SOIL REMEDIATION DESIGN REPORT

SOIL VAPOR EXTRACTION PILOT STUDY
FORMER SOLVENT STORAGE TANK AREA
(AREA 5)

MARTIN MARIETTA CORPORATION
FARRELL ROAD PLANT
TOWN OF GEDDES
SYRACUSE, NEW YORK

October 1993

ERM-NORTHEAST, INC.
5788 Widewaters Parkway
Dewitt, New York 13214

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1.0 *INTRODUCTION*

ERM-Northeast, Inc. (ERM) has conducted a phased environmental investigation at the property formerly occupied by General Electric Aerospace Division (GE), now Martin Marietta Corporation (MMC), located on Farrell Road in the Town of Geddes, New York. The property is referred to as the Farrell Road Plant (FRP) or the "site". Previous environmental investigations conducted at the site have determined that soil and ground water have been affected by past activities at FRP. As a result, the site was listed by the New York State Department of Environmental Conservation (NYSDEC) on the registry of Inactive Hazardous Waste Sites (Site No. 734055).

A review of building plans and plant personnel interviews indicate that up to nine solvent underground storage tanks (USTs) and a drywell were located along the west wall of FRP-Building No. 2 ("FRP-2"). This area is referred to as Area 5 in previous reports. A soil gas survey of the area revealed elevated concentrations of Volatile Organic Compounds (VOCs) in the soil and a Ground Penetrating Radar (GPR) survey revealed buried pipes and an area of disturbed soil, indicating the location of the former tanks.

During the investigation, an abandoned "paint drippings" drywell was discovered near the solvent tanks. The drywell was excavated under a source control action. The drywell contents were sampled and shown to contain the same suite of VOCs discovered in the solvent tank area soils.

ERM conducted a soil boring program in the vicinity of the removed tanks and throughout the interior of FRP-2 to determine the extent of affected soil and ground water beneath the building. The zone of affected soil is limited mainly to the area around the solvent tanks and drywell. The suite of compounds detected included three chlorinated solvents [1,1-dichloroethene (1,1-DCE); 1,1-dichloroethane (1,1-DCA); and 1,1,1-trichloroethane (1,1,1-TCA)] and three non-chlorinated solvents [toluene,ethylbenzene and xylenes].

Ground water samples were collected from ground water monitoring wells located both upgradient (west of the building) and downgradient (beneath the building) of the affected zone. Upgradient samples contained only trace concentrations of VOCs. Downgradient samples contained a suite of compounds similar to those detected in the solvent tank and drywell area. The area of affected ground water extends eastward from the solvent tank area to approximately the center of FRP-2 (220 linear feet). From the center of FRP-2 it extends northward approximately two-thirds of the building length (350 linear feet).

Various remedial alternatives have been evaluated for this area. This soil remediation design report summarizes the evaluation of soil remediation alternatives, develops recommendations for remediation, and details the soil venting pilot test results and remediation system design.

2.0 SOIL REMEDIATION ALTERNATIVES

Soil remediation alternatives were evaluated for the clean up of approximately 3300 cubic yards (cy) of soil located on the west side of FRP-2 near the nine removed solvent USTs. Approximately 2300 cy of soil are located beneath the building and 1000 cy are located beneath grass/asphalt areas west of FRP-2. This section of the report provides a summary of the soil remediation alternatives evaluated.

2.1 SOIL EXCAVATION AND OFF-SITE DISPOSAL

This alternative consists of the excavation and disposal of approximately 1000 cubic yards of soil. Soil from grade to 3 1/2 feet below grade is clean and would be stockpiled for use as backfill. Soil excavated from 3 1/2 feet to 10 feet would be loaded for transport and disposal at a thermal destruction facility. In addition to excavation and disposal, the excavated area would require backfill and site restoration, including paving. Soil samples would be collected for analysis prior to transportation off-site.

Remediation of affected soil located beneath the building was deemed impractical, due to the volume of affected soil and structural consideration.

The advantages of implementing the excavation and off-site disposal alternative include: 1) complete remediation of the soil outside the building; 2) minimization of on-going O&M costs; and 3) easy implementation. The disadvantages of this alternative include: 1) the very high capital cost; and 2) the lack of remediation of contaminated soils beneath FRP-2.

2.2 *SOIL EXCAVATION AND ON-SITE EX-SITU SOIL VENTING*

This alternative consists of the excavation of 1000 cy of soil and installation of an "above grade" soil venting system at a location on site. In addition to excavation and soil venting, the excavated area would require backfill and site restoration to include paving. Soil would be staged on-site for treatment. Engineering design of the soil venting system would be required and operation and maintenance activities would be performed for the time period necessary to achieve clean-up goals.

The advantages of implementing the soil excavation and on-site ex-situ soil venting alternative include: 1) a proven technology; 2) the cost of on-site treatment is considerably less than off-site soil disposal; and 3) the potential liabilities associated with off-site disposal are eliminated. The disadvantages of this alternative include: 1) non-remediation of contaminated soils beneath the building; and 2) visibility of on-site ex-situ treatment.

2.3 *IN-SITU SOIL VENTING*

This alternative consists of the engineering design of a soil venting system, which would include: extraction wells, vacuum blower, air emission controls and necessary instrumentation, O&M to obtain clean-up goals and confirmation sampling.

The advantages of implementing the in-situ soil venting alternative include: 1) lower capital costs as compared to other alternatives; 2) all affected soil is addressed, including soil beneath FRP-2; and 3) a proven technology. The disadvantages of this alternative include: 1) the on-going O&M costs; 2) lower visibility of on-site treatment related to ex-situ approach; and 3) a longer time to complete remediation as compared with off-site alternatives.

2.4 *IN-SITU SOIL WASHING*

This alternative consists of providing in-situ soil flushing of the contaminated soil. Soil washing would be utilized to accelerate movement of contaminants through unsaturated soil by solubilizing, emulsifying or chemically modifying the contaminants. Wash water would be mixed with a solvent surfactant and allowed to percolate downward through the zone of contaminated soil. The addition of the treatment solution can be applied by gravity or forced methods. The treatment solution interacts with the contaminated soil. Contaminants are mobilized by the treatment solution and transported downward to a saturated zone. The contaminants are collected in drains or wells below the depth of contamination, and pumped to the surface for recovery, treatment and disposal. In some instances, the flushing solution may be treated to remove the contaminants and reused.

The advantages of implementing the soil washing alternative include: 1) addressing the contaminated soil both outside and beneath the building; and 2) reduced cost. The disadvantages of this alternative include: 1) non-proven technology; 2) may be inappropriate for dense non-aqueous phase liquids (DNAPLs); and 3) excessive cost.

3.0 RECOMMENDATIONS

Based on the summary of soil remediation alternatives discussed in Section 2.0, and discussions with New York State Department of Environmental Conservation Project Managers, Martin Marietta requested authorization to further investigate the in-situ soil venting alternative. ERM recommended that a pilot test be conducted to determine the most effective design parameters for the soil venting technology.

4.0 SOIL VENTING PILOT TEST RESULTS

A soil venting pilot test was conducted on July 27 and 28, 1993 in order to determine the design parameters for the soil venting system. The pilot test examined site geology to define the size and number of extraction and injection wells required for a full-scale design. A summary of the soil vapor extraction pilot test results are included as Appendix A.

5.0 REMEDIATION SYSTEM DESIGN

Based upon pilot test results, soil venting was determined to be an appropriate interim remedial measure (IRM) for the area of known on-site soil contamination in the former underground solvent storage tank/drywell area (Area 5). The remediation system design drawings are included as Appendix B.

6.0 CONSIDERATIONS

In designing a soil venting system it is important to consider the quantity and level of ground water in the area of soil contamination. Presently, there is a relatively small saturated thickness within the zone of soil contamination in Area 5. To address this condition, the following will be provided:

- soil venting extraction wells will be screened from 3 1/2 feet to the top of the clay layer (approximately 15 feet) thus extending the well screen into the limited saturated zone;

- a ground water pump and treat system will be designed and installed which, in addition to treating contaminated ground water from other locations of the site, will lower the water levels in the area of affected soil;

- the soil venting system will also be designed to allow for concurrent operation of a ground water dewatering system and soil venting.

Implementation of these provisions will allow treatment of affected soil presently in the saturated zone in one or more of the following ways:

- extending soil venting wells into the saturated zone may desiccate part of the area, thus exposing soil;

- the pump and treat system will lower water levels site-wide, exposing additional affected soil to treatment;

- venting wells will be constructed so that dewatering pumps can be installed in the wells; and

- the system will be designed such that it can be expanded or modified in the future as needed.

Implementing these measures as appropriate will not only control ground water levels, but also allow for soil remediation of affected soil below present ground water levels.

7.0 *SUMMARY AND CONCLUSIONS*

ERM's investigation revealed soil contamination on the west side of FRP-2 near the former location of underground solvent storage tanks. Four remedial alternatives were evaluated and in-situ soil venting is deemed appropriate based on costs and overall site-specific considerations. Results of a soil venting pilot test indicate that a full-scale soil venting system can provide efficient and cost effective clean-up of the contaminated soil. A full-scale design based on the results of the pilot testing is complete and it is recommended that the full-scale soil venting system be installed to address the affected soils.

APPENDIX A

SOIL VAPOR EXTRACTION

PILOT TEST RESULTS

SOIL VAPOR EXTRACTION
PILOT TEST RESULTS

MARTIN MARIETTA CORPORATION
FARRELL ROAD PLANT
SYRACUSE, NEW YORK

AUGUST 1993

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1.0 INTRODUCTION

A soil vapor extraction pilot test was performed at Martin Marietta Corporation's FRP site in the area (Area 5) where volatile organic compound (VOC) contamination has been found. The pilot test was conducted to determine the technical feasibility of employing this technology in site remediation and to collect the necessary data to design a full-scale system. Specifically, the goals of the pilot study were to establish: 1) the effective "radius of influence" in order to determine appropriate well spacing and the number of wells needed for full-scale operation; 2) the soil vapor extraction rate; 3) the required vacuum to be applied to the extraction well; and 4) the air quality of the extracted soil vapor to determine the appropriate vapor treatment alternative.

The approximate extent of unsaturated soil contamination near the old solvent storage tank location has been delineated in a previous report entitled 1992 Environmental Investigation, GE Farrell Road Plant Two (FRP-2) dated July 10, 1992. The extent of contamination is indicated in Figure 1, which shows the locations of the soil borings used to delineate the area. Unsaturated soil contamination was found in six borings B-13, B-33, B-36, B-40, B-44 and B-47. The highest level of contamination was found in B-13, where the concentration of total VOCs was 7,580,000 ppb. The VOCs present at relatively high levels included 1,1,1-TCA, toluene, MIBK, ethyl benzene, and xylene. A summary of the VOC analytical data from soil borings obtained near the removed solvent tanks is presented in Table 1. Contamination was found in soil borings taken at depths of approximately 5.0 feet below grade down to the perched water table, which is approximately 9.0 feet below grade.

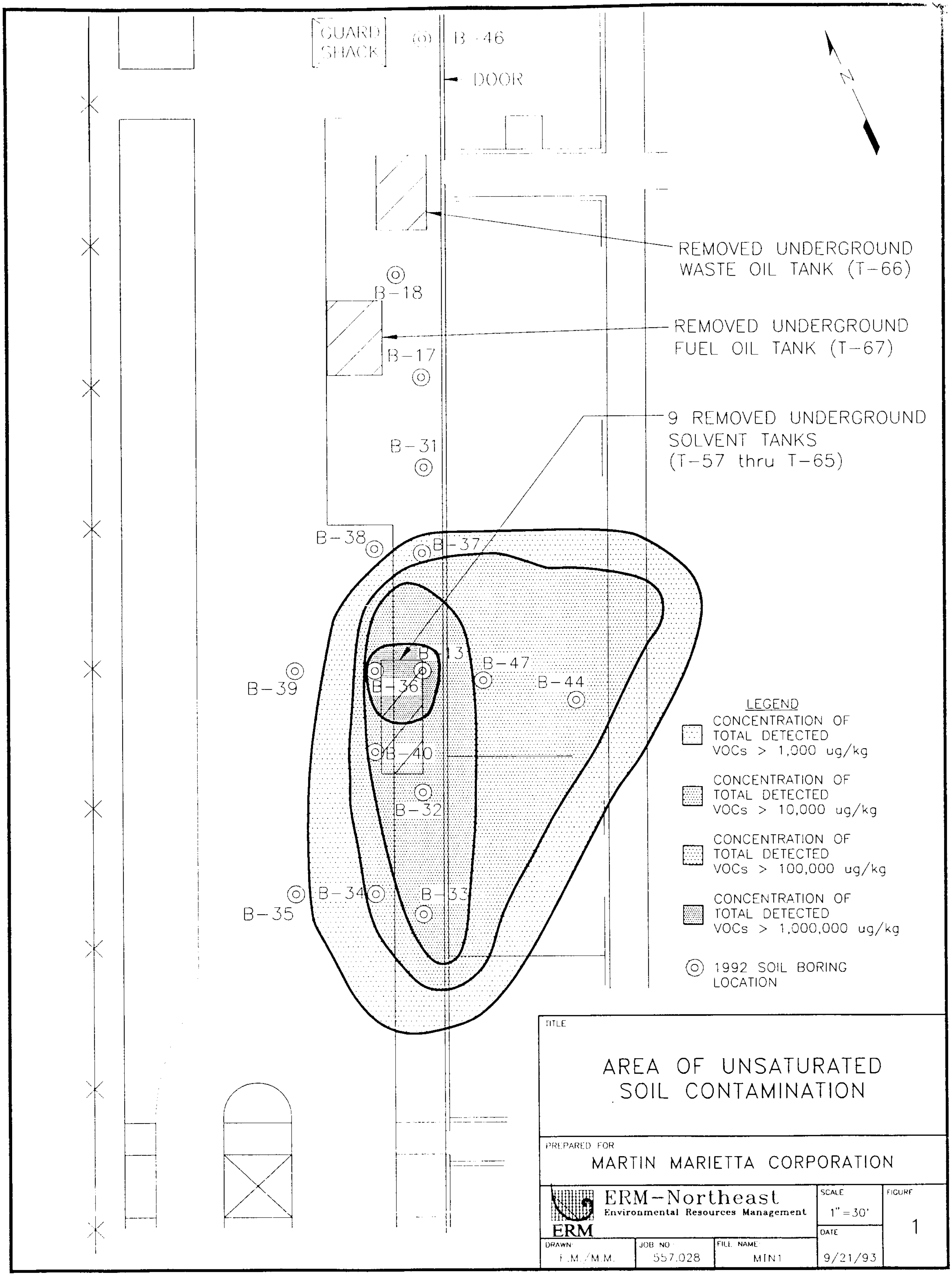

GUARD SHACK
B-46
DOOR
N
REMOVED UNDERGROUND WASTE OIL TANK (T-66)
B-18
REMOVED UNDERGROUND FUEL OIL TANK (T-67)
B-17
9 REMOVED UNDERGROUND SOLVENT TANKS (T-57 thru T-65)
B-31
B-38
B-37
B-13
B-47
B-44
B-39
B-36
B-40
B-32
B-34
B-33
B-35
LEGEND
CONCENTRATION OF TOTAL DETECTED VOCs > 1,000 ug/kg
CONCENTRATION OF TOTAL DETECTED VOCs > 10,000 ug/kg
CONCENTRATION OF TOTAL DETECTED VOCs > 100,000 ug/kg
CONCENTRATION OF TOTAL DETECTED VOCs > 1,000,000 ug/kg
1992 SOIL BORING LOCATION
TITLE
AREA OF UNSATURATED SOIL CONTAMINATION
PREPARED FOR
MARTIN MARIETTA CORPORATION
ERM-Northeast
Environmental Resources Management
ERM
SCALE 1"=30'
FIGURE 1
DATE 9/21/93
DRAWN: F.M./M.M.
JOB NO: 557.028
FILE NAME: MIN1

TABLE 1
MARTIN MARIETTA CORPORATION
FARRELL ROAD PLANT

VOC ANALYTICAL DATA
SOIL NEAR REMOVED SOLVENT TANKS

ANALYTE	B-12 (5)	B-13 (6)	B-17 (10)	B-18 (6-8)	B-31	B-32	B-33	B-34	B-35	B-36	B-37	B-38	B-39	B-40	B-44 (6)	B-44 (10)	B-45 (6)	B-46 (6)	B-47 (9)	B-47a (9)
1,1 DCE	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	210	25
1,2 DCE	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1,1 DCA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	12	350	---	---	140	28
1,1,1-TCA	---	650,000	---	---	30	NS	17,000	NS	---	140,000	NS	14	---	34,000	23	1,300	80	---	12,000	40
TCE	---	---	---	---	---	NS	---	NS	---	---	NS	---	---	1,600	---	---	---	---	---	---
Benzene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Toluene	---	2,100,000	---	---	---	NS	80,000	NS	10	740,000	NS	5	9	220,000	---	11,000	---	---	5,600	---
Ethylbenzene	---	630,000	---	6	---	NS	2,400	NS	---	220,000	NS	---	---	16,000	---	780	---	---	3,800	160
MIBK	---	2,000,000	---	---	---	---	---	---	---	---	---	---	---	---	---	21,000	---	---	---	---
Xylenes	---	4,200,000	---		---	NS	15,0000	NS	---	1,200,000	NS	---	---	100,000	---	4,600	---	---	28,000	570
TOTAL	0	7,580,000	0		30		144.400		10	2,300,000		19	9	371,600	35	39,030	80	0	49,750	923

NOTES:

All values are in ug/kg (ppb).
NS = No sample (field screening only) for this boring.
--- = Compound not detected in this sample but present in another.
All Samples analyzed for priority pollutant volatile organic compound; compounds not listed were not detected in any sample.

2.0 *DESCRIPTION OF TESTING PROGRAM*

The soil vapor extraction test involves pumping air out the soil vapor extraction well, which is screened both above and below the water table. The applied vacuum at the extraction well is varied while measuring the corresponding vapor extraction flow rate. The blower exhaust is monitored with an explosimeter and photoionization detector (PID). If necessary, dilution air is added to keep the gas concentrations below explosive levels to ensure safe operating conditions. The vapor extraction flow rate is then set while monitoring negative changes in pressure at the observation wells. The organic vapor concentration of the blower exhaust and carbon vessel (used for emission control) exhaust is monitored, along with the flow rates of soil vapor and dilution air. To characterize the soil vapor, samples of the blower exhaust are taken, using adsorptive sample tubes or summa canisters, which are analyzed in a laboratory for VOCs.

In some cases, a surface seal is required in order to prevent atmospheric air from being drawn down into extraction well and thus short-circuiting the contaminated soil. In addition, the surface seal prevents excess amounts of rain water from entering the test zone. The pilot testing in this area was conducted with a surface seal in place.

2.1 DETERMINATION OF PNEUMATIC RESPONSE

In order to determine the effective radius of influence at a particular operating condition, the steady state vacuum responses at various distances from the extraction well are monitored. When no passive venting or reinjection is applied, the vacuum response generally decreases exponentially with distance, the pressure gradient also decreases and therefore the soil gas flow rate through that point decreases. Typically, a point is considered effectively influenced if the vacuum response is at least 0.1 inches at that location. Observation wells are installed at various distances from the extraction well in an attempt to empirically determine the distance where the vacuum response falls within this range. Alternatively, by plotting the logarithm of vacuum versus distance, linear interpolation or extrapolation can be done to determine the effective radius of influence (EROI) at that particular extraction flow rate and vacuum.

Typically, steady state vacuum response is reached after 30 to 60 minutes. However, the vacuum may slowly continue to propagate out over a period of several days. As the formation dries out and the pore spaces are evacuated, the EROI would tend to expand slightly. Therefore, results taken after a one hour test would be somewhat conservative, although usually not too different from a longer term test.

2.2 CHARACTERIZATION OF EXTRACTED SOIL GAS

The soil gas is characterized by the frequent use of field monitoring equipment, supplemented by less frequent gas sampling and laboratory analysis to confirm the constituents of the soil vapor and establish the correlation between field monitor readings and actual analytical results.

The field devices used include a photoionization detector (PID) to determine VOC concentration readings and a combustible gas/oxygen meter to determine lower explosive limit (LEL) readings.

The soil vapor is frequently monitored to determine the effects that changes in operating conditions may have on the extracted soil vapor. For example, attempts to minimize short-circuiting may result in higher VOC concentrations. Also, increasing the soil vapor flow rate may result in diffusion or volatilization limiting conditions and/or increase the impacts of short-circuiting, thereby reducing the VOC concentration.

The characteristics of the soil vapor are critical to the selection of the emission control technology. High concentrations of VOCs prohibit the use of activated carbon, and in some cases would cause oxidation systems to operate with large amounts of dilution air in order to keep the oxidizer influent below 25% of the LEL. These could result in very large, oversized units as the concentrations drop off over time.

The laboratory data is necessary to determine the concentrations of the specific compounds present. Certain compounds, such as MIBK, play an important role in determining the control requirements needed to meet air emission regulations. Other less regulated compounds play an important role in adding to the British Thermal Unit (BTU) value of the soil vapor, increasing the explosivity and the loading on treatment equipment.

2.3 EQUIPMENT USED

A portable soil vapor extraction unit was mobilized to the site. This unit can deliver up to 250 cfm at a vacuum of 40 inches water column but can also pump less by turning down a throttling valve on the blower inlet piping. A process schematic of the pilot unit is presented on Figure 2.

The mobile unit is equipped with the following: a 10 HP blower, moisture separator, in-line filter, interconnecting piping for soil gas and dilution air, control panel and various instruments and controls.

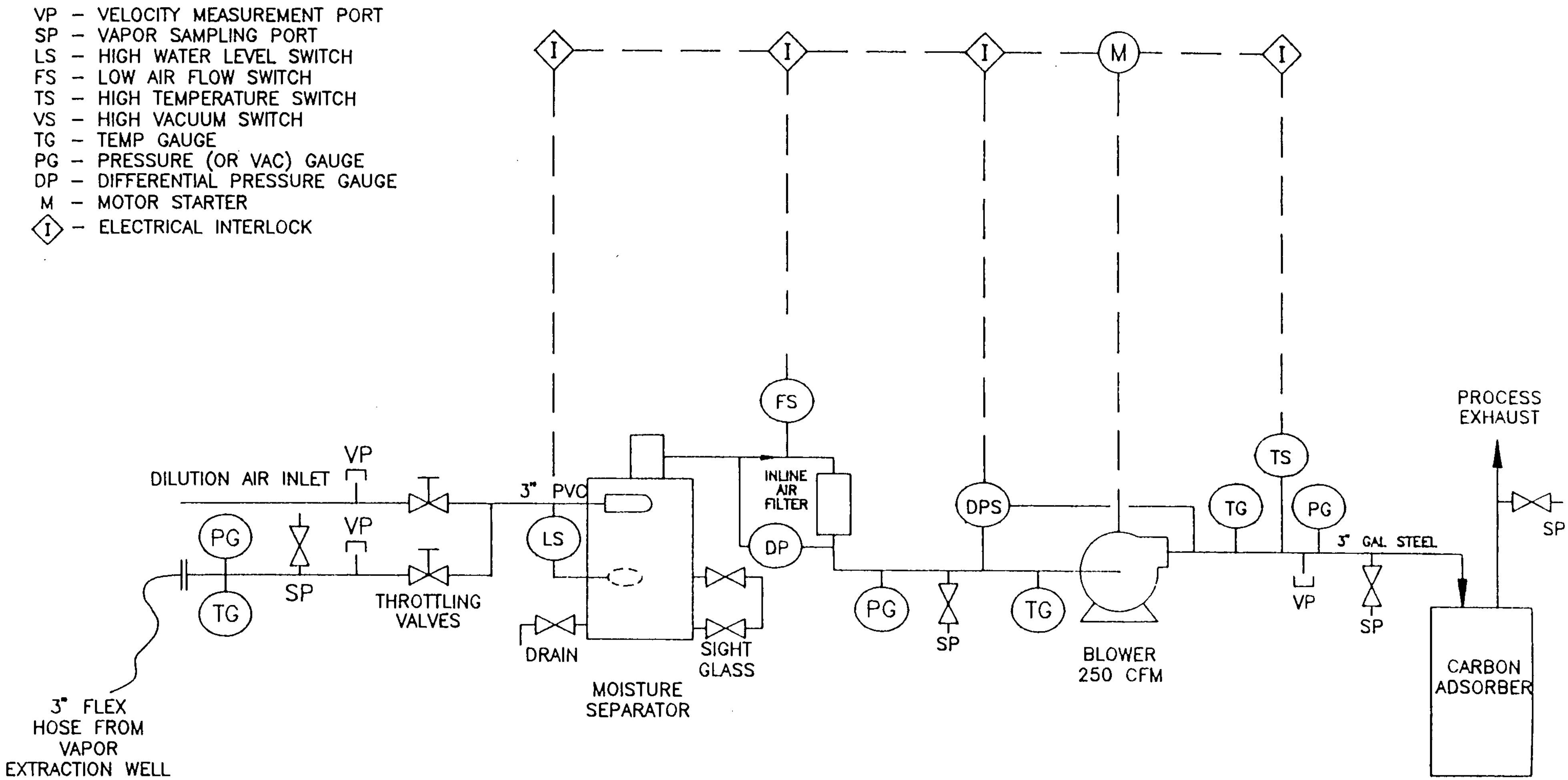
The blower housing, impeller and cover are constructed of spark-proof die-cast aluminum. The blower package includes inlet and outlet internal muffling, (keeping the noise level within OSHA standards), and a direct drive 10 HP explosion-proof motor.

The moisture separator is a high efficiency cyclonic type, designed to remove condensate from the soil gas. It is inherently safe, and includes a drain valve, sight glass, vacuum relief valve and an explosion proof level switch designed to cause a blower shutdown and an alarm to sound at high liquid levels in the moisture separator. A small peristaltic pump can be used to remove liquid from the moisture separator without interrupting the vacuum extraction process.

The in-line filter removes particulates from the air stream to protect the blower. The filter element is easily replaced, if necessary. A differential pressure gauge is provided on the inlet and outlet of the filter to indicate if it needs to be replaced.

The control panel includes the following: motor starter, transformer, alarm shutdown relays, alarm (audio and indicator light), alarm silence and reset, main disconnect, start/stop push buttons, and remote start/stop push buttons on a 25-foot cord. The control panel can be configured to accept either a 240 volt or 480 volt, 3 phase, 60 Hz power supply. The panel housing is a NEMA 4 enclosure.

FIGURE 2
VAPOR EXTRACTION PILOT UNIT FLOW DIAGRAM



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Environmental Resources Management
ERM

The interconnecting piping, instrumentation and controls are illustrated on Figure 2. The following alarm/shutdowns are included: high liquid level in moisture separator, low air flow (due to blower failure or a blockage), high differential pressure across blower, high discharge air temperature, and motor overload. The control switches are explosion proof and are configured to protect the blower from permanent damage. These controls prevent a minor, temporary malfunction from causing a major setback in performing the pilot tests.

Various instruments are provided to monitor operating conditions. These instruments include several vacuum, pressure and temperature gauges. A change in readings alerts the operator of a potential problem. Sample ports are provided to allow for easy gas sampling from either the inlet soil gas (before mixing with dilution air), or at the blower outlet. A gas sample pump with a flow meter is available to obtain gas samples.

Throttling valves are provided on the soil gas inlet piping and the dilution valve inlet piping. These allow control of the total air flow by increasing the back pressure on the blower, and/or by varying the ratio of soil gas to dilution (atmospheric) air. Flow measurement ports are provided in the piping on the soil gas inlet, dilution air inlet, and blower discharge. Flow rates were determined using an air velocity meter.

The soil gas inlet piping is connected to the extraction well, with flexible hose. The dilution air inlet draws in atmospheric air through slotted polyvinyl chloride (PVC) pipe.

The blower discharge is connected to a vapor phase carbon adsorption system, situated adjacent to the vapor extraction unit, to treat the extracted gases prior to release to the atmosphere. The carbon system consists of two drums, each containing 200 pounds of activated carbon with a flow capacity of 100 cfm connected in-series. The purpose of the second drum is to provide back-up emission control if there is contaminant breakthrough in the first drum.

The outlet of the carbon system is discharged to the atmosphere through a 10 foot high stack, and the discharge piping includes sample ports for discharge air monitoring, both after the first carbon drum and at the discharge.

2.4 *TESTING PROCEDURES*

The portable soil vapor extraction unit was used to withdraw subsurface vapor via the pilot extraction well. During system startup, the following were continuously monitored while adjusting the soil vapor and dilution air throttling valves:

- soil vapor flow rate,
- dilution air flow rate,
- applied vacuum, and
- explosive level at the blower discharge.

This information was immediately evaluated to select a range of soil vapor flow rates and vacuums to be applied. An applied vacuum was then set, and the system allowed to operate to reach a steady state condition. During the test run, the following were monitored:

- soil vapor flow rate,
- dilution air flow rate,
- applied vacuum at extraction well,
- vacuum response at each vapor observation well, and

- vapor characteristics at the blower discharge and carbon discharge.

After a steady state condition had been established (or reasonably close to steady state), the next condition was applied. For several of the operating conditions, an air sample of the blower exhaust was collected for laboratory analysis.

Two different types of sampling and analysis protocols were used; EPA Method T0-14 and NIOSH 1003. For the NIOSH method, the sample gas (blower exhaust) is drawn through the tube at a constant rate, using a sample pump and a flow meter. The sample flow rate and sample time is used to calculate the sample volume drawn through the tube. The tube media is then analyzed in the laboratory to determine the mass of contaminants in the tube. Once the mass of contaminants and sample volume is known, the concentration can be calculated. For Method T0-14, a summa canister is used. The laboratory provided summa canister is an evacuated steel container, at a vacuum of about 23 inches mercury. The sample gas is drawn into the canister by simply opening a valve and allowing the sample to flow into the evacuated canister. The laboratory measures the vacuum within the canister before and after the sampling to determine the sample volume drawn into the canister and can then determine the VOC concentrations in the sample.

The sample gas is taken from the blower exhaust, which includes a combination of atmospheric air (dilution air) and soil vapor. The flow rate of both dilution air and soil vapor are measured and used to calculate the dilution factor, which is the ratio of blower exhaust air flow rate to soil vapor air flow rate. The VOC concentration in the blower exhaust is then multiplied by the dilution factor to determine the VOC concentration in the soil vapor.

2.5 *WELL LOCATION AND DESCRIPTION*

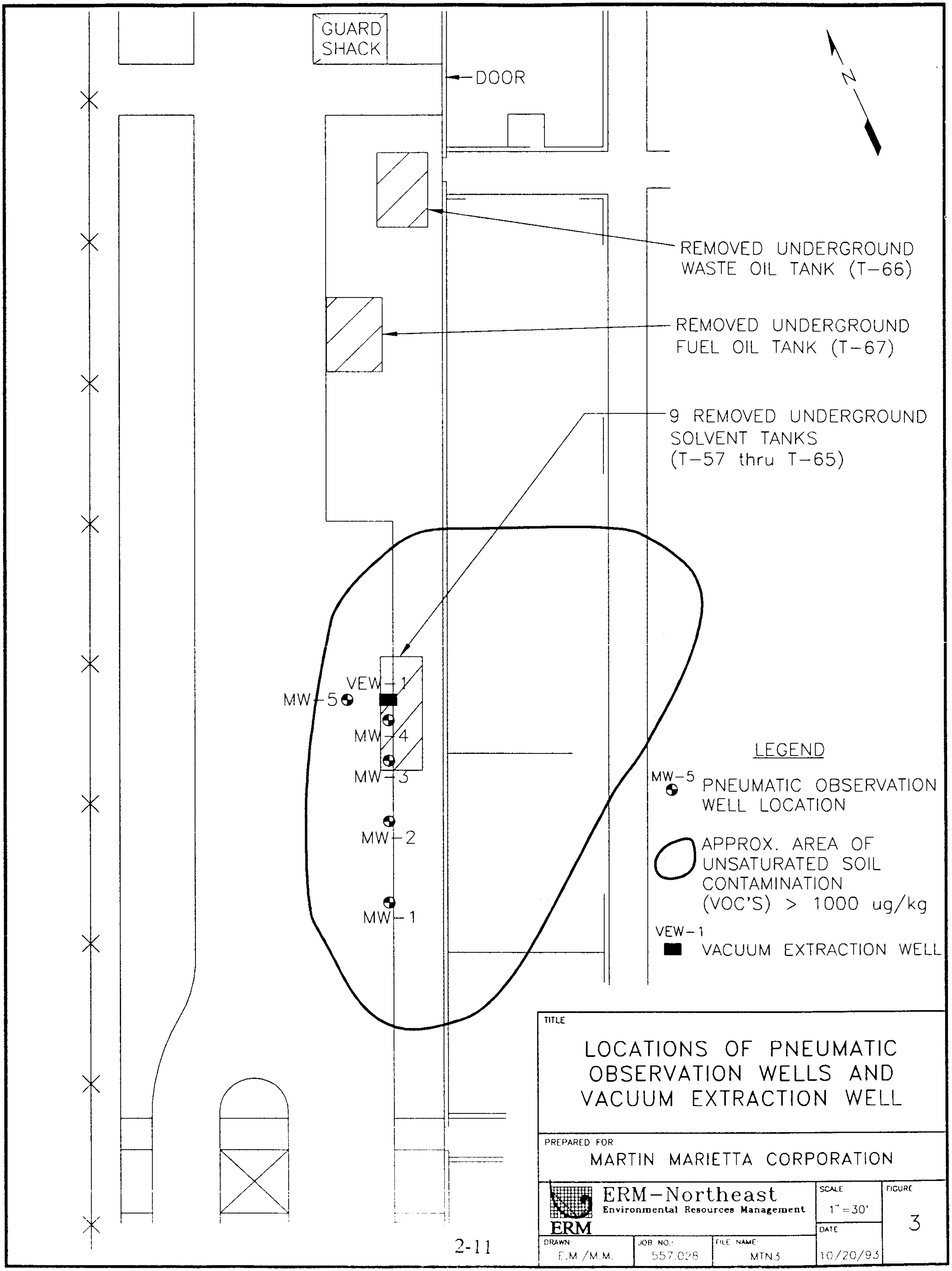
One vacuum extraction well and five pneumatic observation wells were installed for the vapor extraction pilot testing. The vacuum extraction well was installed at the location where the highest concentration of VOC's were detected.

The pilot test was conducted on a newly installed vacuum extraction well, designated as VEW-1. The well was installed by Empire Soils Investigations, Inc. The vacuum extraction well was constructed with four-inch diameter stainless steel, with 12 feet of 0.020 inch slotted screen and 3 feet of riser. The well is installed at a depth of 15 feet below the ground surface, approximately 5 feet into saturated material and has 2 feet of stick up above the ground surface. The annular space was filled with No. 3 sand pack to 2.5 feet below the ground surface. A bentonite pellet seal was placed above the gravel pack to the ground surface, and hydrated.

Five vapor observation wells were installed for the purpose of measuring the subsurface vacuum response to vapor extraction. The wells were installed with a hand driven sub-soil probe. The vapor observation wells were constructed of one inch diameter PVC with five feet of 0.010 inch slotted screen. A bentonite seal was also installed at the ground surface. The five wells were fitted with a cap and brass valve to allow vacuums to be measured with a hand held vacuum gauge. The radial distance and direction of each observation well from the vacuum extraction well (VEW-1), as well as the screen interval data, are presented in Table 2. The locations of the vapor observation wells and vacuum extraction well are illustrated on Figure 3.

TABLE 2
MARTIN MARIETTA CORPORATION
FARRELL ROAD PLANT
SOIL VENTING PILOT TEST
LOCATION AND DESCRIPTION OF PNEUMATIC OBSERVATION WELLS

Well No.	Distance From VEW-1	Screen Interval (Feet)	Depth To Water (Feet)	Saturated Screen Length (Feet)	Unsaturated Screen Length (Feet)
MW-1	50 feet south	3.10 - 8.10	>8.10	0	5.00
MW-2	30 feet south	3.50 - 8.50	>8.50	0	5.00
MW-3	15 feet south	3.00 - 8.00	>8.00	0	5.00
MW-4	5 feet south	3.00 - 8.00	>8.00	0	5.00
MW-5	10 feet west	3.00 - 8.00	>8.00	0	5.00


GUARD SHACK
DOOR
N
REMOVED UNDERGROUND WASTE OIL TANK (T-66)
REMOVED UNDERGROUND FUEL OIL TANK (T-67)
9 REMOVED UNDERGROUND SOLVENT TANKS (T-57 thru T-65)
VEW-1
MW-5
MW-4
MW-3
MW-2
MW-1
LEGEND
MW-5 PNEUMATIC OBSERVATION WELL LOCATION
APPROX. AREA OF UNSATURATED SOIL CONTAMINATION (VOC'S) > 1000 ug/kg
VEW-1 VACUUM EXTRACTION WELL
TITLE
LOCATIONS OF PNEUMATIC OBSERVATION WELLS AND VACUUM EXTRACTION WELL
PREPARED FOR
MARTIN MARIETTA CORPORATION
ERM-Northeast
Environmental Resources Management
ERM
SCALE 1" = 30'
FIGURE 3
DATE 10/20/93
DRAWN: E.M./M.M.
JOB NO.: 557.028
FILE NAME: MTN3

3.0 *SOIL VAPOR EXTRACTION PILOT STUDY RESULTS*

3.1 *PNEUMATIC CONDITIONS*

Soil vapor extraction tests were conducted for two days on 27 July 1993 and 28 July 1993. The first day of testing was performed to provide a variety of data for several operating conditions. The second day of testing was utilized to obtain data for optimum conditions based on review of day one observations.

The soil vapor extraction field data for the pilot test is summarized in Table 3. As shown in Table 3, a total of four different testing conditions were evaluated. All of the four conditions were run with a surface seal consisting of 10 millimeter thickness plastic sheeting held in place by ten-foot lengths of 4" x 4" timbers and sandbags. The vacuum applied to the vacuum extraction well was varied between 36 and 58 inches water column. The resulting soil vapor flow rate varied from 3.68 to 7.37 cfm. Figure 4 shows a plot of applied vacuum versus resulting soil vapor flow. Figure 4 illustrates how the flow rate increases as the applied vacuum increases.

The vacuum response at the observation wells was affected by the distance of the observation well from extraction well, and by the vacuum applied to the extraction well. Figure 5 presents the site plan with the vacuum response data at the observation wells for each test condition. As expected, the vacuum response in each well increased with increases in the vacuum applied to the extraction well. Also as expected, the vacuum response is greatest in the wells closest to the extraction well and decreases as the distance from the extraction wells increases. Both of these trends are demonstrated in Figure 6 which shows a plot of vacuum response versus distance from the extraction well, for each of the four conditions.

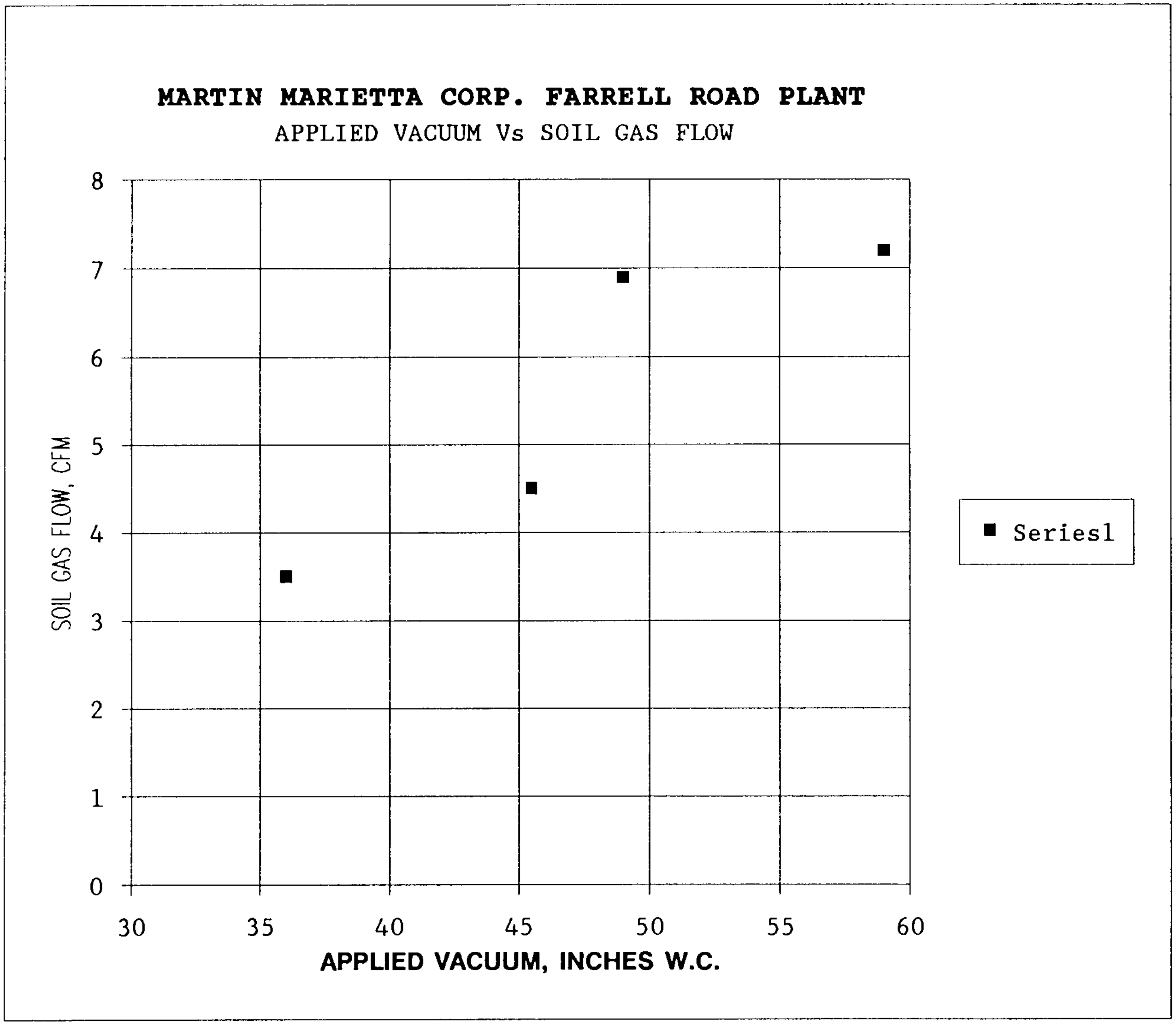
TABLE 3

SOIL VAPOR EXTRACTION PILOT TEST DATA MARTIN MARIETTA CORPORATION - FARRELL ROAD PLANT				
Condition Number	1	2	3	4
Start: Date	7/27/93	7/27/93	7/27/93	7/28/93
Time	1:00 p.m.	2:30 p.m.	4:15 p.m.	8:30 a.m.
Stop: Date	7/27/93	7/27/93	7/27/93	7/28/93
Time	2:00 p.m.	3:45 p.m.	5:15 p.m.	10:30 a.m.
Soil Gas Flow, CFM	4.91	7.36	3.68	7.37
Blower Exhaust Temp., ºF	160	170	150	150
Dilution Air Flow, CFM	294.6	245.40	255.32	270.05
Total Flow, CFM	299.51	252.76	259.0	277.42
Dilution Factor	61	34	70	38
Surface Seal Status	ON	ON	ON	ON
Vacuum Response, IN. W.C.				
VEW-1	46	58	36	47
MW-1	0.02	0.02	0.02	0.01
MW-2	0.04	0.06	0.05	0.08
MW-3	0.18	0.22	0.15	0.22
MW-4	1.9	2.8	2.0	3.0
MW-5	0.20	0.30	0.19	0.30
VOC Concentration, PPM				
Blower Outlet	144	209	109	236
Soil Vapor	8784	7106	7630	8968
Weather Conditions				
Temperature(ºF)	71	71	71	80
Relative Humidity(%)	93	93	93	57
Barometer	29.79 ↓	29.79 ↓	29.79 ↓	29.84 ↓
Winds (mph)	south 10	south 10	south 10	south 13

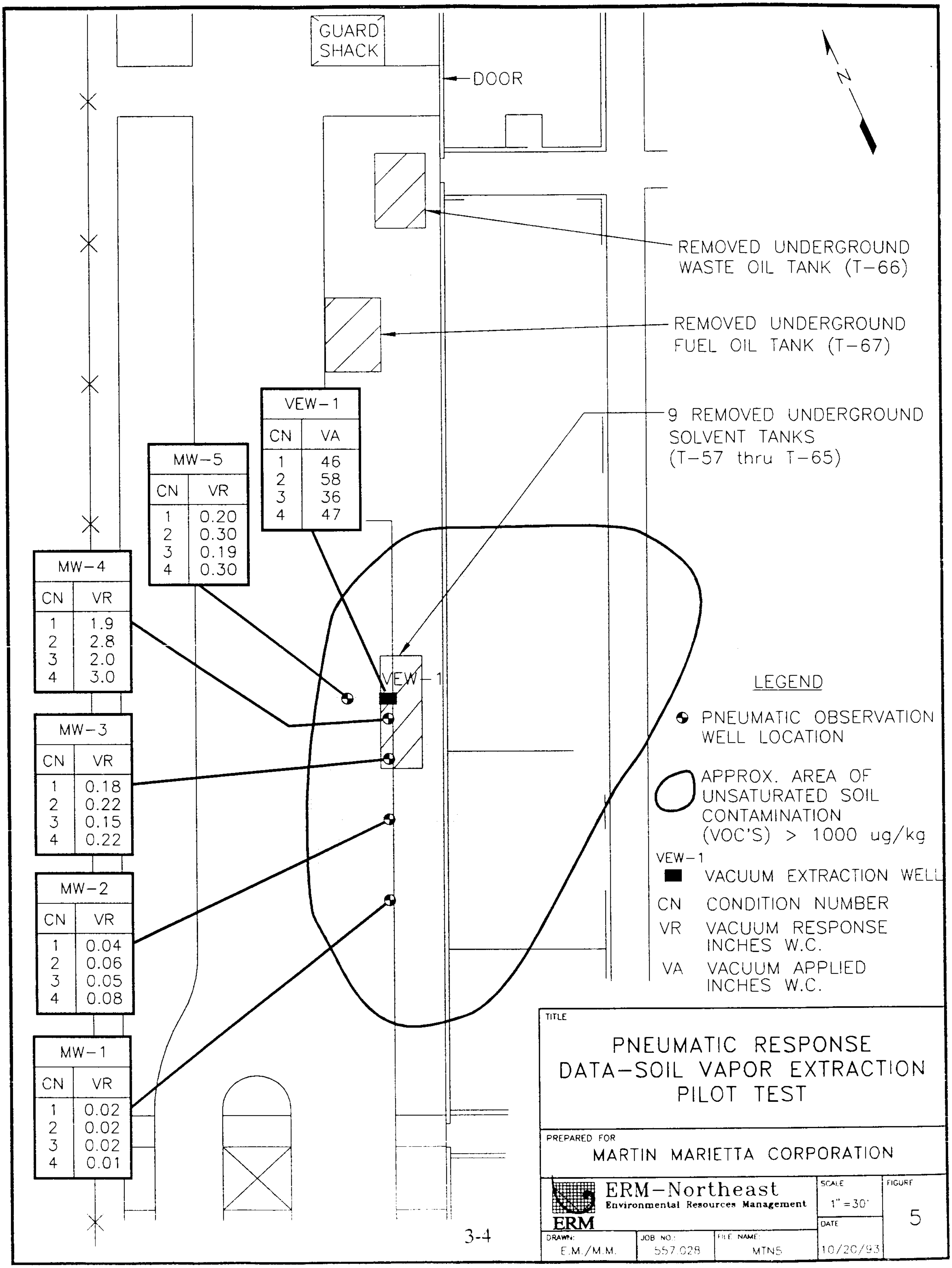
Note: Vacuum response values are based on conditions near the end of the test run.

557.028\task1\table3.tbl

Figure 4



MARTIN MARIETTA CORP. FARRELL ROAD PLANT
APPLIED VACUUM Vs SOIL GAS FLOW
SOIL GAS FLOW, CFM
0
1
2
3
4
5
6
7
8
30
35
40
45
50
55
60
APPLIED VACUUM, INCHES W.C.
Series1



VEW-1

CN	VA
1	46
2	58
3	36
4	47

MW-5

CN	VR
1	0.20
2	0.30
3	0.19
4	0.30

MW-4

CN	VR
1	1.9
2	2.8
3	2.0
4	3.0

MW-3

CN	VR
1	0.18
2	0.22
3	0.15
4	0.22

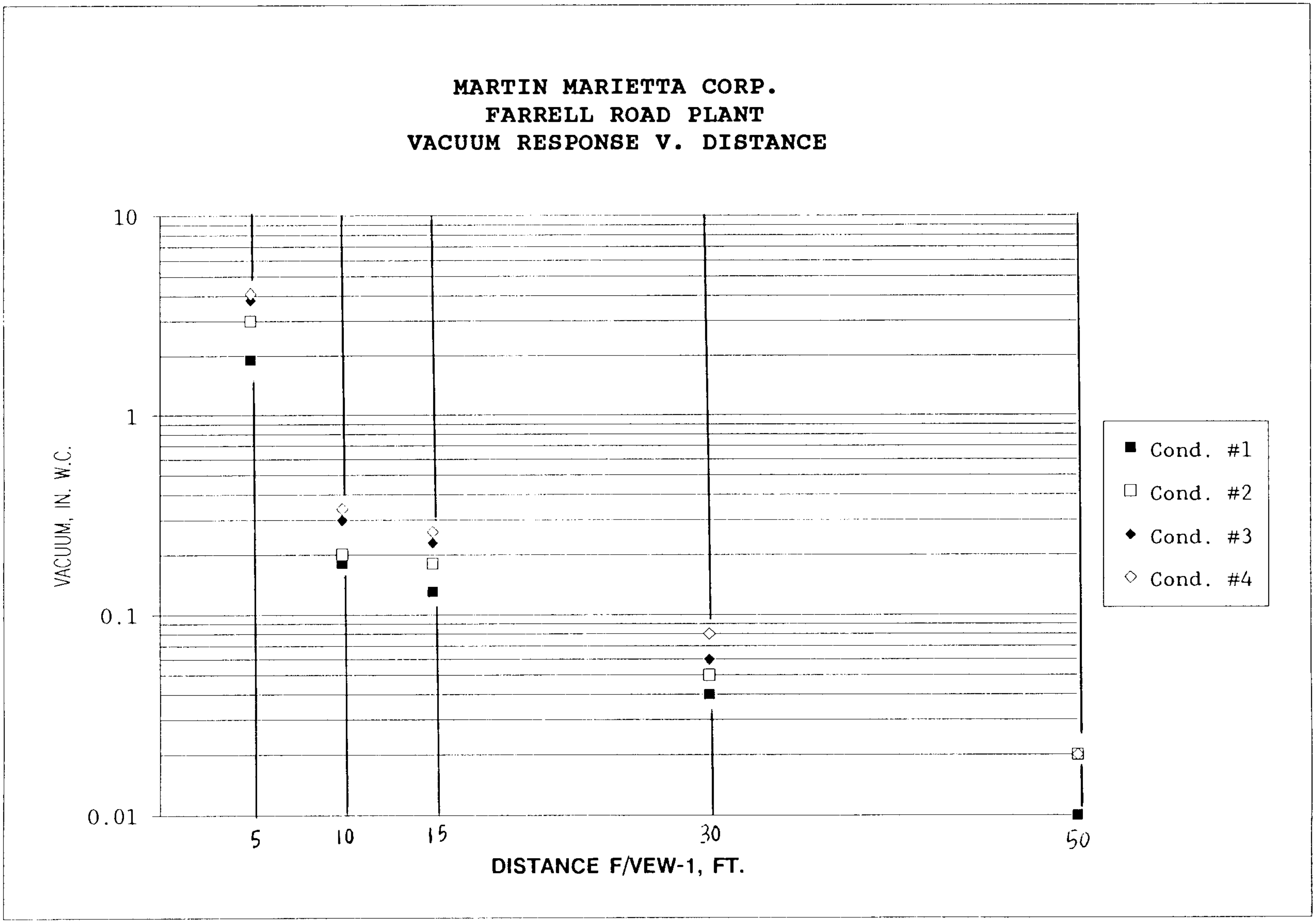
MW-2

CN	VR
1	0.04
2	0.06
3	0.05
4	0.08

MW-1

CN	VR
1	0.02
2	0.02
3	0.02
4	0.01

Figure 6

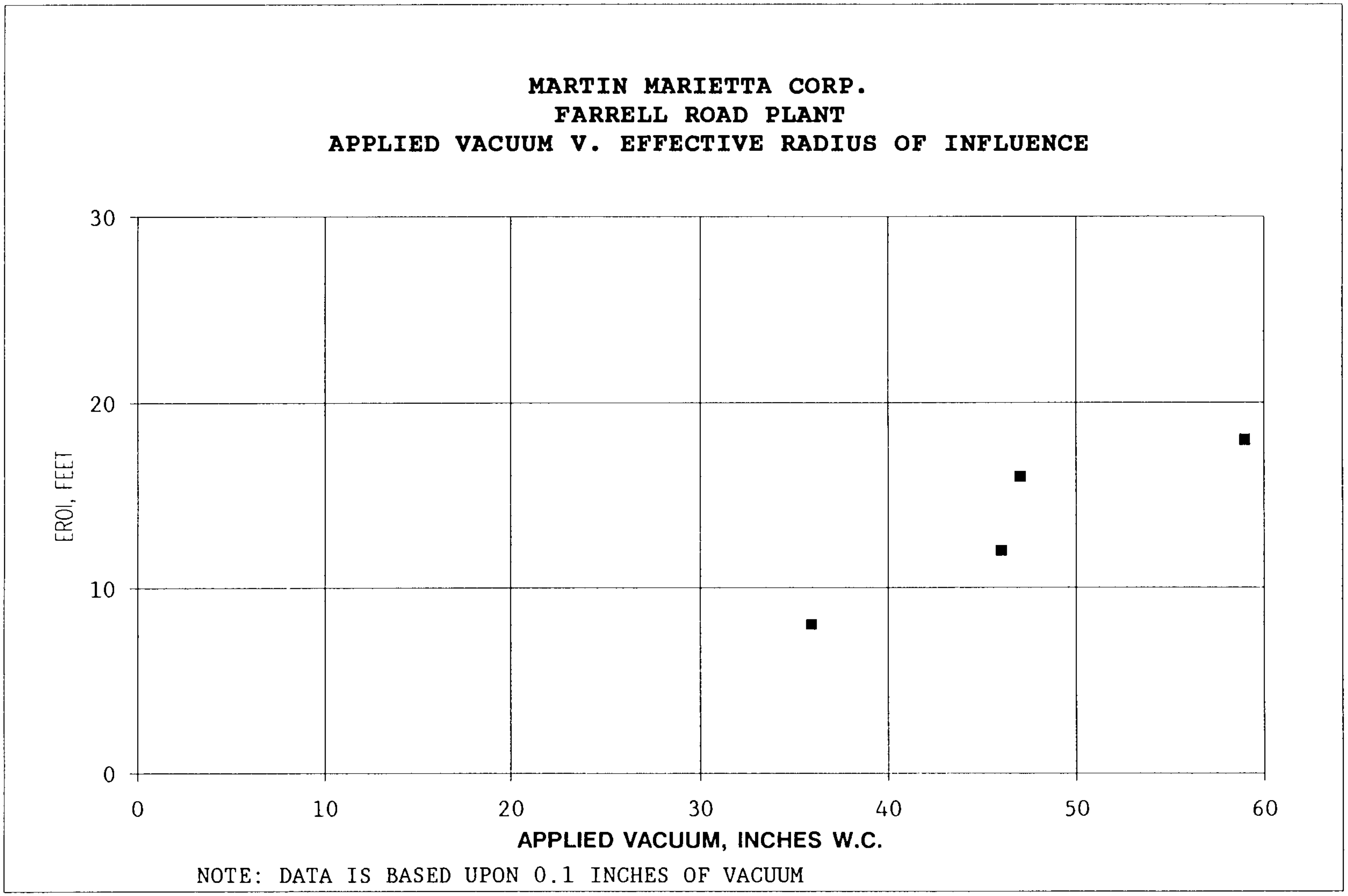

MARTIN MARIETTA CORP.
FARRELL ROAD PLANT
VACUUM RESPONSE V. DISTANCE
10
1
0.1
0.01
VACUUM, IN. W.C.
5
10
15
30
50
DISTANCE F/VEW-1, FT.
Cond. #1
Cond. #2
Cond. #3
Cond. #4

With the exception of observation well VW-4, the semi-log plot of vacuum (log scale) versus distance from the extraction well is linear. The vacuum response for VW-4 is greater then expected based on the data from the other wells. Using the data from observation wells MW-1, MW-2, MW-3 and MW-5 and linear regression analysis, the distance from the extraction well at which the vacuum response is equal to 0.1 inches water can be determined for each run. As discussed earlier, this distance represents the effective radius of influence (EROI). This has been done and the EROI has been determined for each run. A plot of EROI versus applied vacuum is presented in Figure 7. This plot shows how the EROI increases with increasing applied vacuum but then levels off at the higher vacuums. A curve has been drawn through the data points in Figure 7 which can be used to estimate the EROI for any applied vacuum. From the plot, it appears that the optimum applied vacuum is 50 inches water column, (W.C.) which would result in an EROI of 20 feet.

For establishing a design basis for the full-scale soil vapor extraction system, a margin of safety should be applied. It is therefore recommended that an applied vacuum of 50 inches W.C. be used as the design basis with an EROI of 20 feet. From Figure 4, at 50 inches W.C. the expected soil vapor flow rate is approximately 7.0 scfm, although for condition 3, the flow rate was measured at 7.37 cfm at 48 inches W.C. To be conservative, the design soil vapor flow rate (to be used for sizing the emission control system) is 10 scfm per well. The pneumatic design basis is summarized below:

Vacuum Applied to each Extraction Well	50 inches W.C.
Soil Vapor Flow Rate per Well	10 scfm
Effective Radius of Influence	20 feet

Figure 7


MARTIN MARIETTA CORP.
FARRELL ROAD PLANT
APPLIED VACUUM V. EFFECTIVE RADIUS OF INFLUENCE
30
20
10
0
EROI, FEET
0
10
20
30
40
50
60
APPLIED VACUUM, INCHES W.C.
NOTE: DATA IS BASED UPON 0.1 INCHES OF VACUUM

3.2 *SOIL VAPOR CHARACTERISTICS*

The laboratory analytical results of the soil vapor samples are presented in Table 4. As previously discussed, two types of analytical methods were used, EPA Method TO-14 and NIOSH 1003. The following is a summary of information related to the air sampling.

Sample ID	Condition	Pump On (minutes)	Flowrate (ℓ/min)	Volume (ℓ)
MMCS1	Background	13	0.15	1.95
MMCS2	1	14	0.15	2.10
MMCS3	2	14	0.15	2.10
MMCS4A	3	15	0.15	2.25
SUMMA 0002	2	---	---	---

As shown in Table 4, five soil vapor samples were analyzed, each at a different operating condition, including a background condition. The results of samples MMCS2, MMCS3 and MMCS4A were used to calculate the average contaminant concentration to be used for the design basis. As shown in Table 4, the average total VOC concentration is 5272 ppm, the majority of which consists of toluene (2247 ppm), xylenes (994 ppm) and 1,1,1-trichloroethane (1627 ppm).

TABLE 4
MARTIN MARIETTA CORPORATION
FARRELL ROAD PLANT
SOIL VAPOR EXTRACTION ANALYTICAL RESULTS

			CONDITION									
		Background	1	1*	2	2*	3	3*	2	2*		
Code	Compound	MMCS1 (ppm)	MMCS2 (ppm)	(ppm)	MMCS3 (ppm)	(ppm)	MMCS4A (ppm)	(ppm)	SUMMA 0002 (ppm)	(ppm)	Average Design Condition (ppm)	lbs/hr
0856	n-octane	7.2	ND<0.92	56	ND<0.92	31	ND<0.86	60	ND	0	49	0.08
0859	toluene	2100.	41.	2501	65.	2210	29.	2030	15.	510	2247	3.53
0860	ethylbenzene	140.	3.3	201	6.2	211	2.9	203	1.5	51	205	0.32
0861	xylenes	730.	15.	915	32.	1088	14.	980	6.8	231	994	1.56
0869	methylethyl ketone	10.	ND<1.6	98	ND<1.6	54	ND<1.5	105	ND	0	86	0.14
0883	1.1-dichloroethane	19.	ND<1.2	73	ND<1.2	41	ND<1.1	77	ND	0	64	0.10
0885	1.1.1-trichloroethane	1700.	32.	1952	45.	1530	20.	1400	25.	850	1627	2.56
	Total	76.976.20	91.3	5796	148.2	5165	65.9	4855	48.3	1642	5272	8.29

Notes:
1. * Data with dilution factors accounted for.
2. The average design condition is based on condition 1 (MMCS2), condition 2 (MMCS3) and condition 3 (MMCS4A) data.
3. ND (Non-detectable) indicates that the contaminant was below the detection limit of the analytical method.
4. The numbers included in the total line indicate the total for contaminants that were detected.

CONDITION	DILUTION FACTOR
1	61
2	34
3	70
2	34

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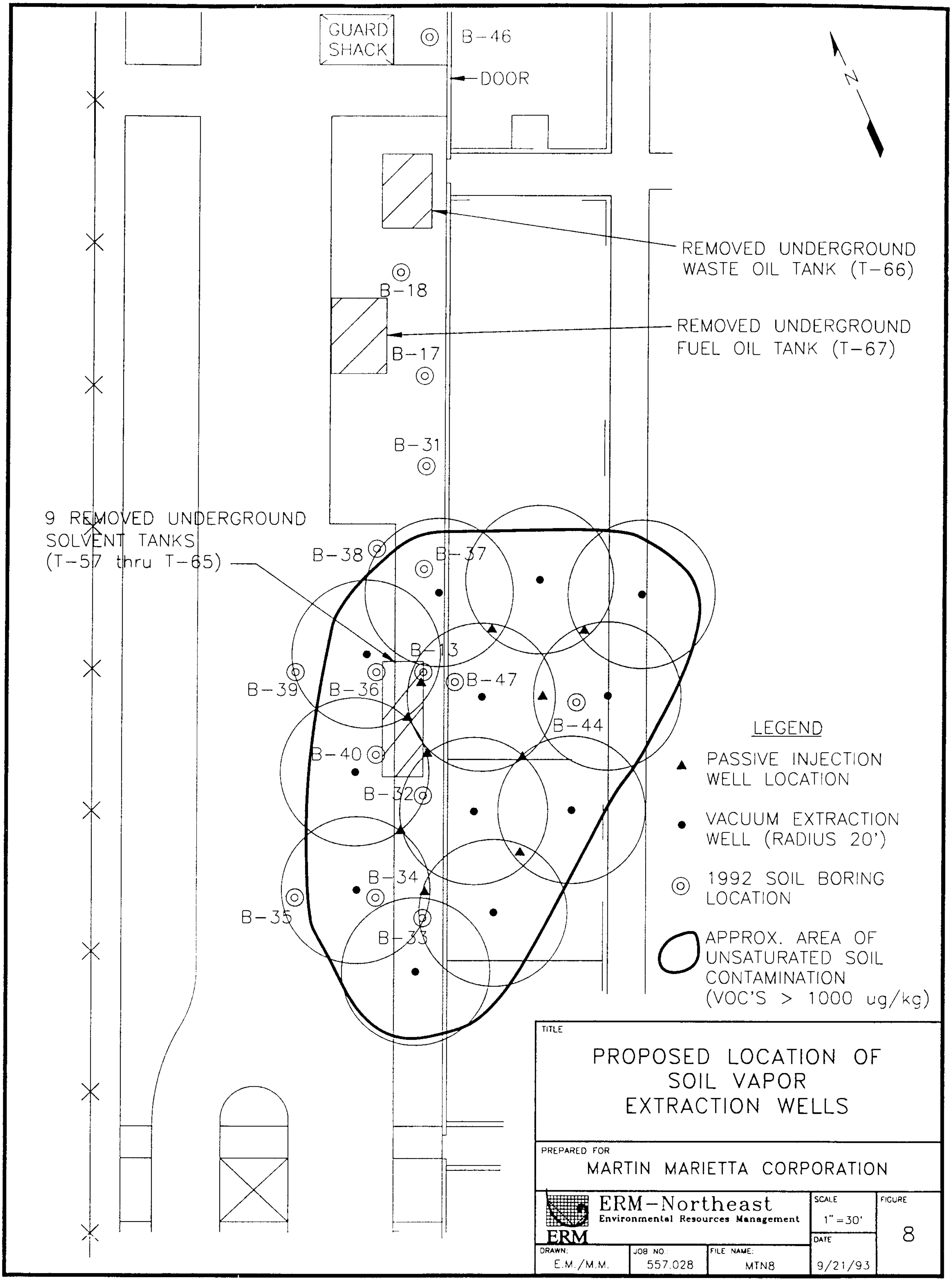
4.0 CONCEPT DESIGN

To effectively remediate the unsaturated contaminated soil near the old solvent storage tank, the extraction wells must be spaced such that the EROI of the extraction wells completely encompass the contaminated area. To do this, a total of twelve extraction wells are needed as shown on Figure 8, which shows the proposed locations of these extraction wells. A 20 foot EROI has been drawn around each extraction well and the EROI of the twelve wells completely encompass the contaminated soils. Seven passive injection wells are also proposed, as shown on Figure 8, to prevent a dead space in between the extraction wells. The results of the pilot study indicate a consistent pneumatic response with the surface seal in place. It is therefore recommended that a surface seal be used in the full scale design.

At a design flow of 10 cfm per well, the total soil vapor flow rate is 100 cfm. The required vacuum at the extraction wells is 50 inches W.C. To account for pressure drops across piping, valves, fittings, the moisture knockout drum and particulate filter, and necessity for dilution air, it is recommended that the vacuum blower be sized for a minimum of 200 cfm at 50 inches W.C. vacuum.

The design soil vapor characteristics are shown in Table 4. This table includes the pounds per hour of each contaminant in the extracted soil vapor at a flow rate of 100 cfm. The total VOC mass removal rate is 8.29 pounds per hour, for a monthly mass removal of 6000 lbs. The use of carbon for emission controls is not feasible due to a high carbon usage rate. For air emission controls, a thermal oxidizer is recommended.


GUARD SHACK
B-46
DOOR
N
REMOVED UNDERGROUND WASTE OIL TANK (T-66)
B-18
REMOVED UNDERGROUND FUEL OIL TANK (T-67)
B-17
B-31
9 REMOVED UNDERGROUND SOLVENT TANKS (T-57 thru T-65)
B-38
B-37
B-13
B-39
B-36
B-47
B-44
B-40
B-32
B-34
B-35
B-33
LEGEND
PASSIVE INJECTION WELL LOCATION
VACUUM EXTRACTION WELL (RADIUS 20')
1992 SOIL BORING LOCATION
APPROX. AREA OF UNSATURATED SOIL CONTAMINATION (VOC'S > 1000 ug/kg)
TITLE
PROPOSED LOCATION OF SOIL VAPOR EXTRACTION WELLS
PREPARED FOR
MARTIN MARIETTA CORPORATION
ERM-Northeast
Environmental Resources Management
ERM
SCALE
1"=30'
FIGURE
8
DATE
9/21/93
DRAWN:
E.M./M.M.
JOB NO.
557.028
FILE NAME:
MTN8

APPENDIX B

SOIL VAPOR EXTRACTION

EQUIPMENT LIST AND DESIGN DRAWINGS

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
FE-2001	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 4" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 200 SCFM @ 70" H2O col.
FE-2011	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2021	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2031	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2041	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2051	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2061	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
FE-2071	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2081	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2091	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2101	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2111	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-2121	PID-2	Dwyer Instrument Inc. DS-200 Series	Flow Element - averaging pitot type - 3/8" dia. 316 sta stl sensor tube for insertion into 1 1/2" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 10 SCFM @ 70" H2O col.
FE-3001	PID-3	Dwyer Instrument Inc. DS-200 Series	Flow element - averaging pitot type - 3/8" dia. 316 st stl sensor tube for insertion into a 4" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 200 SCFM @ 80" H2O col.

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
FE-3002	PID-3	Dwyer Instrument Inc. DS-200 Series	Flow element - averaging pitot type - 3/8" dia. 316 st stl sensor tube for insertion into an 8" dia. pipe - (2) gage conn shutoff valves - with 3/8" tube x 1/2" MNPT Parker CPI compression fitting for packing gland. 200 SCFM @ 20 PSIG.
FI-2001	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 200 SCFM @ 70" H2O col. w/ CFM scale.
FI-2011	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2021	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2031	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2041	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2051	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2061	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
FI-2071	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2081	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2091	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2101	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2111	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-2121	PID-2	Dwyer Instrument Inc. Model 2000	Flow indicator - diaphragm actuated magnehelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or flush mounted. 10 SCFM @ 70" H2O col. w/ CFM scale.
FI-3001	PID-3	Dwyer Instrument Inc. Model 4100	Flow indicator - diaphragm actuated capsuhelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or surface mounted. 200 SCFM @ 80" H2O col.
FI-3002	PID-3	Dwyer Instrument Inc. Model 42XX	Flow indicator - diaphragm actuated capsuhelic differential press gage - 5" dia. die cast alum. - 1/4" NPT connections - panel or surface mounted. 200 SCFM @ 20 PSIA, with CFM scale.
GMP-301	PID-3	Conservative CP Gas Co.Rochester 3610-00001 Supplied by Equipment Vender with PB-301	Gas Monitoring Panel : Low Level Indication.

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
LAL-3003	PID-3	See Electrical Drawings	Level alarm low - autodialer
LIC-3001	PID-3	Supplied by Equipment Vendor with VSM-501	Level indicating controller
LSHH-3001	PID-3	Supplied by Equipment Vendor with VSM-301	Level switch high high
OA-3001	PID-3	See Electrical Drawings	System alarm (autodialer).
OA-3011	PID-3	See Electrical Drawings	System alarm (autodialer).
PB-301	PID-3	Conservative LP Gas Company TANK No. 420 MG	420 LB. fuel capacity with manifold.
PI-2011	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2021	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2031	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2041	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2051	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2061	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2071	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.

EQUIPMENT LIST
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
VAPOR EXTRACTION AND TREATMENT SYSTEM
SYRACUSE, NEW YORK

Instrument Tag Number	P&ID Number	Manufacturer/Vendor and Model Number	Description
PI-2081	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2091	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2101	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2111	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
PI-2121	PID-2	Ashcroft 25-1009-AW-02L	Vacuum indicator - Polished Stainless Steel type - 1/4" NPT bottom connected - 2-1/2" dia. - bronze bourdon tube. 80" H2O Full Scale.
VEM-301	PID-3	J.E. Gasho & Assoc. Inc. SVE Blower Package	200 CFM @ 70" H2O, 7.5 HP blower with ryton non-sparking coating, skid, filter, silencer, vac., press., temp. swithes, relief valve, NEMA 4 panel.
VSM-301	PID-3	J.E. Gasho & Assoc., Inc. Moisture Separator MS-180	40 Gal. cap., 12 gauge carbon steel, coelescer, site tube, drain.
VTM-301	PID-3	Thermtech Inc. Model VAC 25 CL	Thermal Unit, 200 CFM w/ 99% Destruction, Trailer mounted with exhaust stack extension.

CONTRACT DRAWINGS
VAPOR RECOVERY AND TREATMENT SYSTEM
MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
SYRACUSE, NY

SITE LOCATION MAP
SCALE: 1" = 2000'

DRAWING LIST

DRAWING NUMBER	DRAWING TITLE
	STRUCTURAL
S-1	TREATMENT BUILDING, CONCRETE FOUNDATION, SECTIONS AND DETAILS
	EQUIPMENT ARRANGEMENT
EA-1	EQUIPMENT ARRANGEMENT PLAN VIEW & DETAILS

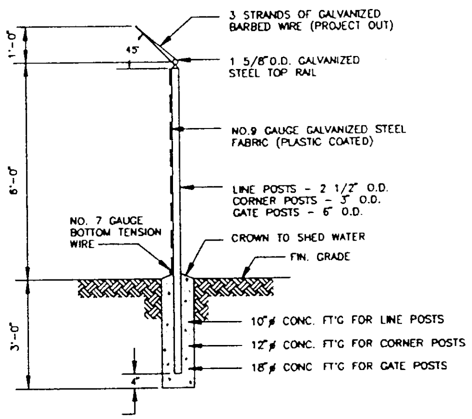
DRAWING NUMBER	DRAWING TITLE
	PIPING & INSTRUMENTATION DIAGRAMS
PID-1	SYMBOLS & LEGEND P & I DIAGRAM
PID-2	SOIL VAPOR EXTRACTION AND PASSIVE AIR INJECTION WELLS P & I DIAGRAM
PID-3	VAPOR EXTRACTION & TREATMENT P & I DIAGRAM
	PIPING
P-1	VAPOR EXTRACTION WELL PIPING PLAN & MISC. PIPING/CIVIL DETAILS

MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT
SYRACUSE, NY

ERM-Northeast
Environmental Resources Management

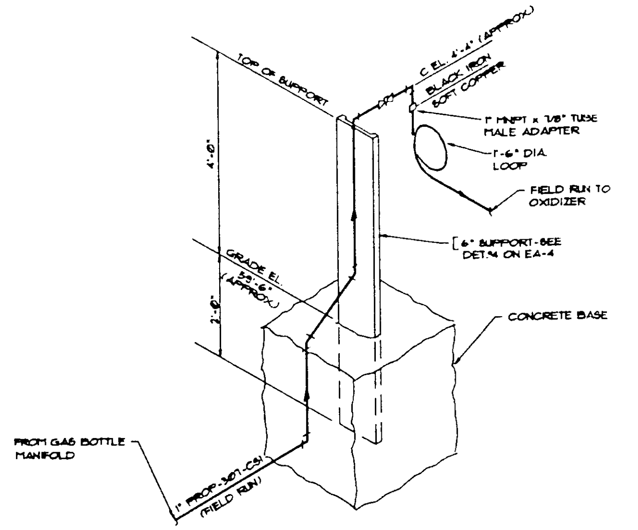
TITLE SHEET

DRAWN: SP/MLM
DATE: OCT. 7, 1993
FILE NAME: MMTITLE



TYPICAL FENCE DETAIL

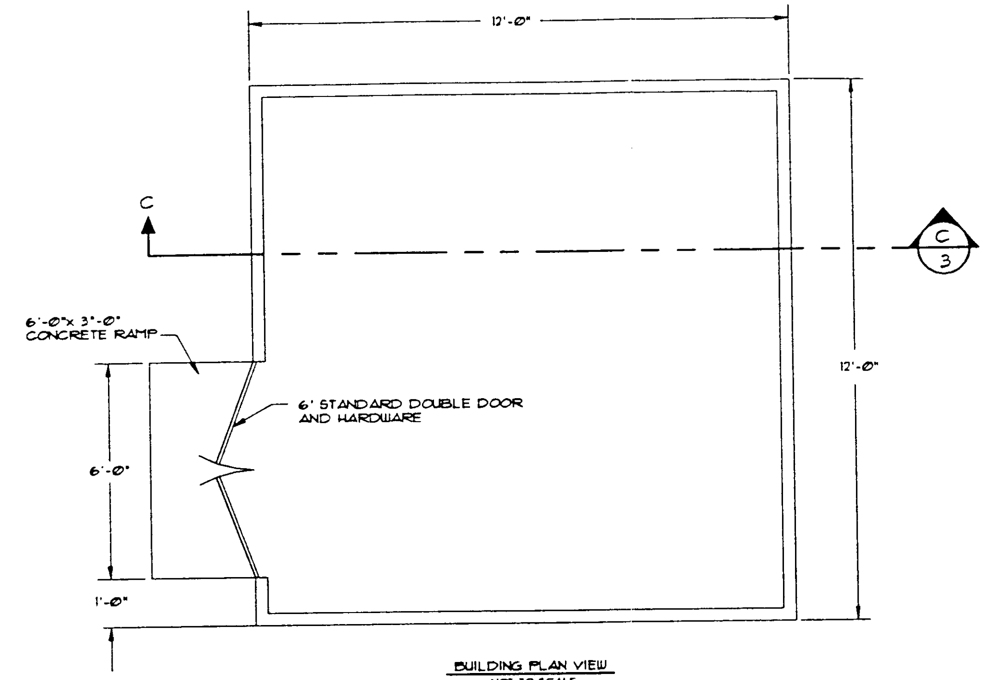
NO SCALE



VIEW "X-X"

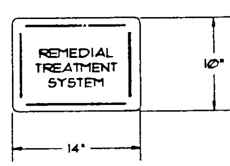
SCALE: NONE

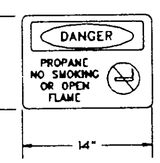
(SEE DETAIL NO.4 ON DWG. EA-1)



BUILDING PLAN VIEW

NOT TO SCALE



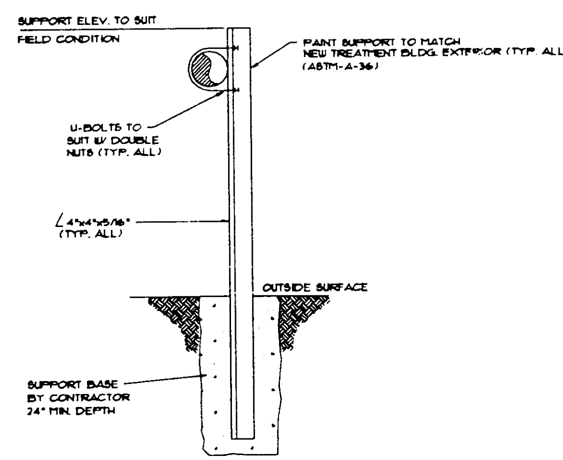


DETAIL #3
SCALE: NONE
(2) REQ'D TO BE PLACED ON FENCE AREA

.04" THK ALUMINUM
WHITE BACKGROUND
GREEN LETTERING
SETON NAME PLATE CORP
STYLE "BEC" (OR EQUAL)

DETAIL #4
SCALE: NONE
(3) REQ'D TO BE PLACED ON FENCE AREA

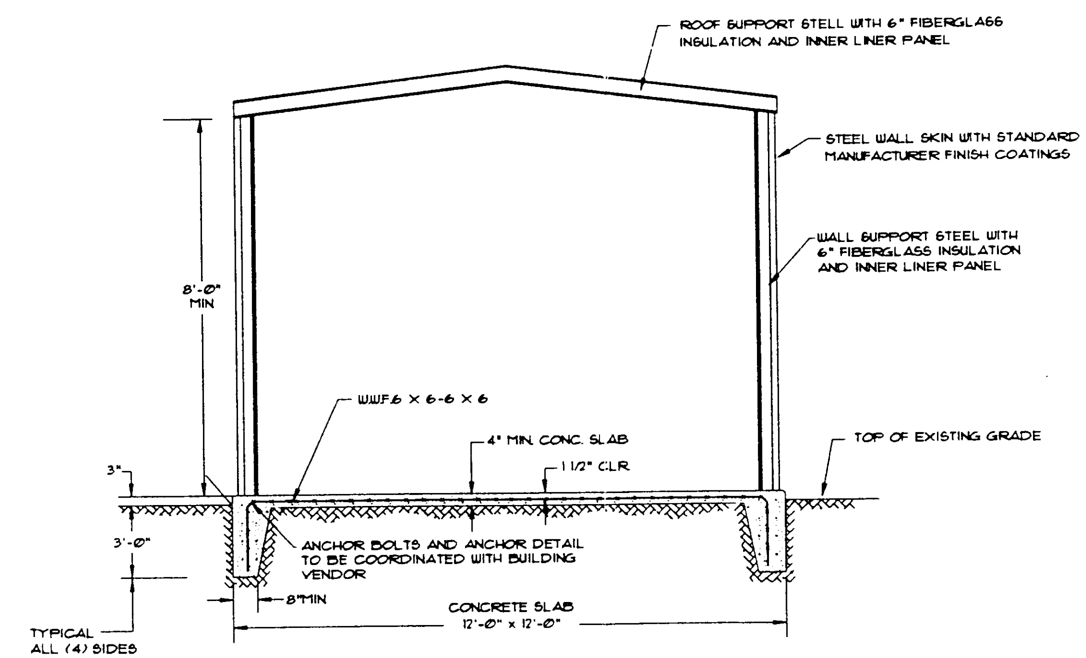
METAL BACKED PLASTIC
WHITE BACKGROUND
RED & BLACK LOGO
AND LETTERING
SETON NAME PLATE CORP
STYLE "BMB" #391 (OR EQUAL)



SUPPORT DETAIL "A"

TYP. ALL OUTSIDE SUPPORT UNLESS SPECIFIED OTHER

SCALE: NONE



SECTION C-C 3

NOT TO SCALE

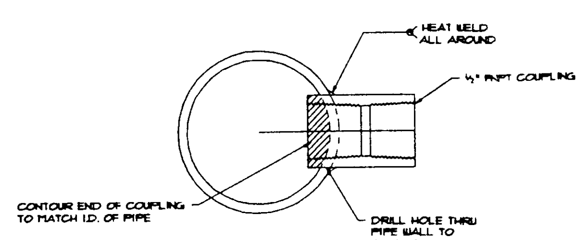
GENERAL NOTE

CONCRETE

1. THE DESIGN, DETAILING & PLACEMENT OF REINFORCED CONCRETE SHALL BE DONE IN ACCORDANCE WITH 1984 ACI-318 & ACI-315 BUILDING CODES. (BUILDING CODE REQUIREMENTS FOR REINFORCED CONC.)
2. THE REINFORCING STEEL SHALL CONFORM TO A.S.T.M. -A-615GRADE 60
3. THE CONCRETE SHALL DEVELOP MINIMUM COMPRESSIVE STRENGTH OF f'c = 4,000 P.S.I AT 28 DAYS.
4. CHAMFER ALL EXPOSED CONC. EDGES (ONE) 1" INCH
5. DO NOT POUR CONCRETE ON MUDDY OR FROZEN GROUND.
6. CONCRETE MIX AT POINT OF PLACEMENT SHALL BE AT TEMPERATURE LESS THAN 85 F. IN EXTREME HOT-WEATHER USE CRUSHED ICE (RELACKING WATER POUND FOR POUND). MOISTEN AGGREGATES WITH COLD WATER (A.C.I. 305-72). IN COLD WEATHER CONC. MIX SHALL BE AT MINIMUM TEMPERATURE OF 50 F. OR OVER
7. THE FRESHLY DEPOSITED CONCRETE SURFACES SHALL BE KEPT CONTINUOUSLY WET FOR AT LEAST (3) DAYS IN ORDER TO AVOID SURFACE PLASTIC CRACKING. USE WET BURLAP BAGS. (OR EQUAL). A.S.T.M. C-309
8. ADD POLYPROPYLENE FIBRILLATED FIBER (70,000 P.S.I.) INTO CONC. MIX TO REDUCE PLASTIC CONC. SHRINKAGE. (SUGGESTED 1.5 LBS. OF FIBER/C.Y. OF CONCRETE)
9. PLACE 6 MIL POLYETHYLENE FILM UNDER CONCRETE WHEREVER POSSIBLE.

SOIL:

10. THE ENTIRE SOIL AREA UNDER CONC. PAD SHALL BE UNIFORMLY WELL COMPACTED TO 95% MIMINUM DENSITY AT OPTIMUM CONTENT AS PER MODIFIED PROCTOR TEST. (A.S.T.M. D-698.) MINIMUM ALLOWABLE SOIL BEARING = 3,000 P.S.F.



DETAIL "X"

SCALE: NONE

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

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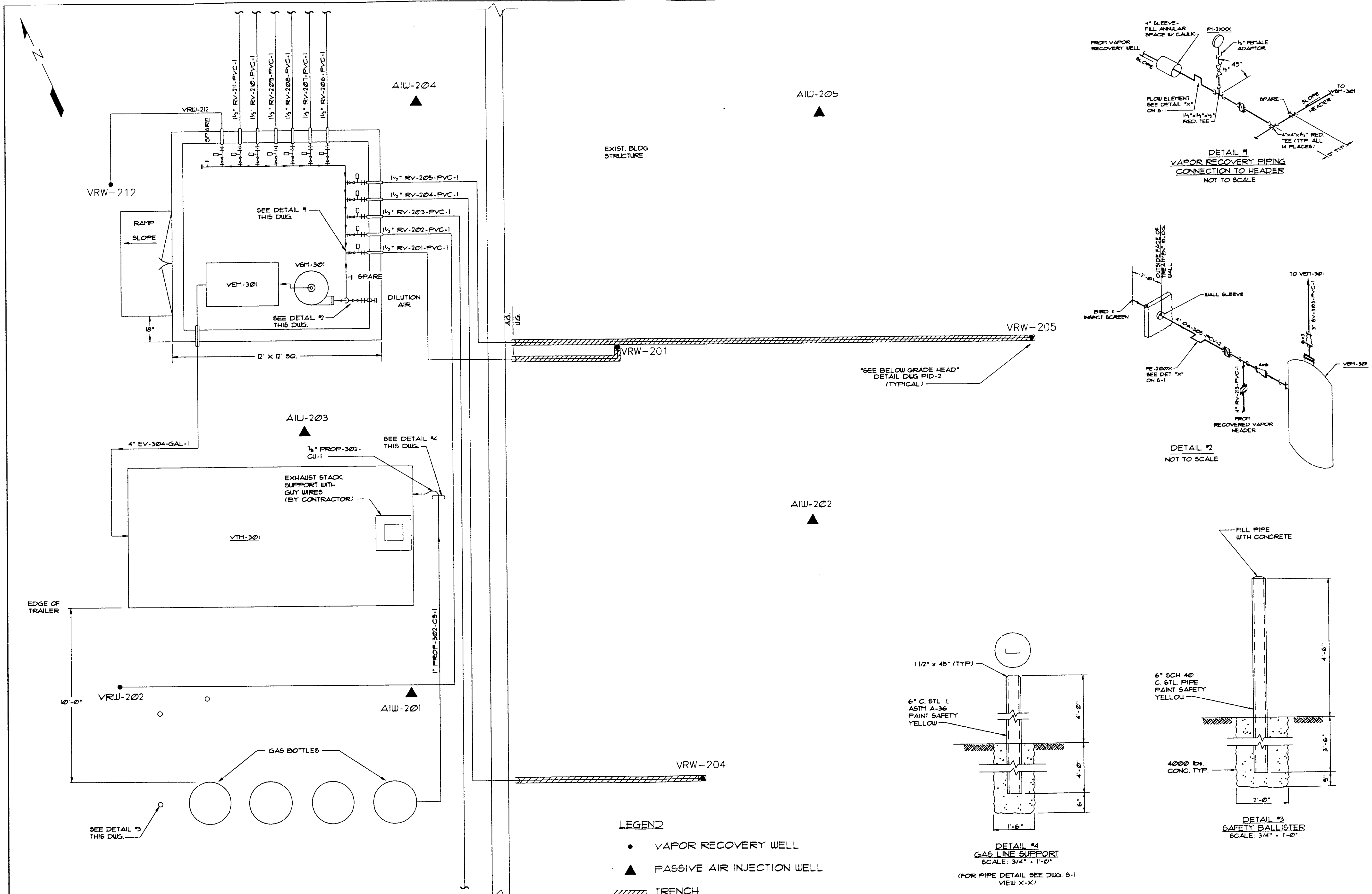
TREATMENT BUILDING, CONCRETE FOUNDATION, SECTION AND DETAILS

DRAWN: M.L.M. DATE: OCT 1993

FILE NAME: MARTINS

DRAWING NO. S-1



LEGEND

- ● VAPOR RECOVERY WELL
- ▲ PASSIVE AIR INJECTION WELL
- ▨ TRENCH

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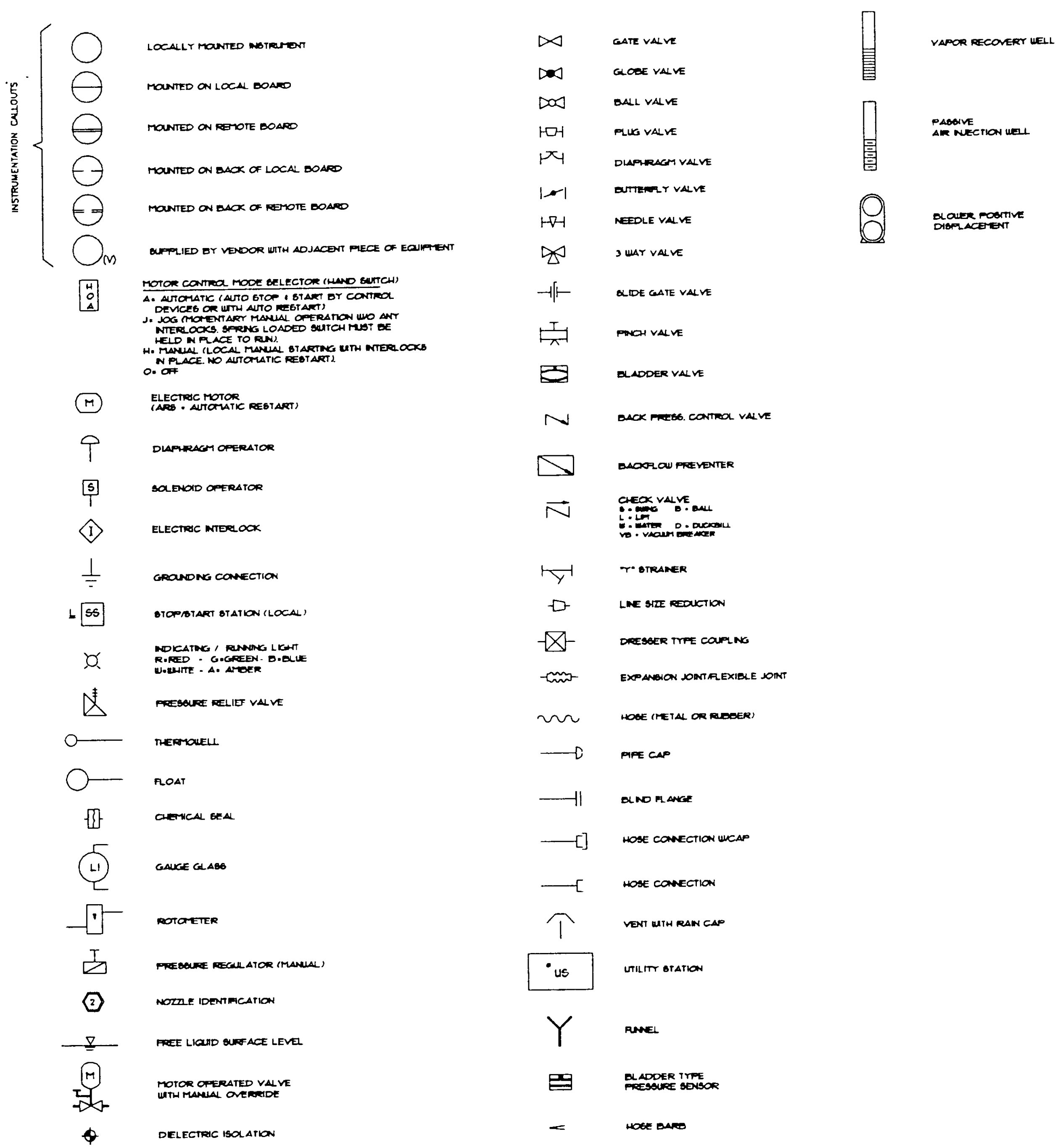
EQUIPMENT ARRANGEMENT PLAN VIEW & DETAILS

EA-1

LEGEND



INSTRUMENT IDENTIFICATION TABLE

ISA S5.1 - TABLE 1 (MODIFIED)

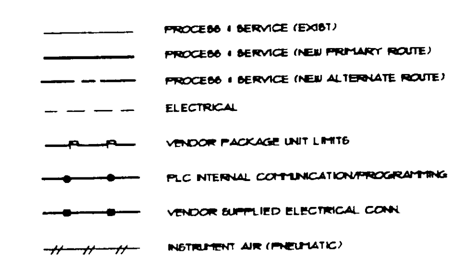
	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME-SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE OR INTERMEDIATE
N					
O	SYSTEM		ORIFICE (RESTRICTION)		
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT	RECORD	
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY			VALVE, DAMPER OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	LEAK DETECTION				
Y	SOLENOID			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	
Δ	DIFFERENTIAL				

PIPELINE USE CODE IDENTIFICATION TABLE

FLOW MEDIUM	CODE	PIPE SPECIFICATION
EFFLUENT (AG)	EFF	PVC-4
EFFLUENT (UG) GRAVITY	EFF	PVC-6
EFFLUENT (UG) PRESSURE	EFF	PVC-7
EVACUATED VAPOR	EV	GAL-1
OUTSIDE AIR	OA	PVC-1
OUTSIDE AIR	OA	PVC-1
PROPANE (AG & UG)	PROP	CS-1
RECOVERED VAPOR (AG)	RV	PVC-2
SERIES FLOW	SF	PVC-4
SEPARATED VAPOR	SV	PVC-2
VAPOR CONDENSATE	VC	CU-3
VENT	VT	PVC-1
VENT	VT	PVC-5
PROPANE (TUBE)	PROP	CU-1

LINE NUMBER DESIGNATION

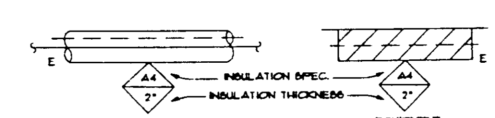
LINE TYPE IDENTIFICATION



ABBREVIATIONS

N.O.	NORMALLY OPEN	A.T.C.	AIR TO CLOSE
N.C.	NORMALLY CLOSED	A.T.O.	AIR TO OPEN
F.O.	FAIL OPEN	S.C.	SAMPLE CONNECTION
F.C.	FAIL CLOSED	S.V.	SAMPLE VALVE
A.R.S.	AUTOMATIC RESTART	C.T.	CONTROL TRANSFORMER
C.S.O.	CAR SEAL OPEN	C.O.	CLEANOUT
C.S.C.	CAR SEAL CLOSED	CH.O.	CHAIN OPERATOR
P.I.V.	POST INDICATING VALVE	F.S.	FIRE SAFE
		V.S.M.	VARIABLE SPEED MOTOR

INSULATION & TRACING DESIGNATION



A4 = MANVILLE MICRO - LOK AP-T
W/0.016" THICK ALUMINUM
JACKET AND POLYKRAFT MOISTURE
BARRIER MANVILLE ZESTON 2000
PVC FITTING COVERS OR APPROVED EQUAL.
PP = PERSONNEL PROTECTION
(INSULATE UP TO 8'-0"
ABOVE FLOOR ETC.)

NOTES:

1. UNLESS OTHERWISE NOTED, ALL VALVES ARE LINE SIZE.
2. EXISTING LINES ARE INDICATED WITH A LIGHTER LINE DENSITY.

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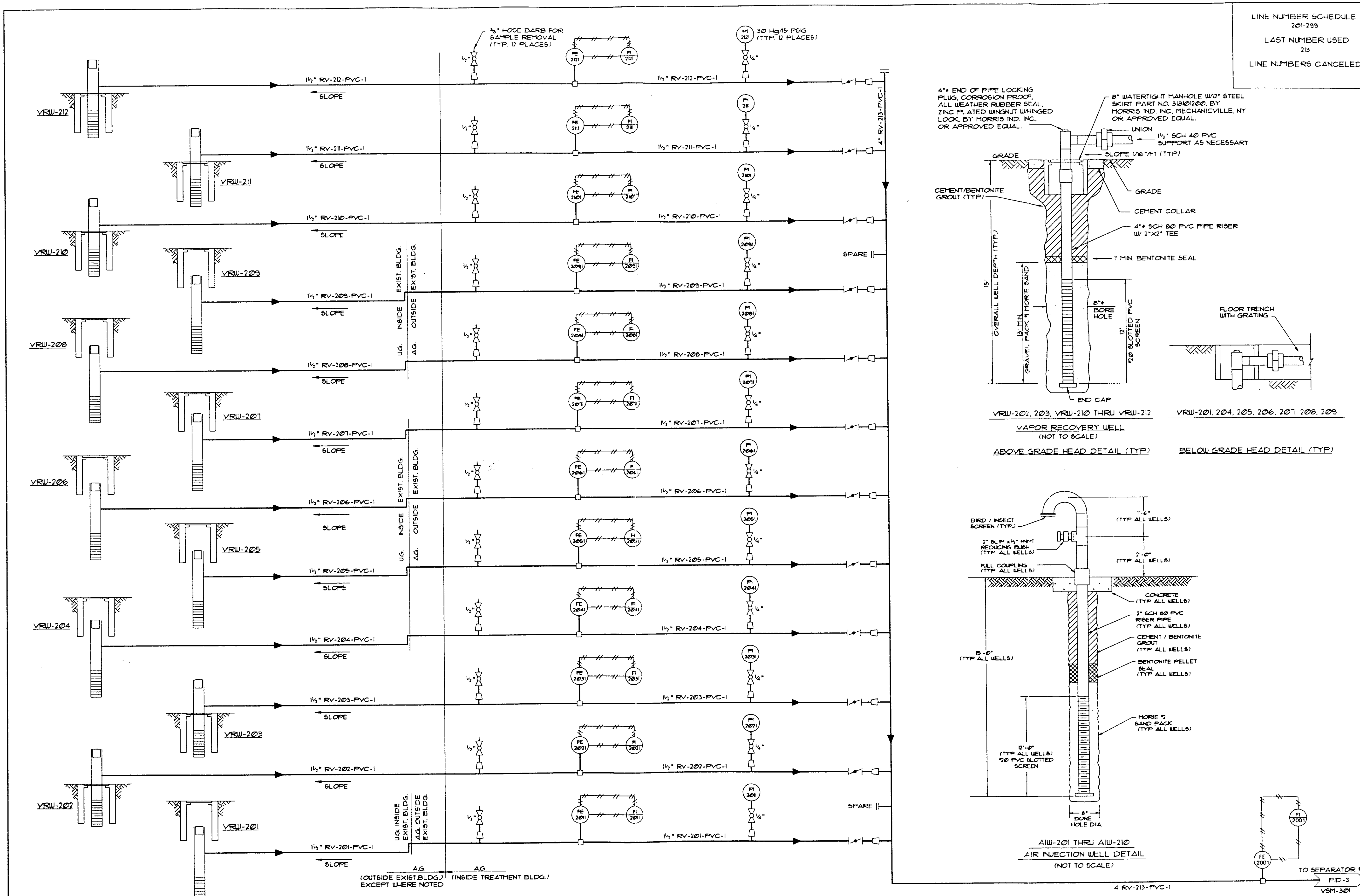
SYMBOLS & LEGENDS
P & I DIAGRAM

DRAWN: EMMLM | DATE: OCT 7, 1993 | SCALE: NONE

DRAWING NO. PID-1



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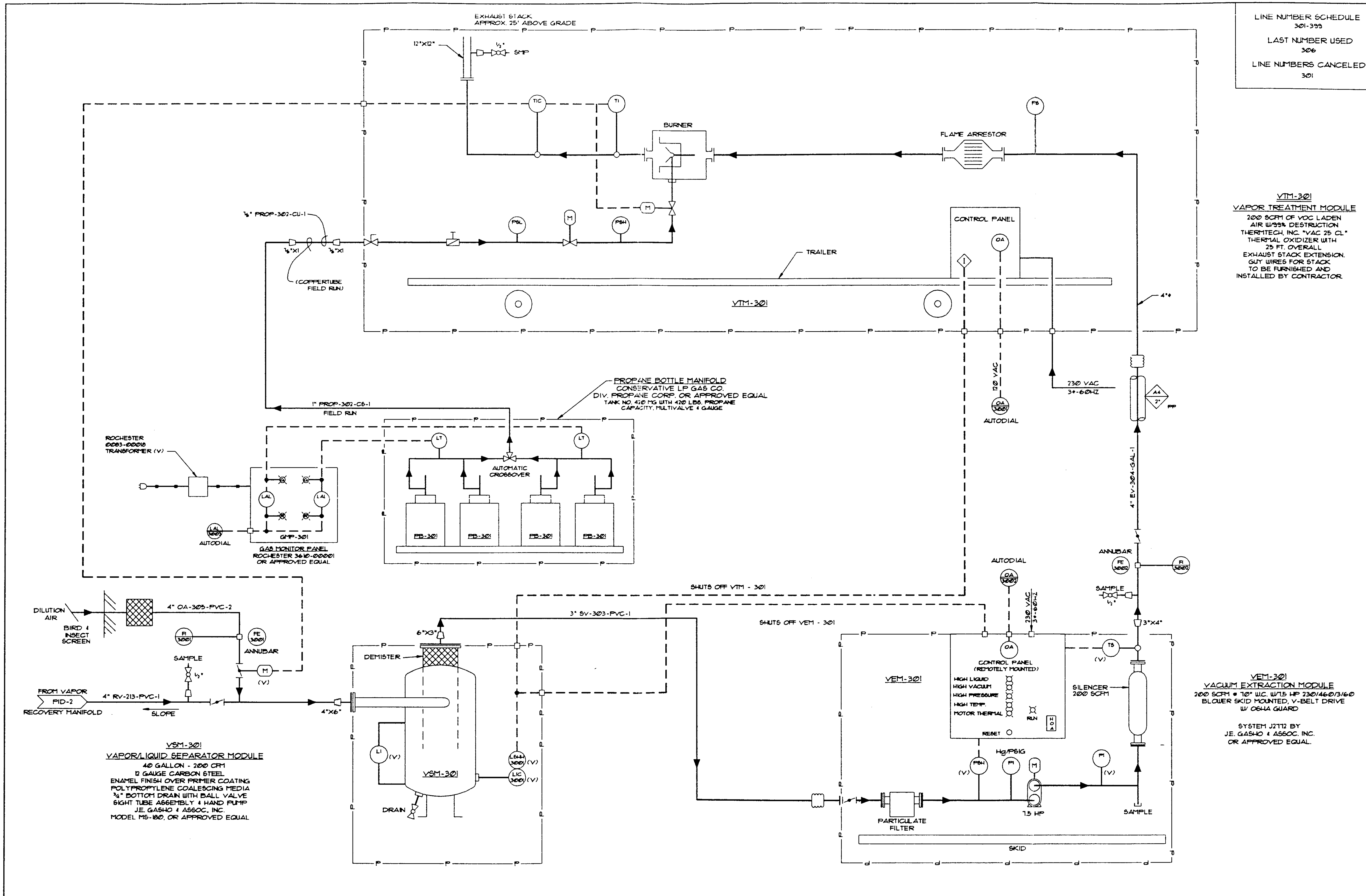
SOIL VAPOR EXTRACTION AND PASSIVE AIR INJECTION WELLS
P & I DIAGRAM

DRAWN	EM/MLM
DATE	OCT 7 1993
SCALE	NONE
JOB NO.	551028.
FILE NAME	PID-2
DRAWING NO.	PID-2
SHEET	0



NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

MARTIN MARIETTA CORPORATION, FARRELL ROAD PLANT

SYRACUSE, NY

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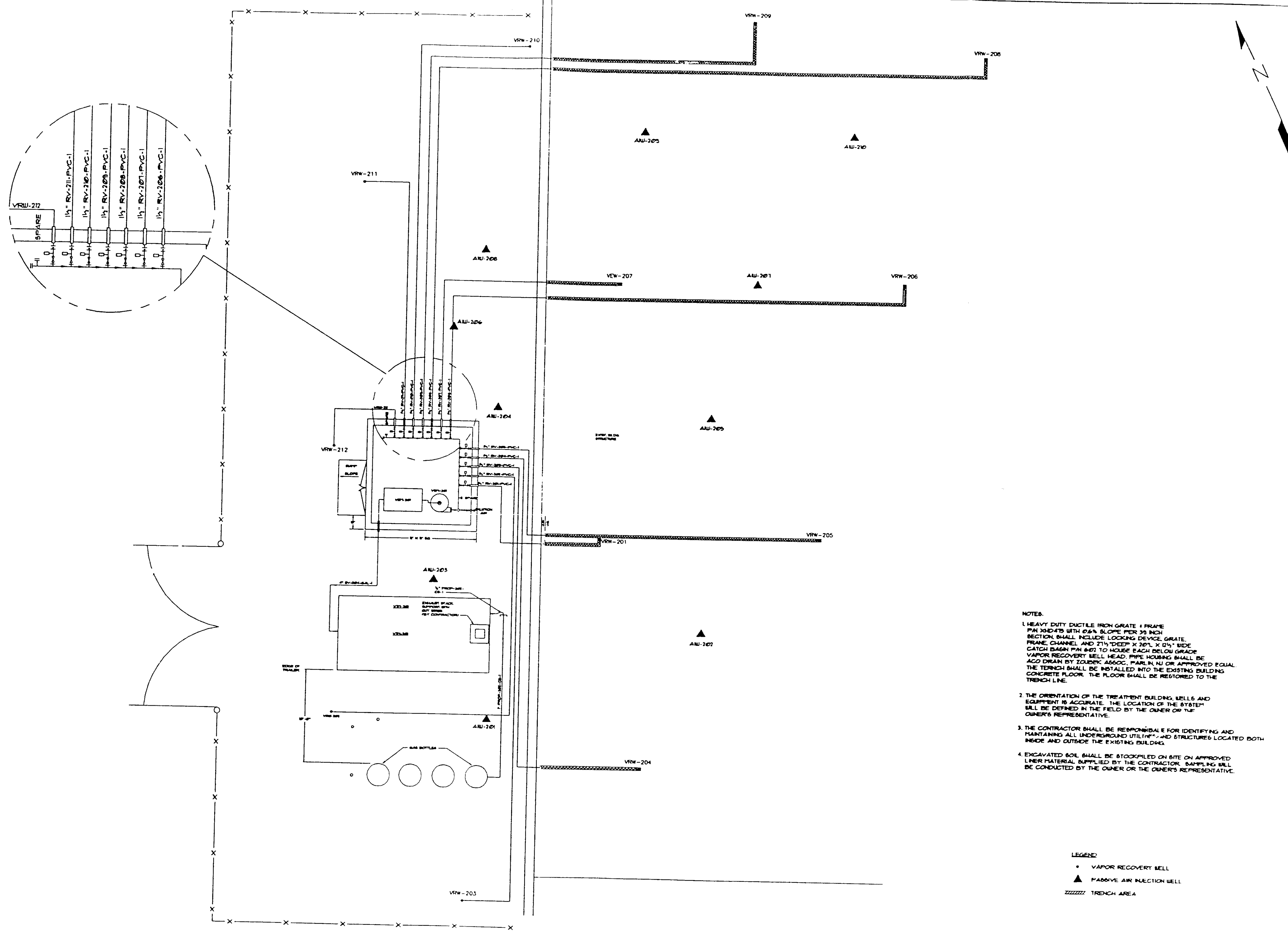
VAPOR EXTRACTION & TREATMENT
P & I DIAGRAM

PID-3

DRAWN: EM/ALM
DATE: OCT 7, 1993
SCALE: NONE
JOB NO.: 3538707
FILE NAME: PID-3



NOTES.

1. HEAVY DUTY DUCTILE IRON GRATE & FRAME P/N XHD475 WITH 0.6% SLOPE PER 39 INCH SECTION, SHALL INCLUDE LOCKING DEVICE, GRATE, FRAME, CHANNEL AND 27½"DEEP X 20"L X 12½" WIDE CATCH BASIN P/N 602 TO HOUSE EACH BELOW GRADE VAPOR RECOVERY WELL HEAD. PIPE HOUSING SHALL BE ACO DRAIN BY ZOUBEK ASSOC., PARLIN, NJ OR APPROVED EQUAL. THE TERNCH SHALL BE INSTALLED INTO THE EXISTING BUILDING CONCRETE FLOOR. THE FLOOR SHALL BE RESTORED TO THE TRENCH LINE.

2. THE ORIENTATION OF THE TREATMENT BUILDING, WELLS AND EQUIPMENT IS ACCURATE. THE LOCATION OF THE SYSTEM WILL BE DEFINED IN THE FIELD BY THE OWNER OR THE OWNER'S REPRESENTATIVE.

3. THE CONTRACTOR SHALL BE RESPONSIBALE FOR IDENTIFYING AND MAINTAINING ALL UNDERGROUND UTILITIES AND STRUCTURES LOCATED BOTH INSIDE AND OUTSIDE THE EXISTING BUILDING.

4. EXCAVATED SOIL SHALL BE STOCKPILED ON SITE ON APPROVED LINER MATERIAL SUPPLIED BY THE CONTRACTOR. SAMPLING WILL BE CONDUCTED BY THE OWNER OR THE OWNER'S REPRESENTATIVE.

LEGEND

- • VAPOR RECOVERY WELL
- ▲ PASSIVE AIR INJECTION WELL
- ////// TRENCH AREA

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VAPOR EXTRACTION WELL PIPING PLAN & MISC PIPING/CIVIL DETAILS

P-1