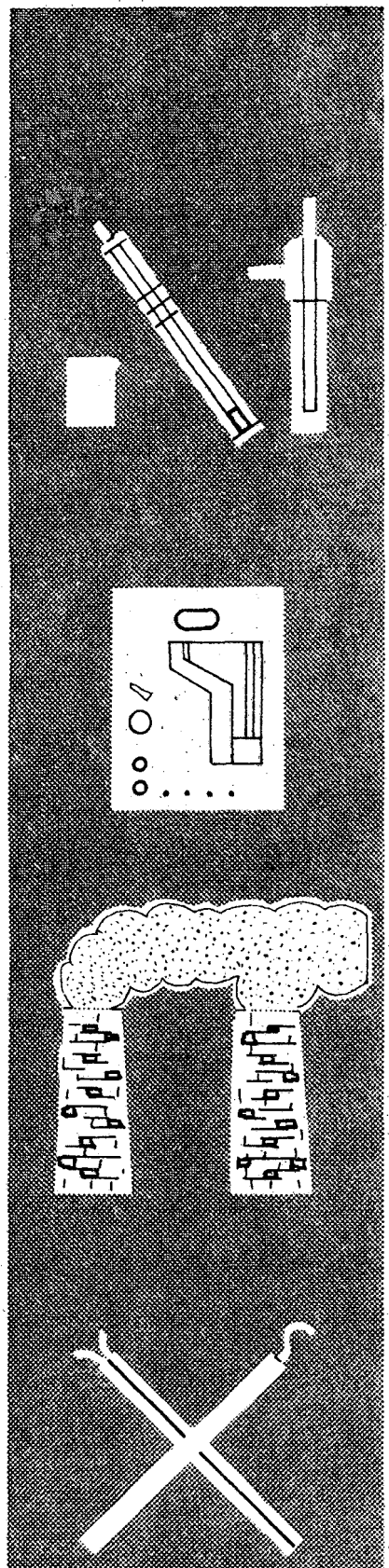
EPA REPORT NUMBER 74-SRY-3



AIR POLLUTION EMISSION TEST

CHAMPLIN PETROLEUM COMPANY

Wilmington, California

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

P.O. Box 13454 • UNIVERSITY STATION • GAINESVILLE, FLORIDA 32604 • 904/372-3318

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SOURCE TEST REPORT

EMISSIONS FROM SULFUR RECOVERY PLANT
Champlin Petroleum Company
Wilmington, California
for

The Environmental Protection Agency
United States Government
Report No. 74-SRY-3

E. R. Hendrickson, Ph.D., P.E.
Senior Advisor

John D. Bonds, Ph.D.
Project Manager

SOURCE TEST REPORT

REPORT NO: 74-SRY-3

PLANT TESTED: Champlin Petroleum Corporation
Wilmington, California

EMISSIONS FROM: Sulfur Recovery Plant

TESTOR: Environmental Science and Engineering, Inc.
Post Office Box 13454
University Station
Gainesville, Florida 32604

CONTRACT NO: 68-02-0232, Task Order No. 34

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1.0 INTRODUCTION

Under Section III of the Clean Air Act of 1970, as amended, the Environmental Protection Agency is charged with the establishment of standards of performance for new stationary sources which may contribute significantly to air pollution. A performance standard is based on the best emission reduction systems which have been shown technically and economically feasible

In order to set realistic performance standards, accurate data on pollutant emission is normally gathered from the stationary source category under consideration.

The sulfur recovery system at Champlin Petroleum Company's refinery at Wilmington, California, was designated as a well-controlled stationary source and was therefore selected by the Office of Air Quality Planning and Standards (OAQPS) for an emission testing program. Tests were conducted on the sulfur recovery unit during March 14-15, 1974. The tests were performed by personnel from Environmental Science and Engineering, Inc. (ESE), Gainesville, Florida, and the U.S. Environmental Protection Agency, Emission Testing Branch, OAQPS, Research Triangle Park, North Carolina.

The sulfur recovery system consists of a Claus Sulfur Recovery Unit followed by a SCOT tail gas treatment unit before the incinerator. The

SCOT process unit treats the Claus off-gas to remove additional sulfur before incineration. The incinerator converts all remaining reduced sulfur compounds to sulfur dioxide prior to release to the atmosphere.

Tests were conducted on the system at sampling points before and after the incinerator. The tests were designed to determine the average emission rates during four-hour sampling periods on the specified sampling dates. The emissions measured were: sulfur compounds (hydrogen sulfide, carbonyl sulfide, sulfur dioxide and carbon disulfide), hydrocarbons, carbon monoxide, nitrogen oxides, visible emissions and odors.

2.0 SUMMARY AND DISCUSSION OF RESULTS

2.1 A summary of the data collected for the two tests completed at Champlin Petroleum Company, Wilmington, California, is included as Table 1. To facilitate a comparison of results, all concentrations are presented as ppmv dry (except % dry for CO_2 and O_2 and odor units (o.u.) per standard cubic foot (scf) for odor testing results), and all emission rates are standardized (with the exception of odor) as grams per hour (gm/hr). Additional partial data collected on dates other than March 14 and 15 are presented in the Appendix. Sample calculations and conversions are presented in Appendix A.

2.2 Sulfur compound concentrations were determined by gas chromatography (COS, H_2S, SO_2, CS_2 and total sulfur), EPA Method 6 (SO_2), and Meloy Sulfur Analyzer (total sulfur).

Sulfur dioxide concentrations, as measured by EPA Method 6 and gas chromatography, averaged 5.2 and 9.6 ppmv, respectively, at the inlet sampling location. These results are considered to be in good agreement, especially since EPA Method 6 cannot be expected to yield accurate results at the low concentration present at the inlet sampling location. Concentration at the outlet sampling points for the two days were 50.6 and 86.8 ppmv by EPA Method 6 and 220 and 118 ppmv by gas chromatography. The 220 ppmv value obtained on the first day of testing is based on one observation and is not considered representative. The other values are considered to be within reasonable agreement.

TABLE I

DATA SUMMARY - SCOT SULFUR RECOVERY UNIT

CHAMPLIN PETROLEUM COMPANY
WILMINGTON, CALIFORNIA

EMISSION CONCENTRATIONS, ppmv, dry

Date*	Location	Flow Rate DSCFM at STP(11)	% Moisture	Orsat Data % CO_2	Orsat Data SO_2	Orsat Data CO	NDIR/Paramagnetic % CO_2(1)	NDIR/Paramagnetic SO_2(2)	NDIR/Paramagnetic CO, ppmv(1)	Gas Chromatography SO_2, ppmv(3)	Gas Chromatography SO_2(4)	Gas Chromatography COS(4)	Gas Chromatography H_2S(4)	Gas Chromatography CS_2(4)	Gas Chromatography TS(5)	TS, ppmv(6) as SO_2	THC, ppmv(7) as CH_4	NO_x, ppmv(8)	Odor Concentration OU/SCF (9)	Visible Emissions (10)
3/14/74	Outlet	65.28	9.5	3.6	12.4	<0.2	--	--	--	50.6	220	18.0	--	<1.7	240	--	--	0.27	--	0
	Inlet	--	6.7	4.6	0.7	<0.2	4.9	<0.02	29	4.7	7.6	25.4	290	1.6	320	490	7.4	0	--	--
3/15/74	Outlet	115.52	2.6	1.8	13.0	<0.2	4.3	12.0	1109	86.8	118	56.0	58	<11.5	230	160	16.0	--	80	0
	Inlet	--	9.1	4.8	0.8	<0.2	5.6	0.3	12	5.8	<11.5	59.8	560	<11.5	620	630	12.0	--	200	--
AVERAGE	Outlet	90.4	6.0	2.7	12.7	<0.2	4.3	12.0	1100	68.7	170	37.0	58	<6.6	240	160	16.0	0.27	80	0
	Inlet	--	7.9	4.7	0.8	<0.2	5.2	0.2	20	5.2	9.6	42.6	420	<6.6	470	560	9.7	0	200	--

MASS EMISSION RATES, gm/hr

Date	Location	CO(1)	SO_2(3)	SO_2(4)	COS(4)	H_2S(4)	CS_2(4)	TS(5)	TS(6)	THC(7)	NO_x(8)	Odor Emission Rate (9)
3/14/74	Outlet	--	518	2250	173	--	<20.1	2460	--	--	2.0	--
3/15/74	Outlet	8730	1570	2140	952	860	<240	<170	2900	72.6	--	318,000

* Various data collected on dates other than March 14 and 15 are found in Appendix A and B.

(1) NDIR
(2) Paramagnetic
(3) EPA Method 6
(4) Gas Chromatograph
(5) Summation of G.C. Sulfur Compounds
(6) Total Sulfur as SO_2 by Haley
(7) Total Hydrocarbons (as CH_4) by flame ionization
(8) EPA Method 7
(9) EPA Dilution Method
(10) EPA Method 9
(11) Dry normal cubic meters/minute, 21°C., 760 mm Hg

The total sulfur results were obtained by summation of the individual sulfur compounds determined by gas chromatography as sulfur dioxide and by use of the Meloy total sulfur analyzer. The values obtained at the inlet ranged from 320 to 620 ppmv by the summation method and between 490 and 630 ppmv by the direct instrumental method. Values obtained at the outlet sampling location varied from 230 to 240 ppmv by summation and 160 ppmv by the instrumental method. The inlet and outlet concentrations obtained on March 15 by the two methods appear to be in reasonable agreement.

Hydrogen sulfide was the major constituent present at the inlet sampling point and the concentration ranged from 290 to 560 ppmv. At the outlet, hydrogen sulfide was determined by gas chromatography to be 58 ppmv by the tests conducted March 15, 1974.

Carbonyl sulfide concentrations, as determined by gas chromatography, ranged from 18 to 56 ppmv at the outlet location and from 25.4 to 59.8 ppmv at the inlet sampling location. No comparative method was available for the determination of COS.

The carbon disulfide concentration was determined to be 1.6 ppmv at the inlet sampling location on the tests conducted March 14, 1974. On all subsequent tests the dilution factor was so large that exact carbon disulfide concentrations could not be determined. The overall concentration of carbon disulfide, however, was determined to be less than 11.5 ppmv at the inlet and outlet sampling locations.

2.3 Carbon dioxide, carbon monoxide and oxygen were determined by continuous methods (NDIR and paramagnetic) and by the Orsat method. The following paragraphs compare the results obtained by the various methods.

Carbon dioxide concentrations were determined by NDIR and by Orsat. The results obtained varied from 1.8 to 3.6% (Orsat) and 4.3% (NDIR) at the outlet sampling location, and 4.6 to 4.8% (Orsat) and 4.9 to 5.6% (NDIR) at the inlet sampling point. These results are considered to be in reasonable agreement, especially when consideration is given to the fact that the system was not stable throughout the entire test and the Orsat is a sample at one point in time, whereas the NDIR results are the average obtained for the entire testing period.

Average oxygen values obtained were 12.7 (Orsat) and 12.0% (paramagnetic) at the outlet and 0.8 (Orsat) and 0.2% (paramagnetic) at the inlet sampling point. The average versus grab sample argument for the conditions prevalent, and the analyzing methods used can be applied to explain the differences observed in the values obtained by the two methods.

Carbon monoxide concentrations were measured by NDIR and Orsat. The concentrations determined by NDIR ranged from 12 to 29 ppmv at the inlet location and 1100 ppmv was the average value found at the outlet location. These concentrations of carbon monoxide are below the range applicable to the Orsat method as is shown by the fact that no carbon monoxide was measured by the Orsat method.

2.4 Nitrous oxides were determined by EPA Method 7. NO_x was determined to be 0.27 ppmv at the outlet, and less than detectable at the inlet on the day of testing.

2.5 Total hydrocarbons were determined by flame ionization detector. Inlet concentrations ranged from 7.4 to 12.0 ppmv as CH_4 and the outlet concentration was determined to be 16.0 ppmv as CH_4.

2.6 Visible emissions were determined by qualified observers in accordance with EPA Method 9. Visible emissions averaged zero for the duration of all tests.

2.7 Odor concentrations were determined according to an EPA draft method (Dilution Method) and ranged from 80 o.u./scf at the outlet to 200 o.u./scf at the inlet sampling location.

2.8 Moisture and flow rates were determined according to EPA Method 1, 2 and 4. The moisture content at the inlet varied from 6.7 to 9.1% and at the outlet from 2.6 to 9.5%. Flow rates at the outlet varied from 65.28 to 115.52 DNM^3/min with an average value of 90.4 DNM^3/min.

2.9 The overall results from the various tests (SO_2, CO, CO_2, H_2S, CS_2, COS, total sulfur, total hydrocarbons, etc.) are varied. Good agreement was obtained between some parameters as determined by different analysis methods, however, all parameters do not agree as well as would be expected. This variation in the results is attributed to the fact that the general overall operating conditions of the plant were not smooth, due to technical problems. The operating difficulties are explained in detail in Section 3.4 of this report.

3.0 PROCESS DESCRIPTION

3.1 Claus Sulfur Recovery

In petroleum refining, various processes generate "sour" gas streams which contain not only sufficient amounts of hydrocarbons to be used as a fuel gas, but also contain excessive contaminants such as carbon dioxide and hydrogen sulfide. These fuel gases are treated to remove CO_2 and H_2S, but in regenerating the treating solutions by steam stripping "acid" gases are evolved which contain concentrated H_2S and some CO_2.

Most refineries recover the H_2S as elemental sulfur by the Claus process shown below:

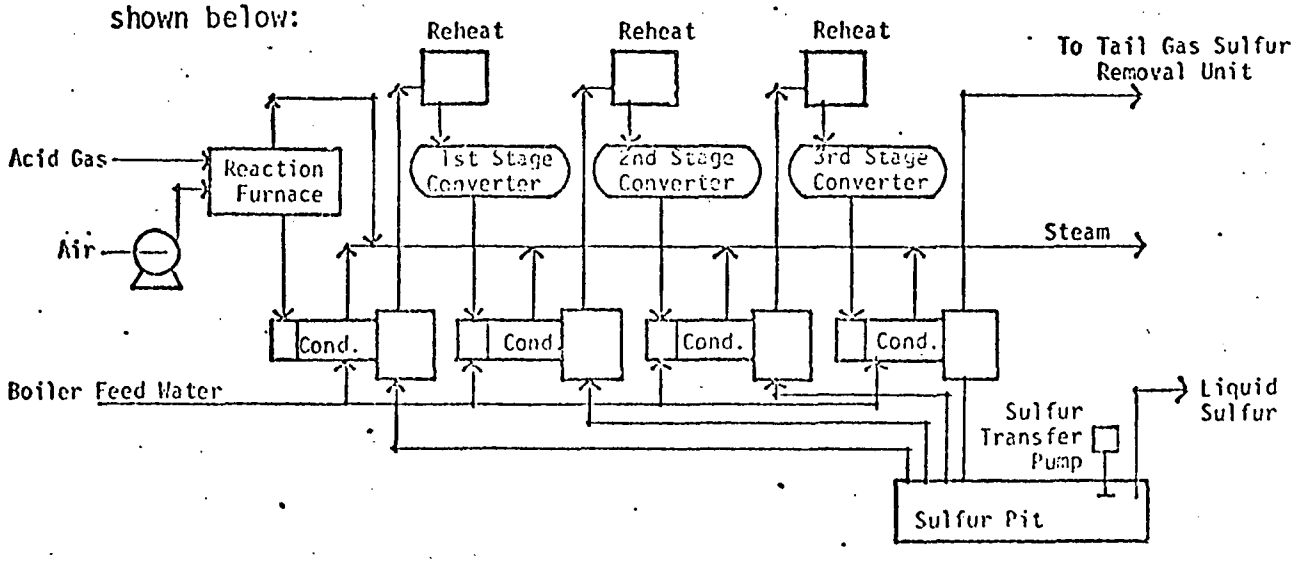


Figure 1. Schematic diagram of Claus Process.

For the high concentrations of H_2S usually found in refinery acid gases, the "straight through" variation of the Claus process is used.

In this process, H_2S is partially oxidized in the reaction furnace:

$$H_2S + 3/2\ O_2 \longrightarrow SO_2 + H_2O + 131\ Kcal$$

The SO_2 then reacts with the remaining H_2S:

$$2H_2S + SO_2 \longrightarrow 3S + 2H_2O + 28\ Kcal$$

The overall reaction, commonly called the Claus Reaction, is:

$$3H_2S + 3/2\ O_2 \longrightarrow 3S + 3H_2O + 150\ Kcal$$

Stagewise condensation, reheating, and catalytic conversion steps push the Claus reaction to the right and remove most of the sulfur gases as elemental sulfur. The efficiency of the Claus Process increases with increasing H_2S inlet concentration and the number of conversion stages.

Some side reactions occur in the reaction furnace which lower Claus efficiencies. Carbonyl sulfide (COS) and carbon disulfide (CS_2) are formed at high temperatures if the acid gas contains CO_2 or hydrocarbons or both:

$$CH_4 + 4S \longrightarrow CS_2 + 2H_2S$$

$$CO_2 + H_2S \longrightarrow COS + H_2O$$

$$COS + H_2S \longrightarrow H_2O + CS_2$$

Though present in relatively small quantities, COS and CS_2 are not

recovered in the Claus process and do become significant in the Claus tail gas after H_2S and SO_2 levels have been reduced by 90-95% or more. Also, the Claus reaction, being exothermic, is favored by lower temperatures, hence the reaction continues in the tail gas to some extent. A typical tail gas analysis from a Claus plant at 94% sulfur removal is:

Component	% Volume
H_2S	0.85
SO_2	0.42
S_8	0.05
COS	0.05
CS_2	0.04
H_2O	33.10
CO	0.22
CO_2	2.37
N_2	61.30
H_2	1.60

Thus, any tail gas treatment to remove sulfur levels to below 500 ppm must address all five sulfur constituents. One of these processes to remove sulfur from tail gases is the SCOT Process, described in the following section.

3.2 Shell's SCOT Process - Commercial Status

The SCOT Process is licensed by Shell Development Company. The following table summarizes the status of SCOT units applied to Claus tail gases:

Company/Location	Onstream Data	Number/Capacity of Claus Plant, LT/D
Champlin Petroleum Company/Wilmington, California	June 1973	1/15*
Douglas Oil Company/ Paramount, California	June 1973	1/9
Shell Canada, Waterton Gas Treating Plant/ Alberta, Canada	December 1974	1/2100
British Petroleum Standard Oil of Ohio/ Marcus Hook, Pennsylvania	October 1974	1/160
Sun Oil Co./Duncan Oklahoma	Late 1974	-
Marathon Oil Co./ Detroit, Michigan		-
Murphy Oil Co./ Meraux, Louisiana	Late 1974	-
Shell Oil/Houston, Texas	Late 1974	-

*During EPA tests, sulfur recovery averaged 13 LT/D.

3.3 Shell's SCOT Process - Process Description

In the SCOT Process, as shown by Figure 2, essentially all sulfur species are hydrogenated

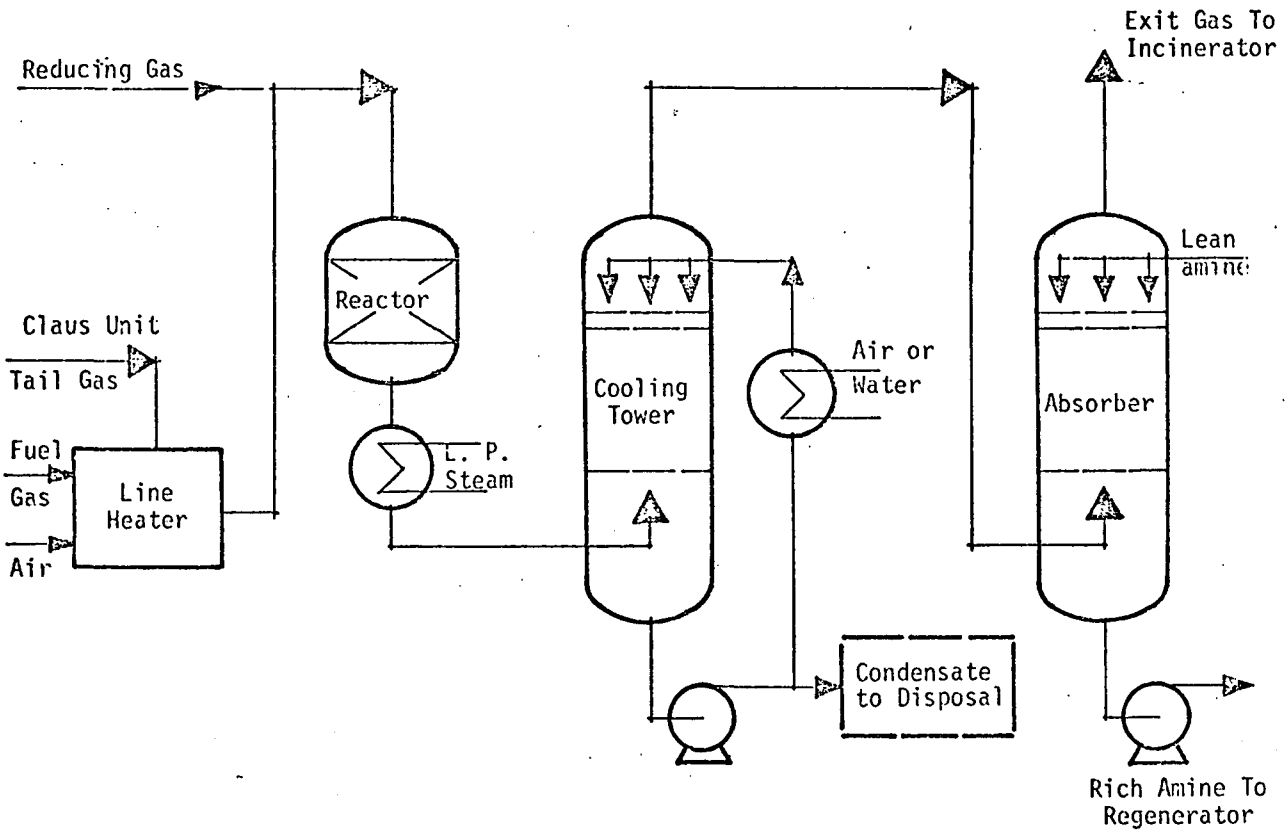


Figure 2. Schematic diagram of SCOT Process.

and hydrolyzed in a reducing atmosphere over an alumina based Co-Mo catalyst. The reactions are:

$$SO_2 + 3H_2 \rightarrow H_2S + 2H_2O$$

$$CS_2 + 2H_2O \rightarrow 2H_2S + CO_2$$

$$COS + H_2O \rightarrow H_2S + CO_2$$

$$S_8 + 8H_2 \rightarrow 8H_2S$$

Water vapor is then removed from the tail gas by a quenching tower and returned to sour water strippers. After quenching, the gas is contacted with an alkanolamine solution which absorbs the H_2S plus about 30% of the CO_2 in the gas. Trace amounts of unabsorbed H_2S, plus the remaining COS and CS_2 which were not converted in the hydrogenator, are incinerated before discharge to the atmosphere. Overall sulfur recovery for the combined Claus and SCOT units is projected to be 99.8+%.

The H_2S and CO_2 are stripped from the rich alkanolamine solution in a conventional stripper and recycled to the Claus plant inlet. The regenerated alkanolamine solution is continually recycled to the absorber for contacting additional gases.

3.4 Plant Operation During Emission Measurements

During the test period, process variables were monitored to assure that emissions measured would be representative of normal process operation. For the Champlin refinery the monitored variables included:

(1) acid gas fee to Claus.

(2) tail gas H_2S/SO_2 ratio.

(3) SCOT reactor temperatures.

(4) SCOT absorber liquid feed rate & temperature.

(5) SCOT absorber off-gas flow rate & temperature.

(6) incinerator temperature.

(7) fuel gas & air feed rates to incinerator.

On March 1 the Claus plant feed was very unstable with surges in the acid gas feed passing through both the Claus and SCOT units. The SCOT unit experienced upsets twice over the weekend (March 1-3) during which the catalyst bed apparently became coated with sulfur. March 4 analyses showed significant quantities of COS/CS_2 which had not been present on March 1.

On March 14 the plant supply of natural gas was cut off, resulting in a drop in plant fuel gas. The coker was adjusted to produce more fuel gas and offset the losses, but the increase in gas flow throughout the fuel gas/acid gas system upset the Claus and SCOT sulfur units. The unsteady operation was noted in variables (1) and (5).

On March 15 natural gas supply was resumed and the acid gas flow to the Claus returned to normal levels. During the first half of the

test period the feed to the Claus and SCOT units stabilized somewhat, then upset again when the daily vapor heating of the coker began. Upon vapor heating, the fuel gas/acid gas flows dropped. Once the Claus and SCOT units stabilized at the lower flows; emission rates were much lower as evidenced by the low flows observed on the SCOT absorber off-gas.

The sulfur plant, rated at 15 LT/D, was operated at 80-90 percent of design during the emission tests. The Claus efficiency was not measured so that the total sulfur feed to the SCOT unit was not determined. From acid gas feed rates and Tutweiler H_2S determinations on the acid gas, the sulfur feed to the Claus was calculated:

Date	Sulfur Feed, LT/D
2/28	11.5 (during vapor heat)
3/1	13.6 11.1 (during vapor heat)
3/14	12.8
3/15	13.2 11.1 (during vapor heat)

Corresponding process data taken during these emission tests are cummarized in Tables 2.0 and 3.0. Data pending confidential determination are maintained in the confidential files of the Emission Standards and Engineering Division, OAQPS, Research Triangle Park, North Carolina 27711.

Table 2.0 PROCESS DATA SHEET - CHAMPLIN PETROLEUM TEST
Emissions From Sulfur Plant Measured March 14-15, 1974

LOCATION: Wilmington, California
DATE: 3/14/74 OBSERVER: C. Sedman

Time	1600	1630	1700	1730	1800	1830	1900	1930	2000		
Acid gas to Claus, MSCFD	384	378	378	378	372	UPSET*	→	→	→		
Air to Claus, MSCFD	795	795	795	795	780						
Claus furnace temp, °F	1080	1080	1100	1100	1100						
H_2S/SO_2 ratio	2.4	2.8	3.2	2.8	2.6						
Amine flow rate, gpm	CONFIDENTIAL STATUS										
Fuel gas to reactor, SCFH											
Air to reactor, SCFH											
Reactor Temp: Inlet, °F	BEING DETERMINED										
Outlet, °F											
Absorber gas to Claus, SCFH											
Absorber gas to incin., SCFH	31500	33750	30750	30750	30750						

*Acid gas to Claus fluctuating between 324 and 456 MSCFD; entire system upset, ARCO cut off natural gas....fuel gas/acid gas increased to make up deficit.

Table 3.0 PROCESS DATA SHEET - CHAMPLIN PETROLEUM TEST
Emissions From Sulfur Plant Measured March 14-15, 1974

LOCATION: Wilmington, California
DATE: 3/15/74 OBSERVER: C. Sedman

Time	1000	1030	1100	1130	1200*	1230	1300	1330	1400	1430	1500**	1530
Acid gas to Claus, MSCFD	432	408	420	408	372	378	384	360	372	372	372	312
Air to Claus, MSCFD	915	870	900	855	780	795	780	750	780	780	780	660
Claus furnace temp, °F	1110	1120	1110	1110	1100	1100	1110	1100	1090	1090	1090	1090
H_2S/SO_2 ratio	3.6	3.0	2.8	2.2	2.6	3.0	2.5	2.1	2.8	3.6	3.2	2.5
Amine flow rate, gpm	CONFIDENTIAL STATUS											
Fuel gas to reactor, SCFH												
Air to reactor, SCFH												
Reactor Temp: Inlet, °F	BEING DETERMINED											
Outlet, °F												
Absorber gas to Claus, SCFH												
Absorber gas to incin., SCFH	37500	35000	33500	32250	30750	37500	37500	31500	30000	30000	27500	25000

*natural gas resumed
**began vapor heat of coker

4.0 LOCATION OF SAMPLING POINTS

The sampling points selected for emission tests at Champlin Petroleum Company's Wilmington, California refinery are shown in Figure 3.

The inlet sample location (outlet from the SCOT absorber) was used to obtain samples for the EPA van (gas chromatographic systems), sulfur dioxide, moisture, velocity, integrated bag, fixed gases (carbon monoxide, carbon dioxide and oxygen), Orsat and odor analysis panel. The sampling port at this point consisted of a 3/4" gate valve connected into the main 8" pipe between teh SCOT Absorber and the thermal oxidation unit.

The outlet sample location (after the thermal oxidation unit) was used to obtain samples for the same systems as the inlet. The presence of an existing sampling port, normally used by the manufacturer to monitor sulfur gas emissions, facilitated sampling of the outlet. This sampling port consisted of a 1 1/4" tee preceded by a shut-off valve.

No major problems were encountered in using these locations for sampling.

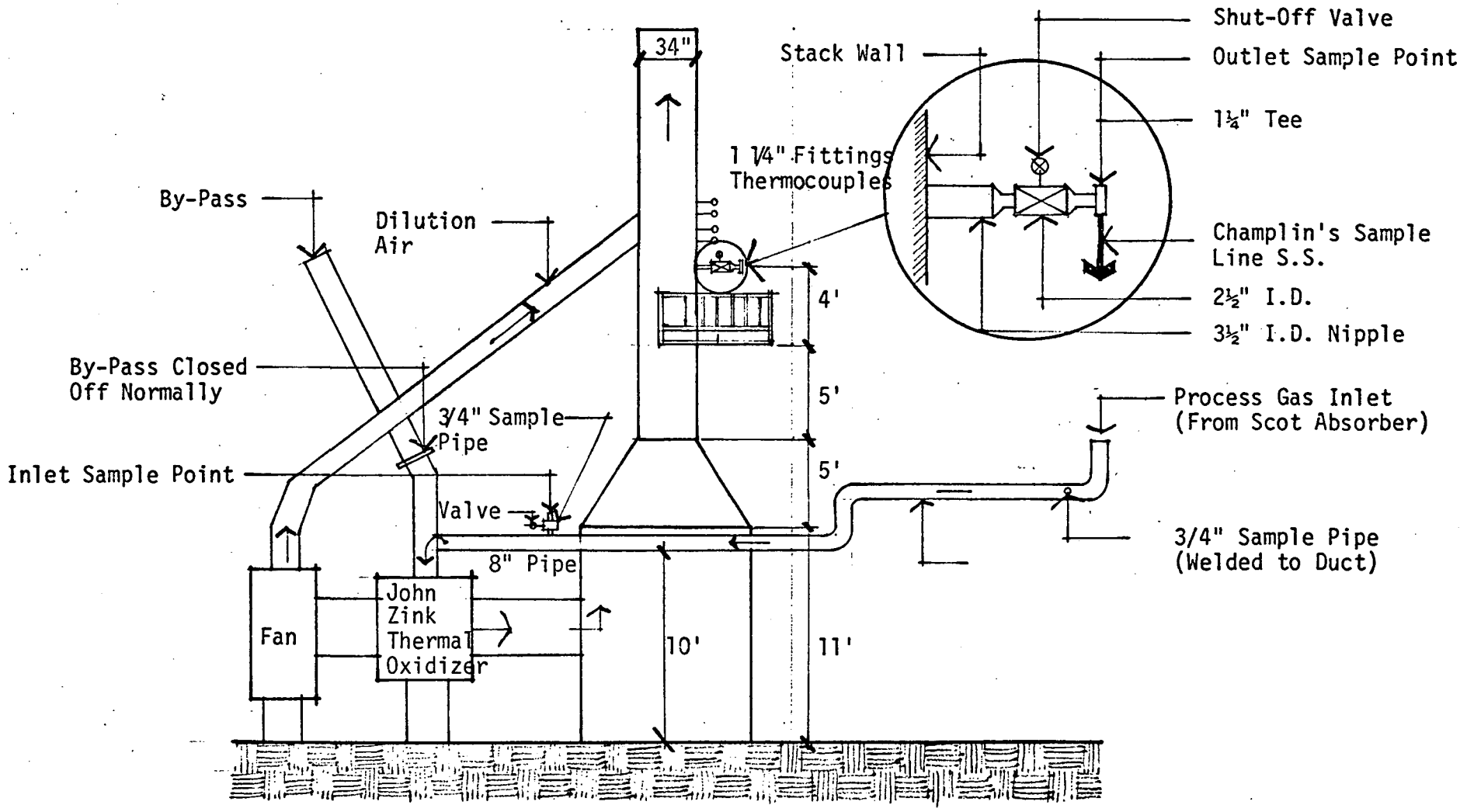


Figure 3. Schematic of sampling locations, Champlin Petroleum Company, Wilmington, California.

5.0 ANALYTICAL PROCEDURES

A brief summary of each procedure is presented in this section.

5.1 Sampling Procedures

Sample gases were extracted from the emission source for the determination of sulfur-containing compounds using a 3/16" FEP Teflon tubing sample line, heated and maintained at 100°C. This sample line terminated in the dilution manifold in the EPA mobile laboratory. Either direct or diluted sample could be withdrawn from the system as dictated by the analytical range of the instruments. The samples were simultaneously analyzed for total sulfur, carbon disulfide, sulfur dioxide, hydrogen sulfide and carbonyl sulfide. FEP Teflon parts or Teflon coated parts (including the sample pump heads) were used throughout the system to take advantage of the minimum reactivity of the Teflon to low level concentrations of sulfur compounds. Figures 4, 5, and 6. show the sample dilution system in the EPA mobile laboratory the sample handling system for CO, CO_2 and O_2, and a flow system for the sample from the source to the collection and analysis locations.

Sample gases for the determination of CO, CO_2 and O_2 were obtained from the EPA sample line and the concentrations of the gases were determined by instruments located in a truck adjacent to the EPA mobile laboratory. An integrated bag sample was obtained at the same source point as the EPA sample and this sample was used for NO_x analysis and Orsat determination of CO, CO_2 and O_2. NO_x and SO_2 were determined in situ in the mobile laboratories assembled by ESE.

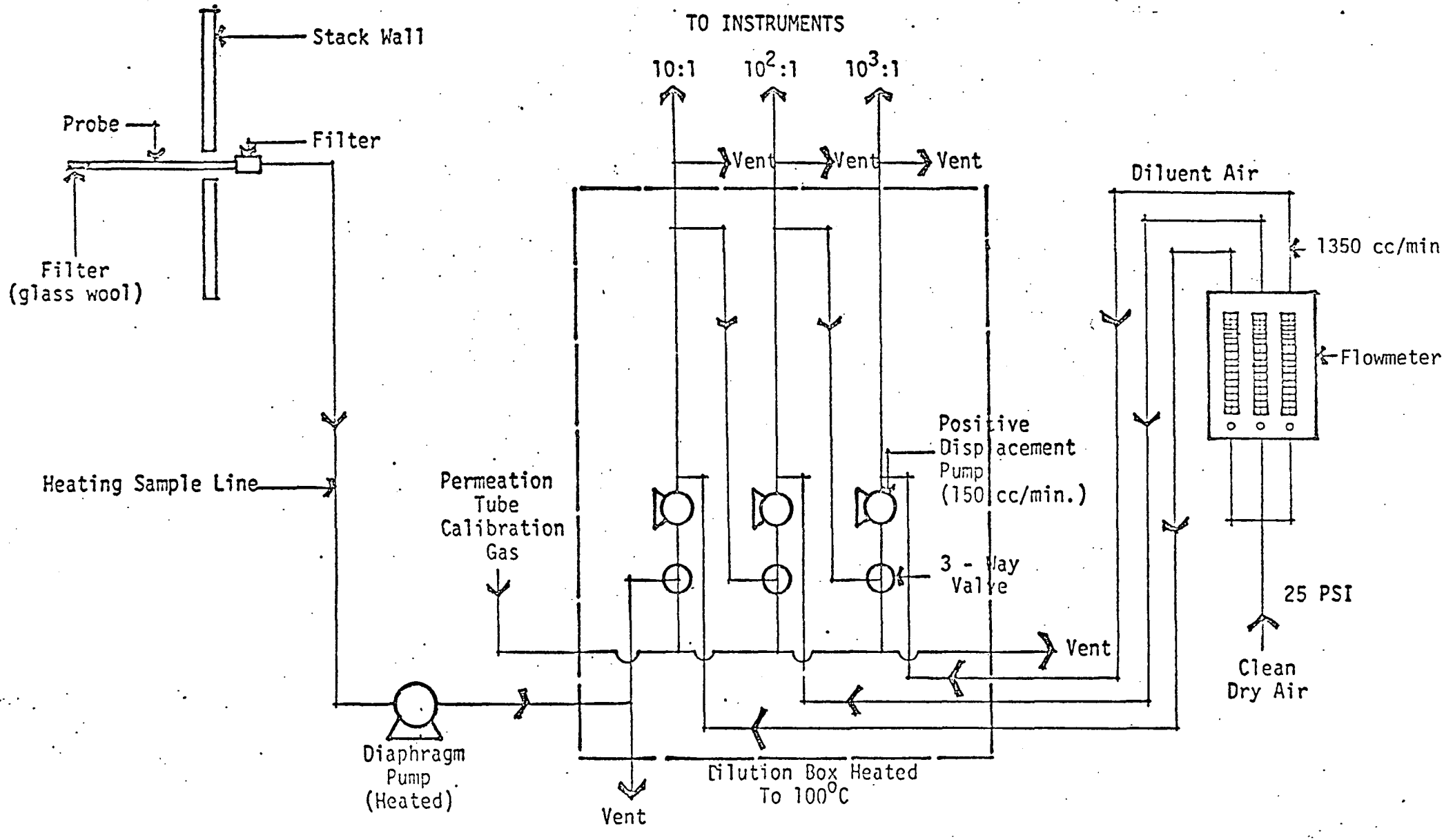


Figure 4.0. Sample Dilution System in EPA Mobile Laboratory

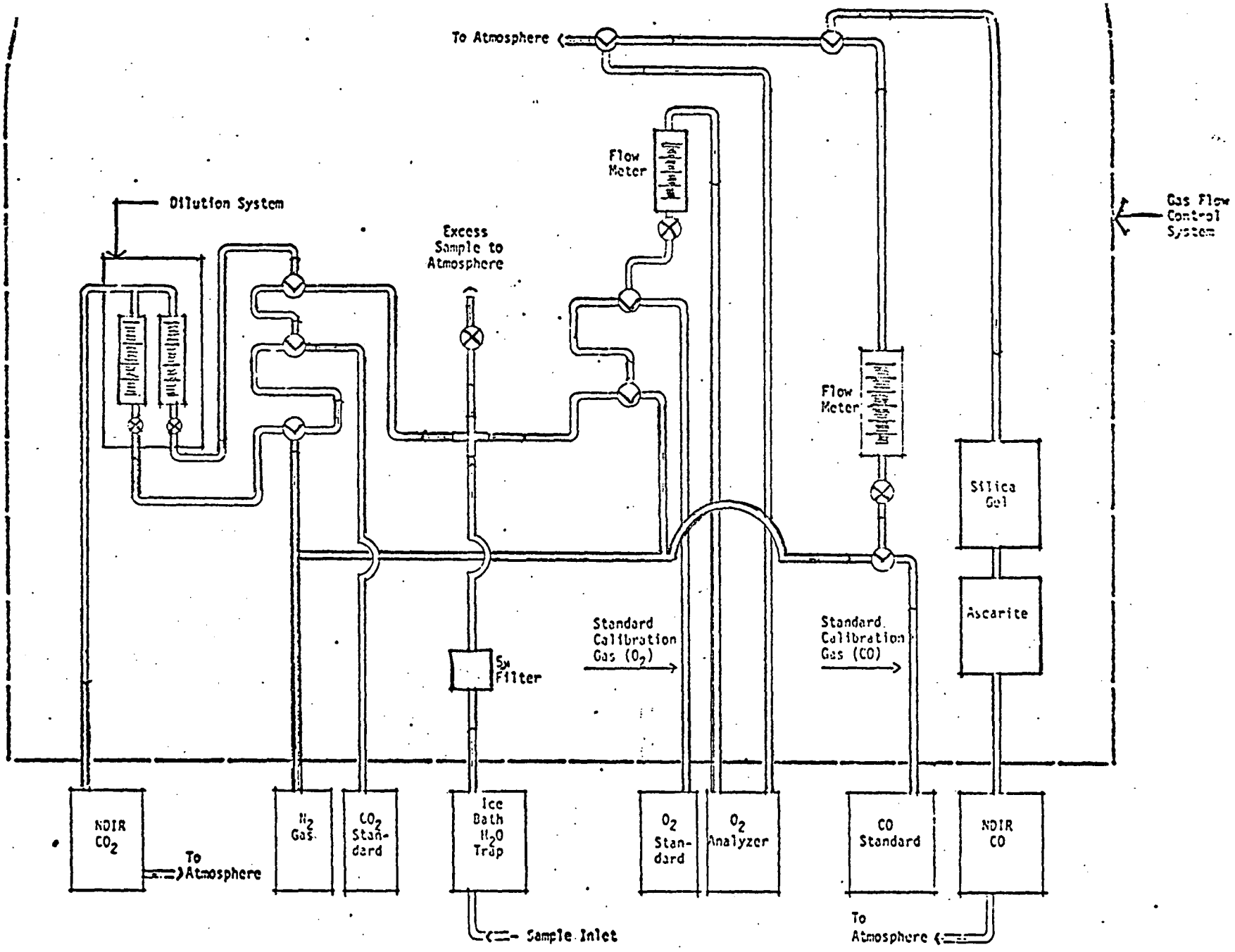


Figure 5.0. . Schematic of sampling system for CO_2, CO, and O_2.

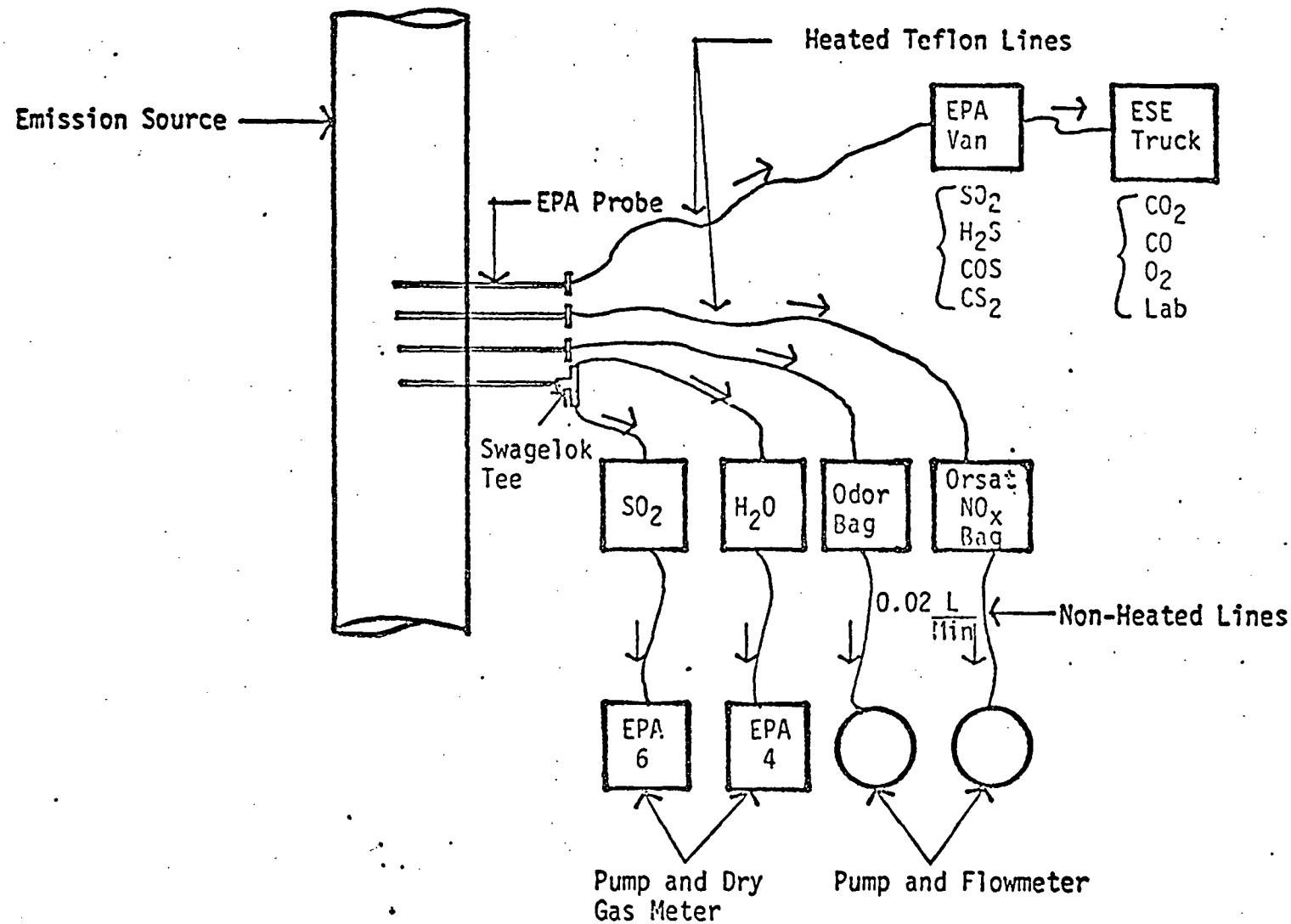


Figure 6.0. Schematic of sampling systems.

5.2 Analytical Procedures for Sulfur Compounds

Sulfur compounds were measured by gas chromatography and by wet chemical methods. The analytical methods for the various sulfur compounds are described in the following paragraphs.

5.2.1 Sulfur compounds by Gas Chromatography

Sulfur compounds, when introduced into a hydrogen-rich flame, produce strong luminescent emissions between 300 and 423 nm. Through the use of a narrow band optical filter that permits transmission at 394 nm, a flame photometric detector (FPD) can measure the chemiluminescent emissions produced by the S_2 species and can differentiate between sulfur containing and non-sulfur containing compounds. Through the use of a gas chromatograph (GC) equipped with the appropriate analytical columns, it is possible to separate and quantify the various sulfur compounds.

Applicability of Method

The compounds of interest in emissions from sulfur recovery systems are hydrogen sulfide (H_2S), carbon disulfide (CS_2), sulfur dioxide (SO_2) and carbonyl sulfide (COS).

The two GC/FPD systems available in the EPA mobile laboratory are capable of the separation and quantitation of all of the compounds

of interest with the exception that COS and H_2S could not be determined simultaneously on any one system due to the relatively small difference in the retention times and the relatively large differences in concentration which results in the overlap of peaks. The difficulty presented by the H_2S - COS separation and determination was overcome through the use of a scrubbing system which effectively removes one component (H_2S) from the sample. Silver wool, which reacts readily with H_2S, was installed in one of the GC systems between the sample loop and the analytical column. Removal of the H_2S makes possible the determination of COS while the other system determines H_2S + COS. The difference between the two systems gives the H_2S concentration.

Instrumentation and Standards

GC/FPD System - The system provided in the EPA mobile laboratory was assembled from components available from various commercial sources.

Sulfur Compound Permeation Tubes - Provided by EPA and gravimetrically calibrated by EPA personnel.

Analysis of Samples

The sample gas was extracted from the test source and diluted with clean, dry, sulfur-free air in the dilution system. Diluted sample was continuously flowed through the sample loop and injected at fifteen minute intervals throughout the test. The fifteen minute interval was selected due to the retention time of CS_2.

Responses obtained from each compound were compared to the standard curve for that component and the concentrations were determined. In the series of tests conducted, two GC/FPD systems were utilized. GC#1 was equipped with a scrubbing system and was used for a direct determination of COS concentration. GC#2 was used to determine SO_2, CS_2 and H_2S was determined on GS#2 by subtracting the COS concentration. The analytical methods used for the analysis of sulfur compounds in this series of tests were the same as described in an EPA preliminary draft method entitled "Semicontinuous Determination of Malodorous Reduced Sulfur Emissions From Stationary Sources." Example calculations for the determination of H_2S by difference are given in Appendix A.

5.2.2 Total Sulfur by the Meloy Analyzer

The detection system of this instrument is the same as for the gas chromatograph. The major difference between the two systems is that no analytical column is present to effect a separation of the various sulfur compounds. Another difference between the systems is that sulfur compounds in the sample gas are oxidized to sulfur dioxide by passage through a tube furnace maintained at 1500°C in the presence of excess oxygen before entering the Meloy Analyzer. The principle of the method and the applicability, however, are the same for the two systems.

Instrumentation and Standards

Detector System - Meloy Sulfur Analyzer, Model 160SA

Oxidation System - Lindberg Hevi - Duty Tube Furnace, Model 55035

Calibration Standards - Permeation tubes provided by and gravimetrically calibrated by EPA personnel.

Analysis of Samples

The sample was obtained from the test source and diluted with clean, dry, sulfur-free air in the dilution system. Diluted sample was flowed through the tube furnace and into the Meloy Analyzer. A continuous read-out of total sulfur concentration was displayed on a strip chart recorder. Comparison of the recorder response with the analytical curve obtained by plotting response versus concentration gave the total sulfur (as SO_2) concentration presence in the sample stream at any given point in time.

5.2.3 Titrimetric Method for the Determination of Sulfur Dioxide

Sulfur dioxide was oxidized to sulfate in the presence of hydrogen peroxide according to EPA Method 6 as outlined in the Federal Register, Vol. 36, No. 59, Part II, August 17, 1971. The sulfate which was formed and collected was subsequently titrated with a standardized solution of barium perchlorate in the presence of thorin indicator, and the sulfur dioxide concentration was calculated.

5.3 Analytical Procedures for Carbon Monoxide, Carbon Dioxide and Oxygen. Carbon monoxide, carbon dioxide and oxygen were monitored continuously from the source during the three four-hour tests. The sample was obtained as described in section 5.1.

Instrumentation and Standards

Carbon Dioxide - Beckman Model 315A NDIR configured for 0-5% carbon dioxide.

Carbon Monoxide - Beckman Model 315B NDIR configured for 0-1000 ppm carbon monoxide.

Oxygen - Beckman Model F-3, paramagnetic oxygen analyzer capable of measuring 0-25% oxygen.

Standard Gases - Obtained from Matheson Gas Products, Inc., Cucamonga, California. All standards were either primary or certified and were analyzed by Matheson Gas Products, Inc. All standards consisted of the component of interest with the balance of the mixture as nitrogen.

Analysis of Samples

The sample gas was extracted from the test source and flowed through the instruments. In the case of the carbon dioxide the sample was diluted with clean, dry, carbon-dioxide free nitrogen in order to maintain the concentration within the operating range of the instrument. A schematic of the instrument flow system is presented as Figure 5.

Responses obtained from the instrument were displayed on a strip chart recorder and these responses were compared to the appropriate standard curve to obtain the concentrations of the different constitutents.

EPA Method 10 (Federal Register, 39, No. 47, March 8, 1974) was used as a guideline in the determination of carbon monoxide concentrations.

5.4 Determination of Hydrocarbons by Flame Ionization

Hydrocarbons (as methane, CH_4) were measured by a flame ionization detector according to the instruction manual as provided by the manufacturer. Sample gas was obtained from the dilution system in the EPA Mobile Laboratory and diluted as necessary to maintain the concentration within the operating range of the instrument.

Instrumentation and Standards

Hydrocarbons - Beckman Model 400 Total Hydrocarbon Analyzer with a range of 0 - 1000 ppm hydrocarbons as methane.

Standard Gases - obtained from Matheson Gas Products, Inc., Cucamonga, California. The standards consisted of methane in air and concentrations were certified and analyzed by Matheson Gas Products, Inc.

5.5 Analytical Procedure for Nitrogen Oxides

Nitrogen oxides were measured according to EPA Method 7 (Federal Register, 39, No. 47, March 8, 1974). A portion of the contents of the integrated bag sample was collected in an evacuated flask which contained sulfuric acid and hydrogen peroxide. After the oxides of nitrogen had been oxidized to nitrate, the nitrate was reacted with phenoldisulfonic acid and a spectrophotometric method was used to determine concentration.

5.6 Procedure for the Determination of Moisture

The moisture content was measured in accordance with EPA Method 4 which appeared in Federal Register, 36, No. 59, Part II, August 17, 1974.

5.7 Procedure for the Determination of Stack Gas Velocity

The stack gas velocity was determined after sample and velocity traverse points were located. EPA Method 1 and 2 as they appeared in Federal Register, 36, No. 59, Part II, August 17, 1974 were used for these determinations.

5.8 Procedure for the Determination of Visible Emissions

EPA Method 9, as outlined in the Federal Register, 36, No. 247, Part II, December 23, 1971 was used as the guideline in the determination of visible emissions. A certified observer was used to observe emissions from the sample source.

5.9 Carbon Dioxide, Oxygen and Carbon Monoxide by Orsat

Orsat determinations were made on the integrated bag sample in accordance with EPA Method 3 which appeared in Federal Register, 36, No. 247, Part II, December 23, 1971.

5.10 Analytical Method for Odor Emissions

The Determination of Odor Potential from Stationary Sources (Dilution Method), an EPA draft method, was used as a guideline for the odor emissions portion of the report. This method is based on the fact that

the human olfactory sense is very perceptive to trace quantities of odorous compounds and that by standardizing the selection of the odor panel, methods of dilution of sample gas, etc., odor potentials may be determined.

Selection of the Odor Panel

Students from a local high school were selected by conducting a screening test as outlined in Figure 7.0. In the screening test the potential panel members were required to identify the odd sample in each set of 3. Sample concentrations ranged from 1% to .001% of vanilla extract and methyl salicylate in benzyl benzoate. Additional information on the screening test is found in Section A-11 of Appendix A.

Collection and Analysis of Samples

The samples for odor analysis were collected in the apparatus shown in Figure 8.0.

Analysis of Samples

The samples were collected at each site as prescribed by the product officer. The teflon bags containing the samples were transported to the high school by the personnel responsible for the analysis. The samples were diluted with clean, dry, odor-free air and analyzed by the panel on a detectable, non-detectable basis. Blank sample (clean, dry, odor-free air) were given to the panel periodically to insure the integrity of the odor panel procedure.

The data obtained were plotted on log probability paper and the best line through the plotted data was determined by the method of least squares. The odor concentration for each sample was used to calculate the odor emission rate according to the equation E = CVA, where:

E = odor emission rate, odor units/minute

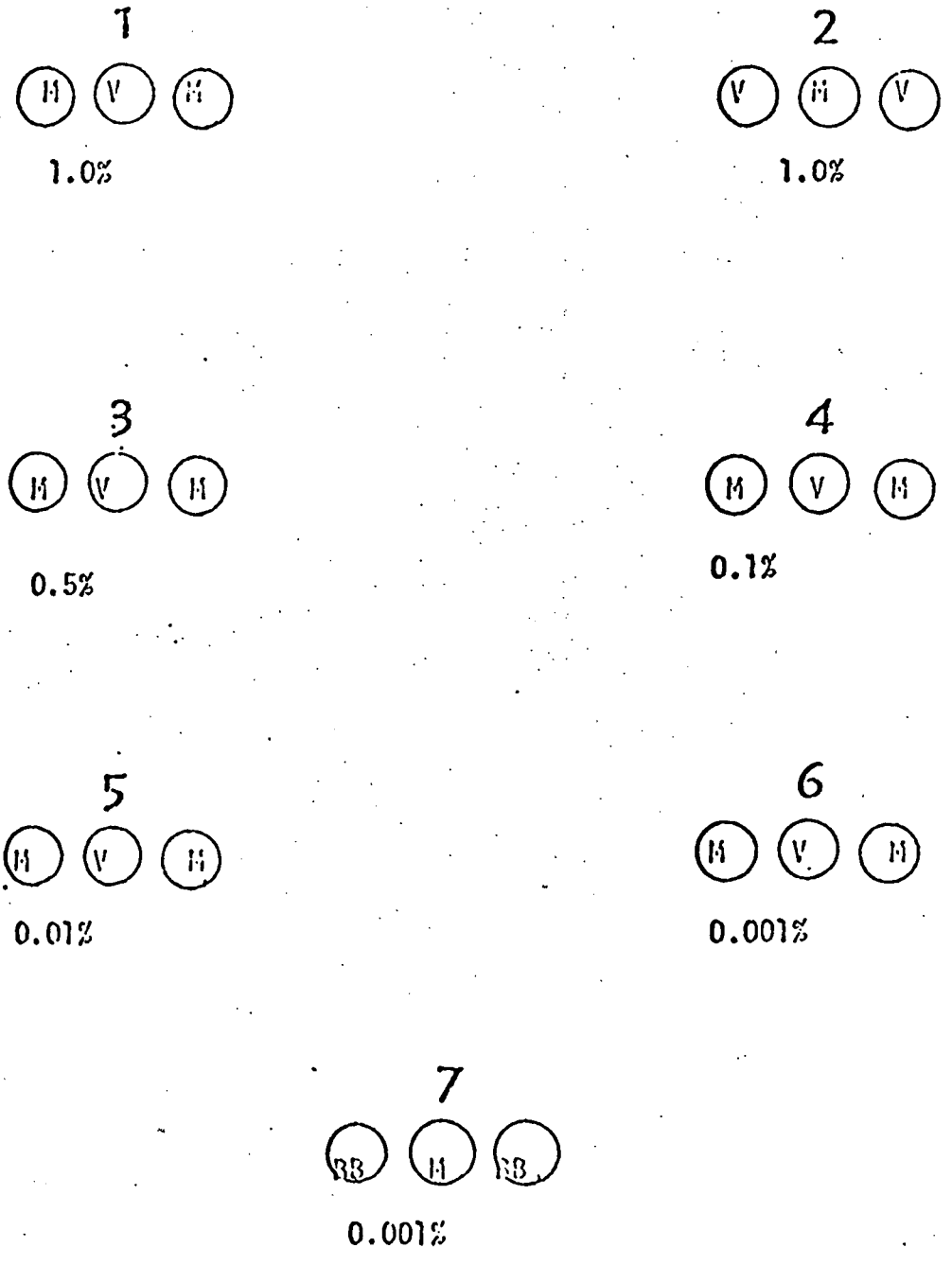
C = odor concentration, odor units/SCF

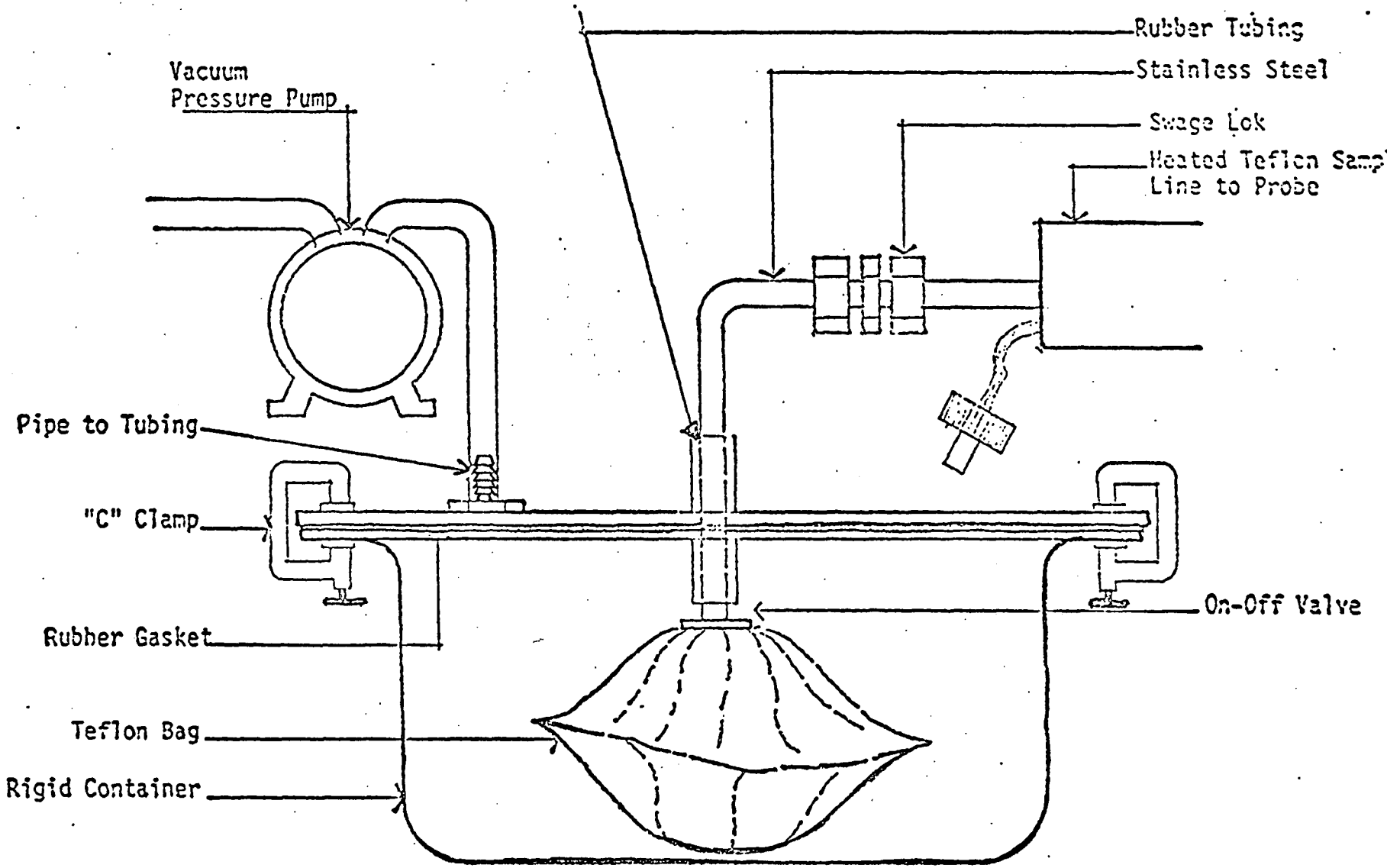
V = velocity of source, feet/minute

and A = cross-sectional area of the stack, square feet.

FIGURE 7.0

Layout of Screening Test
V=Vanilla Extract M= Methyl Salicyate
BB= Benzyl Benzoate





Sampling Bag Assembly
Figure 8.0

A P P E N D I X A

COMPLETE EMISSION TEST RESULTS

WITH SAMPLE CALCULATIONS

A-1 CALCULATIONS

A.1.1. General Calculations

A.1.1.1. Flow Rate

Q_{STPD} = flow rate dry in DNM^3/min

$$Q_{STPD} = \left(\frac{V, ft}{min}\right)(A, ft^2)(F)\left(\frac{530}{T_s+460}\right)\left(\frac{D_s}{29.92}\right) \times 2.832 \times 10^{-2}\frac{m^3}{ft^3}$$

where V = stack velocity in ft/min,

A = stack area in ft^2,

F = fraction of dry air

T_s = stack temperature in degrees F,

and P_s = stack pressure in inches of Hg

A.1.1.2. Emission Rate in gms/hr

$$gms/hr = \left[ppmv \times \frac{mw}{24.45}\left(\frac{mg}{m^3}\right)\right] \times \text{flow rate}\left(\frac{m^3}{min}\right) \times \frac{60\ min}{hr} \times \frac{1\ gm}{1000\ mg}$$

$$= ppmv \times mw \times \text{flow rate} \times 2.453 \times 10^{-3}$$

A.1.1.3. Conversion From Wet to Dry Gas Basis

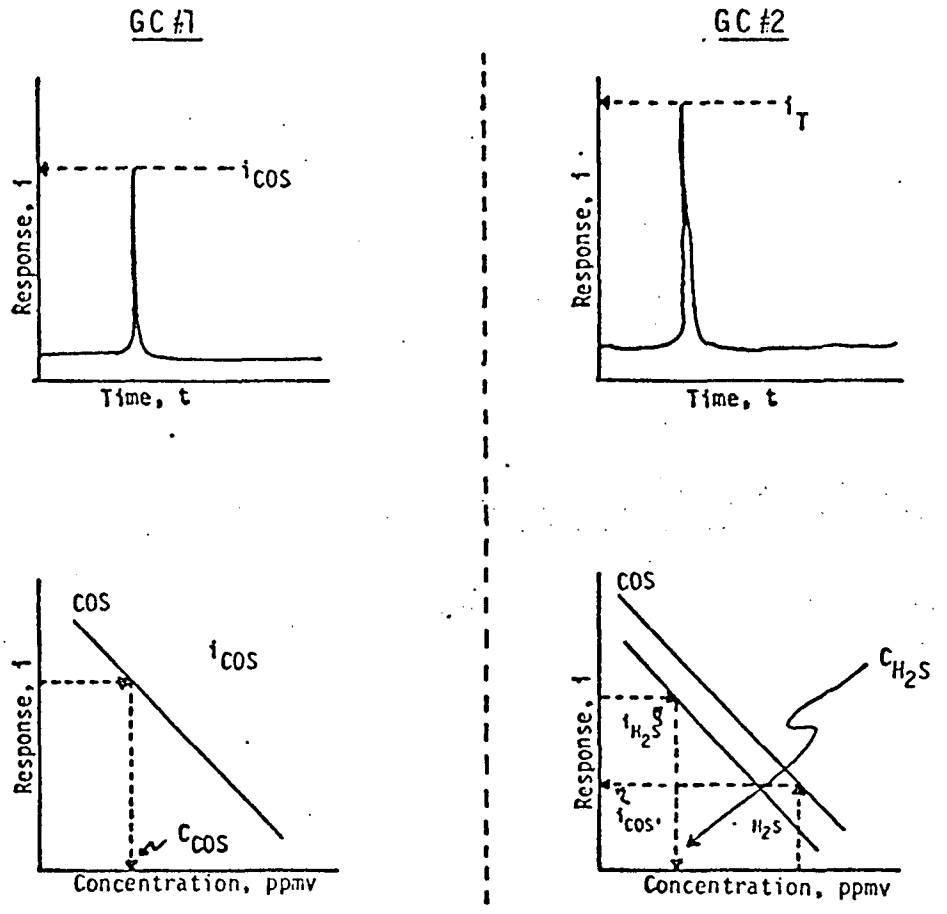
$$ppmv\ dry = \frac{ppmv\ wet}{\text{fraction of dry air}} = \frac{ppmv\ wet}{1\text{-moisture fraction}}$$

A.1.2. Specific Calculations

A.1.2.1. Sulfur Compounds by G.C.

The individual sulfur compounds (with the exception of H_2S) were determined directly from a standard curve.

A.1.2.2 Hydrogen Sulfide Determination by Difference (G.C.)



a. Calibration plots were prepared on GC#1 for COS and GC#2 for H_2S and COS.

b. The response for COS (i_{COS}) and for COS + H_2S (i_T) were determined for each injection sample.

c. The COS concentration (C_{COS}) was determined from the calibration curve for GC#1 and subsequently converted to an equivalent response for GC#2 ($i_{COS'}$).

d. The equivalent COS response ($i_{COS'}$) was subtracted from i_T to determine the H_2S response (i_{H_2S}).

e. Using i_{H_2S}, the hydrogen sulfide concentration (C_{H_2S}) was determined from the calibration curve.

A.1.2.3. Total Sulfur Calculations from G.C. Data

$S_{total\ as\ SO_2}$ = (ppmv SO_2) + (ppmv H_2S) + (ppmv COS) + 2(ppmv CS_2)

e.g. at 1635 hrs on 14 March 1974

$S_{total\ as\ SO_2}$ = 7.6 + 240 + 146 + 2(1.6) = 396.8 = 400 ppmv as SO_2

A.1.3. Calculations for NO_x, CO_2, O_2, CO, SO_2 and moisture are found in the raw data sheets in Appendix B.

A.1.4. Gas Chromatograph Dilution Factor

$$\text{Dilution Factor (D.F.)} = \frac{\text{Concentration before dilution}}{\text{Concentration determined after dilution}}$$

Test #1 $\quad D.F. = \frac{0.44}{0.040} = 11.0$

Test #2 $\quad D.F. = \frac{2.2}{0.22} = 10.0$

AVERAGE DILUTION FACTOR - $\frac{11.0 + 10.0}{2} = 10.5$

SULFUR COMPOUNDS BY GAS CHROMATOGRAPHY

CHAMPLIN PETROLEUM

14 MARCH 1974

WILMINGTON, CALIFORNIA

Source	Time	COS(1), ppmv	H_2S(1), ppmv	SO_2(1), ppmv	CS_2(1), ppmv	Total S as SO_2(1), ppmv ***
Outlet	1620	18.0	--	220	<1.7	240
Inlet	1635	146*	240	7.6	1.6	400
"	1650	12.3	180	<10	1.6	190
"	1700	12.3	150	<10	<10	160
"	1710	15.7	190	<10	<10	210
"	1721	20.3	250	<10	<10	270
"	1730	18.0	350	<10	<10	370
"	1740	25.9	510	<10	<10	580
"	1750	15.7	340	<10	<10	360
"	1800	13.5	--	<10	<10	--
"	1805	31.5	220	<10	<10	250
"	1810	15.7	290	<10	<10	310
"	1815	22.5	280	<10	<10	300
"	1820	39.4	210	<10	<10	250
"	1825	65.2	620	<10	<10	690
"	1830	20.2	300	<10	<10	320
"	1835	46.1	210	<10	<10	260
"	1840	25.9	220	<10	<10	260

Continued

Source	Time	COS(1) ppmv	H_2S(1) ppmv	SO_2(1) ppmv	CS_2(1) ppmv	Total S as SO_2(1), ppmv ***
Inlet	1845	31.5	190	<10	<10	230
"	1850	25.9	390	<10	<10	420
Inlet—Maximum		146	620	<10	<10	690
Inlet—Minimum		12.3	150	<10	<10	160
Inlet—Mean		25.4	290	7.6**	1.6	320
Outlet—Maximum		18.0**	--**	220**	< 1.7**	240**
Outlet—Minimum		18.0**	--**	220**	< 1.7**	240**
Outlet—Mean		18.0**	--**	220**	< 1.7**	240**

(1) All values reported on a dry gas basis.

* considered non-representative

** based on one observation only

*** does not include indeterminate value

SULFUR COMPOUNDS BY GAS CHROMATOGRAPHY

CHAMPLIN PETROLEUM

15 MARCH 1974

WILMINGTON, CALIFORNIA

Source	Time	COS(1), ppmv	H_2S(1), ppmv	SO_2(1), ppmv	CS_2(1), ppmv	Total S as SO_2 (1), ppmv *
Inlet	1010	55.4	470	<11.5	<11.5	530
"	1020	69.3	460	<11.5	<11.5	530
"	1030	54.3	520	<11.5	<11.5	570
"	1040	60.0	980	<11.5	<11.5	1040
"	1050	104	730	<11.5	<11.5	830
"	1100	56.6	510	<11.5	<11.5	570
"	1110	48.5	570	<11.5	<11.5	620
"	1120	--	--	--	--	--
"	1130	85.5	680	<11.5	<11.5	760
"	1140	55.4	510	<11.5	<11.5	570
"	1151	38.1	350	<11.5	<11.5	390
"	1200	38.1	350	<11.5	<11.5	390
"	1210	40.4	380	<11.5	<11.5	420
"	1220	42.7	440	<11.5	<11.5	480
"	1231	50.8	460	<11.5	<11.5	510
"	1241	30.0	--	--	--	--
"	1250	--	--	--	--	--
"	1300	280**	1500**	--	--	1780**
"	1310	68.1	570	<11.5	<11.5	640
"	1320	78.5	620	<11.5	<11.5	700
"	1330	79.7	840	<11.5	<11.5	920

Continued

Source	Time	COS(1), ppmv	H_2S(1), ppmv	SO_2(1), ppmv	CS_2(1), ppmv	Total S as SO_2 (1), ppmv *
Inlet	1340	104	810	<11.5	<11.5	910
"	1350	50.8	480	<11.5	<11.5	530
"	1400	45.0	480	<11.5	<11.5	520
Outlet	1410	63.6	71	140	<11.5	270
"	1420	66.8	67	130	<11.5	260
"	1430	56.1	56	118	<11.5	230
"	1440	37.7	38	84	<11.5	160
	Maximum	280**	1500**	<11.5	<11.5	1780**
Inlet	Minimum	30.0	350	<11.5	<11.5	390
	Mean	59.8	560	<11.5	<11.5	620
	Maximum	66.8	71	140	<11.5	270
Outlet	Minimum	37.7	38	84	<11.5	160
	Mean	56.0	58	118	<11.5	230

(1) All values reported on a dry gas basis

* Does not include indeterminate values for SO_2 or CS_2

** Considered non-representative

Carbon Monoxide (NDIR)
Carbon Dioxide (NDIR)
Oxygen (Paramagnetic)

CHAMPLIN PETROLEUM COMPANY

14 MARCH, 1974

WILMINGTON, CALIFORNIA

SOURCE	TIME	CO (ppm) (1)	CO_2 (%) (1)	O_2 (%) (1)
Inlet	1620-1635	45	4.9	0
"	1635-1650	39	4.9	0
"	1650-1705	39	4.9	0
"	1705-1720	47	4.9	0
"	1720-1735	37	5.0	0
"	1735-1750	31	5.0	0
"	1750-1805	30	4.7	0
"	1805-1820	18	4.9	0
"	1820-1835	16	4.8	0
MAXIMUM		55	5.2	0
MINIMUM		12	4.6	0
MEAN		29	4.9	0

(1) All values reported on a dry gas basis.

Carbon Monoxide (NDIR)
Carbon Dioxide (NDIR)
Oxygen (Paramagnetic)

CHAMPLIN PETROLEUM COMPANY

15 MARCH, 1974

WILMINGTON, CALIFORNIA

SOURCE	TIME	CO, ppmv (1)	CO_2, % (1)	O_2, % (1)
Inlet	1000-1015	18	5.8	0
"	1015-1030	10	5.8	0
"	1030-1045	20	5.8	0
"	1045-1100	28	5.7	0.1
"	1100-1115	23	5.7	0.1
"	1115-1130	13	5.4	0.2
"	1130-1145	17	5.6	0.3
"	1145-1200	16	5.5	0.3
"	1200-1215	8	5.5	0.4
"	1215-1230	6	5.4	0.5
"	1230-1245	8	5.4	0.5
"	1245-1300	8	5.4	0.5
"	1300-1315	4	5.7	0.5
"	1315-1330	6	5.5	0.5
"	1330-1345	4	5.7	0.7
"	1345-1400	3	5.7	0.7
	MAXIMUM	46	5.9	0.7
	MINIMUM	23	5.0	0
	MEAN	12	5.6	0.3

(1) All values reported on a dry gas basis

Carbon Monoxide (NDIR)
Carbon Dioxide (NDIR)
Oxygen (Paramagnetic)

CHAMPLIN PETROLEUM COMPANY

15 MARCH, 1974

WILMINGTON, CALIFORNIA

SOURCE	TIME	CO(ppmv)	CO_2,(%)	O_2,(%)
Outlet	1400-1415	1100	4.3	12
"	1415-1430	1100	4.5	11.9
"	1430-1445	1090	4.2	12
MAXIMUM		1120	4.7	12.2
MINIMUM		1080	4.1	11.7
MEAN		1100	4.3	12

HYDROCARBONS AS METHANE (CH_4) BY FLAME IONIZATION

CHAMPLIN PETROLEUM COMPANY

15 MARCH 1974

WILMINGTON, CALIFORNIA

Source	Time	Mean, ppmv CH_4(1)	Source	Time	Mean, ppmv CH_4(1)
Inlet	1627	7.1	Inlet	1807	7.6
"	1632	7.6	"	1812	7.8
"	1637	7.4	"	1817	7.5
"	1642	7.3	"	1822	7.4
"	1647	7.4	"	1827	7.4
"	1652	8.4	"	1832	7.4
"	1657	8.3	"	1837	7.5
"	1702	7.8	"	1842	7.8
"	1707	7.5	"	1847	8.0
"	1712	7.3	"	1852	8.4
"	1717	7.1	"	1857	7.3
"	1722	6.9	"	1902	6.6
"	1727	7.0	"	1907	6.4
"	1732	8.0	"	1912	5.8
"	1737	8.9	"	1917	6.2
"	1742	9.0	"	1922	5.9
"	1747	8.5	"	1927	5.9
"	1752	8.0	"	1932	6.3
"	1757	7.4			
"	1802	7.1			

Inlet	Maximum	9.0
	Minimum	5.8
	Mean	7.4

(1) All values reported on a dry gas basis.

HYDROCARBONS AS METHANE (CH_4) BY FLAME IONIZATION

CHAMPLIN PETROLEUM COMPANY

15 MARCH 1974

WILMINGTON, CALIFORNIA

Source	Time	Mean, ppmv as CH_4 (1)	Source	Time	Mean, as ppmv CH_4 (1)
Inlet	1015	13	Inlet	1205	12
"	1020	13	"	1210	11
"	1025	13	"	1215	9.9
"	1030	13	"	1220	11
"	1035	13	"	1225	11
"	1040	12	"	1230	11
"	1045	11	"	1235	14
"	1050	11	"	1240	13
"	1055	11	"	1245	12
"	1100	11	"	1250	12
"	1105	11	"	1255	12
"	1110	11	"	1300	11
"	1115	11	"	1305	11
"	1120	11	"	1310	12
"	1125	12	"	1315	13
"	1130	13	"	1320	13
"	1135	13	"	1330	15
"	1140	13	"	1135	14
"	1145	15	"	1340	14
"	1150	15	"	1345	14
"	1155	14	"	1350	14
"	1200	12	"	1355	14
			"	1400	11
Outlet	1405	15			
"	1410	11			
"	1415	14			

Source	Time	Mean, ppmv as CH_4(1)
Outlet	1420	14
"	1425	13
"	1430	14
"	1435	20
"	1440	21
"	1445	24
"	1450	18
"	1455	12

	Maximum	Minimum	Mean
Inlet, as ppmv CH_4	15	10	12
Outlet, as ppmv CH_4	24	11	16

(1) All values reported on a dry gas basis.

A-5

TOTAL SULFUR (AS SO_2) USING MELOY SULFUR ANALYZER

CHAMPLIN PETROLEUM COMPANY

14 MARCH 1974

WILMINGTON, CALIFORNIA

Time	Maximum ppmv as SO_2(1)	Minimum ppmv as SO_2(1)	Mean ppmv as SO_2(1)
1810	580	250	410
1820	450	230	340
1830	940	230	580
1840	1300	240	760
1850	600	230	410
1900	620	300	460

Inlet	(Maximum	1300	ppmv as SO_2
	(Minimum	210	" " "
	(Mean	490	" " "

(1) All values reported here on a dry gas basis.

TOTAL SULFUR (AS SO_2) USING MELOY SULFUR ANALYZER

CHAMPLIN PETROLEUM COMPANY

15 MARCH 1974

WILMINGTON, CALIFORNIA

Source	Time	Maximum ppmv as SO_2(1)	Minimum ppmv as SO_2	Mean ppmv as SO_2(1)
Inlet	1020	670	420	550
"	1040	1100	550	830
"	1050	860	520	680
"	1100	920	390	660
"	1110	750	460	610
"	1120	650	410	530
"	1130	690	390	540
"	1140	620	410	510
"	1150	650	350	510
"	1200	500	330	420
"	1210	550	390	460
"	1220	650	370	510
"	1230	880	460	670
"	1240	670	240	460
"	1250	1500	250	900
"	1300	<1500	1200	--
"	1310	1200	540	880
"	1320	630	350	480
"	1330	1100	470	770
"	1340	1100	470	790
"	1350	960	440	700
"	1400	810	440	630
Outlet	1410	230	150	200
"	1420	200	160	180
"	1430	180	130	160
"	1440	140	87	110

Continued

Source	Time	Maximum ppmv as SO_2(1)	Minimum ppmv as SO_2	Mean ppmv as SO_2(1)
Inlet	Maximum	<1500 ppmv as SO_2		
	Minimum	240 " " "		
	Mean	630 " " "		
Outlet	Maximum	230 ppmv as SO_2		
	Minimum	140 " " "		
	Mean	160 " " "		

(1) All values reported on a dry gas basis

SULFUR DIOXIDE
EMISSION DATA
EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - INLET*

Run No.	2-*A*	2-*B*	
Date	3/1/74	3/1/74	
Time of Sample	10:40	1:05 - 2:50	
Barometric Pressure, "HG	30	30	
Stack Pressure, "HG	30	30	
Final Meter Reading, FT^3	142.85	144.53	
Initial Meter Reading, FT^3	141.46	143.03	
Average Meter Temp. $^\circ F$	87	90	
Average Stack Temp. $^\circ F$	90	90	
Gas Volume Sampled, FT^3, VSTPD *	1.3553	1.4513	
SO_2 Conc., LB/FT^3 (CSO)	$3.5844E^{-}7$	$4.3954E^{-}7$	
SO_2 Conc., P.P.M. (PPM)	2.1655	2.6555	

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = \left(7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}\right) \frac{(VT\text{-}VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE
EMISSION DATA
EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - INLET*

Run No.	3-A		
Date	3/1/74		
Time of Sample	6:40		
Barometric Pressure, "HG	30		
Stack Pressure, "HG	30		
Final Meter Reading, FT^3	146.19		
Initial Meter Reading, FT^3	145.26		
Average Meter Temp. °F	90		
Average Stack Temp. °F	230		
Gas Volume Sampled, FT^3, VSTPD *	0.90244		
SO_2 Conc., LB/FT^3 (CSO)	$6.1314E^{-}6$		
SO_2 Conc., P.P.M. (PPM)	37.043		

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = \left(7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}\right) \frac{(VT-VTB)(N)\left(\frac{Vsoln}{VA}\right)}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE

EMISSION DATA

EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - OUTLET*

Run No.	2-A	2-B	
Date	3/1/74	3/1/74	
Time of Sample	11:10 - 13:10	13:35 - 15:35	
Barometric Pressure, "HG	30	30	
Stack pressure, "HG	30	30	
Final Meter Reading, FT^3	88.9	90.32	
Initial Meter Reading, FT^3	87.4	89.1	
Average Meter Temp. °F	74	75	
Average Stack Temp. °F	1040	1040	
Gas Volume Sampled, FT^3, VSTPD *	1.4927	1.2118	
SO_2 Conc.,LB/FT^3 (CSO)	$7.889E^{-}7$	$1.3193E^{-}5$	
SO_2 Conc., P.P.M. (PPM)	4.7662	79.707	

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = (7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}) \frac{(VT\text{-}VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE
EMISSION DATA
EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - OUTLET*

Run No.	3-A	3-B	
Date	3/1/74	3/1/74	
Time of Sample	4:15-6:15	6:35-6:50	
Barometric Pressure, "HG	30	30	
Stack pressure, "HG	30	30	
Final Meter Reading, FT^3	92.115	92.631	
Initial Meter Reading, FT^3	90.5	92.3	
Average Meter Temp. °F	87	87	
Average Stack Temp. °F	1020	1020	
Gas Volume Sampled, FT^3, VSTPD *	1.569	0.32157	
SO_2 Conc., LB/FT^3 (CSO)	$8.6315E^{-5}$	0.00014113	
SO_2 Conc., P.P.M. (PPM)	521.47	852.66	

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = (7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}) \frac{(VT\text{-}VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE
EMISSION DATA
EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - INLET*

Run No.	4-A		
Date	3/14/74		
Time of Sample	16:00-18:30		
Barometric Pressure, "HG	30		
Stack pressure, "HG	30		
Final Meter Reading, FT^3	159.49		
Initial Meter Reading, FT^3	157.1		
Average Meter Temp. $^\circ F$	85		
Average Stack Temp. $^\circ F$	94		
Gas Volume Sampled, FT^3, VSTPD *	2.3295		
SO_2 Conc.,LB/FT^3 (CSO)	$7.7235E^{-7}$		
SO_2 Conc., P.P.M. (PPM)	4.6662		

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = (7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}) \frac{(VT\text{-}VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE
EMISSION DATA
EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY UNIT - OUTLET*

Run No.	4-A		
Date	3/14/74		
Time of Sample	4:00-6:30		
Barometric Pressure, "HG	30		
Stack pressure, "HG	30		
Final Meter Reading, FT^3	129.19		
Initial Meter Reading, FT^3	127		
Average Meter Temp. $^{\circ}F$	81		
Average Stack Temp. $^{\circ}F$	1045		
Gas Volume Sampled, FT^3, VSTPD *	2.1463		
SO_2 Conc., LB/FT^3 (CSO)	$8.3826E^{-}6$		
SO_2 Conc., P.P.M. (PPM)	50.644		

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = \left(7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}\right) \frac{(VT-VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE
EMISSION DATA

EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY SYSTEM - INLET*

Run No.	5-A	5-B	
Date	3/15/74	3/15/74	
Time of Sample	9:30-11:15	11:45-13:30	
Barometric Pressure, "HG	30	30	
Stack pressure, "HG	30	30	
Final Meter Reading, FT^3	161.98	162.28	
Initial Meter Reading, FT^3	159.7	161.2	
Average Meter Temp. °F	80	81	
Average Stack Temp. °F	92	92	
Gas Volume Sampled, FT^3, VSTPD *	2.2438	1.0589	
SO_2 Conc., LB/FT^3 (CSO)	$7.4718E^{-7}$	$1.1739E^{-6}$	
SO_2 Conc., P.P.M. (PPM)	4.5141	7.0922	

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = \left(7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}\right) \frac{(VT\text{-}VTB)(N)\left(\frac{Vsoln}{VA}\right)}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SULFUR DIOXIDE

EMISSION DATA

EPA METHOD 6

PLANT CHAMPLIN PETROLEUM COMPANY

STACK *SULFUR RECOVERY UNIT - OUTLET*

Run No.	5-A	5-B	
Date	3/15/74	3/15/74	
Time of Sample	9:30-11:15	11:45-1:30	
Barometric Pressure, "HG	30	30	
Stack Pressure, "HG	30	30	
Final Meter Reading, FT^3	134.08	136.23	
Initial Meter Reading, FT^3	132.4	134.4	
Average Meter Temp. $^\circ F$	70	84	
Average Stack Temp. $^\circ F$	1055	1040	
Gas Volume Sampled, FT^3, VSTPD *	1.6815	1.7838	
SO_2 Conc., LB/FT^3 (CSO)	$1.8301E^{-}5$	$1.0418E^{-}5$	
SO_2 Conc., P.P.M. (PPM)	110.56	62.942	

* VSTPD = Dry, 29.92 "HG, 70°F

$$VSTPD = VM \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Pstd} \right) \left(\frac{Tstd}{TM} \right)$$

$$CSO = \left(7.05 \times 10^{-5} \times \frac{LB\text{-}L}{g\text{-}ml}\right) \frac{(VT-VTB)(N)(\frac{Vsoln}{VA})}{VMSTD}$$

$$PPM = CSO \times 6041500$$

SOURCE TEST CALCULATIONS

PLANT CHAMPLIN PETROLEUM CO. STACK SULFUR RECOVERY UNIT INLET DATE 3/1/74 RUN NO. 2

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS 30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 55.687 FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 90 °F

AVE. METER TEMP, TM 84° °F, AVE. $\sqrt{\text{VEL. HEAD}}$, H .24 "H_2O, AVE. METER ORIFICE ΔH 1.67 "H_2O

METER VOL, VM 9.249 FT^3, MOISTURE PLUS SILICA GEL, VC 0 Ml, SAMPLE TIME 240 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 -- 0.000085 FT^2; 3/16 -- 0.0001916 FT^2; 1/4 -- 0.000341 FT^2

3/8 -- 0.000767 FT^2; 1/2 -- 0.0013 FT^2. ORSAT : CO_2 3.0 %, O_2 7.2 %, CO 0.0 %

VWV = (0.0474) X (VC) _____ SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ _____ SCF

VT = (VWV) + (VSTPD) _____ SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) USE DATA FROM 2/28/74 0.061

FDA = FRACTION OF DRY AIR = (1.0) - (W) 0.939

MD = [(0.44) X (____ %CO_2)] + [(0.32) X (____ %O_2)] + [(0.28) X (____ %N_2 + ____ %CO)] 28.77

MS = [(MD) X (FDA)] + [(18) X (W)] 28.108

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) ~~0.970~~ .970

$$EA = \text{EXCESS AIR} = \frac{\left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ \%CO}{2})\right]}{\left[(0.266) \times (\_\_\_\ \%N_2)\right] - \left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ \%CO}{2})\right]} \times 100$$ _____ %

$$U = \text{AVE. VELOCITY} = (174) \times (CP) \times (\sqrt{H}) \times \sqrt{(\frac{TS + 460}{GS}) \times (\frac{29.92}{PS})}$$ 824.108 ~~4594~~ FPM

QS = GAS FLOW RATE = (U) X (AS') 4600.171 ACFM

$$QSTPD = \text{GAS FLOW RATE AT S.T.P.} = (QS) \times (FDA) \times (\frac{530}{TS + 460}) \times (\frac{PS}{29.92})$$ 4151.565 SCFMD

$$VI = \text{ISOKINETIC VOL.} = (U) \times (AN) \times (FDA) \times (TIME) \times (\frac{530}{TS + 460}) \times (\frac{PS}{29.92})$$ _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) _____ %

$$\text{PERCENT ISOKINETIC BY E.P.A.} = \frac{\left[(0.00267 \times VC \times TS)\right] + \left[(PO \times TS \times VM \div TM)\right]}{\left[(TIME \times U \times PS \times AN)\right]} \times 100$$ _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

SOURCE TEST CALCULATIONS

PLANT CHAMPLIN PETROLEUM CO. STACK SULFUR RECOVERY UNIT OUTLET DATE 3/1/74 RUN NO. 2

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS .30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 56.987 FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 1050 °F

AVE. METER TEMP, TM 75 °F, AVE. $\sqrt{\text{VEL. HEAD, H}}$ .24 $"H_2O$, AVE. METER ORIFICE ΔH 1.7 $"H_2O$

METER VOL, VM 17.058 FT^3, MOISTURE PLUS SILICA GEL, VC 25.5 Ml, SAMPLE TIME 240 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 -- 0.000085 FT^2; 3/16 -- 0.0001916 FT^2; 1/4 -- 0.000341 FT^2

3/8 -- 0.000767 FT^2; 1/2 -- 0.0013 FT^2. ORSAT : CO_2 3.4 %, O_2 12.5 %, CO 0.0 %

VWV = (0.0474) X (VC) 1.209 SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ 17.011 SCF

VT = (VWV) + (VSTPD) 18.22 SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) .066

FDA = FRACTION OF DRY AIR = (1.0) - (W) .934

MD = [(0.44) X (3.4 %CO_2)] + [(0.32) X (12.5 %O_2)] + [(0.28) X (84.1 %N_2 + 0 %CO)] 29.044

MS = [(MD) X (FDA)] + [(18) X (W)] 28.315

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) .977

EA = EXCESS AIR = $\frac{\left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ \%CO}{2})\right]}{\left[(0.266) \times (\_\_\_\ \%N_2)\right] - \left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ \%CO}{2})\right]} \times 100$ _____ %

U = AVE. VELOCITY = (174) X (CP) X ($\sqrt{H}$) X $\sqrt{(\frac{TS + 460}{GS}) \times (\frac{29.92}{PS})}$ 1360.598 FPM

QS = GAS FLOW RATE = (U) X (AS') 7594.858 ACFM

QSTPD = GAS FLOW RATE AT S.T.P. = (QS) X (FDA) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ 2471.7519 SCFMD

VI = ISOKINETIC VOL. = (U) X (AN) X (FDA) X (TIME) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) _____ %

PERCENT ISOKINETIC BY E.P.A. = $\frac{\left[(0.00267 \times VC \times TS)\right] + \left[(PO \times TS \times VM \div TM)\right]}{\left[(TIME \times U \times PS \times AN)\right]} \times 100$ _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

SOURCE TEST CALCULATIONS

PLANT CHAMPLIN PETROLEUM CO, STACK SULFUR RECOVERY UNIT INLET DATE 3/14/74 RUN NO. 1

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS 30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 66.987 FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 92 °F

AVE. METER TEMP, TM 81 °F, AVE. $\sqrt{\text{VEL. HEAD}}$, H .22 "H_2O, AVE. METER ORIFICE ΔH 1.67 "H_2O

METER VOL, VM 12.079 FT^3, MOISTURE PLUS SILICA GEL, VC 18 Ml, SAMPLE TIME 150 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 -- 0.000085 FT^2; 3/16 -- 0.0001916 FT^2; 1/4 -- 0.000341 FT^2

3/8 -- 0.000767 FT^2; 1/2 -- 0.0013 FT^2. ORSAT : CO_2 4.6 %, O_2 0.9 %, CO 0.0 %

VWV = (0.0474) X (VC) .553 SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ 11.911 SCF

VT = (VWV) + (VSTPD) 12.764 SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) .067

FDA = FRACTION OF DRY AIR = (1.0) - (W) .933

MD = [(0.44) X (____ %CO_2)] + [(0.32) X (____ %O_2)] + [(0.28) X (____ %N_2 + ____ %CO)] 26.504

MS = [(MD) X (FDA)] + [(18) X (W)] 25.93

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) .894

EA = EXCESS AIR = $\frac{[(\text{\%}O_2) - (\frac{\text{\%CO}}{2})]}{[(0.266) \times (\text{\%}N_2)] - [(\text{\%}O_2) - (\frac{\text{\%CO}}{2})]} \times 100$ _____ %

U = AVE. VELOCITY = (174) X (CP) X ($\sqrt{H}$) X $\sqrt{(\frac{TS + 460}{GS}) \times (\frac{29.92}{PS})}$ _____ FPM

QS = GAS FLOW RATE = (U) X (AS') _____ ACFM

QSTPD = GAS FLOW RATE AT S.T.P. = (QS) X (FDA) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ _____ SCFMD

VI = ISOKINETIC VOL. = (U) X (AN) X (FDA) X (TIME) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) _____ %

PERCENT ISOKINETIC BY E.P.A. = $\frac{[(0.00267 \times VC \times TS)] + [(PO \times TS \times VM \div TM)]}{[(TIME \times U \times PS \times AN)]} \times 100$ _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

SOURCE TEST CALCULATIONS

PLANT CHAMPLIN PETROLEUM CO. STACK SULFUR RECOVERY UNIT OUTLET DATE 3/14/74 RUN NO. 1

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS 30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 5.585 66.487 FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 1045 °F

AVE. METER TEMP, TM 77 °F, AVE. $\sqrt{\text{VEL. HEAD}}$, H .22 "H_2O, AVE. METER ORIFICE ΔH 1.7 "H_2O

METER VOL, VM 18.358 FT^3, MOISTURE PLUS SILICA GEL, VC 21.2 Ml, SAMPLE TIME 150 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 -- 0.000085 FT^2; 3/16 -- 0.0001916 FT^2; 1/4 -- 0.000341 FT^2

3/8 -- 0.000767 FT^2; 1/2 -- 0.0013 FT^2. ORSAT : CO_2 3.633 %, O_2 12.4 %, CO 0.133 %

VWV = (0.0474) X (VC) → 1.005 SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ → 18.239 SCF

VT = (VWV) + (VSTPD) → 19.244 SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) → .0520 .052

FDA = FRACTION OF DRY AIR = (1.0) - (W) → .948

MD = [(0.44) X (3.633 %CO_2)] + [(0.32) X (12.4 %O_2)] + [(0.28) X (83.833 %N_2 + .133 %CO)] → 29.076

MS = [(MD) X (FDA)] + [(18) X (W)] → ~~28.56~~ 28.5

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) → .983

$$EA = \text{EXCESS AIR} = \frac{\left[(\_\_\_\ \%O_2) - (\frac{\_\_\_}{2}\ \%CO)\right]}{\left[(0.266) \times (\_\_\_\ \%N_2)\right] - \left[(\_\_\_\ \%O_2) - (\frac{\_\_\_}{2}\ \%CO)\right]} \times 100$$ → _____ %

$$U = \text{AVE. VELOCITY} = (174) \times (CP) \times (\sqrt{H}) \times \sqrt{(\frac{TS + 460}{GS}) \times (\frac{29.92}{PS})}$$ → 1241.319 FPM

QS = GAS FLOW RATE = (U) X (AS') → 6929.043 ACFM

$$QSTPD = \text{GAS FLOW RATE AT S.T.P.} = (QS) \times (FDA) \times (\frac{530}{TS + 460}) \times (\frac{PS}{29.92})$$ → 2305.257 SCFMD

$$VI = \text{ISOKINETIC VOL.} = (U) \times (AN) \times (FDA) \times (TIME) \times (\frac{530}{TS + 460}) \times (\frac{PS}{29.92})$$ → _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) → _____ %

$$\text{PERCENT ISOKINETIC BY E.P.A.} = \frac{\left[(0.00267 \times VC \times TS)\right] + \left[(PO \times TS \times VM \div TM)\right]}{\left[(TIME \times U \times PS \times AN)\right]} \times 100$$ → _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

SOURCE TEST CALCULATIONS

PLANT CHAMPLIN PETROLEUM CO STACK SULFUR RECOVERY UNIT INLET X DATE 3/15/74 RUN NO. 2

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS 30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 3.352 (5.587) FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 93 °F

AVE. METER TEMP, TM 81 °F, AVE. $\sqrt{\text{VEL. HEAD}}$, H .38 "H_2O, AVE. METER ORIFICE ΔH 1.67 "H_2O

METER VOL, VM 11.584 FT^3, MOISTURE PLUS SILICA GEL, VC 24 Ml, SAMPLE TIME 240 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 -- 0.000085 FT^2; 3/16 -- 0.0001916 FT^2; 1/4 -- 0.000341 FT^2

3/8 -- 0.000767 FT^2; 1/2 -- 0.0013 FT^2. ORSAT : CO_2 4.8 %, O_2 .8 %, CO .2 %

VWV = (0.0474) X (VC) = 1.138 SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ = 11.423 SCF

VT = (VWV) + (VSTPD) = 12.561 SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) = 0.091

FDA = FRACTION OF DRY AIR = (1.0) - (W) = 0.909

MD = [(0.44) X (4.8 %CO_2)] + [(0.32) X (.8 %O_2)] + [(0.28) X (94.2 %N_2 + .2 %CO)] = 28.800

MS = [(MD) X (FDA)] + [(18) X (W)] = 27.090

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) = .935

EA = EXCESS AIR = $\frac{[(\_\_\_\ \%O_2) - (\frac{\_\_\_}{2}\ \%CO)]}{[(0.266) \times (\_\_\_\ \%N_2)] - [(\_\_\_\ \%O_2) - (\frac{\_\_\_}{2}\ \%CO)]} \times 100$ = _____ %

U = AVE. VELOCITY = (174) X (CP) X ($\sqrt{H}$) X $\sqrt{(\frac{TS + 460}{GS})} \times (\frac{29.92}{PS})$ = 1332.641 FPM

QS = GAS FLOW RATE = (U) X (AS') = 7438.802 ACFM

QSTPD = GAS FLOW RATE AT S.T.P. = (QS) X (FDA) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ = _____ SCFMD

VI = ISOKINETIC VOL. = (U) X (AN) X (FDA) X (TIME) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ = _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) = _____ %

PERCENT ISOKINETIC BY E.P.A. = $\frac{[(0.00267 \times VC \times TS)] + [(PO \times TS \times VM \div TM)]}{[(TIME \times U \times PS \times AN)]} \times 100$ = _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

SOURCE TEST CALCULATIONS

PLANT HAMPTON PETROLEUM CO. STACK SULFUR RECOVERY UNIT OUTLET DATE 3/15/74 RUN NO. 2

BAR. PRESS, PB 30 "Hg, STACK PRESS, PS 30 "Hg, STACK DIMENSIONS 32 IN, C_p 0.83

STACK AREA, AS 5583 / 6.487 FT^2, EFF. STACK AREA, AS' _____ FT^2, AVE. STACK TEMP, TS 1055 °F

AVE. METER TEMP, TM 68 °F, AVE. $\sqrt{\text{VEL. HEAD, H}}$ .38 "H_2O, AVE. METER ORIFICE ΔH 1.7 "H_2O

METER VOL, VM 25.930 FT^3, MOISTURE PLUS SILICA GEL, VC 15 Ml, SAMPLE TIME 180 Min

NOZZLE DIA, _____ IN, NOZZLE AREAS : 1/8 — 0.000085 FT^2; 3/16 — 0.0001916 FT^2; 1/4 — 0.000341 FT^2

3/8 — 0.000767 FT^2; 1/2 — 0.0013 FT^2. ORSAT : CO_2 1.8 %, O_2 13.0 %, CO 0.0 %

VWV = (0.0474) X (VC) .711 SCF

VSTPD = (17.71) X (VM) X (PO) ÷ (TM + 460), Where PO = $(PB + \frac{\Delta H}{13.6})$ 26.251 SCF

VT = (VWV) + (VSTPD) 26.962 SCF

W = MOISTURE FRACTION = (VWV) ÷ (VT) .026

FDA = FRACTION OF DRY AIR = (1.0) - (W) .974

MD = [(0.44) X (1.8 %CO_2)] + [(0.32) X (13.0 %O_2)] + [(0.28) X (85.2 %N_2 + 0 %CO)] 28.808

MS = [(MD) X (FDA)] + [(18) X (W)] 28.528

GS = SPECIFIC GRAVITY REFERRED TO AIR = (MS) ÷ (28.99) .984

EA = EXCESS AIR = $\frac{\left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ }{2}\ \%CO)\right]}{\left[(0.266) \times (\_\_\_\ \%N_2)\right] - \left[(\_\_\_\ \%O_2) - (\frac{\_\_\_\ }{2}\ \%CO)\right]} \times 100$ _____ %

U = AVE. VELOCITY = $(174) \times (CP) \times (\sqrt{H}) \times \sqrt{(\frac{TS + 460}{GS}) \times (\frac{29.92}{PS})}$ 2150.128 FPM

QS = GAS FLOW RATE = (U) X (AS') 12002.684 ACFM

QSTPD = GAS FLOW RATE AT S.T.P. = (QS) X (FDA) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ 4079.269 SCFMD

VI = ISOKINETIC VOL. = (U) X (AN) X (FDA) X (TIME) X $(\frac{530}{TS + 460})$ X $(\frac{PS}{29.92})$ _____ SCF

PERCENT ISOKINETIC BY E.S.E. = (100 X VSTPD) ÷ (VI) _____ %

PERCENT ISOKINETIC BY E.P.A. = $\frac{\left[(0.00267 \times VC \times TS)\right] + \left[(PO \times TS \times VM \div TM)\right]}{\left[(TIME \times U \times PS \times AN)\right]} \times 100$ _____ %

PARTICULATE CONC. @ S.T.P., ESTP = (15.43 X GRAMS) ÷ (VSTPD)

PARTICULATE CONC. @ STACK COND., EACF = (ESTP) X (17.71) X (PS) X (FDA) ÷ (TS + 460)

PARTICULATE CONC. CORRECTED TO 12% CO_2, E12 = (12 X ESTP) ÷ (% CO_2)

PARTICULATE CONC. CORRECTED TO 50% EXCESS AIR, E50 = (ESTP) X (EA + 100) ÷ (150)

PARTICULATE EMISSION RATE, EM = (ESTP) X (QSTPD) X (0.00857)

LAB ANALYSIS, GRAMS	PARTICULATE CONCENTRATIONS GRAINS/ FT^3	PART. EMISSION RATE LBS/ HR

A-8

VISIBLE EMISSIONS BY EPA METHOD 9

CHAMPLIN PETROLEUM COMPANY

WILMINGTON, CALIFORNIA

Date	Time	Avg. Visible Emissions
1 March 1974	1045 - 1445	0 (1)
14 March 1974	1600 - 2000	0 (2)
15 March 1974	930 - 1330	0 (3)

(1) Observer located 125' south-southeast of stack. Wind was from south at 5 mph and the aky was cloudy (brownish haze).

(2) Observer located 120' south-southeast of stack. Wind was from west at 10 mph and the cky was clear.

(3) Observer located 120' south-southeast of stack. Wind was from west at 5 mph and the sky was overcast (smog).

NOX SOURCE EMISSION TEST DATA

TEST NUMBER - 4
PLANT NAME - CHAMPLIN PETROLEUM REFINERY.
SOURCE TESTED - INLET SULFUR RECOVERY UNIT
TYPE OF PLANT - OIL REFINERY
CONTROL EQUIPMENT-
POLLUTANT SAMPLED- NO_x

1) RUN NUMBER	4	4	4
2) DATE	3/14/74	3/14/74	3/14/74
3) TIME	7:00	7:00	7:00
4) FLASK NUMBER	4	6	11
5) VF - FLASK AND VALVE VOLUME, ML	1914	1876	1896
6) VA - ABSORBING SOLUTION VOLUME, ML	25	25	25
7) PB - BAROMETRIC PRESSURE, IN HG	30	30	30
8) PS - STACK PRESSURE, IN HG	30	30	30
9) PI - INITIAL FLASK VACUUM, IN HG	22.6	22.5	22.6
10) PF - FINAL '' '' ''	0.9	0.6	0.8
11) TI - INITIAL FLASK TEMPERATURE, DEG F	75	75	75
12) TF - FINAL '' '' '' ''	75	75	75
13) VSTPD - VOL OF GAS SAMPLED, ML, S.T.P.	1345.252	1344.030	1358.552
14) TS - STACK GAS TEMPERATURE, DEG F	94	94	94
15) PCT M - STACK GAS MOISTURE, PCT VOL	6.1	6.1	6.1
16) QSTPD- STK GAS FLOW RTE,CU FT/MIN,STP			
17) MNO2 - MASS OF NO2 IN SAMPLE,GM×1.0E6	0 ug	0 ug	0 ug
18) MILLIGRAMS NO2/CU METER, STP	0	0	0
19) LBS NO2 /CU FT , STP			
20) PARTS PER MILLION OF NO2, STP			
21) LBS NO2/HOUR			
22) BTU'S PER HOUR INPUT			
23) LBS NO2/MILLION BTU			

$VSTPD = (17.71) \times (VF-VA) \times [((PS-PF) \div TF) - ((PS-PI) \div TI)]$

$MG\ NO2/CU\ MTR = (35.31) \times (MNO2) \div (VSTPD)$

$LBS\ NO2/CU\ FT = (6.2E^{-}5) \times (MNO2) \div (VSTPD)$

$P.\ P.\ M. = (8.406E6) \times (LBS\ NO2/CU\ FT)$

$LBS\ NO2/\ HOUR = (60) \times (QSTPD) \times (LBS\ NO2/CU\ FT)$

$LBS\ NO2/MILLION\ BTU = (LBS\ NO2/HR) \div (MILLION\ BTU\ /HR\ ,\ INPUT)$

* @ INPUT OF FUEL GAS UNKNOWN.

S. T. P. ↔ DRY, 70 DEGREES F, 29.92 INCHES MERCURY

NOX SOURCE EMISSION TEST DATA

TEST NUMBER - 4
PLANT NAME - CHAMPLIN PETROLEUM CO
SOURCE TESTED - OUTLET SULFUR RECOVERY UNIT
TYPE OF PLANT - OIL REFINERY
CONTROL EQUIPMENT -
POLLUTANT SAMPLED - NOx

1) RUN NUMBER	4	4
2) DATE	3/14/74	3/14/74
3) TIME	7:00	7:00
4) FLASK NUMBER	2	4
5) VF - FLASK AND VALVE VOLUME, ML	1885	1932
6) VA - ABSORBING SOLUTION VOLUME, ML	25	25
7) PB - BAROMETRIC PRESSURE, IN HG	30	30
8) PS - STACK PRESSURE, IN HG	30	30
9) PI - INITIAL FLASK VACUUM, IN HG	22.6	22.5
10) PF - FINAL " " "	0.0	0.8
11) TI - INITIAL FLASK TEMPERATURE, DEG F	75	75
12) TF - FINAL " " " "	75	75
13) VSTPD - VOL OF GAS SAMPLED, ML, S.T.P.	1383.505	1354.692
14) TS - STACK GAS TEMPERATURE, DEG F	1045	1045
15) PCT M - STACK GAS MOISTURE, PCT VOL	5.2	5.2
16) QSTPD - STK GAS FLOW RTE, CU FT/MIN, STP	2305.3	2305.3
17) MNO2 - MASS OF NO2 IN SAMPLE, GM×1.0E6	53.1 ug	33.8 ug
18) MILLIGRAMS NO2/CU METER, STP	38.14 ~~1365.2~~	24.4
19) LBS NO2 /CU FT , STP	~~0.0~~ 2.4×10^{-6}	1.5×10^{-6}
20) PARTS PER MILLION OF NO2, STP	20.2	12.6
21) LBS NO2/HOUR	0.33	0.21
22) BTU'S PER HOUR INPUT	—	—
23) LBS NO2/MILLION BTU	—	

$VSTPD = (17.71) \times (VF-VA) \times [((PS-PF) \div TF) - ((PS-PI) \div TI)]$

$MG\ NO2/CU\ MTR = (\text{~~35.31~~}) \times [(MNO2) \div (VSTPD)] \times 10^3$

$LBS\ NO2/CU\ FT = (6.2E^{-}5) \times (MNO2) \div (VSTPD)$

$P.\ P.\ M. = (8.406E6) \times (LBS\ NO2/CU\ FT)$

$LBS\ NO2/\ HOUR = (60) \times (QSTPD) \times (LBS\ NO2/CU\ FT)$

$LBS\ NO2/MILLION\ BTU = (LBS\ NO2/HR) \div (MILLION\ BTU\ /HR\ ,\ INPUT)$

* INPUT OF FUEL GAS UNKNOWN.

S. T. P. ↔ DRY, 70 DEGREES F, 29.92 INCHES MERCURY

DRY MOLECULAR WEIGHT DETERMINATION

ORSAT BY EPA METHOD 3

PLANT CHAMPLIN

DATE MARCH 1, 1974

SAMPLING TIME (24-hr CLOCK) _____

SAMPLING LOCATION INLET

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) _____

ANALYTICAL METHOD _____

AMBIENT TEMPERATURE _____

OPERATOR _____

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	3.0	3.0					3.0	44/100	1.32
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	10.2	7.2					7.2	32/100	2.304
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	10.2	0.0					0.0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)	89.8	89.8					89.8	28/100	25.144
								TOTAL	28.768

EPA (Dur) 230
4/72

DRY MOLECULAR WEIGHT DETERMINATION

ORSAT BY EPA METHOD 3

PLANT CHAMPLIN

DATE MARCH 1, 1974

SAMPLING TIME (24-hr CLOCK) (OUTLET)

SAMPLING LOCATION

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

ANALYTICAL METHOD

AMBIENT TEMPERATURE

OPERATOR

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	3.4	3.4					3.4	44/100	1.496
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	15.9 ~~12.5~~	12.5					12.5	32/100	4.0
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	15.9	0.0					0.0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)	84.1 ~~15.9~~	84.1					84.1	28/100	23.548
								TOTAL	29.044

EPA (Dur) 230
4/72

DRY MOLECULAR WEIGHT DETERMINATION
ORSAT BY EPA METHOD 3

PLANT CHAMPLIN PETROLEUM CO.
DATE MARCH 14, 1974
SAMPLING TIME (24-hr CLOCK)
SAMPLING LOCATION STACK HEATER INLET
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG - INT.
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE
OPERATOR J. DOLLAR

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	4.8	4.8	4.4	4.4	4.6	4.6	4.6	44/100	2.024
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	5.2	0.4	5.5	1.1	5.5	0.9	.68	32/100	.218
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	5.3	0.1	5.6	0.1	5.5	0.0	.07	28/100	.020
N_2 (NET IS 100 MINUS ACTUAL CO READING)	94.7	94.7	94.4	94.4	95.5	95.5	94.9	28/100	26.572
								TOTAL	28.834

EPA (Dur) 230
4/72

DRY MOLECULAR WEIGHT DETERMINATION

ORSAT BY EPA METHOD 3

PLANT CHAMPLIN PETROLEUM CO.

DATE MARCH 14, 1974

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION STACK HEATER OUTLET

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG - INT.

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE

OPERATOR J. DOLLAR

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	3.4	3.4	3.8	3.8	3.7	3.7	3.633	44/100	1.598
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	12.6	16.0	12.2	16.1	12.4	12.4	32/100	3.968
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	16.2	0.2	16.1	0.1	16.2	0.1	0.133	28/100	0.037
N_2 (NET IS 100 MINUS ACTUAL CO READING)	83.8	83.8	83.9	83.9	83.8	83.8	83.833	28/100	23.473
								TOTAL	29.076

EPA (Dur) 230
4/72

DRY MOLECULAR WEIGHT DETERMINATION

ORSAT BY EPA METHOD 3

PLANT CHAMPLIN

DATE MARCH 15, 1974

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION STACK HEATER INLET

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG - INT.

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE

OPERATOR L. ROBY

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	4.8	4.8					4.8	44/100	2.112
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	5.6	.8					.8	32/100	.256
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	5.8	.2					.2	28/100	.056
N_2 (NET IS 100 MINUS ACTUAL CO READING)	94.2	94.2					94.2	28/100	26.376
								TOTAL	28.800

EPA (Dur) 230
4/72

DRY MOLECULAR WEIGHT DETERMINATION

ORSAT BY EPA METHOD 3

PLANT CHAMPLIN

DATE MARCH 15, 1974

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION STACK HEATER OUTLET

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG - INT.

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE

OPERATOR L. ROBY

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	1.8	1.8					1.8	44/100	0.792
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	14.8	13.0					13.0	32/100	4.160
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	14.8	0.0					0.0	28/100	0.0
N_2 (NET IS 100 MINUS ACTUAL CO READING)	85.2	85.2					85.2	28/100	23.856
								TOTAL	28.808

EPA (Dur) 230
4/72

ODOR BY EPA DRAFT METHOD (DILUTION METHOD)

ODOR PANEL SCREENING TEST
UNION OIL COMPANY
Wilmington, California

Participant No.	Age	% Positive Response	Stability(1)	Acceptability(2)	Selected(3)
1	15	71.4	0	OK	-
2	16	57.1	0	OK	-
3	17	57.1	0	OK	-
4	16	71.4	+	OK	+
5	17	57.1	+	OK	+
6	15	71.4	+	OK	+
7	17	57.1	0	OK	-
8	17	42.8	0	--	-
9	17	14.3	+	--	-
10	17	28.6	+	OK	+
11	17	85.7	+	--	-
12	17	71.4	+	OK	+
13	17	57.1	0	OK	-
14	17	57.1	+	OK	+
15	17	42.8	+	OK	+
16	17	----	-	--	-
17	17	57.1	+	--	-
18	17	71.4	+	OK	+
19	15	71.4	+	OK	-
20	16	42.8	+	OK	+
21	16	42.8	+	OK	+
22	16	28.6	+	OK	+
23	17	28.6	+	OK	-
24	17	42.8	+	OK	+
25	16	14.3	+	OK	-
26	18	71.4	+	OK	-
27	15	57.1	0	--	-

1 Based on consistency of response as concentrations decreased.
2 Based on personal observation of conduct during screening test.
3 Based on stability, acceptability, and % positive response (as compared with the group as a whole).

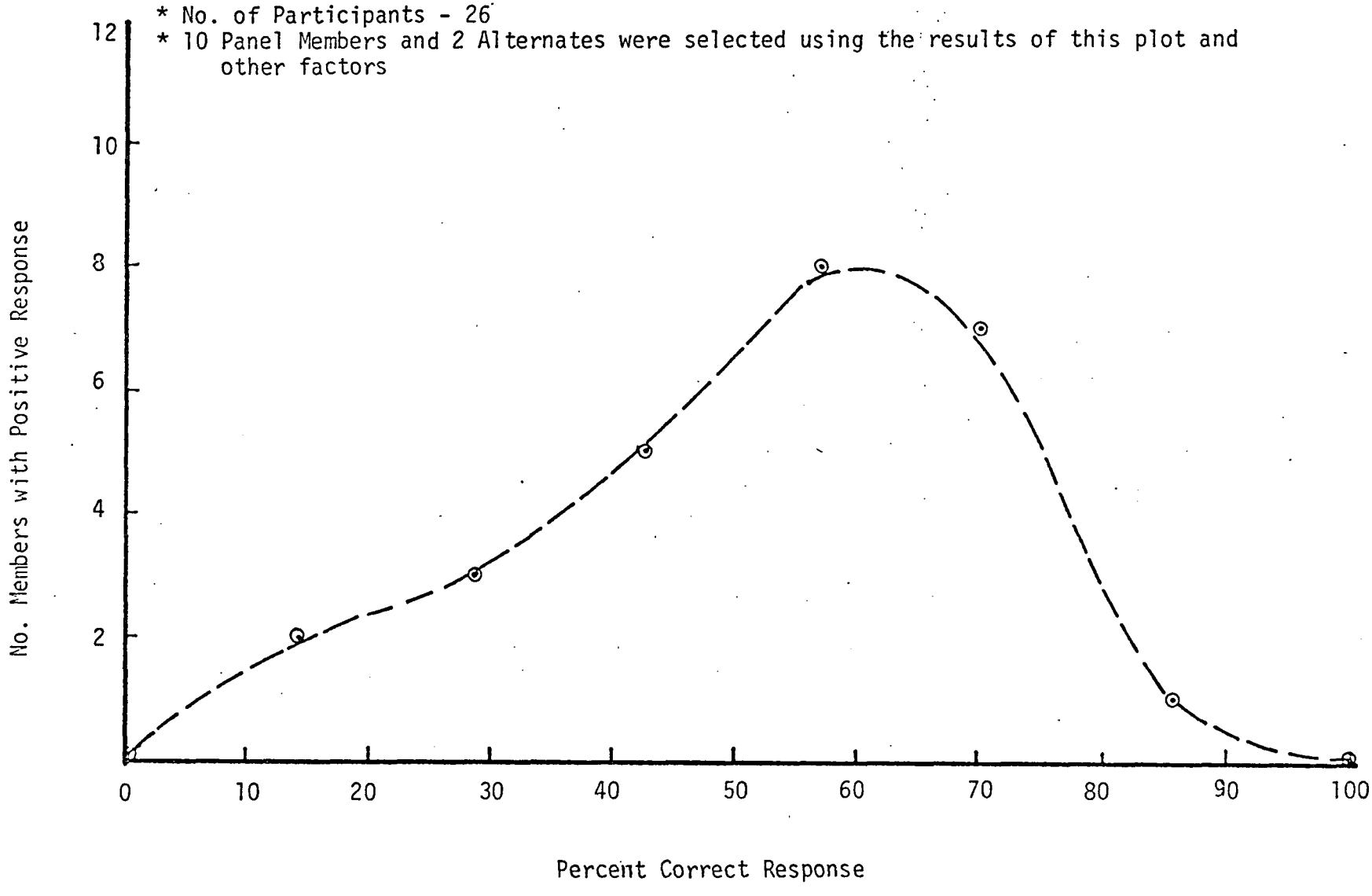


Figure 10 . Odor Panel Screening Test Plot.

SUMMARY OF ODOR SURVEY

CHAMPLIN PETROLEUM COMPANY

WILMINGTON, CALIFORNIA.

FEB. & MARCH, 74

SOURCE	DATE	DILUTION FACTOR	PERCENT REPORTING POSITIVE RESPONSE
INLET	2/27/74	1,000.	100.
		5,000.	90.
		10,000.	90.
		50,000.	40.
		100,000.	50.
OUTLET	2/27/74	10.	80.
		10.	60.
		20.	60.
		50.	40.
		50.	20.
INLET	2/28/74	100,000.	80.
		200,000.	60.
		500,000.	30.
OUTLET	2/28/74	5.	90.
		10.	70.
		20.	50.
		50.	20.
		100.	50.
		100.	40.
		100.	30.
INLET	3/1/74	5,000.	90.
		10,000.	70.
		50,000.	30.
		100,000.	60.
		100,000.	70.
OUTLET	3/1/74	5.	80.
		5.	60.
		5.	50.
		10.	50.
		10.	10.
		20.	30.

SUMMARY OF ODOR SURVEY, Continued

SOURCE	DATE	DILUTION FACTOR	PERCENT REPORTING POSITIVE RESPONSE
INLET	3/15/74	20.	77.
		50.	77.
		50.	55.
		100.	0.
		200.	0.
OUTLET	3/15/74	10.	88.
		100.	55.
		500.	44.
		10,000.	11.

ODOR EMISSIONS
CHAMPLIN OIL COMPANY
WILMINGTON, CALIFORNIA
FEB. 27-28 MAR.1 & 15, 1974

C=ODOR CONCENTRATION IN ODOR UNITS PER CUBIC FOOT
(DERIVED AT 50 PERCENTILE DETECTION POINT)

VA= VOLUME FLOW RATE IN STACK, STANDARD CONDITIONS, SCFM

(70°F AND 29.92 IN Hg)

E= ODOR EMISSION RATE, IN ODOR UNITS PER MINUTE,

SOURCE	DATE	C	VA	E	
INLET	2/27/74	55,000.	------	------	
OUTLET	2/27/74	22.	-------	------	
INLET	2/28/74	25,000.	-------	-------	
OUTLET	2/28/74	30.	------	-------	
INLET	3/1/74	50,000.	------	------	
OUTLET	3/1/74	7.	2646.42	18,500.	
INLET	3/15/74	200.	2761.87	552,000.	
OUTLET	3/15/74	80.	3973.21	318,000.	

APPENDIX B

FIELD DATA

CHAMPLIN OIL COMPANY

DATE: 14 MARCH 1974

SAMPLE TIME	$COS + H_2S$,* ppm	SO_2 ppm	CS_2, ppm	SAMPLE SOURCE
1620	1.7	200	< 1.5	OUTLET
1635	210	6.8	"	INLET
1650	160	—	"	"
1700	130	—	"	"
1710	170	—	"	"
1721	220	—	"	"
1730	310	—	"	"
1740	450	—	"	"
1750	300	—	"	"
1800	—	—	"	"
1805	200	—	"	"
1810	260	—	"	"
1815	250	—	"	"
1820	190	—	"	"
1825	550	—	"	"
1830	270	—	"	"
1835	190	—	"	"
1840	200	—	"	"
1845	170	—	"	"
1850	350	—	"	"
MAXIMUM (INLET)	550	—		
MINIMUM (INLET)	130	—		
MEAN (INLET)	250		<	

14 March 1974 Champlin

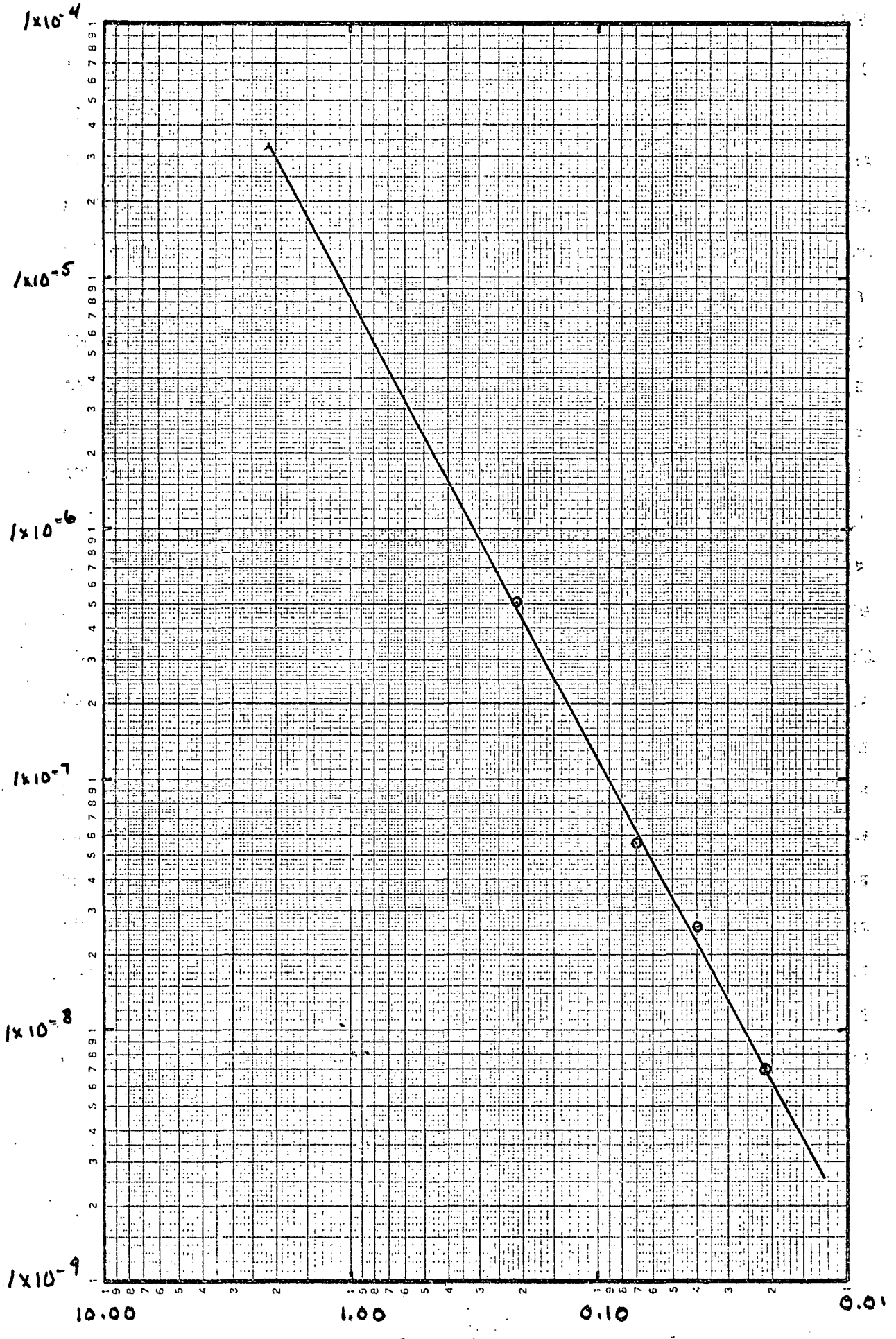
Inject #		GC #1 COS	GC #1 SO_2	GC #1 CS_2	GC #2 COS+H_2S	GC #2 SO_2	GC #2 CS_2	GC #2 H_2S
1 - OUTLET	100	0.015	3.5		0.017	2.0		
2	100	0.13	0.36		2.1	0.068		
3		<0.015			0.16			
4		<0.015			0.13			
5		<0.015			0.17			
6		0.018			0.22			
7		0.015			0.31			
8		0.023			0.45			
9		<0.015			0.30			
10		<0.015			—			
11		0.024			0.20			
12		<0.015			0.26			
13		0.020			0.25			
14		0.035			0.19			
15		0.058			0.55			
16		0.018			0.27			
17		0.042			0.19			
18		0.023			0.20			
19		0.024			0.17			
20		0.023			0.35			

INLET — 1000:1

GC #1 -- COS

CHAMPLIN OIL
14 MARCH 1974

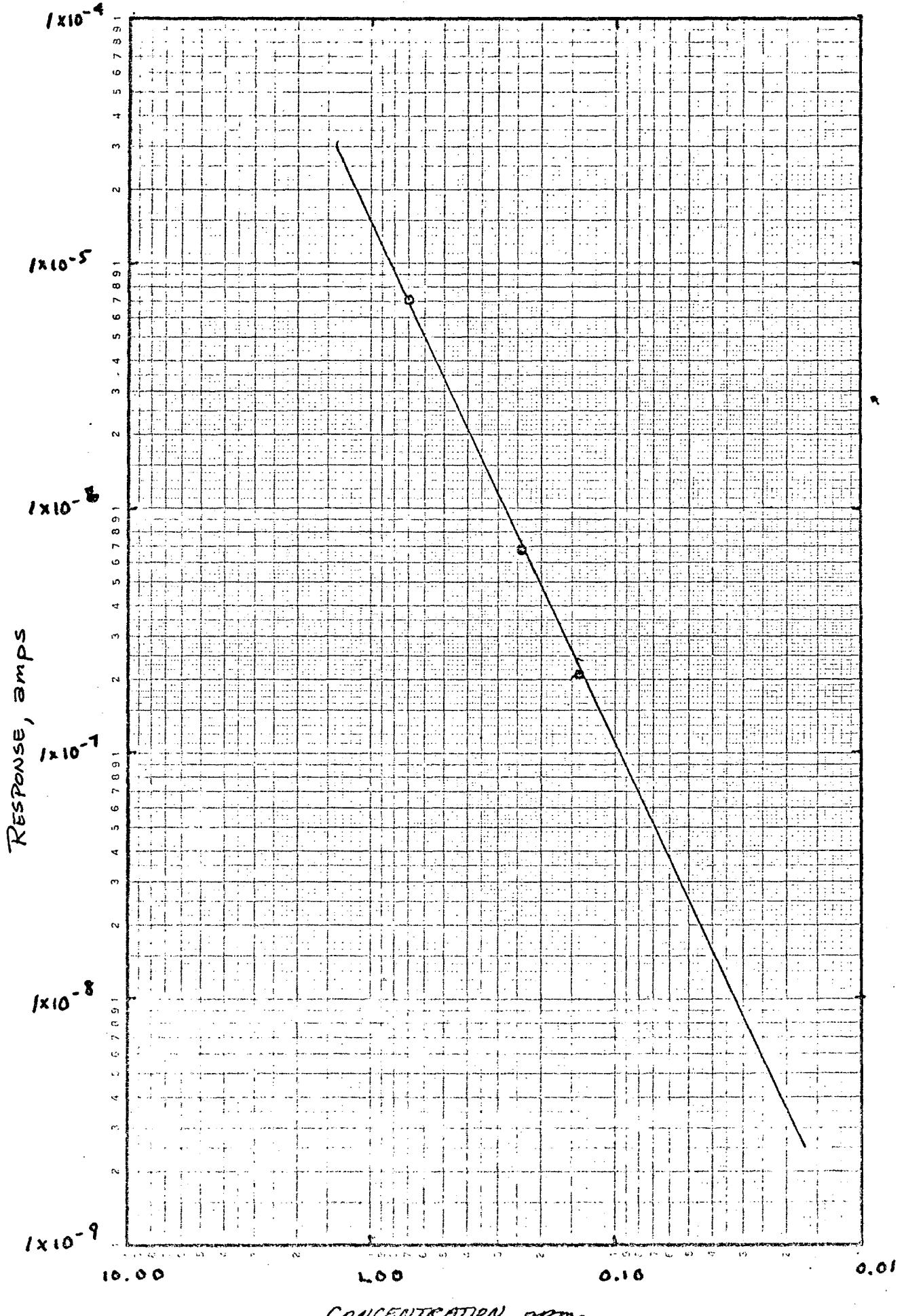
CALIBRATION PLOT



GC #2 -- SO_2

CHAMPLIN OIL
14 MARCH 1974

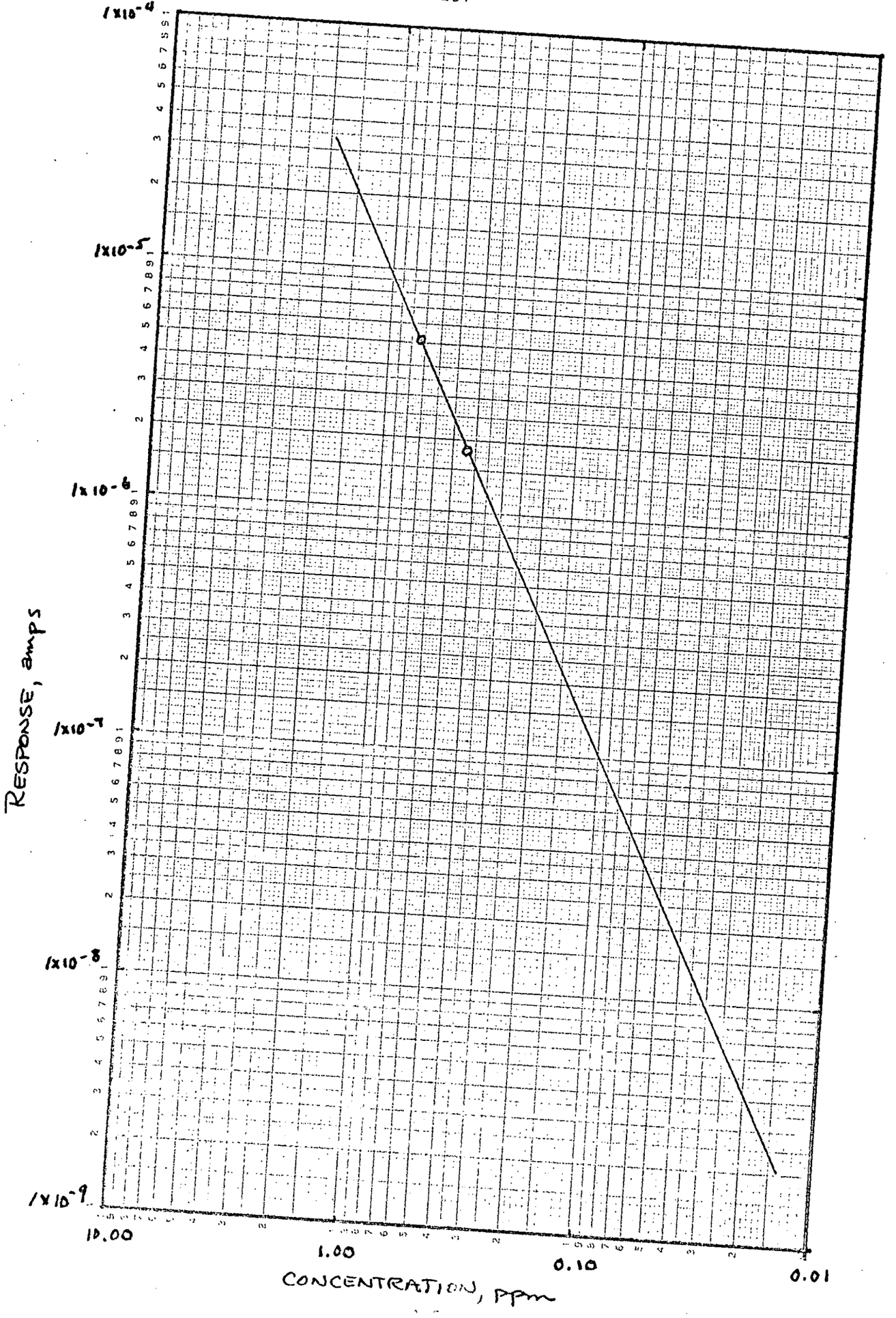
CALIBRATION PLOT



GC #2 -- H_2S

CHAMPLIN OIL
14 MARCH 1974

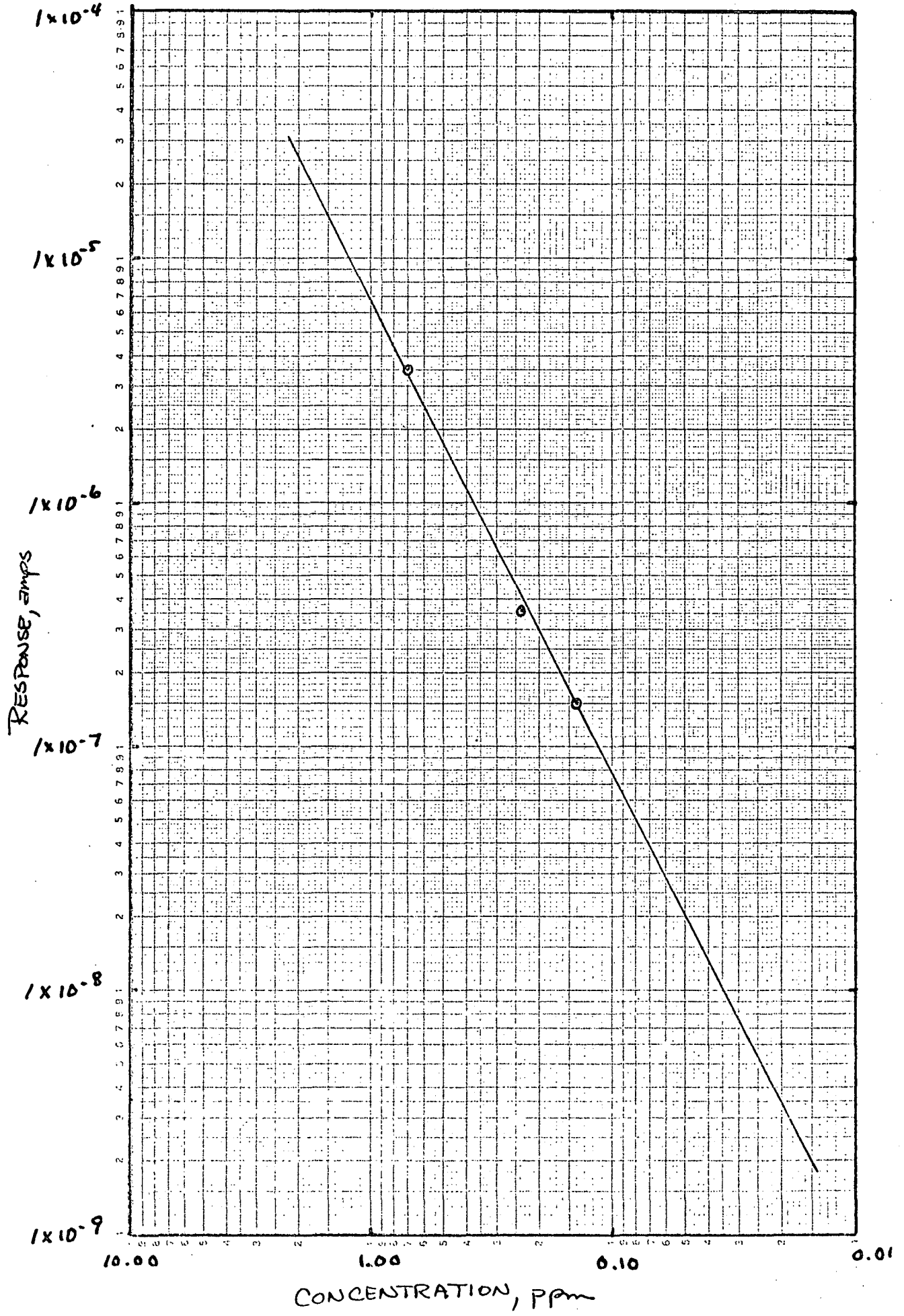
CALIBRATION PLOT



GC #1 -- SO_2

CHAMPLIN OIL
14 MARCH 1974

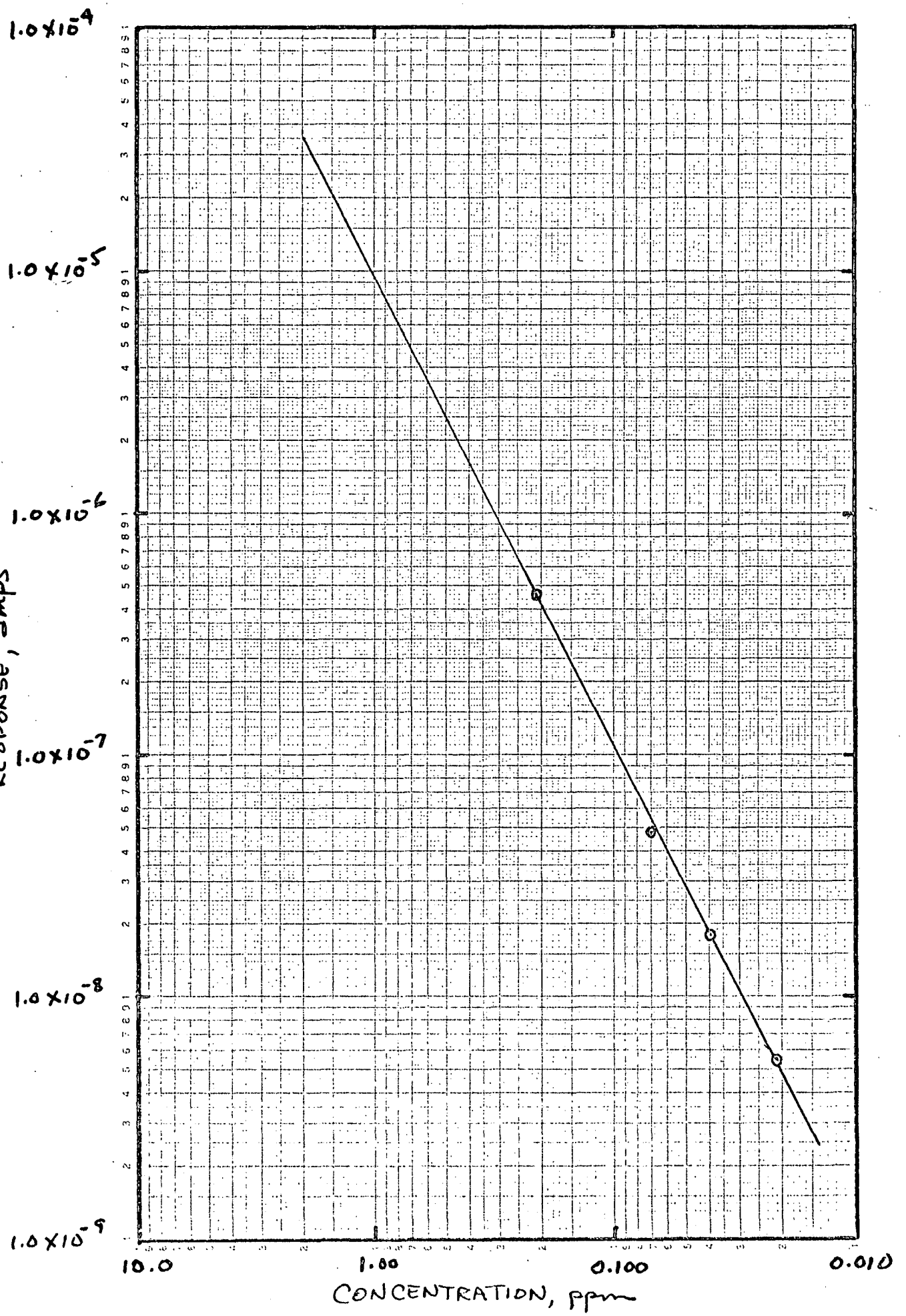
CALIBRATION PLOT



QC #2 -- COS

CHAMPLIN OIL
14 MARCH 1974

CALIBRATION PLOT



Champlin Air

14 March 1974

Water Bath temps = 30.0°C

Total Flow	G.C #1	GC #2	concentration
	SO_2		
1000 ml/min	3.5×10^{-6}	7.1×10^{-6}	0.700
3000 ml/min	3.6×10^{-7}	6.8×10^{-7}	0.236
5000 ml/min	1.5×10^{-7}	2.1×10^{-7}	0.140
10:1 at 1000 ml/min			
	COS		
1000 ml/min	5.1×10^{-7}	4.6×10^{-7}	0.205
3000 ml/min	5.6×10^{-8}	4.8×10^{-8}	0.070
5000 ml/min	2.6×10^{-8}	1.8×10^{-8}	0.042
10:1 @ 1000 ml/min	7.0×10^{-9}	5.5×10^{-9}	0.20
	H_2S		
1000 ml/min	4.6×10^{-7}	[illegible]	2.200
3000 ml/min	6×10^{-9}	5.1×10^{-6}	0.730
5000 ml/min	—	1.8×10^{-6}	0.440
10:1 @ 1000			0.220

14 MARCH 1974 Champlin Petroleum

		GC #1			GC #2		
INJ. #	DILUTION	COS	SO_2	CS_2	$COS+H_2S$	SO_2	CS_2
1-0	100:1	4×10^{-9}	7.5×10^{-5}		3×10^{-9}	6.8×10^{-5}	
2-i	100:1	1.9×10^{-7}	1.1×10^{-8}		4.2×10^{-5}	5×10^{-8}	
3-i	1000:1	2×10^{-9}			2.6×10^{-7}		
4-i	1000:1	2×10^{-9}			1.8×10^{-7}		
5i	1000:1	3×10^{-9}			3.0×10^{-7}		
6-i	1000:1	5×10^{-9}			4.9×10^{-7}		
7-i	1000:1	4×10^{-9}			9.3×10^{-7}		
8-i	1000:1	8×10^{-9}			2×10^{-6}		
9-i	1000:1	3×10^{-9}			9.2×10^{-7}		
10-i	1000:1	1×10^{-9}			masked		
11-i	1000:1	9×10^{-9}			4.0×10^{-7}		
12-i	1000:1	3×10^{-9}			6.7×10^{-7}		
13-i	1000:1	6×10^{-9}			6.4×10^{-7}		
14-i	1000:1	1.7×10^{-8}			3.6×10^{-7}		
15-i	1000:1	4.4×10^{-8}			2.9×10^{-6}		
16-i	1000:1	5×10^{-9}			8.1×10^{-7}		
17-i	1000:1	2.4×10^{-8}			3.6×10^{-7}		
18-i	1000:1	8×10^{-9}			3.8×10^{-7}		
19-i	1000:1	9×10^{-9}			3.0×10^{-7}		
20-i	1000:1	8×10^{-9}			1.2×10^{-6}		

COMPANY NAME: CHAMPLIN OIL

DATE: 15 MARCH 1974

SAMPLE TIME	H_2S, ppm	COS,* ppm	SO_2, ppm	CS_2, ppm	SAMPLE SOURCE
1010	410	—	<1.5	<1.5	INLET
20	460	—	"	"	"
30	520	—	"	"	"
40	980	—	"	"	"
50	730	—	"	"	"
1100	510	—	"	"	"
10	570	—	"	"	"
20 30	680	—	"	"	"
40	510	—	"	"	"
51	350	—	"	"	"
1200	350	—	"	"	"
10	380	—	"	"	"
20	440	—	"	"	"
31	460	—	"	"	"
41	—	—	"	"	"
50	—	—	"	"	"
1300	1500	—	"	"	"
10	570	—	"	"	"
20	620	—	"	"	"
30	840	—	"	"	"
40	810	—	"	"	"
50	480	—	"	"	"
1400	480	—	"	"	"
MEAN	600				
MAX	1500				
MIN	350				

COMPANY NAME: CHANPLIN

DATE: 15 MARCH 1974

SAMPLE TIME	H_2S, ppm	COS,* ppm	SO_2, ppm	CS_2, ppm	SAMPLE SOURCE
1410	71	—	130	<1.5	OUTLET
20	57	—	120	<1.5	OUTLET
30	46	—	110	<1.5	OUTLET
40	37	—	76	<1.5	OUTLET
AVG	53		110		
MAX	71		130		
MIN	37		76		

15 March 1974 Champlin

Inject #	GC #1 COS	GC #1 SO_2	GC #1 CS_2	GC #2 $COS+H_2S$	GC #2 SO_2	GC #2 CS_2	GC #2 H_2S
1	0.048			0.41			
2	0.059			0.46			
3	0.047			0.52			
4	0.053			0.98			
5	0.088			0.73			
6	0.049			0.51			
7	0.045			0.57			
8	0.068			—			
9	0.074			0.68			
10	0.048			0.51			
11	0.033			0.35			
12	0.033			0.35			
13	0.034			0.38			
14	0.037			0.44			
15	0.044			0.46			
16	0.026			—			
17	—			—			
18	0.24			1.5			
19	0.058			0.57			
20	0.065			0.62			
21	0.070			0.84			
22	0.088			0.81			
23	0.043			0.48			
24	0.040			0.48			
25		0.085		.071	0.13		
26		0.092		.057	0.12		
27		0.076		.046	0.11		
28		0.055		.037	0.076		

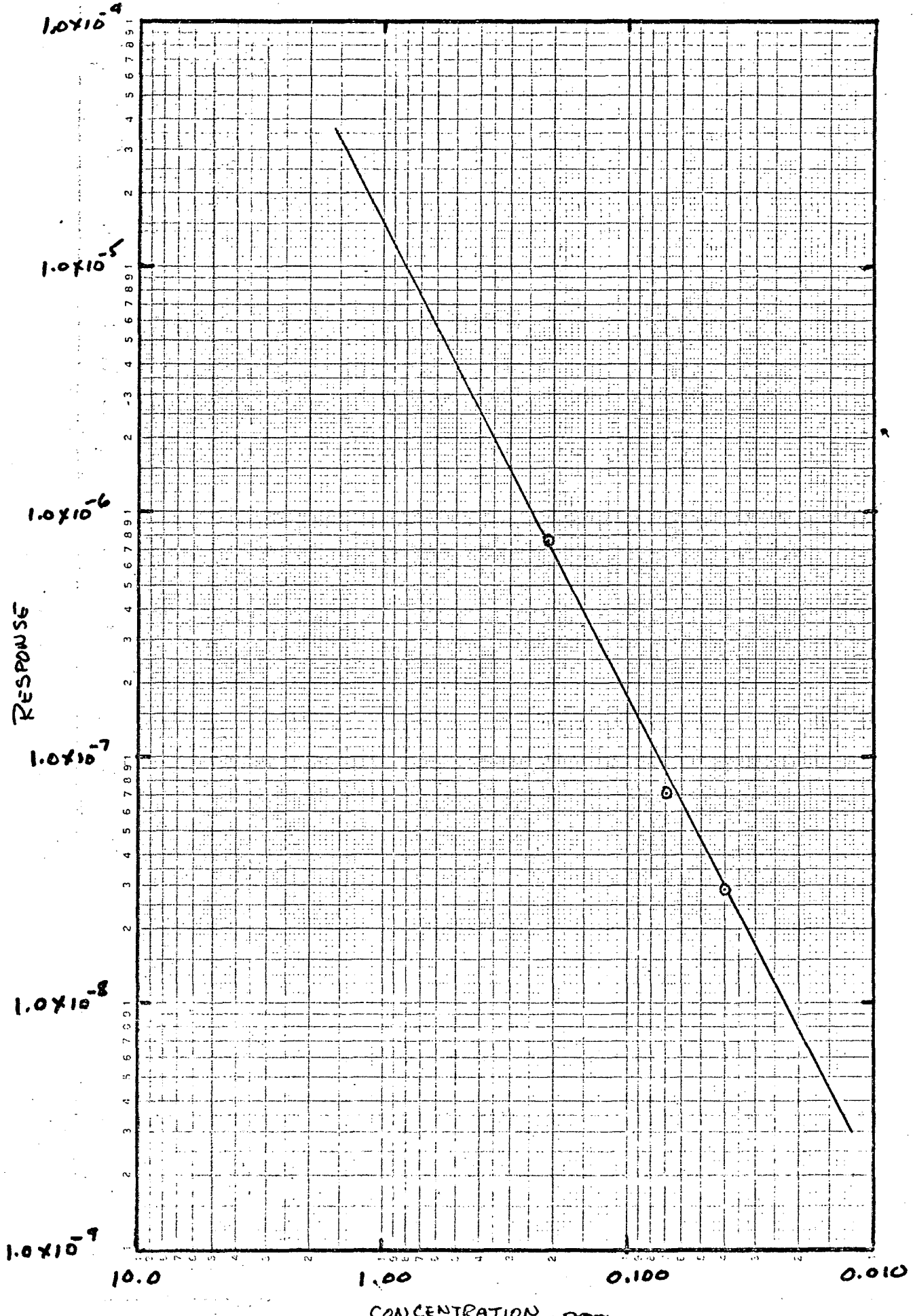
all 1000:1

OUTLET

GC #1 -- COS

CHAMPION OIL
15 MARCH 1974

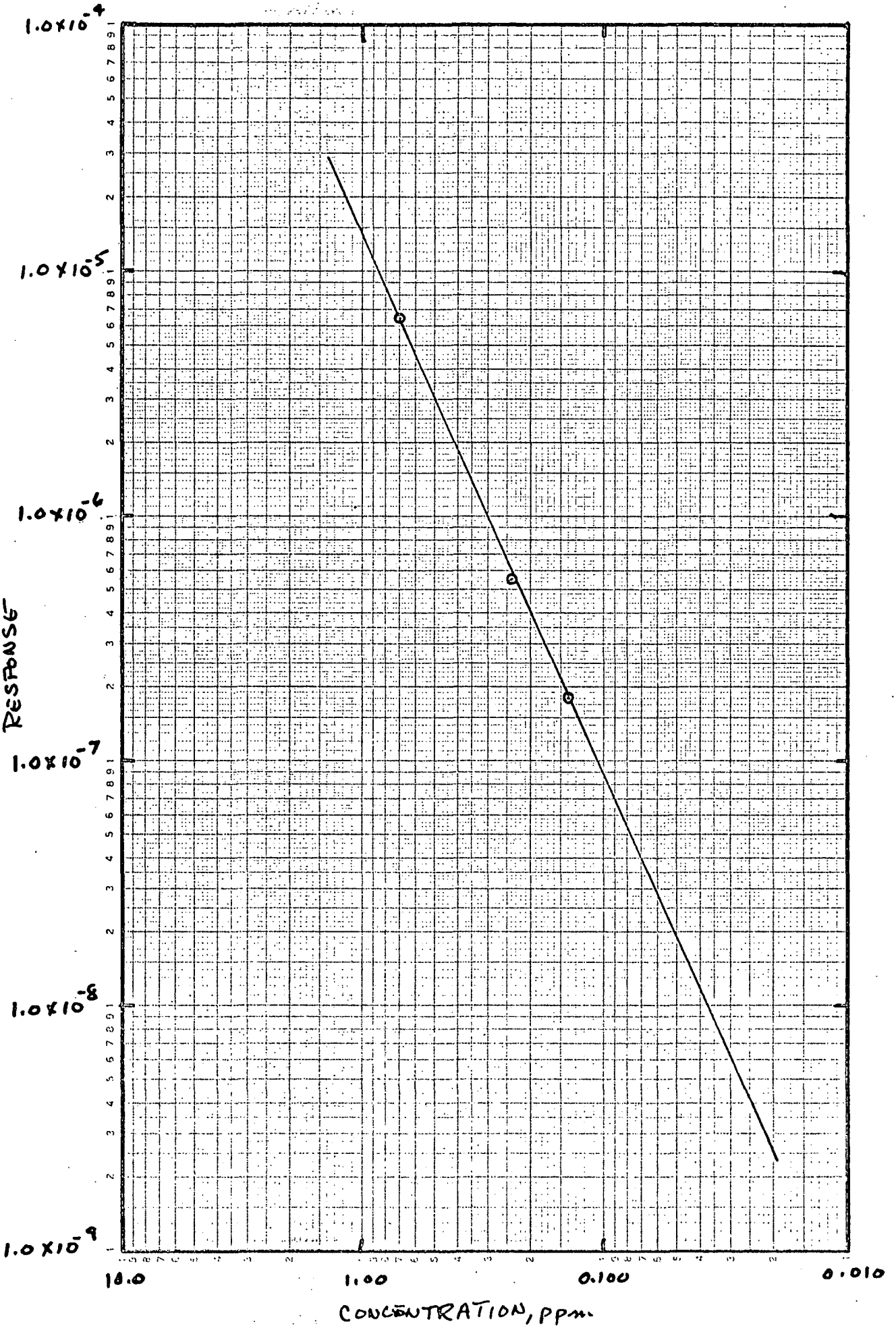
CALIBRATION PLOT



GC #1 -- SO_2

CALIBRATION PLOT

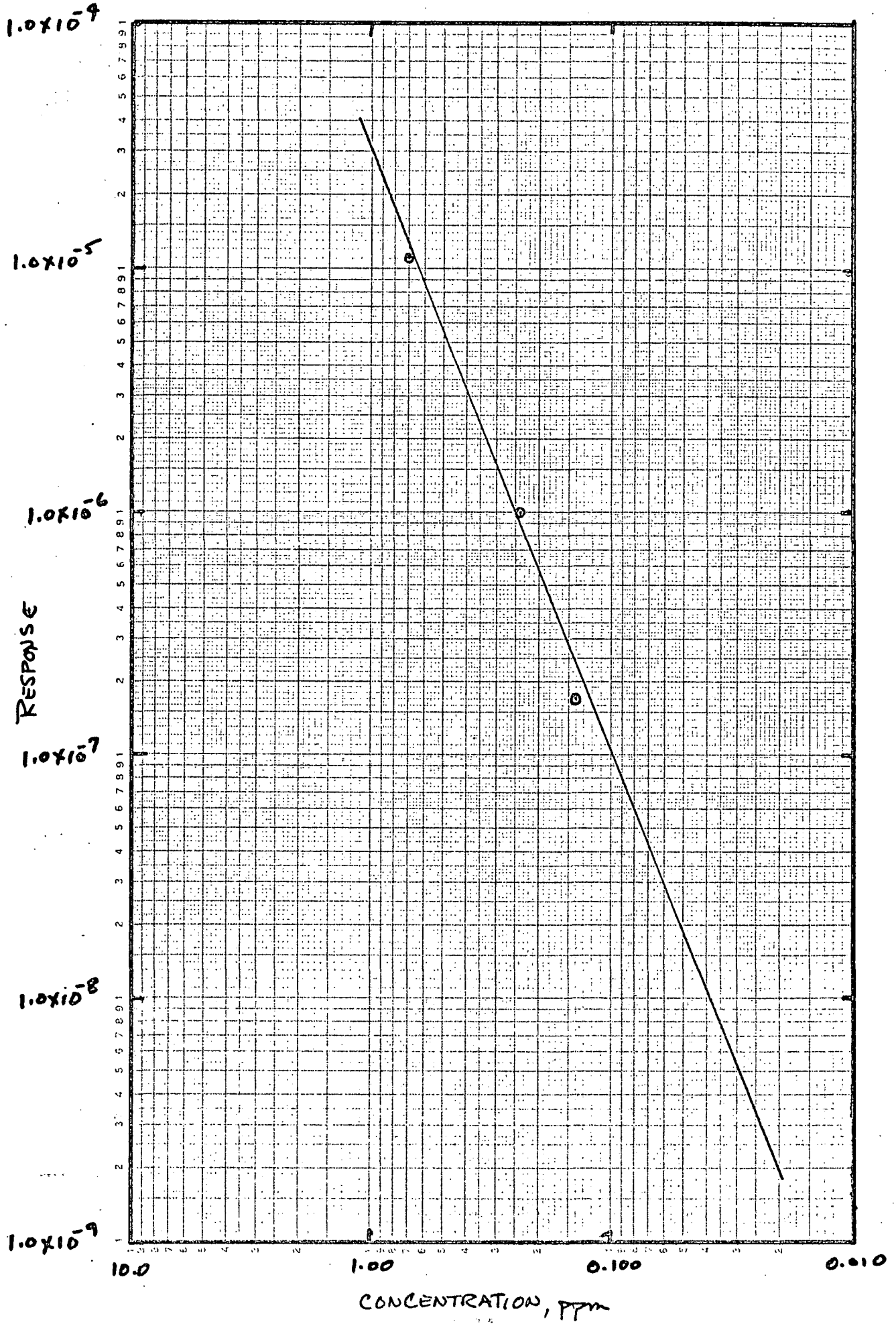
CHAMPLIN OIL
15 MARCH 1974



GC #2 -- SO_2

CHAMPLIN OIL
15 MARCH 1974

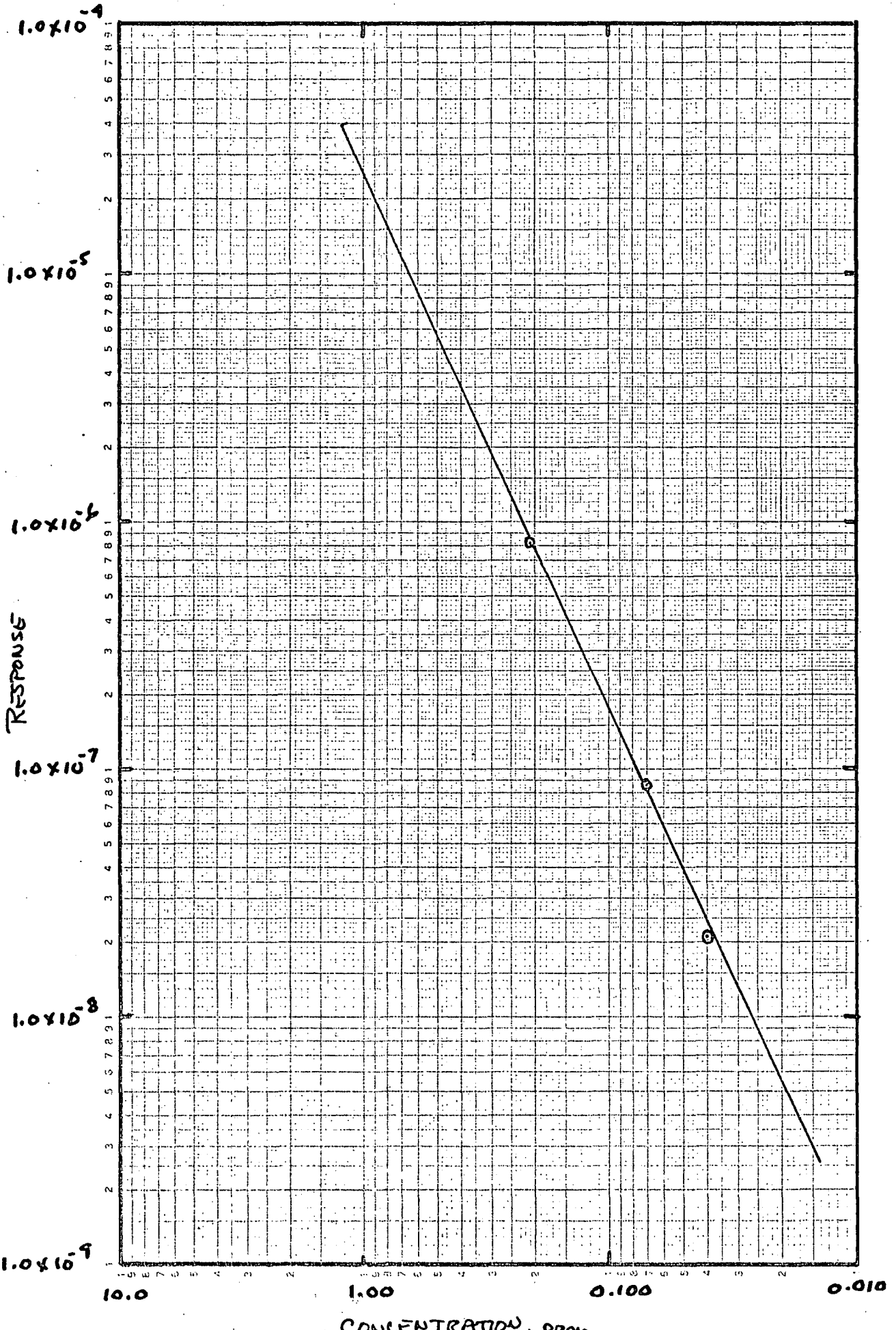
CALIBRATION PLOT



GC#2 -- COS

CHAMPLIN OIL
15 MARCH 1974

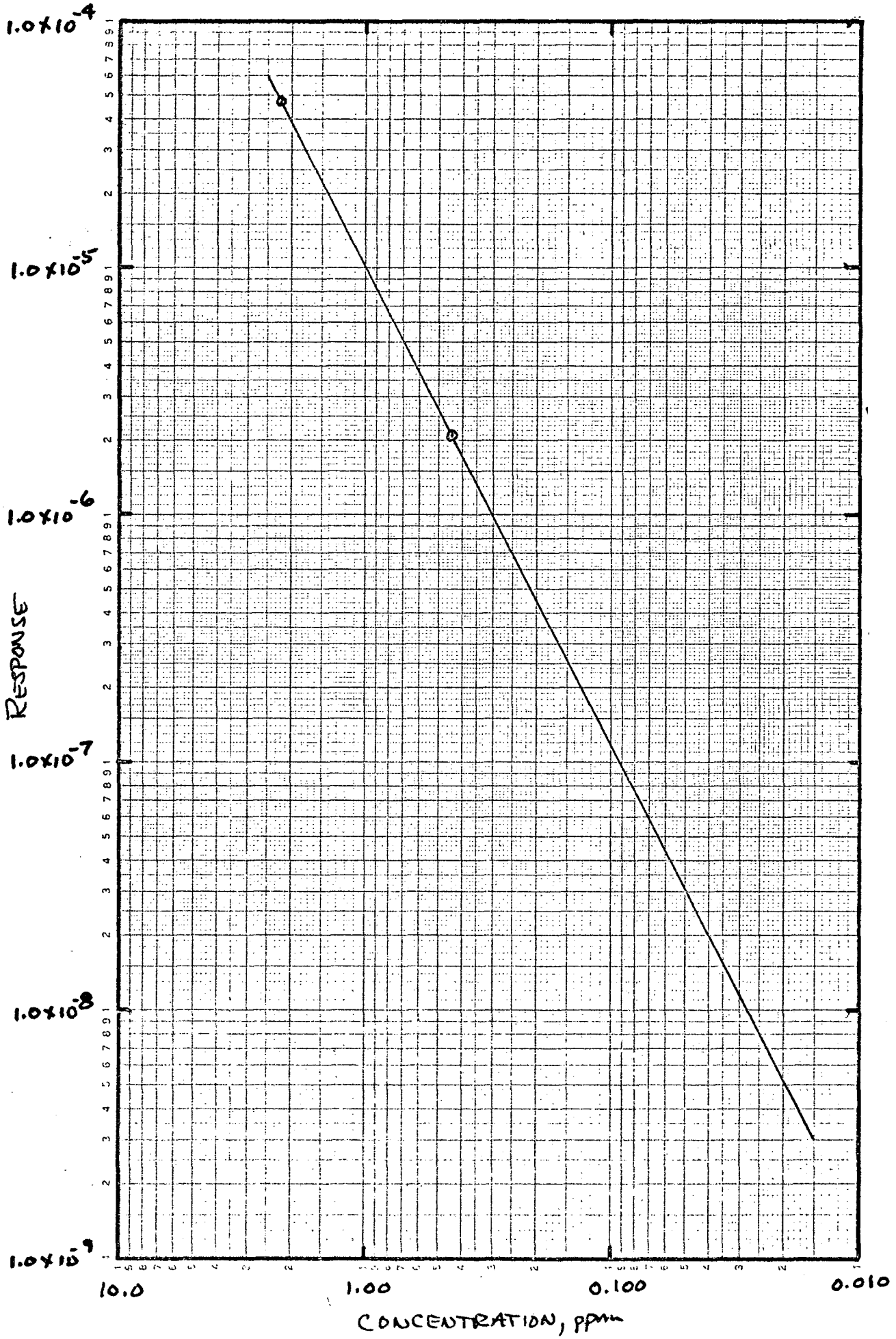
CALIBRATION PLOT



QC#2 -- H_2S

CHAMPLIN OIL
15 MARCH 1974

CALIBRATION PLOT



1st March 1974

CHAMPLIN OIL CALIBRATION

	GC #1		GC #2		
flowrate	COS	SO_2	COS	SO_2	H_2S
5000 cc/min	2.8×10^{-8}	1.8×10^{-7}	2.1×10^{-8}	1.7×10^{-7}	2.1×10^{-6} 4.7×10^{-6}
3000 cc/min	7.1×10^{-8}	5.5×10^{-7}	8.7×10^{-8}	9.9×10^{-7}	
1000 cc/min	7.6×10^{-7}	6.4×10^{-6}	8.2×10^{-7}	~~9.1×10^{-5}~~ 1.1×10^{-5}	4.7×10^{-6} 2.1×10^{-6}

	GC #1		GC #2	
	COS	SO_2	$COS + H_2S$	SO_2
	INLET			INLET
	4.2×10^{-8}		1.8×10^{-6}	
	6.4×10^{-8}		2.2×10^{-6}	
	4.1×10^{-8}		2.9×10^{-6}	
	5.1×10^{-8}		9.6×10^{-6}	
	1.1×10^{-7}		5.5×10^{-6}	
	4.4×10^{-8}		2.8×10^{-6}	
	3.7×10^{-8}		3.3×10^{-6}	
	8.2×10^{-8}		—	
	9.7×10^{-8}		4.7×10^{-6}	
	4.3×10^{-8}		2.8×10^{-6}	
	8.0×10^{-8}		1.3×10^{-6}	
	2.0×10^{-8}		1.3×10^{-6}	
	2.2×10^{-8}		1.5×10^{-6}	
	2.6×10^{-8}		2.0×10^{-6}	
	3.6×10^{-8}		2.3×10^{-6}	
	1.3×10^{-8}		—	
1250	—		—	
1300	9.4×10^{-7}		2.1×10^{-5}	
1310	6.2×10^{-8}		3.5×10^{-6}	
1320	7.8×10^{-8}		3.9×10^{-6}	
1330	8.7×10^{-8}		7.1×10^{-6}	
1340	1.4×10^{-7}		6.8×10^{-6}	
1350	3.4×10^{-8}		2.5×10^{-6}	
1400	2.9×10^{-8}		2.5×10^{-6}	

Dilution = 1000:1 for all samples.

	OUTLET		OUTLET	
1410		6.2×10^{-8}	6.0×10^{-8}	2.1×10^{-7}
1420		7.3×10^{-8}	4.0×10^{-8}	1.7×10^{-7}
1430		4.8×10^{-8}	2.6×10^{-8}	1.3×10^{-7}
1440		2.3×10^{-8}	~~3×10^{-8}~~	~~1.3×10^{-8}~~
			1.7×10^{-8}	5.3×10^{-8}

14 March 1974 Champlin Petroleum Co.

ppm	
486	551.7
0	-1
106	100

All Inlet

Hydrocarbons

Time			
1627	6.6	1817	7.0
1632	7.1	1822	6.9
1637	6.9	1827	6.9
1642	6.8	1832	6.9
1647	6.9	1837	7.0
1652	7.8	1842	7.3
1657	7.7	1847	7.5
1702	7.3	1852	7.8
1707	7.0	1857	6.8
1712	6.8	1902	6.2
1717	6.6	1907	6.0
1722	6.4	1912	5.4
1727	6.5	1917	5.8
1732	7.4	1922	5.5
1737	8.3	1927	5.5
1742	8.4	1932	5.9
1747	7.9		
1752	7.5		
1757	6.9		
1802	6.6		
1807	7.1		
1812	7.3		

Hydrocarbon analyzer on all night; values ranged from 6 to 15

15 March 1974 Champlin Oil

Hydrocarbons

ppm	
486	49.2
106	10.0
0	0

INLETS

Time					
1015	11.8	1155	12.7	1340	12.9
1020	11.5	1200	10.8	1345	13.2
1025	12.0	1205	10.0	1350	13.0
1030	12.1	1210	10.2	1355	13.2
1035	12.0	1215	9.0	1400	10.0
1040	11.0	1220	9.6	~~1405~~	~~15.0~~
1045	10.0	1225	9.8		
1050	9.8	1230	9.7		
1055	10.0	1235	12.8		
1100	10.1	1240	12.0		
1105	10.0	1245	10.9		
1110	10.3	1250	11.3		
1115	10.5	1255	11.0		
1120	10.5	1300	10.4		
1125	11.0	1305	9.8		
1130	12.0	1310	11.4		
1135	12.0	1315	11.5		
1140	12.5	1320	12.0		
1145	13.6	1330	13.7		
1150	13.8	1335	13.0		

OUTLETS 15 March 1974

1405	15.0
1410	11.3
1415	13.5
1420	13.8
1425	13.3
1430	14.0
1435	19.0
1440	19.5
1445	23.0
1450	17.5
1455	12.0

CALIBRATION PLOT

10 Millimeters to the Centimeter

B-3

Total Sulfur
14 March 1974
Champlin Def

Time	MAXIMUM	MINIMUM	MEAN
1800	—	—	—
1810	540	230	380
1820	420	210	320
1830	880	210	540
1840	1,200	220	710
1850	560	210	380
1900	580	280	430

Calibration curve

concentration, ppm	Response, amps
1.00	4.0×10^{-6}
0.72	2.1×10^{-6}
0.44	8.0×10^{-7}

Total Sulfur — 14 March 1974 — PPM

Time)	max	min)	max	min)	max	min
[redacted]00	—	—	—	—	—	—
[redacted]10	1.5×10^{-6}	6.5×10^{-7}	1.2	2.1	0.54	0.23
[redacted]20	17×10^{-7}	5.0×10^{-7}	7.2	1.7	0.42	0.21
[redacted]30	10×10^{-6}	5.0×10^{-7}	3.2	1.7	0.88	0.21
1840	15×10^{-6}	6.0×10^{-7}	5.6	2.0	1.2	0.22
[redacted]50	2.0×10^{-6}	5.0×10^{-7}	1.3	1.7	0.56	0.21
[redacted]00	3.0×10^{-6}	10.0×10^{-7}	1.4	3.2	0.58	0.28
[redacted]						
0.72	6.5×10^{-6}		2.1			
0.44	18×10^{-7}		8.0			

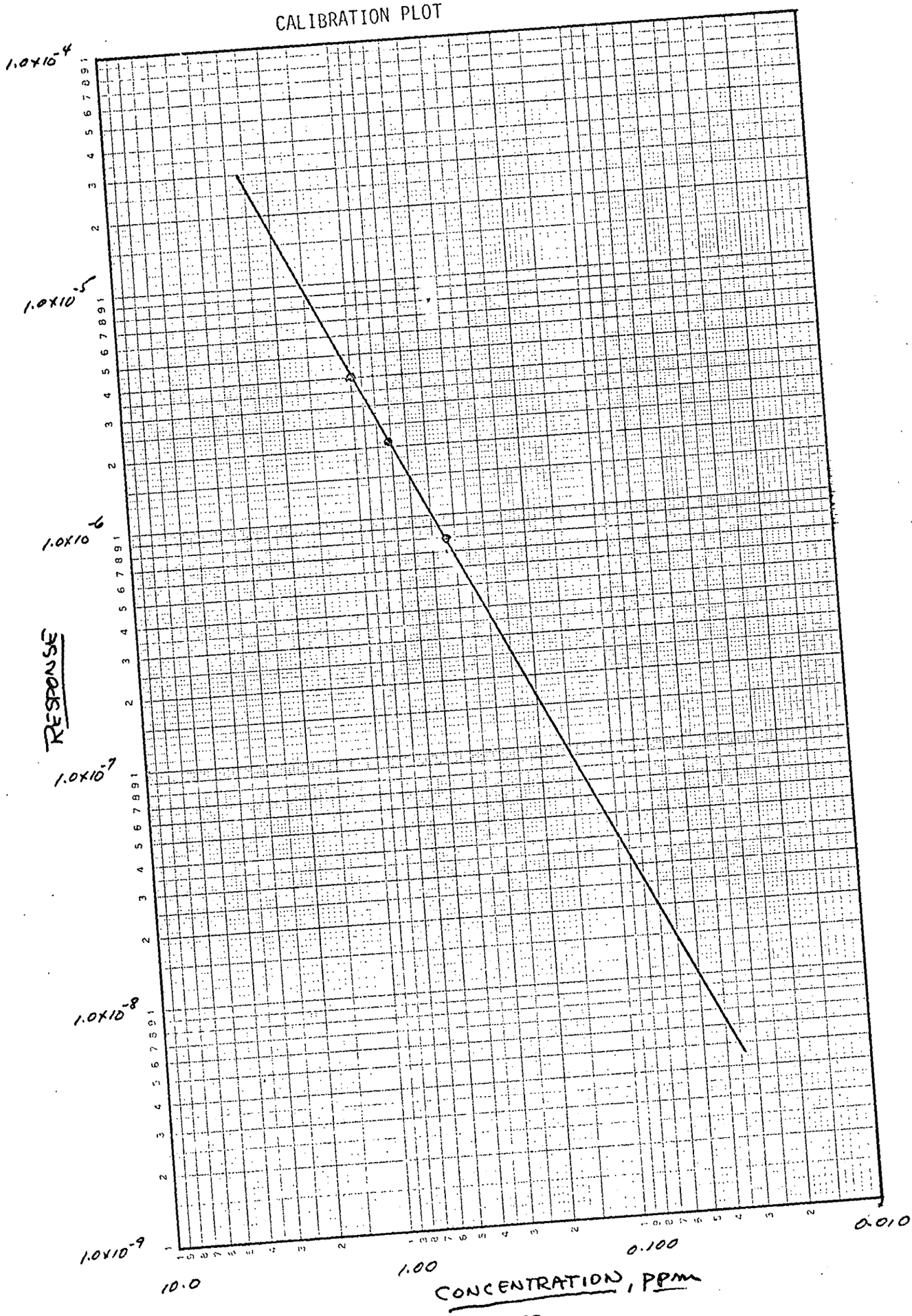
Total sulfur 15 March 1974

Time		max	min	max ppm	min ppm
[redacted]1020	INLET	1.5 3.6×10^{-6}	5.5 14.8×10^{-7}	.61	.38
[redacted]1040		4.0 12.0×10^{-6}	8 $\times 10^{-6}$	1.0	.50
[redacted]1050		2.5 8.0×10^{-6}	8.7 $18.8 \times ^{-7}$	.78	.47
1100		2.8 8.8×10^{-6}	5.0 14×10^{-7}	.84	.35
[redacted]1110		1.8 5.2×10^{-6}	7.1 17×10^{-7}	.68	.42
[redacted]1120		1.4 2.8×10^{-6}	6.0 15.6×10^{-7}	.59	.37
1130		1.6 4×10^{-6}	4.8 13.5×10^{-7}	.63	.35
[redacted]1140		1.3 2×10^{-6}	6.0 15.5×10^{-7}	.56	.37
1150		1.4 3×10^{-6}	4.0 12×10^{-7}	.59	.32
[redacted]1200		8.0 18×10^{-7}	3.7 11.5×10^{-7}	.45	.30
[redacted]1210		1 0×10^{-6}	4.8 13.5×10^{-7}	.50	.35
1220		1.4 3×10^{-6}	4.5 13×10^{-7}	.59	.34
[redacted]1230		2.5 8×10^{-6}	7.1 17×10^{-7}	.80	.42
1240		1.5 3.5×10^{-6}	2.0 6×10^{-7}	.61	.22
[redacted]1250		8.0 18×10^{-6}	2.2 7×10^{-7}	1.4	.23
[redacted]1300		>1 $\times 10^{-5}$	5.0 14×10^{-6}	>	1.1
1310		5.0 14×10^{-6}	9.5 19.5×10^{-7}	1.1	.49
[redacted]1320		1.3 2×10^{-6}	4.2 12.5×10^{-7}	.57	.32
1330		3.8 11.5×10^{-6}	7.6 17.5×10^{-7}	.96	.43
[redacted]1340		4.0 12×10^{-6}	7.6 17.5×10^{-7}	1.0	.43
[redacted]1350		3.2 10×10^{-6}	6.3 16×10^{-7}	.87	.40
1400		2.2 7×10^{-6}	6.3 16×10^{-7}	.74	.40
[redacted]1410	OUTLET	2.0 6×10^{-7}	9.0 19×10^{-8}	.22	.15
[redacted]1420		1.5 3.5×10^{-7}	9.5 [illegible]	.19	.16
[redacted]1430		1.3 3×10^{-7}	7.1 17×10^{-8}	.18	.13
[redacted]1440		7.6 17.5×10^{-8}	2.8 7×10^{-8}	.14	.086

14 March 1974
Champlin Oil

TOTAL SULFUR ANALYZER

CALIBRATION PLOT



SAMPLING DATA SHEET FOR SO_2

Plant CHAMBLIN OIL Stack SULFUR RECOVERY SYSTEM - INLET

Remarks EPA METHOD #6

Run No.	2A	2B	
Date	3/1/74	3/1/74	
Time of Sample 12:40 PM	~~10:40~~ AM	1:05 PM ~~2:50~~	
Barometric Pressure, "Hg	30	30	
Stack Pressure, "Hg	30	30	
Final Dry Test Meter Reading, Ft^3	142.850	144.532	
Initial Dry Test Meter Reading, Ft^3	141.455	143.030	
Meter Volume Sampled @ Meter Cond., Ft^3	1.395	1.502	
Average Meter Temperature, °F	87°F	90	
Average Stack Temperature, °F	~~235~~ 90°	~~235~~ 90°	
Average Meter Vacuum, "Hg	1	1	
Average Meter Orifice ΔH, "H_2O	1.67	1.67	
Observed Sampling Rate, ~~LPM~~ CFM	.013	.013	
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant CHAMPLIN PETROLEUM CO Stack SULFUR RECOVERY SYSTEM - OUTLET

Remarks EPA METHOD #6

Run No.	2A	2B	
Date	3/1/74	3/1/74	
Time of Sample	AM 11:10 / PM 13:10	PM 13:35 / PM 15:35	
Barometric Pressure, "Hg	30	30	
Stack Pressure, "Hg	30	30	
Final Dry Test Meter Reading, Ft^3	88.900	90,320	
Initial Dry Test Meter Reading, Ft^3	87.400	89.100	
Meter Volume Sampled @ Meter Cond., Ft^3	1.500	1.220	
Average Meter Temperature, °F	74	75	
Average Stack Temperature, °F	1040	1040	
Average Meter Vacuum, "Hg	—	—	
Average Meter Orifice ΔH, "H_2O	1.7	1.7	
Observed Sampling Rate, ~~CFM~~ CFM	.013	.013	
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg	--	-	

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant CHAMBLIN PETROLEUM CO. Stack SULFUR RECOVERY SYSTEM - INLET

Remarks EPA METHOD #6

Run No.	3A	3B	
Date	3/1/74	3/1/74	
Time of Sample ~~4:47 PM~~ 5:00 PM	6:40 PM		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	146.193		
Initial Dry Test Meter Reading, Ft^3	145.259		
Meter Volume Sampled @ Meter Cond., Ft^3	.934		
Average Meter Temperature, °F	90°		
Average Stack Temperature, °F	230°		
Average Meter Vacuum, "Hg	—		
Average Meter Orifice ΔH, "H_2O	1.67		
Observed Sampling Rate, ~~LPM~~ CFM	.011		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant Champlin Petroleum Co. Stack Sulfur Recovery System - Outlet

Remarks EPA Method # 6

Run No.	3-A	3-B	
Date	3-1-74	3-1-74	
Time of Sample	~~4~~-4:15 6:15	6:35 6:50	
Barometric Pressure, "Hg	30	30	
Stack Pressure, "Hg	30	30	
Final Dry Test Meter Reading, Ft^3	92.115	92.631	
Initial Dry Test Meter Reading, Ft^3	90.500	92.300	
Meter Volume Sampled @ Meter Cond., Ft^3	1.615	.331	
Average Meter Temperature, °F	87	87	
Average Stack Temperature, °F	1020	1020	
Average Meter Vacuum, "Hg	—	—	
Average Meter Orifice ΔH, "H_2O	1.7	1.7	
Observed Sampling Rate, ~~CPM~~ CFM	.013 ~~.075~~	.013	
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant CHAMPLIN PETROLEUM CO Stack SULFUR RECOVERY SYSTEM-INLET

Remarks EPA METHOD #6

Run No.	4A		
Date	3/14/74		
Time of Sample	1600/1830		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	159.489		
Initial Dry Test Meter Reading, Ft^3	157.100		
Meter Volume Sampled @ Meter Cond., Ft^3	2.389		
Average Meter Temperature, °F	85		
Average Stack Temperature, °F	94		
Average Meter Vacuum, "Hg	—		
Average Meter Orifice ΔH, "H_2O	1.67		
Observed Sampling Rate, ~~LPM~~ CFM	0.02		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg	--	-	

Calculations:

SAMPLING DATA SHEET FOR SO_2

Champlin Petroleum Company

Plant Wilmington, Calif. Stack ~~ESP~~ Sulfur Recovery Unit - Outlet

Remarks EPA Method #6 with heated Teflon Sample Line and Stainless Steel Probe with Heating Tape

Run No.	4-A	4-B	
Date	3-14-74		
Time of Sample	4:00 PM - 6:30		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	129.185		
Initial Dry Test Meter Reading, Ft^3	127.000		
Meter Volume Sampled @ Meter Cond., Ft^3	2.185		
Average Meter Temperature, °F	81		
Average Stack Temperature, °F	1045		
Average Meter Vacuum, "Hg	—		
Average Meter Orifice ΔH, "H_2O	1.7		
Observed Sampling Rate, ~~LPM~~ CFM	.012		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant CHAMPLIN PETROLEUM CO. Stack SULFUR RECOVERY SYSTEM - INLET

Remarks EPA METHOD #6

Run No.	5A	5B	
Date	3/15/74	3/16/74	
Time of Sample	09:30/11:15	11:45/13:30	
Barometric Pressure, "Hg	30	30	
Stack Pressure, "Hg	30	30	
Final Dry Test Meter Reading, Ft^3	161.980	162.278	
Initial Dry Test Meter Reading, Ft^3	159.700	161.200	
Meter Volume Sampled @ Meter Cond., Ft^3	2.28	1.078	
Average Meter Temperature, °F	~~82~~ 80	81	
Average Stack Temperature, °F	92	92	
Average Meter Vacuum, "Hg	—	—	
Average Meter Orifice ΔH, "H_2O	1.67	1.67	
Observed Sampling Rate, ~~LPM~~ CFM	0.02	0.01	
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg	--		

Calculations:

SAMPLING DATA SHEET FOR SO_2

Plant Champlin Petroleum Company Wilmington, Calif. Stack Sulfur Recovery Unit - Outlet

Remarks EPA Method # 6

Run No.	5A	5B	
Date	3-15-74		
Time of Sample	Am 9:30 - 11:15	Am 11:45 -	Pm 1:30
Barometric Pressure, "Hg	30	30	
Stack Pressure, "Hg	30	30	
Final Dry Test Meter Reading, Ft^3	134.077	136.226	
Initial Dry Test Meter Reading, Ft^3	132.400	134.400	
Meter Volume Sampled @ Meter Cond., Ft^3	1.677	1.826	
Average Meter Temperature, °F	70	84	
Average Stack Temperature, °F	1055	1040	
Average Meter Vacuum, "Hg	—	—	
Average Meter Orifice ΔH, "H_2O	1.70	1.70	
Observed Sampling Rate, ~~LPM~~ CFM	.016	.015	
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations:

SAMPLING DATA SHEET FOR ~~PM~~ % MOISTURE

Plant CHAMPLIN OIL Stack SULFUR RECOVERY UNIT - INLET

Remarks _____

Run No.	2		
Date	3/1/74		
Time of Sample 2:40 PM	10:40		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	779.544		
Initial Dry Test Meter Reading, Ft^3	770.295		
Meter Volume Sampled @ Meter Cond., Ft^3	9.249		
Average Meter Temperature, °F	84°		
Average Stack Temperature, °F	~~235~~ 90°		
Average Meter Vacuum, "Hg	1		
Average Meter Orifice ΔH, "H_2O	1.67		
Observed Sampling Rate, ~~LPM~~ CFM	.070		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations: -3 ON MOISTURE INCREASE.

THERE WAS A MAL FUNCTION OF SOME SORT & ~~WATER~~ CONDEN MOISTURE WAS SUCKED OUT OF THE IMPINGERS. THIS WAS UNDETECTED UNTIL NEAR THE END OF THE RUN.

SAMPLING DATA SHEET FOR Moisture

Plant Champlin Petroleum Co. Stack Sulfur Recovery System - Outlet

Remarks Moisture

Run No.	~~2~~ 2		
Date	3-1-74		
Time of Sample	10:45 - 2:45		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	146.658		
Initial Dry Test Meter Reading, Ft^3	129.600		
Meter Volume Sampled @ Meter Cond., Ft^3	17.058		
Average Meter Temperature, °F	78		
Average Stack Temperature, °F	1080		
Average Meter Vacuum, "Hg	1		
Average Meter Orifice ΔH, "H_2O	.020		
Observed Sampling Rate, ~~LPM~~ CFM	0.075		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations: Outlet 25.5 ml.

SAMPLING DATA SHEET FOR H_2O

Plant CHAMPLIN Stack SULFUR RECOVERY UNIT INLET

Remarks FINLET

Run No.	1		
Date	3/14/74		
Time of Sample	16:00/18:30		
Barometric Pressure, "Hg	30.0		
Stack Pressure, "Hg	30.		
Final Dry Test Meter Reading, Ft^3	62.479		
Initial Dry Test Meter Reading, Ft^3	50.400		
Meter Volume Sampled @ Meter Cond., Ft^3	12.079		
Average Meter Temperature, °F	81		
Average Stack Temperature, °F	92°		
Average Meter Vacuum, "Hg	1		
Average Meter Orifice ΔH, "H_2O	1.67		
Observed Sampling Rate, ~~LPM~~ CFM	.073		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg	--		

Calculations: MOISTURE INCREASE $\frac{18}{20}$ ml

SAMPLING DATA SHEET FOR Moisture

Champlin Petroleum Company

Plant Wilmington, Calif. Stack Sulfur Recovery Unit - Outlet

Remarks EPA Method #4 with Heated Sample Line (Teflon) and Stainless Steel Probe with Heating Tape

Run No.	1		
Date	3-14-74		
Time of Sample	PM 4:00-6:30		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	302.458		
Initial Dry Test Meter Reading, Ft^3	284.100		
Meter Volume Sampled @ Meter Cond., Ft^3	18.358		
Average Meter Temperature, °F	77		
Average Stack Temperature, °F	1045		
Average Meter Vacuum, "Hg	1		
Average Meter Orifice ΔH, "H_2O	.020		
Observed Sampling Rate, ~~LPM~~ CFM	.123		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations: 21.2 ml Increase

SAMPLING DATA SHEET FOR H_2O

Plant CHAMPLIN Stack SULFUR RECOVERY UNIT - INLET

Remarks INLET

Run No.	2		
Date	3/15/74		
Time of Sample	9:30/13:30		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	74.184		
Initial Dry Test Meter Reading, Ft^3	62.600		
Meter Volume Sampled @ Meter Cond., Ft^3	11.584		
Average Meter Temperature, °F	81°		
Average Stack Temperature, °F	93		
Average Meter Vacuum, "Hg	1"		
Average Meter Orifice ΔH, "H_2O	1.67		
Observed Sampling Rate, ~~EPM~~ CFM	.073 Ft^3		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg	--		

Calculations: MOISTURE INCREASE 24 ML.

SAMPLING DATA SHEET FOR Moisture

Plant Champlin ~~Oil~~ Petroleum Company Wilmington, Calif. Stack Sulfur Recovery Unit - Outlet

Remarks EPA Method # 4

Run No.	2		
Date	3-15-74		
Time of Sample	Am Pm 9:30-130		
Barometric Pressure, "Hg	30		
Stack Pressure, "Hg	30		
Final Dry Test Meter Reading, Ft^3	330.480		
Initial Dry Test Meter Reading, Ft^3	304.500		
Meter Volume Sampled @ Meter Cond., Ft^3	25.980		
Average Meter Temperature, °F	68		
Average Stack Temperature, °F	1055		
Average Meter Vacuum, "Hg	1		
Average Meter Orifice ΔH, "H_2O	.020		
Observed Sampling Rate, ~~LPM~~ CFM	.111		
Gas Volume Sampled, Ft^3, Dry, 70°F, 29.92 "Hg			

Calculations: 15 ML INCREASE

PRELIMINARY VELOCITY TRAVERSE

PLANT CHAMPION
DATE 8/1/74
LOCATION ~~CATALYST~~ OUTLET
STACK I.D. 32
BAROMETRIC PRESSURE, in. Hg 30
STACK GAUGE PRESSURE, in. H_2O 30
OPERATORS GREG BENTON, L. ROBY

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.01	90
2	.01	
3	.02	
4	.03	
5	.05	
6	.06	
7	.06	
8	.06	
9	.06	
10	.06	
11	.07	
12	.08	
13	.08	
14	.08	
15	.08	
16	.08	
17	.08	
18	.08	
19	.08	
20	.07	
AVERAGE	$\overline{\sqrt{\Delta p_s}}^2$ .24	

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

EPA (Dur) 233
4/72

PRELIMINARY VELOCITY TRAVERSE

PLANT CHAMPLIN PETROLEUM CO.
DATE MARCH 14, 1974
LOCATION STACK HEATER OUTLET
STACK I.D. 32"
BAROMETRIC PRESSURE, in. Hg 30
STACK GAUGE PRESSURE, in. H_2O
OPERATORS G. BENTON & M. JACKSON

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	—	—
2	0	1050
3	0	
4	0.04	
5	0.06	
6	0.07	
7	0.07	
8	0.07	
9	0.07	
10	0.07	
11	0.07	
12	0.08	
13	0.08	
14	0.08	
15	0.08	
16	0.08	
17	0.08	
18	0.09	
19	0.09	
20	—	—
AVERAGE	.22655	

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

EPA (Dur) 233
4/72

PRELIMINARY VELOCITY TRAVERSE

PLANT CHAMPLIN
DATE MARCH 15, 1974
LOCATION STACK HEATER OUTLET
STACK I.D. 34
BAROMETRIC PRESSURE, in. Hg 30
STACK GAUGE PRESSURE, in. H_2O
OPERATORS

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	—	
2	.1	
3	.13	
4	.16	
5	.18	
6	.2	
7	.21	
8	.21	
9	.21	
10	.21	
11	.21	
12	.22	
13	.22	
14	.21	
15	.17	
16	.16	
17	.16	
18	.16	
19	.16	
20	—	
AVERAGE	$\overline{\sqrt{\Delta p_H}}$ = .38	

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

EPA (Dur) 233
4/72

Source of Air Contaminants Sulphur Recovery Unit (Thermal Oxidizer)

Type of Air Contaminants $SO_2 + CO_2 + H_2O + O_2$

Point of Discharge: Stack ☑ Other _____

Point of Observation: East, South East.

Distance to Base of Point of Discharge, feet 110 - 125 Ft.

Height of Point of Discharge Above Ground Level, ~~feet~~ 60 ft.

Background Description ~~Grey~~ Clouds (Brownish Color)

Weather: Clear ☐ Overcast ☒ Partly Cloudy ☐ Other _____

Wind Direction ~~@~~ from South Wind Velocity, mi/hr ~~@~~ 5

Plume Description:

N.A.

Detached: Yes ☐ No ☐

Color: Black ☐ White ☐ Other _____

Plume Dispersion Behavior: Looping ☐ Coning ☐ Fanning ☐

Lofting ☐ Fumigating ☐ See Comments ☐

N.A.

Estimated Distance (feet) Plume Visible (Maximum) _____ (Minimum) _____

Comments To the (N. NE.) the visability is very poor - the Air has a brownish tent to it. to the South it is much cleaner what pollution there is lays on the ground (200-300 Ft thick). So even though it marked overcast the background is not white it is more a blue gray. I haven't observed any readable smoke from the stack from Monday to Today.

Signed Michael H Jackson Title Tec.

ENVIRONMENTAL PROTECTION AGENCY

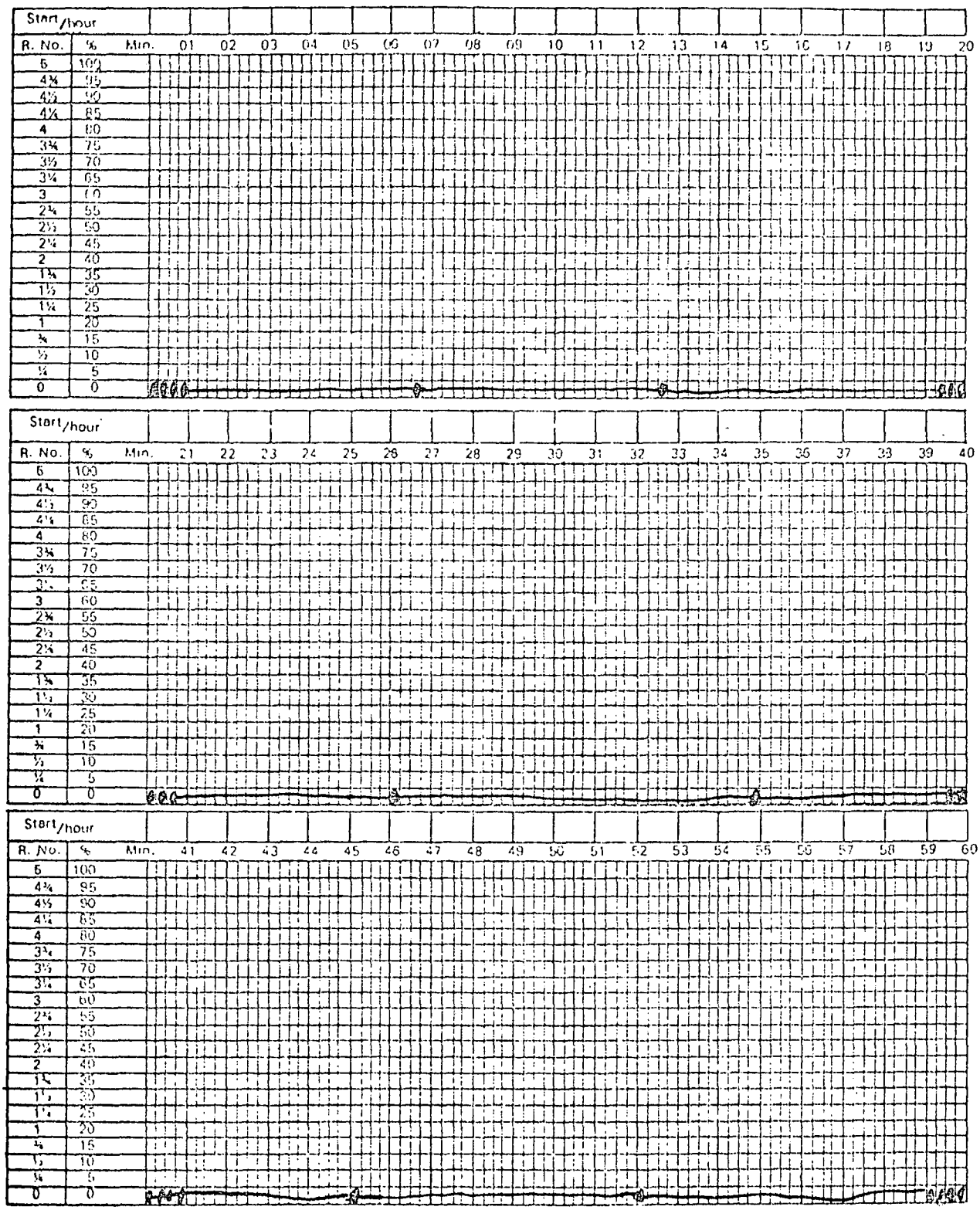
COMPANY NAME Champlin Petroleum Co.

EQUIPMENT LOCATION (ADDRESS) Wilmington, Calif.

TIME OF OBSERVATION: FROM 10:45 A.M./P.M. TO 11:45 A.M./P.M. DATE March 1, 74

RECORD OF VISIBLE EMISSIONS

(1)



NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

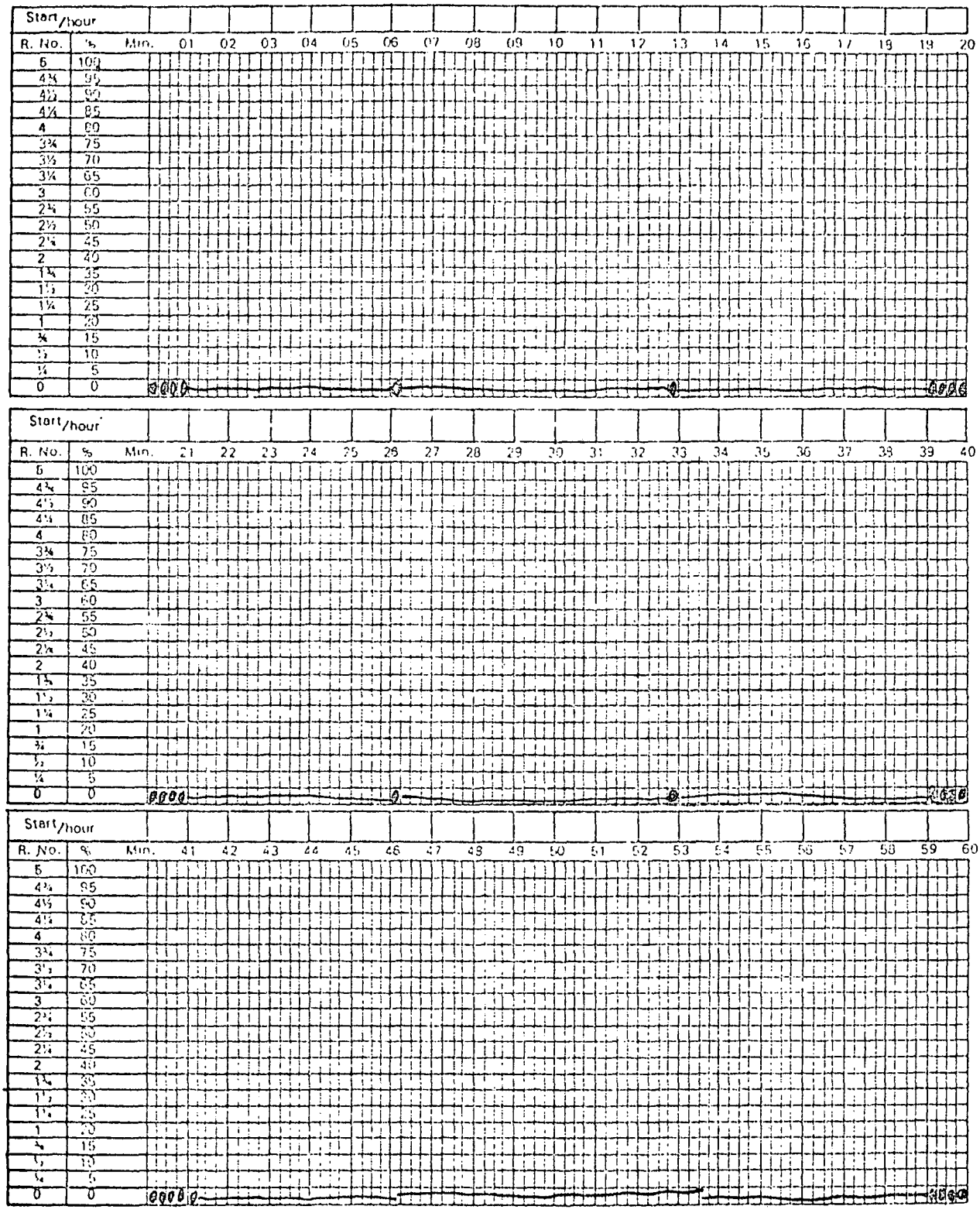
COMPANY NAME _____

EQUIPMENT LOCATION (ADDRESS) _____

TIME OF OBSERVATION: FROM 11:45 A.M. P.M. TO 12:45 A.M. P.M. DATE Monday

RECORD OF VISIBLE EMISSIONS

(2)



NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

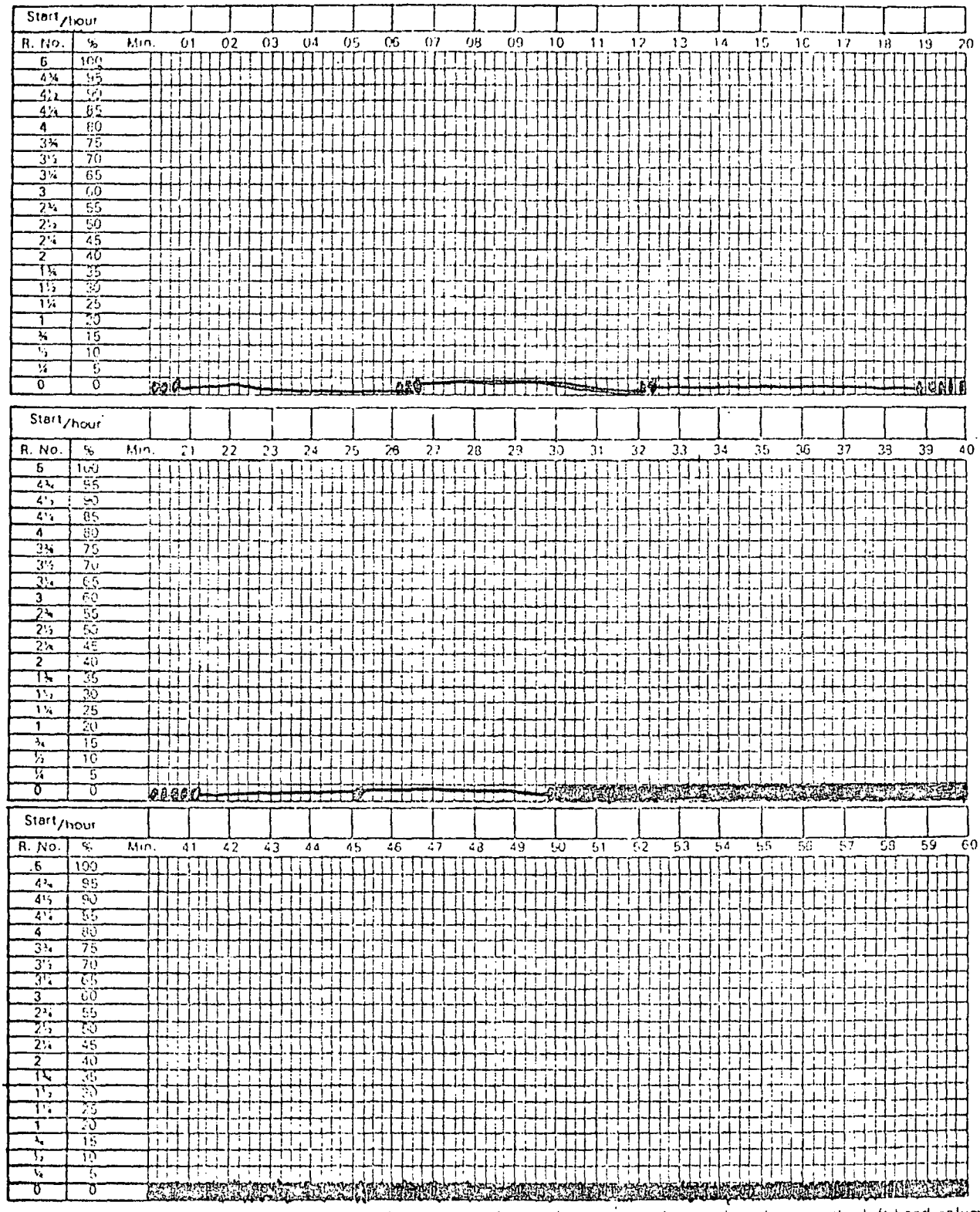
COMPANY NAME _____

EQUIPMENT LOCATION (ADDRESS) _____

TIME OF OBSERVATION: FROM 12:45 A.M. P.M. TO 1:45 A.M. P.M. DATE March 1

RECORD OF VISIBLE EMISSIONS

(3)



NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME _____

EQUIPMENT LOCATION (ADDRESS) _____

TIME OF OBSERVATION: FROM 1:45 A.M. P.M. TO 2:45 A.M. P.M. DATE March 1

RECORD OF VISIBLE EMISSIONS

fff ⑥

R. No.	%	Min. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20
		Start/hour
5	100	
4¾	95	
4½	90	
4¼	85	
4	80	
3¾	75	
3½	70	
3¼	65	
3	60	
2¾	55	
2½	50	
2¼	45	
2	40	
1¾	35	
1½	30	
1¼	25	
1	20	
¾	15	
½	10	
¼	5	
0	0	

R. No.	%	Min. 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
		Start/hour
5	100	
4¾	95	
4½	90	
4¼	85	
4	80	
3¾	75	
3½	70	
3¼	65	
3	60	
2¾	55	
2½	50	
2¼	45	
2	40	
1¾	35	
1½	30	
1¼	25	
1	20	
¾	15	
½	10	
¼	5	
0	0	

R. No.	%	Min. 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
		Start/hour
5	100	
4¾	95	
4½	90	
4¼	85	
4	80	
3¾	75	
3½	70	
3¼	65	
3	60	
2¾	55	
2½	50	
2¼	45	
2	40	
1¾	35	
1½	30	
1¼	25	
1	20	
¾	15	
½	10	
¼	5	
0	0	

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

#8

Source of Air Contaminants Sulpher Recovery Unit. (Champlin Petrolium Co.)

Type of Air Contaminants SO_2 CO_2 H_2O O_2 H_2S

Point of Discharge: Stack [X] Other _____

Point of Observation:

Distance to Base of Point of Discharge, feet 120Ft.

Height of Point of Discharge Above Ground Level, feet [redacted] 60 Ft.

Background Description Clear Sky.

Weather: Clear [X] Overcast [ ] Partly Cloudy [ ] Other _____

Wind Direction From West Wind Velocity, mi/hr 10

Plume Description: None

Detached: Yes [ ] No [ ]

Color: Black [ ] White [ ] Other _____

Plume Dispersion Behavior: Looping [ ] Coning [ ] Fanning [ ]
Lofting [ ] Fumigating [ ] See Comments [ ]

Estimated Distance (feet) Plume Visible (Maximum) _____ (Minimum) _____

Comments Clear Day but no signs of any opasity.

Signed Michael H. Jackson Title Tec.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin Petroleum Co.

EQUIPMENT LOCATION (ADDRESS) 2402 E. Anahyme, Wilmington, Calf.

TIME OF OBSERVATION: FROM 4:00 PM TO 5:00 P.M. DATE March 14, 74

RECORD OF VISIBLE EMISSIONS

(1)

R. No.	%	Min. 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Start/hour																					
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

R. No.	%	Min. 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Start/hour																					
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

R. No.	%	Min. 41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Start/hour																					
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

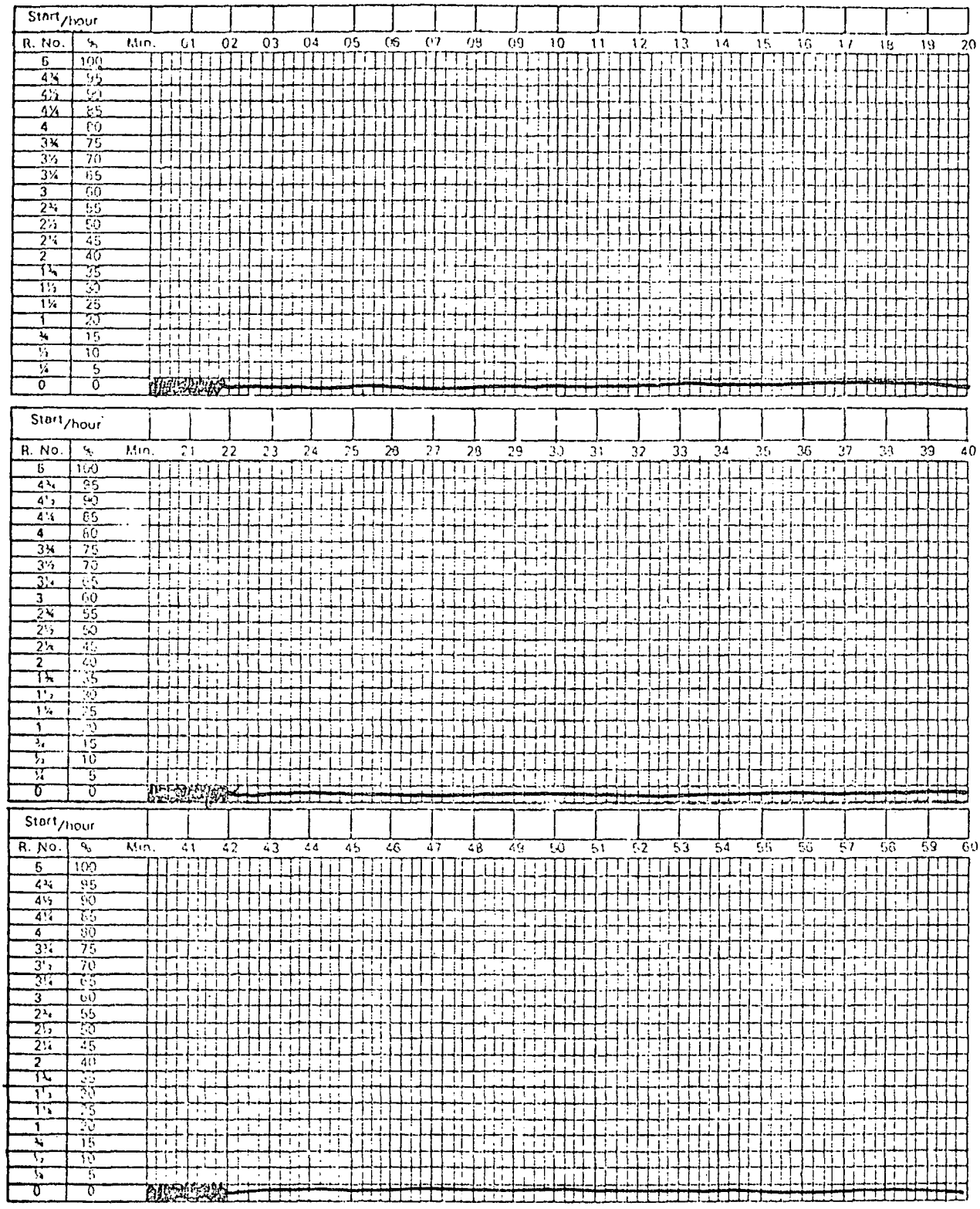
COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 5:00 A.M. P.M. TO 6:00 A.M. P.M. DATE March 14, 74

RECORD OF VISIBLE EMISSIONS

(2)



NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 6:00 P.M. TO 7:00 P.M. DATE 3/14/74

RECORD OF VISIBLE EMISSIONS

(3)

Start/hour																					
R. No.	%	Min.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

Start/hour																					
R. No.	%	Min.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

Start/hour																					
R. No.	%	Min.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 7:00 P.M. TO 8:00 P.M. DATE 3/14/74

RECORD OF VISIBLE EMISSIONS

(4)

R. No.	%	Min. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20
		Start/hour
6	100	
5¾	95	
5½	90	
5¼	85	
5	80	
4¾	75	
4½	70	
4¼	65	
4	60	
3¾	55	
3½	50	
3¼	45	
3	40	
2¾	35	
2½	30	
2¼	25	
2	20	
1¾	15	
1½	10	
1¼	5	
1	0	

R. No.	%	Min. 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
		Start/hour
6	100	
5¾	95	
5½	90	
5¼	85	
5	80	
4¾	75	
4½	70	
4¼	65	
4	60	
3¾	55	
3½	50	
3¼	45	
3	40	
2¾	35	
2½	30	
2¼	25	
2	20	
1¾	15	
1½	10	
1¼	5	
1	0	

R. No.	%	Min. 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
		Start/hour
6	100	
5¾	95	
5½	90	
5¼	85	
5	80	
4¾	75	
4½	70	
4¼	65	
4	60	
3¾	55	
3½	50	
3¼	45	
3	40	
2¾	35	
2½	30	
2¼	25	
2	20	
1¾	15	
1½	10	
1¼	5	
1	0	

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

#9

Source of Air Contaminants Sulpher Recovery Unit (Champlin Petroleum Co)

Type of Air Contaminants SO_2 CO_2 H_2O O_2 H_2S

Point of Discharge: Stack [X] Other ____

Point of Observation:

Distance to Base of Point of Discharge, feet 120 ft.

Height of Point of Discharge Above Ground Level, feet 60 ft.

Background Description Cloudy - Overcast - Some Smog + fog.

Weather: Clear [ ] Overcast [X] Partly Cloudy [ ] Other ____

Wind Direction from West Wind Velocity, mi/hr 5.

Plume Description: None.

Detached: Yes [ ] No [ ]

Color: Black [ ] White [ ] Other ____

Plume Dispersion Behavior: Looping [ ] Coning [ ] Fanning [ ]
Lofting [ ] Fumigating [ ] See Comments [ ]

Estimated Distance (feet) Plume Visible (Maximum) ____ (Minimum) ____

Comments Verry Poor visabality because of smog But not any traces of smoke.

Signed Michael H. Jackson Title Tec.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin Petroleum Co.

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 9:30 A.M. TO 10:30 A.M. DATE March 15

RECORD OF VISIBLE EMISSIONS

(1)

R. No.	%
5	100
4¾	95
4½	90
4¼	85
4	80
3¾	75
3½	70
3¼	65
3	60
2¾	55
2½	50
2¼	45
2	40
1¾	35
1½	30
1¼	25
1	20
¾	15
½	10
¼	5
0	0

Start/hour

Min. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

Start/hour

Min. 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Start/hour

Min. 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 1830 A.M. TO 1130 A.M. DATE March 15, 74

RECORD OF VISIBLE EMISSIONS

(2)

Start/hour

R. No.	%	Min. 01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

Start/hour

R. No.	%	Min. 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

Start/hour

R. No.	%	Min. 41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
5	100																				
4¾	95																				
4½	90																				
4¼	85																				
4	80																				
3¾	75																				
3½	70																				
3¼	65																				
3	60																				
2¾	55																				
2½	50																				
2¼	45																				
2	40																				
1¾	35																				
1½	30																				
1¼	25																				
1	20																				
¾	15																				
½	10																				
¼	5																				
0	0																				

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

– NO (no smell)
+ YES (some smell) B-8

B-8

ODOR PANEL RESPONSES

Source TEST No. 5
Port OUTLET
Date 3/1/79
Champlin Oil Company

Panel Member	Dilution											
	AIR	1/10	1/20	AIR	1/50	1/100	1/5	1/5	1/20			
1. SHARI BAKER	–	–	+	–	–	+	+	+	–			
2. BRUCE SUTHERLAND	–	–	–	–	–	–	–	–	–			
3. Mike Klinicke	–	–	–	–	+	–	–	–	–			
4. SOUNG KIM	–	+	–	–	+	+	+	+	+			
5. RICH THOMURE	–	–	–	–	+	+	+	+	–			
6. BOB BORGWAT	–	–	+	–	+	–	+	–	–			
7. CINDY SHERWOOD	–	–	–	–	+	+	+	+	–			
8. Mark MAUNO	–	–	–	+	+	–	–	–	–			
9. JULIE MARBLE	–	–	–	–	+	–	–	–	–			
10. JANICE LIU	–	–	–	–	+	+	+	+	+			
Number of Positive Responses	0	1	2	1	8	5	6	5	2			
Percent Positive Responses	0	10	20	10	80	50	60	50	20			

TIME

ENVIRONMENTAL PROTECTION AGENCY

COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 12:30 P.M. TO 1:30 P.M. DATE March 15, 74

RECORD OF VISIBLE EMISSIONS

(9)

Start/hour																				
R. No.	%	Min.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

Start/hour																				
R. No.	%	Min.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

Start/hour																				
R. No.	%	Min.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
6	100																					
4¾	95																					
4½	90																					
4¼	85																					
4	80																					
3¾	75																					
3½	70																					
3¼	65																					
3	60																					
2¾	55																					
2½	50																					
2¼	45																					
2	40																					
1¾	35																					
1½	30																					
1¼	25																					
1	20																					
¾	15																					
½	10																					
¼	5																					
0	0																					

NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ENVIRONMENTAL PROTECTION AGENCY

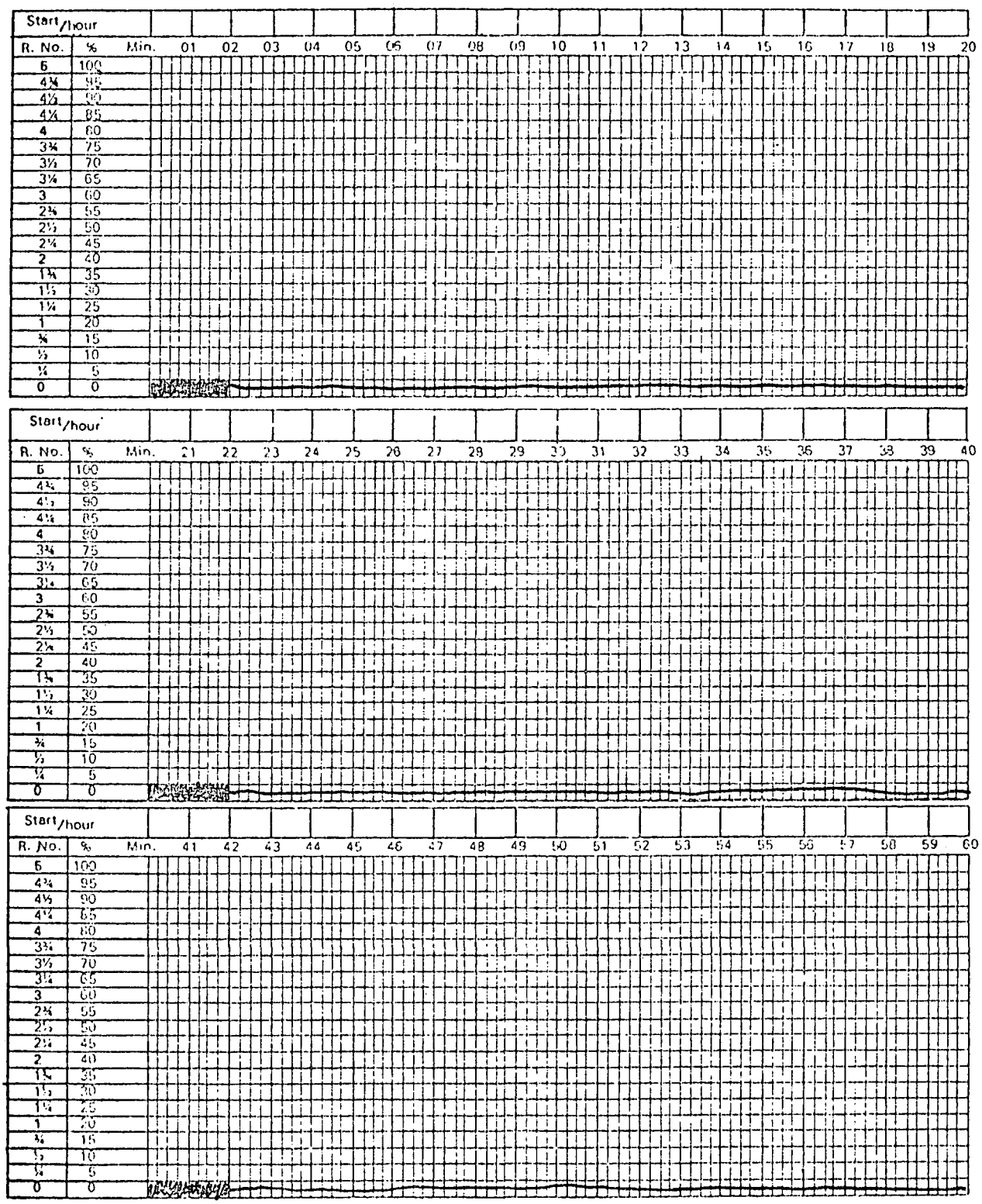
COMPANY NAME Champlin

EQUIPMENT LOCATION (ADDRESS)

TIME OF OBSERVATION: FROM 1:30 A.M. TO 2:30 P.M. DATE March 15, 74

RECORD OF VISIBLE EMISSIONS

(3)



NOTE: Each small square represents an individual reading of intensity corresponding to that shown in the left-hand column over a time span of ¼ minute. Insert an "S" in the top row of blank squares to indicate the exact minute of the start of observation. In the next square after the "S", insert the hour in which the measurement was made. Each page of this form can thus be used to record 1 hour of measurements.

ODOR PANEL RESPONSES

Source TEST No. 6

Port INLET

Date 3/1/79

Champlan Oil Co.

Ten Students.

March 1, 79

B-61

Panel Member	Dilution												
	1/100,000	AIR	1/50,000	1/10,000	1/5000	1/1000	1/500	AIR	AIR	1/10	AIR	1/100,000	AIR
1. Shari Baker	−	+	−	+	+	+	+	+	−	+	+	−	+
2. Bruce Sutherland	+	−	−	−	+	+	−	−	−	+	−	−	−
3. Mike Klinicke	+	−	−	−	+	+	−	−	−	+	+	+	+
4. Soung Kim	+	−	−	+	+	−	+	−	+	+	+	+	+
5. Rich Thomure	+	−	−	+	−	−	−	+	−	+	−	−	−
6. Bob Bogwat	+	−	+	+	+	+	+	−	−	+	+	+	+
7. Cindy Sherwood	−	−	−	−	+	+	+	+	−	+	+	+	−
8. Mark Mauno	−	−	−	+	+	+	+	−	+	+	+	+	−
9. Julie Marble	−	−	+	+	+	−	+	+	−	+	+	−	−
10. Janice Liu	+	+	+	+	+	+	+	+	+	+	+	+	+
Number of Positive Responses	6	2	3	7	9	7	7	5	3	10	8	6	5
Percent Positive Responses	60	20	30	70	90	70	70	50	30	100	80	60	50

Break

ODOR PANEL RESPONSES

Source Chaplin Oil Co.
Port Outlet
Date March 15, 74
Run # 16 Sample # 8

Panel Member	X 1/10	X 1/5	X 1/20	X 1/10	✓ Air	Dilution ✓ 1/10	✓ 1/100	✓ 1/500	✓ 1/10000	✓ 1/500		
1. Bruce Sutherland	−	+	+	+		+	+	+	−	−		
2. Song kim	−	+	+	+		+	+	−	−	−		
3. ~~Rick~~ ~~Romine~~	O	O	O	O	O	O	O	O	O	O	O	
4. Dolly Langtry	+	+	+	+	+	+	+	+	−	−		
5. Janice Liu	+	+	+	+	+	+	−	+	+	+		
6. Julie Marble	−	+	+	+		+	+	−	−	−		
7. Mike Knickie	−	+	+	+		−	−	−	−	−		
8. ~~Mark~~ Shani ~~Mattoo~~ Baken	−	+	+	+		+	−	−	−	−		
9. Cindy Sherwood	+	+	+	+		+	−	−	−	−		
10. Patsy Sweetnam	+	+	+	+		+	+	+	−	−		
Number of Positive Responses	4	9	9	9	6	8	5	4	1	1		
Percent Positive Responses	44.	99.	99	99	66.	88	55	44	11	11		

ODOR PANEL RESPONSES

Source Champlin Oil Co.
Port Inlet
Date March 15, 74
Run #17 Sample# 8

Panel Member	Dilution											
	1/50	1/100	1/10	1/200	1/100	1/200	1/20	1/50				
1. Bruce Sutherland	−	−	+	−	−	−	+	−				
2. Song Kim	+	−	+	−	+	−	+	+				
3. ~~Mark Tomme~~	0	0	0	0	0	0	0	0				
4. Dolly Langtry	+	−	+	−	+	−	+	+				
5. Janice ~~Lin~~ Liu	−	−	+	−	+	−	+	+				
6. Julie Manble	+	−	+	−	+	−	+	+				
7. Mike Knickie	+	−	+	−	−	−	−	−				
8. ~~Mark~~ Shari ~~Marino~~ Baker	−	−	+	−	+	−	−	+				
9. Cindy Sherwood	−	−	+	−	−	−	+	+				
10. Patsy Sweetnam	+	−	+	−	+	−	+	+				
Number of Positive Responses	5	0	~~8~~ 9	0	6	0	7	7				
Percent Positive Responses	55	0	99	0	66	0	77	77				

ODOR PANEL RESPONSES

Source 2

Port Outlet

Date 2/27/79

Chamblian Oil

Panel Member	Dilution 1/10	1/50	AIR	1/10	1/20	1/50						
1. Shani Baker	+	+	-	+	+	-						
2. Bruce Sutherland	+	-	-	+	+	-						
3. Mike Klinicke	-	-	-	-	+	-						
4. Saung Kim	+	-	-	+	+	+						
5. Rick Thomune	+	-	-	+	-	-						
6. Bob Borgwat	+	-	-	+	-	+						
7. Cindy Sherwood	-	-	-	+	-	+						
8. Mark Mauno	-	-	-	+	-	-						
9. Julie Marble	-	-	+	-	+	-						
10. Janice Liu	+	+	+	+	+	+						
Number of Positive Responses	6	2	2	8	6	4						
Percent Positive Responses	60	20	20	80	60	40						

ODOR PANEL RESPONSES

Source TEST No. 4

Port INLET

Date 2/28/79

Took Break

Chamblain 0:1

10 Students

Panel Member	AIR	1/50,000	1/10,000	AIR	AIR	1/100,000	1/50,000	1/100,000	1/200,000	AIR		
						Dilution						
1. SHARI BAKER	+	+	+	−	−	+	−	+	+	−		
2. BRUCE SUTHERLAND	+	+	+	+	+	+	+	+	+	−		
3. MIKE KLINICKE	−	+	+	−	−	+	−	−	−	−		
4. SOUNG KIM	+	+	+	−	−	+	+	+	+	−		
5. RICK THOMURE	−	+	+	+	−	+	−	−	+	−		
6. BOB BORGWAT	+	+	+	+	−	+	−	+	−	−		
7. CINDY SHERWOOD	−	+	+	+	−	+	−	+	−	−		
8. MARK MAUNO	−	+	+	−	+	+	+	+	−	+		
9. JULIE MARBLE	−	+	+	−	−	+	−	+	+	−		
10. JANICE LIU	−	+	+	−	−	+	−	+	+	−		
Number of Positive Responses	4	10	10	4	2	10	3	8	6	1		
Percent Positive Responses	40	100	100	40	20	100	30	80	60	10		

4 4:57 5:05 5:09 5:19

Break

ODOR PANEL RESPONSES

Source TEST No. 3

Port ~~Inlet~~ OUTLET

Date 2/28/79

Champlain Oil

Panel Member	Dilution											
	AIR	1/10	1/20	1/50	1/100	AIR	1/100	1/5	1/100			
1. SHARI BAKER	−	+	−	−	−	+	−	+	−			
2. BRUCE SUTHERLAND	−	−	+	−	−	−	−	+	−			
3. MIKE KLINICKE	−	+	−	−	+	−	+	+	−			
4. SOUNG KIM	−	+	−	+	+	−	−	+	+			
5. RICK THOMURE	−	+	−	−	−	−	+	+	−			
6. BOB BORGWAT	−	−	−	−	−	+	+	+	−			
7. CINDY SHERWOOD	+	+	+	−	+	−	+	+	+			
8. MARK MAUNO	−	−	+	−	−	−	−	+	−			
9. JULIE MARBLE	−	+	+	−	−	−	−	−	−			
10. JANICE LIU	−	+	+	+	+	−	+	+	+			
Number of Positive Responses	1	7	5	2	4	2	5	9	3			
Percent Positive Responses	10	70	50	20	40	20	50	90	30			

ODOR PANEL RESPONSES

Source ~~TARGET~~ TEST NO. 1

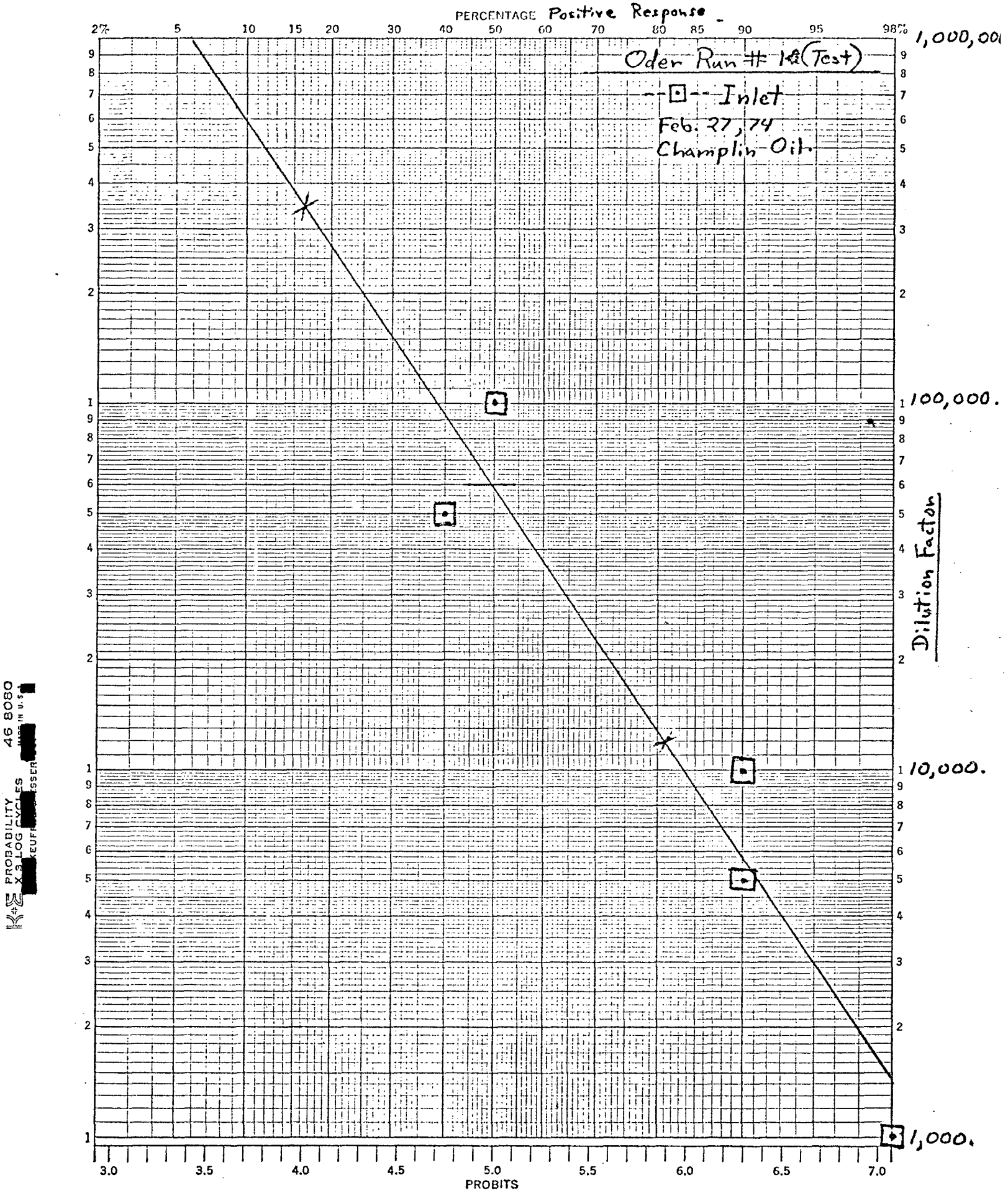
Port INLET 1

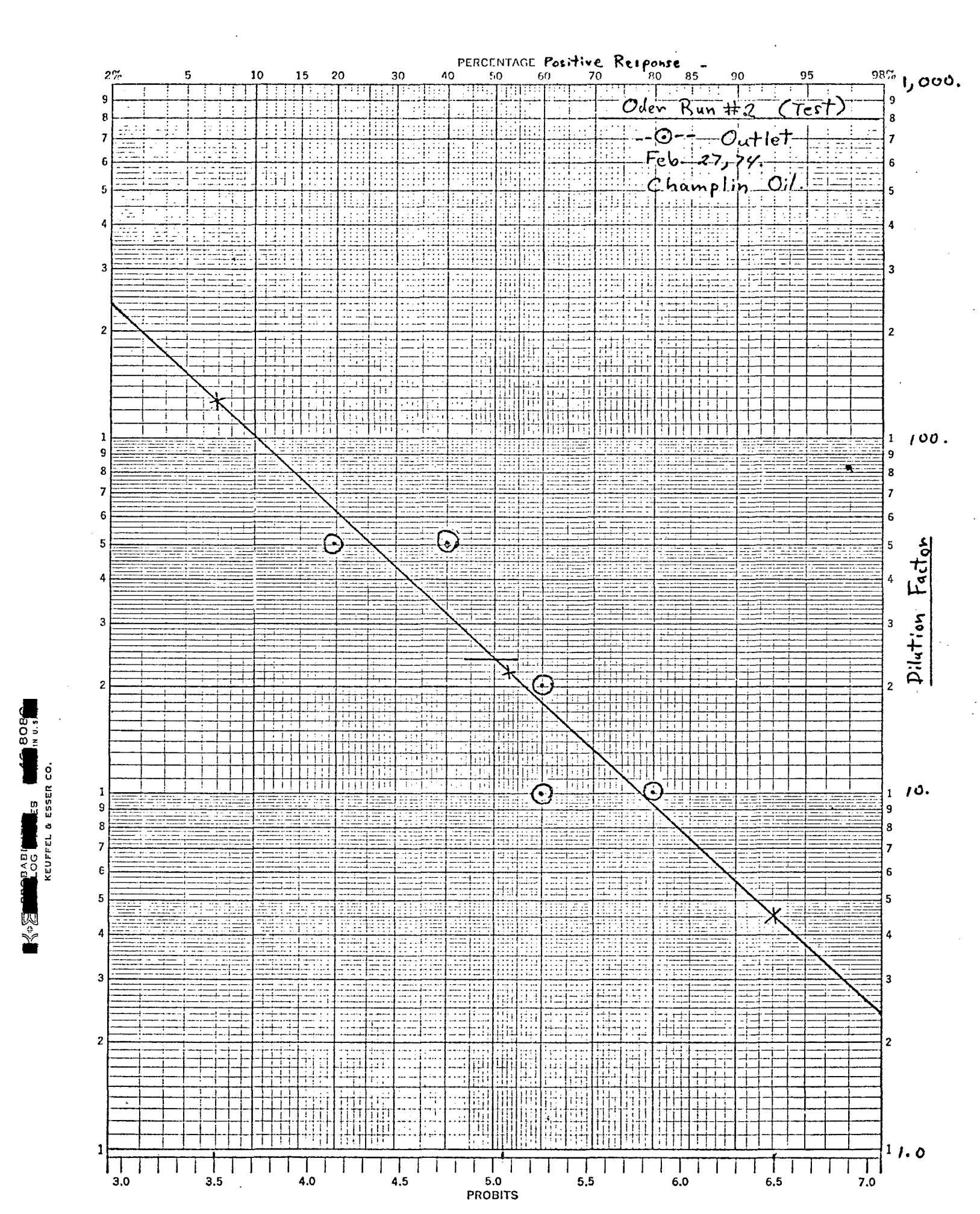
Date 2/27/89

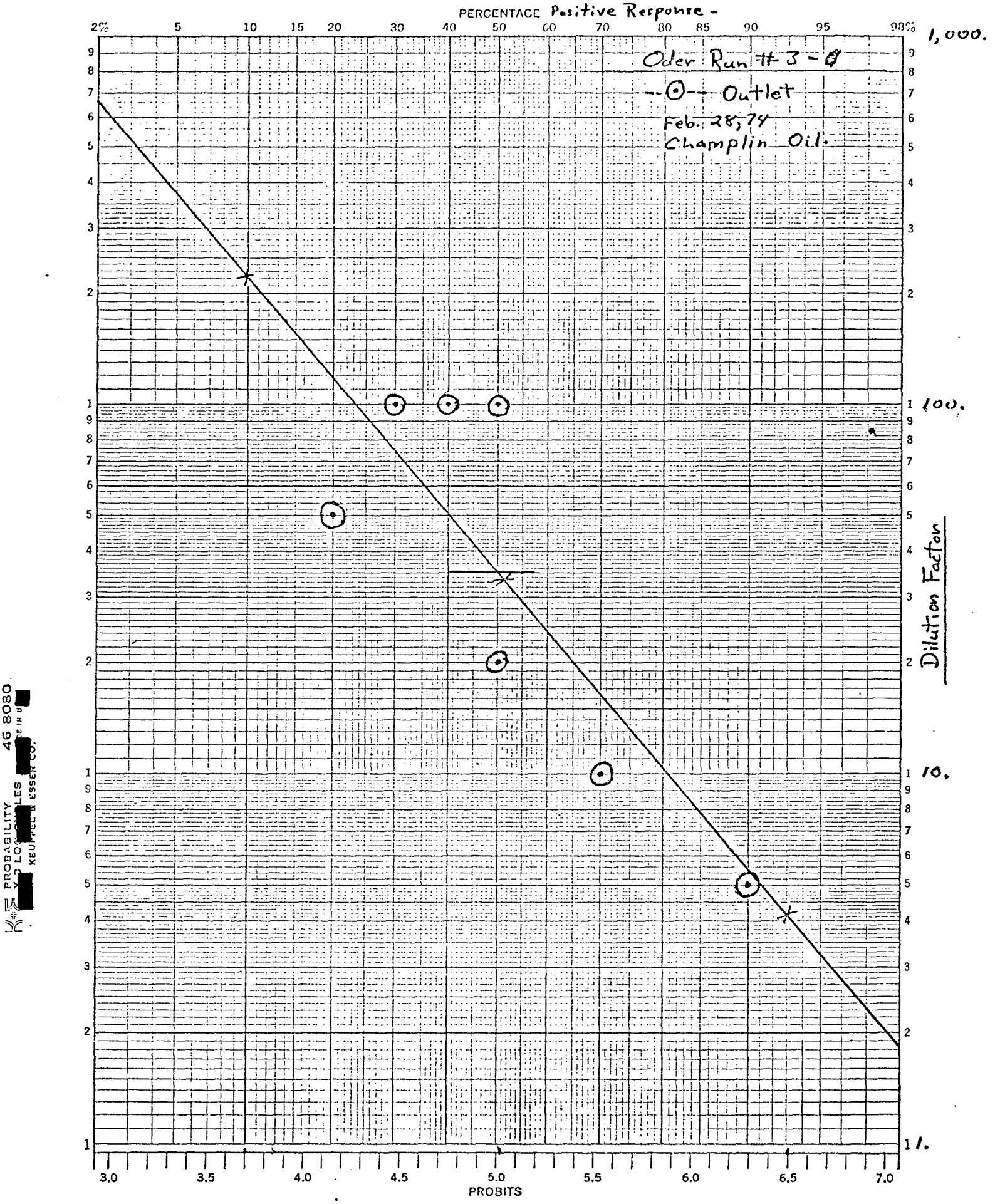
Chamber Ou

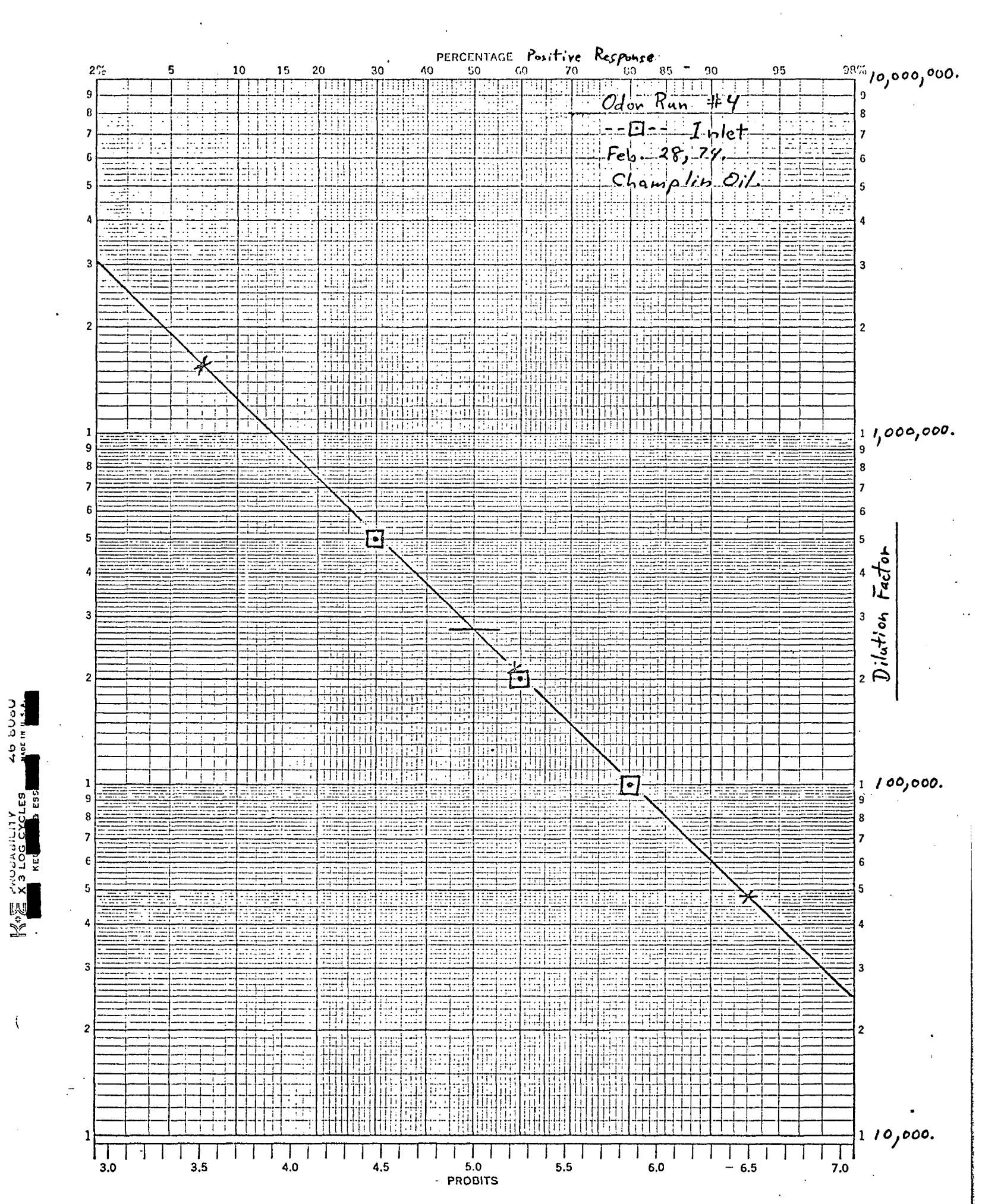
Ten Students

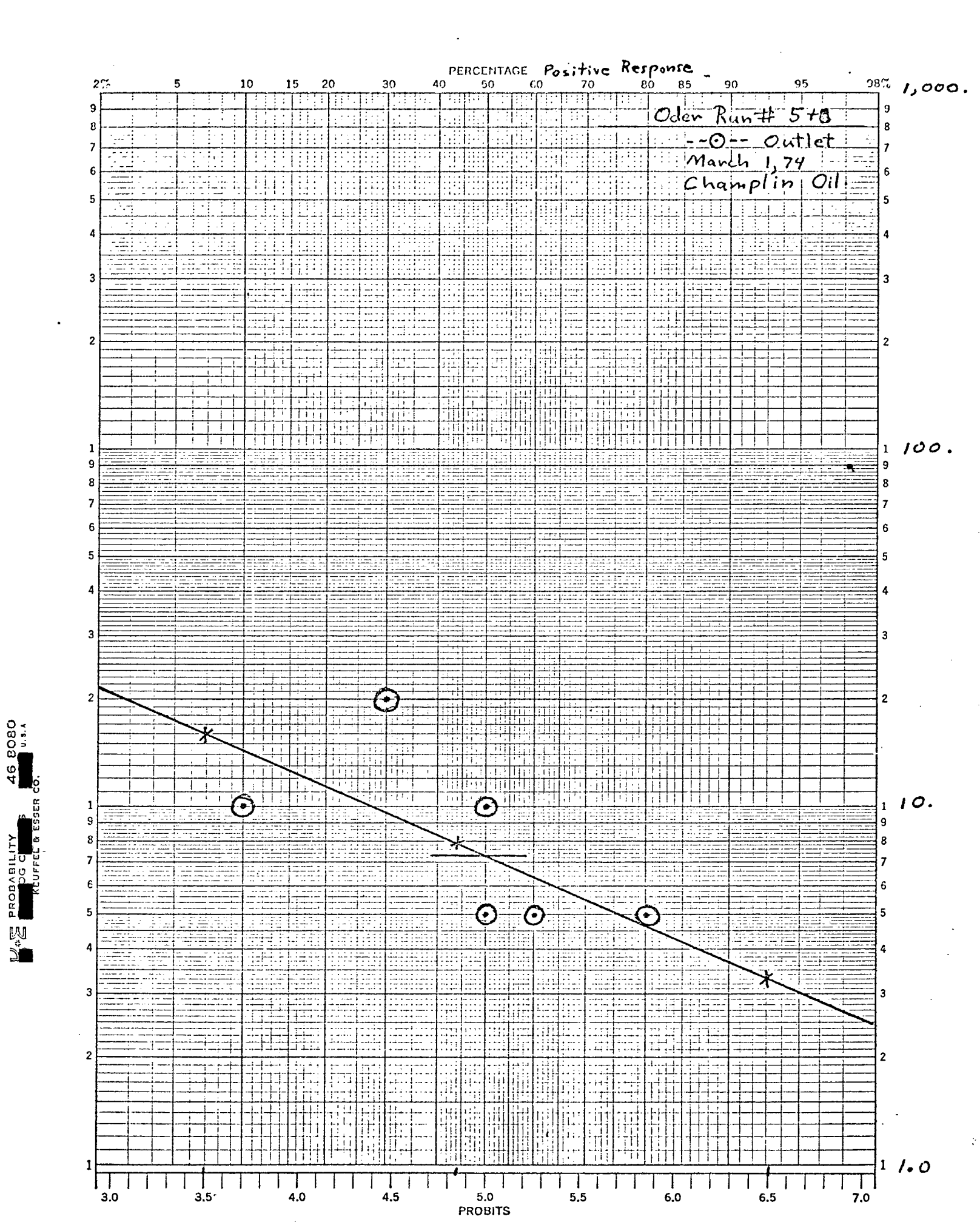
Panel Member	Dilution											
	1/10	AIR	1/50	1/1000	1/5000	AIR	1/10,000	1/50,000	1/100,000			
1. Shari Baker	+	−	+	+	+	−	+	−	−			
2. Bruce Sutherland	+	+	+	+	−	−	+	+	+			
3. Mike Klimicke	+	−	+	+	+	−	+	−	+			
4. Sang Kim	+	−	+	+	+	−	+	−	+			
5. Rick Thomas	+	−	+	+	+	−	+	+	−			
6. Bob Borgwat	+	+	+	+	+	+	−	+	+			
7. Cindy Sherwood	+	−	+	+	+	−	+	−	−			
8. Mark Mamo	+	−	+	+	+	−	+	−	−			
9. Julie Kable	+	−	+	+	+	−	+	−	−			
10. Louie Lim	+	−	+	+	+	−	+	+	+			
Number of Positive Responses	10	2	10	10	9	1	9	4	5			
Percent Positive Responses	100	20	100	100	90	10	90	40	50			
Patsy Sweetman	+	−	+	+	+	−	+	−	−			
Dolly Longstreet	+	−	+	+	+	−	+	−	−			

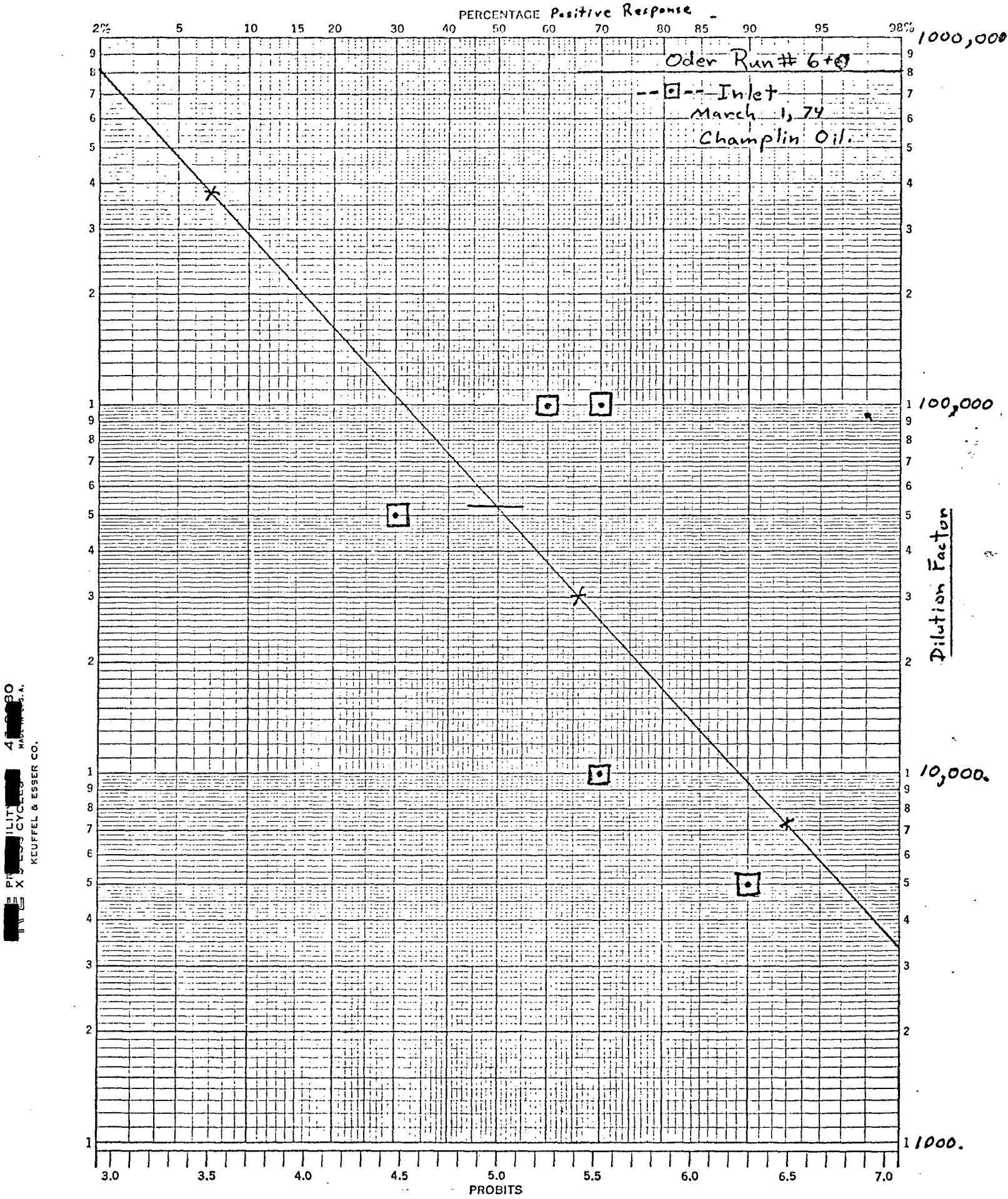

PERCENTAGE Positive Response
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Oder Run # 14 (Test)
--□-- Inlet
Feb. 27, 74
Champlin Oil.
1,000,000.
100,000.
10,000.
1,000.
Dilution Factor
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS
PROBABILITY
46 8080

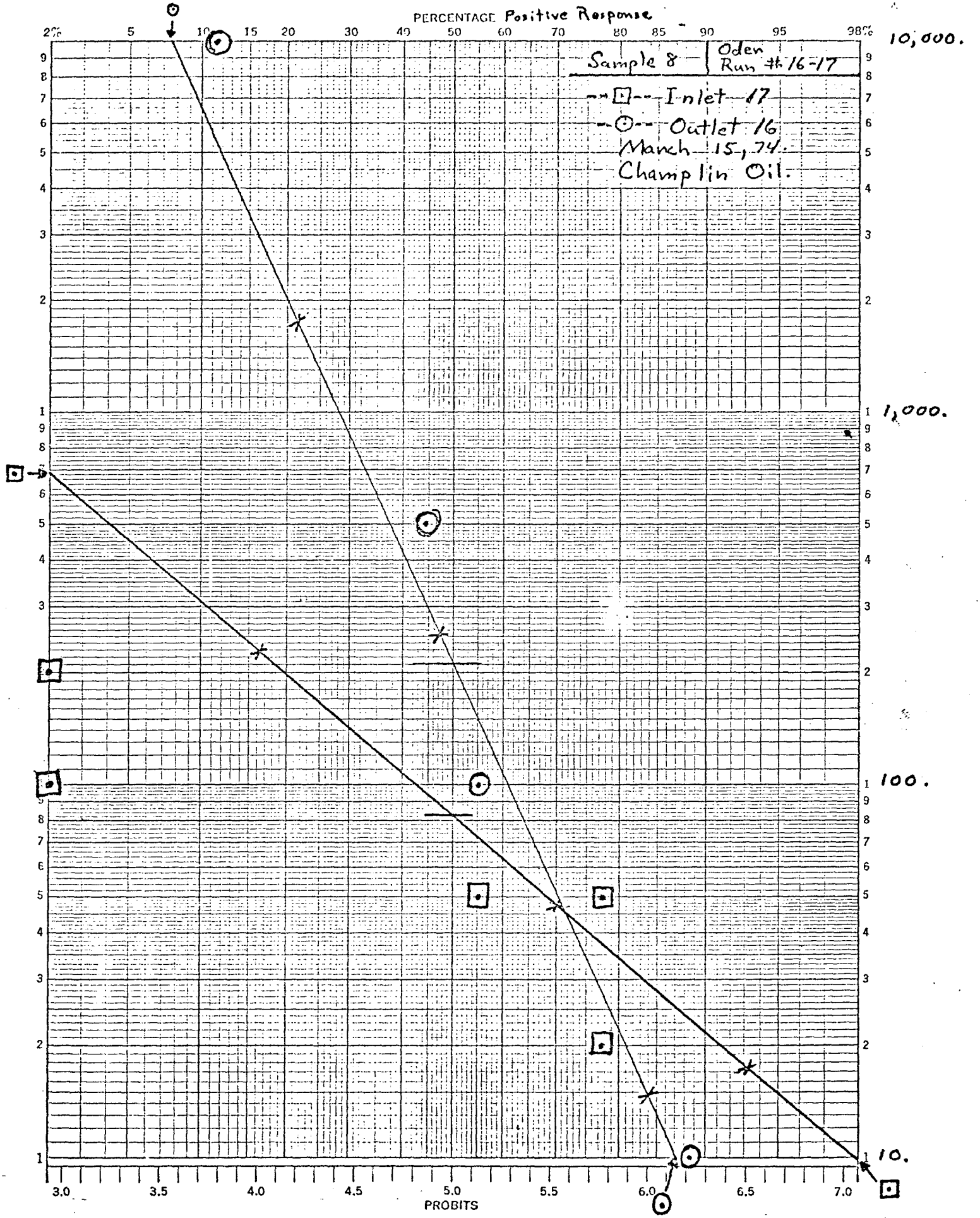

PERCENTAGE Positive Response
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Oder Run #2 (Test)
--⊙-- Outlet
Feb. 27, 74.
Champlin Oil.
1,000.
100.
10.
1.0
Dilution Factor
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS
KEUFFEL & ESSER CO.


PERCENTAGE Positive Response -
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Oder Run #3-0
--O-- Outlet
Feb. 28, 74
Champlin Oil.
1,000.
100.
10.
1.
Dilution Factor
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS


PERCENTAGE Positive Response
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Odor Run #4
--⊡-- Inlet
Feb. 28, 74.
Champlin Oil.
10,000,000.
1,000,000.
100,000.
10,000.
Dilution Factor
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS


PERCENTAGE Positive Response
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Oder Run# 5+8
--O-- Outlet
March 1, 74
Champlin Oil
1,000.
100.
10.
1.0
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
PROBITS
PROBABILITY
KEUFFEL & ESSER CO.
46 8080


PERCENTAGE Positive Response
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Oder Run # 6+9
--⊡-- Inlet
March 1, 74
Champlin Oil.
1000,000
100,000
10,000.
1000.
Dilution Factor
PROBITS
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
KEUFFEL & ESSER CO.



A P P E N D I X C

LABORATORY REPORT

ENVIRONMENTAL ENGINEERING, INC.

LAB DATA SHEET

SULFUR DIOXIDE ANALYSIS

Plant Name Champlin Petroleum Date Analyzed 3-1-74

Analyzed By Smith Hours

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
INLET	Run 2A	0.18	0.01	0.0116	33	10
"	"	0.19	0.01	0.0116	33	10
OUTLET	Run 2A	0.44	0.01	0.0116	32	10
"	"	0.48	0.01	0.0116	32	10

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

ENVIRONMENTAL ENGINEERING, INC.

LAB DATA SHEET

SULFUR DIOXIDE ANALYSIS

Plant Name Champlin Petroleum Date Analyzed 3-2-74

Analyzed By Smith Hours

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
INLET	Run 2B	0.26	0.01	0.0116	30	10
"	"	0.28	0.01	0.0116	30	10
OUTLET	Run 2B	5.72	0.01	0.0116	34	10
"	"	5.79	0.01	0.0116	34	10
INLET	Run 3A	2.02	0.01	0.0116	34	10
"	"	1.98	0.01	0.0116	34	10
OUTLET	Run 3A	20.18	0.01	0.0116	32	5
"	"	21.23	0.01	0.0116	32	5
"	"	8.40	0.01	0.0116	32	2
OUTLET	Run 3B	9.92	0.01	0.0116	28	5
"	"	9.92	0.01	0.0116	28	5

INLET Run 3B not taken due to H_2S sampling and meter box malfunction

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

ENVIRONMENTAL ENGINEERING, INC.

LAB DATA SHEET

SULFUR DIOXIDE ANALYSIS

Plant Name Champlin Petroleum Date Analyzed 3-2-74

Analyzed By Smith Hours

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
INLET	Run 2B	0.26	0.01	0.0116	30	10
"	"	0.28	0.01	0.0116	30	10
OUTLET	Run 2B	5.72	0.01	0.0116	34	10
"	"	5.79	0.01	0.0116	34	10
INLET	Run 3A	2.02	0.01	0.0116	34	10
"	"	1.98	0.01	0.0116	34	10
OUTLET	Run 3A	20.18	0.01	0.0116	32	5
"	"	21.23	0.01	0.0116	32	5
"	"	8.40	0.01	0.0116	32	2
OUTLET	Run 3B	9.92	0.01	0.0116	28	5
"	"	9.92	0.01	0.0116	28	5

INLET Run 3B not taken due to H_2S sampling and meter box malfunction

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

ENVIRONMENTAL ENGINEERING, INC.

LAB DATA SHEET

SULFUR DIOXIDE ANALYSIS

Plant Name Champlin Petroleum Date Analyzed 3-15-74

Analyzed By Smith Hours

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
Inlet	Run 4A	0.51	0.01	0.0116	44	10
"	"	0.50	0.01	0.0116	44	10
Outlet	Run 4A	4.93	0.01	0.0116	44	10
"	"	5.06	0.01	0.0116	44	10
"	"	5.04	0.01	0.0116	44	10
	Run 4B not taken due to plant failure					

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

ENVIRONMENTAL ENGINEERING, INC.

LAB DATA SHEET

SULFUR DIOXIDE ANALYSIS

Plant Name Champlin Petroleum Date Analyzed 3-15-74

Analyzed By Smith Hours

Stack	Sample No.	V.T.	V.T.B.	N.	V.Soln.	V.A.
Inlet	Run 5A	0.51	0.01	0.0116	41	10
"	"	0.50	0.01	0.0116	41	10
Outlet	Run 5A	8.21	0.01	0.0116	46	10
"	"	8.17	0.01	0.0116	46	10
Inlet	Run 5B	0.36	0.01	0.0116	40	10
"	"	0.42	0.01	0.0116	40	10
Outlet	Run 5B	4.92	0.01	0.0116	46	10
"	"	4.98	0.01	0.0116	46	10

V.T. = Volume of Barium perchlorate titrant used for sample (ml)
V.T.B. = Volume of Barium perchlorate titrant used for blank (ml)
N. = Normality of Barium perchlorate
V.Soln. = Total solution volume
V.A. = Volume of sample aliquot titrated (ml)

Project No. 73-011-032 ANALYSIS: NO_x Chemist: [redacted]

Project Title: LA Refineries Standard Curve Date: 2/28/74

Project Coordinator: _____ No. Hours: _____

Sample Number	ABS.	Cell Size	Sample Volume	Dilution Factor	Conc.	S N
A	0				0	
B	.024				25 ug.	
C	.061				50 ug.	
D	.174				125 ug.	
E	.134				250 ug.	
F	.490				375 ug.	
G	.650				500 ug.	

Flask Volumes

1	1924 mls
2	1885 mls
3	1958 mls
4	1932 mls
6	1876
11	1896 mls

Notes:

C-6

C-2

Project No. I 211 134 ANALYSIS [illegible] Analyst: [illegible]

Project Title: Champlin (IV) Date: 3/15/74

Project Coordinator: _____ No. Hours: _____

Sample Number	ABS.	Cell Size	Sample Volume	Dilution Factor	Conc. µg
1	0				0
2	.069				53.1
4	.044				33.8
6	0				0
11	0				0

Sample Number	ABS.	Cell Size	Sample Volume	Dilution Factor	Conc

Pressure inches Hg

Flask #	Initial	Final	Temp °F
			75
Inlet			
1	22.6	0.9	
11	22.6	0.8	
6	22.5	0.6	
Outlet			
2	22.6	0.0	
4	22.5	0.8	

C-7

Sample Calculation:

Notes:

A P P E N D I X D

CALIBRATION STANDARDS

MATHESON GAS PRODUCTS

POST OFFICE BOX 608
CUCAMONGA, CALIFORNIA 91730
TELEPHONE: (714) 987-4611

A DIVISION OF WILL ROSS, INC.

Environmental Science & Eng.
P.O. Box 13454
University Station
Gainesville, Fl. 32601
Attn: Charles L. Stratton

R. BELL
MAR - 4 1974

Date 2-25-74

Our Invoice No. C98823

Your P.O. No. 949

Lot No. 1-2-21

Gentlemen:

Below are the results of the analysis you requested, as reported by our laboratory. Results are in volume percent, unless otherwise indicated.

LABORATORY REPORT ON GAS ANALYSIS

COMPONENT	Cyl. No. FF-4767 Requested	Actual	Cyl. No. FF21809 Requested	Actual	Cyl. No. FF28731 Requested	Actual
CARBON DIOXIDE						
OXYGEN			4.9%	5.14%	9.9%	10.21%
HYDROGEN						
CARBON MONOXIDE	5000ppm	5175ppm				
NITROGEN	BAL.	BAL.	BAL.	BAL.	BAL.	BAL.
ARGON						
AIR						
METHANE						
HELIUM						

Analyst KEN ROPER

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

LABORATORY REPORT ON GAS ANALYSIS - Cont'd

Your P.O. # 949 Date 2-26-74

COMPONENT	Cyl. No. FF18905 Requested	Actual	Cyl. No. FF29515 Requested	Actual	Cyl. No. _____ Requested	Actual
CARBON DIOXIDE	1.0%	1.03%	2.5%	2.58%		
OXYGEN						
HYDROGEN						
CARBON MONOXIDE						
NITROGEN	BAL.	BAL.	BAL.	BAL.		
ARGON						
AIR						
METHANE						
HELIUM						
_____						
_____						

COMPONENT	Cyl. No. _____ Requested	Actual	Cyl. No. _____ Requested	Actual	Cyl. No. _____ Requested	Actual
CARBON DIOXIDE						
OXYGEN						
HYDROGEN						
CARBON MONOXIDE						
NITROGEN						
ARGON						
AIR						
METHANE						
HELIUM						
_____						
_____						

Analyst KEN ROPER

MATHESON GAS PRODUCTS

MATHESON GAS PRODUCTS

POST OFFICE BOX 188
NEWARK, CALIFORNIA 94560
TELEPHONE: (415) 793-2559 / TWX - 910 - 381-6051

A DIVISION OF WILL ROSS, INC.

Date 2-19-74

Our Invoice No. C98823

P.O. # ~~C546~~ YOUR P.O.#949

MATHESON GAS PRODUCTS
POST OFFICE BOX 608
CUCAMONGA, CALIFORNIA
91730

LABORATORY REPORT ON GAS ANALYSIS

Cyl. # 5-2941

Mixture Req.		Analysis
~~5.0%~~	~~CARBON DIOXIDE~~	5.058% ± .02%
BAL	NITROGEN	BAL

Cyl. # FF-28768

Mixture Req.		Analysis
~~20.0%~~	~~OXYGEN~~	19.98% ± .02%
BAL	NITROGEN	BAL

Cyl. # FF-10068

Mixture Req.		Analysis
500 PPM	CARBON MONOXIDE	* 499 PPM
BAL	NITROGEN	BAL

** ± 1.0% OF COMPONENT

Cyl. # FF-26737

Mixture Req.		Analysis
1000 PPM	CARBON MONOXIDE	* 99 PPM
BAL	NITROGEN	BAL

* ± 1.0% OF COMPONENT

Cyl. #

Mixture Req.	Analysis

Cyl. #

Mixture Req.	Analysis

Analyst R. L. KUNDE/R. L. Kunde

MATHESON GAS PRODUCTS

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

MATHESON GAS PRODUCTS

POST OFFICE BOX 608
CUCAMONGA, CALIFORNIA 91730
TELEPHONE: (714) 987-4611

A DIVISION OF WILL ROSS, INC.

Environmental Science
& Engineering
P.O. Box 13454
University Station
Gainesville, Fl. 32601
Attn: Charles L. Stratton

Date 3-1-74

Our Invoice No. C99509

Your P.O. No. Add'l 949

Lot No. 1-2-47

Gentlemen:

Below are the results of the analysis you requested, as reported by our laboratory. Results are in volume percent, unless otherwise indicated.

LABORATORY REPORT ON GAS ANALYSIS

COMPONENT	Cyl. No. FF32629 Requested	Actual	Cyl. No. FF30085 Requested	Actual	Cyl. No. _____ Requested	Actual
CARBON DIOXIDE						
OXYGEN						
HYDROGEN						
CARBON MONOXIDE						
NITROGEN						
ARGON						
AIR	BAL.	BAL.	BAL.	BAL.		
METHANE	500ppm	486ppm	100ppm	106ppm		
HELIUM						
_____						
_____						

Analyst KEN ROPER

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

APPENDIX E

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

Environmental Protection Agency

Winton E. Kelly	Project Officer
Charles Sedman	Project Officer
Frank Butler	Chemist
Gary McAllister	Chemist

Environmental Science and Engineering, Inc.

John R. Dollar, M.S.*	Project Manager/Engineer
John D. Bonds, Ph.D.	Project Manager/Chemist
A. L. Wilson, M.S.	Engineer
Al Linero, M.S.	Engineer
Mary L. Smith, B.S.	Chemist
Lee Roby	Technician
Greg Benton	Technician
Mike Jackson	Technician

* No longer associated with Environmental Science and Engineering, Inc.