Chevron U.S.A. Inc.
2410 Camino Ramon, San Ramon, California • Phone (415) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

Marketing Department

91 SEP -5 AM 11:10

August 19, 1991

This is for 7420 Dublin Blvd -
Is this same unit proposed for
7007 San Ramon Blvd & Chevron
station?

Permit Services
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Re: Air Permit Discharge Application
Former Chevron Station # 9-2582
7420 Dublin Blvd., Dublin, CA

Dear Sir or Madam:

Please find enclosed a Remedial System Description, BAAQMD Data forms A, G, P, P-201, and P-101B, all pertaining to a Soil Vapor Extraction System at the former Chevron station referenced above. Also enclosed is a check for $442 as payment for the following: $150 filing fee, $105 initial fee per source for one source, $105 additional fee for one toxic compound (benzene), and $82 start-up fee.

Thank you for your attention to these matters. If you require any further information, please contact me at (415) 842-8658.

Sincerely,

Clint B. Rogers

Clint B. Rogers
Environmental Engineer

Enclosures

cc: Ravi Arulananthum, Alameda County Environmental Health, Oakland, CA
Gary Keyes, Geraghty & Miller, Richmond, CA

SHD 3841

AIR PERMIT APPLICATION
REMEDIAL SYSTEM DESCRIPTION

for July 1991

CHEVRON U.S.A. INC.
FORMER SERVICE STATION #9-2582
7420 DUBLIN BOULEVARD
DUBLIN, CALIFORNIA

Submitted for

CHEVRON U.S.A. INC.

July 31, 1991

by

Geraghty & Miller, Inc.
Environmental Services
1050 Marina Way South
Richmond, California 94804
(415) 233-3200

CONTENTS

Project No. RC008501

CONTENTS (cont.)

APPENDICES

1. INTRODUCTION

This Remedial System Description has been prepared by Geraghty & Miller, Inc. on behalf of our client, Chevron U.S.A. Inc. (Chevron) for submission to the Bay Area Air Quality Management District (BAAQMD) in conjunction with an Application for Authority to Construct and Permit to Operate a soil vapor extraction system. This document concerns former Chevron Service Station #9-2582, located at 7420 Dublin Boulevard, Dublin, California. The purpose of the vapor extraction system is to achieve remediation of gasoline contamination of the soil at the site. This Remedial System Description provides additional information about the proposed vapor extraction and treatment system to aid BAAQMD personnel in review of this application. Manufacturer's literature describing the vapor extraction pump and the catalytic oxidation abatement device are presented in Appendices A and B, respectively.

Section 2 of this document provides background information about this site and summarizes the investigation activities performed by EA Engineering, Science, and Technology, Inc. (EA) and Western Geologic Resources (WGR) between February 1988 and March 1991. A copy of the WGR document entitled "Vadose Zone Characterization: Vadose Well Installation and Vacuum Extraction Testing" is included as Appendix C.

The remediation system is described in Section 3. Calculations and sources for the information reported on BAAQMD Data Forms G, A, P, and P-201 are also explained. Copies of these forms are presented in Appendix D.

2. BACKGROUND

2.1 FACILITY DESCRIPTION

The former Chevron service station is located at the southwest corner of the intersection of Dublin Boulevard and Village Parkway in a commercial district of Dublin, California (see Figure 1). This property adjoins Caltrans property (Interstate 680) to the west and a pizza restaurant to the south. The property was formerly leased by Chevron for use as a gasoline station. Three underground gasoline storage tanks used by Chevron to store product were removed from the site in February 1989. The facility is currently operated as a BP Oil Company gasoline station and car wash.

2.2 HYDROGEOLOGIC CONDITIONS

The service station is located on semi-consolidated and unconsolidated alluvium of Quaternary Age. The alluvium was deposited in lake, playa, stream, and alluvial environments in the San Ramon Valley. Historic ground-water sample analytic results and water level measurements are presented in Tables 1 and 2 within the Vadose Zone Characterization (Appendix C).

2.3 PETROLEUM HYDROCARBONS IN SOIL

During March 1989 WGR supervised the removal and disposal to landfills of approximately 180 cubic yards of pea gravel. Samples from soil borings, which were collected and analyzed, indicated the existence of total petroleum hydrocarbons (TPH) on both sides of the southernmost pump island. In May 1989, an additional 100 cubic yards of material was excavated and disposed of. Analytical results of soil samples from borings and excavation sidewalls are presented in Tables 1 and 2, respectively.

2.4 LIQUID-PHASE PETROLEUM HYDROCARBONS

Liquid-phase hydrocarbons in ground-water samples have not been described by previous consultants, although analytical results (100,000 parts per billion by volume [ppbv], August 1989) from ground-water samples from the 10-inch casing in the former tank backfill suggest that a sheen of product may exist within the backfill.

2.5 DISSOLVED PETROLEUM HYDROCARBONS

Analytical results for ground-water samples collected from Monitor Wells AE-1, AE-2, AE-3, and the 10-inch casing during 1989 are summarized in Table 2 of the Vadose Zone Characterization document (Appendix C). TPH as gasoline were detected in the ground-water samples collected from Monitor Wells AE-3 at a concentration of 2,300 ppbv (March 1989). BTEX were detected in the ground-water samples collected from Monitor Wells AE-2 and AE-3 at concentrations ranging from 1.2 ppbv (xylenes in Monitor Well AE-2) to 910 ppbv (xylenes in Monitor Well AE-3). The highest observed concentration of benzene was 380 ppbv (AE-3, March 1989); the subsequent sample for this well was non-detect. (<0.1 ppbv, August 1989). Petroleum hydrocarbons were not detected in the ground-water sample collected from Monitor Well AE-1.

2.6 RESULTS OF SOIL VENTING PILOT TEST

A Vapor Extraction Test performed by WGR on May 22-25, 1990, lasted 65 hours. The purpose of the pilot test was to collect performance and chemical composition data on the proposed recovery wells and the extracted soil vapors. The performance data are used for the selection of a remedial system blower and to estimate the flow rate that will be produced by that blower. The data from analysis of the soil vapors are used for selection of the appropriate emission control equipment and for inclusion in this air permit application. During the pilot test, the soil vapors were pumped through two 200-pound granular activated carbon vessels, plumbed in series, prior to discharge.

The soil vapor extraction test involved applying a vacuum to the 3-inch diameter slotted pipe which was installed 6 feet below grade between the two pump islands. When a vacuum of 26 inches of water column (" w.c.) was applied with a 1-$^1/_2$ hp blower, 93 standard cubic feet per minute (scfm) of soil vapors were extracted from the pipe. When the vacuum was reduced to 15" w.c., 50 scfm of air was extracted from the wellhead.

Vapor samples were collected throughout the pilot test. Presented in Appendix C, analytic results for benzene concentrations in soil vapors from the extraction piping (Sample Numbers 3A3, 4A1, 5A3, and 6A3) ranged from 5,300 to 8,300 ppbv and averaged 6,675 ppbv. This value of 6,675 ppbv benzene has been used in Section 3.1, below, to calculate benzene extraction rates.

3. REMEDIATION SYSTEM DESCRIPTION

3.1 VAPOR EXTRACTION PUMP

The soil vapors will be extracted from the existing vapor extraction piping through a below grade pipe leading to the treatment system enclosure by a 5-horsepower positive displacement vacuum pump. Based on data acquired during the pilot test, this blower will be able to move 100 scfm of soil vapors. After being compressed by the blower, the temperature of the air will be approximately 150°F. The blower will be powered through a magnetic starter wired to turn off the blower in the event of incomplete treatment, as indicated by the temperature of the catalyst bed being out of range. A manual safety shut-off switch will also be located on site. Manufacturer's literature about the blower is presented in Appendix A.

The rationale and calculations leading to entries on Data Form G are as follows:

Gasoline emissions before abatement device:

100 scfm Air Flow {maximum operating flow of SVE system}

x 2,500 parts per million by volume (ppmv) {maximum hydrocarbon concentration}

x 60 min/hr =

15 cubic feet per hour TVH as hexane {product of above quantities}

x 0.23 lb/scfm {density of hexane} =

3.5 lb TVH/hour mass flow of gasoline {TVH flow x density}

Benzene emissions before abatement device:

100 scfm Air Flow {maximum operating flow of SVE system}

x 6,675 parts per billion by volume {average benzene concentration, see Section 2.6}

x 60 min/hr =

0.040 cubic feet per hour benzene

x 0.206 lb/scfm - {density of benzene} =

0.00825 lb benzene/hour mass flow of benzene {benzene flow x density}

3.2 CATALYTIC OXIDATION UNIT

This abatement device (King, Buck/Hasstech MMC-5A Catalytic Oxidation Unit), consists of an ambient air bleed, electric preheater, heat exchanger, platinum/palladium catalyst, stainless steel piping, enclosure, and associated electronic controls. The control circuitry monitors the temperature of the catalyst bed and adjusts the duty cycle of the electric preheater to maintain the catalyst bed at the set point temperature. The unit is approximately 3 feet x 10 feet x 4 feet with a connection for influent gases from the extraction pump and a discharge stack.

Two valves to bleed in ambient air are used to reduce the hydrocarbon concentration in influent gases. One valve is adjusted manually to give a concentration near 2,500 ppmv as hexane in order to maximize hydrocarbon recovery and energy efficiency while maintaining safe operation of the unit. The other bleed valve is controlled electronically and serves as a safety device. Should catalyst bed temperatures exceed 1050°F, this valve opens and dilutes the influent stream by 50% with ambient air. (The oxidation of hydrocarbons on the surface of the catalyst element releases heat; concentrations above 3,000 ppmv TVH can shorten the life of the catalyst.) The pilot test, performed on May 22-25, 1990, found concentrations above 2,500 ppmv TVH only for the first day of operation, indicating that ambient air will not have to be bled into the unit. For the purpose of estimating emissions from the unit, the maximum air flow of 100 scfm and the maximum hydrocarbon concentration of 2,500 ppmv as hexane will be used. These figures represent the worst case; for the majority of the project life concentrations extracted from the ground will be considerably less than 2,500 ppmv.

The minimum normal operating temperature of the catalyst bed is 600°F. Destruction efficiencies of greater than 95% are reported by the manufacturer. Destruction efficiencies increase with higher concentrations, higher temperatures, and higher molecular weight hydrocarbons. For the purposes of this permit, a 95% reduction of hydrocarbons and of benzene is assumed.

3.3 DISCHARGE STACK & LOCATION

The exhaust from the catalytic reactor, after passing through the heat exchanger, will discharge through a stack 15 feet high and 2 inches in diameter. Converting this volume and the 100-scfm flow rate to SI units for use in the BAAQMD's PTPLU modeling program results in the following:

Stack height: 4.6 meters

Inside Diameter at discharge point: 0.05 meter

Velocity of discharge stream: 23 meters/second

Temperature: 425°F = 218°C

Benzene Emissions: 0.00825 lb/hr x (5% non-removal)/(3600 sec/hr) = 1.15×10^{-7} lb/sec (=0.010 lb benzene/day)

1.15×10^{-7} lb/sec x 454 grams/lb = 0.000052 grams/sec

3.4 BUILDING DOWNWASH CONSIDERATIONS

Maximum ground level concentrations of a plume can result from entrainment in a building's wake. The car wash to the east (Figure 2) is the largest building close to the discharge stack; however, it is not close enough to significantly affect the plume. The Air Toxics Manual (CAPCOA, October, 1987) defines "nearby" structures as those within a distance of 5a (5 times the lesser of either building height or width). The building is 15 feet tall, so in this case 5a equals 75 feet. The proposed discharge stack location is 110 feet from the building; hence, building downwash is not a concern at this site.

4. PROJECT MANAGEMENT AND SCHEDULE

The installation and start-up of the vapor extraction system is scheduled for September 1, 1991, or the date of issue of an Authority to Construct, whichever is later. The vapor extraction system may operate for up to 24 months. Site visits will be scheduled to conduct maintenance checks and to monitor the effluent vapor stream for volatile hydrocarbons. Two site visits will occur during the first month, followed by monthly visits over the duration of the vapor extraction and treatment operation.

5. PROPOSED MONITORING PROGRAM

Upon start-up of the remedial system, grab samples of the influent and effluent gases will be collected and analyzed for total volatile hydrocarbons (TVH) with benzene, toluene, ethylbenzene, and xylenes (BTEX) distinction. These results will be used to confirm compliance with BAAQMD discharge requirements, adjust the system for optimal operating conditions, and quantify the mass of hydrocarbons removed from the soils. Copies of the certified analytical reports on initial influent and effluent concentrations will be forwarded to the BAAQMD.

After start-up, monitoring will be performed monthly. During these monitoring visits, the concentration of TVH in effluent gases will be measured with a photo-ionization detector (PID). This test is proposed for the confirmation of effluent concentration (without the undue expense of repeated gas chromatograph analyses). The operational parameters of air flow, inlet/outlet temperatures, and vacuum at well head will also be recorded. Monthly TVH levels and operational data will be made available to BAAQMD personnel upon request.

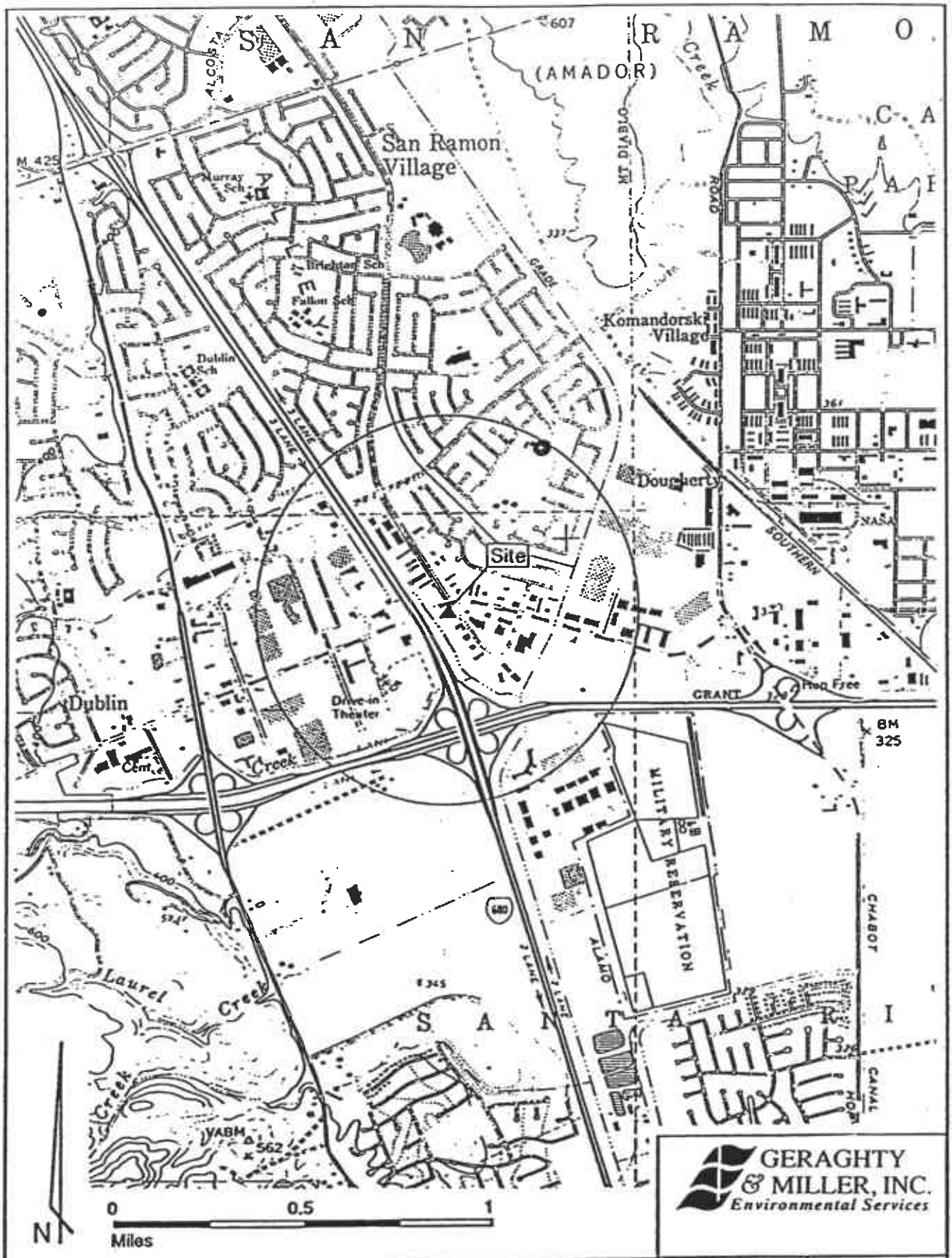
REFERENCES

King, Buck/Hasstech, 1989, Multi-Mode Combuster Product Literature

M-D Pneumatics, Febuary 1988, Maintenance Manual, Model 3200 Series Rotary Lobe Blower.

Western Geologic Resources, July 17,1990, Vadose Zone Characterization: Vadose Well Installation and Vacuum Extraction Testing, Chevron Service Station #9-2582, 7420 Dublin Boulevard, Dublin, California.

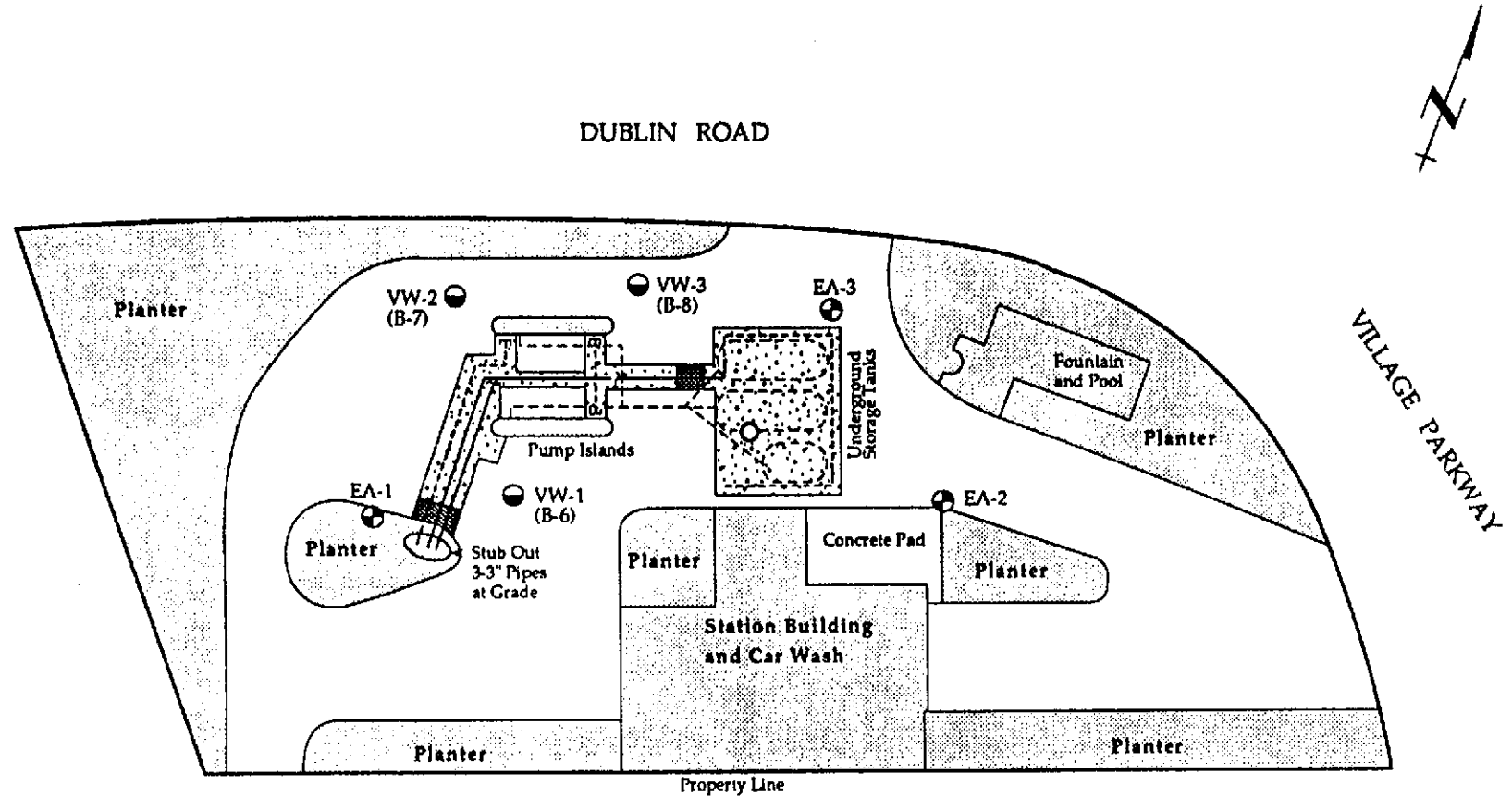
Western Geologic Resources, August,1989, Soil Boring, Sampling, and Excavation, Chevron Service Station #9-2582, 7420 Dublin Boulevard, Dublin, California.



GERAGHTY & MILLER, INC.
Environmental Services

Drawn	Date
Reviewed	Date

Figure 1. Location and topography of Chevron SS 9-2582, Dublin ,California.



LEGEND

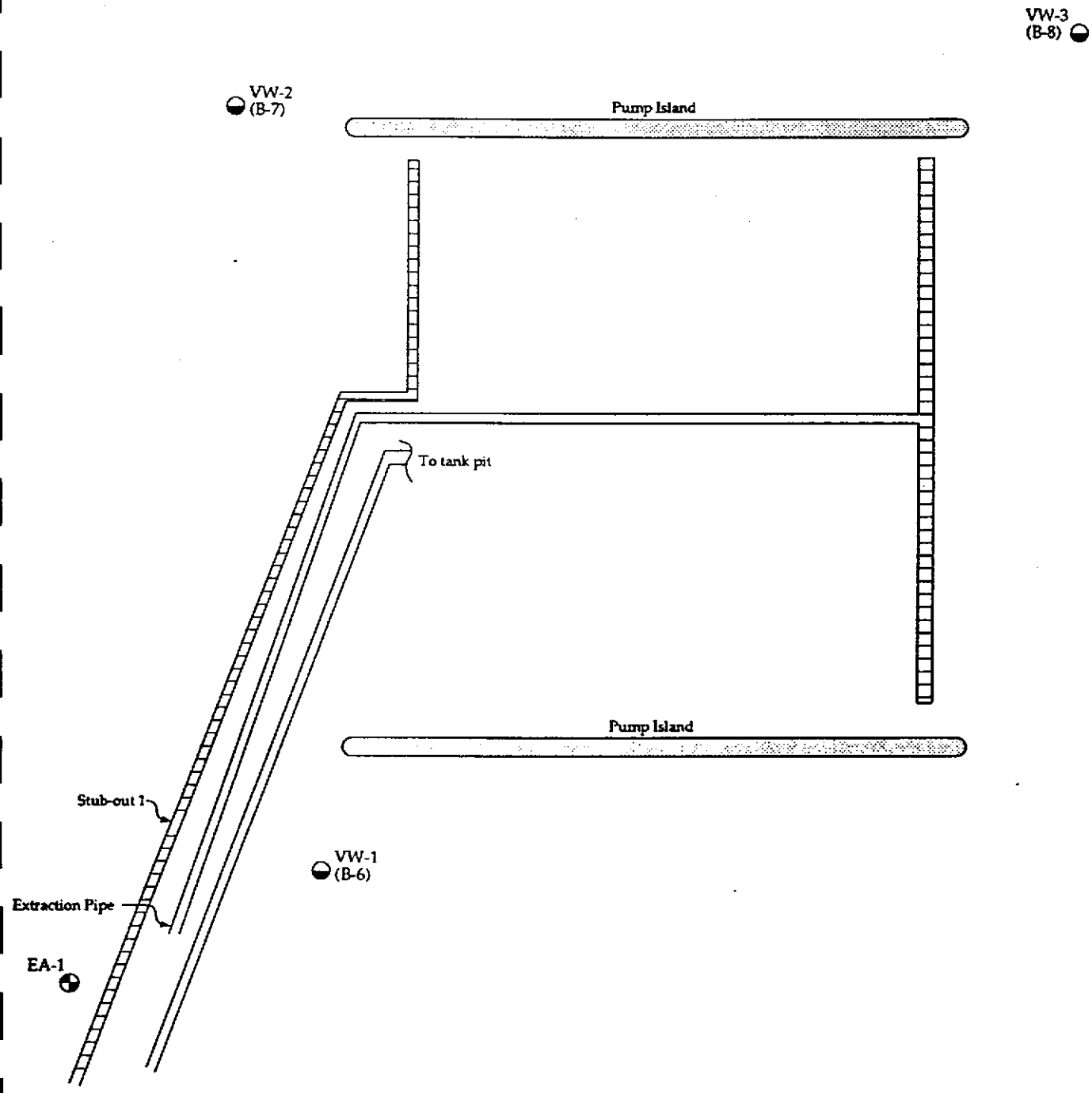
EA-1	Groundwater Monitor Well		Pea-Gravel Backfill
O	10" Diameter PVC Casing		Bentonite Grout
VW-1	Vadose Monitor Well		
-------	Perforated 3" Pipe, buried		
———	Non-Perforated 3" Pipe, buried		

Site Map with Vadose Monitor Well Locations
Former Chevron Service Station #92582
Dublin, California

FIGURE
2

WESTERN GEOLOGIC RESOURCES, INC.

1-124.04



OT TO SCALE

7/90

EGEND

VW-2 Vadose Well Locations

EA-1 Monitor Well Locations

Three Inch Diameter Vapor Extraction Piping Layout
Former Chevron Service Station #92582
Dublin, California

FIGURE
3

WESTERN GEOLOGIC RESOURCES, INC.

1-124.04

TABLE 1 - ANALYTIC RESULTS: SOIL SAMPLES FROM BORINGS
Chevron Service Station # 92582
Dublin, CA
WGR Project # 1-124.02

SAMPLE ID#	DATE	DEPTH (FT)	BENZENE	TOLUENE	XYLENES	E-BENZENE	TPH
			<----------PPM---------->				
B-1	17 Mar 89:	3-4	0.24	ND	ND	ND	ND
B-1	17 Mar 89:	4.5-5.5	0.43	ND	ND	ND	ND
B-1	17 Mar 89:	6.5-7.5	0.13	ND	ND	ND	ND
B-1	17 Mar 89:	9.5-10.5	0.09	ND	ND	ND	ND
B-1	17 Mar 89:	14.5-15.5	ND	ND	ND	ND	1.8
B-2	17 Mar 89:	3.5-4.5	NA	NA	NA	NA	NA
B-2	17 Mar 89:	5.5-6.5	0.06	ND	ND	ND	ND
B-2	17 Mar 89:	9.5-10.5	ND	ND	ND	ND	ND
B-2	17 Mar 89:	14.5-15.5	ND	ND	ND	ND	ND
B-3	17 Mar 89:	5.5-6.5	ND	ND	ND	ND	ND
B-3	18 Mar 89:	9.5-10.5	ND	ND	ND	ND	ND
B-4	18 Mar 89:	3-4	0.06	ND	ND	ND	ND
B-4	18 Mar 89:	5.5-6.5	0.07	ND	ND	ND	ND
B-4	18 Mar 89:	9.5-10.5	ND	ND	ND	ND	ND
B-5	18 Mar 89:	3-4	ND	ND	ND	ND	ND
B-5	18 Mar 89:	5.5-6.5	0.06	0.20	0.10	ND	ND
B-5	18 Mar 89:	9.5-10.5	0.9	0.40	0.09	0.08	ND

TPH = Total Petroleum Hydrocarbons
NA = Not Analyzed
ND = Non Detectable (less than 0.5 ppm)

TABLE 2 - ANALYTIC RESULTS: SOIL SAMPLES
Chevron Service Station # 92582
Dublin, CA
WGR Project # 1-124.02

SAMPLE ID#	DATE	DEPTH (FT)	BENZENE	TOLUENE	XYLENES	E-BENZENE	TPH
			<----------PPM---------->				
PS-1	17 Mar 89:	4	2.4	10.0	5.6	2.9	170
PS-1	17 Mar 89:	6	2.7	11.0	6.3	3.2	190
PS-1	17 Mar 89:	8	4.1	12.0	7.4	3.8	170
PS-1	17 Mar 89:	10	2.3	15.0	19.0	9.5	750
PS-2	18 Mar 89:	4	ND	ND	0.20	0.09	6.7
PS-2	18 Mar 89:	6	0.23	0.47	1.8	0.98	41.0
PS-3	18 Mar 89:	4	0.12	ND	0.04	0.05	ND
PS-3	18 Mar 89:	6	0.51	0.62	0.24	0.18	1.8
PS-3	18 Mar 89:	8	0.21	ND	ND	ND	ND
PS-4	18 Mar 89:	4-4.5	0.18	0.41	0.17	0.11	2.1
PS-4	18 Mar 89:	6-6.5	0.58	0.50	1.0	0.73	16.0
PS-4	18 Mar 89:	8-8.5	ND	ND	ND	ND	ND
PS-5	18 Mar 89:	4-4.5	ND	ND	0.06	ND	3.5
PS-5	18 Mar 89:	6-6.5	0.06	ND	0.32	0.17	9.6
PS-5	18 Mar 89:	8-8.5	ND	ND	ND	ND	ND
PS-6	18 Mar 89:	4-4.5	0.12	ND	0.28	0.12	2.8
PS-6	18 Mar 89:	6-6.5	0.51	ND	2.0	1.0	26.0
PS-6	18 Mar 89:	8	0.14	ND	0.04	0.06	ND

2' HAS BEEN ADDED TO EACH SAMPLE DEPTH.
ALL CONCENTRATIONS ARE REPORTED IN PPM = PARTS-PER-MILLION

Table 2, Continued

SAMPLE ID#	DATE	DEPTH (FT)	BENZENE (PPM)	TOLUENE (PPM)	XYLENES (PPM)	E-BENZENE (PPM)	TPH (PPM)
PS-7	18 Mar 89	4-4.5	ND	ND	ND	ND	ND
PS-8	18 Mar 89	4-4.5	0.06	ND	ND	ND	ND
PS-9	18 Mar 89	2-2.5	1.4	5.1	15.0	7.4	440
PS-9	18 Mar 89	8-8.5	0.60	0.31	1.3	1.0	40
PS-9	18 Mar 89	10-10.5	ND	ND	0.05	ND	ND

2' = HAS NOT BEEN ADDED TO THIS SAMPLE BECAUSE THERE IS NO TRENCH AND SAMPLES ARE COLLECTED FROM BELOW ASPHALT SURFACE.
E-Benzene = Ethylbenzene
TPH = Total Petroleum Hydrocarbons
ppm - parts-per-million

WARNING:
Do Not Operate
Before Reading The
Enclosed Instruction Manual

TUTHILL CORPORATION | M-D Pneumatics
A Tuthill Subsidiary

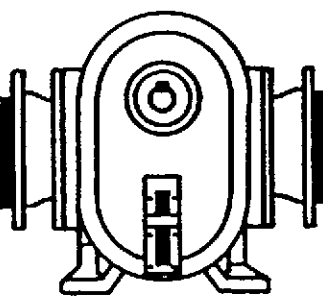
4840 West Kearney Street, P.O. Box 2877
Springfield, Missouri USA 65801-0877
Tel 417 865-8715 Fax 417 865-2950 Twx 9107754704

MAINTENANCE MANUAL

MODEL 3200

SERIES

16/47 HORIZONTAL FLOW / VERTICAL FLOW
17/46 HORIZONTAL FLOW / VERTICAL FLOW
57/81 HORIZONTAL FLOW (GAS SERVICE) / VERTICAL FLOW (GAS SERVICE)
64/67 HORIZONTAL FLOW (GAS SERVICE) / VERTICAL FLOW (GAS SERVICE)



"Leading the Search for New Solutions"

VB 2000
2-88

TABLE OF CONTENTS

SERVICE

M D Pneumatics, Inc. offers 2 to 3 day service (working days) on all repair parts shipments. If any trouble occurs to a unit within the warranty period, we suggest you immediately contact the factory for assistance. When returning units under warranty, transportation charges must be prepaid to M D Pneumatics, Inc., Springfield, Missouri.

REPAIR PARTS

When ordering repair parts or replacement units, please give the following information:

1. Model Number and Serial Number of unit.
2. Description of part — use item number shown on parts list.

Operating Characteristics

The M D Pneumatics rotary lobe blower is a positive displacement type unit, whose pumping capacity is determined by size, operating speed, and pressure conditions. It employs tri-lobe or dual-lobe rotors rotating in opposite directions within a housing closed at the ends by end plates.

Effective sealing of the blower inlet area to the discharge area is accomplished by use of very small operating clearances. Resulting absence of moving contacts eliminates the need for any internal lubrication. Clearances between the rotors during rotation are maintained by a pair of accurately machined helical timing gears, mounted on the two shafts extended outside the air chamber. The two intermeshing rotary lobes are designed to rotate and trap air or gas between each rotor and the housing. As the rotor lobes rotate past the edge of the suction port, the trapped air or gas is essentially at suction pressure and temperature, since the blower is a constant volume device, the trapped air remains at suction pressure until the leading rotor lobe opens into the discharge port. Immediately, the high pressure air in the discharge line compresses the low pressure air to discharge pressure. The rotors continue to rotate and force the air from the blower into the discharge line.

It can be seen by the illustration that the air moves not between the rotors but between the rotors and the side of the housings. Also, the rotation of the blower can make either side the inlet or discharge.

No attempt should ever be made to control capacity by means of a throttle valve in the intake or discharge piping. This will increase the power load on the drive system, increase operating temperatures, and can overload and/or seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, then an adequate vacuum relief valve must be installed near the blower. A pressure type relief valve in the discharge line near the blower is also strongly recommended for protection against cut-off or blocking in this line Check valves should also be used on every blower when more than one blower is connected to a discharge line. This is for both safety and operating conditions.

When a belt drive is employed, blower speed, if necessary, can usually be adjusted to obtain desired capacity by changing the diameter of one or both sheaves, or by using a vari-speed motor pulley. In a direct coupled arrangement, a variable speed motor or transmission is required, or excess air or gas may be blown off through a manually controlled unloading valve and silencer. Gas units can use bypasses, but some application may require additional cooling. If there is a large volume of high pressure air or gas downstream of the blower, a check valve in the piping downstream of the blower will protect the blower from overspeeding backwards on shutdown.

Consult your M D Pneumatics sales representative if questions arise.

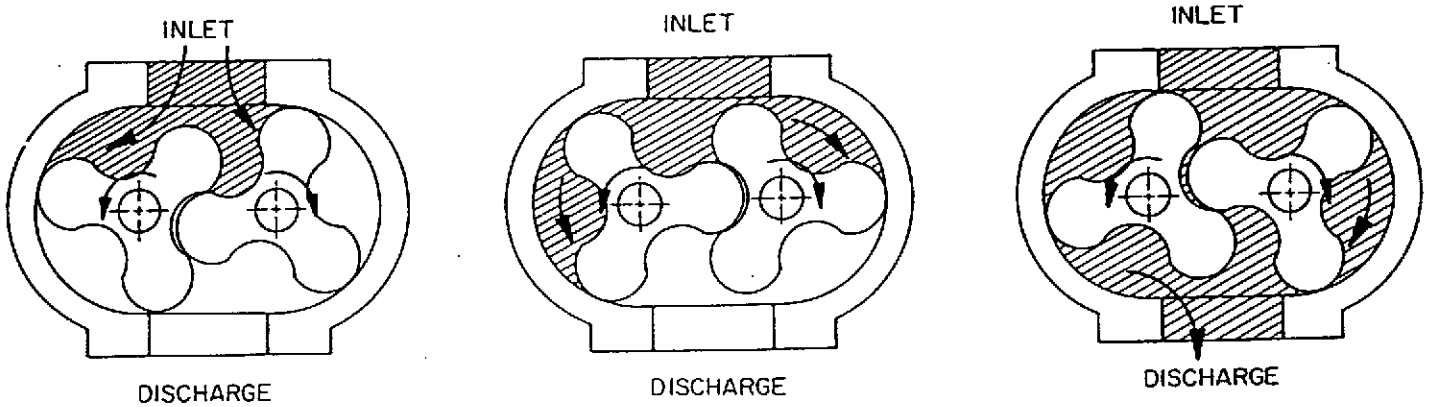


FIGURE 1

Operating Limitations

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation. Maximum limits for pressure, temperature and speed are specified here for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any one of these limits.

Example: The listed maximum allowable temperature limit (the limit is a function of the temperature rise as well as the inlet temperature) for any particular blower may occur well before the maximum speed or maximum pressure rating is reached. Temperature rise then becomes the limiting condition. In other words, the operating limit is always to be determined by the maximum rating reached first, and it can be any one of the four: pressure, temperature, speed, or horsepower.

Note: Special attention must be paid when a blower has a higher than standard ambient suction temperature. Special recommendations for operating parameters and/or additional cooling may be recommended. Consult the factory or local representative for appropriate information.

Be sure to arrange connections or taps for thermometers and mercury type pressure or vacuum gauges near the inlet and discharge connections of the blower. These, along with a good tachometer will enable periodic checks of operating conditions to be made easily.

Note: Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown on page 11, will not have the operating limits specified here. Contact your M D Pneumatics sales representative for specific information.

PRESSURE: On pressure service with an inlet of 14.7 PSIA, the pressure differential in pounds per square inch (between blower inlet and discharge) must not exceed the figure listed in Table 1 for the specific blower model concerned. Individual blowers may have further restrictions on operating limits (ref. performance curves). Consult the factory in any system where the blower inlet is a positive pressure above atmosphere.

On vacuum service, with the discharge going to 14.7 PSIA, the inlet suction or vacuum in inches of mercury (In. Hg.) must not be greater than the values listed in Table 1.

TABLE 1 — 3200 MODELS

Series	Max. PSIG or "HG" Vac.	Max. RPM*
16/47	10	3600
17/46	15	3600
57/81	15	3600
64/67	15	3600

*Maximum RPM may vary depending upon unit size, pressure and CFM.

TEMPERATURE: Best life for continuous service will be obtained where the maximum discharge temperature on splash lubrication blowers does not exceed 250°F.

Cooling coils installed in oil chamber reservoirs or an external lube system with cooler are generally recommended for air discharge temperatures from 250-300°F. Discharge temperatures above 300°F normally require an external lube system with cooler. Consult your MD Pneumatics sales representative if temperature questions arise.

Flow Direction by Rotation

Refer to the illustrations below before installing inlet and discharge piping.

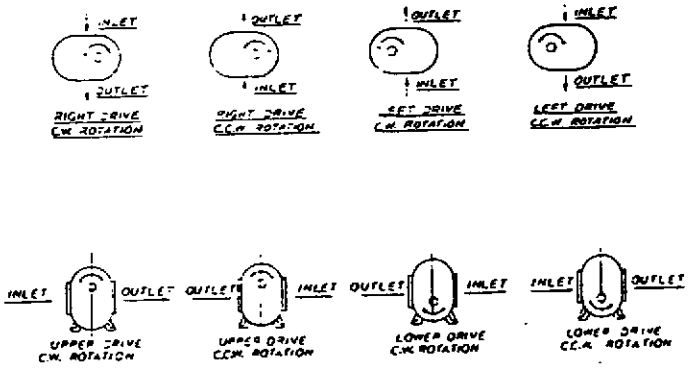


FIGURE 2

Installation

Install blower in a protected indoor location, if possible. However, an unprotected outdoor installation will be satisfactory if correct lubrication for expected temperatures is provided (see recommended lubrication section). Just before starting the installation, remove plugs or covers from inlet and discharge connections. Inspect for dirt or foreign objects inside blower, then turn drive shaft by hand to make sure it rotates freely.

Mount blower in a level position. Use of a rigid, solidly supported, structurally sound baseplate is recommended. Make sure blower feet rest evenly on the plate before fastening down. Twisting or cramping the blower in mounting will cause rotor contact and binding during operation.

A blower, factory-mounted on a base, should not require the above adjustments. The assembly can become twisted in shipping or installation, however, this needs to be done after base installation. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. The base should be mounted on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly.

Transmission of small operating vibrations to a support structure in some cases may be objectionable. Use of vibration isolators or vibration absorbing materials can be effective in overcoming this problem. To avoid blower casing distortion, the treatment used should be applied under the motor-blower common mounting plate or base, rather than directly under the blower feet alone.

Piping should be accurately squared with the blower and supported independently. Use only clean new pipe and make certain it is free of scale, cuttings, weld beads, dirt, or any other foreign material. To guard against damage to the blower, insure that an inlet filter is used. Make provisions to clean the filter of collected debris after a few hours of operation and periodically thereafter.

Figure 3 shows a typical complete installation of blower and accessories. Note the absence of throttle or shut-off valves in either discharge or intake piping. If it is possible for air flow to be cut off in either of these lines, make provisions to add a pressure and/or vacuum relief valve as discussed under Operating Characteristics.

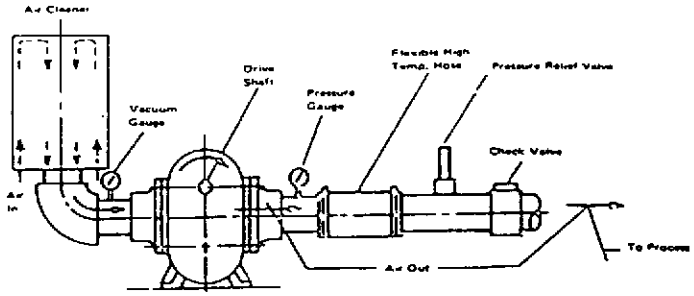


FIGURE 3

In some installations, it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. Weight of accessories and piping must be kept to a minimum to prevent blower casing distortion. Weights in excess of 10% of blower weight should be supported independently of blower and connected with a flexible hose or connectors.

A blower may be driven by direct coupling to the driver or by v-belt drive to obtain other speeds within the approved range.

Coupling halves must correctly fit the blower and drive shafts so that only light tapping is required to install each half. The two shafts must be accurately aligned, per the coupling manufacturer's requirements, both horizontally and vertically, to limit operating strain on either shaft. Proper gap between coupling halves must be established according to coupling manufacturers instructions with the motor armature. This will minimize the change for end thrust on the blower shaft. All direct coupled base mounted units must be re-aligned and greased after field installation.

In a v-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted as close to the bearing housing as possible to minimize bearing loads.

A tight or driving fit will force the drive shaft out of its normal position and cause internal damage. A loose fit will probably result in shaft damage or breaking. The motor sheave must also fit correctly and be properly aligned with the blower sheave.

Adjust motor position on its sliding base so that belt tension is in accordance with drive manufacturer's instructions. Avoid excessive belt tension at all times. Recheck tension after the first ten hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

Check blower after installation and before applying power by rotating the drive shaft by hand. If it does not rotate freely, look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment. Check blower at this time to insure oil was added to reservoirs.

Lubrication

Every M D Pneumatic Blower is factory tested, oil drained, and shipped dry to its installation point. Both independent oil reservoirs must be filled to proper level before operation.

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil reservoir formed in the end plate and cover. Shaft bearings at the free end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill sumps as instructed below:

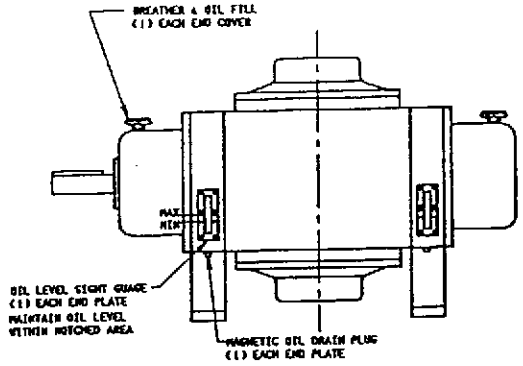
1. Remove fill plugs or breathers from gear end and free end covers.
2. Pour oil through fill hole slowly until oil appears in oil sight glass. Slowly bring oil up to proper level. See figure 4.
3. Replace plugs or breathers in end covers (64/67 series does not have breathers.)

M D Pneumatics recommends a good grade industrial type non-detergent oil (heavy duty type). Recommended oil viscosity as follows:

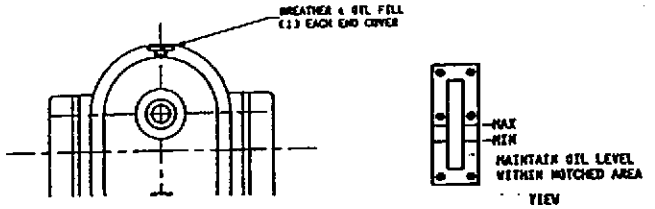
Ambient Temperature	
A. 30°F and under	SAE 20
B. 30-90°F	SAE 30
C. above 90°F	SAE 40

Lubrication should be checked every 24 hours of operation. Time lapse between oil changes will have to be determined for each individual installation and normally will be between 250-1000 operating hours.

Note: For blowers using the external lube system, the oil sump capacity is 7½ gallons and oil change interval can be 4-6 months.



VERTICAL AIR FLOW



per King Buck:

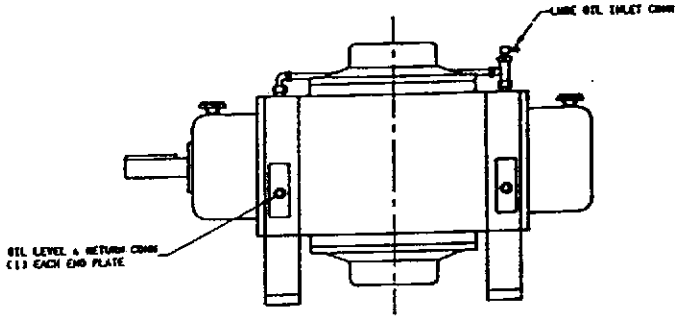
nonmetallic aviation oil

Aero Shell 65 (winter)

Aero Shell 80 (summer)

or equivalents

GAS SERVICE



BLOWER W/ EXTERNAL LUBE CONNECTIONS

FIGURE 4

Operation

Before starting the blower for the first time under power, recheck the installation thoroughly to reduce the likelihood of troubles. Use the following check list as a guide, but also consider any othe special conditions in your installation.

1. Be certain no bolts, rags, or dirt have been left in blower.
2. Be certain that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by an inlet filter. This also applies to indoor use.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. Be certain the proper volume of oil is in the oil reservoir chambers.
5. Be certain the driving motor is properly lubricated, and that it is connected through suitable electrical overload devices.
6. Rotate blower shaft several times by hand to make sure blower is rotating freely. Unevenness or tight spots is an indication of a problem.
7. Check motor rotation by momentarily pushing the start button and check flow direction of the blower. Reverse the motor connections if flow is in the wrong direction.

Initial operation should be carried out under "no load" conditions by opening all valves and venting the discharge to atmosphere, if possible. Then start motor briefly, listen for unusual noises, and check that the blower coasts freely to a stop. If no problem appears, repeat this check, and let the motor run a little longer. If any questions exist, investigate before proceeding further.

Assuming all tests are satisfactory, the blower will now be ready for continuous full load operation. During the first several days, make periodic checks to determine that all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove inlet filter. Also, recheck leveling, coupling alignment or belt tension, and mounting bolts for tightness.

Special Instructions For External Lube Systems

Blowers furnished with external lube tanks are designated with a suffix number after the model number, for example, 3210-84. On older units, it will appear before the model number. There are four variations manufactured.

85 Lip Seal/Vertical Flow *(46)
18 Lip Seal/Horizontal Flow *(17)
84 Mechanical Seal/Vertical Flow *(81)
54 Mechanical Seal/Horizontal Flow *(57)

*Use this corresponding number when following the repair procedure. The blowers are the same except for the end plates which have different drillings for lubrication purposes.

WARNING: Field conversions cannot be made on 46 and 81 series without replacing end plates. Consult factory before making any conversions.

1. The M D external lube tank is equipped with an oil filter which has a replaceable element. The part number for the element is 91999-1.
2. Each tank has an oil pressure relief valve which is set at the factory between 12 and 15 PSIG and normally requires no adjustment. If an adjustment becomes necessary, remove the cap and adjust the screw. Clockwise will increase pressure, and counterclockwise will reduce pressure.
3. Oil tank should be on a level surface with return connections of tank below the blower return connections (2 inch drop per foot approximately). Each end of blower shall have separate return hose lines (¾" I.D. minimum) not over six feet from farthest blower.
4. The oil supply hose and connections must be kept free of dirt and foreign material during installation to prevent clogging of blower oil supply restrictors (.055 diameter).
5. Make sure motor pump wiring connection is for correct rotation as indicated by arrow on motor.
6. Tanks equipped with heat exchangers should have water flow direction counter to oil flow. Water flow rate approx. .25 to 1.0 GPM dependent upon blower operating condition (sump temperature should not exceed 250°F maximum).

7. WARNING: Fill both ends of blower with oil to the proper level, then operate oil supply system, and be sure oil is returning from both blower return hoses prior to starting blower.

Methane Gas

Instructions for injecting fuel oil, kerosene, and lube oil into blowers sludged by sewage gas.

Some sewage gases will adhere to the rotors in a gas blower. If enough sludge from the gas being pumped builds up on the rotors, it destroys the clearances between the rotors. The build-up can cause the blower to clatter and eventually freeze up when the rotors no longer have clearance to turn.

This can be easily prevented by periodically flushing the blower with a mixture of 75% kerosene or fuel oil and 25% lubricating oil. The kerosene or fuel oil disolves the sludge buildup and the lubricating oil coats the rotors to slow the build-up.

The mixture should be injected on the inlet side through a valve set to feed a gallon of mixture in 15-20 minutes. On units regularly flushed, once a week is sufficient. If the unit is dirty, it should be flushed daily until the hard build-up is removed then put on a weekly cycle. In very dirty gas installations, the cycle must be varied to meet the demand.

Water Injected Vacuum or Pressure Blowers

Water injected into the inlet of a blower operating on vacuum service will cool the blower. The water absorbs the heat of compression as it passes through the unit along with the air/gas being compressed. A blower cooled in this manner can operate safely at higher vacuums or higher inlet temperatures than a normally uncooled unit.

The amount of water required depends on the inlet air/gas temperature, inlet vacuum, water temperature, and the maximum discharge temperature desired. Check with the factory or sales representative for additional guidance.

OPERATION:

1. Check oil level in sight glass of blower and assure all fittings are tight.
2. Check the water injection system to assure water is available.
3. Operate the blower dry for a few minutes at no load to check correct rotation and smooth operation.
4. Turn water on and adjust flow as recommended for the individual blower. Assure water discharges freely from the outlet piping.
5. Apply vacuum and observe operation at the desired inlet condition.

SHUTDOWN:

1. The blower can be shut down for brief periods by relieving the inlet vacuum, shutting the water off, and then stopping the unit.
2. Rusting during a slightly longer shutdown period can be avoided by operating the blower under a partial vacuum without the water injection, allowing the blower to heat to within safe limits. The heat will tend to drive off residual moisture.
3. For extended shutdown, oil may be injected into the inlet of the heated blower just prior to shutting the unit down. The oil will provide a protective coating on the internals. Insure that the water is completely shut off after shutdown.
4. Special coatings or platings are available to minimize rusting or corrosion in applications where units can remain wet.

CAUTION: Water injection can cause lime buildup on rotors. Check water supply for hardness. The use of water softeners, other chemicals, or distilled water may be necessary to prevent or remove this build-up. M D Pneumatics will not be responsible for damage which may result should this build-up occur. Units should be inspected regularly to determine any problems.

NOTE: For liquid injection other than water, consult the factory.

Vertical flow units with two-lobed, plugged rotors should always be used. Suction at top and discharge at bottom.

Long Term Storage

1. Spray the interior (lobes, housing and end plates) with a rust preventative.
2. Fill both end bells completely full of oil.
3. Firmly attach a very prominent tag stating that the end bells are full of oil and must be drained and refilled to proper levels prior to startup.
4. Apply a rust preventative grease to the drive shaft.
5. Attach a desiccant bag to either of the port fitting caps to prevent condensation from occurring inside the blower. Make sure any desiccant bag (or bags) is so attached to the covers that they will be removed when dust cover is removed. It is imperative that these be removed before startup of the blower.
6. Store the blower in an air conditioned and heated building if at all possible. At least insure as dry conditions as possible.
7. If possible, rotate the drive shaft by hand at least monthly in order to prevent the seals from setting in one position.

Safety Precautions

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong, coarse screen over the inlet and avoid standing in discharge air stream.
- Stay clear of the blast from pressure relief valves and the suction area of the vacuum relief valves.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.
- Hearing protection may be required depending on silencing capabilities.

Maintenance & Replacements

Regular inspection of the blower and its installation, along with complete checks on operating conditions will pay dividends in added life and usefulness. Particular attention should be paid to lubrication of timing gears and bearings in accordance with comments under LUBRICATION. Also, service the driver per manufacturer's instructions and lubricate the coupling or check belt drive tension. By use of thermometers and gauges, make sure that blower operating temperature and pressure remain within allowed limits.

When a blower is taken out of service, it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgement based on existing conditions as well as length of down time. Under atmospheric conditions producing rapid corrosion, the blower should be protected immediately.

Should adjustments or replacements eventually be needed, these can often be performed locally as described in this book after obtaining required parts. Personnel should have a good background of mechanical experience and be thoroughly familiar with these instructions. Major repairs not covered in this book should be referred to the nearest M D Pneumatics service representative.

When ordering parts, give all blower nameplate information, plus the item numbers and names as taken from the appropriate assembly drawing in this book. Numbers shown in brackets () in the following repair procedures correspond to item numbers in the drawings.

Trouble Shooting Blowers

How to spot blower trouble

Trouble	Cause	Reasons
Lack of performance.	Loss of RPM. Restricted inlet. Excessive slip. Leaking pressure or vacuum relief valve	V-belts worn or loose. Clogged or undersized filter. Rotor tips worn. Worn seats or incorrect setting.
Unusual noises.	Rotors making contact with case, end plates or each other.	Excessive pressure ratio. Failing bearings or gears.
Leaking oil.	Seals failing. Oil Foaming.	Excessive pressure ratio and temperatures. Improper oil spec. or overfilling. Seal vent holes plugged (17/46 Series only).
Over heating.	Loss of RPM. Restricted inlet. Excessive slip. Over pressure. High vacuum.	Worn or loose V-belts. Clogged or undersized filter. Rotor tips worn. Pressure relief valve setting incorrect. Vacuum relief valve setting incorrect or restricted discharge.
Failing bearings and/or gears.	Using incorrect oil. Low or high oil levels. Oil temperatures too high. Infrequent oil changes.	Instructions on page 5 or contact factory. Check levels as required. Excessive pressure ratio and RPM. Instructions on page 5.

Trouble Shooting V-Belts

How to spot V-belt trouble

Trouble	Cause	To Correct
Belt slip (sidewalls glazed)	Not enough tension.	Replace belts; apply proper tension.
Drive squeals	Shock load. Not enough arc of contact. Heavy starting load.	Apply proper tension. Increase center distance. Increase tension.
Belt turned over.	Broken cord caused by prying on sheave. Overloaded drive. Impulse loads. Misalignment of sheave and shaft. Worn sheave grooves. Excessive belt vibration.	Replace set of belts correctly. Redesign drive. Apply proper tension. Realign drive. Replace sheaves. Check drive design. Check equipment for solid mounting. Consider use of banded belts.
Mismatched belts.	New belts installed with old belts. Sheave grooves worn unevenly; Improper groove angle. Give appearance of mismatched belts. Sheave shafts not parallel. Give appearance of mismatched belts.	Replace belts in matched set only. Replace sheaves. Align drives.
Belt breaks.	Shock loads. Heavy starting loads. Belt pried over sheaves. Foreign objects in drives.	Apply proper tension; Recheck drive. Apply proper tension; Recheck drive. Use compensator starting. Replace set of belts correctly. Provide drive shroud.
Belt wears rapidly.	Sheave grooves worn. Sheave diameter too small. Mismatched belts. Drive overloaded. Belt slips. Sheaves misaligned. Oil or heat condition.	Replace sheaves. Redesign drive. Replace with matched belts. Redesign drive. Increase tension. Align sheaves. Eliminate oil. Ventilate drive.

Disassembly of Blower

1. Drain lubricant from both ends of blower by removing magnetic drain plugs (31).
2. Remove inlet and outlet port fittings (38). Model 3202 does not have port fittings.
3. On 64/67 series only, remove spanner lock nut (83), dust washer (82), screws (93), and seal adapter housing (91). Tap out seal (76) and discard O rings (92 & 140). Remove spacers (77 and 74), adjusting shim (118) and discard O ring (75).
4. Remove cap screws (26A & 26B) and both end covers (6 & 7). Use sharp chisel and hammer for gear end cover (6) unless jack screw holes have been provided.
5. Remove lockwire (49), socket head screws (66), and drive shaft (45). Using puller remove bearing (9 or 50).
6. Remove flat head allen screws (29) from each rotor shaft. Remove washers (25), spacers (57), and oil slinger (21).
   Note: The flat head screws have nylok in their threads and may be difficult to remove. Strike the head a couple of blows with a flat face hammer for easy removal.
7. Mark housing, end plates, rotors, and gears before proceeding with disassembly.
   There are two methods which can be used to disassemble the rest of the unit. Method "A" requires an arbor press and method "B" requires the use of bar or yoke pullers. See Figure 5.
8. Method A:
   a. Place two support blocks, 5½ to 6 inches high (hard wood or steel), on the bed of an arbor press. Set the unit, with the gears pointing down, on the two blocks making sure the blocks support the rotor housing only. Press both rotors out of free end bearings simultaneously.
   b. Lift the housing off the rotors and remove the nondrive end plate (4) by tapping the end plate from the inside of the housing. Place the rotor housing back over the rotors.
   c. Set the unit on the support blocks with the gears pointing upward. Do not extend blocks into the rotor bores. The rotors may now be pressed from the gear end plate. Do not damage rotors.

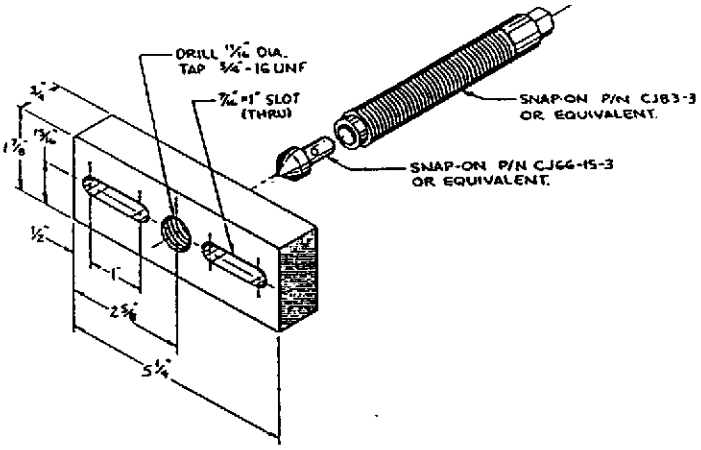
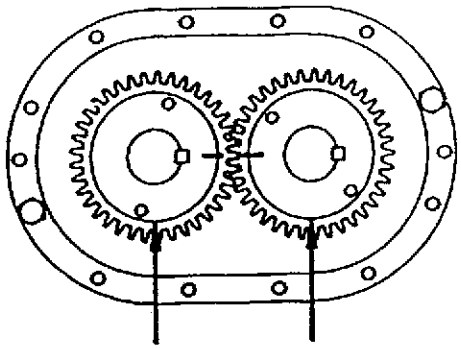


FIGURE 5

Method B.:

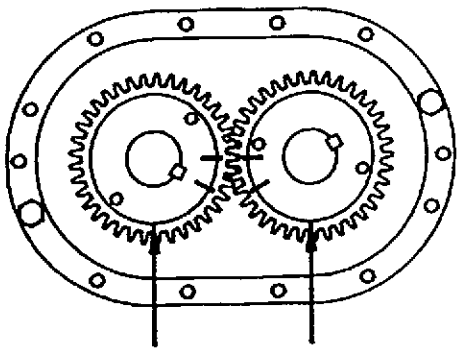
a. Align timing marks on gears (Figure 6A). Rotate drive gear clockwise approximately three teeth and mark a matching reference line on each gear as shown in Figure 6B. This gear position is necessary so rotors will clear and not jam. Do not allow the gears to move from the matched reference line while pulling. Use a light rocking motion to insure that the lobes have not jammed. Remove driven gear first then drive gear.
   WARNING: Failure to properly pull this gear could result in damage to rotor keyway or a bent rotor shaft. Never use excessive force.



DRIVE GEAR DRIVEN GEAR

FIGURE 6A

KEYWAYS IN LINE AND TIMING MARKS MATCHED



DRIVE GEAR DRIVEN GEAR

FIGURE 6B

TIMING MARKS ADVANCED 3 TEETH.
(REFERENCE MARKS ALIGNED)

NOTE: Position of timing marks is for removing or installing driven gear. To remove the drive gear, advance three teeth in the opposite direction.

b. Remove button head allen screws (30) and bearing retainer rings (14) from both end plates.
c. Attach a pair of bar pullers to the bearing bores of the free end plate. Use 10-32 x 4" long screws. Alternately push both rotors from end plate. Separate end plate from housing.
d. Turn the unit around and attach a single bar puller to either bore and push rotor from end plate. Repeat for opposite rotor.
   Note location of timing shims (16), oil slinger (20), and spacers (17 & 18).
e. Tap end plate from housing.

9. Tap out bearings from both end plates. Note location of spacers under bearings and retain for reassembly. To remove seals (54 or 12) use a cape chisel or similar tool being careful not to nick or cut the bearing or seal bores.
   On 17/46/57/81/64/67 series remove the labyrinth seal (51). The seals will be damaged by removal and must be replaced.
10. Wash all parts and inspect for wear or damage.

Assembly of Blower

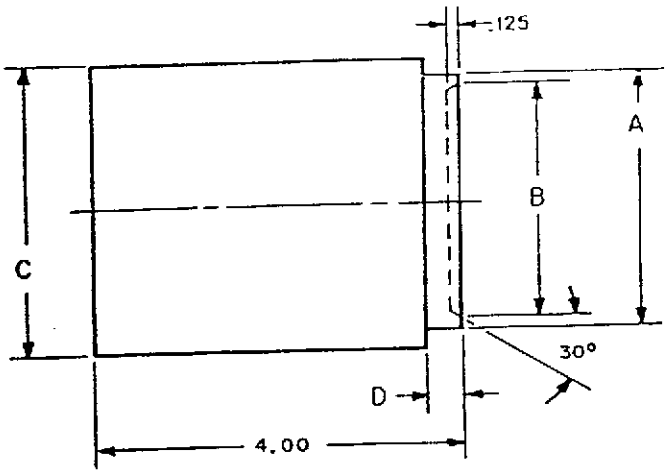
The assembly procedure is generally the same for all series, but where there are differences, notations will be made.

Gaskets are **never used** between rotor housing and end plates. Gaskets are used between end covers and end plates to seal against oil leakage. Dowel pins are used to locate end plates, housing, and drive end cover in the proper location relative to each other. Be sure they are in place.

It is recommended that the gear end rotor shaft bearings be purchased from M-D, as they are specially ground to locate the rotors with correct end clearance relative to the gear end plate.

PREPARATION OF END PLATES FOR ASSEMBLY

1. Make sure all parts are clean and free of any nicks or burrs caused by disassembly. See Figure 7 for dimensions of seal pressing tool.



MATERIAL: MILD STEEL

SEAL & TOOL No.	A DIA.	B DIA.	C DIA.	D
27565	1.871 / 1.870	1.751 / 1.771	2.045 / 2.044	.312

FIGURE 7

2. Press the labryinth seals (51) into seal bores of both end plates (4) making sure the scalloped areas of seal case are aligned with openings in vent area of seal bore. (All series except 16/47.)
3. Lip seal installation 16/47/17/46 series: Apply a thin coat of #2 Permatex or equivalent to O.D. of seal and press into seal bore. Make sure seals are fully seated without deforming. Seal lip should face towards the bearing. Lubricate lip seal only, with grease.
4. Mechanical seal installation 57/81/64/67 series: Follow instructions for lip seal but do not grease.

   Note: For units handling gases other than air, it may be necessary to use an RTV or Locktite sealer instead of Permatex. Care should be taken that no sealer is left on the carbon. Clean with soft tissue and cleaning agent if necessary. Failure to remove will result in leakage.
5. Stand rotors (1) on arbor press with gear end shafts up and both keyways facing to the right. The drive rotor should be on the left.
6. Install the gear end plate (4), making sure the feet are facing in the right direction, over the rotor shafts and coming to rest on top of the rotor lobes. Be careful not to damage seals.
7. On 57/81/64/67 series, lubricate and install shaft O rings (314). Check lapped surface of seal mating ring to be sure it is perfectly clean. Use soft tissue and cleaning agent (acetone) if necessary. Place a few drops of lubricating oil on its surface and install on shaft with lapped surface coming to rest on top of carbon. Gently press with fingers to insure compression is taking place and ring is not hung up for any reason.
8. Lubricate shafts and press the double row ball bearings (9) on rotor shafts and into end plate bores. Secure with retainer rings (14) and screws (30).
9. Check clearance between the face of the end plate and rotor lobes. See exploded view for correct gear end clearances. If clearances are not within specifications, recheck parts to find cause of improper clearances before proceeding.
10. Install spacer (17) (.260 thickness) on one shaft and spacer (18) (.200 thickness) and oil slinger (20) on the other shaft.

    Note: Oil slinger and its spacer should always be mounted on lower rotor for horizontal flow units. It can be mounted on either shaft for vertical flow units.

    Install timing shim in same location as found in disassembly. This does not necessarily insure the unit will be in proper time. Adjustments can be made later in the assembly process.
11. Insert gear keys (24) into the rotor shaft keyways. Loose fits are not acceptable.

12. Lubricate shafts and install drive gear (right hand helix) on drive rotor (left side). To install driven gear, align reference marks as shown in Figure 6B. Install driven gear carefully to avoid mashing any teeth when engaging opposite gear.
13. Install spacers (57) washers (25) and flat head allen screws (29).
14. Remove assembly from press and stand on work table with gears down. Place blocks under end plate to prevent assembly from falling over. Drive gear should remain on left side.
15. On 57/81/64/67 series, use an RTV silicone type sealer. Place a small bead around the periphery of the end plate and encircling each bolt hole.
16. Install rotor housing (3) and secure with 4 screws evenly spaced.
17. Check clearances between end of lobes and housing using a flat bar and feeler gauges or a depth micrometer. Refer to exploded view for free end clearances.

FREE END ASSEMBLY

18. On 57/81/64/67 series put sealer on free end plate. (Same as 15).
19. Install free end plate and secure with 4 screws.
20. On 57/81/64/67 series, lubricate and install O rings. Repeat instructions given in step 7.
21. Install bearing spacers (123) (.025 thickness) on each shaft. Lubricate shafts and tap on bearings (10).
22. Install oil retainer rings (14) with button head screws (30).
23. Install oil slinger (21) on lower rotor, (either shaft on veritical flow units) spacer (57) on opposite shaft, washers (25), and screws (29).

ADJUSTING ROTOR INTERLOBE CLEARANCE

24. Lay the unit down with the drive gear on the left.

Using feeler gauges take interlobe readings and record on each side of housing as indicated in Figure 8.

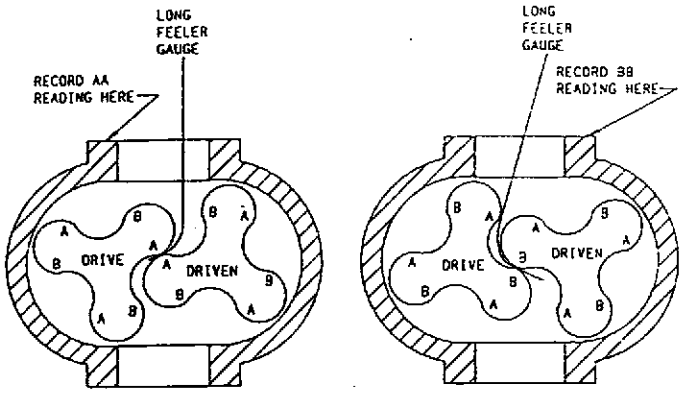


FIGURE 8

By removing or adding shim behind the helical gear, it rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes. Changing the shim thickness .006 will change the rotor lobe clearance .003 or one half the amount.

EXAMPLE: Referring to Figure 8 check the clearance at AA (right hand reading) and BB (left hand reading). If AA reading is .003 and BB reading .009, by removing .006 shims, the readings will change one half the amount removed or .003. AA should then read .006 and BB should read .006. The final reading should be within .002 of each other.

To determine the amount of shim to add or remove, subtract the small figure from the larger. If the right side reading is higher than the left side, remove shim. If the right side reading is lower, add shim.

25. Install drive shaft (45) and secure with allen screws (66). Check drive shaft runout at seal journal. Do not exceed .002 T.I.R. Install lockwire (49).

26. Install bearing (9 or 50) on drive shaft and secure with retaining ring (47). (This item not required on 64/67 series.)

NOTE: To continue assembly for series 64/67, see Special Instructions following this section.

27. Remove temporary cap screws from each end plate and install cover gasket (28) and gear end cover (6). Make sure dowel pins (22) are in place. Sealer is not required on factory supplied gaskets. Secure with cap screws (26A) and washers (27).
28. Coat O.D. of drive shaft seal (13) with sealer and grease I.D. Install carefully over keyway and tap into cover.
29. Install free end cover (7), with gasket (28) and secure with cap screws (26B) and washers (27).
30. Install port fittings (38), gaskets (39), and secure with cap screws and washers (40 & 41).

SPECIAL INSTRUCTIONS 64/67 SERIES

Continue assembly:

A. Grease and install O ring (140) into groove of seal adapter housing (91). Press in stator portion (carbon) of mechanical seal (76).
B. Place a bead of silicone sealer around the periphery of the end plate and encircle each bolt hole. Install gear end cover (6), and secure with cap screws and washers (26A & 27).
C. Install shim pack (118) on drive shaft, O ring spacer (74), O ring (75), and mating ring portion of mechanical seal with lapped surface facing outward. Make sure surface is clean and place a few drops of lubricating oil on its surface. Install sleeve (77) with grooved side facing mating ring.
D. Slide seal assembly housing (91) over drive shaft and against cover. Slide dust washer (82) against spacer sleeve (77). Dust washer should be flush to plus .005 with face of housing (91). Adjust with shim pack (118).
E. Remove housing and install O ring (92). Reinstall housing (91), dust washer (82) and secure with allen screws (93) and spanner nut (83).
F. Install free end cover (7) as in B above and secure with cap screws 26B and washers (27).
G. Install port fittings by placing a bead of silicone around the inside of bolt hole pattern. Secure with cap screws (40) and washers (41).

APPROXIMATE OIL CAPACITIES ALL MODELS

Series	Total Per Unit
16/17/57	1 Pint
47/46/81	1 Quart

APPROXIMATE DRY WEIGHTS OF 3200 BLOWERS

MODEL	SERIES	WEIGHT IN LBS.
3202	16	70
	47/17/57/64	85
	46/81/67	90
3204	16	80
	47/17/57/64	95
	46/81/67	110
3206	16	95
	47/17/57/64	110
	46/81/67	120
3210	16	125
	47/17/57/64	140
	46/81/67	155

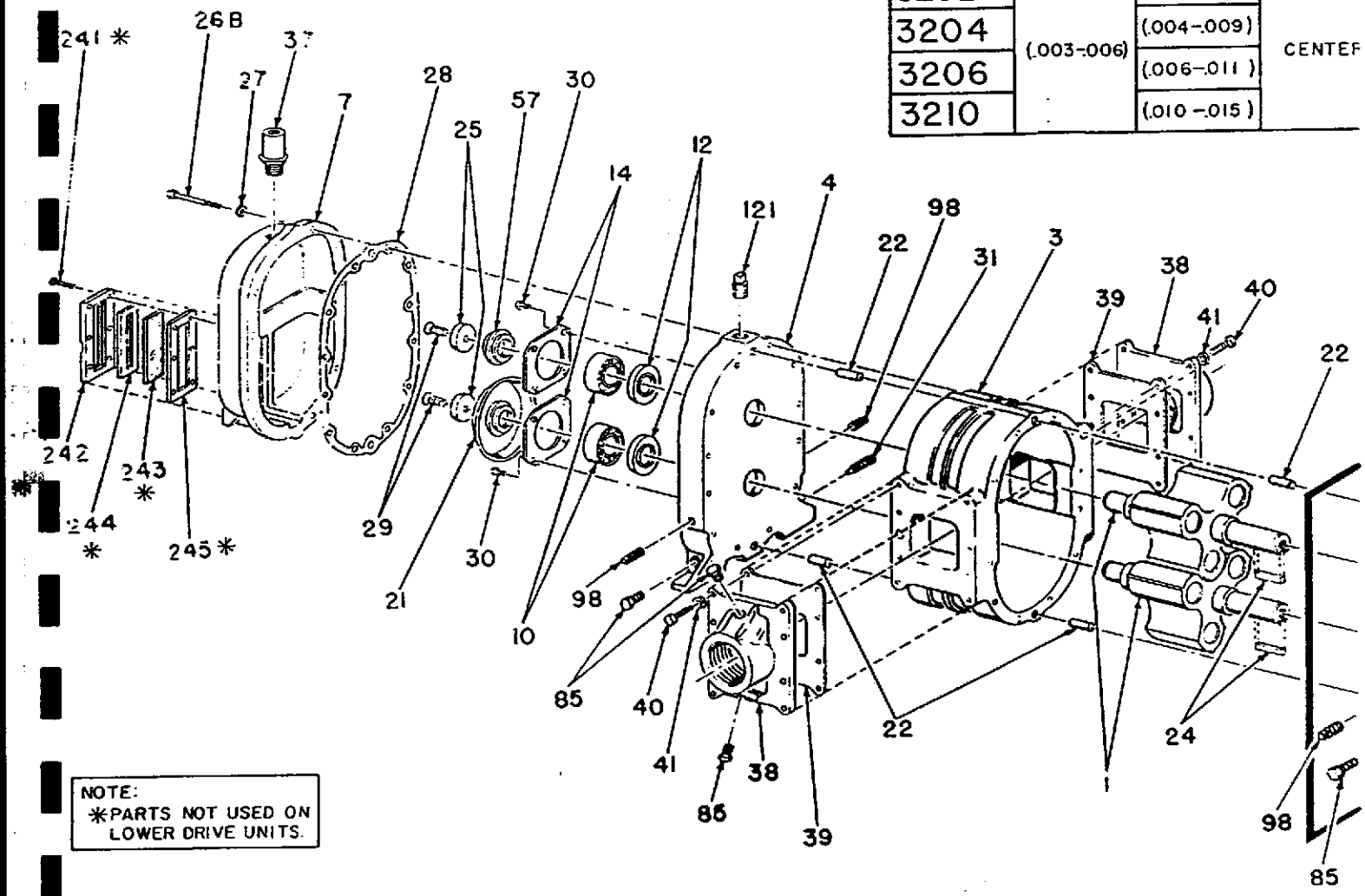
ITEM NO.	DESCRIPTION	3200 SERIES 16/47	17/16	57/81	64/67
1	Rotor	2	2	2	2
3	Housing	1	1	1	1
4	End Plate	2	2	2	2
6	Drive End Cover	1	1	1	1
7	Free End Cover	1	1	1	1
8	Timing Gear Assy	1	1	1	1
9	Bearing	3	3	3	—
10	Bearing	2	2	2	2
12	Rotor Shaft Lip Seal	4	4	—	—
13	Drive Shaft Lip Seal	1	1	1	—
14	Bearing Retainer Ring	4	4	4	4
16	Timing Gear Shim Pack	1	1	1	1
17	Drive Gear Spacer	1	1	1	1
18	Driven Gear Spacer	1	1	1	1
19	Spacer	—	—	—	2
20	Oil Slinger	1	1	1	1
21	Oil Slinger	1	1	1	1
22	Dowel Pin	6	6	6	6
23	Drive Shaft Key	1	1	1	1
24	Timing Gear Key	2	2	2	2
25	Rotor Shaft Washer	4	4	4	4
26A	Hexhead Cap Screw	12	12	12	12
26B	Hexhead Cap Screw	12	12	12	12
27	Lockwasher	24	24	24	24
28	Gasket	2	2	2	—
29	Flathead Socket Screw	4	4	4	4
30	Buttonhead Cap Screw	12	12	12	12
31	Magnetic Pipe Plug	2	2	2	2
34	Dowel Pin Spacer	2*	—	—	—
37	Breather	2	2	2	—
38	Port Fitting†	2	2	2	2
39	Port Fitting Gasket†	2	2	2	—
40	Hexhead Cap Screw	AR	AR	AR	AR
41	Lockwasher	AR	AR	AR	—
45	Driveshaft	1	1	1	1
47	Retaining Ring	1	1	1	—
49	Lockwire	1	1	1	1
50	Bearing	—	—	—	1
51	Lab Seal	—	4	4	4
54	Face Seal	—	—	4	4
57	Spacer	3	3	3	3
66	Drilled Sockethead Screw	2	2	2	2
67	Spacer	—	—	2	2
74	Spacer	—	—	—	1
75	O-Ring	—	—	—	1
76	Face Sal	—	—	—	1
77	Sleeve	—	—	—	1
82	Seal Dust Washer	—	—	—	1
83	Locknut	—	—	—	1
85	Pipe Plug	AR	AR	AR	AR
91	Seal Adapter Housing	—	—	—	1
92	O-Ring	—	—	—	1
93	Sockethead Screw	—	—	—	4
98	Plug	AR	AR	AR	AR
118	Shim	—	—	—	AR
121	Plug	AR	AR	AR	AR
123	Spacer	—	—	2	2
140	O-Ring	—	—	—	1
174	Pipe Plug	—	AR	AR	AR
241	Sockethead Cap Screw	12	12	12	12
242	Frame, Sightglass	2	2	2	2
243	Window	2	2	2	2
244	Gasket, Window	2	2	2	2
245	Gasket, Frame	2	2	2	2
255	Roll Pin	2**	—	—	—
314	O-Ring	—	—	4	4

* 16 Series Only
** 47 Series Only

† Not required on Model 3202

ROTARY BLOWER ASSEMBLY
SERIES 3200-16/47

3200-16/47 MODEL (			
MODEL	GEAR END	FREE END	INTEF
3202	(.003-.006)	(.004-.009)	CENTEF
3204		(.004-.009)	
3206		(.006-.011)	
3210		(.010-.015)	



NOTE:
*PARTS NOT USED ON LOWER DRIVE UNITS.

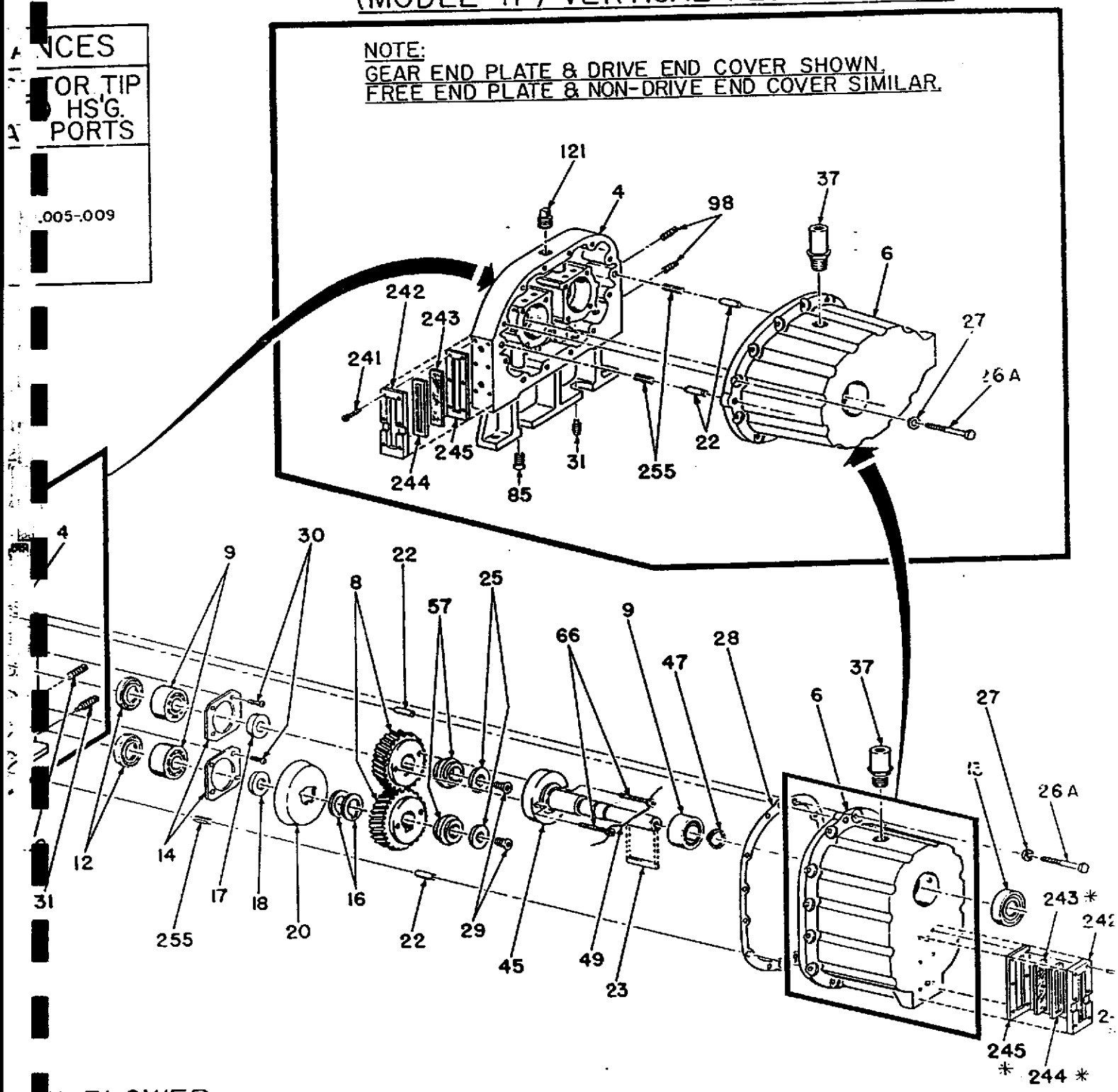
(MODEL 16) HORIZON

(MODEL 47) VERTICAL FLOW BLOWER

NCES

TOR TIP
HS'G.
PORTS

.005-.009



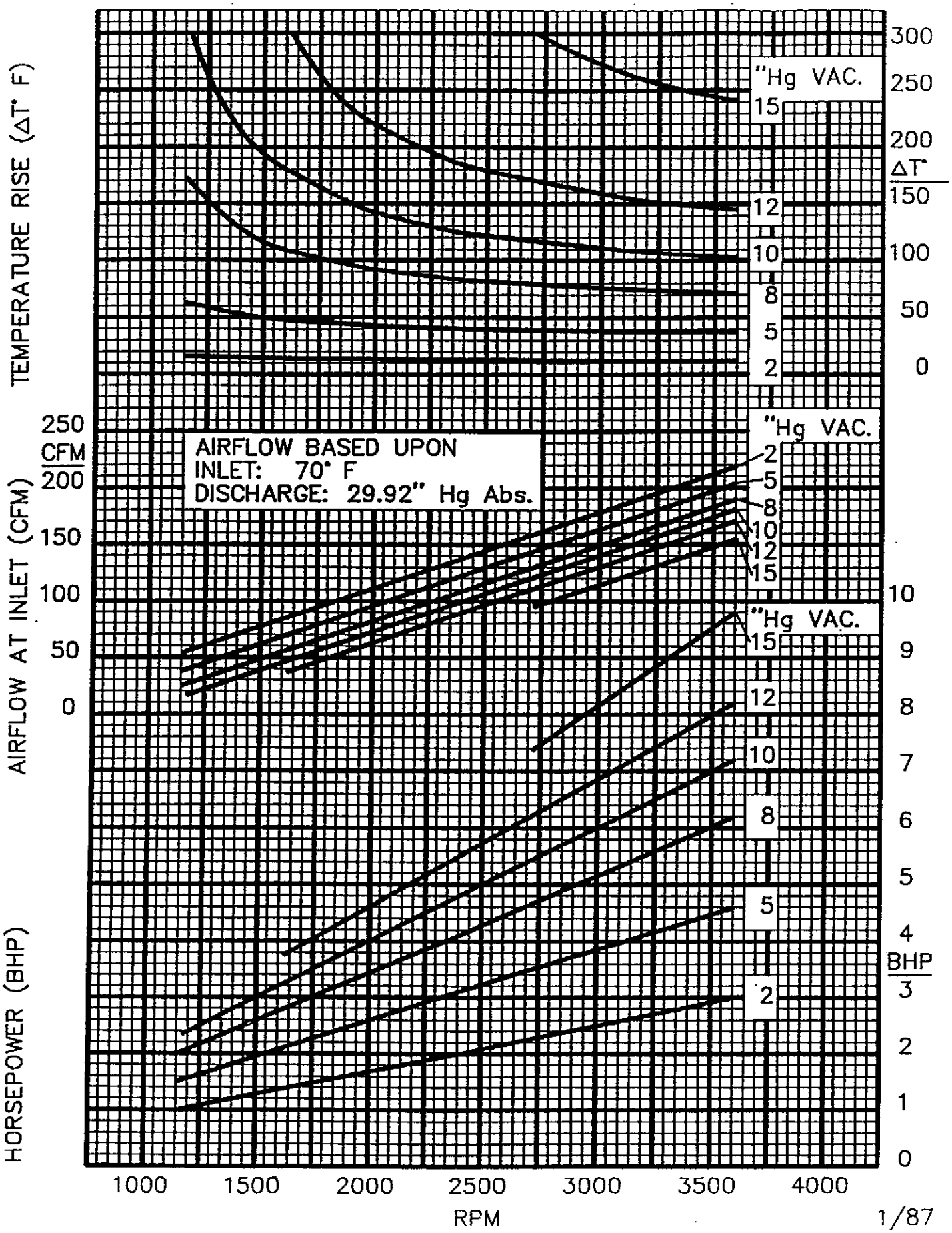
V BLOWER

C – 1322

M–D pneumatics inc.

3206 VACUUM SLIP CURVE

(NOTE: 16/47 SERIES LIMITED TO 10 IN HG) (.0675 CFR DISPL.)



1/87

WARRANTY AND LIMITATION OF LIABILITY

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, MD Pneumatics, Inc. (the Seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with Seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period, within one (1) year after date of shipment. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation.

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event, within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations, or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's F.O.B. point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original F.O.B. point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive fluids or those which may tend to build up material within the product quoted. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid, nor for problems resulting from build-up of material within the unit.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an officer of the Company is authorized to change this warranty in any way or grant any other warranty.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the following sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has accrued.

JANUARY 1, 1987

WHAT WAS YESTERDAY'S VOC (VOLATILE ORGANIC COMPOUNDS) POLLUTION, IS TODAY'S "BREATH OF FRESH AIR!"

KING BUCK HAS STEC H

MULTIMODE COMBUSTER

KING, BUCK / HASSTECH

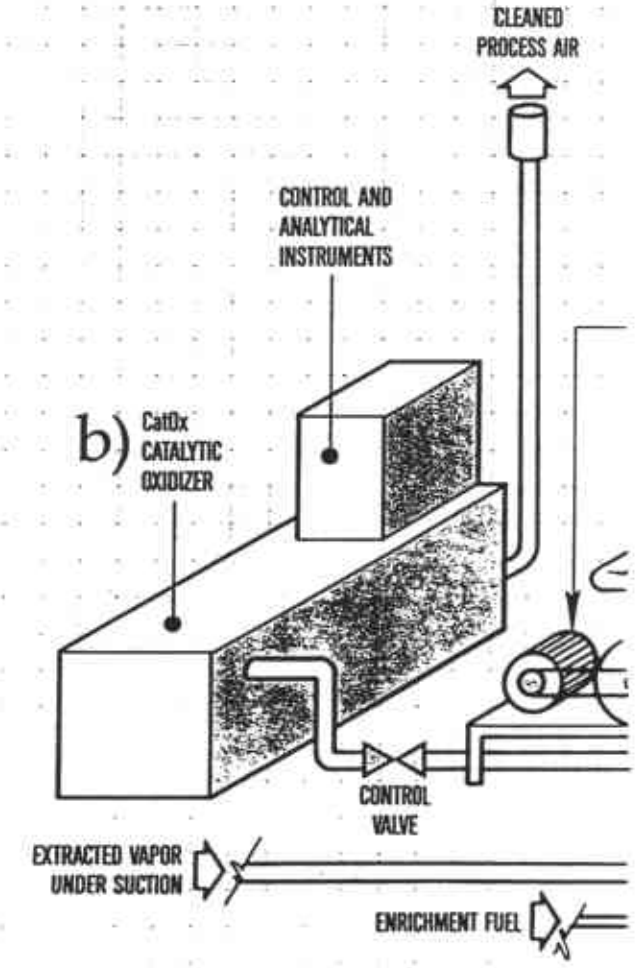
MULTIMODE™ COMBUSTER

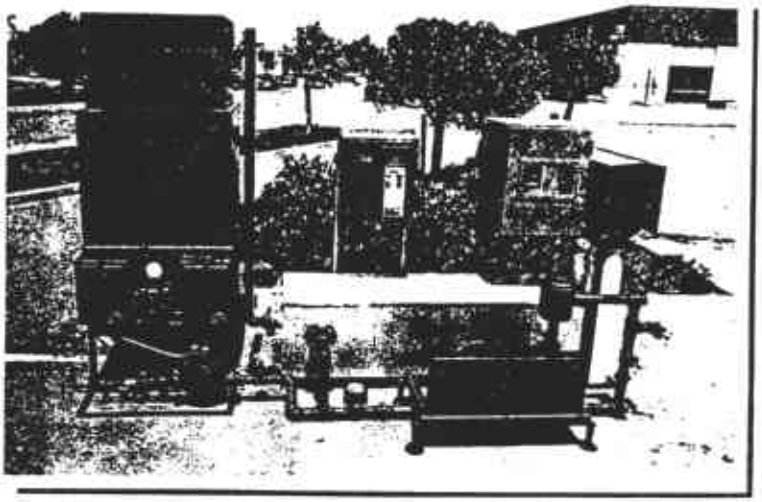
The MULTIMODE™ COMBUSTER (MMC) treats the vapors from the air venting of VOC-contaminated soils. It is effective with combustible vapor concentrations ranging from full saturation to near zero.

The MMC has a vacuum pump/compressor unit (VCU) that induces air flow through the contaminated soil and specially designed extraction wells into the suction port of the VCU. Then, depending on the concentration of combustibles in the fume gas, the compressor discharge is sent to either:

a) A thermal oxidizer (ThOx) in which the fume gas is burned above proprietary burner heads for an efficient, quiet flame. ThOx is a development from the commercially successful Hasstech burner used in automotive service station vapor recovery systems. Operating and safety features include a pilot flame and ultra-violet sensor for system shutdown in the event of a flame-out, and an in-line flame arrester between the VCU and the burners, or

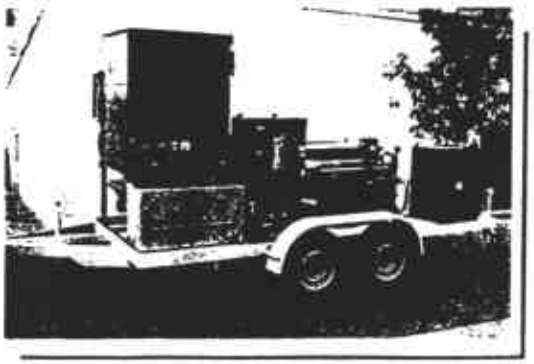
b) A catalytic oxidizer (the CatOx), in which oxidation of the fume gas is catalyzed by finely divided noble metals (e.g. platinum). The catalyst units of the CatOx are similar to those used in catalytic converters of the modern automobile. The CatOx has an effluent/influent heat exchanger and a temperature-controlled electric preheater for low operating costs and high oxidation efficiency.



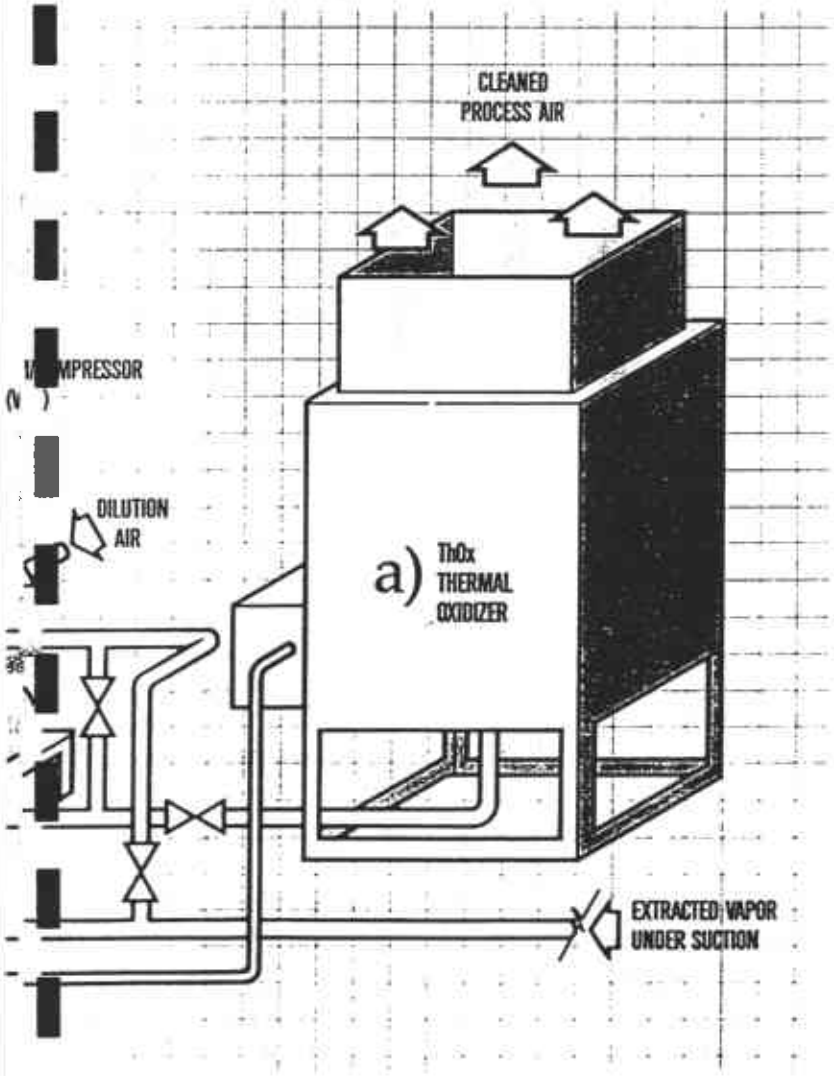


MMC-5
100 cfm capacity.

MMC-5 On customer's trailer.



MMC



The MULTIMODE COMBUSTER system gives controlled efficient operation with any concentration of gasoline in the extracted vapors, from saturation to essentially zero. The ThOx mode is used when the gasoline content of the fume gas is high with a resulting high heat of combustion; the CatOx mode is used when the gasoline content is lower and the heat of oxidation will not overheat the catalyst units. In addition, the MMC provides:

1 A dilution air valve for lowering the heat of combustion from rich vapors,

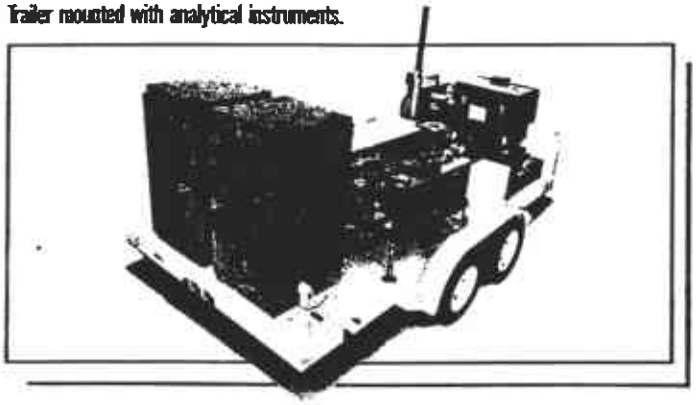
2 A pressure-compensating regulator for adding supplementary fuel to provide a more stable flame in the ThOx when the fume gas has marginal BTU content, and

3 A system for adding supplementary fuel to boost the preheat input to the CatOx.

As standard equipment, the MMC has controls and indicating instruments (e.g. pressure gauges) for efficient and safe operation. Available options are hydrocarbon analyzers, strip chart recorders, modems, and remote read-outs. The MMC can also manage industrial vapor exhaust outputs.

MMC-2

Trailer mounted with analytical instruments.



MMC-3

Clean-up of a pipeline leak at 1000 cfm.

☐ King, Buck/Hasstech provides the following services:

- **DESIGN/MANUFACTURING**
- **INSTALLATION**
- **OPERATIONAL TRAINING**
- **MAINTENANCE SUPPORT**
- **ON-GOING TECHNICAL ADVICE**
- **SELL/LEASE**

The MMC is a proprietary system (patent pending) engineered as a joint venture by the following firms:

King, Buck & Associates, Inc.
2384 San Diego Avenue
San Diego, CA 92110

Telephone: (619) 299-8431

Hasstech, Inc. PEI

[redacted]

CONTACT:

WESTERN GEOLOGIC RESOURCES INC.

2169 E. FRANCISCO BLVD., SUITE B / SAN RAFAEL
CALIFORNIA 94901 / FAX 415 457.8521
TELE 415.457.7595

17 July 1990

Mr. Robert Foss
Chevron USA
2410 Camino Ramon
San Ramon, California 94583

Re: Vadose Zone Characterization:
Vadose Well Installation and Vacuum Extraction Testing
Chevron Service Station #92582
7420 Dublin Boulevard
Dublin, California
WGR Job # 1-124.04

Dear Mr. Foss:

This letter report presents methodologies and data for vadose zone well installation and the soil vapor extraction test conducted at former Chevron service station #92582 located in Dublin, California. The scope of work included drilling three vadose zone monitoring wells, collecting soil samples during drilling, analysis of the soil samples, conducting a soil vapor extraction test and collecting air samples from the soil vapor air stream during the test. The air stream evacuated from the vadose zone contained hydrocarbons. Even though vadose zone vacuum monitoring wells responded minimally to the induced vacuum created by the test, these data suggest a permanent soil vapor extraction system could be designed and operated to produce a reduction in hydrocarbon concentrations in the soils.

BACKGROUND

Historical analytic results and water level measurements as presented in the following reports are available on Tables 1 and 2 respectively.

In February 1989, three underground storage tanks were removed under the supervision of Blaine Tech Services, Inc. (BTS) of San Jose, California. BTS collected soil and water samples from the excavated area confirming Total Petroleum Hydrocarbons (TPH) in the soil and low- to medium-boiling point hydrocarbons in the groundwater (EPA Methods 8015 and 8020). Based on the hydrocarbon concentrations in both the soil and water samples, Western Geologic Resources, Inc. (WGR) was contracted by Chevron to oversee further excavation and proper disposal of the excavated soil.

During March 1989, WGR supervised excavation and separation of approximately 180 cubic yards of pea gravel into Class I and Class II stockpiles. Approximately 2,846 gallons of water containing

petroleum hydrocarbons were pumped out of the excavated area. All material was properly disposed in appropriate landfills (Reference WGR report 12 April 1989).

Soil borings were collected and analyzed, confirming the existence of TPH on the north and south side of the most southern pump island (EPA Methods 8015 and 8020). In May 1989, additional excavation of approximately 100 cubic yards of material was conducted (Reference WGR report August 1989).

On 23 May 1989, representatives from WGR and Chevron met with Gil Wistar, Hazardous Materials Specialist with the Alameda County Health Agency, to discuss the implementation of a soil vapor extraction system in the vicinity of the pump islands, due to limited access in this area of the site. The installation of a soil-vapor system was approved, the excavation process was terminated, the 100 cubic yards of material properly disposed of and the excavated area backfilled with pea gravel in June of 1989. WGR staff coordinated the installation of underground piping for a future soil-vapor extraction system. The piping was installed near the pump islands and in the underground storage tank backfill.

On 2 August 1989, groundwater was sampled and analyzed. Although no detectable Total Purgeable Petroleum Hydrocarbons (TPPH), aromatic hydrocarbons or halocarbons were found in samples from groundwater monitoring wells EA-1, EA-2 and EA-3, samples taken from the 10-inch diameter PVC casing installed within the underground fuel tank backfill confirmed concentrations of 100,000 ppb TPPH, aromatic hydrocarbons and halocarbons (EPA Method 8260). This 10-inch casing was installed in the backfill to allow for safe drilling in the future (Reference WGR report 30 October 1989).

On 6 November 1989, a second set of groundwater samples again taken from EA-1, EA-2 and EA-3. TPPH, aromatic hydrocarbons and halocarbons were not detected in these samples (EPA Method 8015 and 8240). Groundwater samples were not collected from the 10-inch diameter PVC casing as it was not intended as a groundwater monitoring well (Reference WGR report 1 February 1990).

SOIL VAPOR EXTRACTION TEST

At Chevron's request WGR installed three vadose zone monitoring wells, VW-1, VW-2 and VW-3 (Figure 2). A soil vapor extraction test was performed using a previously installed, 3-inch diameter slotted pipe (extraction pipe) installed 6 feet below grade between the pump islands as the

extraction point (Figure 3). VW-1, VW-2, VW-3, EA-1 and the other previously installed 3-inch slotted pipe (stub-out 1) were used as vacuum monitoring points. Soil sample results from the three wells and soil vapor extraction test results are presented below.

FIELD PROCEDURES: VADOSE ZONE WELL INSTALLATION

WGR's standard well installation procedure is included as Attachment 1. A staff geologist as well as the project engineer were on-site during drilling. Appendix A presents the boring logs and Figure 4 presents a standard vadose zone well installation. The two inch diameter wells were bored to 9 feet below grade and slotted from 3 feet to 9 feet below grade. Installation was initiated and completed on 1 May 1990.

SOIL VAPOR EXTRACTION TEST

The soil vapor extraction test was conducted on 22 May through 25 May 1990. The test equipment consisted of 2-inch diameter piping running from the previously installed 3-inch diameter slotted pipe (extraction pipe) to a water-dropout. A fresh air bleed valve was installed to allow for fine tuning the vacuum and flowrate at the extraction pipe. The air, pulled through the extraction pipe and bleed valve, was then filter through two 200-pound activated carbon vessels arranged in series. A regenerative blower capable of drawing a maximum vacuum of 59 inches of water and a maximum air flowrate of 127 standard cubic feet per minute (SCFM) was placed after the carbon vessels and exhausted through an eight-foot stack to the atmosphere. Various pressure/vacuum gauges, velocity ports and sampling ports were placed throughout the system for data collection (Figure 5).

All vadose zone monitoring wells were sealed from the atmosphere during the test. Ports to allow for vacuum monitoring were installed.

The system was installed and started at 16:14 on 22 May 1990. Data was collected according to the procedure outlined in Attachment 2.

The test was completed at 11:10, 25 May 1990.

DATA

Soil samples collected during boring of VW-1, VW-2 and VW-3 had total petroleum hydrocarbon/gasoline (TPH-G) levels of 96, 33 and 74 parts per million (ppm) respectively at 8 feet below grade. These levels represent the maximum for these wells. Benzene, toluene, ethyl-benzene and total xylenes (BTEX) were also reported. All BTEX compounds were below 10 ppm.

The velocity measured at the various ports were used to calculate volumetric flow rates. The vacuum gauges on the test skid were used to check for pressure drop through the system. The velocity, vacuum readings and volumetric flow rates are presented in Table 3. A total of approximately 206,150 cubic feet of air was evacuated from the vadose zone during the duration of the test. Vacuum data collected from the vadose zone monitoring wells is included in Table 4. Maximum vacuums were reported as follows: vadose monitoring well, VW-1, measured a vacuum of 0.2 inches of water; vadose monitoring well, VW-2, measured a vacuum of 1.09 inches of water; vadose zone monitoring well, VW-3, measured a vacuum of 0.15 inches of water; groundwater monitoring well, EA-1, had a vacuum of 1.53 inches of water; and, stub-out pipe 1, showed a vacuum of 0.32 inches of water (Figure 6).

Air samples collected during the soil vapor extraction test also contained TPH-G and BTEX and are described in greater detail in the following section.

RESULTS

Due to the low permeability to air of clayey soils surrounding the previously installed piping and pea gravel backfill, as well as the unique layout of the extraction piping system, an accurate radius of influence calculation could not be made. The permeability to air of the surrounding clay soils was estimated to be less than 0.01 Darcy (Reference, "A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil-Venting Systems, P.C. Johnson, et all, Groundwater Monitoring Review, Spring 1990).

Air samples for TPH-G had a maximum concentration of 7,900 at the beginning of the test and decreased to a minimum of 1,600 ppm at 2,049 minutes into the test. The concentration of benzene in air samples had a maximum concentration of 26,000 parts per billion (ppb) at the beginning of the test and a minimum concentration of 5,300 ppb at 2,049 minutes into the test. Toluene concentrations ranged from a maximum of 12,000 ppb at 2,049 minutes into the test and decreased to a minimum of 6,200 ppb at the completion of the test. Ethyl-benzene levels varied from a

maximum of 1,600 ppb at 1,389 minutes into the test and had a minimum of 690 recorded at 3,095 minutes into the test. Total xylenes had a maximum concentration of 13,000 ppb at 3,389 minutes into the test and a minimum of 4,600 ppb at 2,049 minutes into the test (See Figure 7).

COMMENTS AND CONCLUSIONS

The area tested was previously backfilled with high permeability pea gravel that created channeling of air during the test as demonstrated by the high flow rates and low vacuum readings at the extraction point (Figure 8). This affected the flow of air from the surrounding soils as demonstrated by the low vacuum readings recorded at the vadose zone monitoring wells.

Air samples collected suggest that removal of hydrocarbons from the low permeability soils is feasible. However, the process would be slow since the test data also suggest that extraction of the compounds is carried out by diffusion. This is demonstrated by the relatively flat curves for BTEX compounds and the increase of TPH concentration in the middle of the curve generated from the air sample concentrations versus time.

An accurate estimate of operating time for a permanent soil vapor extraction system can not calculated at this time. However, a permanent system could be designed and time-lines generated as additional data are collected during system operation.

Western Geologic Resources is please to provide geologic and environmental services to Chevron and hope this report meets your needs. If you have any questions or comments, please contact us at (415) 457-7595.

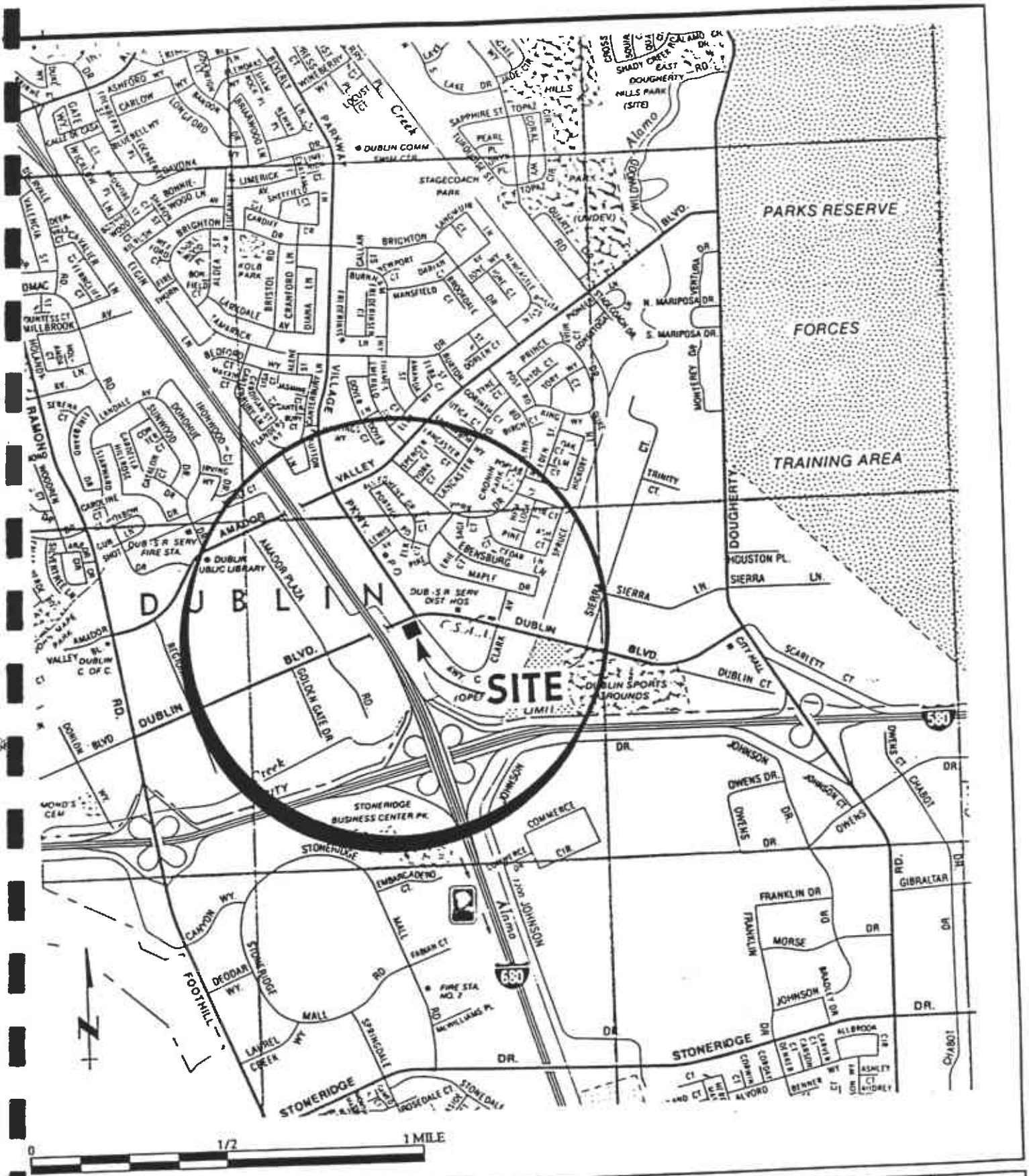
Sincerely,
Western Geologic Resources, Inc.

Eric D. Stevenson
Senior Staff Engineer

J. Mark Inglis
Principal Hydrogeologist

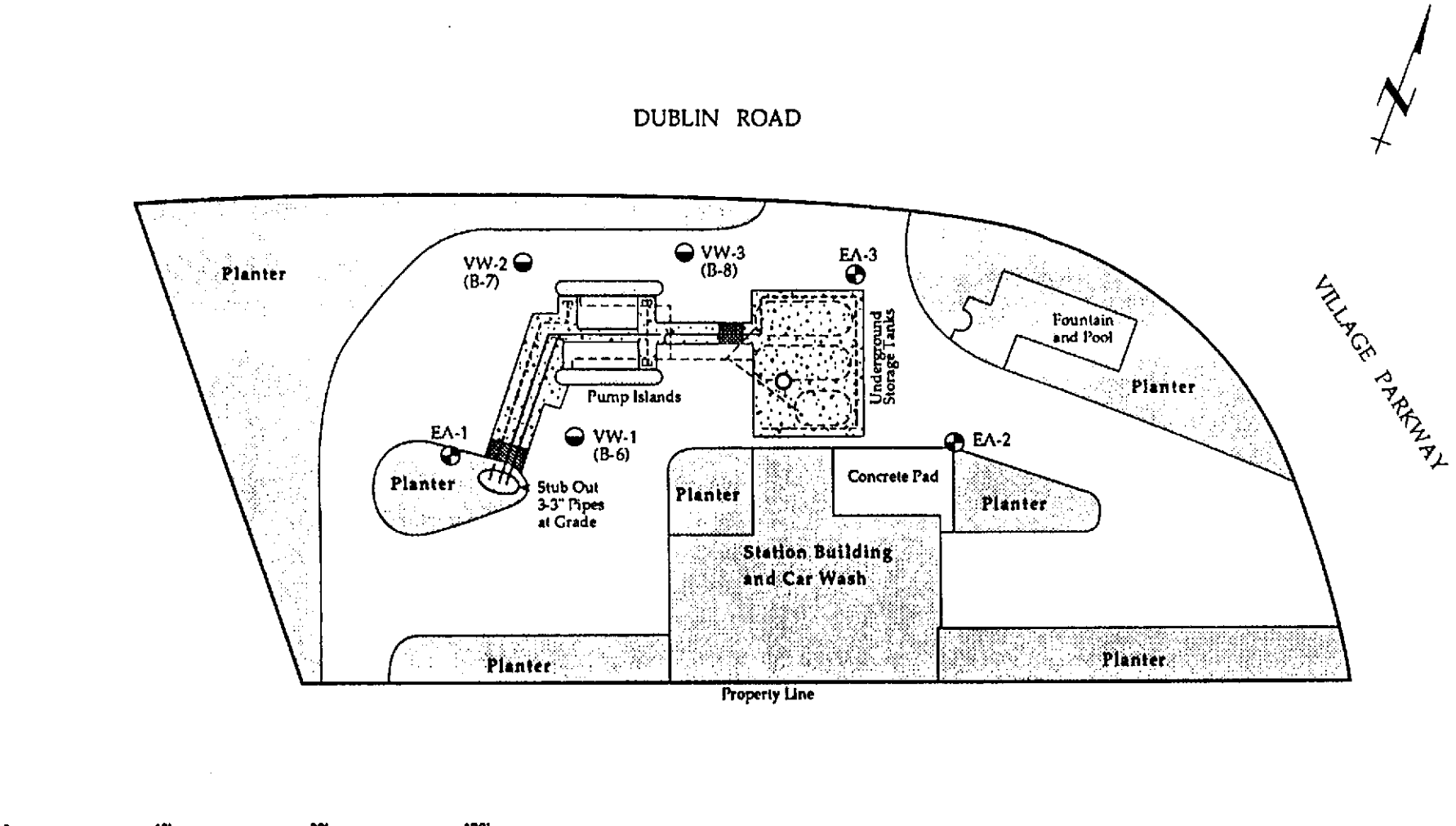
124R1JL0.va

FIGURES



Site Location Map
Former Chevron Service Station #92582
Dublin, California

FIGURE
1



LEGEND

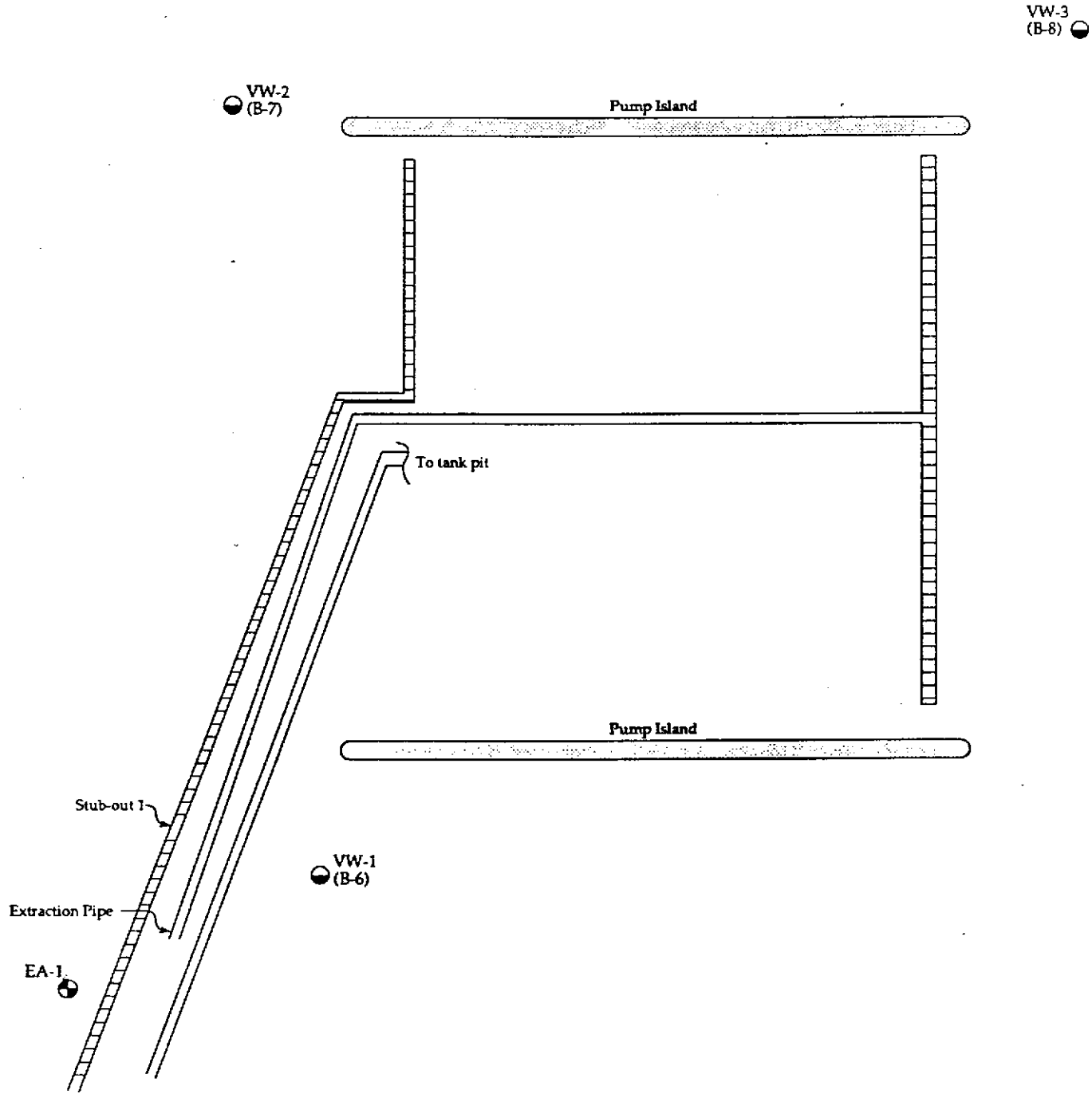
EA-1	Groundwater Monitor Well		Pea-Gravel Backfill
O	10" Diameter PVC Casing		Bentonite Grout
VW-1	Vadose Monitor Well		
-------	Perforated 3" Pipe, buried		
———	Non-Perforated 3" Pipe, buried		

Site Map with Vadose Monitor Well Locations
Former Chevron Service Station #92582
Dublin, California

FIGURE
2

WESTERN GEOLOGIC RESOURCES, INC.

1-124.04



7/90

NOT TO SCALE

LEGEND

VW-2 Vadose Well Locations

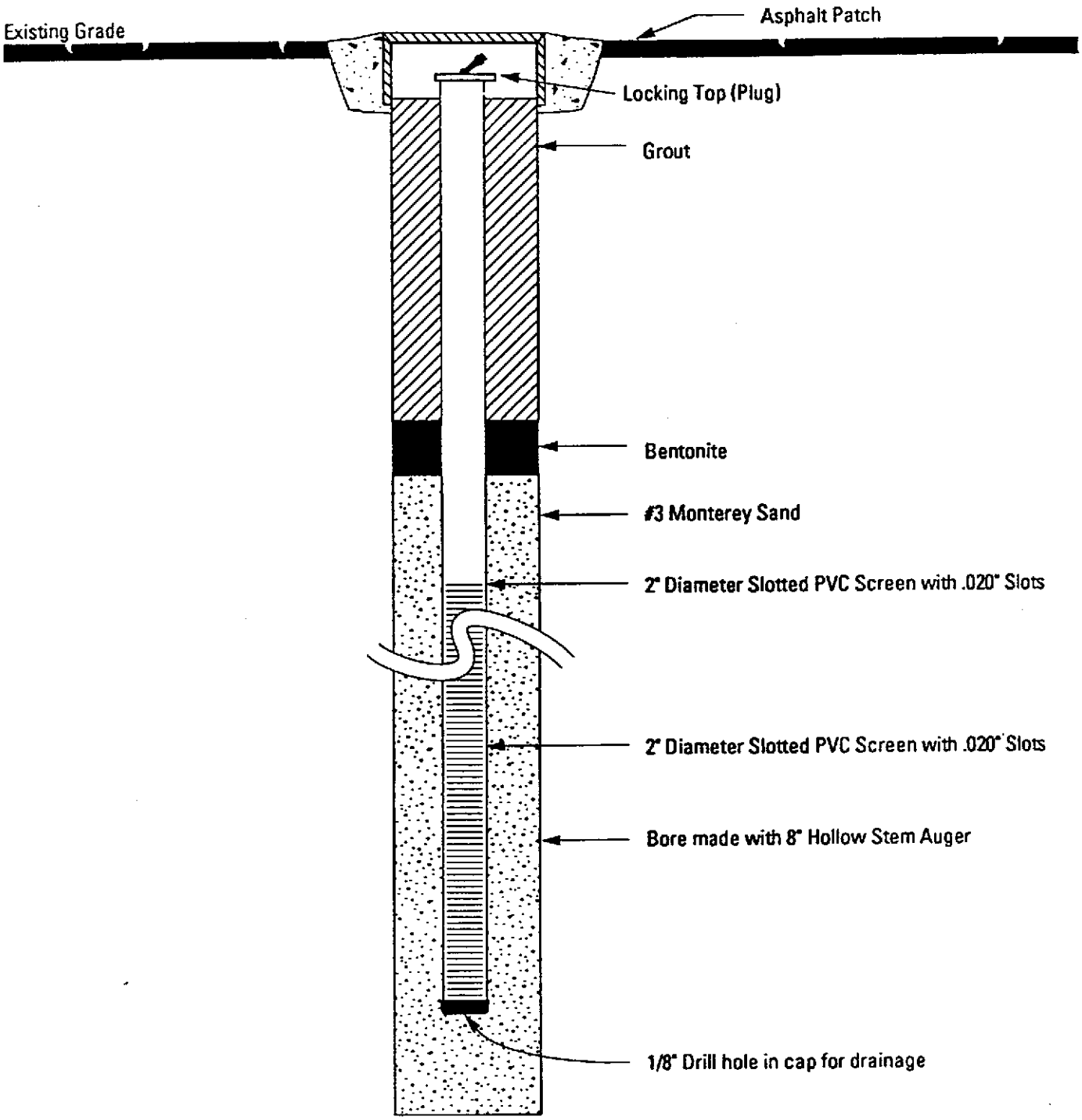
EA-1 Monitor Well Locations

Three Inch Diameter Vapor Extraction Piping Layout
Former Chevron Service Station #92582
Dublin, California

FIGURE
3

WESTERN GEOLOGIC RESOURCES, INC.

1-124.04



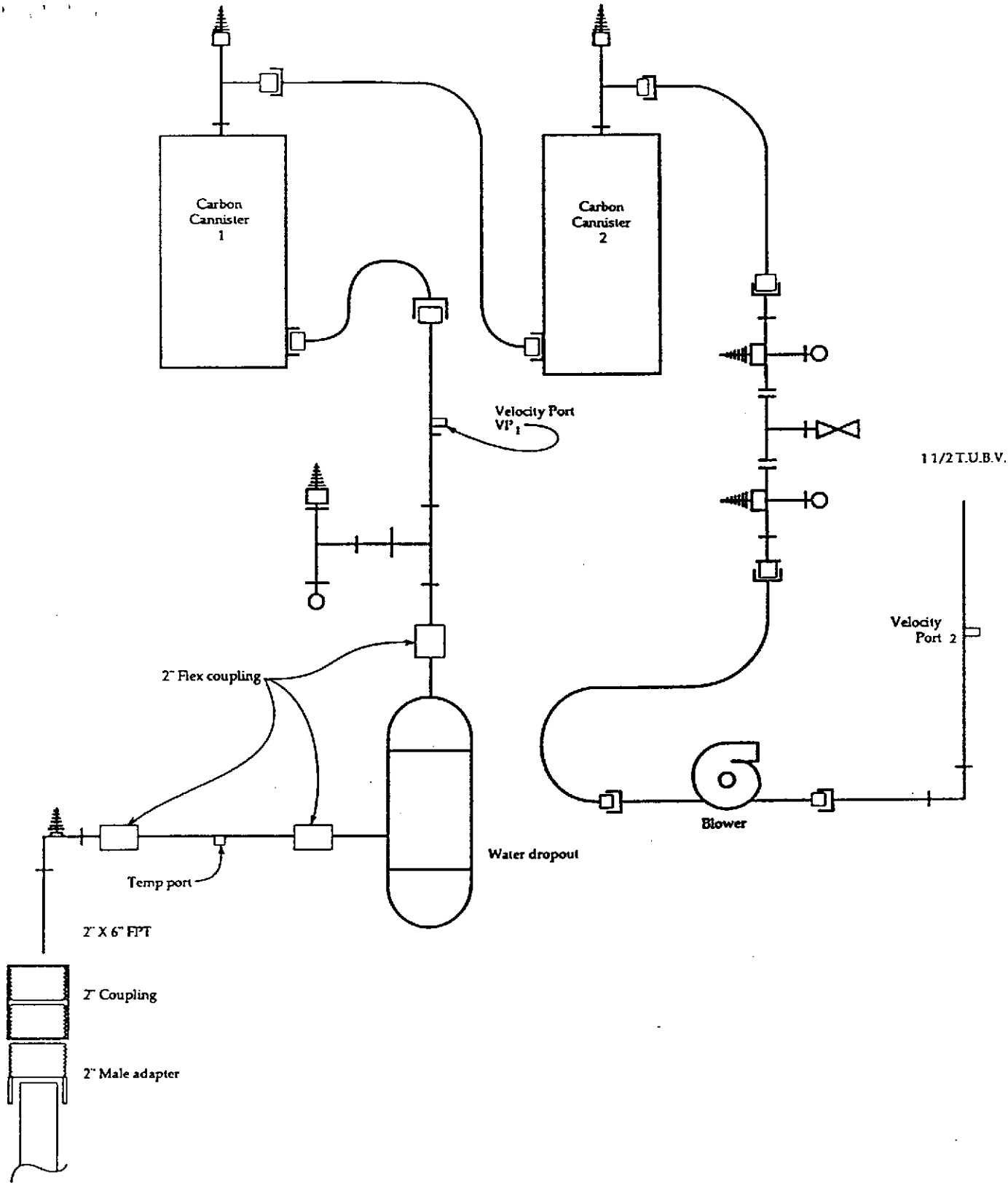
NOT TO SCALE

Typical Vent Well Construction Details

FIGURE 4

WESTERN GEOLOGIC RESOURCES, INC.

1-124.04



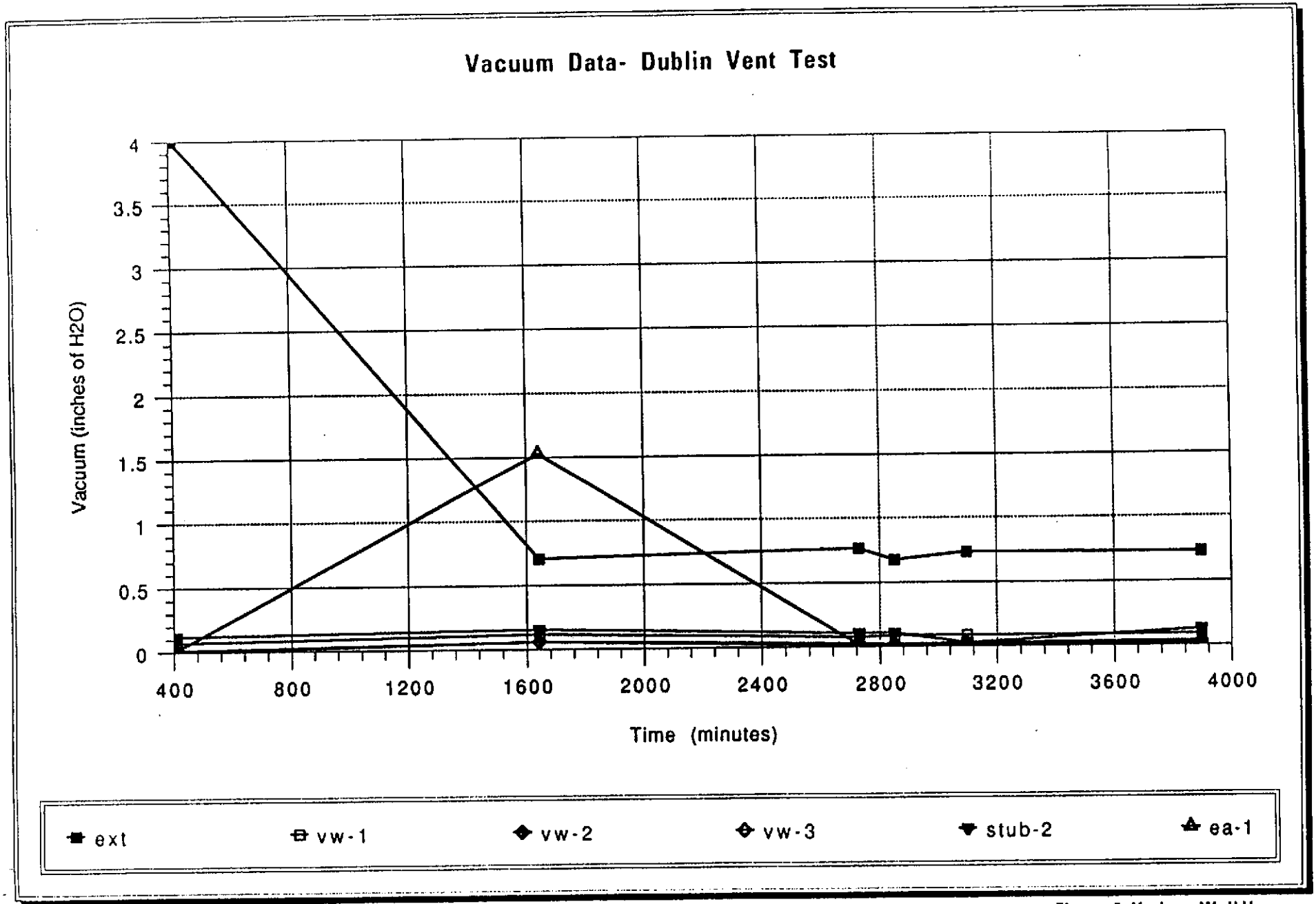
LEGEND

- Manometer/Sample Quick Disconnect
- Vacuum Gauges
- Fresh Air Bleed Valve

Vapor Extraction System
Former Chevron Service Station #92582
Dublin, California

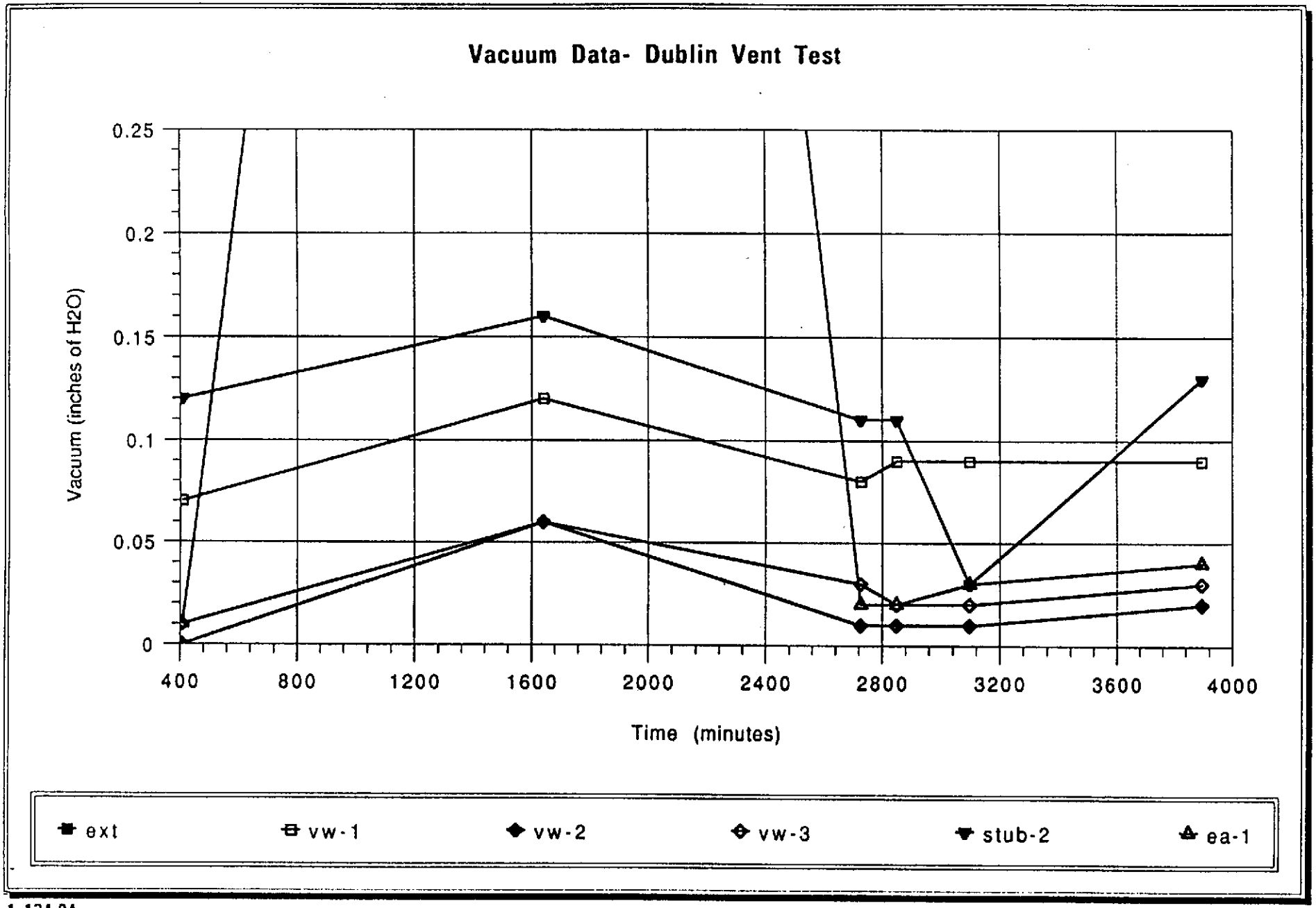
FIGURE 5

WESTERN GEOLOGIC RESOURCES, INC. 1-124.04



1-124.04

Figure 6: Vadose Well Vacuum



1-124.04

Figure 6: Vadose Well Vacuum (Expanded View)

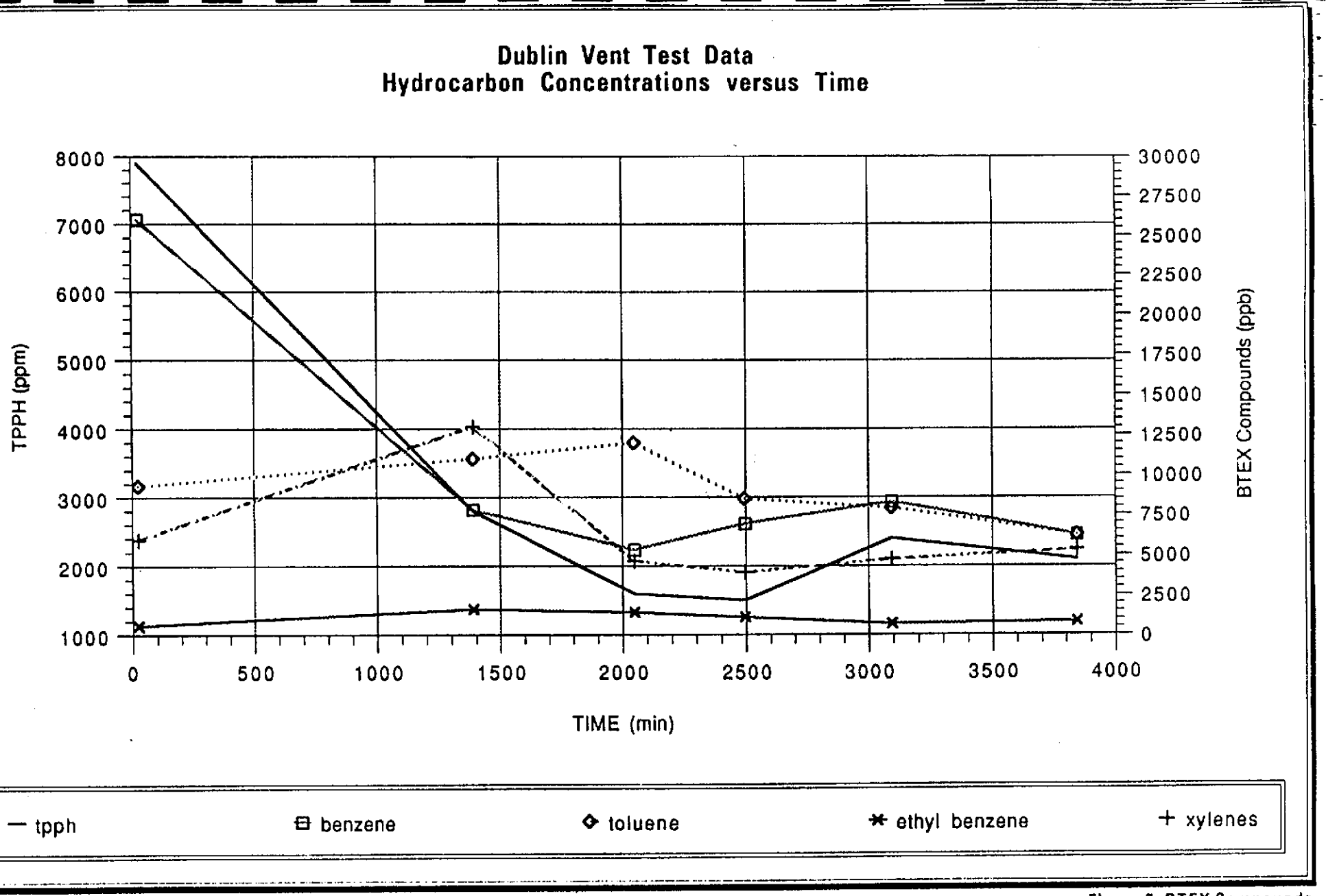


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Figure 7: BTEX Compounds

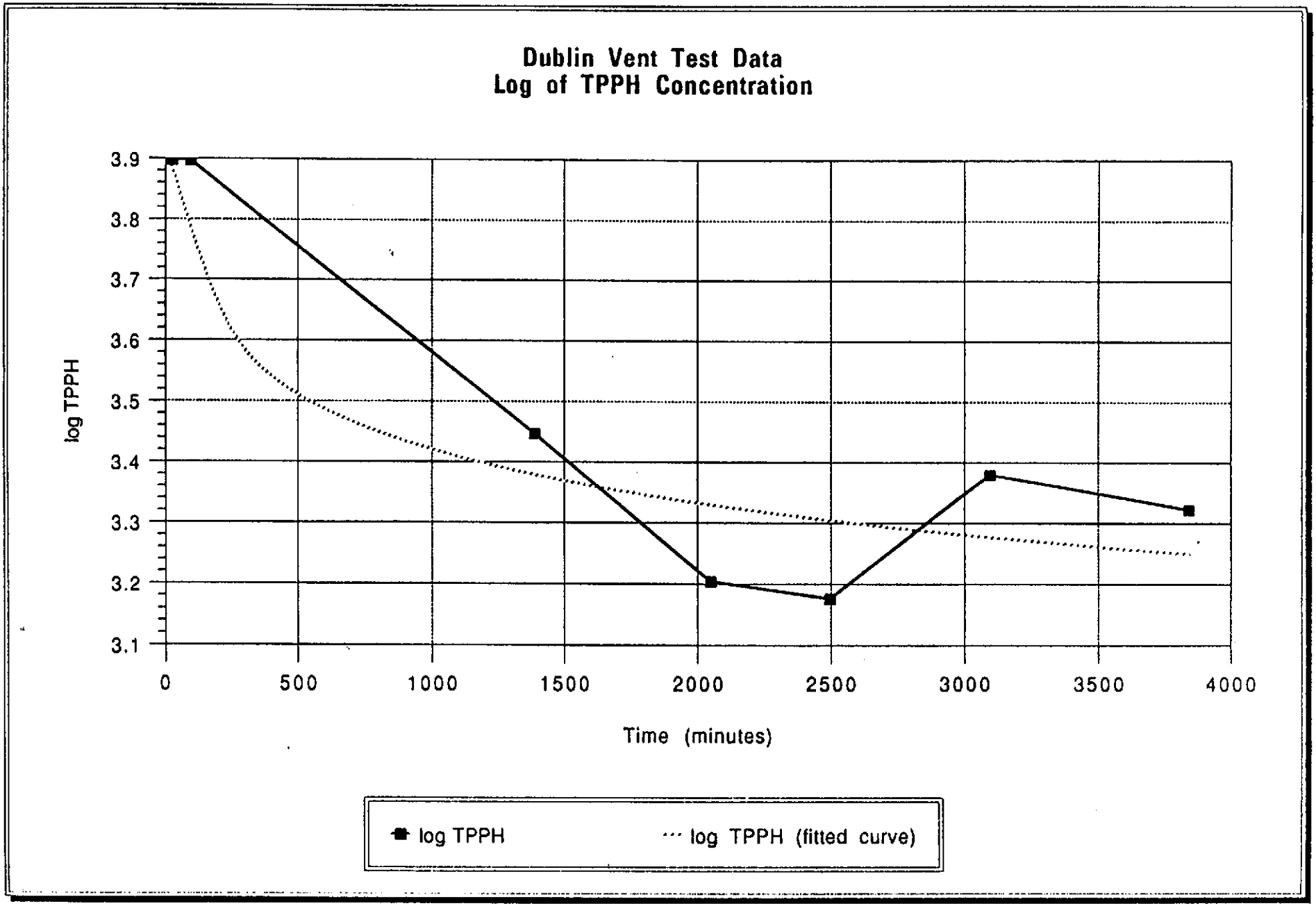

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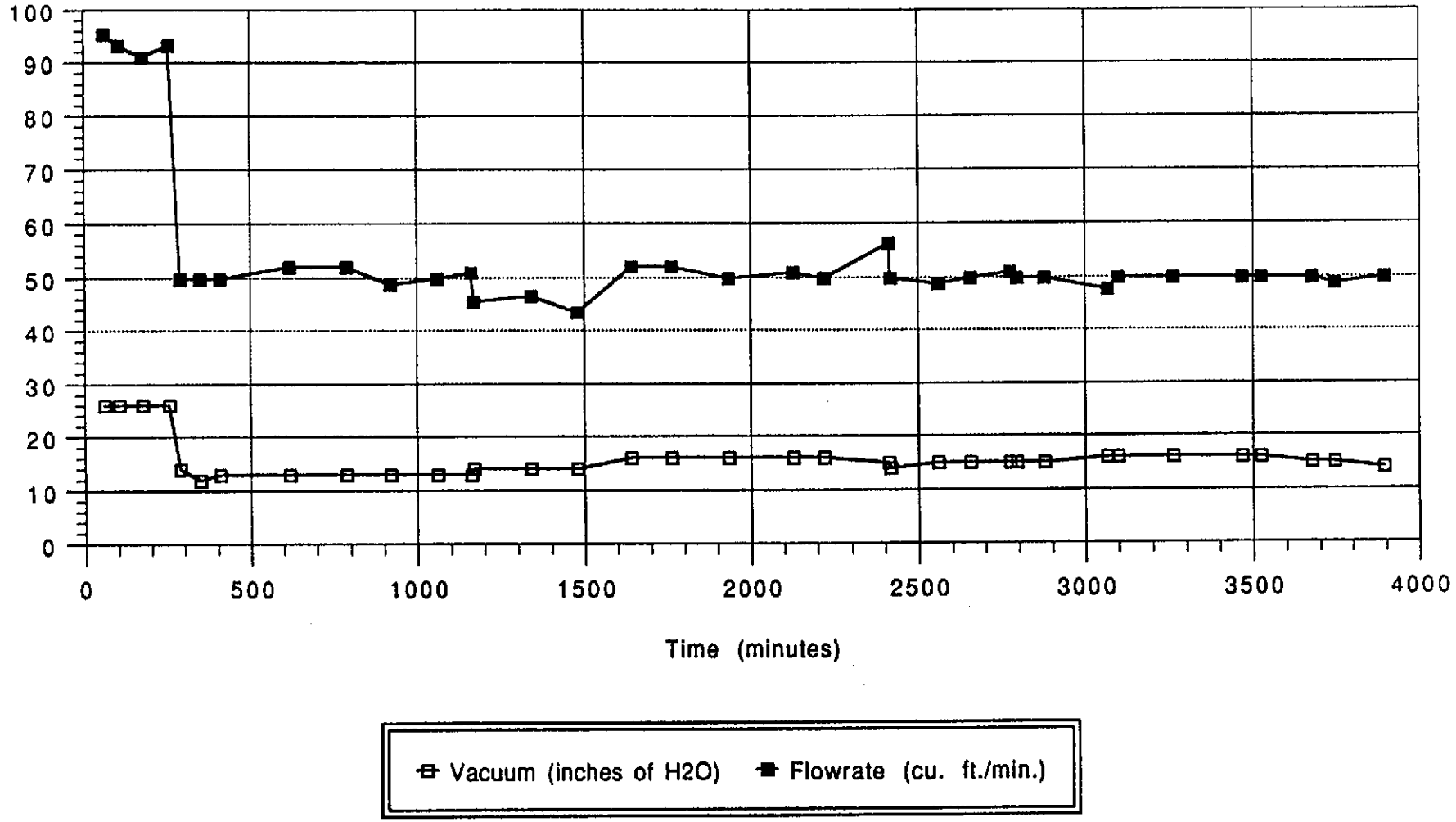
Figure 7: TPPH Log

Vent Test Vacuum and Flowrate
Chevron Service Staion #92582
Dublin, California



1-124.04

Figure8: Vent Test Vacuum and Flowrate

TABLES

TABLE 1. Analytic Results: Groundwater Samples
Chevron Station #92582
Dublin, California

Well ID #	Date	Lab	EPA Method	TPPH	FC	Benzene	Toluene	E-Benz	Xylenes	EDC
				<----------		ppb				---------->
EA-1	17 Oct 88*	NA	NA	<50.0	---	<0.5	<0.5	<0.5	<0.5	---
EA-1	20 Dec 88*	PL	8015/8020	<50.0	---	<0.5	<0.5	<0.5	<0.5	---
EA-1	28 Mar 89*	PL	8015/8020	<250	---	<0.5	<0.5	<0.5	<0.5	---
EA-1	2 Aug 89	CCAS	8260	<50.0	---	<0.1	<0.1	<0.1	<0.1	<0.1
EA-2	17 Oct 88*	NA	NA	<50.0	---	<0.5	<0.5	<0.5	1.2	---
EA-2	20 Dec 88*	PL	8015/8020	<50.0	---	<0.5	<0.5	<0.5	<0.5	---
EA-2	28 Mar 89*	PL	8015/8020	<250	---	<2.0	<0.5	<0.5	<0.5	---
EA-2	2 Aug 89	CCAS	8260	<50.0	---	<0.1	<0.1	<0.1	<0.1	<0.1
EA-3	17 Oct 88*	NA	NA	<50.0	---	1.8	<0.5	<0.5	3.0	---
EA-3	20 Dec 88*	PL	8015/8020	240	Gas	90.0	1.2	13.0	3.3	---
EA-3	28 Mar 89*	PL	8015/8020	2300	Gas	380.0	130.0	240.0	910.0	---
EA-3	2 Aug 89	CCAS	8260	<50.0	---	<0.1	<0.1	<0.1	<0.1	<0.1
10" PVC CASING	2 Aug 89	CCAS	8260	180,000	Gas	8,700	14,000	1,700	17,000	50
10" PVC CASING Duplicate	2 Aug 89	CCAS	8260	140,000	Gas	9,200	14,000	1,800	13,000	50
EB	28 Mar 89*	PL	8015/8020	<250.0	---	<0.5	<0.5	<0.5	<0.5	---
TB	28 Jul 89	CCAS	8260	<50.0	---	<0.1	<0.1	<0.1	<0.1	<0.1

NOTES:

- TPPH = Total Purgeable Petroleum Hydrocarbons
- FC = Fuel Characteristics
- E-Benz = Ethylbenzene
- EDC = 1,2-Dichloroethane
- ppb = Parts-Per-Billion
- * = Sample collected by EA Engineering, Science and Technology, Inc.
- PL = Pace Laboratories, Inc.
- CCAS = Central Coast Analytical Services, Inc.
- EB = Equipment Blank
- TB = Travel Blank
- Gas = Gasoline
- < = Less than indicated detection limit
- NA = Not Available
- --- = Not Analyzed/Not Applicable

TABLE 2. Liquid Level Measurements
Chevron Station #92582
Dublin, California

Well ID #	Date	DTLH	DTW	LHT	TOC*	Elev-LH	Elev-W
			<----------ft---------->				
EA-1	24 Oct 88*	---	10.64	---	333.41	---	322.77
EA-1	2 Nov 88*	---	10.69	---	333.41	---	322.72
EA-1	20 Dec 88*	---	10.51	---	333.41	---	322.90
EA-1	28 Mar 89*	---	9.87	---	333.41	---	323.54
EA-1	2 Aug 89	---	10.34	---	333.41	---	323.07
EA-2	24 Oct 88*	---	9.70	---	332.59	---	322.89
EA-2	2 Nov 88*	---	10.03	---	332.59	---	322.56
EA-2	20 Dec 88*	---	9.98	---	332.59	---	322.61
EA-2	28 Mar 89*	---	8.80	---	332.59	---	323.79
EA-2	2 Aug 89	---	9.44	---	332.59	---	323.15
EA-3	24 Oct 88*	---	11.03	---	333.64	---	322.61
EA-3	2 Nov 88*	---	11.03	---	333.64	---	322.61
EA-3	20 Dec 88*	---	10.96	---	333.64	---	322.68
EA-3	28 Mar 89*	---	9.77	---	333.64	---	322.87
EA-3	2 Aug 89	---	10.65	---	333.64	---	322.99
10" PVC CASING	2 Aug 89	---	9.83	---	NA	---	---

NOTES:

* = Data obtained by EA Engineering, Science, and Technology, Inc.
DTLH = Depth-to-Liquid Hydrocarbon
DTW = Depth-to-Water
TOC = Top-of-Casing Elevation
Elev-LH = Elevation of Liquid Hydrocarbons
Elev-W = Elevation of Water
NA = Not Available
--- = Not Measured

TABLE 3.

Time (minutes)	Velocity At Well Head (ft/min)	Flowrate From Vadose (cu. ft/min)	Cumulative Flow From Well (cu. ft)	Velocity At Stack (ft/min)	Flowrate At Stack (cu. ft/min)	Cumulative Flow Through Carbon (cu. ft.)
59	4400	95	5627	4400	95	5627
104	4300	93	9821	4300	93	9821
174	4200	91	16194	4200	91	16194
255	4300	93	23745	4300	93	23745
289	2300	49	25440	4400	95	26987
349	2300	49	28431	4500	97	32840
409	2300	49	31423	4600	99	38823
619	2400	52	42348	4500	97	59308
789	2400	52	51192	4500	97	75891
920	2250	48	57581	4600	99	88953
1060	2300	49	64561	4600	99	102913
1162	2350	50	69757	4700	101	113305
1169	2100	45	70076	4700	101	114019
1340	2150	46	78046	4700	101	131440
1479	2000	43	84072	4800	104	145903
1642	2400	52	92552	4900	106	163217
1762	2400	52	98795	4900	106	175963
1934	2300	49	107370	4700	101	193487
2129	2350	50	117304	4700	101	213354
2220	2300	49	121841	4750	102	222724
2413	2600	56	132718	4800	104	242805
2418	2300	49	132968	4800	104	243325
2559	2250	48	139845	4900	106	258302
2656	2300	49	144681	4700	101	268185
2776	2350	50	150794	4700	101	280410
2796	2300	49	151791	4800	104	282491
2879	2300	49	155929	4800	104	291128
3069	2200	47	164990	4800	104	310897
3099	2300	49	166486	4900	106	314084
3262	2300	49	174612	4800	104	331044
3467	2300	49	184833	4800	104	352374
3525	2300	49	187725	4800	104	358409
3678	2300	49	195353	5200	112	375655
3746	2250	48	198670	4800	104	382730
3896	2300	49	206148	5200	112	399638

TABLE 4. Vacuum Data

Time (minutes)	Extraction Well	VW-1	VW-2	VW-3	STUB-1	EA-1
	<----------Vacuum Inches of Water---------->					
409	4:00	0.07	0.00	0.01	0.12	0.01
1642	0.71	0.12	0.06	0.06	0.16	1.53
2729	0.77	0.08	0.01	0.03	0.11	0.02
2850	0.68	0.09	0.01	0.02	0.11	0.02
3099	0.74	0.09	0.01	0.02	0.03	0.03
3896	0.73	0.09	0.02	0.03	0.13	0.04

ATTACHMENTS

STANDARD OPERATING PROCEDURES
RE: ROTARY DRILLING MONITORING WELL INSTALLATION AND DEVELOPMENT
SOP-7

Stratigraphic test holes for monitoring wells may be drilled using truck-mounted drill rigs capable of: air and/or mud-rotary drilling, and continuous wire-line coring and/or drilling with tri-cone roller or fixed-blade drag bits. Generally, rotary drilling is used when conventional auger drilling is initially not possible or becomes no longer possible. Various drilling fluids (muds or air), are used to keep the hole from caving and to remove cuttings. These are chosen according to the formations expected to be encountered and the nature of the monitoring program. Samples may be collected directly from cores. A geologist from Western Geologic Resources continuously logs each test hole during drilling, and constantly checks drilling returns for odors. All drilling equipment is steam cleaned between test holes to prevent cross-contamination.

Frequently, hollow-stem augers are used to drill and sample to a minimum depth, or to auger refusal. The augers can be left in place as temporary surface casing. The center plug is then removed and coring is carried out through the augers. Alternatively, a shallow conductor casing or surface casing may be set by drilling to a desired depth with a large diameter bit, setting the casing, and proceeding with the coring. After total depth is reached, the test hole may be geophysically logged and/or hydraulically tested. If the casing is not to be set at the bottom of the hole, the lower portion of the hole may be grouted or backfilled according to well installation guidelines. Next, the test hole is drilled-out (reamed) after removal of the hollow-stem augers or conductor casing, if necessary, with a bit that is a minimum of 4 inches larger than the outside diameter of the well casing.

Upon reaching total depth for the reamed portion of the hole, the drilling fluid is circulated to remove cuttings and thinned as necessary. The selected casing is then placed down the hole. Monitoring wells are cased with threaded, factory-perforated and blank casing. No solvents or cements are used to assemble the casing. Centering devices may be affixed to the casing if there is concern that an even distribution of filter material and grout within the borehole annulus will not be attained. The well casing is thoroughly washed and steam-cleaned prior to installation. All recoverable drilling fluids and cuttings are collected for temporary storage and then are disposed of properly depending on analytic results.

After setting the casing, sand or gravel filter material is poured or tremied in to fill the annular space from the bottom of the hole to the top of the perforated interval. A 1- to 2-foot thick bentonite plug is placed above this filter material to prevent grout from infiltrating down into the filter material. Neat cement, containing about 5% bentonite, is then tremied into the annular space from the top of the bentonite plug to the surface. A lockable, water-tight cap is placed on each wellhead. Traffic-rated Christy boxes are installed around the wellhead for wells in parking lots and driveways while steel stove pipes are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing any fine material in the filter pack that can pass from the formation into the well. Well development techniques used include pumping, bailing, surging, swabbing, jetting, flushing, and airlifting. All development water is collected for temporary storage in 55-gallon drums, and is then properly disposed of depending on analytic results. To

assure that cross-contamination does not occur between wells during drilling and development, all development equipment is steam-cleaned prior to introduction into a new well.

ATTACHMENT 2

The soil vacuum extraction test will be conducted according to the following procedures:

1. Mobilize.
2. Secure power.
3. Place and check all equipment.
4. Start blower.
5. Read pressure gauges and air velocity on test skid and record readings, confirm proper operation every 15 to 30 minutes and record any deviations;

    a. Read pressure gauges on vadose wells continuously until vacuum is noted. Once a pressure drop occurs, readings will be recorded every 15 minutes.

6. Collect air samples every hour for two hours after blower begins operation and every five hours thereafter. Air samples will be collected in three liter Tedlar bags. Two bags will be filled at each sampling to accommodate laboratory sample volume requirements.

    a. Screen every sample with the FID or PID if needed and record results.
    b. Samples taken at the beginning, end and one third and two third points will be analyzed for TPH and BTEX.
    c. Samples not sent for analysis will be flushed with nitrogen and the bags reused.

7. Take FID readings of exhaust every 15 minutes and record results. Should levels exceed 5 ppm for more than 5 minutes, check levels with PID. If PID does not produce a reading, assume the gas producing the FID readings is methane. If PID reads higher than 5 ppm for more than 5 minutes contact project engineer or his designee.

8. When pressure readings at the furthest vadose well stabilize for two hours, pressure readings vary by 1% of less on all wells or after 72 hours, whichever happens first, shut blower down.

9. When the blower is shut down, vacuum pressure will be measured for two hours or until wells have recovered to 50% of atmospheric pressure.

10. Demobilize and police area.

Any deviations from the plan should be documented accordingly and should be approved verbally by the senior engineer, field operations manager or their designee.

ANALYSIS

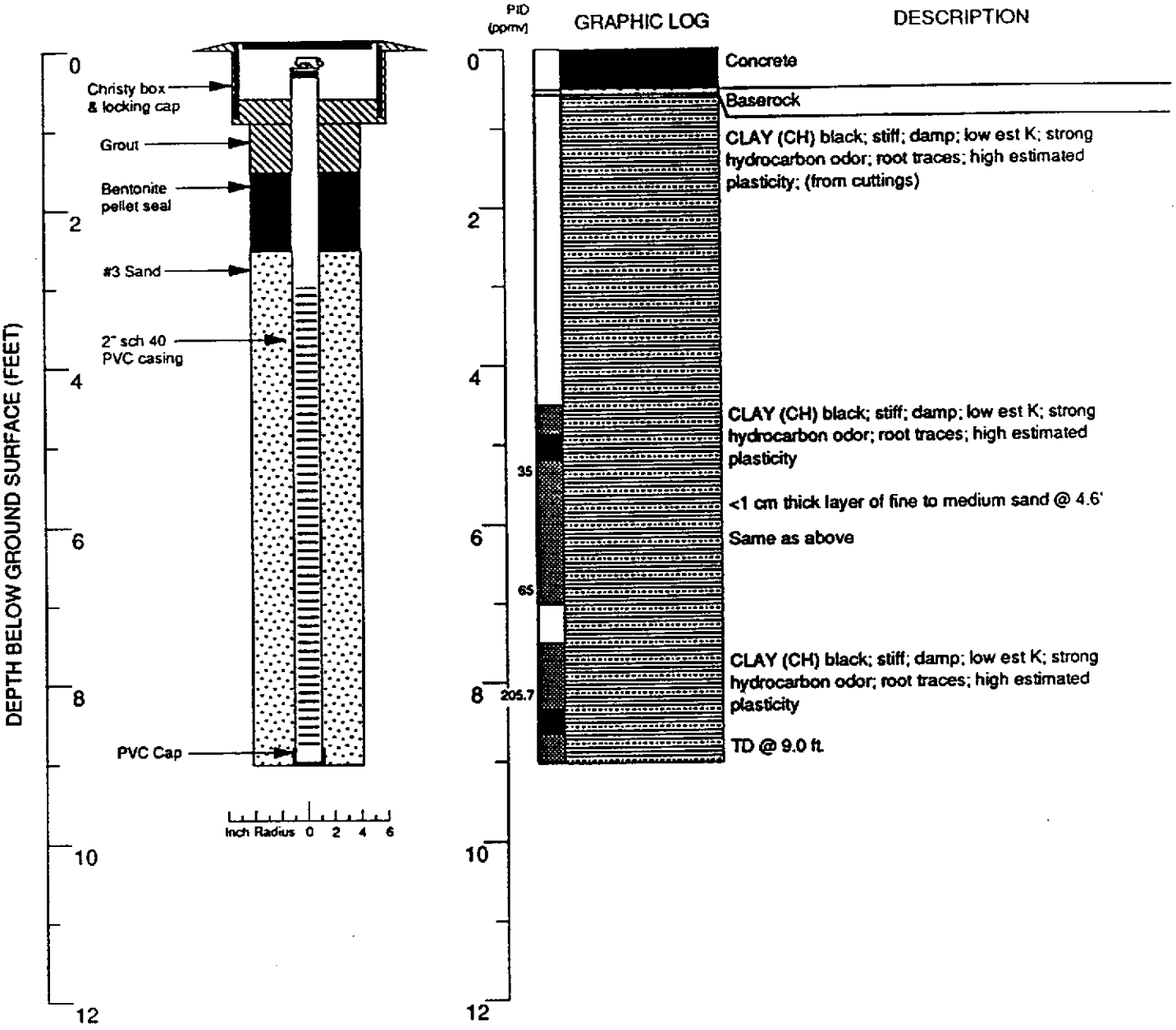
The data obtained from the vapor extraction test will be analyzed by several methods to determine the soil characteristics and their potential impact on the extraction and treatment system design. Some of the methods being considered for data analysis include:

- Time-vacuum analysis
- Distance-vacuum analysis
- Time-recovery analysis

Other methods of analysis may be employed if it is established that they are appropriate for the conditions of the test.

Chemical analysis of selected air samples collected during the test will be performed. The test will be broken into four equal sampling intervals. The sample taken at the beginning of the first interval and the last sample taken in the fourth interval will be analyzed. Samples taken near the beginning of the second and third intervals will be stored until the end of the test when the beginnings of these intervals can be determined. The samples taken closest to the beginning of the second and third interval will also be analyzed. Analytic results will be used to evaluate vapor extraction rates aiding in the design of the final extraction system.

APPENDICES



Logged by:	Ken Leonard	Drilling Company:	B & F Drilling (Chempro)	Well Head Completion:	Christy box & locking cap
Project Mgr:	Tom Howard	Drilling Method:	8.25" Hollow stem auger	Type of Sampler:	2" split barrel
Dates Drilled:	5/1/90	Driller:	Breese Franks	TD (Total Depth):	9.0 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample
- Contacts: Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR — No recovery

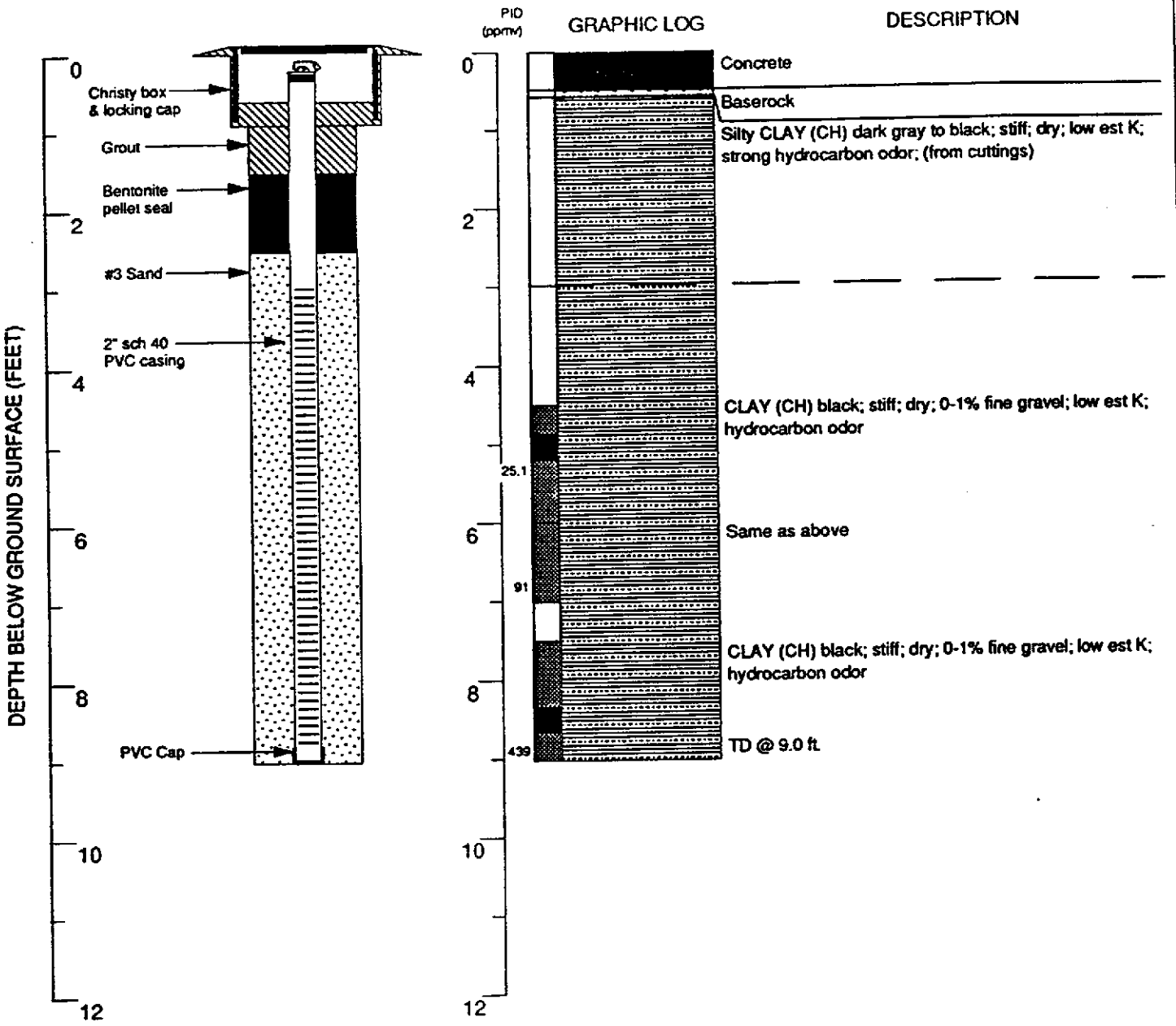
Boring Log and Well Completion Details
VW-1 (Boring B-6)

Chevron Service Station #92582
Dublin, California

VADOSE WELL 1

WESTERN GEOLOGIC RESOURCES, INC.

1-124.05



Logged by:	Ken Leonard	Drilling Company:	B & F Drilling (Chempro)	Well Head Completion:	Christy box & locking cap
Project Mgr:	Tom Howard	Drilling Method:	8.25" Hollow stem auger	Type of Sampler:	2" split barrel
Dates Drilled:	5/1/90	Driller:	Breese Franks	TD (Total Depth):	9.0 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

- est K — Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR — No recovery

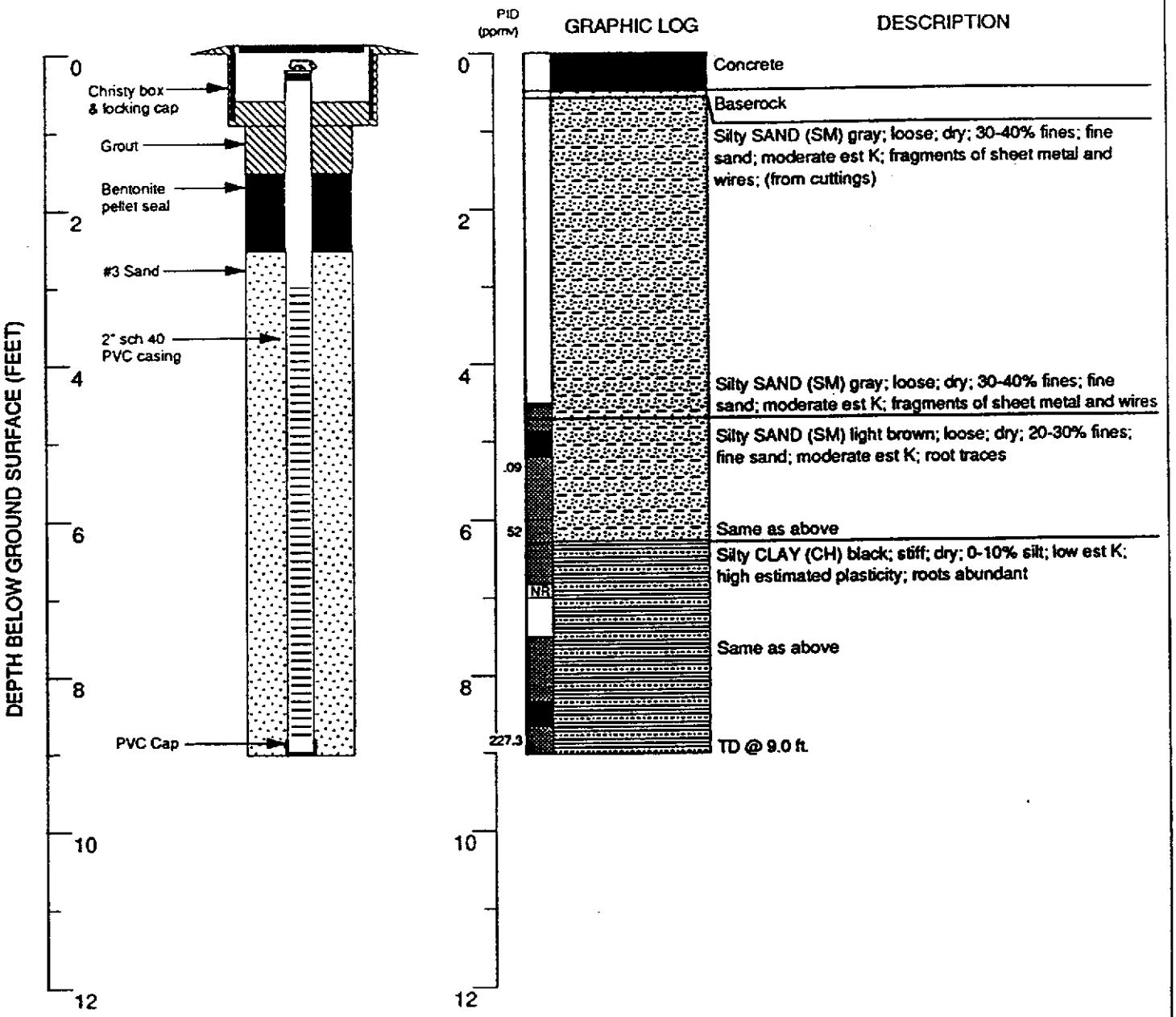
Boring Log and Well Completion Details
VW-2 (Boring B-7)

Chevron Service Station #92582
Dublin, California

VADOSE WELL
2

WESTERN GEOLOGIC RESOURCES, INC.

1-124.05



Logged by:	Ken Leonard	Drilling Company:	B & F Drilling (Chempro)	Well Head Completion:	Christy box & locking cap
Project Mgr:	Tom Howard	Drilling Method:	8.25" Hollow stem auger	Type of Sampler:	2" split barrel
Dates Drilled:	5/1/90	Driller:	Breese Franks	TD (Total Depth):	9.0 ft.

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered drill sample
- Location of sample sealed for chemical analysis
- Sieve sample
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational

- est K: Estimated permeability (hydraulic conductivity) 1K = primary 2K = secondary
- NR: No recovery

Boring Log and Well Completion Details
VW-3 (Boring B-8)

Chevron Service Station #92582
Dublin, California

VADOSE WELL 3

WESTERN GEOLOGIC RESOURCES, INC.

1-124.05

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 80811
CLIENT: Western Geologic Resources
CLIENT JOB NO.: 1-124.05

DATE RECEIVED: 05/04/90
DATE REPORTED: 05/08/90

Lab Number	Customer Sample Identification	Date Sampled	Date Analyzed
80811- 1	B-6 5.0	05/01/90	05/05/90
80811- 2	B-6 8.5	05/01/90	05/07/90
80811- 3	B-7 5.0	05/01/90	05/05/90
80811- 4	B-7 8.5	05/01/90	05/05/90
80811- 5	B-8 5.0	05/01/90	05/05/90
80811- 6	B-8 8.5	05/01/90	05/05/90

Laboratory Number:	80811 1	80811 2	80811 3	80811 4	80811 5
ANALYTE LIST	Amounts/Quantitation Limits (mg/kg)				
OIL AND GREASE:	NA	NA	NA	NA	NA
TPH/GASOLINE RANGE:	1	74	1.5	33	ND<1
TPH/DIESEL RANGE:	NA	NA	NA	NA	NA
BENZENE:	0.12	0.60	0.055	2.6	ND<0.05
TOLUENE:	ND<0.05	2.5	ND<0.05	4.5	ND<0.05
ETHYL BENZENE:	ND<0.05	0.31	ND<0.05	2.8	ND<0.05
XYLENES:	0.15	5.2	ND<0.05	3.7	ND<0.05

Laboratory Number:	80811 6
ANALYTE LIST	Amounts/Quantitation Limits (mg/kg)
OIL AND GREASE:	NA
TPH/GASOLINE RANGE:	96
TPH/DIESEL RANGE:	NA
BENZENE:	0.90
TOLUENE:	3.5
ETHYL BENZENE:	1.5
XYLENES:	9.4

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

C E R T I F I C A T E O F A N A L Y S I S

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
Diesel by Modified EPA SW-846 Method 8015
Gasoline by Purge and Trap: EPA Method 8015/5030
ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

QA/QC INFORMATION
SET: 30611

NA = ANALYSIS NOT REQUESTED
ND = ANALYSIS NOT DETECTED ABOVE QUANTITATION LIMIT

mg/Kg = part per million (ppm)

OIL AND GREASE ANALYSIS By Standard Methods Method 5520E:
Duplicate RPD NA
Minimum Detection Limit in Soil: 20mg/Kg

Modified EPA Method 8015 for Extractable Hydrocarbons:
Minimum Quantitation Limit for Diesel in Soil: 10mg/Kg
Daily Standard run at 200mg/L; RPD Diesel = NA
MS/MSD Average Recovery = NA: Duplicate RPD = NA

8015/5030 Total Purgable Petroleum Hydrocarbons:
Minimum Quantitation Limit for Gasoline in Soil: 1mg/Kg
Daily Standard run at 2mg/L; RPD Gasoline = 2
MS/MSD Average Recovery = 93%: Duplicate RPD = 7

8020/BTXE
Minimum Quantitation Limit in Soil: 0.005mg/Kg
Daily Standard run at 20ug/L, RPD = 10%
MS/MSD Average Recovery = 110%: Duplicate RPD = 6

Richard Srna, Ph.D.
Laboratory Manager

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10702
CLIENT:WESTERN GEOLOGIC RESOURCES
CLIENT ID: 1-124.05

DATE RECEIVED:05/22/90
DATE ANALYSED:05/23/90
DATE REPORTED:05/24/90

ANALYSIS FOR VOLATILE PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Methods 8015 AND 5030

Lab #	Sample Id	Concentration Gasoline Range
1	1A1	7900 ppm
2	2A2	2800 ppm
3	2C2	ND< 30 ppm

MINIMUM DETECTION LIMIT IN AIR 30 ppm.
Concentrations expressed v/v assuming standard temperature and pressure and an average molecular weight for gasoline equal to that of hexane.

QA/QC SUMMARY: STANDARD RUN FOR CALIBRATION CHECK: < 15 % DIFF.
MS/MSD 86 % RECOVERY AVEAGE; % RSD < 4 %.

Richard Srna, Ph.D
Laboratory Director

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10702
CLIENT: WESTERN GEOLOGIC RESOURCES
JOB NO.: 1-124.05

DATE SAMPLED: 05/22/90
DATE RECEIVED: 05/23/90
DATE ANALYZED: 05/24/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE AND XYLENES
EPA SW-846 METHODS 5030 AND 8020 IN AIR

LAB #	SAMPLE ID	BENZENE	TOLUENE	ETHYL BENZENE	XYLENES
1	1A1	26000	9300	570	5900
2	2A2	7800	11000	1600	13000
3	2C2	ND< 85	ND< 250	ND< 65	ND< 65

MINIMUM DETECTION LIMITS IN AIR:
BENZENE: 85 ppb ; ETHYL BENZENE 65 ppb
TOLUENE: 250 ppb ; XYLENES: 250 ppb.
Concentrations assume standard temperature and pressure and are expressed V/V.

QA/QC Summary:
Daily standards run at 20 ug/L; RPD = <15%
MS/MSD: Average Recovery = 105 % ; Duplicate RPD = < 7 % .

Richard Srna, Ph.D.
Laboratory Director

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10704
CLIENT:WESTERN GEOLOGIC RESOURCES
CLIENT ID: 1-124.05

DATE RECEIVED:05/24/90
DATE ANALYSED:05/25/90
DATE REPORTED:05/25/90

ANALYSIS FOR VOLATILE PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Methods 8015 AND 5030

Lab #	Sample Id	Concentration Gasoline Range
1	3A3	1600 ppm
2	2B2	1500 ppm
3	3C3	ND< 30 ppm
4	4A1	1500 ppm

MINIMUM DETECTION LIMIT IN AIR 30 ppm.
Concentrations expressed v/v assuming standard temperature and pressure and an average molecular weight for gasoline equal to that of hexane.

QA/QC SUMMARY: STANDARD RUN FOR CALIBRATION CHECK: < 15 % DIFF.
MS/MSD 94 % RECOVERY AVEAGE; % RSD < 4 %.

Richard Srna, Ph.D
Laboratory Director

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10704
CLIENT: WESTERN GEOLOGIC RESOURCES
JOB NO.: 1-124.05

DATE SAMPLED: 05/24/90
DATE RECEIVED: 05/24/90
DATE ANALYZED: 05/25/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE AND XYLENES EPA SW-846 METHODS 5030 AND 8020 IN AIR

LAB #	SAMPLE ID	BENZENE	TOLUENE	ETHYL BENZENE	XYLENES
1	3A3	5300	12000	1400	4600
2	3B3	ND< 85	330	ND< 65	290
3	3C3	ND< 85	ND< 250	ND< 65	ND< 65
4	4A1	6900	8500	1100	3900

MINIMUM DETECTION LIMITS IN AIR:
BENZENE: 85 ppb ; ETHYL BENZENE 65 ppb
TOLUENE: 250 ppb ; XYLENES: 250 ppb.
Concentrations assume standard temperature and pressure and are expressed V/V.

QA/QC Summary:
Daily standards run at 20 ug/L; RPD = <15%
MS/MSD: Average Recovery = 96 % ; Duplicate RPD = < 3 % .

Richard Srna, Ph.D.
Laboratory Director

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 10708
CLIENT:WESTERN GEOLOGIC RESOURCES
CLIENT ID: 1-124.05

DATE RECEIVED:05/25/90
DATE ANALYSED:05/25/90
DATE REPORTED:05/26/90

ANALYSIS FOR VOLATILE PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Methods 8015 AND 5030

Lab #	Sample Id	Concentration Gasoline Range
1	5A3	2400 ppm
2	5B3	63 ppm
3	5C3	ND< 30 ppm
4	6A3	2100 ppm
5	6B3	560 ppm
6	6C3	ND< 30 ppm

MINIMUM DETECTION LIMIT IN AIR 30 ppm.
Concentrations expressed v/v assuming standard temperature and pressure and an average molecular weight for gasoline equal to that of hexane.

QA/QC SUMMARY: STANDARD RUN FOR CALIBRATION CHECK: < 15 % DIFF.
MS/MSD 91 % RECOVERY AVEAGE; % RSD < 4 %.

Richard Srna, Ph.D

Laboratory Director

SUPERIOR ANALYTICAL LABORATORY, INC.

1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 10708
CLIENT: WESTERN GEOLOGIC RESOURCES
JOB NO.: 1-124.05

DATE SAMPLED: 05/25/90
DATE RECEIVED: 05/25/90
DATE ANALYZED: 05/26/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE AND XYLENES EPA SW-846 METHODS 5030 AND 8020 IN AIR

LAB #	SAMPLE ID	BENZENE	TOLUENE	ETHYL BENZENE	XYLENES
1	5A3	8300	7900	690	4700
2	5B3	ND< 85	ND< 250	ND< 65	ND< 250
3	5C3	ND< 85	ND< 250	ND< 65	ND< 65
4	6A3	6200	6200	830	5300
5	6B3	ND< 85	ND< 250	ND< 65	ND< 250
6	6C3	ND< 85	ND< 250	ND< 65	ND< 250

MINIMUM DETECTION LIMITS IN AIR:
BENZENE: 85 ppb ; ETHYL BENZENE 65 ppb
TOLUENE: 250 ppb ; XYLENES: 250 ppb.
Concentrations assume standard temperature and pressure and are expressed V/V.

QA/QC Summary:
Daily standards run at 20 ug/L; RPD = <15%
MS/MSD: Average Recovery =106 Duplicate RPD = < 7 % .

Richard Srna, Ph.D.
Laboratory Director

PERMIT SERVICES DIVISION
BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 Ellis Street, San Francisco, CA. 94109
(415) 771-6000

AQMD PLANT NO._____ APPLICATION NO._____

APPLICATION FOR AUTHORITY TO CONSTRUCT AND PERMIT TO OPERATE
INDUSTRIAL SOURCES

BUSINESS NAME Chevron U.S.A.

MAILING ADDRESS 2410 Camino Ramon, San Ramon, CA 94583-0804

PLANT ADDRESS 7420 Dublin Blvd., Dublin, CA

NAME OF CONTACT Clint Rogers PHONE (415) 842-8658

EQUIPMENT DESCRIPTION Soil Vapor Extraction system with a catalytic oxidation abatement device

NUMBER OF SOURCES [1] NEW CONSTRUCTION [x] MODIFICATION [ ] REPLACEMENT [ ]

RELOCATION [ ] DEMOLITION OR SHUT DOWN [ ] TRANSFER OF OWNERSHIP [ ]

ABATEMENT EQUIPMENT ONLY [ ]

WAS AN ENVIRONMENTAL IMPACT REPORT (EIR) BEEN PREPARED FOR THIS PROJECT? YES____ NO x

IF YES, BY WHOM?_____

IS THIS APPLICATION A RESULT OF A VIOLATION NOTICE? YES____ NO x

IF YES, GIVE THE VIOLATION NOTICE NUMBER: _____

TOTAL EMISSIONS FOR THIS APPLICATION: _____ (SEE FORM P-202 FOR DETAILS)

EMISSIONS IN LB/HR				
TSP	NMHC	SOx	NOx	CO
N/A	0.175	N/A	N/A	N/A

TYPICAL USAGE RATE: HOURS/DAY 24 ; DAYS/WEEK 7 ; WEEKS/YEAR 52

ARE OFFSETS OR TRADEOFFS INVOLVED IN THIS APPLICATION? YES____ NO x

IF YES, GIVE DOCUMENTS AND PAGE NUMBERS ON WHICH THIS INFORMATION IS PROVIDED: _____

(OVER)

HAVE YOU PROVIDED AN AIR QUALITY ANALYSIS? YES ____ NO x

IF YES, GIVE DOCUMENTS AND PAGE NUMBERS ON WHICH THIS INFORMATION IS PROVIDED: _____

THE FOLLOWING ITEMS SHOULD ACCOMPANY THIS APPLICATION: (a) Topographical Map showing t. location of this facility; (b) Process Flow Diagram (if applicable) and; (c) a descripti or manufacturer's catalogue of equipment and air pollution abatement equipment. (See AB 3. -Lists and Criteria for further details.

IMPORTANT: All information that you submit will be considered as public information unl. ss you indicate that it is considered TRADE SECRET and give the reasons.

[ ] ACKNOWLEDGEMENT

SIGNATURE _____ TITLE Principal Engineer

NAME (PRINTED) Gary W. Keyes, P.E. DATE 7/31/91

NOTE: PERMITS FOR YOUR PROJECT MAY ALSO BE REQUIRED FROM OTHER AGENCIES. FOR FURTHER INFORMATION, YOU SHOULD CONTACT THE LOCAL CITY OR COUNTY OFFICE IN WHICH THE PROPO: PROJECT WILL BE LOCATED. ALSO, THE OFFICE OF PERMIT ASSISTANCE WITHIN THE OFFICE O PLANNING AND RESEARCH IN SACRAMENTO IS AVAILABLE TO PROVIDE INFORMATION ON PERMITTI THE ADDRESS IS AS FOLLOWS:

OFFICE OF PLANNING AND RESEARCH
1400 Tenth Street
Sacramento, California 95814

FORM P-101B
Revised 9/86
jrb

BAY AREA
QUALITY MANAGEMENT DISTRICT
Ellis Street, San Francisco, CA 94109 (415) 771-6000

DATA FORM G
General Air Pollution Source

If in addition to the general process described hereon this source burns fuel, then complete Form C also.
Use specific forms if applicable: Form T (organic tankage, loading), Form S (surface coating, solvent use).

1 Business Name: Chevron U.S.A. Plant No: _____ (If unknown, leave blank)

2 SIC Number: _____ Date of Initial Operation: Sept. 1, 1991

3 Name or Description: Soil Vapor Extraction System Source No.: S

4 Make, Model, and Rated Capacity of Equipment: King, Buck/Hasstech Catalytic Oxidation Unit, 100 scfm
(catalytic) (gasoline)

5 Process Code* (Column A): _____ Materials Code* (Column B): _____ Usage Unit* (Column C): 1 hour = 6,000ft^3

6 Total throughput, last 12 months: 0 Usage Units* Max operating rate: 1 Usage Units*/hr

7 Typical % of total throughput: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

8 Typical operating times: 24 hrs/day 7 days/week 52 weeks/year

9 For batch or cyclic processes: N/A min/cycle N/A min. between cycles

10 Exhaust gases from source: (at max. operation) Wet gas flow rate 170 cfm at 425 °F (100 scfm)
Approximate water vapor content 2 vol %

EMISSION FACTORS (at maximum operating rate)

If this form is being submitted as part of an application for an AUTHORITY TO CONSTRUCT, completion of the following table is mandatory. If not, and the Source is already in operation, completion of table is requested but not required.

If this source also burns fuel, do not include those combustion products in the emission factors below; they are accounted for on Form C. If source test or other data are available for composite emissions only, estimate from those data the emissions attributable to just the general process and show below.

[X] Check box if factors apply to emissions after Abatement Device(s).

		EMISSION FACTORS lbs/Usage Unit*	Basis Code (see reverse)
11	Particulate	N/A	0
12	Organics	0.175	1
13	Nitrogen Oxides (as NO_2)	N/A	0
14	Sulfur Dioxide	N/A	0
15	Carbon Monoxide	N/A	0
16	Other: Benzene	0.0004	1
17	Other:		

18 With regard to air pollutant flow from this source, what source(s), abatement device(s) and/or emission points(s) are immediately downstream?

S	S	S					
A 1	A	A	P 1	P	P	P	P

*From Tables G-1 through G-7 (See listing on reverse side)

Person Completing this Form: _____ Date: AUGUST 1, 1991

6-8-77

Basis Codes

CODES	METHOD
0	Not applicable for this pollutant
1	Source Testing or other measurement by plant
2	Source Testing or other measurement by BAAQMD.
3	Specifications from vendor
4	Material balance by plant using engineering expertise and knowledge of process
5	Material balance by BAAQMD using engineering expertise and knowledge of process
6	Taken from AP-42 ("Compilation of Air Pollutant Emission Factors", E.P.A.)
7	Taken from literature, other than AP-42
8	Guess

CODE TABLES* for GENERAL AIR POLLUTION SOURCES

Table	Process
G-1	Food & Agricultural
G-2	Metallurgical (Primary Metals)
G-3	Metallurgical (Secondary Metals)
G-4	Mineral
G-5	Petroleum Refining
G-6	Incineration
G-7	Chemical/Other

*Available from the BAAQMD upon request.

BAY AREA
AIR QUALITY MANAGEMENT DISTRICT
939 Ellis Street, San Francisco, CA 94109 (415) 771-6000

DATA FORM A
ABATEMENT DEVICE

Abatement Device: Equipment/process whose primary purpose is to reduce the quantity of pollutant(s) emitted to the atmosphere.

1. Business Name: Chevron U.S.A. Plant No.: _____ (If unknown, leave blank)

2. Name or Description: Soil Vapor Extraction System Abatement Device No.: A 1

3. Make, Model and Rated Capacity: King, Buck/Haastech Catalytic Oxidation Unit, 100 scfm

4. Abatement Device Code (Table on reverse side): 2 Date of Initial Operation: Sept. 1, 1991

5. With regard to air pollutant flow into this abatement device, what source(s) and/or abatement device(s) are immediately upstream?

S 1	S	S	S	S	A	A	A
A	A	A	A	S	S	S	S

6. Typical Gas Stream Temperature at Inlet: 150 °F

If this form is being submitted as part of an application for an AUTHORITY TO CONSTRUCT, completion of the following table is mandatory. If not, and the Abatement Device is already in operation, completion of table is requested but not required.

	POLLUTANT	WEIGHT PERCENT REDUCTION (at typical operation)	BASIS CODE (Codes on reverse side)
7.	Particulate	N/A %	0
8.	Organics	95 %	3
9.	Nitrogen Oxides (as NO_2)	N/A %	0
10.	Sulfur Dioxide	N/A %	0
11.	Carbon Monoxide	N/A %	0
12.	Other: Benzene	95 %	3
13.	Other:	%	

14. ☐ Check box if this Abatement Device burns fuel; complete lines 1, 2 and 15-36 on Form C (using the Abatement Device No. above for the Source No.) and attach to this form.

15. With regard to air pollutant flow from this abatement device, what source(s), abatement device(s) and/or emission point(s) are immediately downstream?

S	A	A	P 1	P	P	P	P

6-8-77

Person Completing this Form: Jean Kluge Date: AUGUST 1, 1991

Abatement Device Codes

CODE	DEVICE
	ADSORBER (See VAPOR RECOVERY)
	AFTERBURNER
1	CO Boiler
2	Catalytic
3	Direct Flame
4	Flare
5	Furnace-Firebox
6	Other
	BAGHOUSE (See DRY FILTER)
	CYCLONE (See DRY INERTIAL COLLECTOR and SCRUBBER)
	DRY FILTER
7	Absolute
8	Baghouse, Pulse Jet
9	Baghouse, Reverse Air
10	Baghouse, Reverse Jet
11	Baghouse, Shaking
12	Baghouse, Simple
13	Baghouse, Other
14	Envelope
15	Moving Belt
16	Other
	DRY INERTIAL COLLECTOR
17	Cyclone, Dynamic
18	Cyclone, Multiple, (12 inches diam. or more)
19	Cyclone, Multiple, (less than 12 inches diam.)
20	Cyclone, Simple
21	Settling Chamber, Baffled/Louvered
22	Settling Chamber, Simple
23	Other
	ELECTROSTATIC PRECIPITATOR
24	Single Stage
25	Single Stage, Wet
26	Two Stage
27	Two Stage, Wet
28	Other
	INCINERATOR (See AFTERBURNER)
	KNOCK-OUT POT (See LIQUID SEPARATOR)
	LIQUID SEPARATOR
29	Knock-Out Pot
30	Mist Eliminator, Horizontal Pad, Dry
31	Mist Eliminator, Panel, Dry
32	Mist Eliminator, Spray/Irrigated
33	Mist Eliminator, Vertical Tube, Dry
34	Mist Eliminator, Other
35	Other
	MIST ELIMINATOR (See LIQUID SEPARATOR)
	SCRUBBER
36	Baffle and Secondary Flow
37	Centrifugal
38	Cyclone, Irrigated
39	Fibrous Packed
40	Impingement Plate
41	Impingement and Entrainment
42	Mechanically Aided
43	Moving Bed
44	Packed Bed
45	Preformed Spray
46	Venturi
47	Other
	SETTLING CHAMBER (See DRY INERTIAL COLLECTOR)
	SULFUR DIOXIDE CONTROL
48	Absorption and Regeneration, for Sulfur Plant
49	Claus Solution Reaction, for Sulfur Plant
50	Dual Absorption, for H_2SO_4 Plant
51	Flue Gas Desulfurization, for Fossil Fuel Combustion
52	Reduction and Solution Regeneration, for Sulfur Plant
53	Reduction and Stretford Process, for Sulfur Plant
54	Sodium Sulfite-Bisulfite Scrubber, for H_2SO_4 Plant
55	Other
	VAPOR RECOVERY
56	Adsorption, Activated Carbon/Charcoal
57	Adsorption, Silica
58	Adsorption, Other
59	Balance
60	Compression/Condensation/Absorption
61	Compression/Refrigeration
62	Condenser, Water-Cooled
63	Condenser, Other
64	Other
	MISCELLANEOUS
65	Not classified above

Basis Codes

CODES	METHOD
0	Not applicable for this pollutant
1	Source Testing or other measurement by plant
2	Source Testing or other measurement by BAAPCD
3	Specifications from vendor.
4	Material balance by plant using engineering expertise and knowledge of process
5	Material balance by BAAPCD using engineering expertise and knowledge of process
6	Taken from AP-42 ("Compilation of Air Pollutant Emission Factors", E.P.A.)
7	Taken from literature, other than AP-42
8	Guess

BAY AREA
AIR QUALITY MANAGEMENT DISTRICT
939 Ellis Street, San Francisco, CA 94109 (415) 771-6000

DATA FORM P
Emission Point

Form P is for well-defined emission points such as stacks or chimneys only; do not use for windows, room vents, etc.

Business Name: Chevron U.S.A. Plant No.:

Emission Point No.: P1

With regard to air pollutant flow into this emission point, what source(s) and/or abatement device(s) are immediately upstream?

				S[1]	S	S
S	S	S	A[1]	A	A	A

Exit Cross-section Area: 0.022 Square feet Height above grade: 15 Feet

Effluent Flow from Stack:

	Typical Operating Condition		Maximum Operating Condition	
Actual Wet Gas Flow Rate	170	cfm	190	cfm (100 scfm)
Percent Water Vapor	2	Vol %	4	Vol %
Temperature	425	°F	550	°F

If this stack is equipped to measure (monitor) the emission of any air pollutants,

-is monitoring continuous? N/A

-what pollutants are monitored? N/A

On behalf of our client, Chevron U.S.A.:

Person Completing this Form [signature] Date AUGUST 1, 1991

4-25-77

BAY AREA
ALITY MANAGEMENT DISTRICT

3 Ellis Street, San Francisco
California 94109
(415) 771-6000

PLANT DATA P-201

Plant Identification No.

Chevron U.S.A. Inc.
Business Name

c/o Geraghty & Miller, Inc.

currently a BP service station
Other Business Name(s)(if any)

(415) 233-3200
Plant Telephone Number

Name of Parent Company (if any)

c/o Geraghty & Miller, Inc.
1050 Marina Way South

PLANT ADDRESS: 7420 Dublin Blvd.

MAILING ADDRESS

Dublin, CA
City State Zip Code

Richmond, CA 94804
City State Zip Code

PLANT AREA (Acres) 0.7

NUMBER OF EMPLOYEES 12

PRINCIPAL PRODUCT gasoline dispensing
car wash

OWNERSHIP:

(x) Private
( ) Utility
( ) Local Government
( ) State Government
( ) Federal Government

Pleaee submit a name and address to whom all correspondence regarding air pollution control can be sent.

David B. Thomas, Staff Engineer
Contact Name & Title

1050 Marina Way South
Street Address

Richmond, CA 94804
City State Zip Code

*Plant Identification Numbers are assigned by the BAAQMD. Leave blank if number is not known.

On behalf of our client, Chevron U.S.A.

Gary Keyes - GARY KEYES, ASSOCIATE
Name & Title of person preparing this form

Geraghty & Miller, Inc.