0.01)
3207	5/18	10.2	150	20	13	1232	3775	1.9	675	74	83	1182	51	ND(1.0)	ND(1.0)	0.8
3216	5/19	10.1	110	56	35	1069	3760	2.2	555	60	70	1175	44	1.4	1.3	4.8
3225	5/20	10.2	147	59	37	981	3380	0.9	435	47	59	1195	38	ND(1.0)	1.2	0.1
3243	5/23	10.1		62	40	1144	3205		655	82	99	1650	92	ND(1)	3.1	0.25
3252	5/24	9.8		37	21	830	2700	ND(0.1)	465	52	62	1059	60	3.0	2.0	0.45
3261	5/25	9.7	217	34		717	2955	ND(0.1)	460	37	45	798	59	6.0	1.7	0.22
3265	5/26	9.5	325	71	36	956	4135	1.4	480	37	47	1060	91	ND(0.05)	2.3	0.37
3281	5/27	9.3	369	34	30	981	4640	0.66	530	40	42	1226	68	ND(0.02)	3.4	0.05
3285	5/31	8.3	91	38	34	327	1635	0.95	75	8	12	274	0.12	ND(0.02)	ND(1.0)	ND(0.01)
3291	6/1	8.2	142	77	54	327	1465	1.7	90	7	9	410	0.09	ND(0.02)	ND(1.0)	ND(0.01)
3297	6/2	9.9	480	178	158	817	2390	ND(0.5)	550	22	33	1954	70	ND(0.02)	4.2	0.5
3303	6/3	9.8	68	39	38	453	1365	ND(0.5)	120	6	12	388	13	ND(0.02)	1.1	0.25
3315	6/6	10.7	80	37	22	553	2240	0.5	170	8	12	416	25	ND(0.02)	1.8	ND(0.01)
3324	6/7	9.6	89	92	44	918	8845	1.0	860	37	47	1307	49	ND(0.02)	4.5	0.25
3333	6/8	10.5	63	96	35	566	2865	1.0	165	5	14	313	15	ND(0.021)	ND(1)	ND(0.01)
3342	6/9	9.0		132	44	905	7850		785	59	76	1457	51	ND(0.021)	4.8	1.25
3354	6/10	10.7	322	71	19	2062	8650	1.0	680	126	148	1641	70	ND(0.021)	6.1	0.75
3373	6/13	10.5	174	194	96	1924	4785	0.5	820	116	133	1592	75	ND(0.021)	3.5	0.5
3382	6/14	9.7	149	56	27	377	1550	ND(0.5)	195	11	13		11	ND(0.021)	ND(1)	0.75
3391	6/15	10.1	212	170	66	1974	5170	ND(0.5)	790	116	129	1496	87	ND(0.021)	4.0	1.87

ND = Not detected, (Value reported = limit of detection)

TABLE 1 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity Ca(CO$_3$) mg/l	TDS mg/l	NO$_2$-N mg/l	BOD mg/l	NH$_3$-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3354	6/10	10.7	322	71	19	2062	8650	1.0	680	126	148	1641	70	ND(0.021)	6.1	0.75
3373	6/13	10.5	174	194	96	1924	4785	0.5	820	116	133	1592	75	ND(0.021)	3.5	0.5
3382	6/14	9.7	149	56	27	377	1550	ND(0.5)	195	11	13		11	ND(0.021)	ND(1)	0.75
3391	6/15	10.1	212	170	66	1974	5170	ND(0.5)	790	116	129	1496	87	ND(0.021)	4.0	1.87
3409	6/17	10.2	188	114	59	1622	4445	ND(0.5)	1260	71	86	1748	79	ND(0.021)	3.0	ND(0.01)
3426	6/20	10.3	170	170	77	1962	5140		1170	95	103	1649	59	ND(0.021)	4.1	ND(0.01)
3435	6/21	9.9	148	75	44	868	2480	ND(0.5)	720	30	36	724	24	ND(0.021)	1.3	ND(0.01)
3457	6/22	10.4	120	213	91	2238	4985	ND(0.5)	1200	134	144	1718	52	ND(0.021)	5.0	ND(0.01)
3466	6/23	9.9	64	102	66	1094	2810	ND(0.5)	475	41	44	734	17	ND(0.021)	ND(1.0)	ND(0.01)
3475	6/24	10.0	122	126	67	1836	12365	ND(0.5)	860	113	123	1236	52	ND(0.021)	3.0	ND(0.01)
3484	6/27	10.3	144	119	77	1886	3825	ND(0.5)	860	120	133	1413	46	ND(0.021)	2.5	ND(0.01)
3512	6/28	10.2	64	82	51	1471	3350	ND(0.5)	680	94	104	800	83	ND(0.021)	2.5	ND(0.01)
3522	6/29	10.0	102	171	93	2000	4360	ND(0.5)	800	144	157	1143	58	ND(0.021)	4.6	ND(0.01)
3532	6/30	9.9	25	53	24	812	2360		220	49	58	304	17	ND(0.02)	1.2	ND(0.01)
3550	7/5	11.0	114	69	38	1710	3395		780	35	43	972	34	ND(0.02)	2.9	ND(0.01)
3559	7/6	9.7	114	137	101	1540	4445		1200	112	120	1707	67	ND(0.02)	5.2	ND(0.01)
3568	7/7	9.5	24	42	21	376	1770		180	18	14	54	46	ND(0.02)	0.80	0.8
3577	7/8	8.9	126	77	49	1031	4215		780		104	1117	100	ND(0.02)	2.9	0.25
3595	7/11	9.1	59	60	29	1433	4590		370	115	117	829			3.6	0.15
3604	7/12	9.5	152	125	70	2552	6810		1320	184	198	1635	95		5.8	ND(0.01)
3642	7/14	8.5	26	40	29	477	2130		130	25	38	239	0.45		1.1	0.2
3654	7/15	9.5	170	74	33	1898	6025		840	106	138	1451	100		7.3	0.55
3675	7/18	9.3														0.25
3687	7/19	8.9														0.2
3693	7/18 to 7/19			198	102		8874		593		62.1	1703	0.86		6.3	

ND = Not detected, (Value reported = limit of detection)

TABLE 1 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity Ca(CO$_3$) mg/l	TDS mg/l	NO$_2$-N mg/l	BOD mg/l	NH$_3$-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3714	7/20	9.4														ND(0.01)
3723	7/21	7.8														ND(0.01)
3726	7/20 to 7/21		49	89	50		6489		237		43.6	1545	56		4.0	
3735	7/22	9.0	18	64	44		2696		150		26.1	412	0.07		0.78	ND(0.01)
3760	7/25	9.6														ND(0.01)
3763	7/26	9.5														ND(0.01)
3766	7/22 to 7/26		16	32	21		1968		120		25.5	3904	12		0.85	
3769	7/27	12.0														ND(0.01)
3772	7/28	10.4														ND(0.01)
3781	7/27 to 7/28		127	97	67		2296		292		17.3	4091	33		1.8	
3784	7/29	9.5	111	251	160		9280		795		67.6	622	84		11.0	ND(0.01)

ND = Not detected, (Value reported = limit of detection)

TABLE 2
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
1st BIO-REACTOR EFFLUENT

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity $Ca(CO_3)$ mg/l	TDS mg/l	NO_3-N mg/l	NO_2-N mg/l	BOD mg/l	NH_3-N mg/l	TEN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2879	4/28		31	25	18	236	4675	* 13.5		ND(1)	ND(0.3)	4	88	ND(0.1)	ND(1.1)	ND(1.0)	
2907	4/29		25	55	45	180	4165	78.6	0.24	6	ND(0.15)	5.6	130	0.16	ND(2.2)	ND(1.0)	
2945	5/2	7.3	20	70	39	92	6970	86.5	0.16	4	ND(0.12)	0.4	130	0.14	ND(2.2)	ND(1.0)	ND(0.1)
2972	5/3	7.4	32	48	36	134	6855	* 83.5		4	ND(0.1)	0.3	144	0.19	ND(2.2)	ND(1.2)	ND(0.1)
2999	5/4	7.3	43	19	9	214	8200	* 49.4		1	ND(0.1)	1.7	83	0.28	ND(2.2)	ND(1.0)	ND(0.1)
3028	5/5	7.3	35	63	46	201	6180	54.5	ND(0.1)	1	ND(0.1)	2.5	127	0.18	ND(2.2)	ND(1.0)	ND(0.1)
3047	5/6	7.0	22	108	39	69	7170	*102		5	ND(0.1)	4.1	151	0.26	ND(2.2)	1.2	ND(0.1)
3073	5/9	7.1	66	124	93	109	7640	82.1	ND(0.1)	10	ND(0.1)	10	223	0.33	ND(1.1)	1.4	ND(0.1)
3091	5/10	7.4	45	126	101	197	7335		ND(0.1)	9	ND(0.1)	9	221	0.45	ND(1.1)	1.2	ND(0.1)
3122	5/11	7.2	31	146	106	146	6530	74.5	ND(0.1)	9	ND(0.1)	11	246	0.29	ND(1.1)	1.3	ND(0.1)
3142	5/12	6.7	30	92	34	58	6660	89	ND(0.1)	8	ND(0.1)	5	114	0.14	ND(1.1)	1.0	ND(0.1)
3169	5/13	7.3	46	86	16	65	6940	82.3	ND(0.1)	6	ND(0.1)	3	75	0.10	ND(1.1)	ND(1.0)	ND(0.1)
3196	5/17	6.7	110	179	165	56	7945	85	ND(0.1)	9	ND(0.1)	17	384	0.21	ND(1.0)	1.1	ND(0.1)
3205	5/18	6.8	41	59	57	46	6005	75	ND(0.1)	9	ND(0.1)	8	193	0.14	ND(1.0)	ND(1.0)	ND(0.1)
3214	5/19	7.0	35	158	147	89	5455	61	ND(0.1)	12	ND(0.1)	14	414	0.24	ND(1.0)	ND(1.0)	ND(0.1)
3223	5/20	7.1	19	55	54	74	5340	90	ND(0.1)	5	ND(0.1)	6	134	0.10	ND(1.0)	ND(1.0)	ND(0.1)
3241	5/23	7.0	76	57		118	4010	47	ND(0.1)	9	ND(0.1)	8	187	0.23	ND(0.1)	1.9	ND(0.1)
3250	5/24	7.4		27	34	149	3580	56	ND(0.1)	3	ND(0.1)	5	123	0.22	ND(0.1)	ND(1.0)	ND(0.1)
3259	5/25	7.5	48	29		176	4415	48	ND(0.1)	2	ND(0.1)	4.6	125	0.34	ND(0.1)	1.3	ND(0.1)
3263	5/26	7.6	29	41	37	166	4235	38	ND(0.1)	ND(1)	ND(0.1)	4.9	99	0.21	ND(0.02)	0.7	ND(0.1)
3279	5/27	7.5	47	19	18	272	4640	85.7	0.26	2	ND(0.1)	3	127	0.17	0.025	0.9	ND(0.1)
3283	5/31	7.6	45	32	39	146	2365	20.1	ND(0.1)	5	ND(0.1)	3	109	0.14	ND(0.02)	0.3	ND(0.1)
3289	6/1	7.5	42	25	25	140	1870	17.7	ND(0.1)	1	ND(0.1)	3	96	0.09	ND(0.02)	0.4	ND(0.1)
3295	6/2	7.3	63	49	34	182	1760		ND(0.1)	3	ND(0.1)	4	115	0.15	ND(0.02)	0.7	ND(0.1)
3301	6/3	7.7	46	15	11	146			ND(0.1)	ND(1)	ND(0.1)	3	85	0.15	ND(0.02)	0.8	ND(0.1)

*NO_2 + NO_3-N

ND = Not detected, (Value reported = limit of detection)

TABLE 2 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity $Ca(CO_3)$ mg/l	TDS mg/l	NO_3-N mg/l	NO_2-N mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3313	6/6	7.7	45	42	34	230	5255	8.9	ND(0.1)	4	ND(0.1)	3	154	0.18	ND(0.02)	1.1	ND(0.1)
3322	6/7	7.6	61.6	109	21	220	4625	4.5	ND(0.1)	3	ND(0.1)	3	128	0.15	ND(0.02)	1.7	ND(0.1)
3331	6/8	7.4	48	141	36	84	8980	10.2	ND(0.1)	2	ND(0.1)	4	140	0.13	ND(0.02)	0.8	ND(0.1)
3340	6/9	7.0		101	27	18	4920	14.0		3	ND(0.1)	3	136	ND(0.05)	ND(0.021)	1.0	ND(0.1)
3352	6/10	7.1	34	135	39	104	5375	13.2	2.9	3	ND(0.1)	3	86	0.07	ND(0.021)	1.8	ND(0.1)
3371	6/13	7.0	29	84	19	80	2465	42.2	0.3	3	ND(0.1)	1	67	0.11	ND(0.021)	1.1	ND(0.1)
3380	6/14	7.4	31	90	36	98	4825	48.6	0.2	4	ND(0.1)	4	78	0.07	ND(0.021)	1.1	ND(0.1)
3389	6/15	7.1	40	92	29	137	5255	53.6	0.2	3	ND(0.1)	3	76	0.20	ND(0.021)	0.3	ND(0.1)
3398	6/16	7.3	29	77	36	127	4060	36.3	ND(0.1)	7	ND(0.1)	3	88	0.14	ND(0.021)	0.8	ND(0.1)
3407	6/17	7.3	40	89	19	197	4020	26.3	ND(0.1)	ND(1)	ND(0.1)	4	72	0.15	ND(0.021)	ND(0.25)	ND(0.1)
3424	6/20	7.2	50	96	45	132	3880	12.5	ND(0.1)	2	ND(0.1)	1.9	76	ND(0.05)	ND(0.021)	5.8	ND(0.1)
3433	6/21	7.1	25	57	24	78	3960	32.5	ND(0.1)	2	ND(0.1)	2.3	72	ND(0.05)	ND(0.021)	0.6	ND(0.1)
3435	6/22	7.0	25	71	15	76	3995	36.4	ND(0.1)	2	ND(0.1)	1.5	64	0.02	ND(0.021)	0.7	ND(0.1)
3464	6/23	7.3	19	100	34	74	4510	83.5	ND(0.1)	ND(1)	ND(0.1)	0.7	72	ND(0.05)	ND(0.021	0.6	ND(0.1)
3473	6/24	7.0	38	75	33	121	2570	73.1	ND(0.1)	ND(1)	ND(0.1)	2.3	70	ND(0.05)	ND(0.021)	0.8	ND(0.1)
3492	6/27	7.4	45	48	37	144	4015	45.3	ND(0.1)	2	ND(0.1)	1.6	80	0.07	ND(0.021)	1.1	ND(0.1)
3510	6/28	7.2	32	42	30	125	4775	31.1	ND(0.1)	2	ND(0.1)	1.7	27	0.06	ND(0.021)	1.0	ND(0.1)
3520	6/29	6.9	28	120	45	82	4535	75.5	ND(0.1)	ND(1)	ND(0.1)	1.2	34	0.07	ND(0.021)	1.7	ND(0.1)
3530	6/30	7.5	37	30	25	169	3985	7.6	ND(0.1)	10	ND(0.1)	2.3	29	0.12	ND(0.021)	1.3	ND(0.1)
3548	7/5	7.8	18	150	130	330	3310	30.4	ND(0.1)	14	ND(0.1)	9.7	34	0.10	0.05	1.2	ND(0.1)
3557	7/6	6.9	43	130	106	80	3705	49.8	0.2	15	ND(0.1)	4.9	206	0.16	0.05	2.7	ND(0.1)
3566	7/7	7.3	32	110	92	101	3675	47.5	ND(0.1)	10	ND(0.1)	7.2	174	0.24	ND(0.02)	1.1	ND(0.1)
3575	7/8	6.8	24	100	91	69	3110	47.1	ND(0.1)	11		7.4	172	26	ND(0.02)	1.1	ND(0.1)
3593	7/11	7.0	56	153	136	78	2875	46.7	ND(0.1)	13	1	11	238	ND(0.005)	ND(0.02)	0.63	ND(0.1)
3602	7/12	7.0	36	130	107	118	4845	77.2	ND(0.1)	14	1	10.8	218	0.09	ND(0.02)	1.0	ND(0.1)
3617	7/13	7.4	89	93	75	154	5145	88.5	0.2	12	1	9	200	0.13	ND(0.02)	2.3	ND(0.1)
3640	7/14	7.4	97	103	90	110	3455	59.2	0.2	10	1	9.3	177	0.08		0.91	ND(0.1)
3652	7/15	7.2	45	59	42	130	4045	67.0	0.2		ND(0.1)	8.4	152	0.18		0.06	ND(0.1)
3673	7/18	7.8						19.2	0.1								ND(0.1)
3685	7/19	7.2						22.4	ND(0.1)								ND(0.1)
3691	7/18 to 7/19		46	75	47		6992			3		5.5	177	0.14			

ND = Not detected, (Value reported = limit of detection)

TABLE 2 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Alkalinity Ca(CO$_3$) mg/l	TDS mg/l	NO_3-N mg/l	NO_2-N mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3712	7/20	7.4							ND(0.1)								ND(0.1)
3721	7/21	9.0							ND(0.1)								ND(0.1)
3724	7/20 to 7/21		51	65	14		15164			ND(1)		2.6	101	0.10			
3733	7/22	7.6	27	62	26	123	7228	24.4	ND(0.1)	3		4.6	120			2.3	ND(0.1)
3758	7/25	7.8							ND(0.1)							1.6	ND(0.1)
3761	7/26	7.7							ND(0.1)								ND(0.1)
3764	7/25 to 7/26		42	46	26		3812			1		3.9	183	0.10			
3767	7/27	7.7															ND(0.1)
3770	7/28	7.6															ND(0.1)
3779	7/27 to 7/28		22	27	20		2592			1		4.5	152	0.16			
3782	7/29	7.2	15	48	36	217	2644	6.3		4		4.8	286				ND(0.1)

TABLE 3
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
2nd BIO-REACTOR EFFLUENT

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Ca(CO$_3$) mg/l	TDS mg/l	NO$_3$-N mg/l	NO$_2$-N mg/l	BOD mg/l	NH$_3$-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2881	4/28		25	46	14	96	3385	25.4	ND(0.1)	ND(1)	ND(0.3)	4	60	ND(0.1)	ND(2.2)	ND(1.0)	
2910	4/29		17	20	20	94	3540	20.3	0.1	ND(1)	ND(0.15)	2.8	60	ND(0.1)	ND(2.2)	ND(1.0)	
2948	5/2	7.9	35	13	12	132	5395	30.7	0.13	ND(1)	ND(0.12)	ND(0.1)	66	0.15	ND(2.2)	ND(1.0)	ND(0.01)
2975	5/3	8.0	17	13	13	103	5910	*40.8		ND(1)	ND(0.1)	ND(0.1)	70	0.31	ND(2.2)	ND(1.0)	ND(0.01)
3002	5/4	7.6	28	24	8	102	5915	*50.0		ND(1)	ND(0.1)	2.0	47	0.18	ND(2.2)	ND(1.0)	ND(0.01)
3031	5/5	7.6	26	35	9	111	7835	50.0	ND(0.1)	ND(1)	ND(0.1)	0.3	47	0.10	ND(2.2)	ND(1.0)	ND(0.01)
3048	5/6	7.8	27	27	7	89	6660	72.6		ND(1)	ND(0.1)	1.1	60	0.10	ND(2.2)	ND(1.0)	ND(0.01)
3074	5/9	7.5	24	59	20	67		90.4	ND(0.1)	ND(1)	ND(0.1)	2.5	75	0.21	ND(1.1)	ND(1.0)	ND(0.01)
3092	5/10	7.8	16	29	11	74	8182			ND(1)	ND(0.1)	0.8	58	0.24	ND(1.1)	1.3	ND(0.01)
3123	5/11	7.8	28	84	22	97	7110	71.5	ND(0.1)	ND(1)	ND(0.1)	2.0	58	0.33	ND(1.1)	ND(1.0)	ND(0.01)
3143	5/12	7.7	29	80	30	57	6825	80	ND(0.1)	ND(1)	ND(0.1)	2.0	46	ND(0.05)	ND(1.1)	1.0	ND(0.01)
3170	5/13	7.6	42	80	12	58	6885	58.9	ND(0.1)	ND(1)	ND(0.1)	1.0	52	0.10	ND(1.1)	ND(1.0)	ND(0.01)
3197	5/17	7.6	25	11	11	55	6380	104	ND(0.1)	ND(1)	ND(0.1)	0.2	87	0.10	ND(1.0)	ND(1.0)	ND(0.01)
3206	5/18	7.5	19	74	20	39	6145	83	ND(0.1)	ND(1)	ND(0.1)	0.5	71	0.17	ND(1.0)	ND(1.0)	ND(0.01)
3215	5/19	7.4	35	31	31	41	7150	65	ND(0.1)	ND(1)	ND(0.1)	0.3	124	0.13	ND(1.0)	ND(1.0)	ND(0.01)
3224	5/20	7.4	17	12	12	42	6165	95	ND(0.1)	ND(1)	ND(0.1)	0.3	76	0.08	ND(1.0)	ND(1.0)	ND(0.01)
3242	5/23	7.6	39	39		62	4945	59	ND(0.1)	ND(1)	ND(0.1)	4	119	0.15	ND(1)	1.0	ND(0.01)
3251	5/24	7.7		27	23	75	4465	71	ND(0.1)	ND(1)	ND(0.1)	3	90	0.15	ND(1)	1.2	ND(0.01)
3260	5/25	7.9	31	22		105	4085	66	ND(0.1)	ND(1)	ND(0.1)	3	84	0.22	ND(1)	ND(1.0)	MD(0.01)
3264	5/26	7.9	19	83	23	127	4670	99	ND(0.1)	ND(1)	ND(0.1)	2	61	0.15	0.045	0.4	ND(0.01)
3280	5/27	8.0	24	11	10	141	4710	99.9	0.13	ND(1)	ND(0.1)	1	66	0.14		0.4	ND(0.01)
3284	5/31	7.8	25	13	10	113	2820	23.1	ND(0.1)	ND(1)	ND(0.1)	ND(0.2)	62	0.09	ND(0.02)	0.5	ND(0.01)
3290	6/1	7.8	32	12	12	113	2350	8.6	ND(0.1)	ND(1)	ND(0.1)	1	107	0.07	ND(0.02)	0.4	ND(0.01)
3296	6/2	7.8	37	11	17	113	2135		ND(0.1)	ND(1)	ND(0.1)	2	64	0.06	ND(0.02)	0.6	ND(0.01)
3302	6/3	7.8	61	13	17	235	1905		ND(0.1)	1	ND(0.1)	3	140	0.11	ND(0.02)	1.1	ND(0.01)
3314	6/6	8.0	40	82	19	240	4450	3.8	ND(0.1)	ND(1)	ND(0.1)	3	130	0.12	ND(0.02)	1.2	ND(0.01)
3323	6/7	7.9	35	17	11	177	3730	4.1	ND(0.1)	ND(1)	ND(0.1)	3	111	0.11	ND(0.02)	1.3	ND(0.01)
3332	6/8	7.7	45	38	13	71	5695	8.8	ND(0.1)	ND(1)	ND(0.1)	3	104	0.10	ND(0.021)	0.6	ND(0.01)
3341	6/9	7.6		88	14	75	5380	7.0		ND(1)	ND(0.1)	2	82	ND(0.05)	ND(0.21)	0.7	ND(0.01)

*NO$_2$ NO$_3$-N

ND = Not detected, (Value reported = limit of detection)

TABLE 3 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	$Ca(CO_3)$ mg/l	TDS mg/l	NO_3-N mg/l	NO_2-N mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3353	6/10	7.1	31	129	39	99	5640	11.3	3.2	3	ND(0.1)	3	86	ND(0.05)	ND(0.021)	0.8	ND(0.01)
3372	6/13	7.8	41	107	33	74	5410	26.3	ND(0.1)	1	ND(0.1)	2	63	0.07	ND(0.021)	1.0	ND(0.01)
3381	6/14	7.6	24	88	30	73	5260	39.9	0.1	1	ND(0.1)	2	63	ND(0.05)	ND(0.021)	0.9	ND(0.01)
3390	6/15	7.9	37	95	25	88	4580	28.8	ND(0.2)	1	ND(0.1)	0.4	51	0.22	ND(0.021)	0.4	ND(0.01)
3399	6/16	7.9	39	136	51	98	4790	51.3	ND(0.1)	1	ND(0.1)	3	100	0.11	ND(0.021)	1.3	ND(0.01)
3408	6/17	7.9	20	79	16	105	4500	17.5	ND(0.1)	ND(1)	ND(1)	6	56	0.17	ND(0.021)	0.7	ND(0.01)
3425	6/20	7.7	32	91	38	101	4110	18.8	ND(0.1)	ND(1)	ND(0.1)	1.9	62	ND(0.05)	ND(0.021)	0.7	ND(0.01)
3434	6/21	7.5	29	76	23	65	3950	11.3	ND(0.1)	ND(1)	ND(0.1)	1.6	58	ND(0.05)	ND(0.021)	0.5	ND(0.01)
3456	6/22	7.4	20	66	12	44	3835	65.8	ND(0.1)	ND(1)	ND(0.1)	1.6	58	ND(0.05)	ND(0.021)	0.7	ND(0.01)
3465	6/23	7.5	18	69	27	44	4200	42.3	ND(0.1)	ND(1)	ND(0.1)	1.5	62	ND(0.05)	ND(0.021)	0.8	ND(0.01)
3474	6/24	7.6	35	86	28	60	4195	41.9	ND(0.1)	ND(1)	ND(0.1)	1.4	64	ND(0.05)	ND(0.021)	0.8	ND(0.01)
3493	6/27	7.5	159	33	29	39	4465	47.4	ND(0.1)	ND(1)	ND(0.1)	ND(0.2)	62	0.07	ND(0.021)	1.2	ND(0.01)
3511	6/28	7.6	25	43	33	79	4585	45.3	ND(0.1)	ND(1)	ND(0.1)	ND(0.2)	27	ND(0.05)	ND(0.021)	0.9	ND(0.01)
3521	6/29	7.8	30	115	41	85	4650	32.5	ND(0.1)	ND(1)	ND(0.1)	0.4	34	0.07	ND(0.021)	1.3	ND(0.01)
3531	6/30	7.9	27	25	19	98	4655	6.7	ND(0.1)	2	ND(0.1)	ND(0.2)	27	0.05	ND(0.02)	1.1	ND(0.01)
3549	7/5	7.9	12	34	22	154	3520	66.3	ND(0.1)	2	ND(0.1)	2.2	27	ND(0.05)	0.04	1.0	ND(0.01)
3558	7/6	7.9	27	63	48	176	3195	48.7	0.3	3	ND(0.1)	9.3	68	ND(0.05)	0.06	1.2	ND(0.01)
3567	7/7	7.7	19	39	35	86	3600	56.8	0.1	4	ND(0.1)	1.9	45	0.66	0.04	1.1	ND(0.01)
3576	7/8	7.5	57	21	19	77	3435	39.4	ND(0.1)	3		2.2	39	ND(0.05)	ND(0.04)	0.78	ND(0.01)
3594	7/11	7.9	19	33	17	115	3705	64.0	ND(0.1)	4	1	1.4	68	ND(0.05)	ND(0.02)	0.74	ND(0.01)
3618	7/13	7.7	31	52	34	105	5022	71.6	02	4	2.0	5.6	108	0.004	ND(0.02)	1.7	ND(0.01)
3603	7/12	7.6	26	75	63	86	4470	54.7	0.1	4	1	5.3	123	ND(0.02)	ND(0.02)	1.1	ND(0.01)
3641	7/14	7.8	26	43	36	114	4830	76.2	0.2	3	1.5	5.3	105	0.04	ND(0.02)	1.7	ND(0.01)
3653	7/15	7.7	42	45	32	100	4450	71.7	0.1	3	0.6	5.4	108	0.06	ND(0.02)	0.61	ND(0.01)
3674	7/18	8.0						40.8	0.1								ND(0.01)
3686	7/19	7.6						36.2	0.1								ND(0.01)
3692	7/18 to 7/19		41	60	45	137	5100					6.0	148	0.06			
3713	7/20	7.9							ND(0.1)								ND(0.01)
3722	7/21	7.6							ND(0.1)								ND(0.01)
3725	7/20 to 7/21		30	47	14	85	7356	27.5				3.3	142	0.043			

ND = Not detected, (Value reported = limit of detection)

TABLE 3 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	TOC mg/l	TSS mg/l	VSS mg/l	Ca(CO$_3$) mg/l	TDS mg/l	NO$_3$-N mg/l	NO$_2$-N mg/l	BOD mg/l	NH$_3$-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3734	7/22	7.7	13	53	15	116	7340	21.9	ND(0.1)			5.3	101	0.07	ND(0.02)	2.2	ND(0.01)
3759	7/25	8.1							ND(0.1)								ND(0.01)
3762	7/26	8.0							ND(0.1)								ND(0.01)
3765	7/25 to 7/26		20	42	20	183	5456					6.5	168	0.04			
3768	7/27	7.6															ND(0.01)
3771	7/28	8.1															ND(0.01)
3780	7/27 to 7/28		17	31	13	174	4008	20				4.5	183	0.04			
3783	7/29	8.0	28	34	24	225	3148	10				5.0	158				ND(0.01)

ND = Not detected, (Value reported = limit of detection)

TABLE 4
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
RAW WASTE

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	TSS mg/l	VSS mg/l	BOD mg/l	NH_3-N mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2868	4/28											
2889	4/29			284	69	54						
2913	4/28 to 4/30							336	160	4.4	4.3	
2927	5/2	12.4			41	21						1,150
2954	5/3	12.5			4	4						2,500
2981	5/4	12.1			63							2,000
3010	5/5	12.4			20	11						5,750
3041	5/6	12.4			70	38						1,400
3052	5/2 to 5/6		72.4	478	68	23	720	398	190	3.7	6.2	
3067	5/9	12.4			46	24						900
3085	5/10	12.4			24	15						1,400
3116	5/11	12.4			92	60						200
3145	5/12	12.3			130	82						1,900
3172	5/13	11.0			50	24						1,900
3181	5/9 to 5/13		64.1	261			870	357	110	6.9	2.3	
3199	5/17	12.1			3	3						3,400
3208	5/18	9.7			25	22						1,200
3217	5/19	8.7			6	5						1,400
3226	5/20	8.5			7	7						300
3235	5/17 to 5/20		17.8	263			825	235	130	3.4	2.0	
3244	5/23	11.3			15							1,500
3253	5/24	11.2			8							1,000
3262	5/25	12.1			22							600
3266	5/26	11.7			25	19						340
3270	5/23 to 5/27		48	510			950	144	160	7.5	3.6	

TABLE 4 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	TSS mg/l	VSS mg/l	BOD mg/l	NH_3-N mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3282	5/27	11.9			16	12						850
3286	5/31	9.0										20
3292	6/1	11.9			254	194						800
3298	6/2	12.7			93	82						19,840
3304	6/3	12.6			203	194						300
3310	5/31 to 6/3		74.7	493	-		730	115	160	7.4	5.5	
3316	6/6	12.6			44	37						1,200
3325	6/7	12.8			18	18						1,100
3334	6/8	12.5			128	79						3,700
3343	6/9	12.7			175	135						1,830
3355	6/10	12.6			206	157						1,850
3364	6/6 to 6/10		93.8	288			744	334	86	1.3	2.5	
3374	6/13	12.6			50	45						1,400
3383	6/14	12.2			87	62						1,700
3392	6/15	11.2			281	197						600
3410	6/17	12.1			151	105						1,580
3418	6/13 to 6/17		167	274			920	320	160	3.5	4.4	
3427	6/20	11.1			286	189						1,740
3436	6/21	10.4			227	170						1,400
3458	6/22	10.3			157	105						835
3467	6/23	9.6			136	86						1,420
3476	6/24	10.2			202	165						1,850
3485	6/20 to 6/24		53.2	214			710	475	110	1.4	1.4	
3495	6/27	10.2			316	276						1,250
3513	6/28	10.3			90	80						1,250
3523	6/29	10.4			232	183						1,350
3533	6/30	10.3			62	57						200
3542	6/27 to 6/30		52.0	272			870	418	110	3.3	1.5	

TABLE 4 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	TSS mg/l	VSS mg/l	BOD mg/l	NH_3-N mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3551	7/5	11.2			100	84						850
3560	7/6	11.4			125	104						1,350
3569	7/7	11.4			65	43						1,500
3578	7/8	10.6			83	76						1,450
3587	7/5 to 7/8		60.4	326			1070	371	220	8.2	5.3	
3596	7/11	9.2			74	61						1,650
3605	7/12	9.2			82	68						1,150
3610	7/13	9.0			78	67						
3643	7/14	12.7			171	124						1,600
3655	7/15	13.0			419	237						1,400
3661	7/11 to 7/15		125	386			1290	360	190	0.19	0.75	
3678	7/18	12.7										950
3688	7/19	12.6			152	124						1,250
3694	7/18 to 7/19				77	61	825		87	0.38	0.60	

TABLE 5
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
V-105

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2877	4/28											
2904	4/29			15,900								
2916	4/29 to 4/03					10,000	10,600	38,460	1,400	ND(44)	90	
2942	5/2	8.8										400
2969	5/3	8.5										8,000
2996	5/4	9.0										11,750
3025	5/5	9.2										6,500
3046	5/6	8.9										6.250
3056	5/2 to 5/6		405	25,100	19,250	11,700			2,200	ND(110)	101	
3072	5/9	6.9										7,000
3090	5/10	9.0										17,250
3121	5/11	9.0										9,750
3150	5/12	9.0										10,500
3177	5/13	8.9										9,250
3186	5/9 to 5/13		332	10,500	13,200	12,000			1,700	5.3	102	
3204	5/17	9.0										5,500
3213	5/18	9.0										9,000
3222	5/19	8.8										500
3231	5/20	8.9										6,750
3240	5/17 to 5/20		454	12,873	21,900	12,110			1,500	11	146	
3247	5/23	8.6										6,750
3255	5/24	8.7										1,625
3273	5/23 to 5/24		294	19,200	21,000	12,050			2,200	16	30.6	
3267	5/31	8.6										500
3293	6/1	8.1										600
3299	6/2	8.9										300
3305	6/3	8.9										600
3311	5/31 to 6/3		481	26,600	21,420	13,490			2,700	ND(0.02)	131	

TABLE 5 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chlor-ide mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3318	6/6	9.1										5,900
3327	6/7	9.3										5,500
3336	6/8	9.0										22,000
3345	6/9	9.3										17,500
3357	6/10	9.3										9,000
3366	6/6 to 6/10		838	11,000	19,600	13,540			2,600	9.3	123	
3376	6/13	9.2										11,000
3385	6/14	9.2										2,500
3394	6/15	9.0										1,000
3403	6/16	9.0										4,000
3412	6/17	8.9										6,500
3420	6/13 to 6/17		462	13,055	20,600	11,400			2,300	8.9	ND(100)	
3429	6/20	9.0										9,000
3438	6/21	8.7										9,500
3460	6/22	9.3										5,900
3469	6/23	9.1										8,300
3478	6/24	8.8										7,000
3487	6/20 to 6/24		950	10,900	17,500	12,500			2,200	4.8	140	
3497	6/27	9.0										6,500
3515	6/28	8.8										6,230
3525	6/29	8.8										5,000
3535	6/30	9.0										3,500
3544	6/27 to 6/30		959	11,000	22,280	12,560			2,500	7.7	430	
3553	7/5	9.0										5,500
3562	7/6	9.0										8,000
3571	7/7	8.9										7,250
3580	7/8	8.9										270
3589	7/5 to 7/8		1070	25,781	23,600	11,200			2,200	2.3	40	

TABLE 5 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3598	7/11	8.7										3,400
3607	7/12	8.3										3,300
3622	7/13	8.7										2,100
3644	7/14	8.5										2,460
3656	7115	8.6										5,200
3663	7/11 to 7/15		1070	7,400	22,800	9,390			480	3.3	5	
3677	7/18	8.3										1,000
3689	7/19	8.6										1,250
3695	7/18 to 7/19		710	6,800	23,100	11,500			290	1.1	80	

TABLE 6
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
K-111

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2875	4/28											
2901	4/29			263								
2916	4/29 to 4/30					14		1656	110	ND(4.4)	3.4	
2939	5/2	7.0										50
2966	5/3	6.3										24
2993	5/4	6.7										38
3022	5/5	6.8										44
3045	5/6	7.0										44
3056	5/2 to 5/6		4.8	271	540	15			200	ND(1.1)	6.2	
3071	5/9	6.9										45
3089	5/10	7.1										36
3120	5/11	7.2										28
3149	5/12	7.0										54
3176	5/13	6.5										43
3185	5/9 to 5/13		ND(1)	416	700	19			140	ND(1.0)	4.7	
3203	5/17	6.8										1.8
3212	5/18	6.8										90
3221	5/19	6.9										20
3230	5/20	6.8										60
3239	5/17 to 5/20		ND(0.2)	354	850	18			300	ND(1.0)	3.9	
3247	5/23	6.5										32
3256	5/24	6.2										70
3273	5/23 to 5/24		0.24	371	710	23			240	ND(0.03)	4.0	

TABLE 6 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3288	5/31	6.8										45
3294	6/1	7.0										33
3300	6/2	6.8										45
3306	6/3	6.6										22
3312	5/31 to 6/3		ND(0.2)	332	1080	12			260	0.14	4.8	
3319	6/6	6.8										40
3328	6/7	7.6										18
3337	6/8	7.8										27
3346	6/9	8.0										26
3358	6/10	8.3										8.7
3367	6/6 to 6/10		ND(0.2)	672	1400	11			420	ND(0.021)	7.5	
3377	6/13	8.5										23
3386	6/14	7.8										11
3395	6/15	7.5										5
3404	6/16	7.9										37.5
3413	6/17	7.9										32
3421	6/13 to 6/17		0.7	1087	2460	9			380	ND(0.021)	20.3	
3430	6/20	7.6										24
3439	6/21	9.1										49
3461	6/22	6.9										33
3470	6/23	7.9										35
3479	6/24	6.6										42
3488	6/20 6/24		0.7	298	600	19			52	0.097	6.5	

TABLE 6 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3498	6/27	7.0										56
3516	6/29	6.3										49
3526	6/29	6.7										32
3536	6/30	6.4										39
3545	6/27 to 6/30		ND(0.2)	265	700	16			270	0.2	6.9	
3554	7/5	6.6										34
3563	7/6	6.8										40
3572	7/7	6.7										48
3581	7/8	6.8										38
3590	7/5 to 7/8		ND(0.47)	297	750	20			230	0.02	4.5	
3599	7/11	6.8										27
3608	7/12	6.6										54
3623	7/13	6.7										50
3645	7/14	7.1										38
3657	7/15	7.2										42
3664	7/11 to 7/15		1.5	464	960	29			240	0.16	9.9	
3678	7/18	7.3										48
3680	7/19	7.1										50
3696	7/18 to 7/19		ND(0.5)	298	840	25			290	0.10	7.2	

TABLE 7
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
V-1080

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2873	4/29											
2898	4/19			2060								
2915	4/29 to 4/30					10,000	954	8617	1100	16		
2936	5/2	9.3										9,000
2963	5/3	9.6										19,500
2990	5/4	10.0										17,000
3014	5/5	9.8										230,000
3044	5/6	9.8										35,000
3055	5/2 to 5/6		23	2315	4090	15,900			1400	ND(22)	12	
3070	5/9	9.7										13,000
3088	5/10	9.7										18,000
3119	5/11	9.6										14,400
3148	5/12	9.6										23,000
3175	5/13	9.4										16,000
3184	5/9 to 5/13		29.9	2280	3900	17,000			1900	5.1	145	
3202	5/17	9.7										24,000
3211	5/18	9.0										8,000
3220	5/19	9.1										10,000
3229	5/20	9.2										2,100
3234	5/17 to 5/20		ND(0.5)	2330	5800	8,524			2100	27	74	

TABLE 7 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chlor-ide mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3248	5/23	8.6										5,750
3257	5/24	8.6										4,000
3274	5/23 to 5/24		ND(0.5)	2,288	5185	3,042			1800	26	6.6	
3320	6/6	8.7										4,500
3329	6/7	9.7										1,000
3338	6/8	9.5										18,000
3347	6/9	10.0										16,000
3359	6/10	9.9										12,200
3359	6/6 to 6/10		13.8	1,140	2315	9,920			590	7.5	ND(10)	
3378	6/13	10.0										18,000
3387	6/14	9.8										17,500
3396	6/15	9.5										21,000
3405	6/16	9.9										8.000
3414	6/17	9.6										3,500
3422	6/13 to 6/17		ND(0.5)	1,866	4500	12,520			920	27	0.8	
3431	6/20	9.7										11,000
3440	6/21	9.9										12,000
3462	6/23	9.8										4,000
3471	6/23	9.7										8,000
3480	6/24	9.7										10,000
3489	6/20 to 6/24		ND(1.0)	1,593	2960	14,090			940	17	1.0	
3499	6/27	9.9										6,500
3517	6/28	9.8										9,000
3527	6/29	9.6										6,250
3537	6/30	9.7										6,750
3546	6/27 to 6/30		ND(0.47)	1,480	4370	13,650			1200	65	ND(10)	

TABLE 7 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3555	7/5	9.8										6,000
3564	7/6	9.8										6,000
3573	7/7	10.0										9,750
3582	7/8	9.6										7,250
3591	7/5 to 7/8		ND(1.04)	1600	4415	10,392			44	ND(5.0)	0.15	
3600	7/11	9.6										11,500
3609	7/12	7.1										12,000
3624	7/13	9.6										7,500
3665	7/11 to 7/13		0.5	1830	4875	14,277			15	47	10	

TABLE 8
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
V-1070

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2871	4/28											
2895	4/29			32								
2941	4/29 to 4/30					227	276		8	26	ND(0.5)	
2933	5/2	8.6										650
2960	5/3	8.7										75
2987	5/4	9.5										350
3016	5/5	9.3										180
3043	5/6	9.4										350
3054	5/2 to 5/6		3.8	21	144	185			14	ND(2.2)	ND(0.25)	
3069	5/9	9.2										150
3087	5/10	9.5										740
3118	5/11	9.2										390
3147	5/12	8.6										79
3174	5/13	8.5										2.9
3183	5/9 to 5/13		ND(1)	30	185	382			32	ND(1.0)	0.25	
3201	5/17	8.1										0.2
3210	5/18	7.9										6.0
3219	5/19	7.8										1.3
3228	5/20	8.8										340
3237	5/17 to 5/20		ND(0.2)	15	90	63			14	ND(1.0)	ND(0.25)	

TABLE 8 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chlor-ide mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3249	5/23	8.3										350
3258	5/24	8.2										280
3275	5/23 to 5/24		5.7	39	165	152			26	ND(0.27)	0.5	
3321	6/6	8.9										20
3330	6/7	9.2										35
3339	6/8	9.9										170
3348	6/9	12.8										320
3360	6/10	9.1										70
3369	6/6 to 6/10		9.5	106	130	110			15	0.62	1.0	
3379	6/12	8.2										10
3388	6/14	6.4										ND(0.01)
3397	6/15	7.4										0.45
3406	6/16	7.3										ND(0.01)
3423	6/13 to 6/16		ND(0.2)	27	3	8			1.9	0.041	ND(0.25)	
3432	6/20	9.3										95
3441	6/21	9.6										120
3463	6/22	8.7										23
3472	6/23	9.3										30
3481	6/24	9.0										96
3490	6/20 to 6/24		ND(0.5)	17	38	188			52	0.083	0.3	

TABLE 8 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	COD mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3500	6/27	9.2										135
3518	6/28	8.9										120
3528	6/29	8.6										100
3538	6/30	9.2										120
3547	6/27 6/30		ND(0.14)	48	110	225			150	0.06	0.29	
3556	7/5	8.9										20
3565	7/6	9.4										37
3574	7/7	9.6										56
3583	7/8	7.3										ND(0.01)
3592	7/5 to 7/8		ND(0.47)	32	90	50			61	ND(0.02)	0.11	
3601	7/11	8.7										5
3610	7/12	9.6										ND(0.01)
3625	7/13	7.3										ND(0.01)
3666	7/11 to 7/13		0.5	27	12	13			0.80	ND(0.02)	0.03	

TABLE 9
CATALYTIC ENVIRONMENTAL LABORATORY
DATA SUMMARY
HYDEOTREATER CAUSTIC SCRUBBER BLOWDOWN

Cat. Lab No.	Sample Date 1982	pH Units	Chloride mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
2870	4/28										
2892	4/29			9						ND(0.3)	
2819	4/92 to 4/30					1120	1680	130	ND(110)	ND(2.5)	
2830	5/2	10.9									275,000
2957	5/3	10.9									300,000
2984	5/4	10.7									350
3013	5/5	11.2									76,000
3042	5/6	10.9									100,000
3053	5/2 to 5/6		3030	42	530	2300		96	ND(110)	ND(25)	
3068	5/9	11.1									180,000
3086	5/10	11.0									132,000
3117	5/11	11.0									130,000
3146	5/12	11.1									150,000
3173	5/13	10.4									148,000
3182	5/9 to 5/13		2686	160	1220	1480		110		ND(2.5)	
3200	5/17	10.9									168,000
3207	5/18	11.0									192,000
3218	5/19	11.8									28,000
3227	5/20	10.9									108,000
3236	5/57 to 5/19		2368	240	500	1260		170	3.4	ND(2.5)	
3245	5/23	11.2									160,000
3254	5/24	11.2									15,600
3271	5/23 to 5/24		2510	28	4450	490		160	ND(2.9)	ND(2.5)	

ND = Not detected, (Value reported = limit of detection)

TABLE 9 (Continued)

Cat. Lab No.	Sample Date 1982	pH Units	Chlor-ide mg/l	TOC mg/l	BOD mg/l	NH_3-N mg/l	TKN mg/l	Phenol mg/l	CN mg/l	SCN mg/l	Sulfide mg/l
3317	6/6	12.4									132,000
3326	6/7	13.0									110,000
3335	6/8	12.4									100,000
3344	6/9	12.9									135,000
3356	6/10	13.0									140,000
3365	6/6 to 6/10		3450	450	5520	740		110	3.8	ND(25)	
3375	6/13	13.2									70,000
3384	6/14	12.5									85,000
3393	6/15	13.0									140,000
3402	6/16	10.7									235,000
3411	6/17	10.7									110,000
3419	6/13 to 6/17		3300	454	6800	96		140	2.3	ND(25)	
3428	6/20	13.2									75,000
3437	6/21	13.1									72,500
3459	6/22	13.4									82,500
3468	6/23	13.3									62,750
3477	6/24	13.4									96,000
3486	6/20 to 6/24		4038	490	1750	350		190	14	5.5	
3496	6/27	13.2									48,000
3514	6/28	13.5									37,000
3524	6/29	13.2									45,000
3534	6/30	13.4									50,000
3543	6/27 to 6/30		3300	370	7750	440		2000	11	31	
3552	7/5	13.0									80,000
3561	7/6	12.8									62,000
3570	7/7	12.2									24,000
3579	7/8										96,000
3588	7/5 to 7/8		2720	28,960	9200	47		1400	1.5	290	
3597	7/11	13.2									132,000
3606	7/12	12.5									136,000
3621	7/13	12.4									8,000
3662	7/10 to 7/13		3600	810	3100	31		11	6.3	15	

ND = Not detected, (Value reported = limit of detection)

TABLE 10
POLLUTANTS IDENTIFIED FOR ANALYSIS IN WILSONVILLE WASTEWATER

	V-105 6/21/82	V-105 7/19/82	K-111 6/21/82	K-111 7/19/82	V-1080 6/21/82	V-1070 6/21/82	CS Blowdown 6/21/82
Metals and Inorganics (mg/l)							
Antimony, total	ND(2.0)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(2.0)
Arsenic, total	ND(0.15)	ND(0.15)	ND(0.015)	ND(0.15)	ND(0.015)	ND(0.15)	ND(0.015)
Barium, total	ND(0.15)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.1)
Boron, total	256	296	ND(0.4)	ND(0.4)	12	ND(0.2)	*
Beryllium, total	ND(1.0)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(1.0)
Cadium, total	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	0.60
Chromium, total	ND(0.6)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.60)	ND(0.60)
Copper, total	0.36	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	1.53
Lead, total	ND(1.0)	ND(1.0)	ND(0.1)	ND(1.0)	ND(0.1)	ND(0.1)	ND(1.0)
Magnesium, total	5.42	0.34	0.67	0.29	0.75	0.57	137
Mercury, total	0.0120	0.016	0.0005	0.0007	ND(0.002)	ND(0.002)	ND(0.002)
Nickel, total	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.6)
Potassium, total	4.33	0.19	0.84	0.17	0.88	0.84	129
Selenium, total	3.4	1.5	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.15)
Silver, total	ND(0.3)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.3)
Sodium, total	71.2	1.50	2.12	0.75	2.04	1.88	149,000
Thallium, total	ND(1.0)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(1.0)
Zinc, total	0.13	ND(0.008)	ND(0.008)	ND(0.008)	ND(0.008)	0.016	0.43
Cyanide, total	4.8	1.1	0.097	0.1	17	0.083	14
Fluoride, total	0.41	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(1.0)

* Severe interference - no value obtained

TABLE 10 (Continued)

	Bio Reactor Feed 6/21/82	Bio Reactor Feed 7/19/82	1st Bio Reactor Effl. 6/21/82	1st Bio Reactor Effl. 7/19/82	2nd Bio Reactor Effl. 6/21/82	2nd Bio Reactor Effl. 7/19/82	Raw Waste 6/21/82	Raw Waste 7/19/82
Metals and Inorganics (mg/l)								
Antimony, total	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)
Arsenic, total	ND(0.15)	0.089	ND(0.015)	0.035	ND(0.015)	0.026	ND(0.015)	ND(0.015)
Barium, total	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Boron, total	ND(1.0)	1.4	1.1	1.4	ND(1.0)	1.2	2.0	3.0
Beryllium, total	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)
Cadium, total	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.01)	0.06	ND(0.01)	0.12	ND(0.01)
Chromium, total	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)
Copper, total	ND(0.03)	0.065	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)
Lead, total	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Magnesium, total	18.2	5.1	14.5	10.9	14.4	11,6	1.41	0.60
Mercury, total	0.001	0.0048	0.0002	0.001	ND(0.0002)	0.0004	ND(0.002)	0.0009
Nickel, total	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)
Potassium, total	7.15	5.63	[illegible].85	3.72	[illegible].20	5.15	2.84	1.44
Selenium, total	0.043	0.16	ND(0.015)	0.026	ND(0.015)	0,034	ND(0.015)	ND(0.015)
Silver, total	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)
Sodium, total	4160	5500	1000	2640	1160	1920	2020	3160
Thallium, total	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.1)
Zinc, total	0.052	0.078	0.037	0.046	0.043	0.023	0.024	0.030
Cyanide, total	ND(0.21)	ND(0.2)	ND(0.21)	ND(0.21)	ND(0.21)	ND(0.21)	1.4	0.38
Fluoride, total	0.14	ND(0.1)	0.24	ND(0.1)	0.11	ND(0.1)	ND(0.1)	ND(0.1)

TABLE 10 (Continued)

	Bio Reactor Feed 6/21/82	Bio Reactor Feed 7/19/82	1st Bio Reactor Effl. 6/21/82	1st Bio Reactor Effl. 7/19/82	2nd Bio Reactor Effl. 6/21/82	2nd Bio Reactor Effl. 7/19/82	Raw Waste 6/21/82	Raw Waste 7/19/82
Volatiles (mg/l)								
Benzene	ND(0.042)	ND(0.009)	ND(0.042)	ND(0.009)	ND(0.042)	ND(0.009)	0.21	0.29
Ethylbenzene	ND(0.042)	ND(0.009)	ND(0.042)	ND(0.009)	ND(0.042)	ND(0.009)	0.71	0.20
Toluene	0.36	1.3	ND(0.042)	ND(0.009)	ND(0.042)	ND(0.009)	13.0	7.2
Base/Neutral (mg/l)								
Acenaphthene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Acenaphthylene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Anthracene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Benzo-anthracene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Benzo-pyrene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Benzo-fluoranthene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Benzo-perylene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Chyrsene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Dinitrololuene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)	ND(0.020)
Fluoranthene	ND(0.022)	0.060	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.100)	0.056
Fluorene	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Naphthalene	ND(0.022)	0.78	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	8.35	34.1
Phenanthrene	ND(0.022)	0.62	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	2.48	1.36
Phthalates	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.020)
Pyrene	ND(0.022)	0.11	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	0.27	0.19
Acid Compounds (mg/l)								
Nitrophenol (2 & 4)	0.34	-	ND(0.050)	-	ND(0.050)	-	ND(0.090)	-
Phenol	7.5	23	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	44	28
o-Cresol	4.2	11	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	14	8.8
m & p-Cresol	5.3	21	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	27	17
2,6 Dimethylphenol	0.16	0.72	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	101	1.3
2,4-2,5 Dimethylphenol	3.0	6.7	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	10	5.2
p-Ethylphenol	2.3	5.5	ND(0.049)	ND(0.049)	ND(0.049)	ND(0.049)	4.6	2.9

TABLE 10 (Continued)

	V-105 6/21/82	V-105 7/19/82	K-111 6/21/82	K-111 7/19/82	V-1080 6/21/82	V-1070 6/21/82	CS Blowdown 6/21/82
Volatiles (mg/l)							
Benzene	0.099	0.70	2.8	1.5	4.5	0.28	4.4
Ethylbenzene	ND(0.042)	0.19	2.6	1.5	0.31	ND(0.042)	ND(0.042)
Toluene	0.26	2.3	30.5	6.7	4.9	0.66	5.6
Base/Neutral (mg/l)							
Acanaphthene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.10)		
Acenaphthylene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.10)
Anthracene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.10)
Benzo-anthracene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Benzo-pyrene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Benzo-fluoranthene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Benzo-perylene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Chyrsene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Dinitrololuene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.010)	ND(0.20)
Fluoranthene	ND(0.022)	ND(0.100)	ND(0.198)	ND(0.100)	ND(0.022)	ND(0.100)	ND(0.22)
Fluorene	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.019)	ND(0.010)	ND(0.20)
Naphthalene	2.46	1.26	16.8	2.76	0.17	0.15	ND(0.22)
Phenanthrene	0.037	0.26	ND(0.198)	ND(0.100)	ND(0.022)	0.43	ND(0.22)
Phthalates	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.040)	ND(0.010)	ND(0.40)
Pyrene	ND(0.022)	ND(0.100)	ND(0.198)	ND(0.100)	ND(0.022)	ND(0.100)	ND(0.22)
Acid Compounds (mg/l)							
2,4 Dinitrophenol	-	-	-	-	0.93	ND(0.040)	ND(0.20)
Nitrophenol (2 & 4)	-	-	-	-	0.32	ND(0.020)	ND(0.20)
Phenol	1700	1200	102	190	760	3.4	130
o-Cresol	200	240	36	70	260	2.5	44
m & p-Cresol	730	1000	62	140	430	2.5	47
2,6 Dimethylphenol	5.5	12	5.7	7.6	9.8	0.17	2.1
2,4-2,5 Dimethylphenol	110	180	50	45	77	0.27	7.7
p-Ethylphenol	92	103	15	18	42	0.35	6.3

TABLE 11
CHLORIDE ANALYSIS THROUGH THE
BIOLOGICAL TREATMENT PLANT
(COMPOSITE SAMPLES)

Sample Date 1982	Bio-Reactor Feed *	1st Bio-Reactor Effluent *	2nd Bio-Reactor Effluent *
4/28 to 4/29	212	231	297
5/2 to 5/6	360	326	-
5/9 to 5/13	269	285	305
5/17 to 5/20	406	382	332
5/23 to 5/27	243	150	140
5/31 to 6/3	286	305	285
6/6 to 6/10	193	199	214
6/3 to 6/17	306	296	270
6/23 to 6/24	424	377	363
6/27 to 6/30	300	349	375
7/5 to 7/8	273	216	268
7/11 to 7/15	244	259	125
7/18 to 7/22	247	268	256
7/25 to 7/29	247	296	288

* mg/l Chloride

TABLE 12
PHENOLIC CHARACTERIZATION OF HTU SAMPLES FOR PHENOL RECOVERY

Sample Date 1982	Sample Site	Phenol mg/l	o-Cresol mg/l	p-Cresol mg/l	2-6 Dimethyl Phenol mg/l	2.4 & 2.5 Dimethyl Phenol mg/l	P-ethyl Phenol mg/l	Total Phenols (4AAP) mg/l
6/20 to 6/24	V-1080	516	188	284	7.5	45	31	940
6/21	V-1080	760	360	430	9.8	77	42	-
*	V-1080	860	61	510	14	100	61	1800
6/20 to 6/24	V-1070	5.5	2.7	3.3	ND(0.05)	ND(0.5)	0.31	52
6/21	V-1070	3.4	2.5	2.5	0.17	0.27	0.35	-
6/20 to 6/24	C.S. Blowdown	110	45	43	4.9	15	60	190

* Samples sent to Dr. R.P. Luthy, Carnegie-Mellon University, for phenol recovery evaluation

ND = Not detected (value reported = limit of detection).

TABLE 13
PLANT OPERATING PARAMETERS - SRC

Date 1982	Run No.	Diss. Temp. °F	Coal Feed Rate lbs/hr	T-102 BTMS Temp. °F	V-105 Flow lbs/hr	K-111 Flow lbs/hr *	Comments
4/24	239	585	400	590	18.59		Start of run
4/25	239	784	350	585	17.24		
4/26	239	785	421	593	18.18		
4/27	239	789	370	595	17.72		Started using HTU SRC
4/28	239	787	424	595	17.52		
4/29	239	785	420	585	17.65		
4/30	239	784	425	590	16.77		08:15 Front end on solvent - CSD down
5/1	239	786	419	595	18.99		09:30 Front end on coal
5/2	239		420	590	14.60		
5/3	239	785	420	590	15.39		
5/4	239	785	420	595	15.65		
5/5	239	785	420	593	14.95		
5/6	239	785	424	595	20.01		14:55 Front end on solvent - CSD down
5/7	239	785	420	590	17.16		03:30 F.E. on coal
						445	17:30 on solvent - CSD down
5/8	239	785	410	593	18.78		07:40 Front end on coal
5/9	239	785	420	590	16.80		
5/10	239	782	420	590	15.57		
5/11	239	785	420	590	16.06		
5/12	239	784	421	593	15.79		
5/13	239	784	422	594	16.09		
5/14	239	785	421	594	16.48		
5/15	239	786	421	594	16.40		22:00 Front end on solvent - HTU Prob.
5/16	239					440	Front end on solvent
5/17	239	786	421	590	15.50		17:00 Front end on coal
5/18	239	786	419	592			
5/19	239	786	413	592	16.78		
5/20	239	785	421	591	14.97		
5/21	239	786	416	592	18.96		
5/22	239	784	417	590	16.55		
5/23	239	784	420	590	17.95		
5/24	239	786	418	590	18.45		22:25 Run ended
5/25							Plant down
5/26							Plant down
5/27							Plant down
5/28							Plant down
5/29							Plant down
5/30							Plant down
5/31	240	849	389	600			11:10 Front end on coal

TABLE 13 (Continued)

Date 1982	Run No.	Diss. Temp. °F	Coal Feed Rate lbs/hr	T-102 BTMS Temp. °F	V-105 Flow lbs/hr	K-111 Flow lbs/hr *	Comments
6/1	240	839	385	600	28.5		
6/2	240	840	380	598	27.1		
6/3	240	840	380	595	23.4		
6/4	240	840	380	598	24.0		
6/5	240	840	380	594	21.5		
6/6	240	840	380	590	21.2		
6/7	240	840	380	598	21.0		
6/8	240	824	380	598	20.5		
6/9	240	824	380	600	18.6		
6/10	240	824	380	598	19.2		
6/11	240	824	382	598	20.2		
6/12	240	823	380	598	22.1		
6/13	240	825	380	598	25.6		
6/14	240	825	377	605	26.6		
6/15	240	828	386	600	24.0		
6/16	240	-	-	614	22.5		
6/17	240	823	379	602	19.8		
6/18	240	825	383	595			
6/19	240	825	382	595			Power failure
6/20	240	825	378	596	19.0		
6/21	240	824	379	595	16.9		
6/22	240	826	384	595	18.6		
6/23	240	825	380	595	19.8		
6/24	240	827	380	595	20.2		
6/25	240	826	383	596	18.3		
6/26	240	826	380	595	19.0		
6/27	240	825	380	595	20.2		
6/28	240	825	380	595	20		
6/29	240	825	380	595	19.3		
6/30	240	825	380	595	19.3		Power failure

TABLE 13 (Continued)

Date 1982	Run No.	Diss. Temp. °F	Coal Feed Rate lbs/hr	T-102 BTMS Temp. °F	V-105 Flow lbs/hr	K-111 Flow lbs/hr *	Comments
7/1	240	825	350	600	19.3		
7/2	240	825	350	600	19.0		
7/3	240	826	380	595	19.0		
7/4	240	824	380	595	19.1		
7/5	240	829	380	593	19.1		
7/6	240	824	380	615	19.6		
7/7	240	824	760	616	19.6		
7/8	240	824	761	616	19.9		
7/9	240	824	760	615	18.8		
7/10	240	825	760	614	27.8		Shut down due to low solvent
7/11	240	825	760	615	32.5		
7/12	240	825	760	615	34.4		
7/13	240	825	382	615	19.1		
7/14	240	825	379	608	19.0		
7/15	240	825	379	612	19.1		
7/16	240	827	327	615	21.8		
7/17	240	825	379	615	-		
7/18	240	825	380	615	-		
7/19	240	825	378	616	-		
7/20	240	825	380	-	-		Plant shutdown
7/21							for turnaround
7/22							run 240
7/23							ended
7/24							20 July
7/25	241						Run 241 started
7/26							
7/27					26.6		
7/28					26.2		
7/29					26		
7/30					27.2		
7/31					27.0		

* Flow measured twice

TABLE 14
PLANT OPERATING PARAMETERS - HTU

Date 1982	Run No.	Temp. °F	SRC Feed Rate lbs/hr	% Solv.	P-1230 Flow (V-1280) lbs/hr	V-1070 Flow lbs/hr*	C.S. B.D. Flow lbs/hr	Comments
4/24	239							02:30 Unit started - on solvent
4/25	239							On solvent
4/26	239	600-610	617	50	72			12:00 Started on SRC Feed
4/27	239	60	700	50	72		0.3	
4/28	239	600-785	700	50	72		0.3	
4/29	239	785	666	53	75		0.3	
4/30	239	795	525	52	70		0.3	07:45 Unit on solvent
5/1	239	600-637	316	49	70		0.3	13:20 Unit on feed
5/2	239	753	648	51	70		0.3	
5/3	239	783	691	53	70		0.3	
5/4	239	784	795	52	70		0.3	
5/5	239	785	650-765	50	72		0.3	
5/6	239	785-600	690-700	50	72		0.4	15:35 On solvent - CSD plugged
5/7	239					265	0.3	Started-up went back down
5/8	239	624	219	51	75		0.3	12:00 Unit on feed
5/9	239	784	325	51	75		0.3	
5/10	239	783	374	52	75		0.3	
5/11	239	785	379	51	75		0.3	
5/12	239	783	355	51	75		0.3	
5/13	239	785	393	51	75		0.3	
5/14	239	784	815	50	72		0.4	
5/15	239	785	917	52	72		0.3	19:25 Unit off feed
5/16	239						0.3	Unit down
5/17	239	665	401	53	72		0.3	06:55 Unit on feed
5/18	239	750	634	50	72			
5/19	239	785	756	52	83		0.3	
5/20	239	784	348	51	75		0.3	
5/21	239	785	718	50	72		0.3	20:00 Power failure
5/22	239	775	700-750	50	72		0.3	
5/23	239	665	650	50	72		0.3	
5/24	239	770	650	50	72		0.3	
5/25							0.3	Unit down
5/26							0.3	Unit down - decoking
5/27							0.3	Unit down - decoking
5/28								Unit down - decoking
5/29								
5/30								Unit down - Unit on solvent 03:40
5/31								Unit down - 03:00 Unit off - solvent down

TABLE 14 (Continued)

Date 1982	Run No.	Temp. °F	SRC Feed Rate lbs/hr	% Solv.	P-1230 Flow (V-1280) lbs/hr	V-1070 Flow lbs/hr*	C.S. B.D. Flow lbs/hr	Comments
5/1	240							Unit down
6/2	240							Unit down
6/3	240							Unit down
6/4	240							Unit on solvent -
						233		06:00 Unit on feed
6/5	240	603	191	48.9	73		0.3	
6/6	240	601	139	51.3	80		0.3	
6/7	240	692	166	62.5	80		0.3	
6/8	240	760	151	66.4	80		0.3	
6/9	240	764	158	52.6	80		0.3	
6/10	240	764	293	49.2	80		0.3	
6/11	240	762	334	50.3	80		0.3	
6/12	240	757	285	50.5	80		0.5	
6/13	240	760	269	52	80		0.3	
6/14	240	760	283	50.3	80		0.3	
6/15	240	760	296	49	81		0.3	
6/16	240	600					0.3	Unit on solvent - recirc.
6/17	240	390					0.3	Unit on solvent - recirc.
6/18	240	760	300	50	72	264	0.3	On feed at 10:00 hours
6/19	240	760	300	50	72		0.3	Power failure
6/20	240	760	300	50	70-75		0.3	
6/21	240	760	295	50	70-75		0.3	
6/22	240	700	275	50	72	214		
6/23	240	760	250-295	50	72		0.3	
6/24	240	760	275	50	72		0.3	
6/25	240	760	292	50	80		0.3	
6/26	240	761	288	50.7	80		0.3	
6/27	240	761	303	49.3	80		0.3	
6/28	240	760	308	50	80		0.3	
6/29	240	761	304	50.6	80			
6/30	240	760	295	50	80		0.3	Power failure 19:15

TABLE 14 (Continued)

Date 1982	Run No.	Temp. °F	SRC Feed Rate lbs/hr	% Solv.	P-1230 Flow (V-1280) lbs/hr	V-1070 Flow lbs/hr*	C.S. B.D. Flow lbs/hr	Comments
7/1	240	600	solvent	50	80			Solvent
7/2	240						0.3	Solvent
7/3	240	680	250	50	76	239	0.3	
7/4	240	760	300	50	76		0.3	
7/5	240	760	300	50	76		0.3	
7/6	240	760	286	49.8	76		0.3	
7/7	240	760	303	49.4	76		0.3	
7/8	240	760	300	50	76		0.3	
7/9	240	760	300	50	76		0.3	
7/10	240	760	301	47.8	76		0.3	
7/11	240	760	296	50.3	76		0.3	
7/12	240	760	297	51	76		0.3	
7/13	240	760	300		83		0.3	
7/14	240			49.9			0.3	
7/15	240						0.3	Unit down
7/16	240							Unit down
7/17	240							Unit down
7/18	240							Unit down
7/19	240							Unit down
7/20	240							Unit down
7/21								Unit down
7/22								Unit down
7/23								Unit on standby
7/24		600						Solvent recirc.
7/25	241	609						Solvent recirc.
7/26		600	330					SRC transf. line flushed 5 dumps
7/27		606						Recircl.
7/28		600		100				
7/29		600		50				
7/30								
7/31								

* V-1070 flow to sewer equals V-1070 flow shown minus P-1230 flow.

TABLE 15

PLANT OPERATING PARAMETERS - WTU

Date 1982	Run No.	Raw Waste Flow Rate Gal.	Bio Plant HRT days	Effl. Flow GPM	H_2O_2 Added Gal.	Carbon Added lbs	Daily Rainfall Inch.
4/24	239	16120	3.5	16.2	30		
4/25	239		2.5	21.7			1.0
4/26	239	15330	2.5	22.1	25		
4/27	239		2.5	21.8			
4/28	239		3.8	19.7			
4/29	239	15620	4.5	12.3			0.1
4/30	239		3.6	15.5			
5/1	239	15620	3.9	18.6			
5/2	239		4.2	13.4			
5/3	239	15475	3.9	14.1	30		
5/4	239	15620	5.4	10.4	25		
5/5	239	15620	4.1	13.7	15		
5/6	239	15620	3.9	14.4			
5/7	239	15620	2.8	19.8		50	
5/8	239		2.7	21.2			
5/9	239	14750	2.7	21.3			
5/10	239	15620	3.7	15.5			
5/11	239		3.1	18.1			
5/12	239	14750	4.0	14.2			
5/13	239		3.6	15.7			
5/14	239	16485	4.5	12.6			
5/15	239	15470	3.6	15.6			
5/16	239		4.8	12.3			
5/17	239	16490	2.5	19.3			
5/18	239		4.9	11.4			
5/19	239	15620	2.9	19.3			
5/20	239	15620	5.3	10.6			
5/21	239	15620	4.2	13.3			
5/22	239		3.6	15.6			
5/23	239		2.4	23.1			0.4
5/24	239	15620	2.9	19.1	120		
5/25			3.1	18.1		100	
5/26			4.5	12.6			0.1
5/27			3.2	17.8			
5/28		15620	3.7	15.2	40		
5/29			2.6	21.2			
5/30		15620	6.5	8.7	35		
5/31	240		2.4	22.9			0.2

TABLE 15 (Continued)

Date 1982	Run No.	Raw Waste Flow Rate Gal.	Bio Plant HRT days	Effl. Flow GPM	H_2O_2 Added Gal.	Carbon Added lbs	Daily Rainfall Inch.
6/1	240	15620	3.9	14.3	8		0.3
6/2	240		2.4	23.2			0
6/3	240		4.0	13.9			0.1
6/4	240	16485	2.3	24.3	55		0.9
6/5	240	15520	2.5	21.8	35		0
6/6	240	16200	2.5	22.0	15		0
6/7	240		2.8	19.5			0
6/8	240		2.3	23.6			0
6/9	240	15620	2.6	21.9	20		
6/10	240	15620	2.3	24.3	10	100	
6/11	240	13600	2,6	21.8	10		-
6/12	240		2.6	22.0			0.5
6/13	240	15620	2.5	22.7	10		
6/14	240	15620	2.3	24.3	10		
6/15	240		2.6	22.0			
6/16	240	15620	2.4	23.9	10		
6/17	240	15620	2.7	20.9	9		0.1
6/18	240		2.9	23.2			0.1
6/19	240	15620	2.7	20.6	10		
6/20	240	15620	3.3	17.3			
6/21	240		4.1	13.8			
6/22	240	15620	3.5	15.7	20		
6/23	240		4.5	12.4			0.1
6/24	240		3.5	16,1			
6/25	240	15620	2.7	21.0			
6/26	240		3.2	17.7			
6/27	240	15620	3.7	15.2	5		0.1
6/28	240	15620	2.4	23.7			0.4
6/29	240		2.5	22.0			0.1
6/30	240	15900	2.3	24.2			0.5

TABLE 15 (Continued)

Date 1982	Run No.	Raw Waste Flow Rate Gal.	Bio Plant HRT days	Effl. Flow GPM	H_2O_2 Added Gal.	Carbon Added lbs	Daily Rainfall Inch.
7/1	240		2.6	21.6			0.9
7/2	240	15618	2.6	21.3			
7/3	240		3.3	17.1			
7/4	240	16341	2.4	23.9			
7/5	240		2.8	19.8			
7/6	240	15618	2.4	23.5		100	
7/7	240	15618	2.8	19.8	110		
7/8	240		2.6	21.6			
7/9	240	15329	2.5	22.3			
7/10	240	15618	2.4	23.4	165		
7/11	240		3.1	18.0			
7/12	240	15309	2.3	24.7	55		0.4
7/13	240	15474	2.6	21.6	55		
7/14	240		2.9	19.5	55		
7/15	240		4.2	13.6			0.5
7/16	240	14751	2.5	22.2		100	0.1
7/17	240	16486	2.8	19.6			
7/18	240		3.2	17.6			0.2
7/19	240	15618	2.8	19.5			
7/20	240		3.2	17.5		100	0.4
7/21			4.2	13.4			
7/22		16486	3.4	16.6			
7/23			4.1	13.6			
7/24			3.4	16.8			
7/25	241	14751	4.2	13.2			0.6
7/26	241	15618	2.7	21.1			0.1
7/27	241		3.0	18.6			
7/28	241		2.6	21.3			
7/29	241		3.4	16.4	15		
7/30	241		2.8	20.0	25		1
7/31	241	14172	2.8	19.8	55		0.2

TABLE 16
Organic Pollutants Identified for Analysis
In SRC-1 Solid Product Leachate

Volatiles (ug/l)	EP Leachate	ASTM"A"	ASTM"B"
Acrolein	ND (20)	ND (20)	ND (20)
Acrylonitrile	ND (20)	ND (20)	ND (20)
Benzene	ND (1.3)	ND (14.3)	145
Bromoform	ND (1.2)	ND (1.0)	ND (1.0)
Ethylbenzene	ND (1.0)	ND (1.0)	MD (1.0)
Methyl bromide	ND (11.1)	ND (40)	ND (40)
Methyl chloride	ND (10.0)	ND (17)	ND (14)
Methylene chloride	ND (2.0)	-	-
Toluene	ND (1.0)	ND (1.0)	ND (1.0)
Vinyl chloride	ND (10.1)	ND (11)	ND (9)
Conventional and Nonconventional Pollutants (mg/l)			
Oil and grease	28	35	ND (15)
Total organic carbon	-	9	-
Total organic nitrogen	ND (2)	ND (2)	ND (2)
Base/Neutral (ug/l)			
Acanaphthene	ND (1.0)	ND (1.0)	ND (1.0)
Acenaphthylene	ND (1.0)	ND (1.0)	ND (1.0)
Anthracene	ND (1.0)	ND (1.0)	ND (1.0)
Benzidine	ND (5.0)	ND (50)	ND (50)
Benzo-anthracene	ND (1.0)	ND (1.2)	ND (1.2)
Benzo-pyrene	ND (1.0)	ND (1.5)	ND (1.5)
Bromophenyl phenyl ether	ND (30)	ND (3.4)	ND (3.3)
Benzo-fluoranthene	ND (1.0)	ND (2.3)	ND (2.3)
Benzo-perylene	ND (1.0)	ND (1.9)	ND (2.0)
Chrysene	ND (1.0)	ND (1.2)	ND (1.2)
Dibenzo-anthracene	ND (10)	ND (6.0)	ND (6.0)
Dinitroroluene	ND (1.4)	ND (4.0)	ND (4.0)
Diphenylhydrazine	ND (1.6)	ND (6.5)	ND (6.5)
Fluoranthene	ND (1.0)	ND (1.0)	ND (1.0)
Fluorene	ND (1.0)	ND (1.4)	ND (1.5)
Indeno-pyrene	ND (1.5)	ND (2.2)	ND (2.2)
Isophorone	ND (1.0)	ND (1.5)	ND (1.5)
Naphthalene	ND (1.0)	ND (1.3)	ND (1.3)
Nitrobenzene	ND (1.0)	ND (3.1)	ND (3.2)
Phenanthrene	ND (1.0)	ND (1.0)	ND (1.0)
Phthalates (priority pollutant pthalates)	ND (1.0	ND (1.0)	ND (1.0)
Pyrene	ND (1.0)	ND (1.0)	ND (1.0)
Acid Compounds (ug/l)			
Dimethylphenol	ND (1.0)	ND (2.1)	ND (2.2)
4,6 Dinitrocresol	ND (3.3)	ND (1.4)	ND (1.3)
2,4 Dinitrophenol	ND (11.9)	ND (29)	ND (28)
Nitrophenol (2 & 4)	ND (6.0)	ND (20)	ND (21)
Phenol	ND (1.0)	ND (1.8)	ND (1.8)

ND = Not dectected, (Value reported = limit of detection)

TABLE 17
BIOLOGICAL SYSTEM OPERATION SUMMARY
1st BIOREACTOR

May 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/1/hr)	MLSS (mg/1)	Carbon Feed (lb/day)
1	42.5	7.5	75.2	17	4760	
1	38.5	7.3	75.2	12	4880	
3	46.8	7.2	77	11	5420	
4		7.3	75.2	12		
5	63.8	7.3	75.2	17	4303	
6	58.5	7.1	77	20	5070	
7	42.2	7.0	75.8	31	5043	
8	63.4	7.1	78.8	28	4926	
9	65.8	7.2	77	19	5116	
10	60.5	7.5	77	23	4385	
11	-	7.3	75.2	19	-	
12	25.7	7.0	77	21	4690	
13	50.7	7.3	80.6	28	5470	
14	46.1	7.0	80.6	20	5403	
15	38.0	7.4	80.6	17	5513	
16	90.2	7.1	82.4	19	5377	
17	31.0	7.0	82.4	18	5367	
18	91.0	7.1	82.4	13	4673	
19	22.9	7.2	80.6	15	4807	
20	29.9	7.3	78.8	17	4560	
21	25.5	7.3	80.6	15	3853	
22	183.2	7.0	78.8	25	4140	
23	125.4	7.0	82.4	34	3563	
24	147.5	7.6	80.6	19	4193	
25	49.0	7.4	82.4	15	5311	50
26	42.6	7.6	80.6	20	4863	
27	45.2	7.3	82.4	15	4890	
28	39.3	7.6	82.0	11	5160	
29	41.0	7.5	84.2	9	4893	
30	175.8	7.6	84.2	6	5059	
31	48.6	7.5	84.2	10	5187	

TABLE 17
1st BIOREACTOR (Continued)

June 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/1/hr)	MLSS (mg/1)	Carbon Feed (lb/day)
1	39.2	7.4	82.4	18	4350	
2	40.4	7.4	80.6	9	3856	
3	39.8	7.9	80.6	18	4310	
4	41.7	7.7	80.6	15	4470	
5	48.8	7.9	80.6	15	3290	
6	60.5	7.8	82.4	21	3283	
7	46.4	7.7	80.6	14	3636	
8	-	7.2	80.4	30	3460	
9	-	7.0	80.4	15	4093	50
10	-	7.0	87.8	27	4266	
11	-	7.3	87.8	29	4223	
12	50.0	7.1	86	39	4560	
13	48.7	7.1	84.2	20	4450	
14	53.3	7.3	87.8	24	4707	
15	48.2	7.2	87.8	32	3980	
16	47.0	7.2	87.8	20	4520	
17	52.7	7.3	82.4	28	4653	
18	42.7	7.4	84.2	16	4713	
19	45.4	7.3	86	28	4790	
20	44.0	7.1	86	28	4417	
21		7.1	82.4	21	-	
22	41.4	7.1	82.4	26	6257	
23	41.0	7.1	80.6	22	6080	
24	27.1	7.2	82.4	15	5403	
25	41.0	7.1	82.4	13	6150	
26	47.6	7.2	84.2	30	6443	
27	52.4	7.4	84.2	15	6160	
28	82.1	7.3	84.2	23	5063	
29	84.3	7.1	84.2	18	4966	
30	49.7	7.5	84.2	24	5153	

TABLE 17
1st BIOREACTOR (Continued)

July 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/1/hr)	MLSS (mg/1)	Carbon Feed (1b/day)
1	59.9	7.2	82.4	31	4913	
1	41.9	7.1	84.2	33	4610	
3	46.3	7.1	84.2	30	4596	
4	51.0	7.6	86	20	3806	
5	68.8	7.8	84.2	18	4546	
6	23.8	7.0	86	32	5046	50
7	19.9	7.4	86	16	5446	
8	35.0	7.0	87.8	32	4817	
9	36.1	7.6	89.6	32	5183	
10	21.7	7.4	89.6	22	4813	
11	75.7	7.1	87.8	18	4720	
12	67.0	7.0	86	25	4976	
13	142.0	7.5	86	25	4917	
14	69.2	7.4	87.8	20	4936	
15	47.6	7.3	86	20	4953	
16	119.0	7.3	82.4	30	5097	50
17	79.4	7.7	82.4	30	5657	
18	45.4	7.7	82.4	29	5173	
19	-	7.2	84.2	23		
20	41.9	7.2	86	31	6213	50
21	78.0	7.5	86	38	6880	
22	54.7	7.6	86	21	5920	
23	41.7	7.7	84.2	20	5553	
24	44.1	7.7	84.2	16	5200	
25	39.5	7.7	82.4	15	6300	
26	31.5	7.5	82.4	14	5433	
27	30.3	7.7	84.2	15	4850	
28	31.8	7.7	84.2	15	4410	
29	31.2	7.3	84.2	21	4456	
30	31.6	7.4	86	25	4583	
31	35.9	7.9	84.2	21	4530	

TABLE 17
BIOLOGICAL SYSTEM OPERATION SUMMARY
2nd BIOREACTOR

May 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/l/hr)	MLSS (mg/l)	Carbon Feed (lb/day)
1	45.0	7.9	73.4	2	2420	
1	46.6	7.8	73.4	0	2823	
3	65.1	7.8	75.2	0	2253	
4	-	7.5	73.4	0		
5	112.5	7.4	73.4	1	1966	
6	118.8	7.9	73.4	7	2156	
7	-	7.6	75.0	7	2113	50
8	220.4	7.8	75.2	0	2340	
9	-	7.5	73.4	3	2286	
10	264.2	7.7	73.4	4	2443	
11	-	7.8	73.4	6	-	
12	-	7.7	73.4	6	2086	
13	-	7.6	77	3	2740	
14	61.9	7.3	77	5	2733	
15	144.7	7.6	77	1	3023	
16	56.3	7.6	78.8	0	2717	
17	71.0	7.7	78.8	2	3043	
18	84.5	7.6	78.8	1	2893	
19	49.8	7.5	78.8	2	2833	
20	60.2	7.4	77	5	2947	
21	46.6	7.5	78.8	3	2666	
22	142.6	7.5	77	6	2833	
23	242.0	7.5	78.8	8	2927	
24	269.0	7.7	78.8	8	2763	
25	73.4	7.9	78.8	8	3140	50
26	64.0	7.9	78.8	9	3529	
27	41.0	7.9	80.6	3	3163	
28	42.7	8.0	80.6	5	3163	
29	45.7	7.7	82.4	4	3083	
30	41.7	7.9	82.4	3	3253	
31	87.8	7.7	82.4	2	3060	

TABLE 17
2nd BIOREACTOR (Continued)

June 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/l/hr)	MLSS (mg/l)	Carbon Feed (lb/day)
1	105.0	7.7	80.6	10	2590	
1	46.2	7.7	80.6	3	2613	
3	58.0	7.4	80.6	6	2663	
4	177.0	7.6	80.6	5	2546	
5	53.2	7.8	80.6	4	2333	
6	101.4	7.9	80.6	5	2326	
7	70.5	7.6	78.8	17	2220	
8	-	7.6	80.6	5	2436	
9	-	7.4	82.6	7	2800	50
10	-	7.1	87.8	6	2676	
11	-	7.9	86	5	2683	
12	-	7.9	84.2	3	2623	
13	-	7.8	84.2	3	2060	
14	-	7.6	84.2	2	2443	
15	-	7.9	86	4	1060	
16	-	7.9	86	6	2363	
17	-	8.0	80.4	9	2360	
18	-	7.8	80.6	8	2220	
19	-	8.0	82.4	6	2303	
20	-	7.7	80.6	7	2410	
21	-	7.5	80.6	9	-	
22	69.9	7.6	84.2	12	2467	
23	47.4	7.5	80.6	8	3233	
24	54.7	7.7	80.6	4	2793	
25	47.9	7.6	82.4	3	2870	
26	49.7	7.8	82.4	5	2810	
27	80.2	7.4	82.4	3	2960	
28	1303.6	7.8	82.4	5	3303	
29	202.9	7.4	82.4	4	2710	
30	265.1	7.9	84.2	3	2996	

TABLE 17.
2nd BIOREACTOR (Continued)

July 1982	SRT Days	pH	Temp. (°F)	D.O. Uptake (mg/1/hr)	MLSS (mg/1)	Carbon Feed (lb/day)
1	59.6	7.7	80.6	23	2713	
1	71.2	7.6	82.4	13	2730	
3	66.3	7.4	82.4	12	2746	
4	78.0	7.6	80.2	13	3153	
5	105.2	7.8	84.2	8	3026	
6	44.6	7.8	84.2	15	3283	50
7	25.7	7.7	84.2	8	3626	
8	34.0	7.5	84.2	8	3467	
9	24.8	7.9	86	10	3623	
10	69.5	7.9	86	13	3453	
11	59.8	7.9	84.2	9	3093	
12	83.6	7.6	84.2	9	3433	
13	121.4	7.8	84.2	10	3283	
14	576.3	7.8	84.2	18	3157	
15	58.8	7.8	84.2	8	2840	
16	-	7.9	82.4	11	3210	50
17	57.1	7.9	78.8	20	3580	
18	51.8	7.8	80.6	16	3160	
19	-	7.5	82.4	18		
20	66.3	7.9	84.2	8	3473	50
21	48.7	7.7	84.2	12	3467	
22	59.7	7.7	84.2	10	3740	
23	51.5	8.0	82.4	6	3437	
24	62.2	7.9	82.4	14	3197	
25	52.1	7.9	82.4	9	3660	
26	46.2	7.8	82.4	7	3290	
27	36.0	7.8	84.2	13	2693	
28	35.6	8.0	84.2	10	2720	
29	36.8	7.9	82.4	10	2863	
30	40.3	7.8	84.2	9	2716	
31	50.0	7.5	82.4	20	2793	

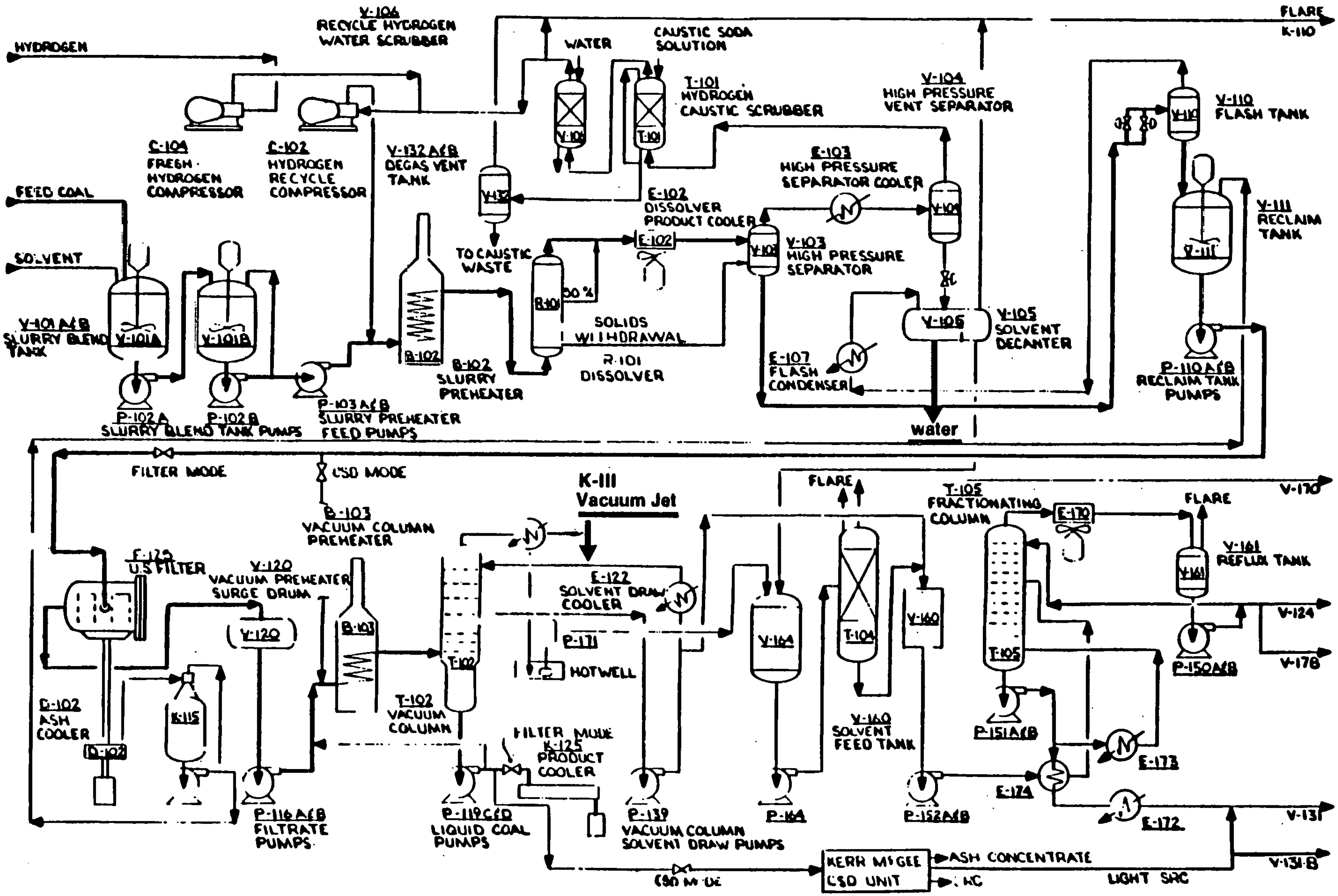

Figure 1
SRC Flow Sheet

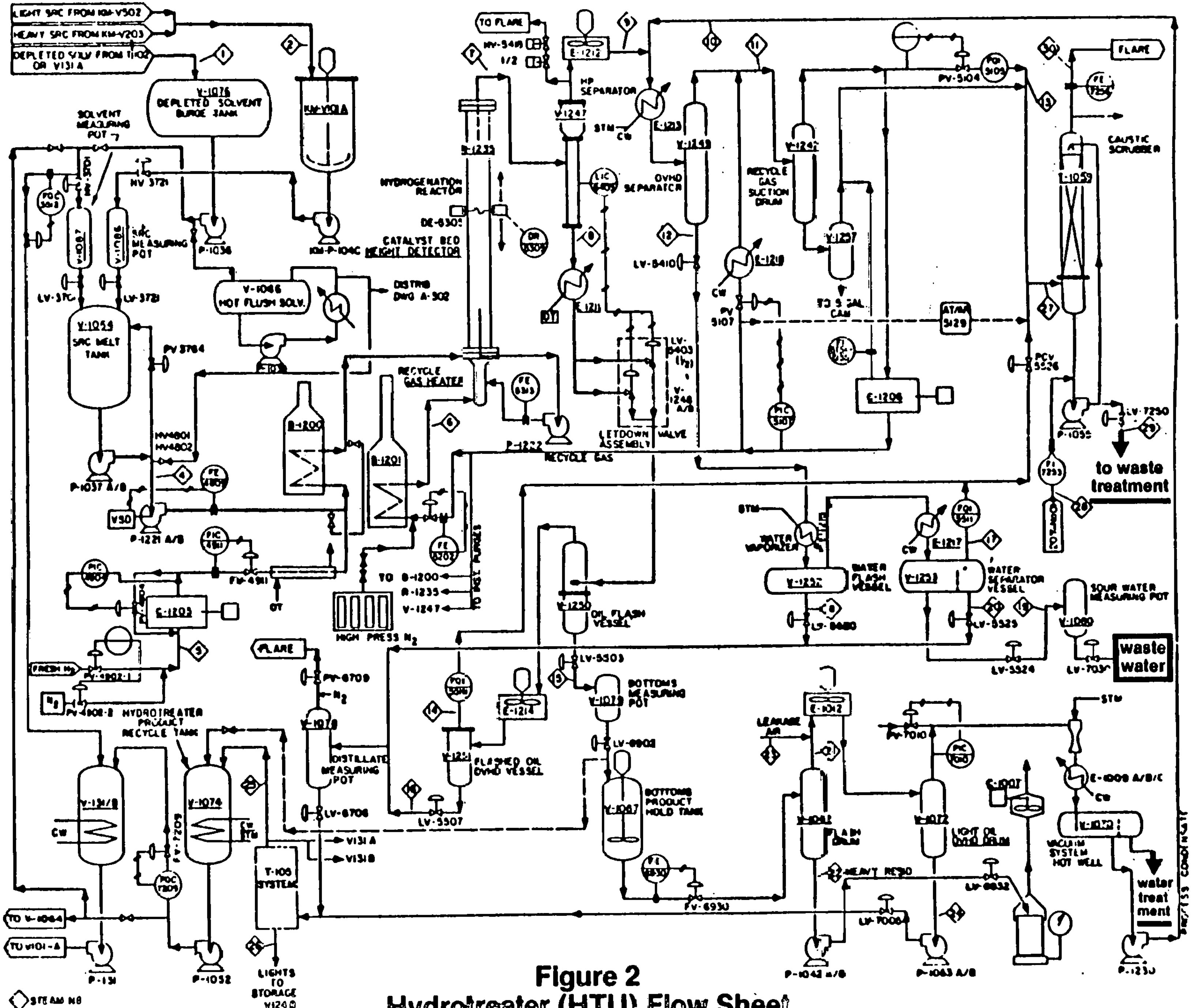

Figure 2
Hydrotreater (HTU) Flow Sheet

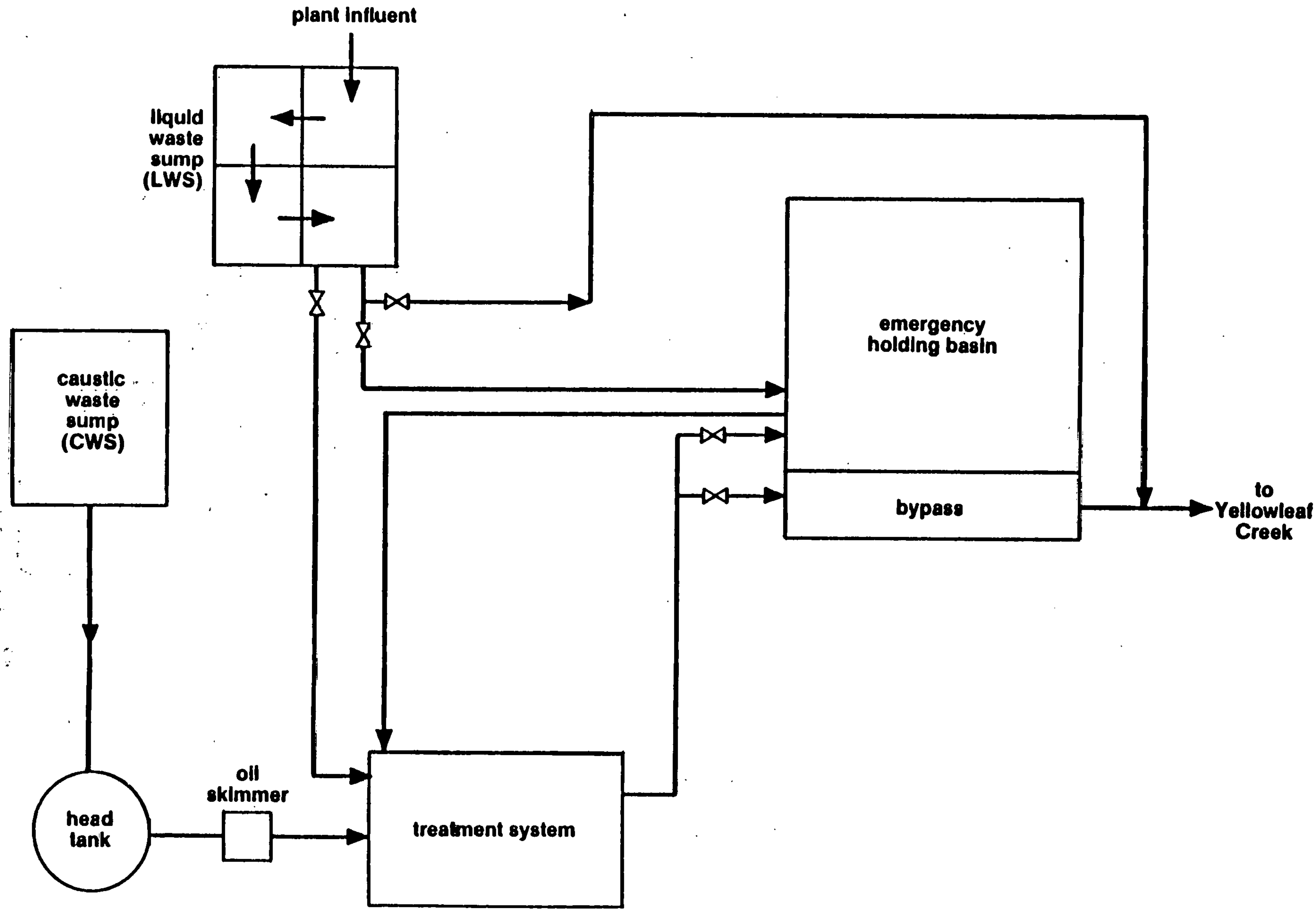

Figure 3
Wastewater Collection System

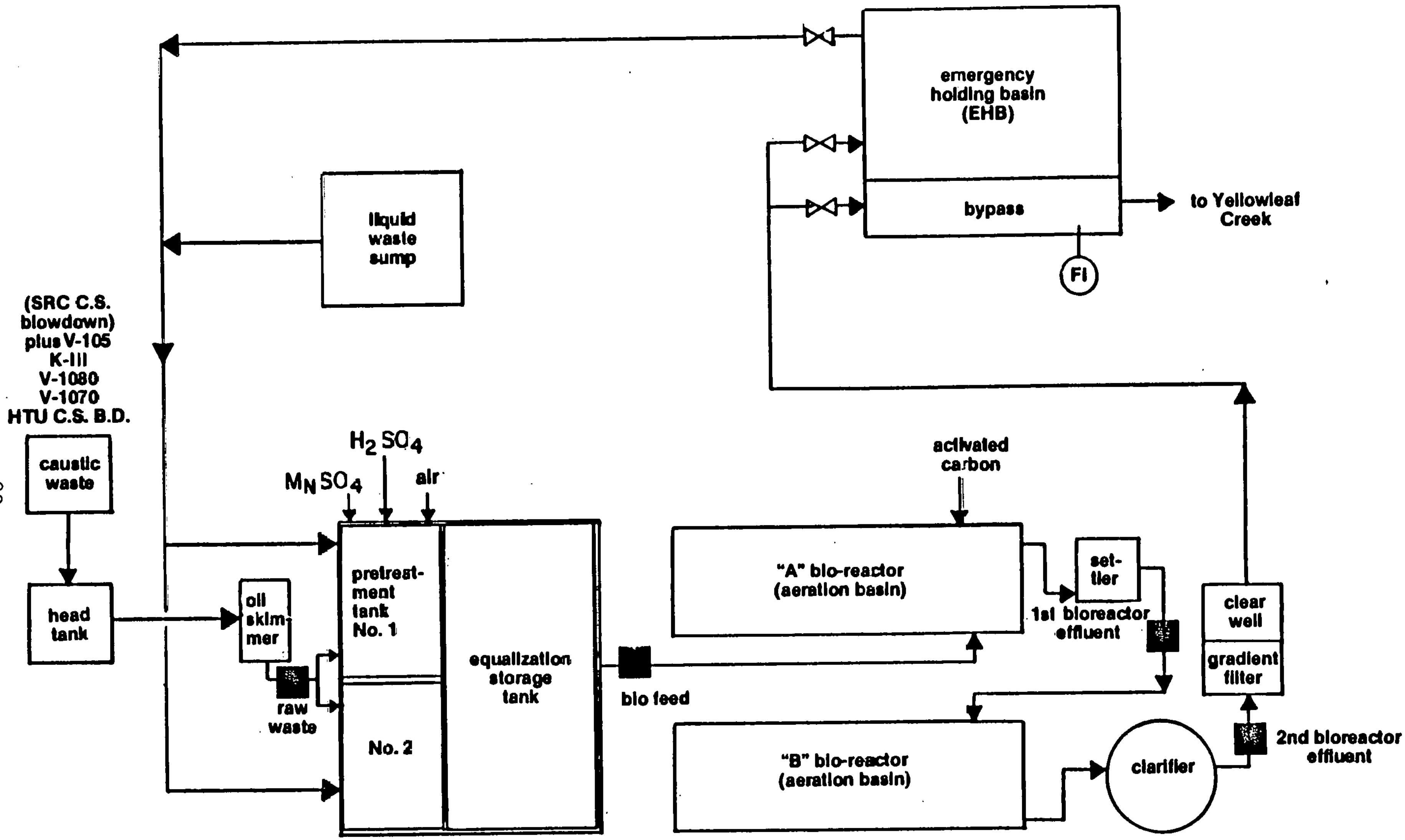

Figure 4
Wastewater Treatment System

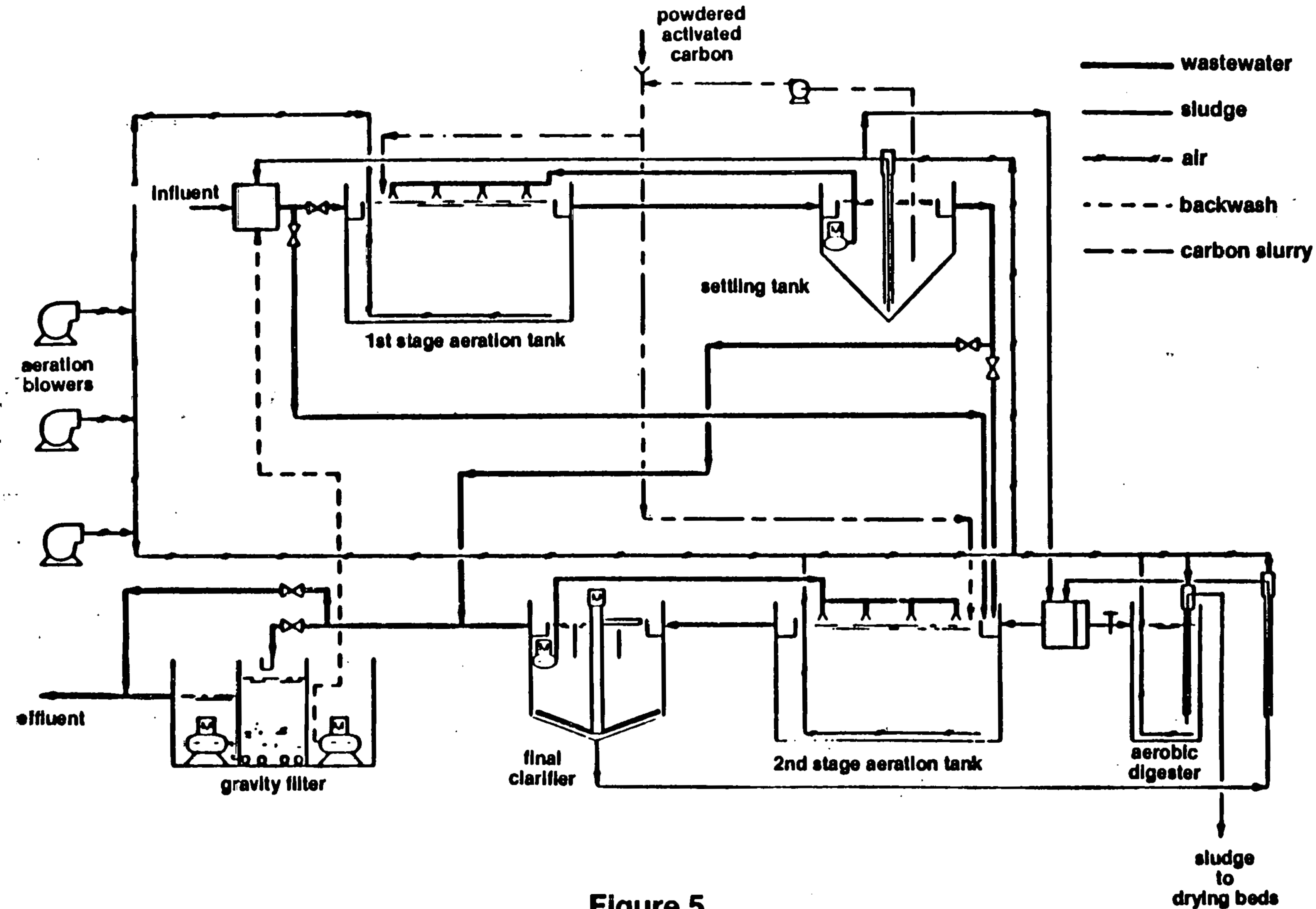

Figure 5
Packaged Biological System

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APPENDIX A

TABLES IN APPENDIX A OF
FINAL REPORT: WILSONVILLE WASTEWATER SAMPLING PROGRAM

TABLE A-1
V-105 ANALYSES
WASTEWATER CHARACTERIZATION

RUN	DATE	COD (mg/l)(lb/hr)	TOC (mg/l)(lb/hr)	NH_3-N (mg/l)(lb/hr)	SULFIDE (mg/l)(lb/hr)	PHENOL (mg/l)(lb/hr)	FEED COAL CHARACTERISTICS TYPE	MOISTURE %	SULFUR % (ORG)(SOL)	COD/TOC
133B	2/10/78	70,840(2.38)	91,200(3.07)	22,040(0.74)	18,870(0.63)	3,500(0.12)	Indiana V			0.78
134C	3/17/78	63,910(1.95)	18,540(0.57)	19,960(0.61)	12,455(0.38)	4,000(0.12)	Old Ben			3.45
135A	4/10/78	49,600(1.63)	1,040(0.03)	12,110(0.40)	9,923(0.33)	3,440(0.11)	No. 1			47.69
140B	7/3/78	60,670(2.66)	14,760(0.65)	13,300(0.58)	9,500(0.42)	3,180(0.14)	"			4.11
143	8/21/78	67,400(1.67)	14,100(0.35)	14,950(0.37)	14,920(0.37)	4,000(0.10)	"			4.78
147	9/9/78	67,960(2.34)	11,000(0.38)	15,413(0.53)	15,413(0.53)	3,080(0.11)				9.30
151	11/5/78	66,500(1.22)	7,300(0.13)	17,380(0.32)	17,500(0.32)	5,440(0.10)	Kentucky #9 Pyro	1.33	2.81(1.54)	9.11
159B	3/9/79	57,070(2.11)	11,710(0.43)	13,340(0.49)	11,029(0.41)	3,800(0.14)	"	1.11	2.79(1.45)	4.87
160C	3/26/79	79,120(1.06)	11,079(0.15)	19,810(0.15)	22,380(0.30)	3,168(0.04)	"	1.02	3.61(2.43)	7.14
161C	4/9/79	67,974(1.67)	7,920(0.19)	14,812(0.36)	16,889(0.41)	2,840(0.07)	"	0.84	2.86(1.51)	8.58
161E	4/10/79	66,394(1.63)	6,600(0.16)	14,616(0.36)	14,667(0.36)	2,800(0.07)	"	0.84	2.86(1.51)	10.06
162	4/27/79	68,178(1.19)	13,660(0.24)	18,956(0.33)	19,829(0.35)	3,760(0.07)	"	0.24	3.27(2.07)	4.99
163A	5/12/79	64,576(1.58)	13,100(0.32)	17,122(0.42)	16,904(0.41)	3,080(0.08)	"	0.84	3.30(1.72)	4.93
163B	5/27/79	66,679(1.63)	15,850(0.39)	16,947(0.42)	15,942(0.39)	3,320(0.08)	"	0.92	2.88	4.21
164A	6/4/79	240,960(5.37)	87,000(1.94)	8,750(0.20)	4,713(0.11)	13,950(0.31)	Lafayette	0.61	3.07(1.61)	2.77
166AB	7/21/79	46,320(0.53)	10,680(0.12)	10,115(0.12)	7,133(0.08)	2,104(0.02)	"	0.99	2.88(2.02)	4.34
166AC	8/3/79	202,352(5.02)	76,000(1.88)	9,590(0.24)	4,642(0.12)	10,000(0.25)	"	1.77	2.81(1.91)	2.66
167C	9/9/79	54,227(1.28)	161,600(3.81)	10,689(0.25)	8,945(0.21)	3,500(0.08)	"	0.65	3.11(1.96)	.34
168A	9/12/79	87,437	16,667	11,403	12,095	2,600			3.11(1.92)	5.25
171A	9/29/79	38,947	230,000	12,971	13,273	3,500				.17
171AB	9/30/79	45,849	260,000	12,208	12,175	3,750				.18
190AB	12/12/79	62,140	20,750	12,825	15,445	2,500				2.99
201ABC	2/19/80	42,824(0.61)	22,160(0.32)	12,586(0.18)	13,380(0.19)	800(0.01)			2.43(1.77)	1.93
202A	3/6/80	63,788(0.91)	12,360(0.18)	11,452(0.16)	14,283(0.20)	3,333(0.05)	Dotiki		3.22(2.04)	5.16
203DE	3/15/80	54,362(0.78)	9,466(0.14)	13,041(0.19)	10,195(0.15)	1,920(0.03)	"		3.55(2.21)	5.74
204	3/31/80	31,652(0.47)	12,120(0.18)	16,415(0.24)	17,024(0.25)	3,712(0.06)	"	0.52	3.26(2.06)	2.61
206A	4/25/80	52,694	6,525	13,212	8,752	4,200	"	1.09	3.41(2.27)	8.08
208B	5/8/80	63,872(0.87)	9,850(0.13)	14,518(0.20)	13,617(0.19)	2,240(0.03)	"	0.64	2.67(1.59)	6.48
209AB	6/4/80	63,781(1.82)	15,760(0.45)	14,595(0.42)	11,381(0.33)	2,150(0.06)	Fies	1.22	3.32(2.14)	4.05
210AB	6/13/80	58,608(2.74)	20,333(0.95)	14,218(0.66)	11,309(0.53)	2,800(0.13)	"	0.44	3.18(1.96)	2.88
211B	7/13/80	45,072(1.28)	14,280(0.41)	8,456(0.24)	6,861(0.19)	1,925(0.05)	"	0.55	3.07(1.77)	3.16
212AB	7/25-28/80	47,752(1.48)	17,650(0.55)	8,834(0.27)	5,162(0.16)	2,150(0.07)	"	0.56	3.09(1.86)	2.71
217AB	9/19/80	55,720(0.73)	10,583(0.14)	10,612(0.14)	6,909(0.09)	3,906(0.05)	"	0.78	3.17(1.86)	5.27
217CD	9/27/80	44,006(0.57)	9,233(0.12)	12,124(0.16)	1,678(0.02)	2,938(0.04)	"	0.86	3.28(1.86)	4.77
219AB	10/20/80	56,172(0.67)	9,280(0.11)	15,904(0.19)	12,888(0.15)	2,625(0.03)	"	1.53	3.38(1.94)	6.05

TABLE A-1 (Continued)

RUN	DATE	COD (mg/l)(lb/hr)	TOC (mg/l)(lb/hr)	NH_3-N (mg/l)(lb/hr)	SULFIDE (mg/l)(lb/hr)	PHENOL (mg/l)(lb/hr)	FEED COAL CHARACTERISTICS TYPE	MOISTURE %	SULFUR % (ORG) (SUL)	COD/TOC
220AB	10/29/80	42,137(0.90)	10,120(0.22)	11,200(0.24)	12,440(0.27)	2,800(0.06)	Pies	1.44	3.69(2.06)	4.16
221B	12/20/80	38,040(0.35)	10,000(0.09)	10,010(0.09)	9,572(0.09)	2,000(0.02)	"	4.68	2.87(1.72)	3.80
222ABC	1/2/81	34,162(0.44)	11,800(0.15)	14,420(0.19)	3,879(0.05)	2,500(0.03)	"	1.81	3.00(1.78)	2.90
225BC	1/31/81	49,588(0.99)	23,083(0.46)	27,230(0.54)	10,500(0.21)	3,025(0.06)	"	2.03	3.35(1.94)	2.15
225F	2/11/81	61,400(1.00)	20,267(0.33)	11,550(0.19)	9,265(0.15)	4,500(0.07)	"	1.35	3.19(1.99)	3.03
225I	2/15/81	77,180(1.36)	23,583(0.42)	10,990(0.19)	7,787(0.14)	2,938(0.05)	"	1.58	3.15(1.94)	3.27
225G	2/13/81	55,820(0.86)	20,600(0.31)	11,690(0.18)	9,044(0.14)	2,656(0.04)	"	1.93	3.10(1.98)	2.76
227CD	4/17/81	42,750(0.49)	10,045(0.11)	13,440(0.15)	10,015(0.11)	4,500(0.05)	"	1.82	3.22(1.93)	4.26
227A	4/15/81	44,475(0.66)	9,350(0.14)	12,460(0.18)	7,518(0.11)	1,450(0.02)	"	1.83	3.01(1.87)	4.76
227E	5/4/81	55,672(1.25)	13,880(0.31)	12,040(0.27)	7,360(0.16)	3,250(0.07)	"	0.93	3.14(1.94)	4.08
227G	5/7/81	52,152(0.30)	15,950(0.09)	12,040(0.07)	10,115(0.06)	3,425(0.02)	"	1.54	3.29(2.02)	3.27
228AB	5/31/81	54,317(2.22)	18,600(0.76)	8,750(0.36)	6,829(0.28)	3,120(0.13)	"	2.20	3.45(1.97)	2.92
229A	6/16/81	54,800(1.81)	28,200(0.93)	9,590(0.32)	6,989(0.23)	3,520(0.12)	"	1.37	2.85(1.64)	1.94
229B	6/18/81	-	24,070(0.42)	11,200(0.19)	5,883(0.10)	4,000(0.07)	"	1.75	2.98(1.83)	-
232A	7/21/81	57,024(0.88)	16,080(0.25)	6,335(0.10)	5,242(0.08)	3,360(0.05)	"			3.55
233		53,644	17,480	5,740	5,098	2,800				3.07
233A		63,632	17,133	7,420	5,723	2,720				3.71
233B		114,848	18,933	7,210	4,777	3,120				6.07
234C		59,148	18,000	6,370	5,920	2,875				3.29
234D		45,792	16,050	8,330	7,053	2,250				2.85
235AB		51,896	13,480	11,340	10,083	2,812				3.85

TABLE A-2
V-105 ANALYSES
OPERATING CONDITIONS

RUN	NH_3-N SULFIDE RATIO	SULFIDE TOC RATIO	DISS. VOLUME	FEED H_2 RATIO	DISS. OUTLET REACTION TEMP. (°F)	REACTION PRESSURE(PSIG)	OPERATING CONDITIONS COAL RATE MF(lb/hr)	MB(UNADJUSTED) ZMF	(lb/hr)	COMPLETE RUN?
133B	1.17	.21			*847°	2,390	442	7.6	33.6	Yes 48hr
134C	1.60	.67			845°	2,390	448	6.8	30.5	Yes 48hr
135A	1.22	9.54		9,705	845°	2,400	431	7.6	32.8	Yes ?
140B	1.40	.64			845°	2,410	430	10.2ELBaL43.9		Yes 48hr
143	1.00	1.06			825°	1,750	468	5.3	24.8	Yes 48hr
147	1.00	1.40			825°	1,750	447	7.7	34.4	Yes 48hr
151	0.99	2.40			825°	2,100	428	4.3	18.4	Yes 48hr
159B	1.21	1.06	50	8,100	825°	1,700	440	8.4	37.0	Yes 24hr
160C	0.89	2.02	75	7,800	825°	1,700	488	2.74	13.4	No 11.5hr
161C	0.88	2.13	75	9,920	825°	1,700	498	4.91	24.5	Yes 24hr
161E	1.00	2.22	75	9,920	825°	1,700	498			Yes 24hr
162	0.96	1.45	75	10,225	825°	2,100	494	3.53	17.4	Yes
163A	1.01	1.29	75	10,360	827°	1,700	498	4.91	24.5	Yes
163B	1.06	1.01	75	10,360	827°	1,700	498	4.91	24.5	12hr
164A	1.86	.05	75	1,770	*827°	2,400	241	9.24	22.3	Yes
166AB	1.42	.67	75	10,689	825°	1,700	523	2.2	11.5	Yes
166AC	2.07	.06	75	10,138	*825°	1,700	536	4.63	24.8	Yes
167C	1.19	18.07	50	9,181	*825°	2,100	473	4.99	23.6	Shortened PF
168A	0.94	1.38	50	9,454	825°	2,100	489	2.66	13.0	Shortened Almost 24hr
171A	0.98	17.33			*825°	2,100	447			Yes
171AB	1.00	21.36			*825°	2,100	447			Yes
190AB	0.83	1.34								
201ABC	0.94	1.66	75	10,345	825°	1,700	518	2.77	14.3	Yes 48hr
202A	0.80	1.16	75	10,300	825°	1,700	525	4.82	25.3	Yes
203DE	1.28	1.08	75	10,314	825°	1,700	505	4.58	23.1	Yes
204	0.96	1.40	75	10,126	840°	1,800	537	2.77	14.9	Yes 24hr
206A	1.51	1.34	75	9,979	840°	1,800	535	?		Yes 24hr
208B	1.07	1.38	75	10,226	840°	1,800	556	2.45	13.6	Yes 24hr
209AB	1.28	0.72	75	9,761	840°	2,100	520	5.50	28.6	Yes 24hr
210AB	1.26	0.56	75	10,276	840°	2,100	535	8.73	46.7	Yes 24hr
211B	1.23	0.48	75	9,120	825°	1,700	542	5.24	28.4	Yes 24hr
212AB	1.71	0.29	75	8,325	825°	1,700	527	5.98	31.0	(A)No 21hr (B)Yes 24hr
217AB	1.54	0.65	50	5,210	785°	2,000	313	4.18	13.1	Yes 24hr
217CD	7.23	0.18	50	5,285	785°	2,000	304	4.25	12.9	
219AB	1.23	1.39	75	7,535	840°	2,100	535	2.24	12.0	

TABLE A- 2 (Continued)

RUN	NH_3-N SULFIDE RATIO	SULFIDE TOC RATIO	DISS. VOLUME	FEED H_2 RATIO	DISS. OUTLET REACTION TEMP. (°F)	REACTION PRESSURE(PSIG)	OPERATING CONDITIONS COAL RATE MF(lb/hr)	MB(UNADJUSTED) %MF	(lb/hr)	COMPLETE RUN?
220AB	0.90	1.23	75	7,488	840°	2,100	544	3.94	21.4	
221B	1.05	0.96	100	3,210	765°	2,000	311	3.00	9.3	
222ABC	3.72	0.33	100	3,360	754°	2,000	304	4.25	12.9	Yes 24hr
225BC	2.59	0.45	75	7,620	840°	2,100	516	3.85	19.9	Yes 24hr
225F	1.25	0.46	75	7,700	840°	2,100	502	3.25	16.3	Yes 24hr
225I	1.41	0.34	75	7,400	840°	2,100	507	3.47	17.6	Yes 24hr
225G	1.29	0.44	75	7,650	840°	2,100	510	2.97	15.1	Yes 24hr
227CD	1.34	1.00	75	7,820	840°		517	2.2	11.4	
227A	1.66	0.80		7,820	840°		529	2.8	14.8	
227E	1.64	0.53		8,051			526	4.2	22.1	
227G	1.19	0.63		7,990			519	1.1	5.7	
228AB	1.28	0.37		7,930	825°	2,100	524	7.8	40.9	
229A	1.37	0.25					508	6.5	33.0	
229B	1.90	0.24					510	3.4	17.3	
232A	1.21	0.33	85	6,100	785°	2,000	439	3.5	15.4	
233	1.13	0.29	75	6,230	785°	2,000	407	3.5		
233A	1.30	0.33								
233B	1.51	0.25								
234C	1.08	0.33								
234D	1.18	0.44								
235AB	1.12	0.75								

TABLE A-3
V-105 Waterside
TOC Data - Log Normal Probability
February 1979 - July 1981

(mg/l)			
1,000-4,999	1	1.9	2.9
50,000-9,999	8	16.7	4.1
10,000-14,999	18	50.0	5.0
15,000-19,999	14	75.9	5.7
20,000-29,999	8	90.7	6.4
25,000-29,999	1	92.6	6.5
75,000-79,999	1	94.4	6.6
85,000-89,999	1	96.3	6.8
90,000-99,999	1	98.1	7.1
160,000-164,999	1		
230,000-234,999	1		
260,000-269,000	1		

50% = 13,100
90% = 37,900

10^{TOC} = .354 (Probit) 2.348 r = .95

TOC (lb/Hr)	No.	% Probability	Probits
0.0-0.09	3	6.8	3.5
.10-.19	15	40.9	4.8
.20-.29	3	47.7	4.9
.30-.39	8	65.9	5.4
.40-.49	6	79.5	5.8
.50-.59	2	84.1	6.0
.60-.69	1	86.4	6.1
.70-.79	1	88.6	6.3
.80-.89	0		
.90-.99	2	93.2	6.5
1.00-1.09	0		
1.50-1.59	1	99.5	6.7
1.90-1.99	1	97.7	7.0
3.00-3.09			
3.80-3.81			

50% = .22
90% = .87

10^{TOC} = .455 (Probit) - 2.929 r = .99

refer to Figures B-6 & B-7

TABLE A-4
V-105 COD Data - Log Normal Probability
February 1979 - December 1981

COD mg/l	No.	% Probability	Probits
30-34,000	2	3.7	3.2
35-39,000	2	7.4	3.6
40-44,000	5	16.7	4.1
45-49.000	6	27.8	4.4
50-54,000	9	44.4	4.9
55-59,000	8	59.3	5.3
60-64,000	9	75.9	5.7
65-69,000	7	88.9	6.2
70-74,000	1	90.7	6.4
75-79,000	2	94.4	6.6
80-84,000			
85-89,000	1	96.3	6.8
90-94,000			
115-119,000	1	98.1	7.1

50% = 53,000
90% = 76,000

10^{COD} = .12 (Probit) + 4.126

lb/hr — February 1979 - July 1981

lb/hr	No.	% Probability	Probits
0.30-0.49	5	11.1	3.8
0.50-0.69	5	22.2	4.3
0.70-0.89	5	33.3	4.6
0.9-1.09	5	44.4	4.9
1.1-1.29	5	55.5	5.2
1.30-1.49	2	60.0	5.3
1.50-1.69	6	73.3	5.7
1.70-1.89	4	82.2	5.9
1.90-2.01	1	84.4	6.0
2.1-2.29	2	88.9	6.3
2.3-2.49	2	93.3	6.5
2.5-2.69	1	95.6	6.7
2.7-2.89	1	97.8	7.0

50% = 1.01 lb/hr
90% = 2.23 lb/hr

10^{COD} = 0.263 (Probit) - 1.309 r = .98

refer to Figures B-8 & B-9

TABLE A-5
V-105 Waterside
NH_3-N Data - Log Normal Probability
February 1980 - December 1981

NH_3-N (mg/1)	Number	% Probability	Probit
4-5,999	1	2.9	3.1
6-7,999	4	14.3	3.9
8-9,999	5	28.6	4.5
10-11,999	8	51.4	5.0
12-13,999	9	77.1	5.8
14-15,999	5	91.4	6.4
16-17,999	1	94.3	6.6
26-27,999	1	97.1	6.8

50% = 10,400
90% = 17,100

$10^{NH_3} = 0.165\ (\text{Probit}) + 3.193$ r= .97

February 1980 - July 1981

(lb/hr)			
.05-.07	1	3.6	3.2
.08-.10	2	10.7	3.8
.14-.16	4	25.0	4.3
.17-.19	9	57.1	5.2
.20-.22	1	60.7	5.3
.23-.26	3	71.4	5.6
.26-.28	2	78.6	5.8
.32-.34	1	82.1	6.0
.35-.37	1	85.7	6.1
.41-.43	1	89.3	6.3
.53-.55	1	92.9	6.5
.65-.67	1	96.4	6.8

50% = 0.19
90% = 0.42

$10^{NH_3} = 0.27\ (\text{Probit}) - 2.081$ r= .99

refer to Figures B-10 & B-11

TABLE A-6
V-105 Waterside
Sulfide Data - Log Normal Probability
February 1980 - December 1981

Sulfide (mg/l)	No.	% Probability	Probit
1-1999	1	2.9	3.1
3-3999	1	5.7	3.4
4-4999	1	8.6	3,7
5-5999	6	25.7	4.4
6-6999	4	37.1	4.7
7-7999	4	48.6	5.0
8-8999	1	51.4	5.0
9-9999	3	60.0	5.3
10-10999	5	74.3	5.6
11-11999	2	80.0	5.8
12-12999	2	85.7	6.1
13-13999	2	91.4	6.4
14-14999	1	94.3	6.6
17-17999	1	97.1	6.9

50% = 7,200
90% = 14,200

$10^{\text{Sulfide}} = .229\ (\text{Probit}) + 2.714$ r = .95

February 1980 - July 1981

(lb/hr)			
0-.02	1	3.6	3.2
.03-.05	1	7.1	3.6
.06-.00	2	14.3	4.0
.09-.11	5	32.1	4.6
.12-.14	2	3.93	4.7
.15-.17	5	57.1	5.2
.18-.20	4	71.4	5.6
.21-.23	2	78.6	5.8
.24-.26	1	82.1	5.9
.27-.29	2	89.3	6.3
.33-.35	1	92.9	6.5
.53-.55	1	96.4	6.8

50% = .17
90% = .36

$10^{\text{Sulfide}} = 0.38\ (\text{Probit}) - 2.386$

refer to Figures B-12 & B-13

TABLE A-7
V-105 Waterside
Phenol Data - Log Normal Probability
February 1980 - December 1981

Phenol (mg/l)	No.	% Probability	Probit
800-1099	1	2.9	3.1
1400-1699	1	5.7	3.4
1700-1999	2	11.4	3.8
2000-2299	5	25.7	4.3
2300-2599	1	28.6	4.4
2600-2899	8	51.4	5.0
2900-3199	5	65.7	5.4
3200-3599	5	80.0	5.8
3600-3899	1	82.9	5.9
3900-4199	2	88.6	6.2
4200-4499	1	91.4	6.4
4500-4799	2	97.1	6.9

50% = 2590
90% = 4170

$$10^{\text{Phenol}} = 0.16\ (\text{Probit}) + 2.614 \qquad r = .97$$

(lb/hr)	No.	% Probability	Probit
.01	1	3.6	3.2
.02	3	14.3	3.9
.03	4	28.6	4.5
.04	2	35.7	4.6
.05	7	60.7	5.1
.06	3	71.4	5.6
.07	4	85.7	6.1
.12	1	89.3	6.3
.13	2	96.4	6.8

50% = .04
90% = .10

$$10^{\text{Phenol}} = .302\ (\text{Probit}) - 2.88 \qquad r = .98$$

refer to Figures B-14 & B-15

TABLE A-8
V-105
COD/TOC Distribution - Log Normal Probability
February 1980 - December 1981

COD/TOC	% Probability	Probit
1.93	2.9	3.1
0.94	5.9	3.4
2.15	8.8	3.7
2.61	11.8	3.8
2.71	14.7	4.0
2.76	17.6	4.1
2.85	20.6	4.2
2.88	23.5	4.3
2.90	26.5	4.4
2.92	29.4	4.5
3.03	32.4	4.5
3.07	35.3	4.6
3.16	38.2	4.7
3.27	41.2	4.8
3.27	44.1	4.9
3.29	47.1	5.0
3.55	50.0	5.0
3.71	52.9	5.1
3.80	55.9	5.2
3.85	58.8	5.2
4.05	61.0	5.3
4.08	64.7	5.4
4.16	67.6	5.5
4.26	70.6	5.6
4.76	73.5	5.6
4.77	76.5	5.7
5.16	79.4	5.8
5.27	82.4	6.0
5.74	85.3	6.1
6.05	88.8	6.2
6.07	91.2	6.4
6.48	94.1	6.6
8.18	97.1	6.9

50% = 3.67
90% = 6.06 r = 0.99

$10^{COD/TOC} = .161 \text{ (Probit)} - .239$

refer to Figure B-16

TABLE A-9
V-105 Waterside
NH_3-N/Sulfide - Log Normal Probability
February 1980 - December 1981

NH_3-N/Sulfide	% Probability	Probit
0.80	2.9	3.1
0.90	5.7	3.4
0.94	8.6	3.6
0.96	11.4	3.8
1.05	14.3	3.9
1.07	17.1	4.0
1.08	20.0	4.2
1.12	22.9	4.3
1.13	25.7	4.4
1.18	28.6	4.4
1.19	31.4	4.5
1.21	34.3	4.6
1.23	37.1	4.7
1.23	40.0	4.8
1.25	42.9	4.8
1.26	45.7	4.9
1.28	48.6	5.0
1.28	51.4	5.0
1.28	54.3	5.1
1.29	57.1	5.2
1.30	60.0	5.3
1.34	62.9	5.3
1.37	65.7	5.4
1.41	68.6	5.5
1.51	71.4	5.6
1.51	74.3	5.7
1.54	77.1	5.8
1.64	80.0	5.8
1.66	82.9	5.9
1.71	85.7	6.0
1.90	88.6	6.2
2.59	91.4	6.4
3.72	94.3	6.6
7.23	97.1	6.9

50% = 1.39 r =.0 85
90% = 2.30

10^{NH_3} = .165 (Probit) - .678

refer to Figure B-17

TABLE A-10
WASTEWATER CHARACTERISTICS VS COAL TYPES

			Arithmetic Mean											
			Organic Sulfur	MB Water Effluent	Moisture Content	COD		TOC		Sulfide		Phenol	
Coal Type	Mine	No. of Data (MB Runs)*	(%)	(lb/hr)	(%)	(mg/l)	(lb/hr)	(mg/l)	(lb/hr)	(mg/l)	(lb/hr)	(mg/l)	(lb/hr)
Indiana V	Old Ben #1	6		33.3		63,397	2.11	25,100	0.84	13,514	0.44	3533	0.12
Kentucky #9	Pyro	8	3.05	22.8	0.89	67,061	1.51	10,902	0.25	16,893	0.49	3526	0.11
Kentucky #9	Lafayette	7	2.86	18.3	1.01	53,953	1.09	46,371	0.67	10,200	0.16	2679	0.12
Kentucky #9	Fies	23	3.18	20.3	1.53	52,103	1.09	16,097	0.34	7,988	0.16	2971	0.06
Kentucky #9	Dotiki	5	3.12	19.2	0.75	53,274	0.76	10,064	0.16	12,774	0.20	3081	0.04

* Mass Balance

TABLE A-11
BIOLOGICAL TREATMENT FACILITIES
DATA SUMMARY
SRC PILOT PLANT
WILSONVILLE, ALA.

Date	BOD inf. mg/l	BOD eff. mg/l	% Removal	COD inf.	COD eff.	% Removal	Phenol inf.	Phenol eff.	% Removal	DO Uptake A	DO Uptake B	Flow MGD	D.T. Days	MLSS "A" mg/l	MLSS "B" mg/l
April 79	861	4.7	99.5	1168	19.2	98.4	86.4	0.04	99.9	11.4	1.8	0.02080	3.8	4700	1332
May 79	861	4.2	99.5	1288	70	94.5	85.2	0.02	99.9	13.5	2.9	0.01727	5.4	3849	4665
June 79	733	5.1	99.3	1009	95	90.5	135	0.03	99.9	11.3	2.6	0.01207	8.1	1790	3283
July 79	885	3.8	99.4	1354	89	93.8	62.3	0.11	99.8	12.8	4.3	0.01676	5.3	3799	2269
Aug. 79	608	5.7	99.0	1565	98.1	93.7	-	0.074	-	10.7	4.1	0.01060	9.4	4048	1648
Sept. 79	695	3.0	99.5	1166	74	93.6	27.4	0.036	99.9	12.5	4.4	0.01901	4.5	3685	819
Oct. 79	470	2.1	99.5	734	73.9	89.9	50.4	0.034	99.9	10.5	2.0	0.01727	4.9	3797	760
Nov. 79	795	1.7	99.8	1516	111	92.7	77.1	0.05	99.9	10.3	2.2	0.01931	4.0	3285	1802
Dec. 79	913	4.6	99.6	1500	120	92	51.2	0.07	99.8	12.6	3.6	0.01570	5.6	3301	2315
Jan. 80	858	6.3	99.2	2275	92.5	95.9	77.2	0.054	99.9	9.3	1.9	0.01894	4.5	3429	1478
Feb. 80	388	5.4	98.5	1283	165	87.1	40.3	0.03	99.9	11.9	4.3	0.02072	4.2	2815	1950
March 80	747	3.5	99.5	1600	97.5	93.9	24	0.035	99.9	15.1	7.1	0.02374	3.4	3414	1582
April 80	834	3.5	99.6	1313	100	92.4	81.4	0.041	99.9	15.1	6.8	0.01884	4.6	3649	1874
May 80	975.3	8.3	99.2	1460	97.3	93.3	55.8	0.059	99.9	15.1	3.5	0.01434	6.6	3722	2166
June 80	107.9	12.9	98.7	1830	108.5	93.1	227.4	0.063	99.9	23.7	7.2	0.01420	5.9	4365	2353
July 80	954	9.9	98.9	2183	158	92.8	88.3	0.074	99.9	24.7	7.9	0.01716	5.1	3981	2809
Aug. 80	498	10.7	97.9	1024	138	86.5	61.5	0.037	99.9	15.2	6.0	0.01959	4.8	5192	2694
Sept. 80	477	11.5	97.6	1046	117.5	88.8	44	0.029	99.9	12.8	2.8	0.01583	5.8	5321	2730
Oct. 80	425	3.2	99	2436	78.5	96.8	57.6	0.033	99.9	15.4	6.0	0.02606	2.8	3977	3544
Nov. 80	311	9.5	95.2	1787	145	91.9	31.6	0.024	99.9	13.6	7.2	0.02072	5.3	3680	4363
Dec. 80	353	10.5	85.8	1186	122	89.7	60.1	0.0365	99.9	9.7	8.2	0.02060	4.4	3877	2681
Jan. 81	498	15.4	96.9	1200	94.3	92.1	39	0.037	99.9	14.3	4.9	0.02509	3.3	4970	2195
Feb. 81	788.8	8.3	98.9	1231.8	169.9	83.6	50.9	0.06	99.9	18.5	6.6	0.02531	3.5	6505	2445
March 81	-	-	-	564.4	148.3	73.7	44.8	0.035	99.9	14.9	5.1	0.01539	6.4	5540	2210
April 81	-	-	-	912.6	160	82.5	59.4	0.072	99.9	18.3	2.4	0.02189	4.4	5919	2388
May 81	-	-	-	750	183	82.3	51	0.05	99.9	23.7	6.8	0.02769	3.0	4860	3547
June 81	166	13.8	91.7	628.6	92.9	95.2	41.5	0.046	99.9	32.5	19.1	0.02899	3.0	5035	3277

TABLE A-12
BIOLOGICAL TREATMENT FACILITY
TOTAL SUSPENDED SOLIDS SUMMARY

	Influent TSS (mg/l)	*Effluent TSS (mg/l)
April 1979	-	-
May 1979	18.0	19.3
June 1979	1.7	3.6
July 1979	3.5	3.8
August 1979	4.0	6.3
September 1979	0.3	1.2
October 1979	1.6	1.7
November 1979	0.1	0.4
December 1979	3.3	4.2
January 1980	2.8	4.2
February 1980	2.8	4.2
March 1980	5.9	6.1
April 1980	6.1	4.5
May 1980	3.8	3.3
June 1980	4.9	3.9
July 1980	19.7	18.2
August 1980	16.8	17.4
September 1980	3.9	4.8
October 1980	13.9	5.8
November 1980	7.5	5.9
December 1980	8.0	9.2
January 1981	8.2	8.7
February 1981	11.3	11.8
March 1981	6.6	6.7
April 1981	9.7	14.6
May 1981	12.6	16.7
June 1981	7.1	9.0

* Final Effluent - after media filter

TABLE A-13
BIOLOGICAL TREATMENT FACILITY
SLUDGE WASTING RATE

	Lb/Day MLSS
April 1979	5.7
May 1979	35.9
June 1979	22.5
July 1979	21.7
August 1979	4.2
September 1979	10.5
October 1979	26.4
November 1979	18.5
December 1979	26
January 1980	74
February 1980	51.8
March 1980	57.0
April 1980	67.9
May 1980	43.8
June 1980	95.0
July 1980	80.6
August 1980	71.2
September 1980	54.3
October 1980	75.8
November 1980	96.5
December 1980	89.3
January 1981	109.6
February 1981	85.6
March 1981	97.3
April 1981	63
May 1981	76.3
June 1981	72.0

Based on

COD removal average	206 lb/day
Approximate Average Sludge Wasting	0.3 lb/lb COD removed

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APPENDIX B

FIGURES IN APPENDIX B OF
FINAL REPORT: WILSONVILLE WASTEWATER SAMPLING PROGRAM

FIGURE B–1
V–105
TOC PROBABILITY PLOT

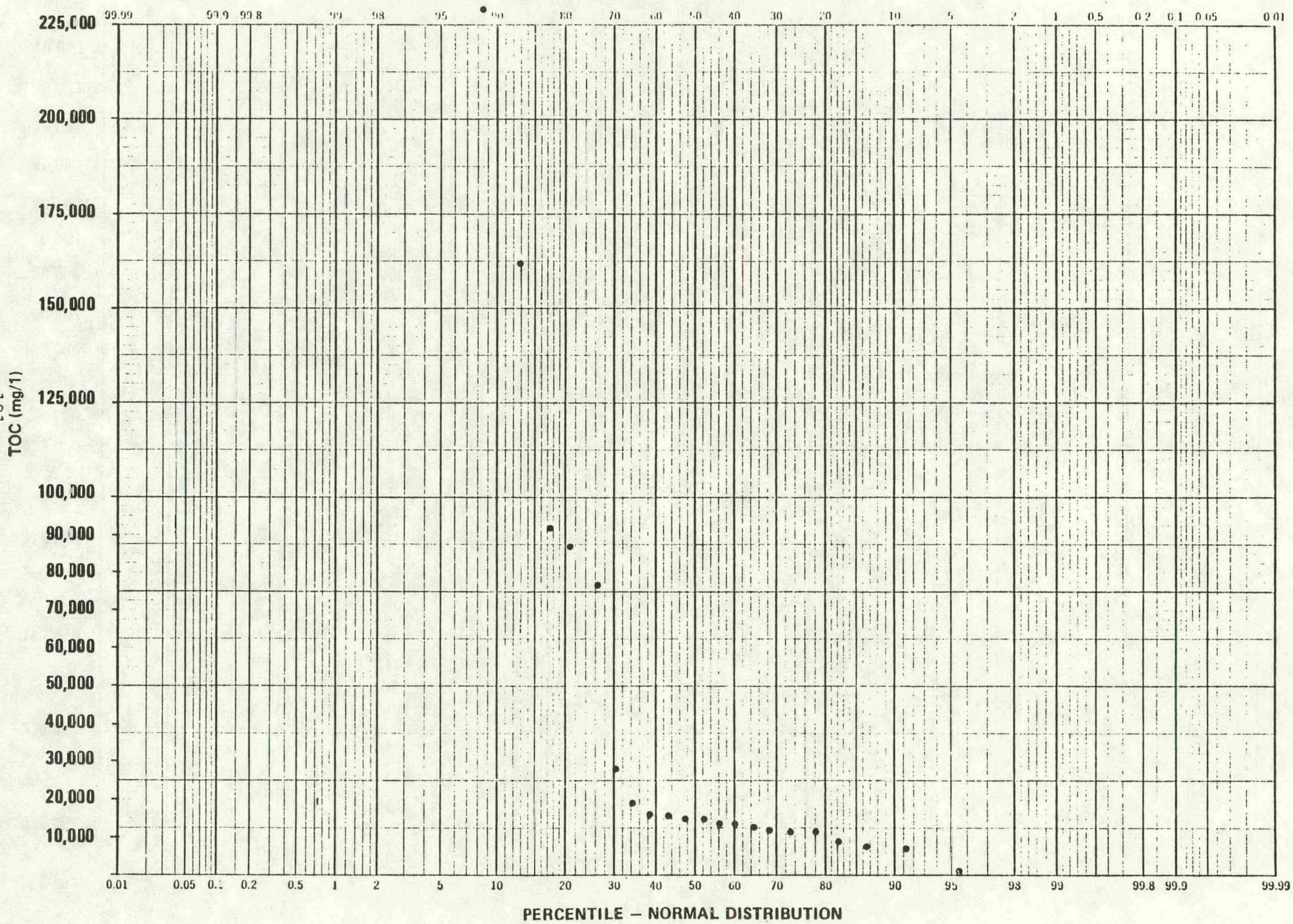
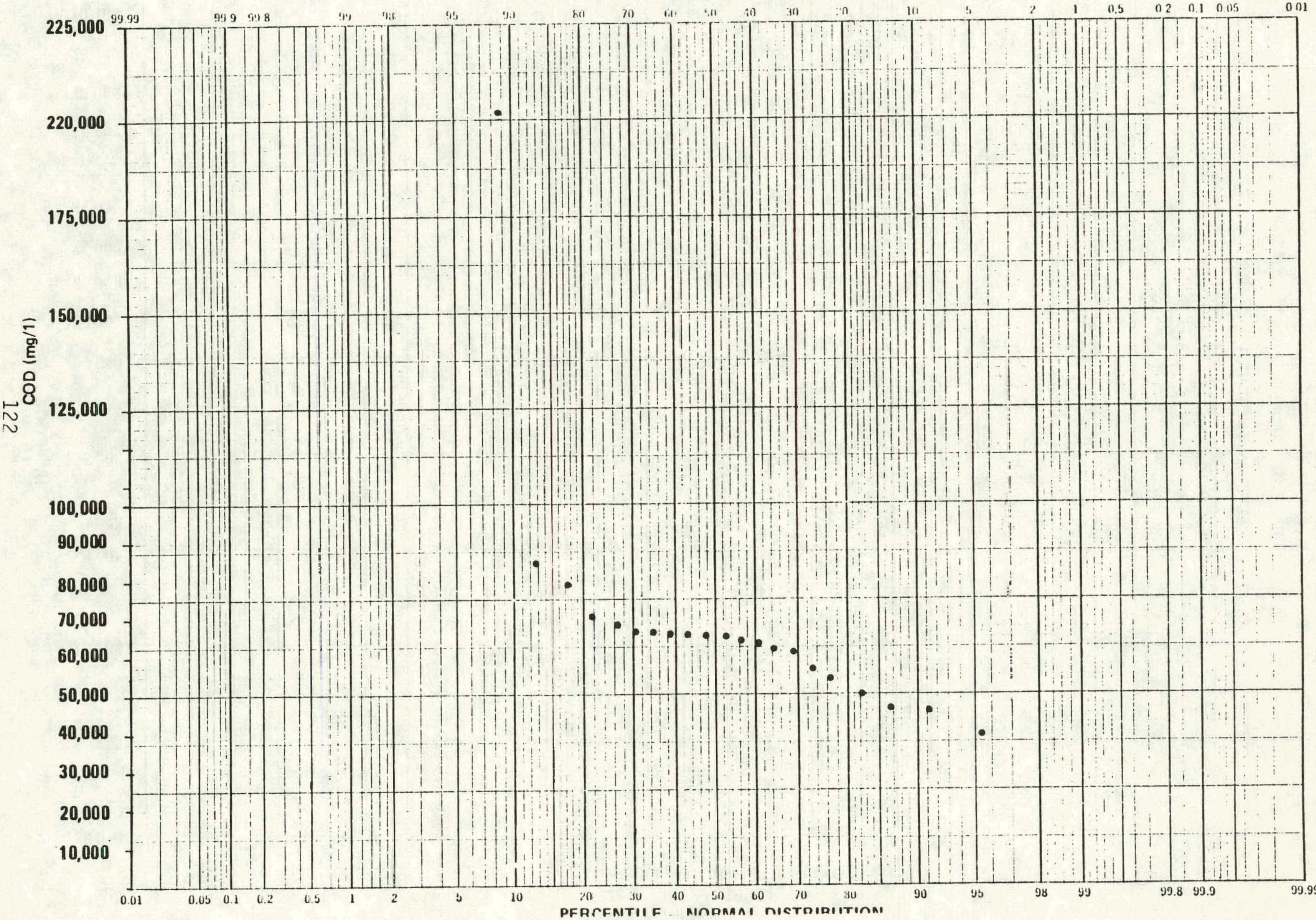
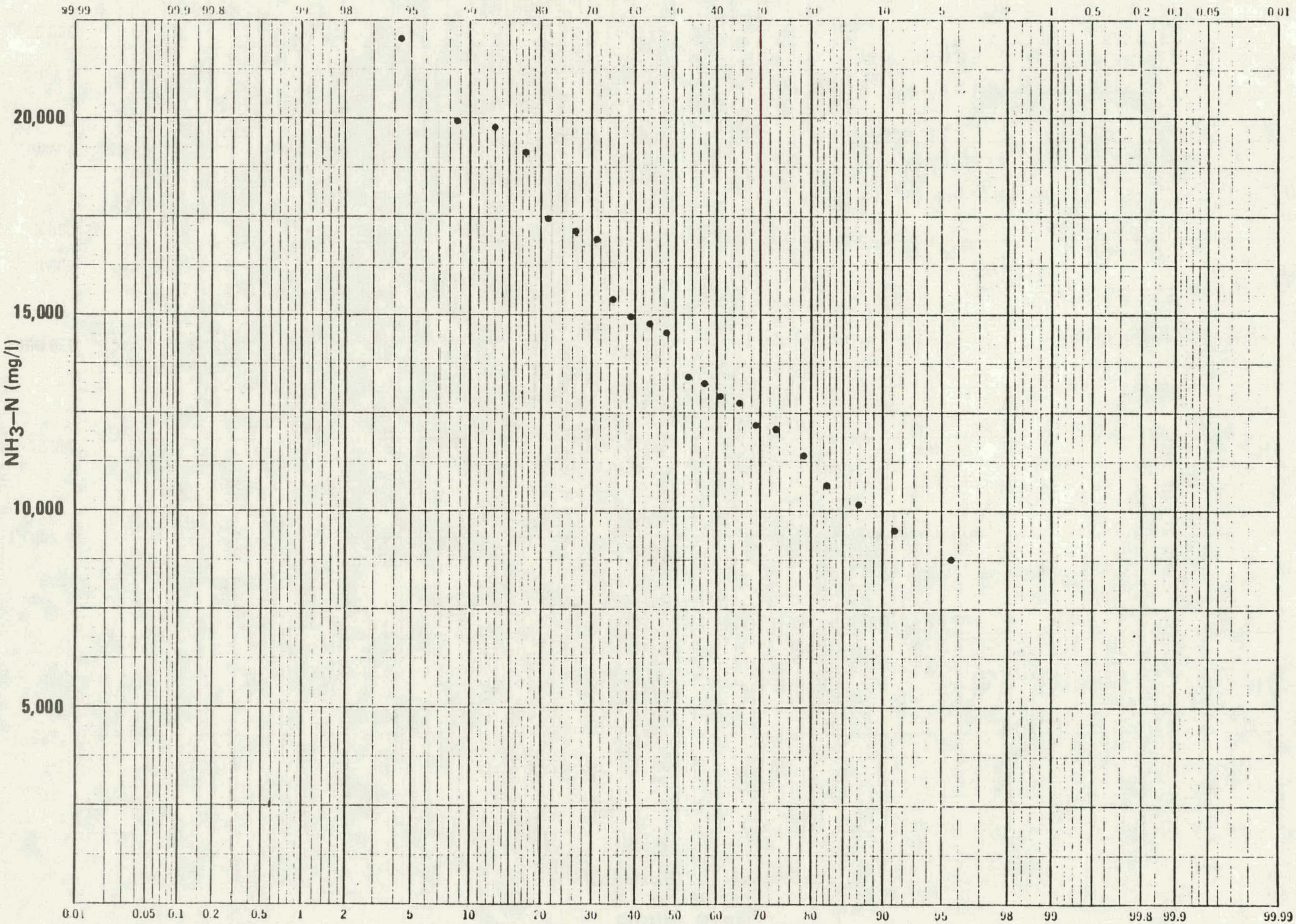


FIGURE B-2
V-105
COD PROBABILITY PLOT



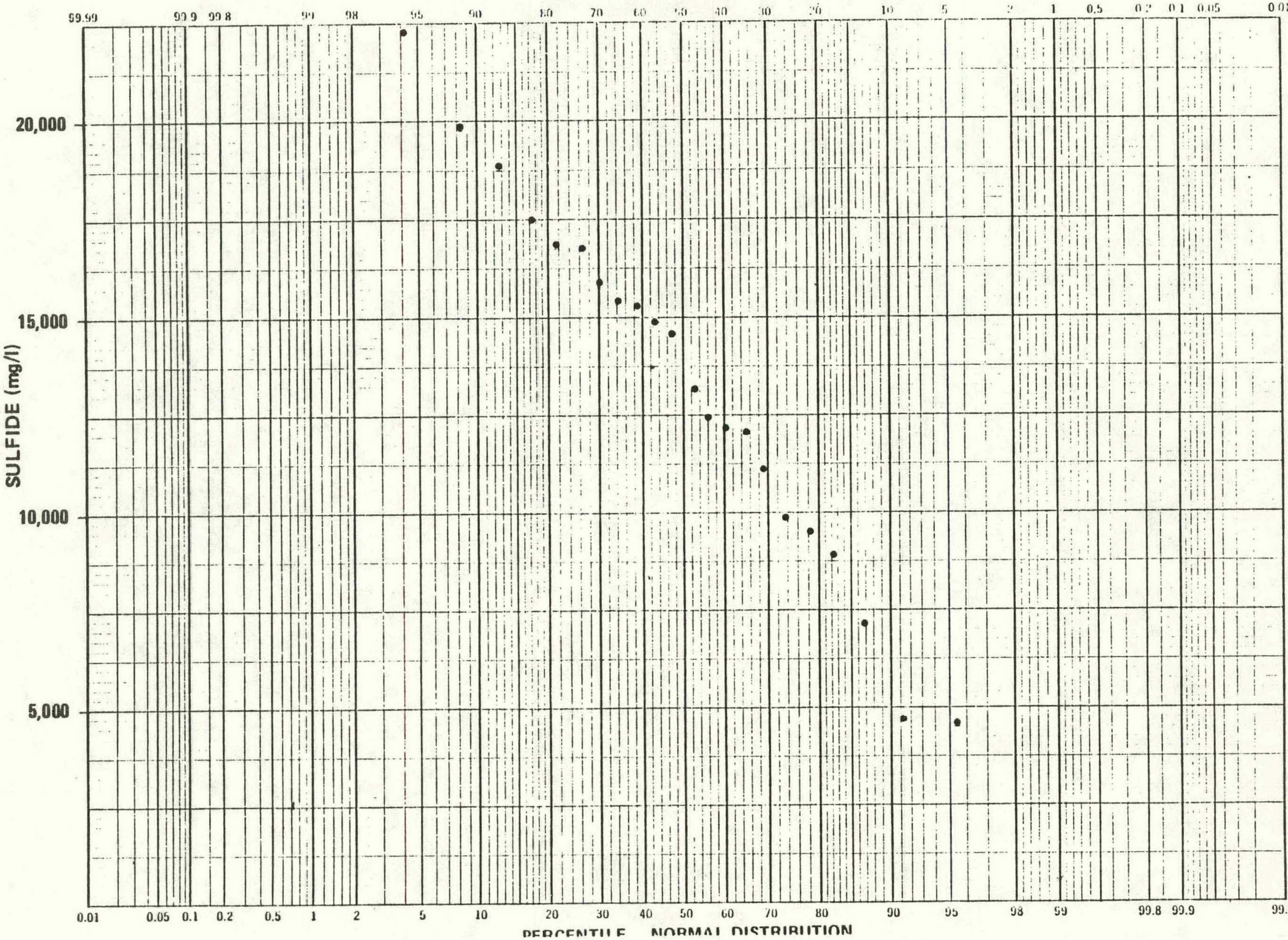
122

FIGURE B-3
V-105
NH_3-N PROBABILITY PLOT



123

FIGURE B-4
V-105
SULFIDE PROBABILITY PLOT



124

FIGURE B–5
V–105
PHENOL PROBABILITY

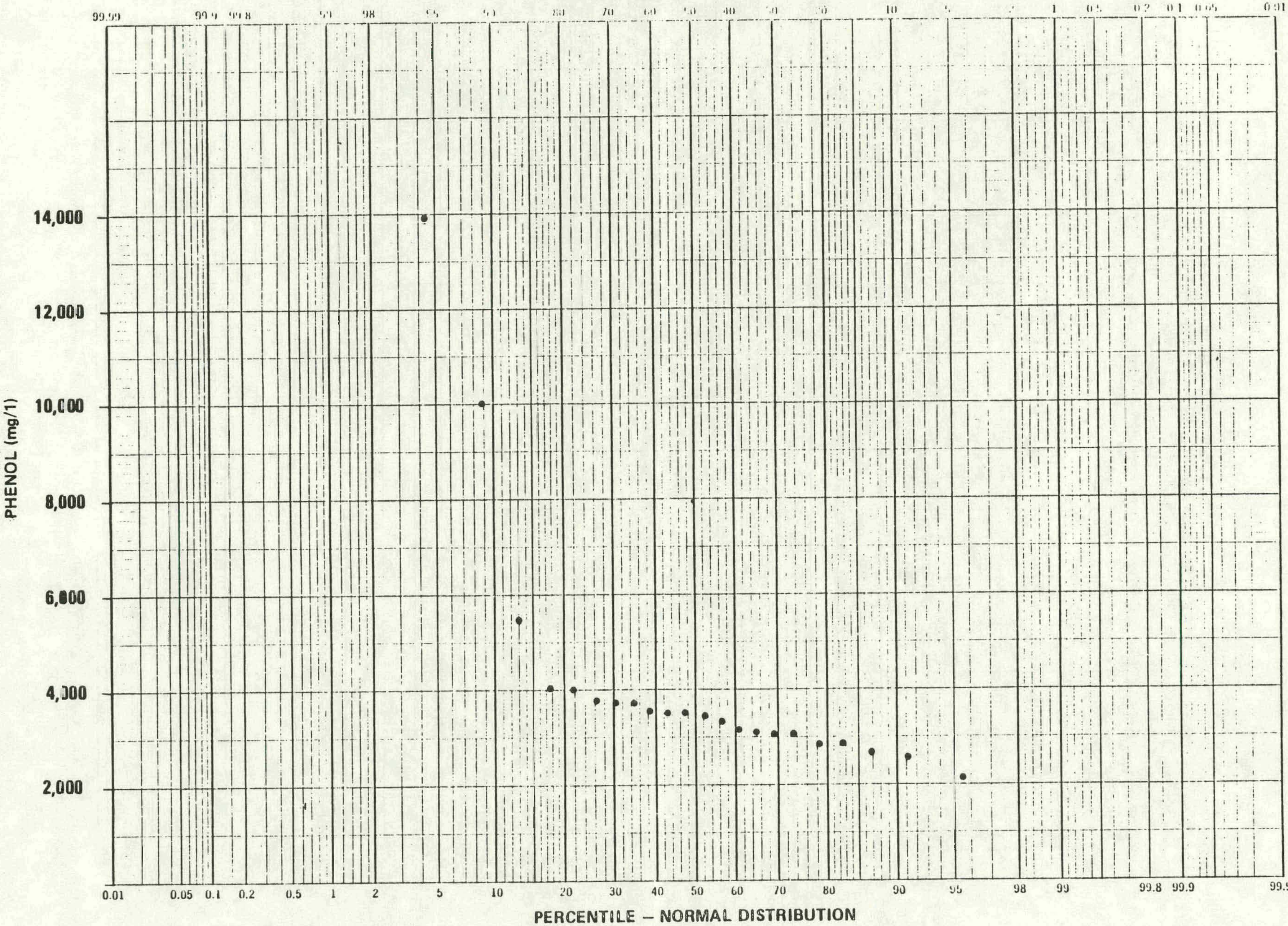
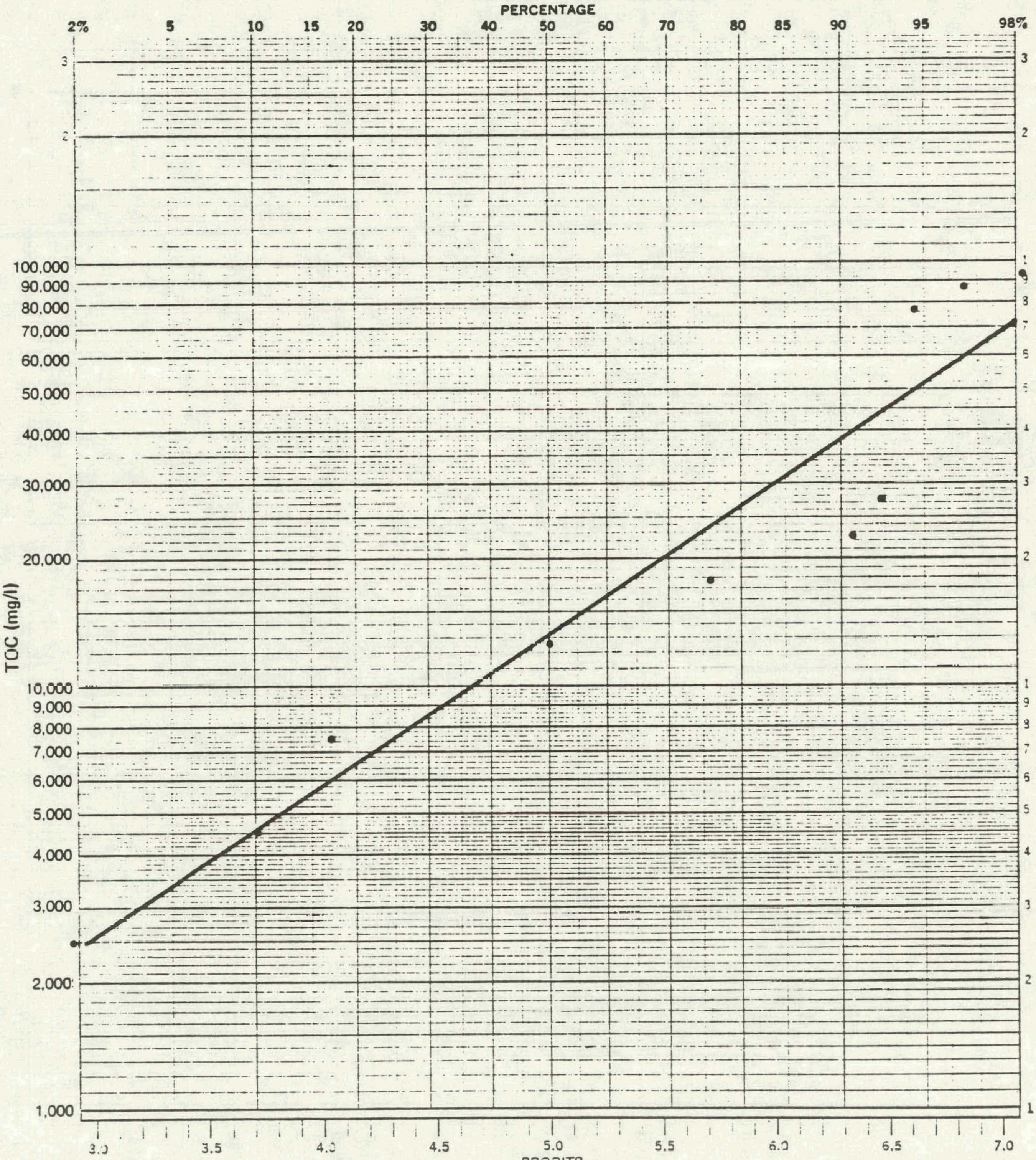


FIGURE B-6
V-105 WATERSIDE
TOC (mg/l) Feb. '79 - Dec. '81 Probability Plot



Log Normal Distribution

Refer to Table A-3

FIGURE B-7
V-105 WATERSIDE
TOC (lb/hr) Feb. '79 - July '81 Probability Plot

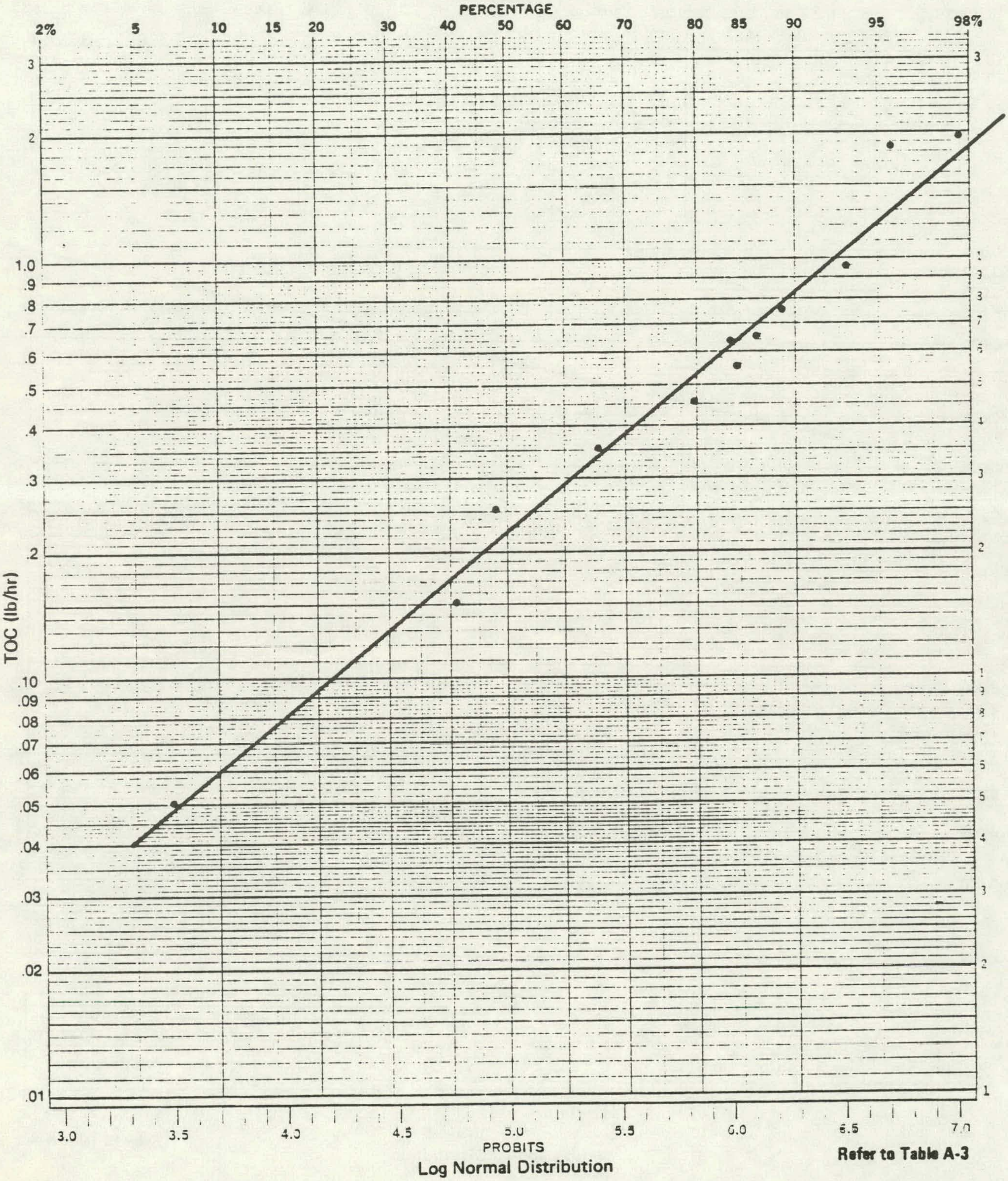


FIGURE B-8
V-105 WATERSIDE
COD (mg/l) Feb. '79 - Dec. '81 Probability Plot

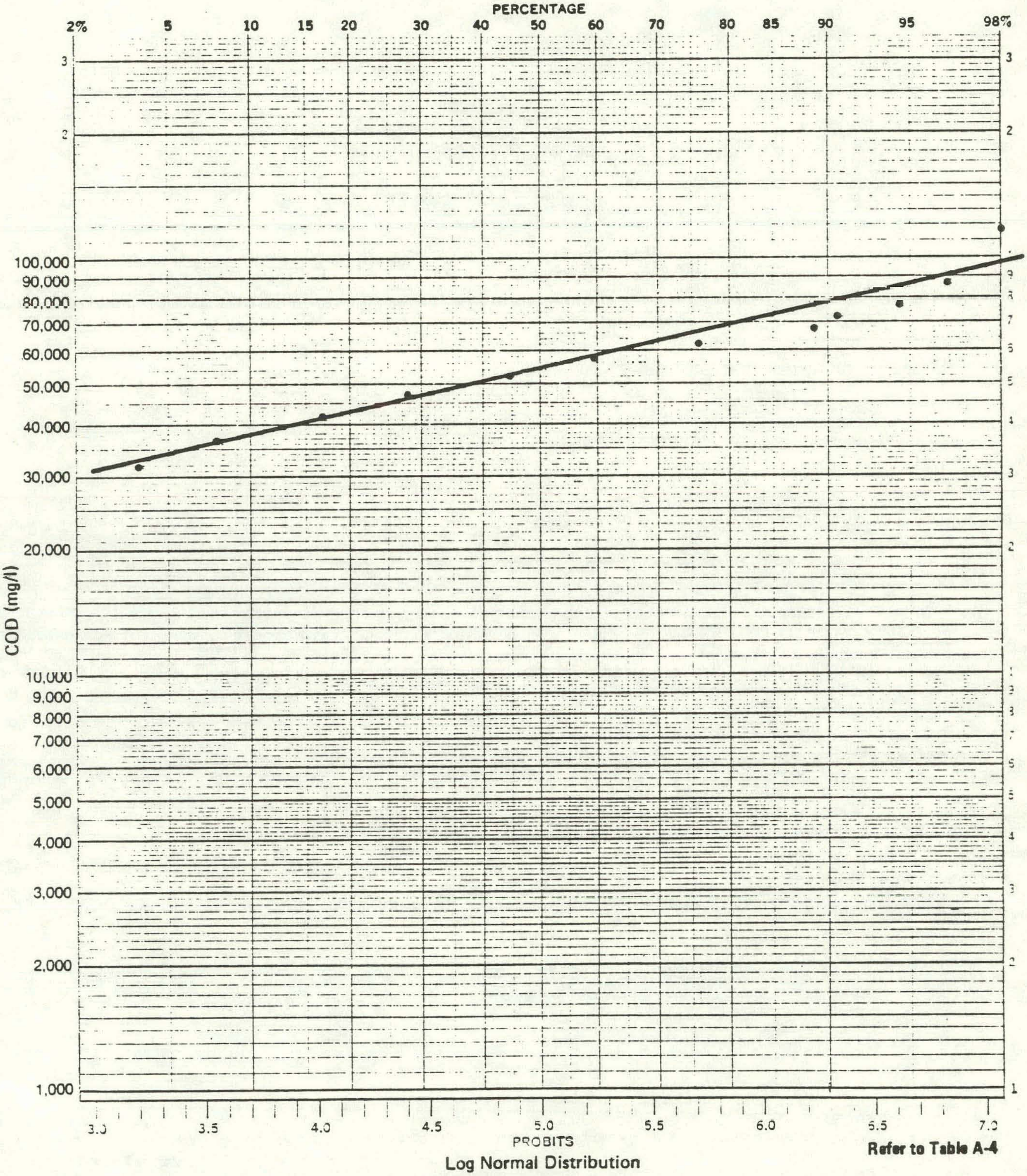
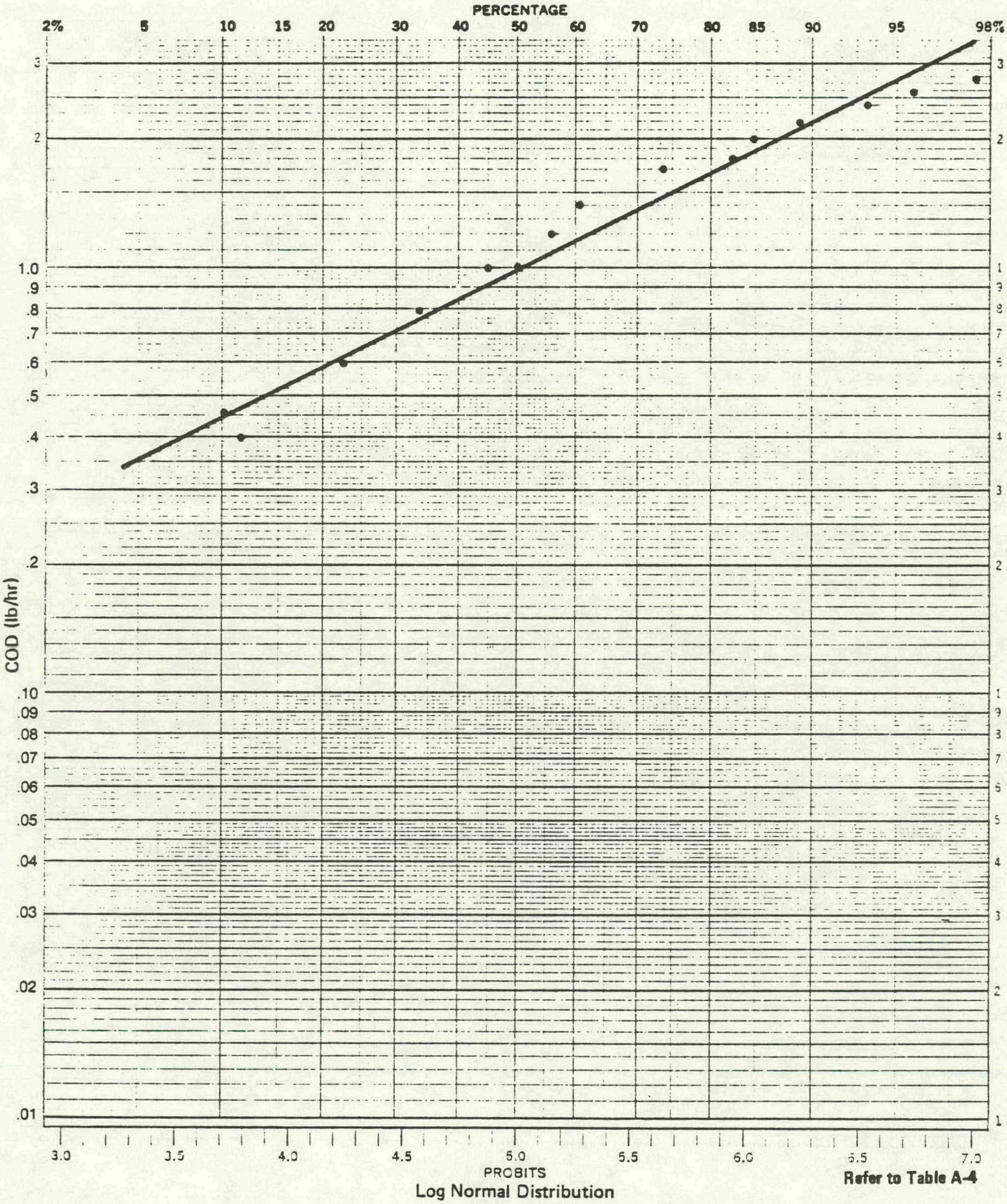


FIGURE B-9
V-105 WATERSIDE
COD (lb/hr) Feb. '79 - Dec. '81 Probability Plot



Log Normal Distribution

Refer to Table A-4

FIGURE B-10
V-105 WATERSIDE
NH_3-N (mg/l) Feb. '80 - Dec. '81 Probability Plot

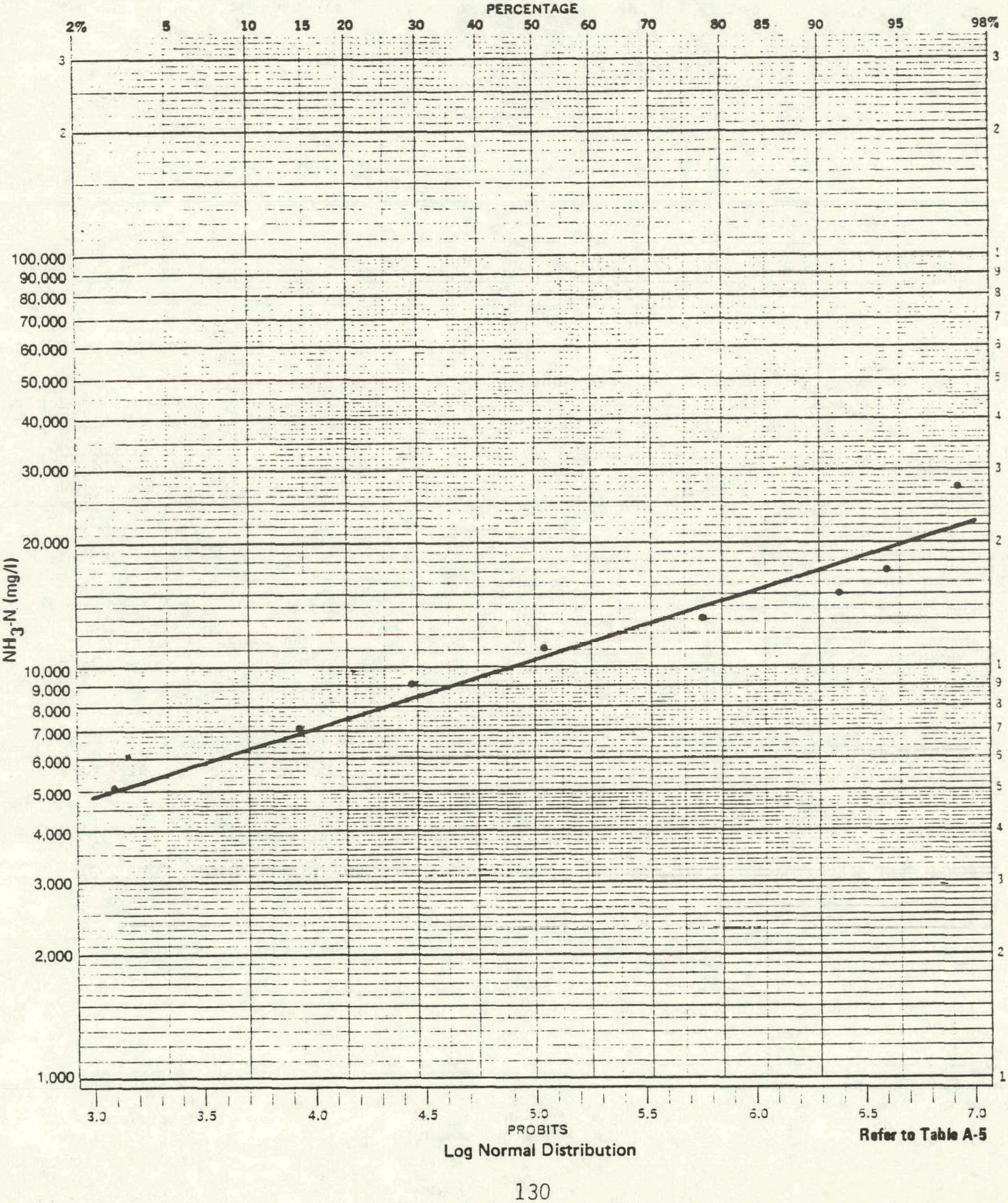
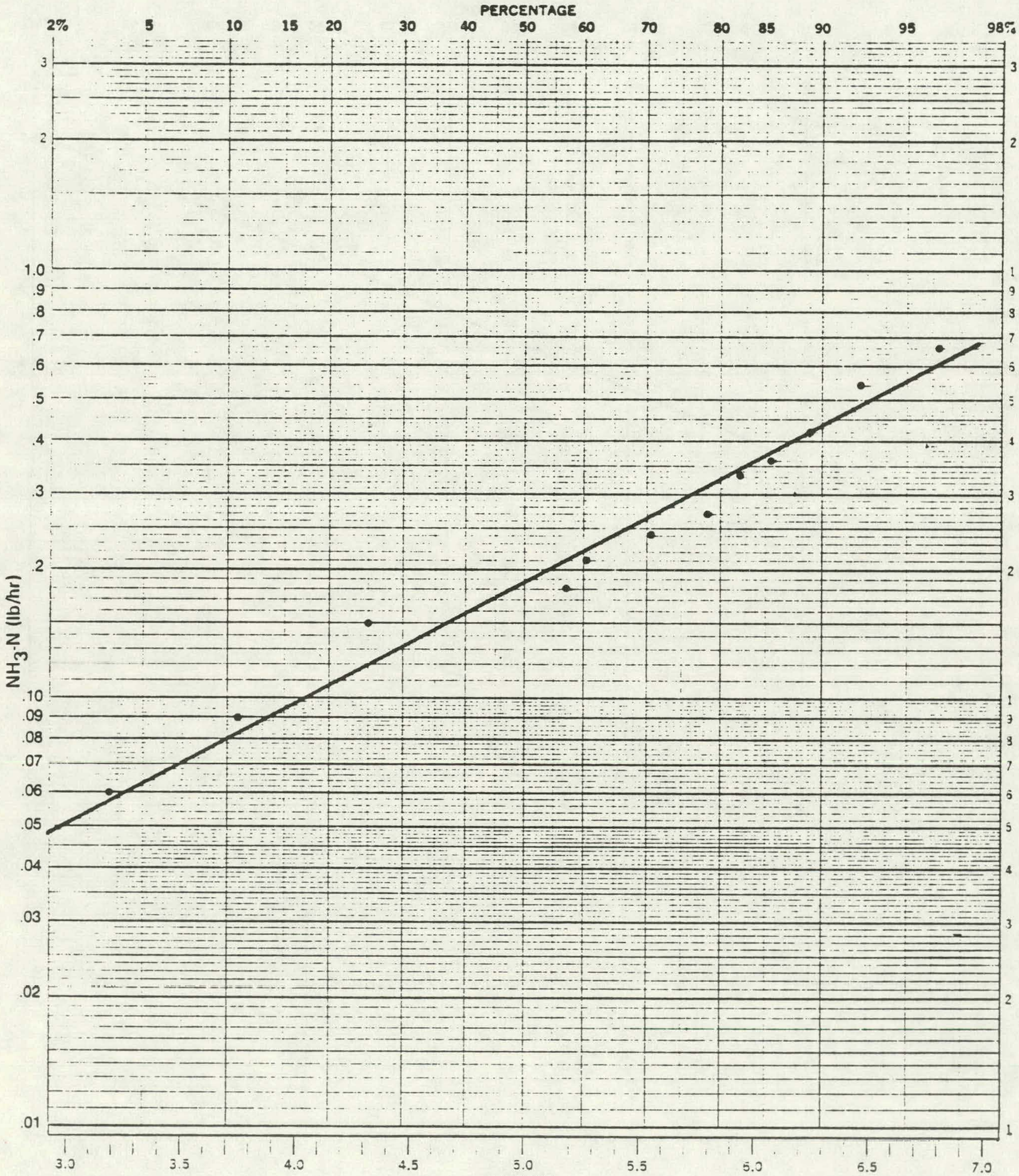


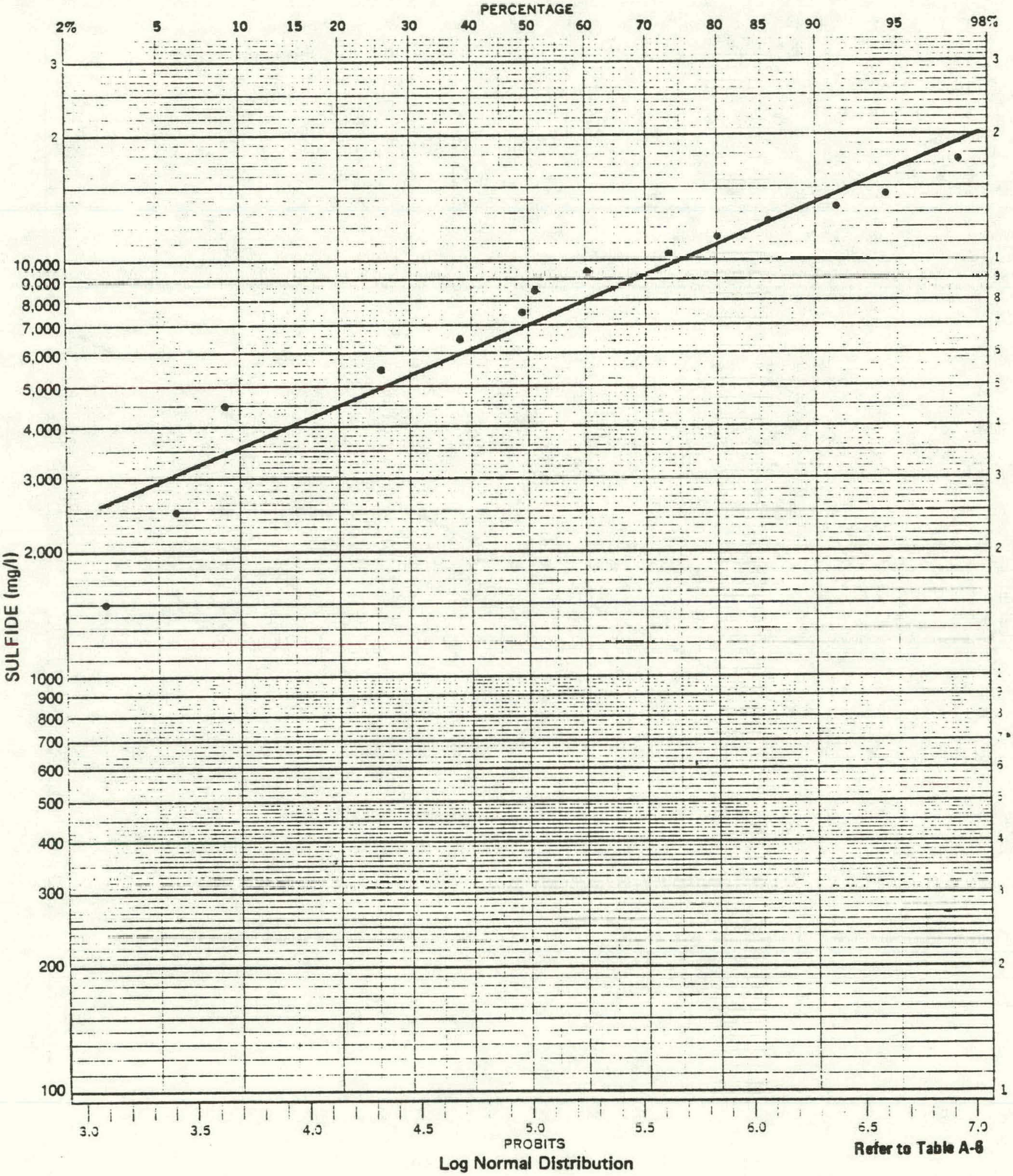
FIGURE B-11
V 105 WATERSIDE
NH_3-N (lb/hr) Probability Plot



Log Normal Distribution

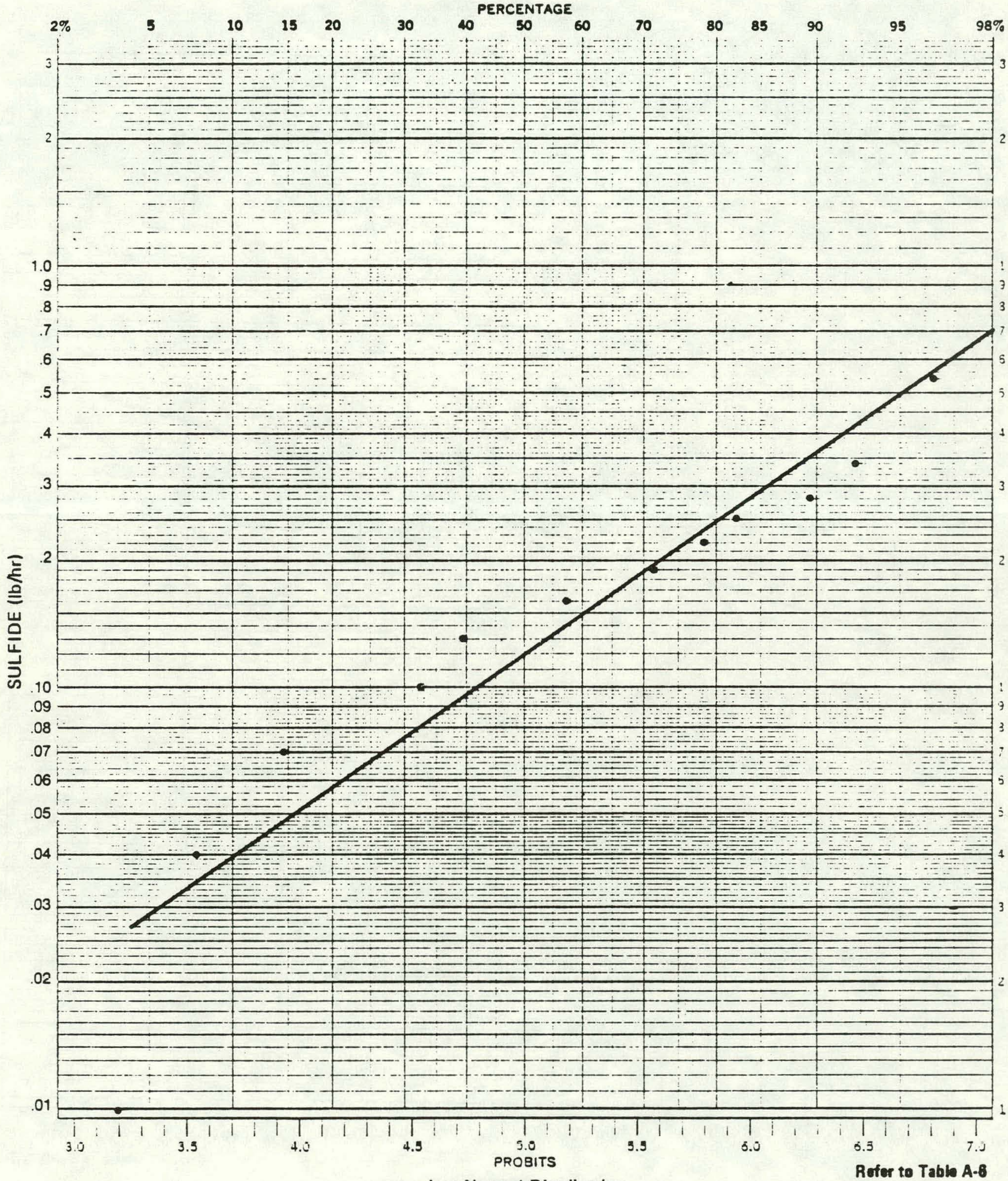
Refer to Table A-5

FIGURE B-12
V-105 WATERSIDE
SULFIDE Feb. '80 - Dec. '81 Probability Plot



Refer to Table A-8

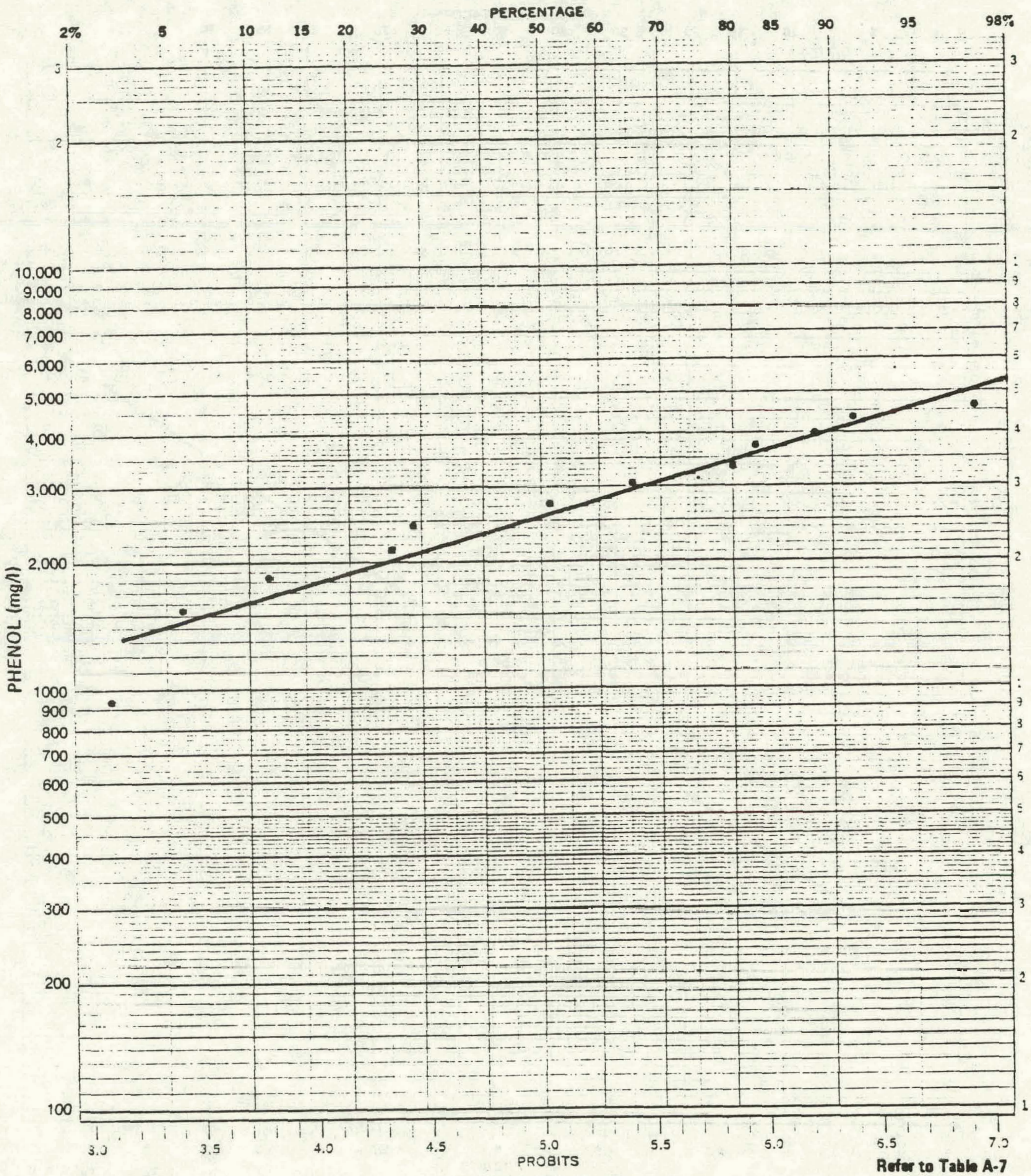
FIGURE B-13
V-105 WATERSIDE
SULFIDE Feb. '80 - July '81 Probability Plot



Log Normal Distribution

Refer to Table A-8

FIGURE B-14
V-105 WATERSIDE
PHENOL (mg/l) Feb. '81 - Dec. '81 Probability Plot



Log Normal Distribution

FIGURE B-15
V-105 WATERSIDE
PHENOL (lb/hr) Feb. '80 - July '81 Probability Plot

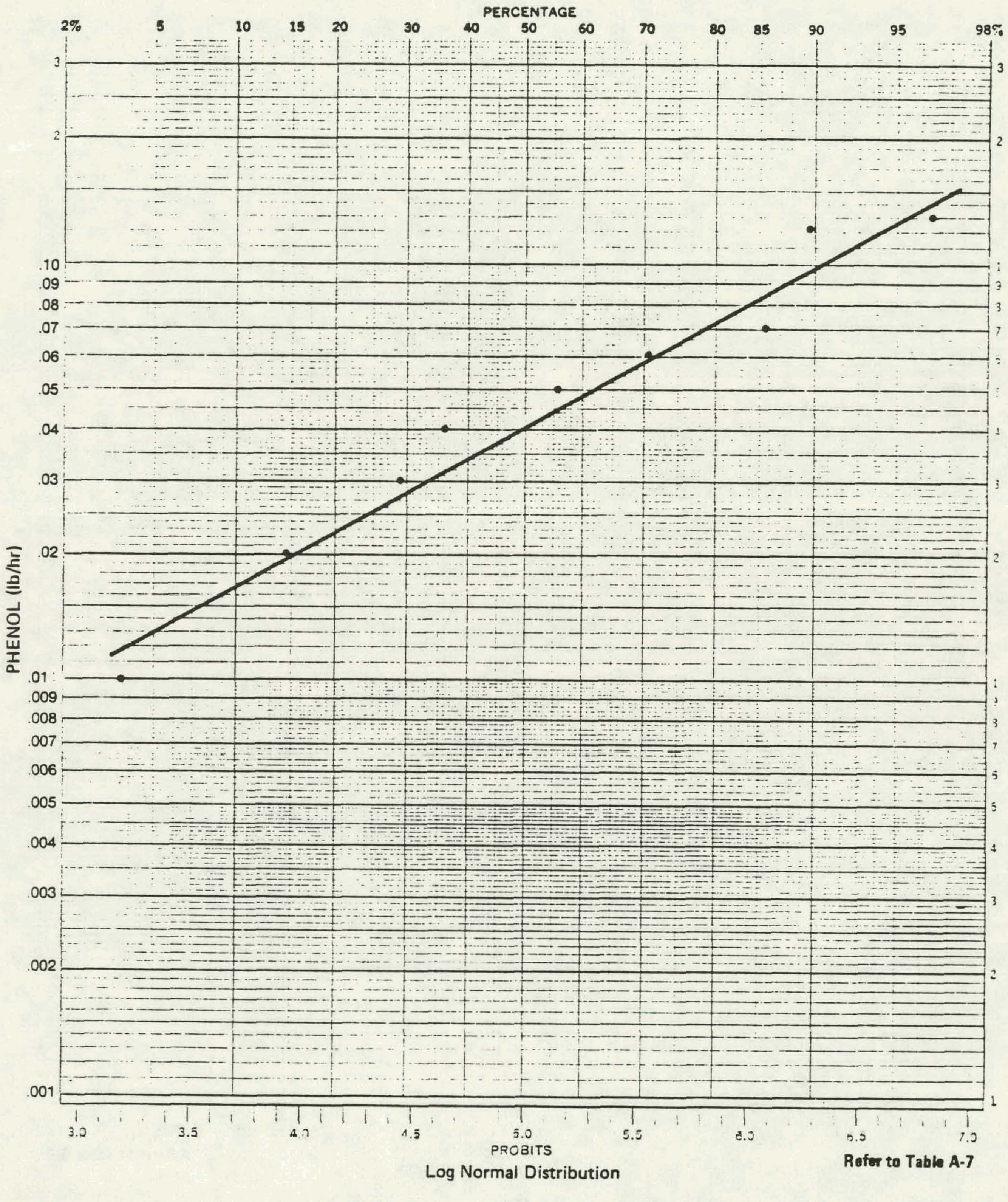
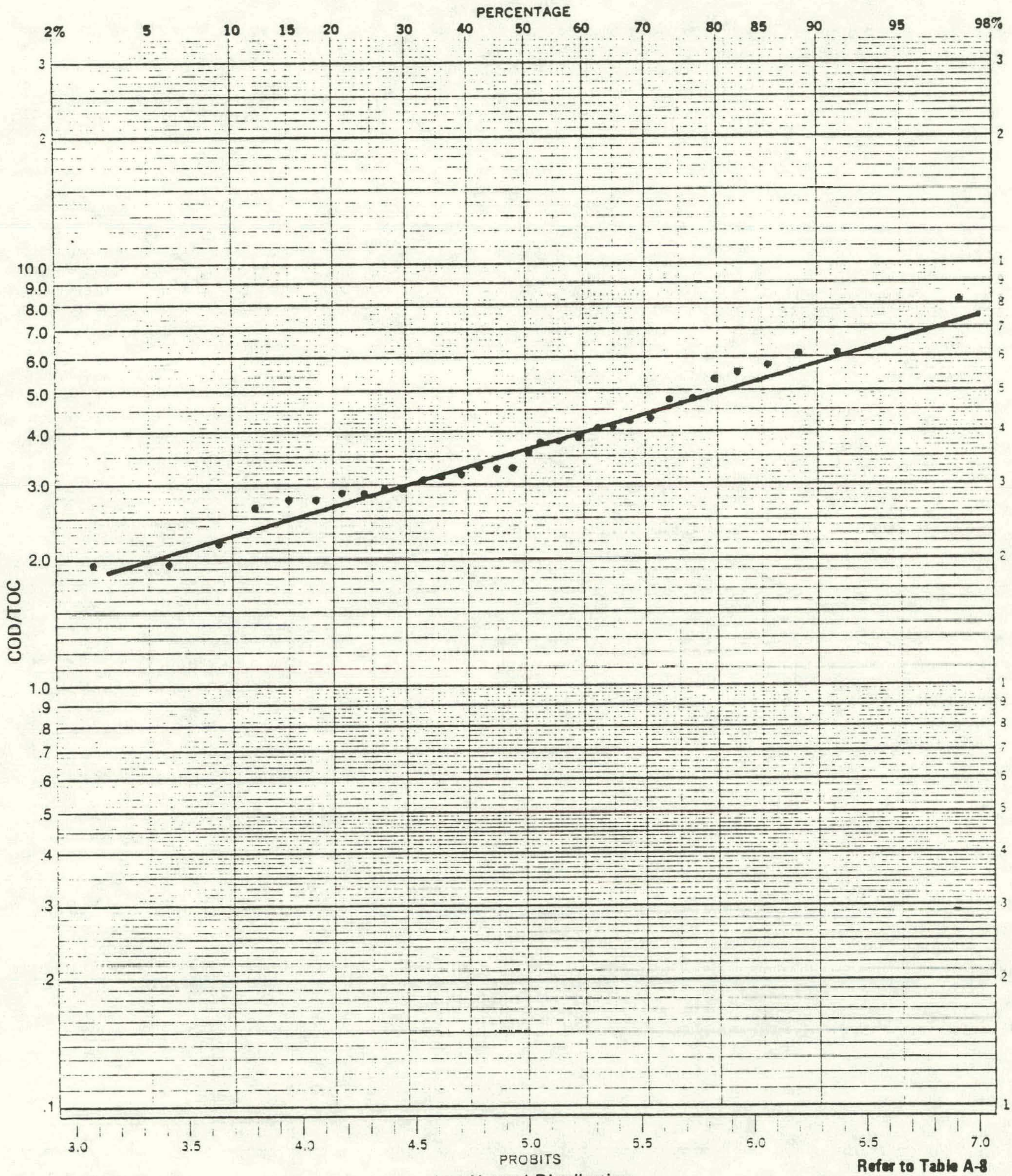


FIGURE B-16
V-105 WATERSIDE
COD/TOC Feb. '80 - Dec. '81 Probability Plot



Log Normal Distribution

Refer to Table A-8

FIGURE B-17
V-105 WATERSIDE
NH_3-N/SULFIDE Feb. '80 - Dec. '81 Probability Plot