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COMPLETION REPORT FOR FUEL FARM 216 MULTI-PHASE RECOVERY SYSTEM NAS CORPUS CHRISTI TX

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MORRISON KNUDSEN CORPORATION

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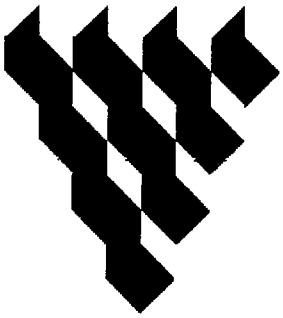


Completion Report
Fuel Farm 216 Multi-Phase Recovery System

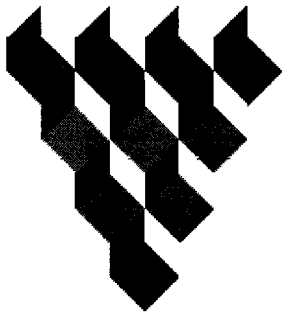
NAS Corpus Christi
Corpus Christi, TX

Unit Identification Code: N 91734
Contract No. N62467-94-D-1106

January 1998

Revision 0

Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina
29419-9010



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COMPLETION REPORT
FUEL FARM 216
MULTI-PHASE RECOVERY SYSTEM

NAVAL AIR STATION, CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

Revision 0

January 29, 1998

CONTRACT N62467-93-D-1106
DELIVERY ORDER #0016
STATEMENT OF WORK #024

Prepared for

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EXECUTIVE SUMMARY

Fuel Farm 216 at Naval Air Station (NAS) Corpus Christi, Corpus Christi, Texas, consisted of thirty-six (36) 25,000 gallon tanks that were constructed in the early 1940s to store aviation fuel for NAS Corpus Christi and two 10,000 gallon tanks to store diesel fuel. Closure of Fuel Farm 216 was completed in November, 1987 under a separate contract. During closure, the two diesel storage tanks were removed from service in 1986 and the 25,000-gallon tanks were abandoned in place and filled with a mixture of sand and cement. The two 10,000 gallon tanks were subsequently removed from the site October 1991. Recovery of free-product and groundwater had been occurring since 1985 via pumping or bailing prior to installation of the multi-phase recovery system (MRS).

Morrison Knudsen Corporation (MK) installed a MRS at Fuel Farm 216 at NAS Corpus Christi. The work was performed for Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) as defined in Delivery Order 16, Statement of Work 24, under Contract N62467-93-D-1106. The work was performed in accordance with the approved Work Plan [MK, 1996].

The work was performed in three phases. Phase 1, a subsurface investigation to delineate the extent of the separate phase hydrocarbon plume at Fuel Farm 216, began 10 September 1996. Direct push and rotary drilling methods were used to collect soil samples continuously from the surface to the groundwater interface at eight (8) borehole locations. Fluid levels were measured 16 September 1996, in all existing monitoring wells and open boreholes for design characterization.

In Phase 2, a pilot test was performed using a liquid ring vacuum (LRV) pump to evaluate the feasibility of MRS and to obtain design information for a full-scale application. The pilot test for the MRS was performed 20 September through 22 September 1996. The pilot test indicated that separate phase hydrocarbon in free phase and in vapor phase could be recovered at this site.

During Phase 3, design, installation, and start-up of a full scale MRS was performed. The design of a full-scale MRS was completed in October 1996. Construction and installation were completed 17 December 1996. During the start-up, phase-separated hydrocarbon vapor, free-hydrocarbon liquid and groundwater were recovered from the site.

The recovery of vapor phase total petroleum hydrocarbon (TPH) was greater than expected. Subsequently, a thermal oxidizer was installed to replace the activated carbon for treating the recovered vapors. Installation of the thermal oxidizer was completed 21 April 1997.

Operation and Maintenance (O&M) of the system began 28 April 1997, and will continue for one year. During operation of the system, system improvements, modifications and additions have occurred. A bag filter was installed prior to the LRV pump to prevent sediment from entering the initial process feed tank and to prevent associated problems with the discharge pump. Two chemical metering pumps were added to the system to inject scale inhibitor and dispersant chemicals into the system. Potable water usage was essentially eliminated by the installation of piping so that recovered groundwater could be recycled for use as seal water for the LRV pump. A moisture separator was added prior to the thermal oxidizer to collect condensate. An automatic discharge system was added to eliminate the need to manually pump out the discharge tank.

As of December 31 1997 the system was operating properly and has removed and destroyed over 16,500 pounds (2300 gallons) of hydrocarbons from the ground at fuel farm 216, NAS Corpus Christi.

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ACRONYMS AND ABBREVIATIONS

AES	Applied Earth Sciences, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethyl benzene, xylenes
FID	Flame ionization detector
FI/FC - #	Flow indicator/flow controller, number
GP - #	Gas probe, number
HDPE	High density polyethylene
LRV	Liquid ring vacuum
MK	Morrison Knudsen Corporation
MRS	Multi-phase recovery system
MW	Monitoring Well
MV	Motor Valve
NAS	Naval Air Station
NPT	Normal pipe thread
O&M	Operation and Maintenance
PLC	Programmable Logic Controller
ppmv	parts per million by volume
PVC	Polyvinyl Chloride
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RW	Recovery Well
SB	Soil Boring
SCFM	standard cubic feet per minute
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
TNRCC	Texas Natural Resource Conservation Commission
TPH	Total Petroleum Hydrocarbon
UL	Underwriters Laboratory
VP	Vacuum Pump

1.0
INTRODUCTION

1.1 BACKGROUND

This Completion Report summarizes the application and installation of an innovative multi-phase recovery system (MRS) at Fuel Farm 216 at Naval Air Station (NAS) Corpus Christi, Texas. This Completion Report was prepared by Morrison Knudsen Corporation (MK) for Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), pursuant to the scope of work defined in Delivery Order 16, Statement of Work 24, under Contract N62467-93-D-1106.

The NAS Corpus Christi facility is under a consent decree by the State of Texas to remediate the subsurface at Fuel Farm 216 by removing residual petroleum left in the subsurface from previous fueling operations at Fuel Farm 216.

Fuel Farm 216 is located on Ocean Drive near the south gate of NAS Corpus Christi. The fuel farm consists of thirty-six (36) 25,000 gallon tanks that were constructed in the early 1940s to store aviation fuel for NAS Corpus Christi. Two 10,000 gallon tanks at the fuel farm were also installed at that time to store diesel fuel. The fuel farm is located immediately adjacent to Corpus Christi Bay. There is no evidence of hydrocarbon migration from the site to the adjacent bay.

Twelve of the thirty-six tanks were taken out of service prior to 1979. In the early 1980s, separate phase hydrocarbons were identified on the site by NAS personnel. In 1983, Geraghty and Miller, Inc., performed a hydrologic investigation and estimated that the volume of separate phase hydrocarbons in the subsurface was about 77,000 gallons, of which about 20,000 gallons was estimated to be recoverable. By November 1987, the closure of Fuel Farm 216 was completed, with all 36 tanks filled with a sand-cement mixture and abandoned in place. The two diesel storage tanks were removed from service in 1986, but were not excavated and removed from the site until October 1991.

Recovery of free-product and groundwater had been occurring since 1985 via pumping or bailing using two 24 inch diameter wells, RW-2 and RW-3 prior to installation of the multi-phase recovery system (MRS). Pumping and bailing resulted in minimal product recovery. In September 1996, MK performed soil borings, groundwater monitoring, subsurface gas monitoring, and a liquid ring vacuum(LRV) pump pilot test. MK then designed and installed a LRV pump recovery system. The system was started up in January 1997 using activated carbon to treat the recovered subsurface vapors. In April, a thermal oxidation unit was added to the system to treat the concentrated vapors. In June, piping was installed to allow recycle of recovered groundwater for use as seal water for the LRV pump. Scale accumulation in the LRV pump necessitated installation of two chemical metering pumps In September to inject scale inhibiting and dispersant chemicals into the system. A bag filter was also installed prior to the LRV pump to collect any sediment being recovered from the wells. In October, a moisture separator was installed prior to the thermal oxidizer. In November, a direct discharge line was installed from the treatment system to the sewage treatment plant. The system is currently in operation, recovering phase-separated hydrocarbon, hydrocarbon vapor, and groundwater.

1.2 PLANNING DOCUMENTS

The following document and its associated appendices were used to plan and perform the interim removal action.

- Work Plan, NAS Corpus Christi, Design, Install, Test, Start-up, and Operations and Maintenance and Training Free Product Recovery, Collection, and Treatment System [MK, 1996]

- Appendix A, *Site Safety and Health Plan*
- Appendix B, *Quality Control Plan*
- Appendix C, *Drawings*
- Appendix D, *Resumes*
- Appendix E, *Activity Hazard Analysis Worksheet*
- Appendix F, *Geoprobe Investigation Work Plan*
- Appendix G, *LRVP Pilot Test Work Plan*

1.3 PURPOSE AND SCOPE

The purpose of this project was:

- to delineate the extent of the hydrocarbon plume at Fuel Farm 216,
- to perform a pilot test using a LRV pump to evaluate the feasibility of an innovative MRS and to obtain design criteria,
- to design and install a full scale MRS, and
- to operate and maintain the MRS for a one year period after successful start-up.

1.4 CONSTRUCTION CONTRACTORS

MK provided project management, construction management, as well as environmental, health, safety, and quality control functions. MK's primary construction subcontractor was Applied Earth Sciences, Inc. (AES). Analytical services were provided by Gulf States Analytical Core Laboratories and Southwest Laboratories. Lower tier subcontractors included:

Drilling	Gemini Technical Services, Inc., Transglobal Environmental Geosampling, Inc.
Civil and Piping	CCC Group, Inc.
Electrical	Johnston Electric Inc.
Remedial Equipment	NEPCCO
Thermal Oxidizer	ThermTech, Inc.
Fencing	Fencing Inc. of Texas
Controls/reprogramming	Eagle Data Control Systems
Analytical Laboratory	Southern Petroleum Laboratory
Materials Testing Laboratories	Professional Service Industries, Inc. Gulf Coast Testing Laboratory, Inc.

1.5 CHRONOLOGY

The following chronology summarizes the chain of events that occurred during the execution of this project. A detailed chronology is included in Appendix H.

10-11 September 1996	Soil Borings
14 September 1996	Design phase initiated
20-22 September 1996	LRV Pump Pilot Test
17 October 1996	Approval of Design by SOUTHNAVFACENGCOM
28 October 1996	Mobilization to construction site
4 November 1996	Construction started
20 November 1996	Completed installation of concrete equipment/tank pads, recovery well (RW) piping, water line tap

2 December 1996	LRV pump skid, oil/water separator, and tanks delivered and set in place
14 December 1996	Completed piping and electrical connections to equipment and fencing of compound
6 January 1997	Startup of MRS
15 January 1997	Installation of moisture separator (Tank T-7) and additional activated carbon drums; vapor concentrations significantly higher than measured during pilot test
22 January 1997	Demobilization from construction site
7 April 1997	Started construction for installation of thermal oxidizer
17 April 1997	Received thermal oxidation unit
21 April 1997	Operation of MRS with thermal oxidation began
28 April 1997	Operation and maintenance (O&M) started
7 June 1997	Installation of groundwater recycle piping from Tank T-6 to LRV pump completed
10 September 1997	Installed bag filter prior to air-water separator (Tank T-1) and LRV pump
12 September 1997	Installed chemical metering pumps
26 September 1997	Installed new level control in seal water tank (Tank T-2)
8 October 1997	Installed moisture separator (Tank T-7)
24-26 November 1997	Installed automatic discharge to sewage treatment system

2.0
SUBSURFACE INVESTIGATION

2.1 DESCRIPTION OF WORK

On 10 and 11 September 1996, MK performed a subsurface investigation to further delineate the extent of separate phase hydrocarbons at Fuel Farm 216 at NAS Corpus Christi, Texas. Direct push and rotary drilling methods were used to collect soil samples continuously from the surface to the groundwater interface at eight (8) borehole locations. Borehole locations are shown on the site layout (Figure 2).

Each soil sample was visually inspected and logged, including soil color, type, moisture content, and presence of odor. Each soil sample was also screened for headspace vapors using a Thermo Environmental Instruments Model 680 Organic Vapor Meter equipped with a flame ionization detector (FID). Following stabilization of the water level in each borehole, the depth to groundwater and thickness of separate phase hydrocarbon in each borehole and monitoring well on-site were measured. Each borehole was abandoned in accordance with Texas Natural Resource Conservation Commission (TNRCC) guidelines.

All sampling equipment was decontaminated between samples using water and detergent, followed with a deionized water rinse. Soil cuttings were collected into 55-gallon drums and stored on-site until proper disposal. (Section 6.0)

2.2 DRILLING AND SAMPLING

Soil borings were initially attempted with a *Mobiledrill* B-61 direct push drill rig capable of sampling to a depth of at least 20 feet below ground surface. A 2-foot long, 2-inch diameter hardened steel split spoon was used to collect soil samples. However, at a depth of approximately six feet, water was encountered and the sandy soil collapsed into the bore hole when the split spoon was retracted to retrieve the soil sample. Past groundwater monitoring indicated that groundwater should be encountered at approximately 10 to 20 feet below ground surface. The drilling method was therefore modified by using a 4-inch diameter hollow flight auger to bore past the perched groundwater and collapsing sands. Soil samples were then collected using the split spoon on the direct push drill rig to a depth of about 16 feet.

2.3 RESULTS

The surface at all boreholes, except soil boring (SB) SB-19, was approximately six inches of topsoil and grass and weeds. SB-19 was located on a concrete slab. In general, tan or brown sand was encountered beneath the surface to a depth of approximately 4 to 6 feet. In general, clayey sand, silty sand, and sandy clay layers were encountered from a depth of approximately six feet. Some caliche layers and nodules were encountered at depths from 10 to 16 feet. Iron staining and orange mottling were encountered at a depth of five feet and between 8 and 12 feet in some bore holes. Hydrocarbon odor was encountered in all eight bore holes at depths of 5 to 14 feet. The water table was encountered at a depth of 13 to 16 feet below ground surface (bgs). Soil boring logs and head space FID screening results are provided in Appendix B.

2.4 FLUID LEVEL MEASUREMENTS

Fluid levels were measured on 16 September 1996, in all existing monitoring wells and open boreholes at Fuel Farm 216 are provided in Appendix C. Separate phase hydrocarbons were detected in recovery wells (RW) RW-2 and RW-3, monitoring wells (MW) MW-13, MW-14, MW-20, MW-21, MW-22, MW-26, and MW-29, and soil borings SB-17, and SB-19. The monitoring wells with the most separate phase hydrocarbon were MW-20 and MW-21 with 1.65 feet and 1.60 feet of product, respectively.

3.0
LRV PUMP PILOT TEST

3.1 DESCRIPTION OF WORK

A LRV pump pilot test was performed from 20 September through 22 September 1996, to collect data required for the design and installation of properly sized LRV extraction equipment for Fuel Farm 216. The LRV unit was a MPX-75 LRV extraction system supplied by Carbtrol Corporation. A schematic of the unit is included in Appendix D. The LRV pump is capable of generating vacuums as high as 29 inches of mercury and can recover liquids as well as vapors, making the unit more versatile than conventional soil vapor extraction or groundwater pump and treat technology.

The pilot test was run using MW-21 as the test well. This monitoring well was selected due to its location near the estimated center of the separate phase hydrocarbon plume. Historically, MW-21 has exhibited between 0.85 and 2.73 feet of separate phase hydrocarbon. Twelve monitoring wells and one soil gas probe (GP) were selected as observation wells for the pilot test.

Prior to the pilot test, six temporary soil vapor monitoring points were installed. The direct push method was used to place a vapor monitoring tube in the vadose zone at the six locations shown in Figure 2. Each vapor probe consisted of a plastic tube that extended to the ground surface, allowing monitoring of soil gas before and after the LRV pump pilot test. Each vapor probe tube was covered at the surface with a polyvinyl chloride (PVC) cap.

The following parameters were collected before the pilot test began and again after the pilot test ended:

- Vadose zone oxygen, carbon dioxide and hydrocarbon concentrations at temporary soil gas probes (both inside and outside of the plume)
- Depth to product in test and observation wells
- Depth to water in test and observation wells
- Saturated zone temperature, dissolved oxygen, and dissolved carbon dioxide in test and observation wells (both inside and outside of the plume)

The vadose zone hydrocarbon concentrations were measured using a Thermo Environmental Hydrocarbon Vapor Meter with an FID. The oxygen and carbon dioxide concentrations were measured using a Landtech GA-90 landfill gas monitor. Depth to product and depth to groundwater in the monitor wells were measured using an electronic oil/water interface probe. The distance of each observation well from the test well was measured using a pedometer.

Saturated zone dissolved oxygen was measured with a YSI Model 57 dissolved oxygen meter. To measure dissolved carbon dioxide, a water sample was collected in a 500 ml dedicated plastic bottle using a dedicated bailer. The water was analyzed for dissolved carbon dioxide using a Hach field test kit equipped with a digital titrator.

A well cap was installed on each observation well. A ball valve with a hose barb was installed on each well cap to facilitate vacuum pressure measurements with a digital manometer.

A sanitary well seal was installed on the test well casing. A one inch diameter PVC drop pipe was inserted through the center of the seal and set at the historical low groundwater level (11.99 feet below the top of the well casing on MW-21). A 0-30 inch mercury vacuum gauge was attached to the sanitary well seal on the test well.

On 21 September 1996, the LRV unit was connected to the test well using transparent vacuum hose with camlock fittings. The LRV unit was powered using a portable generator. Recovered groundwater gravity flowed from the LRV pump seal water tank to a drum equipped with a pump and float switch to transfer the excess water to a storage tank. Vapors from the LRV unit were routed to pass through vapor phase activated carbon prior to release to the atmosphere.

The pilot test was run from 6:00 pm on 21 September 1996, to 7:30 am on 22 September 1996. Operating data was recorded hourly. Data sheets are provided in Appendix E. The following data was recorded:

- Flow Rates of Vapors at Inlet and Outlet of LRV Pump
- Induced Vacuum Pressures at Test Well and Observation Wells
- Radius of Influence
- Vapor Concentration Levels at Inlet and Outlet of LRV Pump
- Temperature of Vapor at Inlet and Outlet of LRV Pump
- Pressure of Vapor at Inlet and Outlet of LRV Pump
- Product Recovery
- Groundwater Recovery

At 10:40 pm on 21 September 1996, a vapor sample was collected from the sample port located at the inlet to the LRV pump to determine well vapor concentration, and another vapor sample was collected from the outlet of the LRV pump to determine the vapor concentration used to size vapor treatment options. These samples were sent to Gulf States/Core Laboratories in Houston for analysis for benzene, toluene, ethyl benzene, xylene (BTEX), TPH, carbon dioxide, and oxygen. The inlet vapor sample had to be collected after the unit was shut down temporarily, since the sample pump was unable to overcome the vacuum pressure created by the LRV pump. Analytical results for the vapor samples are provided in Appendix F.

After allowing the unit to run for approximately six hours, the observation well caps were removed to allow ambient air to be drawn into the wells. The unit continued to run for approximately 7.5 additional hours. At the end of the pilot test, the final seal water tank and water storage tank fluid level measurements were recorded. The fluid levels were recorded in the test well and all observation wells, and oxygen and carbon dioxide concentrations in the vadose zone and the groundwater were determined.

3.2 RESULTS OF THE PILOT TEST

Data sheets from the pilot test are provided in Appendix E. Analytical results for the vapor samples are provided in Appendix F.

The LRV pump extracted separate phase hydrocarbon, groundwater, and soil gas for a period of 13.5 hours. During this time, 3.4 gallons of separate phase hydrocarbon and approximately 253 gallons of groundwater were recovered. Converting these recovery rates to daily rates yielded projected recovery rates of 6.2 gallons of product per day and 449 gallons of groundwater per day, as shown in Table 1.

The soil vapor was recovered at an average rate of 41.5 standard cubic feet per minute (scfm), based on the average differential pressure across the orifice meter on the outlet of the LRV pump. The concentration of TPH in the recovered vapor was 5837 parts per million by volume (ppmv), based on laboratory analysis of the vapor sample collected from the outlet of the LRV pump approximately 4.5 hours into the pilot test. Assuming a TPH molecular weight of 96 lb/lb-mole and a separate phase hydrocarbon specific gravity of 0.8, a recovery rate of approximately 13.1 gallons of separate phase hydrocarbon per day was projected from the vapor phase. This yielded a total projected recovery rate of 19.3 gallons of separate phase hydrocarbon per day as vapor and free product.

The mass recovery rate in the vapor phase was calculated to be 3.63 lb of TPH per hour. This was more than the allowable 1.0 lb/hour under the air emission regulations. Consequently, the recovered vapor would have to be treated prior to release to the atmosphere. Activated carbon was projected to be sufficient to treat this vapor, assuming that the concentration of the vapor typically decreases over time as the recovery system is operated continuously.

TABLE 1
LRV PUMP PILOT TEST RESULTS

Average LRV Outlet Pressure	1.07 inches of water
Average LRV Outlet Temperature	106.0 deg. F
Average LRV Outlet Differential Pressure	0.21 inches of water
Average Velocity of Vapor in Outlet	1,902 feet per minute
Outlet Pipe Diameter	2 inches
Average Vapor Flow Rate	41.5 scfm
Concentration of Vapor	5,837 ppmv TPH
Mass Recovery Rate in Vapor Phase	3.63 lb/hour TPH
Volumetric Recovery Rate in the Vapor Phase	13.1 gallons of product per day
Separate Phase Hydrocarbon Recovery Rate	6.2 gallons/day
Total Hydrocarbon Recovery Rate	19.3 gallons/day
Groundwater Recovery Rate	449 gallons/day

During the pilot test, only one observation well showed vacuum influence. Gas probe (GP-6) located approximately 15 feet from the test well exhibited a vacuum pressure of about 0.33 inches of water during the pilot test. A radius of influence for the vacuum extraction system of about 20 feet can be inferred from the single well point. It is likely that short circuiting of the vacuum is occurring since MW-21 is screened to a depth of two (2) feet below the ground surface. Soil boring logs, included in Appendix B, indicate that the soil at that depth is generally sandy.

Essentially no influence on the product thickness in the observation wells was observed during the pilot test. A slight reduction in the product thickness (0.04 feet) from before the pilot test was started was observed in RW-3 located approximately 15 feet from the test well. Slightly more reduction was observed in MW-22 (0.12 feet) located 190 feet from the test well, and in MW-13 (0.13 feet) located 212 feet from the test well. These results are inconclusive, and may indicate only that the distances to the observation wells were too great to be significantly affected by the LRV pilot test, or that the pilot test did not run long enough to affect more of the observation wells. Fluid levels in all observation wells rose slightly during the pilot test, possibly due to tidal influence.

Carbon dioxide and oxygen levels were measured in the soil gas and in the dissolved phase before and after the pilot test. The oxygen level in the soil gas increased dramatically from 2.2% by volume to 17.9% by volume in GP-6. Oxygen increased slightly in GP-4 and GP-5 located 100 to 200 feet from the test well, and decreased in GP-1 located over 300 feet from the test well. Carbon dioxide concentrations increased in GP-1 and GP-4, and did not change in GP-5 and GP-6. In some of the gas probes, the internal pump on the meter had difficulty pulling a vapor sample, possibly due to low permeable soils or

perched water. This means that some of the measurements may not be representative of the subsurface conditions. However, it does appear that probes nearer to the test well exhibited an increase in oxygen concentration in the soil gas.

In general, both oxygen and carbon dioxide concentrations in the dissolved phase decreased during the pilot test as measured in the observation wells before and after the pilot test. However, dissolved oxygen concentration increased in MW-2 and MW-20, and carbon dioxide concentrations increased in MW-22, MW-23, and MW-20. There does not appear to be any particular correlation of change in concentration or final concentration with distance to the test well.

3.3 CONCLUSIONS

The pilot test successfully indicated that separate phase hydrocarbon in free phase and in vapor phase were recovered in quantity at this site using a LRV pump extraction system. Vacuum influence induced by the LRV system was approximately 20 feet.

Based on the evaluation of the information from the pilot test, the following projections were made for the full-scale MRS.

- An oil/water separator and a groundwater storage tank would be required to handle the quantity of groundwater recovered. In addition, the LRV system would require a supply of make-up water to be used as seal water for the pump.

- A manifold and motorized valves would be required to allow extraction from one recovery well at a time to ensure that each well is fully evacuated on a periodic basis. A timer would allow the recovery wells with the greatest quantity of separate phase hydrocarbons to be placed under vacuum for longer than wells exhibiting less contamination.

- Laboratory analysis of recovered vapor indicated that activated carbon could be used to treat recovered vapor prior to releasing the vapor to the atmosphere.

4.0
MULTI-PHASE RECOVERY SYSTEM

This project was accomplished as a design/build subcontract and included the design of the MRS and the procurement and installation of the equipment. The design of the full-scale MRS was completed in October 1996. MK mobilized on 28 October 1996 and construction of the recovery system commenced on 4 November 1996. The system was started 6 January 1997.

4.1 SYSTEM DESIGN

System design began 14 September 1996. During the design phase, frequent design meetings were held involving MK, AES, SOUTHNAVFACENGCOM Remedial Project Manager (RPM), Resident Officer in Charge of Construction (ROICC), and NAS Corpus Christi Public Works Department. Final design approval occurred 17 October 1996.

4.2 EQUIPMENT PROCUREMENT AND INSTALLATION

Upon approval of the design, equipment orders were placed. Mobilization to the site began 28 October 1996. Construction began 4 November 1996. The major components for the system arrived on site 2 December 1996. System installation was completed 14 December 1996. Photographs documenting the installation are provided in Appendix G.

The MRS installed at the NAS Corpus Christi consists of a skid mounted LRV Pump (VP-1) with a moisture separator (Tank T-1) and seal water tank (Tank T-2), an oil/water separator (Tank T-3), a product tank (Tank T-4), a transfer tank (Tank T-5), a storage tank (Tank T-6), a vapor stream condensate separator (Tank T-7), and a thermal oxidation unit for off gas treatment. A bag filter (F-1) was later added prior to the moisture separator to collect sediment being recovered with the groundwater. Two chemical metering pumps were also installed to control scale buildup in the LRV system.

The recovery equipment was installed in an equipment compound consisting of a bermed concrete equipment pad, a water storage tank pad with secondary containment, a thermal oxidation unit pad, and a security fence. The general equipment layout is shown in Figure 1. An as built drawing of the concrete pads is shown in Figure 4.

Five monitoring wells (MW-13, MW-20, MW-21, MW-26, and MW-29) were converted for use as recovery wells. They are connected to the Remedial system by 2-inch diameter high density polyethylene (HDPE) pipe. The pipes leading from the five recovery wells are routed to the treatment system through a vault located in the northeast corner of the equipment pad. The vault also serves as a sump for the compound. The five wells are connected to an automated manifold which determines which well is in operation. The general site layout, including the location of the five recovery wells, is shown in Figure 2. In addition to the five wells connected to the system there are seven connections in the vault for as many as seven future wells. Each of the seven future lines in the vault have been extended beyond the sides of the concrete pads, plugged, and buried for future access.

Detailed descriptions of major equipment components are provided in the following sections.

4.2.1 LRV Pump

The LRV pump is an Atlantic Fluidics Fluid-Vac Model A75 with a five horsepower motor. Electrical service at this site is single phase 240 volt. The LRV pump capacity is 74 cubic feet per minute of vapor phase or 20 gallons per minute of liquid phase. The LRV pump requires between 2 and 3 gallons per minute of seal water to maintain the vacuum seal and cool the pump.

The LRV pump is positioned on an equipment skid fabricated off-site by NEPCCO, a remediation equipment supplier. The seal water tank (Tank T-2), air water separator (Tank T-1) and two transfer pumps (P-1 and P-2) are also located on the skid. The skid is anchored to the concrete equipment pad with 3/8 inch anchor bolts. All of the steel piping, equipment and the two steel tanks on the LRV skid are coated with a blue industrial enamel coating (Rustoleum 2125 Deep Blue) to minimize corrosion.

4.2.2 Piping and Hoses

The five two-inch diameter PVC recovery wells are equipped with a one-inch diameter PVC drop pipe which can extend to a level two feet below the historic low water level for the well. The drop pipe has been set at or above the historic groundwater low level, but may be adjusted up or down as required to maintain groundwater at a desired level. The wellhead installation details are shown in Figure 5.

A one-inch by two-inch Fernco flexible coupling creates a seal at the top of the well casing and holds the drop tube in place. Clear vacuum hose (1.5 inch diameter) connects the drop tube to two-inch PVC pipe. The wellhead is equipped with a 0 to 30 inch mercury vacuum gauge and a gate valve. A transition fitting connects the two-inch PVC to two-inch SDR 11 HDPE piping. The HDPE piping is routed underground from all of the wells except MW-21 to the equipment compound sump and manifold. Underground piping was placed approximately 12 to 14 inches below the ground surface. Trenches were excavated using a backhoe, and excavated soil was used to backfill the trench.

The PE piping from MW-21 is routed on top of the existing concrete surface and fastened in place with pipe clamps. At the edge of the existing concrete, the pipe is routed underground. All road and driveway crossings were repaired with concrete.

The manifold and all exposed piping within the equipment compound is two-inch or one-inch diameter Schedule 80 PVC pipe, except for some steel piping on the LRV skid and on the thermal oxidizer. The piping from each recovery well in connected to the manifold with two-inch diameter vacuum hose.

The water line leading into the compound is two-inch diameter polyethylene piping. The natural gas line leading to the thermal oxidizer is one-inch diameter doped and wrapped welded normal pipe thread (NPT) steel piping. Both utility lines are buried, emerging aboveground immediately adjacent to the concrete pad.

4.2.3 Fuel/water Separator and Storage Tanks

The fuel/water separator (Tank T-3) is a NEPCCO Petropurge vertical tube coalescing oil/water separator. The maximum design flow of the separator is 12 gallons per minute, and the capacity of the separator is 75 gallons. The separator is constructed of fiberglass and is located on a 56-inch high steel stand which is anchored to the concrete pad.

The product storage tank (Tank T-4) is a steel 150 gallon horizontal tank conforming to Underwriter's Laboratory (UL) UL-142. The tank is anchored to the concrete pad.

The water transfer tank (Tank T-5) is a vertical 550 gallon polyethylene tank equipped with a clear PVC sight glass. The water storage tank (Tank T-6) is a vertical 5000 gallon polyethylene tank. Both water storage tanks are strapped to the concrete pads and anchored using 3/8-inch eye bolts.

4.2.4 Thermal Oxidizer

The recovered vapor is routed to a ThermTech VAC-10 thermal oxidizer for treatment prior to release to the atmosphere. The thermal oxidizer design flow rate is 100 standard cubic feet per minute and uses natural gas as the auxiliary fuel. The main burner has a capacity of one million Btu per hour. The oxidizer

burner chamber is set to operate at 1410 deg. F. The TNRCC air emission Standard Exemption 88 requires that the thermal oxidizer operate at 1400 deg. F or more. The oxidizer is equipped with a circular chart recorder to continuously record the burn chamber temperature, ensuring compliance.

Recovered vapor passes through a moisture separator prior to the thermal oxidizer. The moisture separator is a Rotron Model MS350B with a 40 gallon capacity. It is designed to handle an air flow as high as 350 cubic feet per minute.

The thermal oxidizer is provided with a booster blower to provide dilution air to the recovered vapor stream prior to the burn chamber. The booster blower is a Rotron blower with a 100 standard cubic feet per minute capacity and a one horsepower motor. An automatic dilution air control valve regulates the quantity of dilution air entering the oxidizer, and a flame arrestor is provided to prevent burn back down the vapor phase piping. The oxidizer is also equipped with a 96 standard cubic feet per minute combustion air blower with a one horsepower motor. After the burn chamber, the combusted gas is released to the atmosphere through a ten foot tall steel stack. The thermal oxidizer is anchored to a concrete pad located adjacent to the LRV equipment pad. A Process and Instrumentation Diagram for the thermal oxidizer system is included as Figure 6.

4.2.5 Tank Containment and Equipment Pads

The water storage tank (Tank T-6) is located on a concrete pad (15 feet by 15 feet) with 30 inch tall concrete containment walls. The containment area can be drained through four-inch diameter PVC piping to either the sump or to the concrete drive adjacent to the equipment compound. Water stops were provided at all joints. An as built drawing of the concrete pads is included as Figure 4.

The LRV equipment skid, oil/water separator (Tank T-3), product storage tank (Tank T-4), and water transfer tank (Tank T-5) are located on a concrete pad (12 feet by 19 feet) with a six-inch berm. The thermal oxidizer is located on a flat concrete pad adjacent to the LRV equipment pad.

All of the concrete pads are reinforced with #4 or #5 reinforcing steel spaced 12 inches on center both ways. The containment area walls are supported by a continuous spread foundation as shown in the as built drawing.

4.2.6 Control System

The MRS is controlled by an Allen Bradley SLC 500 programmable logic controller (PLC) in the MRS control panel. The control panel also houses the circuit breakers for all of the equipment in the compound, starters for each of the pump motors (P-1, P-2, and VP-1), control relays, and an automatic dialer (NEPCCO TEL-10). The automatic dialer can call up to three telephone numbers in the event of an alarm condition affecting unit operation. Switches to control the operation of the MRS and indicator lights to show whether the unit is running or in an alarm condition are located on the front of the control panel.

Six of the tanks in the compound (T-1, T-2, T-4, T-5, T-6, and T-7) are provided with high level alarms that will shut down the system and initiate a dial out alarm. A high level probe in the sump will also initiate unit shut down and a dial out alarm. Multilevel level probes in tanks T-1, T-5, and T-7 control operation of the transfer pumps (P-1, P-2, and P-3, respectively). Conductivity probes in the sump cause motor valve (MV) MV-6 to open when water accumulates in the sump, allowing the water to be removed from the sump by the LRV pump (VP-1). A level switch in the seal water tank (Tank T-2) controls addition of makeup water to the tank.

The recovery manifold is provided with a motor valve for each recovery well. The PLC opens each motor valve for a predetermined amount of time. Solenoid valves are controlled by the PLC to provide makeup water, recirculation water from tank T-6, or ambient air as needed by the MRS.

The thermal oxidizer control panel controls operation of the oxidizer. The oxidizer is set to operate at 1410 deg. F. If the temperature traveling through the stack is too high (typically greater than 1600 deg. F), the thermal oxidizer initiates an alarm condition and shuts down both the oxidizer and the MRS. If the burn temperature drops below 1400 deg. F, the thermal oxidizer will temporarily shut down the MRS the burn temperature rises above 1400 deg. F again. No alarm condition is initiated for low temperature in the thermal oxidizer. If the MRS shuts down due to a high level alarm in one of the tanks, the thermal oxidizer also shuts down. The thermal oxidizer can also initiate an alarm condition and shut down both systems due to malfunction of either of the blowers, loss of natural gas pressure, or other system malfunction.

Power for the MRS and thermal oxidizer system is obtained from the existing transformer located adjacent to the equipment compound. Power is single phase 240 volt. The compound is provided with two outdoor 120 VAC receptacles and a high pressure sodium area light activated by a photocell.

4.3 SITE RESTORATION

Following installation of the piping, equipment pads, equipment, and fencing, all construction debris and excess materials were removed from the site. Excess excavated soil was spread to level the ground surface surrounding the equipment compound. All road cuts were backfilled and repaired with concrete doweled into existing concrete.

5.0
START-UP OF MULTI-PHASE RECOVERY SYSTEM

The MRS was started up 6 January 1997. Adjustments and optimization of the MRS were performed as discussed below. A detailed chronology of the start up activities is provided as Appendix H. Correspondence with the TNRCC and permits are included as Appendices I and J respectively.

Before and during the initial start-up, activated carbon was used for treatment of the recovered vapors. A 40 gallon Rotron moisture separator was installed 16 January 1997, to remove excess condensate from the vapor stream.

Laboratory results indicated that TPH concentrations in the recovered vapor were two to three times greater than the concentration of the vapor sample collected during the pilot test (See Appendix F and Appendix K). Thus, the vapor recovery was better than expected. Condensing water vapor and higher TPH concentrations resulted in rapid breakthrough of the activated carbon.

On 28 January 1997, the MRS was adjusted to run at partial vacuum to reduce the quantity and concentration of recovered vapors. However, multi-phase recovery of both liquids and vapors did not occur if the vacuum was reduced too much. Analytical results are provided in Appendix K for samples collected from January 1997, through August 1997.

A thermal oxidizer was installed 17 April 1997 to treat the recovered vapor. A new Allen-Bradley controller was also installed and PLC program changes made to properly coordinate the operation of the thermal oxidizer with the MRS. The MRS was re-started 21 April 1997. Operating data are provided for the period beginning April 1997, when continuous operation began, through November 1997 in Appendix L.

6.0
WASTE SOIL DISPOSAL

Soil cuttings from soil borings performed on 10-11 September 1996, were placed into five 55-gallon drums, labeled, and stored in a bermed area on-site. The five drums were sent off site for disposal by NAS Corpus Christi through an existing separate waste disposal contract. The soil resulting from excavation of pipe trenches and concrete pad beams and footer was screened in the field using a ThermoEnvironmental Model 680 Organic Vapor Meter equipped with a FID. No hydrocarbon vapors were detected from headspace monitoring of the soil. All of the excavated soil was used as backfill for the trenches or used in regrading the site following the completion of construction.

7.0
PROBLEMS AND SOLUTIONS

As the operation of the MRS progressed, some optimization and replacement were required. Some of the problems encountered during the application of this innovative MRS technology, specific solutions used to resolve the problems, and lessons learned for future use are discussed below.

7.1 DETERMINATION OF APPROPRIATE VAPOR TREATMENT TECHNOLOGY

During the pilot test, a vapor sample was collected from the outlet of the rented LRV unit approximately 4.5 hours following the start of the LRV pump pilot test. Analysis of this vapor sample indicated that the concentration of TPH in the vapor was 5837 ppmv. The original proposed design of the remediation system included activated carbon to treat the recovered vapor. Based on the results of the pilot test, it was determined that activated carbon could still be used to treat recovered vapors, assuming that the concentration of the vapor would decrease over time once the permanent recovery system was placed into operation.

Once the permanent recovery system was installed, vapor concentrations were found to be consistently much higher than originally indicated from the pilot test. The highest concentration obtained through analysis of recovered vapor was 110,000 ppmv TPH as JP-4 from MW-26. Condensing water vapor also decreased the adsorption capacity of the carbon. As a result, carbon drums needed to be replaced almost daily when the MRS was being operated continuously. The decision eventually was made to replace the activated carbon with a thermal oxidation unit.

Lessons learned:

- Collect vapor samples and measure vapor flow rates from several potential recovery wells instead of relying on the results of one well during the pilot test; differences in well hydraulics, stratigraphy, and location within the contaminant plume may create dramatic differences in vapor concentrations between wells;
- Collect the vapor samples earlier in the pilot test (within the first hour);
- Collect the vapor samples in summa canisters over a period of at least one hour in order to obtain the most accurate measurement of the recovered vapor concentration;
- If separate phase hydrocarbon is present on the groundwater, it is likely that catalytic or thermal oxidation will be required to treat recovered vapors.

7.2 CONTROL OF MAKE-UP SEAL WATER ADDITION FOR LRV PUMP

The MRS was installed with a seal water tank (Tank T-2) separate from the air/water separator (Tank T-1) into which the recovered groundwater flows. Seal water is required to create the vacuum seal in the LRV pump and to carry away the heat generated within the pump. The purpose of the separate seal water tank was to eliminate introduction of separate phase hydrocarbon or sediments recovered along with the groundwater into the LRV pump. However, this design necessitated the periodic addition of make-up water from the base water distribution. The seal water tank was originally equipped with a temperature switch that would cause the solenoid valve SV-2 to open to add makeup water to tank T-2 when the temperature of the seal water in tank T-2 exceeded 125 deg. F. However, it was discovered that tank T-2 would sometimes run dry due to evaporation and/or flow into tank T-1, causing the LRV pump to lose its seal before the temperature of the water would exceed 125 deg. F.

After the initial start-up, a pressure transducer was added to the bottom of tank T-2 to activate the makeup water solenoid valve SV-2 when the pressure in the tank dropped too low. This worked well to keep a more constant level of seal water in tank T-2 when the LRV system was running continuously. However, if the LRV pump was set to recover from fewer than all five recovery wells, the LRV pump would shut off for a time. When the LRV pump shut off, the reduced pressure would cause tank T-2 to fill up, sometimes higher than the high level alarm in the tank, shutting down the entire system.

Eventually, the pressure transducer was removed from the seal water tank and a differential float switch was installed in tank T-2. This appeared to solve the problem of keeping adequate seal water available for the pump, but the float switch was found over time not to be compatible with the temperature and dissolved hydrocarbon present in the tank. On 26 September 1997, a new level controller equipped with conductivity probes was installed into tank T-2 to properly control the level of seal water in the tank.

Lessons learned:

- If a separate seal water tank is used, equip it with high and low level switches to control the level of water in the tank;

- Even with a separate seal water tank, it is possible for hydrocarbon vapors to condense causing accumulation of some separate phase hydrocarbon in the seal water tank resulting in high levels of hydrocarbons in the tank. Elevated temperatures in the seal water should also be anticipated. Material selection for level controllers and other components is critical. Stainless steel conductivity probes with no moving parts proved to be very reliable for this application.

7.3 QUANTITY OF MAKE-UP SEAL WATER REQUIRED

After operating the MRS for a time, it became apparent that the system was using a large quantity of make-up seal water. The seal water is slowly removed from the seal water tank (Tank T-2) to the moisture separator (Tank T-1) through an adjustable flow meter. From tank T-1, it flows with the recovered groundwater through the oil/water separator into the groundwater transfer tank (Tank T-5), and eventually into the groundwater storage tank (Tank T-6). NAS Corpus Christi was using a vacuum truck to transport water accumulating in the water storage tank (Tank T-6) to the Industrial Wastewater Treatment Plant on base several times per week.

On 6 June 1997, a recirculation line from tank T-6 to the LRV pump was installed. When the seal water level in tank T-2 is low, the LRV pump will now draw make-up water from the water storage tank (Tank T-6) instead of adding more base tap water. This has eliminated the use of base water completely and maintains an adequate supply of seal water for the LRV pump.

Lessons learned:

- Recirculation of partially treated recovered groundwater for use as seal water greatly reduces or eliminates the need for make-up base water;

- Feasibility of recirculating partially treated recovered groundwater would be reduced if minerals were present in the water that caused excessive scaling; this became a concern at Fuel Farm 216;

- Circulation of seal water in tank T-2 through an air-cooled heat exchanger or a chiller would also greatly reduce the quantity of make-up water required.

7.4 SCALE ACCUMULATION IN LRV PUMP

After the installation of the piping from the groundwater storage tank (Tank T-6) to the LRV pump to allow reuse of recovered groundwater as seal water, increased accumulation of scale in the LRV pump became a problem. The scale periodically prevented the pump from rotating, and caused too much current to be drawn by the LRV pump motor. On 12 September 1997, two chemical metering pumps were installed to inject a scale inhibiting and a dispersant chemical into the water being transferred from the groundwater transfer tank (Tank T-5) to tank T-6. This appears to have corrected the scale problem.

Lessons learned:

- If use, or disposal of, make-up tap water is not an issue, it is recommended to use a separate seal water tank with make-up tap water.

- If it is necessary to reuse groundwater as seal water, the groundwater should be analyzed to determine the potential for scale accumulation, and the use of scale inhibiting chemicals in the system should be considered.

7.5 LRV PUMP MOTOR OVERLOADING

The overload circuit breaker for the LRV pump occasionally trips when the LRV pump is stressed. The most common causes of overload include too much flow of seal water to the LRV pump, build up of scale in the LRV pump, and drastic fluctuations of operating conditions from high vacuum conditions to low (ambient) vacuum conditions. The flow of seal water into the LRV pump is controlled by an adjustable flow indicator / flow controller (FI/FC-3). Ambient vacuum conditions occur primarily when tank T-1 receives a large quantity of water from a recovery well or from the sump, and the transfer pump P-1 is unable to keep up with the flow. Scale accumulation was discussed in the previous section.

When the LRV overload breaker tripped, the LRV pump stopped working but the rest of the system continued to operate. A change was eventually made to the program logic to initiate a dial out alarm when the breaker tripped.

Lessons learned:

- The flow of seal water to the LRV pump must be adjusted while monitoring the current loading of the LRV pump motor;

- The flow into the air/water separator (Tank T-1) should be monitored and adjusted to minimize the occasions when the transfer pump (P-1) is unable to pump liquid out faster than water from the recovery wells or from the sump is entering tank T-1;

- Shutdown of the LRV pump due to circuit overload should be programmed as a dial out alarm condition.

7.6 VAPOR CONDENSATE REMOVAL

The MRS was originally installed without an additional moisture separator prior to vapor treatment. A significant quantity of condensate was generated in the vapor piping as the vapor stream cooled after leaving the LRV pump. When too much liquid accumulated into the vapor pipe leading into the thermal oxidizer, the oxidizer shut down due to a flame failure at the burner. Likewise, when vapor phase activated carbon was used for vapor treatment, a large quantity of condensate accumulated in the first carbon drum, greatly reducing its usefulness.

Lessons learned:

- Provide a condensate collection system prior to vapor treatment following recovery by a LRV pump;

- Provide drain taps in all vapor stream piping to allow periodic draining of condensate from the pipes.

- Ensure vapor piping is slightly sloped to assist any condensate to drain away from the vapor treatment system.

7.7 REMOVAL OF SEDIMENT FROM THE GROUNDWATER

On 10 May 1997, it was discovered that sediment from the recovered groundwater was accumulating in the air/water separator (Tank T-1) and possibly interfering with the operation of the submersible transfer pump (P-1). Accumulated sand and sediment was being removed monthly from the bottom of tank T-1. On 10 September 1997, a bag filter was installed prior to the moisture separator (Tank T-1) to prevent accumulation of sediment in tank T-1.

Lessons learned:

- Installation of a bag filter prior to the air/water separator (Tank T-1) should be considered to remove excessive suspended solids in the recovered groundwater.

8.0
QUALITY CONTROL

During the construction phase, MK provided a representative on-site to perform quality control functions as outlined in the Quality Control Plan. This individual was responsible for ensuring that construction was performed in accordance with the approved plans and specifications. In addition, all MK personnel on-site as well as subcontractor and lower tier subcontract personnel were made aware that it was imperative to conform to the approved plans and specifications at all times.

Daily planning meetings were conducted between the subcontractor and supervisors from each lower tier subcontractor in the presence of a representative from MK. Work planned for performance that day was discussed at this meeting, together with any specific safety or quality concerns.

Daily production and QA/QC reports were provided by MK to Navy representatives.

9.0
CONCLUSION

MK has completed the application and installation of a MRS at NAS Corpus Christi for simultaneous recovery of free-phase product, vapor phase hydrocarbon, and contaminated groundwater. The full-scale MRS was designed based on the results of a pilot test performed at site. Several modifications to the MRS were performed during the start-up to resolve some problems encountered and to enhance performance. Currently, the O&M phase of the MRS is in progress with encouraging initial results.

As of December 31 1997 the system was operating properly and has removed and destroyed over 16,500 pounds (2300 gallons) of hydrocarbons from the ground at fuel farm 216, NAS Corpus Christi.

This project has demonstrated that multi-phase recovery technology is feasible and can be applied effectively. Future projects using this technology should evaluate the lessons learned from this project to optimize performance.

10.0
REFERENCES

Texas Natural Resource Conservation Commission Standard Exemption List, 30 TAC 116.211, "Control of Air Pollution By Permits For New Construction or Modification", effective date June 7, 1996 (Standard Exemptions 68, 88 and 118).

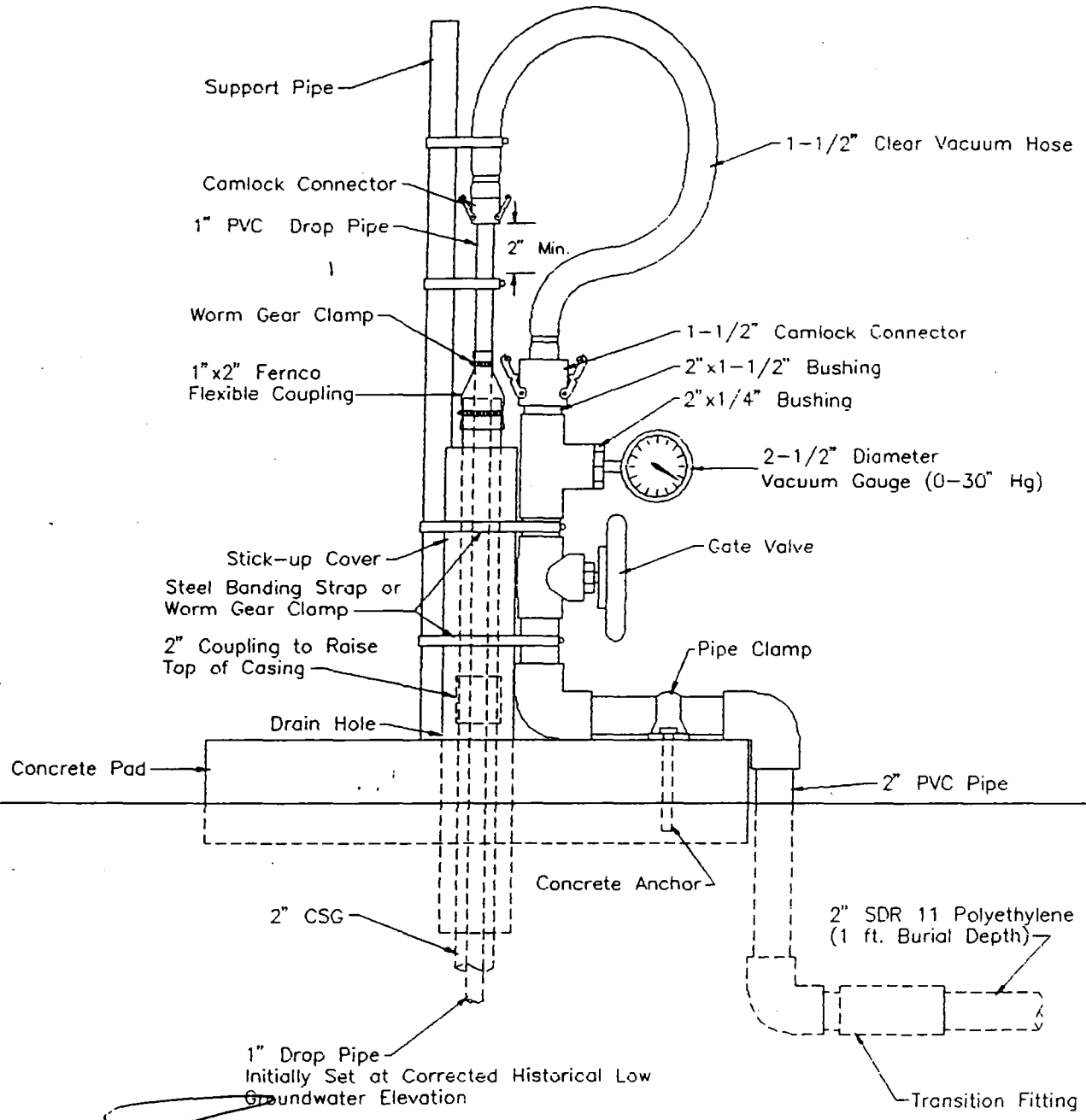
"Draft Contamination Assessment Report, Facility ID No. 0028854, LPST ID No. 91734, CTO-0102", Comprehensive Long-Term Environmental Action Navy, Naval Air Station, Corpus Christi, Texas, prepared by EnSafe/Allen & Hoshall, June 9, 1995.

[MK, 1996] Work Plan, NAS Corpus Christi, Design, Install, Test, Start-up, and Operations and Maintenance and Training Free Product Recovery, Collection, and Treatment System, Prepared by Morrison Knudsen, October 23, 1996.

[MK, 1997] Operation and Maintenance Manual, Multi-Phase Extraction System NAS Corpus Christi, Corpus Christi, Texas, Prepared by Morrison Knudsen, September 9, 1997.

APPENDIX A
AS BUILT FIGURES AND DRAWINGS

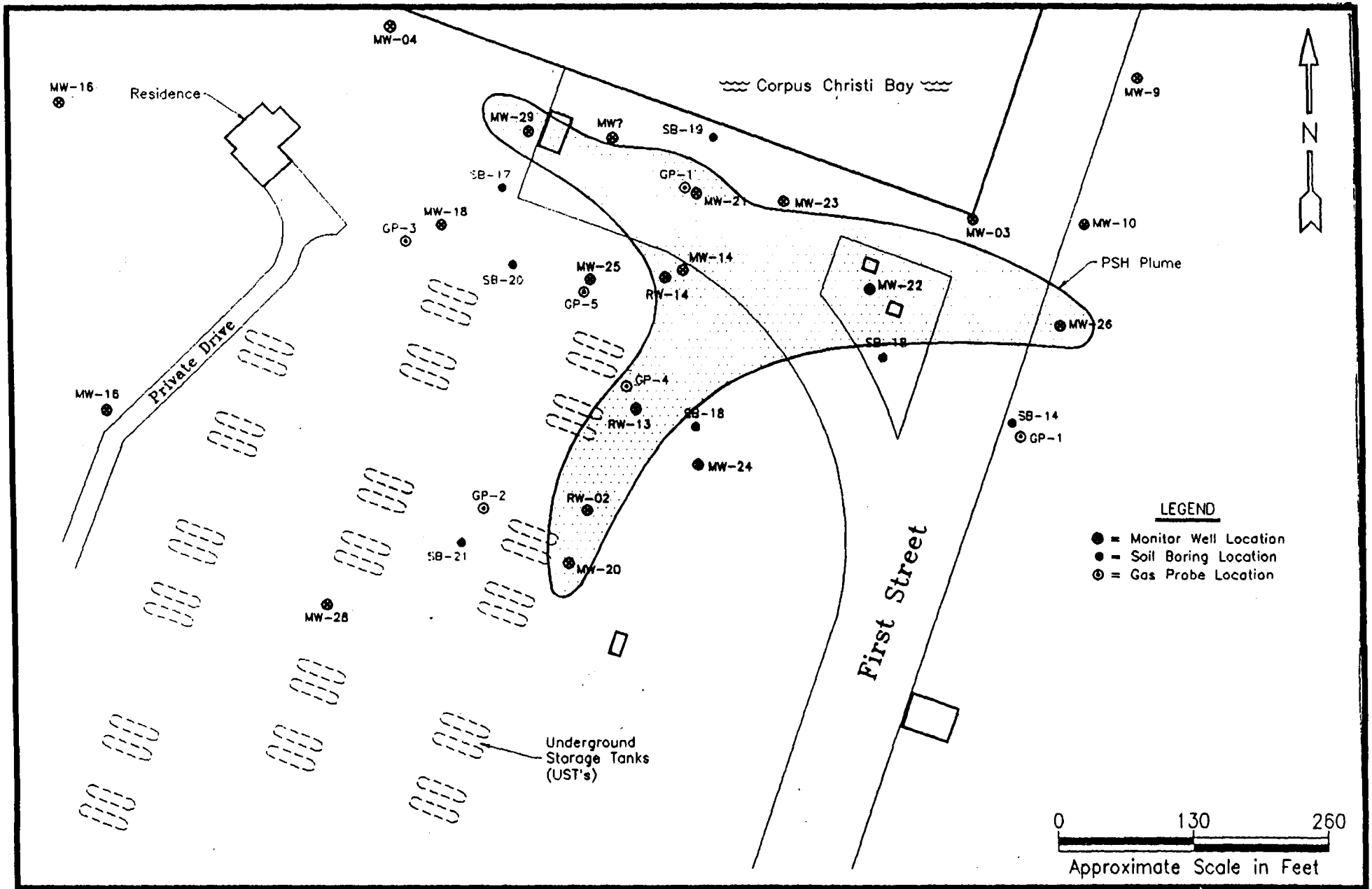
Figure 1	Applied Earth Sciences 04000-1 As Built Treatment Compound Layout P.E. Stamped 12/12/97
Figure 2	Applied Earth Sciences NAS Corpus Christi Fuel Farm 216 Piping Layout, P.E. Stamped 12/12/97
Figure 3	Applied Earth Sciences Process Flow and Instrumentation Diagram, P.E. Stamped 12/12/97
Figure 4	Applied Earth Sciences Concrete Equipment pad, P.E. Stamped 6/20/97
Figure 5	Applied Earth Sciences As Built Well Head, 02623-1 Revised 2/12/97
Figure 6A	Thermtech Inc. P&ID Legend, 946PID Revised 2/26/97
Figure 6B	Thermtech Inc. VAC 10 P&ID, 946PID Revised 5/13/97
Figure 7	Thermtech Inc. General Arrangement, 946GA, 3/26/97
Figure 8	Applied Earth Sciences NAS Corpus Christi Fuel Farm 216 Plume Delineation September 16, 1996, 9/24/97
Figure 9	Applied Earth Sciences NAS Corpus Christi Fuel Farm 216, Piping Detail Connection at Industrial Wastewater treatment Plant 11/11/97, P.E. Stamped 12/12/97
Figure 10	Applied Earth Sciences, NAS Corpus Christi Fuel Farm 216, Piping Detail Connection at Industrial Wastewater treatment Plant 11/11/97, Plan View, P.E. Stamped 12/12/97



STATE OF TEXAS
JOHN H. BROADUS
79833
REGISTERED
PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by John H. Broadus, P.E. 79833 on 10-14-96

APPLIED EARTH SCIENCES	Revised 12-04-96 Revised 01-10-97 Revised 02-12-97	As Built Well Head	5
02623-1	T. Gibson 10-14-96 Ref. File: 026231		



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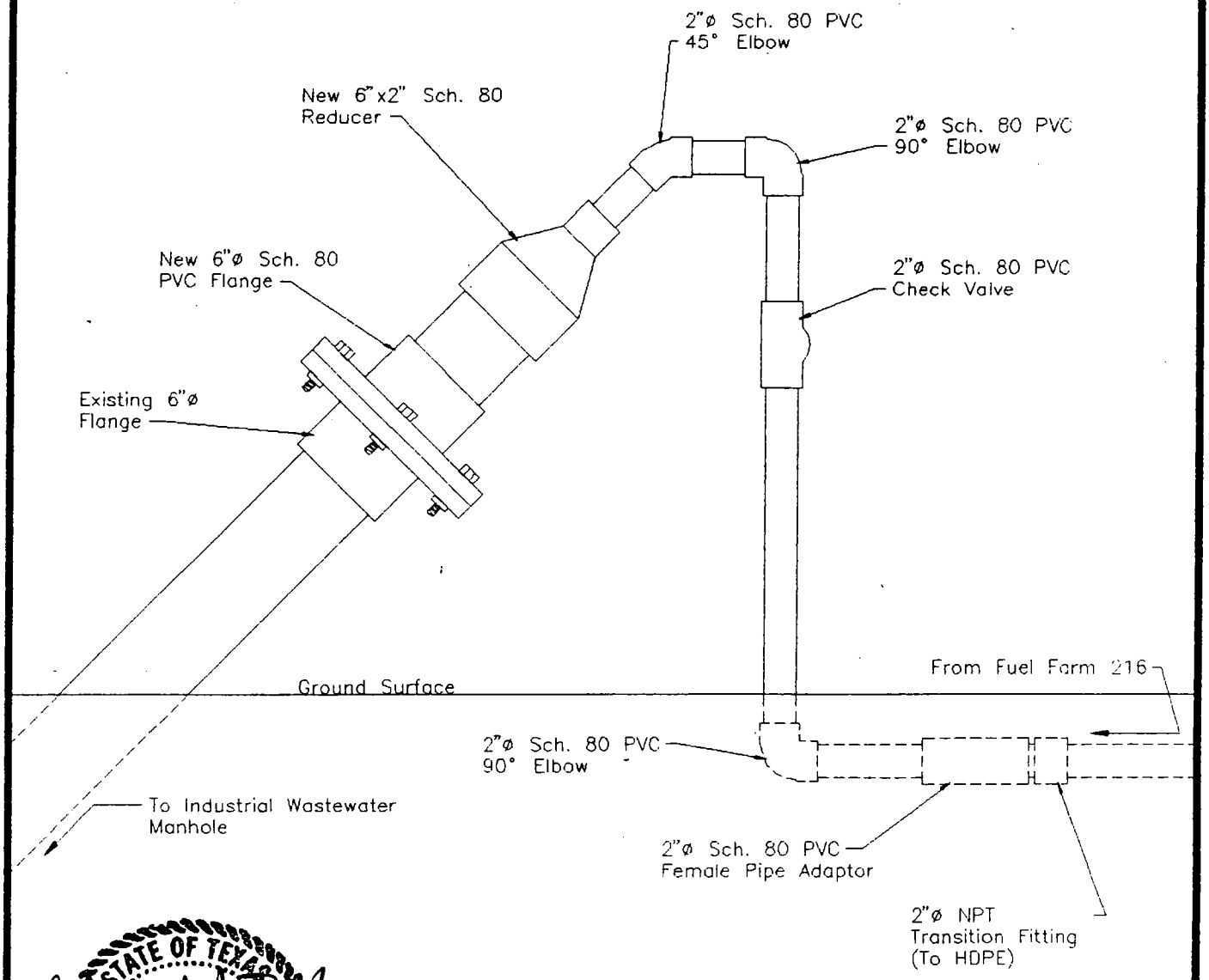
243-05616-01 T. Gibson 09-24-96 Ref. File:05616PLM			



ELEVATION

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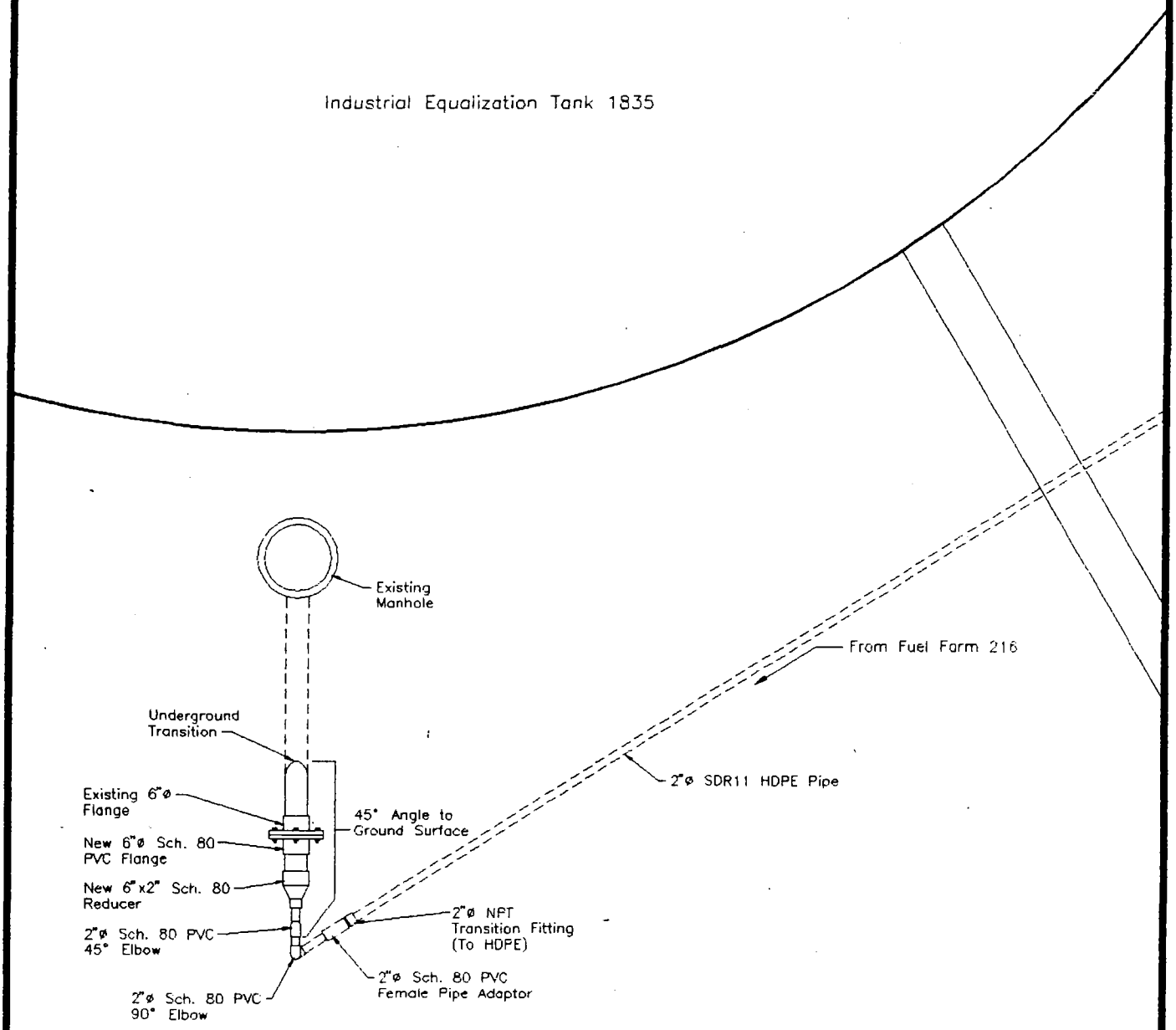
12/12/97

APPLIED EARTH SCIENCES Drawn By: TG Date: 11-11-97 Checked By: CM File: 05616PD	NAS Corpus Christi Fuel Farm 216	Piping Detail Connection at Industrial Wastewater Treatment Plant	9



PLAN VIEW

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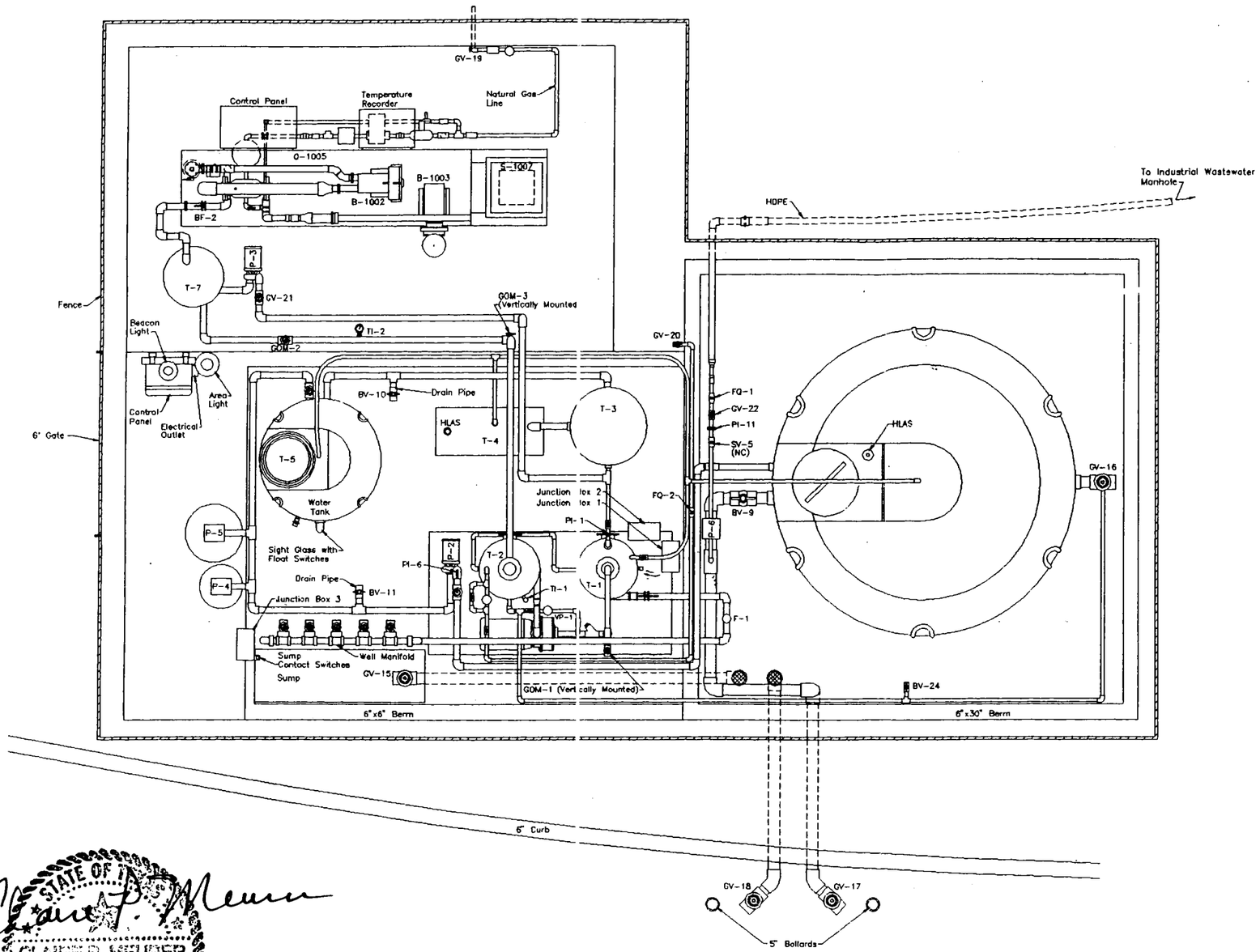
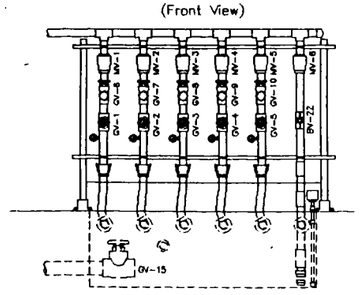
12/12/97

APPLIED EARTH SCIENCES Drawn By:TG Date:11-11-97 Checked By:CM File:05616PD	NAS Corpus Christi Fuel Farm 216	Piping Detail Connection at Industrial Wastewater Treatment Plant	10



Manifold Detail
(Front View)



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REGISTERED PROFESSIONAL ENGINEER

12/12/97

Scale - 1" = 48'

APPLIED EARTH SCIENCES		Revised 10-18-96 Revised 02-12-97 Revised 06-05-97 Revised 09-02-97 Revised 12-03-97	As Built Treatment Compound Layout	1
04000-1	T. Gibson 10-06-96 Ref.File 040001			

N

Trickling Filter No. 1

Primary Clarifier No. 2

Trickling Filter No. 2

Primary Clarifier No. 1

Storage Tank

Industrial Wastewater Equalization Tank

Spill Tank

Industrial Wastewater Manhole

Lab/Office

MW-07

Residence

Private Drive

MW-16

MW-19

MW-28

MW-04

Corpus Christi Bay

MW-29

MW-2

SB-19

SB-17

GP-6

MW-21

RW-03

MW-23

MW-18

GP-3

MW-03

MW-10

MW-14

SB-20

MW-25

GP-5

RW-14

Compound

MW-22

MW-26

RW-01

GP-4

SB-16

MW-27

MW-13

RW-13

SB-18

MW-24

SB-14

GP-1

MW-12

GP-2

RW-02

SB-21

MW-20

SB-15

MW-9

Bermed Decontamination Area

First Street

A

B

C

D

E

F

G

H

I

Underground Storage Tanks (UST's)

LEGEND

- ⊗ = Monitor Well Location
- ⊠ = Recovery Well Location
- ● = Soil Boring Location
- ⊙ = Gas Probe Location
- = Aboveground System Piping (Clamped to Concrete)
- = Existing Underground System Piping
- = New Underground System Piping
- = Underground Road Crossing
- = Natural Gas Piping
- = Water Distribution

Trench	Length	Pipe	Depth	No. of Lines
A	360'	2"	1'	1
B	132'	2"	1'	2
C	158'	2"	1'	1
D	210'	2"	1'	1
E	115'	2"	1'	2
F	187'	2"	1'	1
G	213'	2"	1'	1
H	128'	1"	1.5'	1
I	1315'	2"	1'	1

0 100 200

Approximate Scale in Feet

STATE OF TEXAS
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REGISTERED PROFESSIONAL ENGINEER

12/12/97

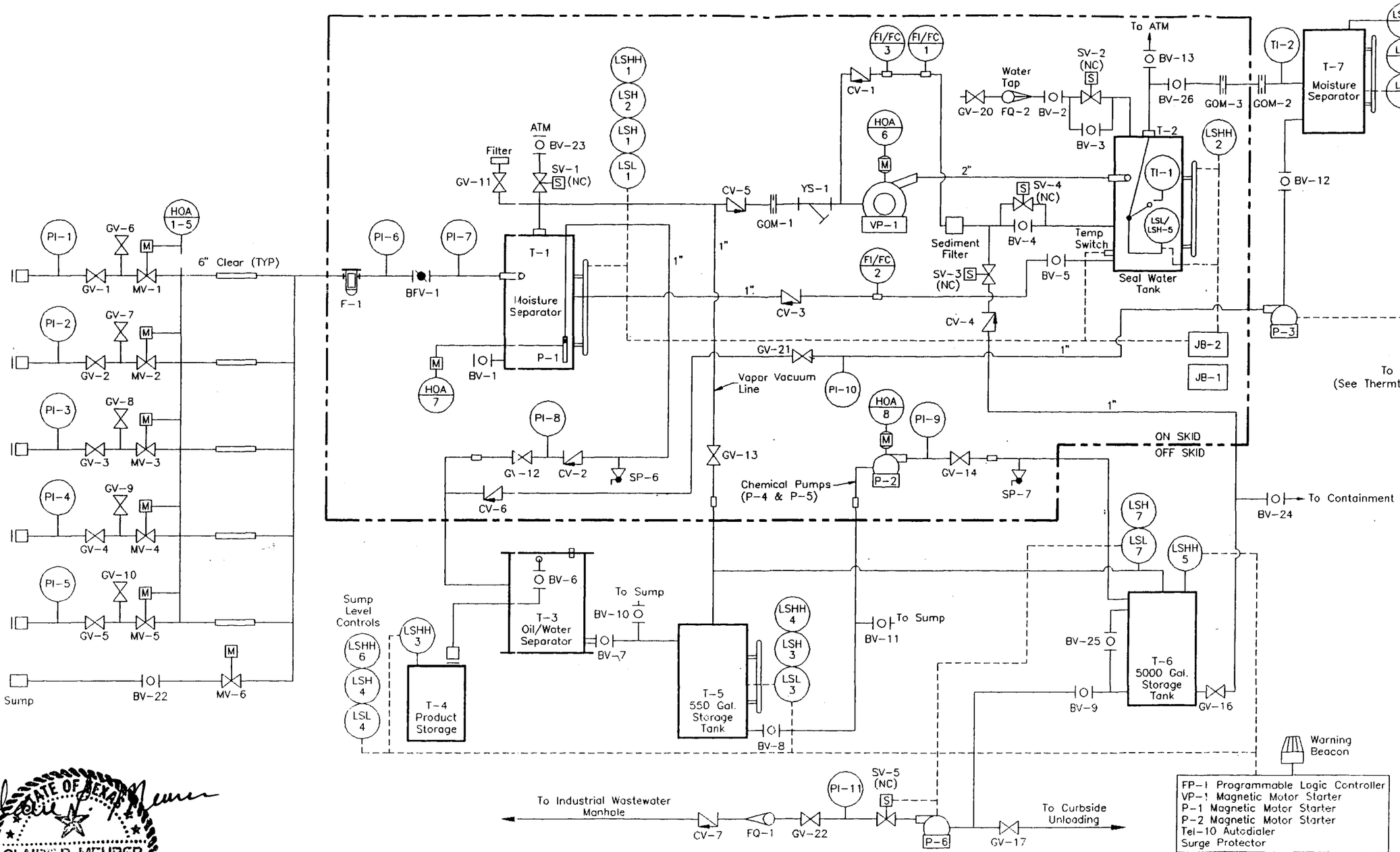
APPLIED EARTH SCIENCES

Drawn By:TG Date:12-05-97
Checked By:CM File:05616PL

NAS Corpus Christi
Fuel Farm 216

Piping Layout

2



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73648
REGISTERED PROFESSIONAL ENGINEER
12/12/97

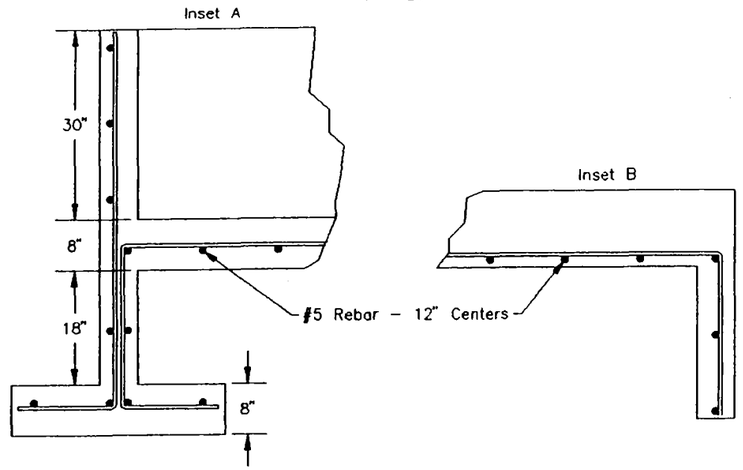
NOTES:

A) System Air Flow Rate is 75 CFM @ 25' Hg
B) System Water Flow Rate is 15 GPM
C) NEMA 4 Controls Off Skid
D) 4'x8' Skid
E) All Process Piping is 2" Sch. 40 PVC Unless Othe wise Noted
F) CV-3 is a Spring Loaded Check Valve
(Prevents Water Level Equalization if System Fails
G) 240 VAC, 1 Phase Power

APPLIED EARTH SCIENCES T. Gibson 12-05-97 Ref.File 05616PFD		Process Flow and Instrumentation Diagram	3

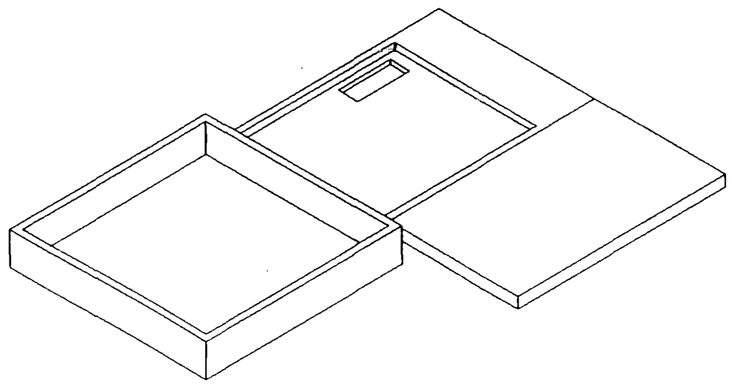
Rebar Detail

1" = 24"



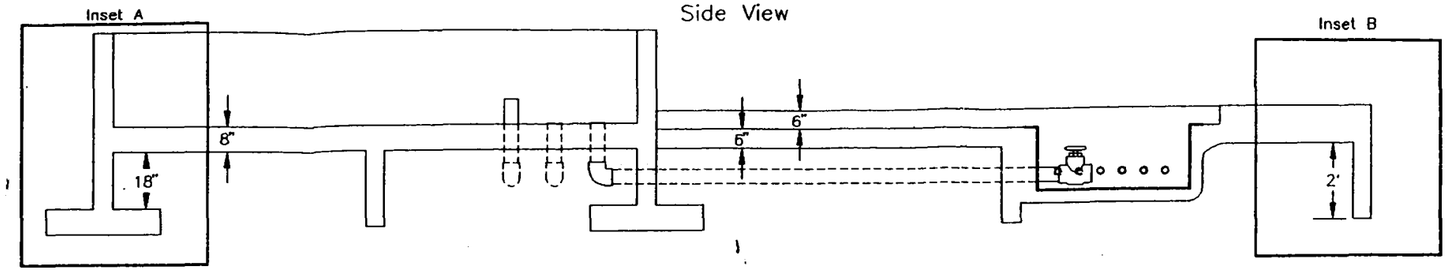
Isometric View

(Piping and Below Grade Not Shown)

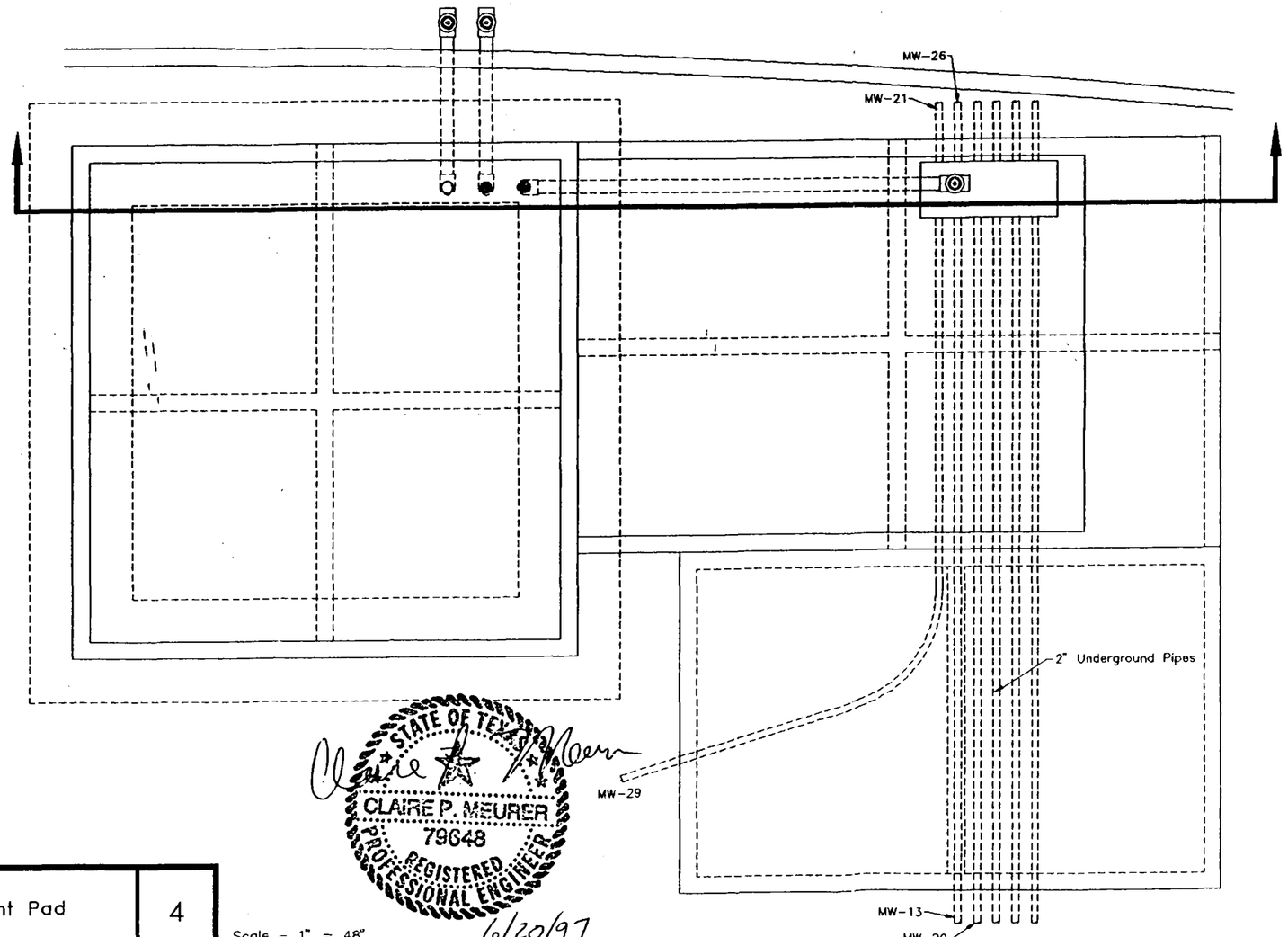


Scale – 1" = 12'

Side View



Plan View



Scale – 1" = 48"

STATE OF TEXAS
CLAIRE P. MEURER
79648
REGISTERED
PROFESSIONAL ENGINEER

6/20/97

APPLIED EARTH SCIENCES	Revised 10/18/96 Revised 10/30/96 Revised 02/12/97 Revised 06/05/97	Concrete Equipment Pad	4
03301-1 T. Gibson 10-09-96 Ref.File 033011			

SYMBOLS

- FLOW LINE
- TRANSMISSION LINE (PNEUMATIC)
- SUPPLY LINE (PNEUMATIC)
- CAPILLARY LINE
- ELECTRICAL SIGNAL
- MATCH LINE
- ELECTRIC HEAT TRACE
- FILTER REGULATOR
- INSULATION
- HEAT TRACE
- LINE SIZE CHANGE
- OPEN DRAIN SYSTEM
- LINE PLUG/CAP
- SPECTACLE BLIND
- "Y" STRAINER
- ANGLE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- WAFER CHECK VALVE
- CHOKE VALVE (FIXED)
- CHOKE VALVE (ADJUSTABLE)
- CONTROL VALVE (DIAPHRAGM OPERATED)
- I.A.S. — CONTROL VALVE WITH VALVE POSITIONER PNEUMATIC
- MOTOR OPERATED VALVE
- GATE VALVE
- GLOBE VALVE
- HAND CONTROL VALVE
- CONTROL VALVE (PNEUMATIC OPERATED)
- NEEDLE VALVE
- THREE-WAY CONTROL VALVE (DIAPHRAGM OPERATED)
- RELIEF VALVE
- DAMPER / LOUVER
- SOLENOID VALVE TWO-WAY
- SOLENOID VALVE THREE-WAY
- THREE-WAY VALVE

- BACKPRESSURE REGULATOR WITH EXTERNAL PRESSURE TAP
- LATCH-TYPE SOLENOID ACTUATOR FOR MANUAL RESET
- PRESSURE REDUCING REGULATOR (SELF CONTAINED)
- BACKPRESSURE REGULATOR (SELF CONTAINED)
- PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
- FLOW ELEMENT VENTURI
- FLOW ELEMENT (TURBINE TYPE)
- FLOW ELEMENT (MAGNETIC TYPE)
- FLOW STRAIGHTENING VANES
- FLOW ELEMENT (ORIFICE TYPE)
- TEMPERATURE ELEMENT W/ WELL
- POSITIVE DISPLACEMENT METER
- FLAME ARRESTOR
- DETONATION ARRESTOR
- CENTRIFIGAL BLOWER
- POSITIVE DISPLACEMENT BLOWER
- LIQUID PUMP
- AIR COMPRESSOR
- FILTER
- FILTER/SILENCER
- FLEXIBLE HOSE
- EXPANSION JOINT
- INDICATING LIGHT
- PURGE DEVICE
- FLOW INDICATOR
- LOCAL INTERLOCK
- MANUAL RESET

ABBREVIATIONS

AAL	ANALYSIS ALARM LOW
AAH	ANALYSIS ALARM HIGH
AY	ANALYSIS RELAY
AE	ANALYSIS ELEMENT
AIC	ANALYSIS INDICATING CONTROLLER
AI	ANALYSIS INDICATOR
AIT	ANALYSIS INDICATING TRANSMITTER
AT	ANALYSIS TRANSMITTER
AR	ANALYSIS RECORDER
BA	BURNER ALARM
BE	BURNER ELEMENT
BS	BURNER SWITCH
FAL	FLOW ALARM LOW
FC	FLOW CONTROLLER
FCV	FLOW CONTROL VALVE
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIC	FLOW INDICATING CONTROLLER
FR	FLOW RECORDER
FRC	FLOW RECORDING CONTROLLER
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
FT	FLOW TRANSMITTER
FX	FLOW STRAIGHTING VANES
FY	FLOW RELAY
FV	FLOW VALVE
FQR	FLOW TOTALIZING RECORDER (TICKET PRINTER)
HIC	HAND INDICATING CONTROLLER
HV	HAND VALVE
HS	HAND SWITCH
KC	TIME CONTROLLER
KIC	TIME INDICATING CONTROLLER
LAHH	LEVEL ALARM HIGH HIGH
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
LALL	LEVEL ALARM LOW LOW
LC	LEVEL CONTROLLER
LCV	LEVEL CONTROL VALVE
LG	LEVEL GUAGE
LN	INTERFACE LEVEL GUAGE
LS	LEVEL SWITCH
LI	LEVEL INDICATOR
LIC	LEVEL INDICATING CONTROLLER
LSH	LEVEL SWITCH HIGH
LR	LEVEL RECORDER
LRC	LEVEL RECORDING CONTROLLER
LSHH	LEVEL SWITCH HIGH HIGH
LT	LEVEL TRANSMITTER
LSH/L	LEVEL SWITCH HIGH LOW
LV	LEVEL VALVE
LY	LEVEL RELAY
ME	MOISTURE ELEMENT
MI	MOISTURE INDICATOR

PE	PRESSURE ELEMENT
PAH	PRESSURE ALARM HIGH
PAHH	PRESSURE ALARM HIGH HIGH
PAL	PRESSURE ALARM LOW
PALL	PRESSURE ALARM LOW LOW
PC	PRESSURE CONTROLLER
PIC	PRESSURE INDICATING CONTROLLER
PCV	PRESSURE CONTROL VALVE
PDC	PRESSURE DIFFERENTIAL CONTROLLER
PDIC	PRESSURE DIFFERENTIAL INDICATING CONTROLLER
PDSH	PRESSURE DIFFERENTIAL SWITCH HIGH
PDI	PRESSURE DIFFERENTIAL INDICATOR
PDS	PRESSURE DIFFERENTIAL SWITCH
PI	PRESSURE INDICATOR
PDSL	PRESSURE DIFFERENTIAL SWITCH LOW
PR	PRESSURE RECORDER
PDT	PRESSURE DIFFERENTIAL TRANSMITTER
PRC	PRESSURE RECORDER CONTROLLER
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSHH	PRESSURE SWITCH HIGH HIGH
PSL	PRESSURE SWITCH LOW
PSLL	PRESSURE SWITCH LOW LOW
PSE	PRESSURE SAFETY ELEMENT
PSV	PRESSURE SAFETY VALVE
PIT	PRESSURE INDICATING TRANSMITTER
PT	PRESSURE TRANSMITTER
PY	PRESSURE RELAY
TAH	TEMPERATURE ALARM HIGH
TAHH	TEMPERATURE ALARM HIGH HIGH
TAL	TEMPERATURE ALARM LOW
TALL	TEMPERATURE ALARM LOW LOW
TC	TEMPERATURE CONTROLLER
TCV	TEMPERATURE CONTROL VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TIC	TEMPERATURE INDICATING CONTROLLER
TR	TEMPERATURE RECORDER
TS	TEMPERATURE SWITCH
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
TT	TEMPERATURE TRANSMITTER
TW	TEMPERATURE WELL
ZSO	LIMIT SWITCH TO PROVE VALVE IN OPEN POSITION
ZSC	LIMIT SWITCH TO PROVE VALVE IN CLOSED POSITION
ZSL	LIMIT SWITCH TO PROVE VALVE IN MINIMUM STOP POSITION

ADDITIONAL INSTRUMENT ABBREVIATION, IF REQUIRED

THE FOLLOWING TABLE IS A GUIDE FOR ADDING ABBREVIATIONS

	USUAL OR PREFERRED USAGE			
	FIRST POSITION	SECOND POSITION	THIRD POSITION	FOURTH POSITION
A	ANALYSIS	ALARM	ALARM	
B	BURNER FLAME	USERS CHOICE	USERS CHOICE	USERS CHOICE
C	CONDUCTIVITY (ELECTRICAL)	CONTROL, CONTROLLER	CONTROLLER/CLOSED	CONTROLLER
D	DENSITY OR SPECIFIC GRAVITY	DIFFERENTIAL		
E	VOLTAGE (EMF)	ELEMENT	ELEMENT	
F	FLOW RATE	FRACTION (RATIO)		
G	CAGING (DIMENSIONAL)	GLASS		
H	HAND INITIATED		HIGH/RUNNING	HIGH
I	CURRENT (ELECTRICAL)	INDICATOR, INDICATING	INDICATOR, INDICATING	INDICATOR
J	POWER	SCAN		
K	TIME	CONTROL STATION	CONTROL STATION	
L	LEVEL	LIGHT (PILOT)	LOW/FAILURE	LOW
M	MOISTURE OR HUMIDITY			
N	USERS CHOICE			
O	USERS CHOICE	ORIFICE (RESTRICTED)	OPEN	
P	PRESSURE OR VACUUM	POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT	INTIGRATE (TOTALIZE)		
R	RADIOACTIVITY	RECORDER, RECORDING	RECORDER, RECORDING	RECORDER
S	SPEED OR FREQUENCY	SAFETY, SWITCH	SAFETY, SWITCH	
T	TEMPERATURE	TRANSMITTER	TRANSMITTER	
U	MULTIVARIABLE	MULTIFUNCTION		
V	VISCOSITY	VALVE	VALVE	VALVE
W	WEIGHT OR FORCE	WELL		
X	SHUTDOWN	UNCLASSIFIED	TELEMETRY/AUTODIALER	
Y	SYSTEM	RELAY	RELAY	
Z	POSITION	DRIVE, ACTUATE, ACTUATOR	DRIVE, ACTUATE, ACTUATOR	

GENERAL INSTRUMENT SYMBOL BALLOONS

(1)	(2)	(3)	(4)	(5)	(6)
LOCALLY MOUNTED	MOUNTED ON MAIN BOARD. BOARD 2 DESIGNATED BY A DASHED LINE.	MOUNTED BEHIND THE BOARD. BOARD 2 DESIGNATED BY DASHED LINES.	PLC FUNCTION		

INSTRUMENT FOR SINGLE MEASURED VARIABLE WITH ANY NUMBER OF FUNCTIONS.
INSTRUMENT WITH TWO MEASURED VARIABLES AND
OPTIONALLY SINGLE-VARIABLE INSTRUMENT WITH MORE THAN ONE FUNCTION,
ADDITIONAL TANGENT BALLOONS MAY BE ADDED AS REQUIRED.

ABBREVIATIONS (OTHER THAN INSTRUMENTS)

A	ANALOG SIGNAL
ACR	AIR COMPRESSOR
AO	AIR TO OPEN
AC	AIR TO CLOSE
AS	AIR SUPPLY
BS&W	BASIC SEDIMENT AND WATER
CCS	CENTRAL CONTROL STATION
CPL	COUPLING
DA	DIRECT ACTING
DTA	DETONATION ARRESTOR
EJ	EXPANSION JOINT
ES	ELECTRICAL SUPPLY
ESD	EMERGENCY SHUT DOWN
FA	FLAME ARRESTOR
FB	FULL BORE
FL	FAIL LOCKED
FC	FAIL CLOSED
FO	FAIL OPEN
HOA	HAND/OFF/AUTO SWITCH
MOV	MOTOR OPERATED VALVE
MR	MANUAL RESET
MW	MANWAY
MCC	MOTOR CONTROL CENTER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
PB	PUSH BUTTON SWITCH
RA	REVERSE ACTING
RO	RESTRICTIVE ORIFICE
SC	SAMPLE CONNECTION
SDV	SHUT DOWN VALVE
STR	STRAINER
SP	SET POINT
SW	SWITCH
MA	MANUAL ACTUATOR
IAS	INSTRUMENT AIR SUPPLY
FR	FILTER REGULATOR

RELAY FUNCTION DESIGNATORS

A/D	ANALOG TO DIGITAL TRANSDUCER
D/A	DIGITAL TO ANALOG TRANSDUCER
E/I	VOLTAGE TO CURRENT TRANSDUCER
I/P	CURRENT TO PNUEMATIC TRANSDUCER
P/I	PNUEMATIC TO CURRENT TRANSDUCER
Σ	ADD OR TOTALIZE SIGNAL SUMMATION
√	SQUARE ROOT EXTRACTION
Δ	DIFFERENTIAL SUBTRACT
>	HIGH SELECT
<	LOW SELECT
x	MULTIPLIER

NOTES

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

NO.	DATE	BY	CHK'D	APP'D	REVISION
7	2/26/97	KUB		SH	ADD FILTER/SILENCER, PD BLOWER.
					CHANGE I/P PNEU. VALVE SYMBOL.
					INSTRUMENT SYMBOL BALLOON
6	1/29/96	RZP		RZF	ADD RUNNING AND FAILURE TO
					3RD POSITION
5	1/3/96	SH		SH	CHANGE 'x' TO TELEMETRY/AUTODIALER
					3RD POSITION
4	11/13/95	SH		SH	MOVED RELAY FUNCT & ADD LINE PLUG

DRAWN	ALZ
DATE	2/16/95
SCALE	NTS
CHECKED	
APP'D	

CUSTOMER
APPLIED EARTH SCIENCES

P&ID LEGEND

THERMTECH INC.
POLLUTION CONTROL SYSTEMS
KINGWOOD, TEXAS 1-800-659-8271

JOB NO	946
JOBSITE	TX
REV NO	7
DWG NO	946PID
PAGE	1 OF 2

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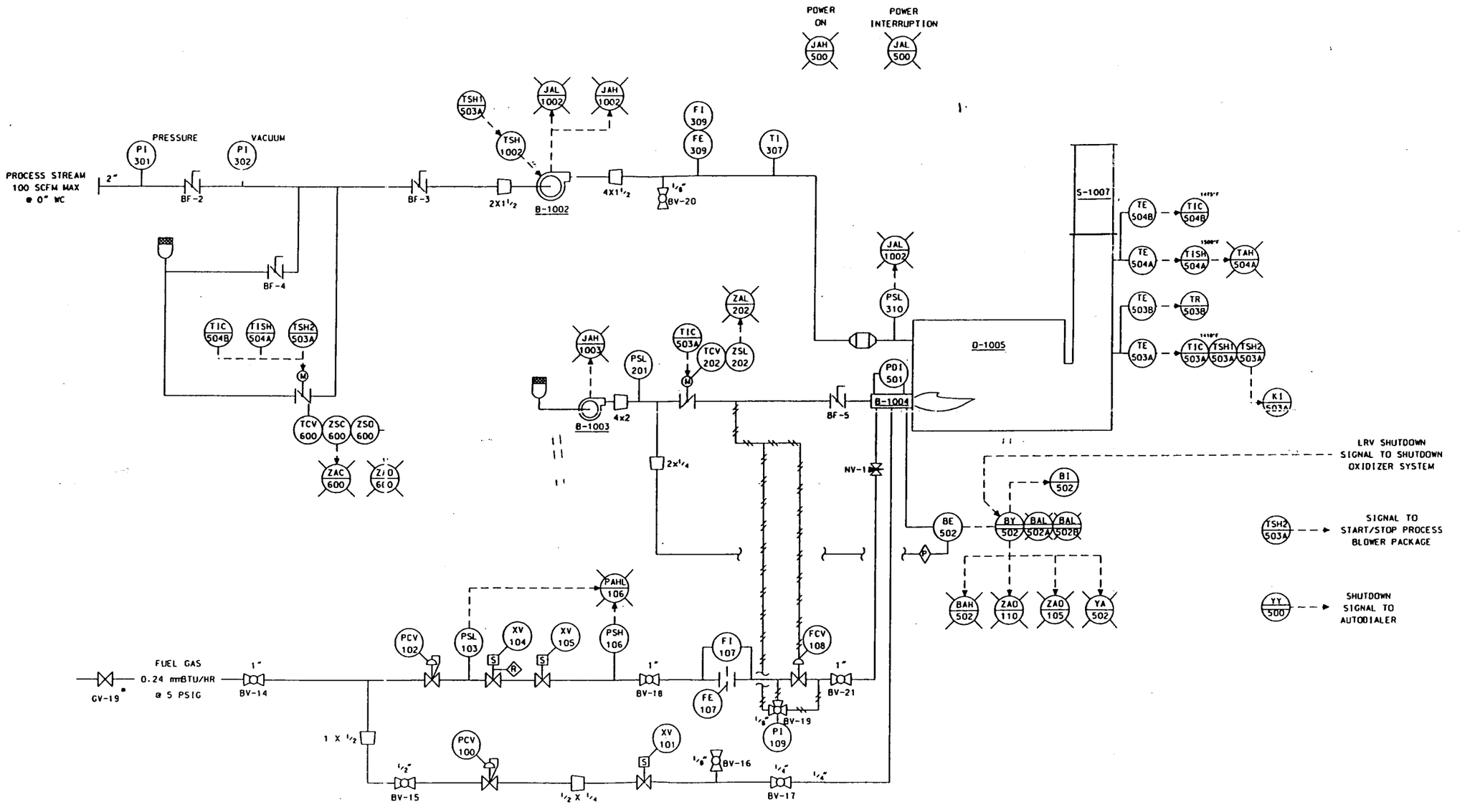
FIGURE 6A

B-1002	B-1003	B-1004	O-1005	S-1007
PROCESS BOOSTER BLOWER	COMB AIR BLOWER	MAIN BURNER	THERMAL OXIDIZER	EXHAUST STACK
100 SCFM @ 7"WC	42 SCFM @ 15" WC	0.5 mmBTU/HR	1410°F OPER TEMP	5 FOOT
1 HP	3/4 HP		95% DRE @ 1 SECOND	



NOTES

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

* SUPPLIED BY CUSTOMER

** SUPPLIED BY THERMTECH INC. TO BE FIELD INSTALLED BY CUSTOMER

NO.	DATE	BY	CHK'D	APP'D	REVISION
1	5/13/97	DLN		SH	CHANGE VALVE #'S (CUSTOMER REQUEST). CHANGE B-1003 TO 42 SCFM & B-1004 TO 0.5 mm

CUSTOMER
APPLIED EARTH SCIENCES

DRAWN	KUB
DATE	3/24/97
SCALE	NTS
CHECKED	
APP'D	

VAC10 P&ID

THERMTECH INC.
POLLUTION CONTROL SYSTEMS
KINGWOOD, TEXAS 1-800-659-8271

JOB NO.	946
JOBSITE	TX
REV NO.	1
DWG NO.	946PID
PAGE	2 OF 2

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FIGURE 6B

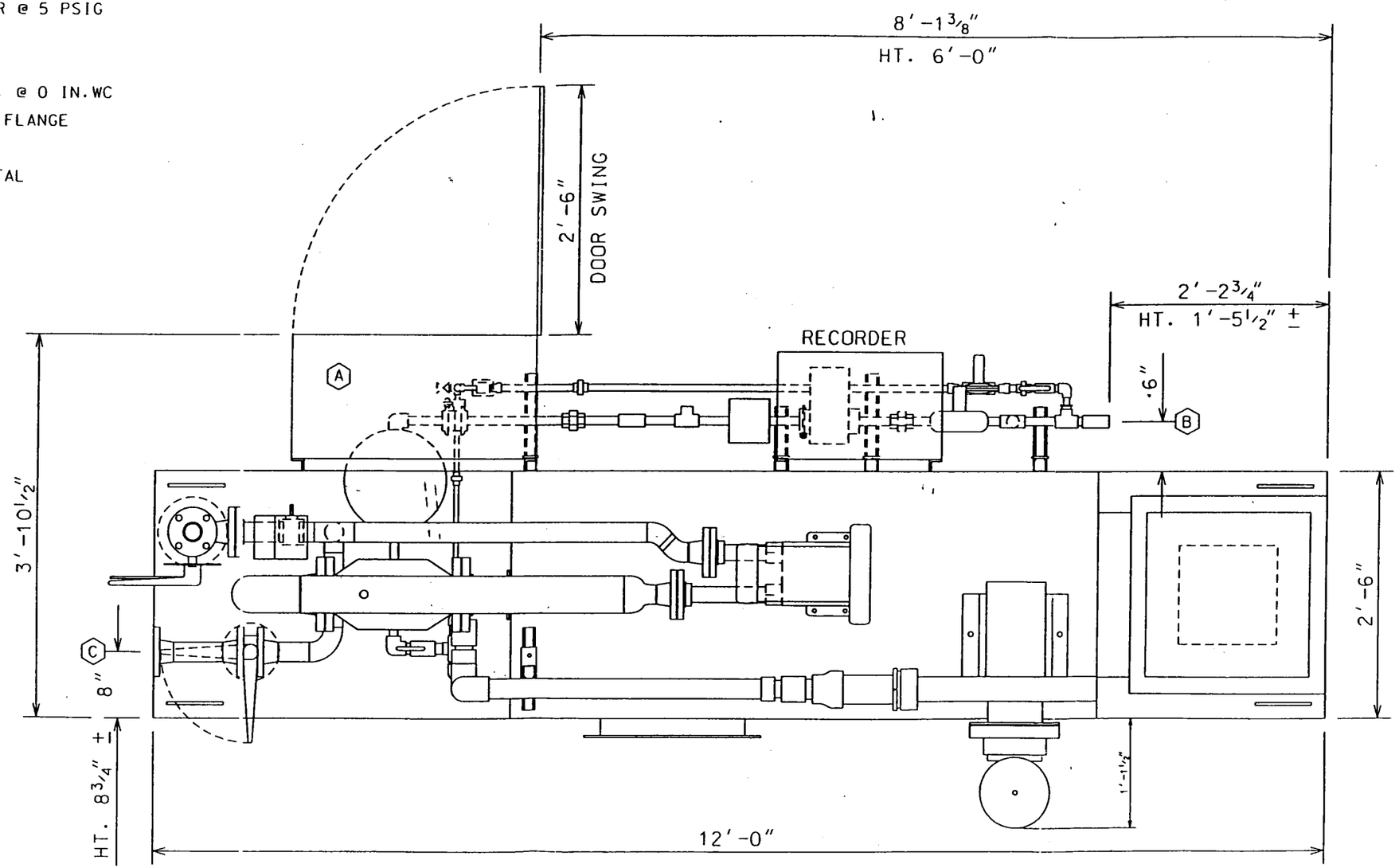
SPECIFICATIONS:

(A) POWER: 240VAC/1PH/60Hz/30A

(B) FUEL GAS: 0.24 mmBTU/HR @ 5 PSIG
1" FNPT

(C) PROCESS: 100 SCFM MAX. @ 0 IN.WC
2" ANSI 150# FLANGE

ESTIMATED WEIGHT: 3,500 lbs TOTAL



NOTES

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

NO.	DATE	BY	CHK'D	APP'D	REVISION

DRAWN	DLN
DATE	3/26/97
SCALE	N.T.S.
CHECKED	
APP'D	

CUSTOMER
APPLIED EARTH SCIENCES

GENERAL ARRANGEMENT

THERMTECH INC.
POLLUTION CONTROL SYSTEMS
KINGWOOD, TEXAS 1-800-659-8271

JOB NO.	946
JOBSITE	TX
REV. NO.	0
DWG NO.	946GA
PAGE	1 OF 1

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FIGURE 7

APPENDIX B
SOIL BORING LOGS

SB-14A	(1 page)
SB-14B	(1 page)
SB-15A	(1 page)
SB-15D	(1 page)
SB-16A	(1 page)
SB-16B	(1 page)
SB-17	(1 page)
SB-18	(1 page)
SB-19	(1 page)
SB-20	(1 page)
SB-21	(1 page)

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No.	SB-14A	**Drilling Contractor:**	Gemini Technical Services, Inc.
Drill Make and Model:	Mobiledrill B-61	**Start Date:** 9/10/96	**Date Completed:** 9/10/96
Drilling Method:	direct push		
Ground Elevation (ft MSL):		**Total Depth (ft):** 6	**Hole Diameter:** 2 in
Logged by:	Brent Balusek	**Depth to Water (ft bgs):**	5.5

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-2'	90%	0		topsoil sand tan with oyster shell
	2'-4'	50%	0		tan and gray sand no odor; moist
	4'-6'	100%	0		tan clayey sand with orange mottling starting at 5' water at 5 1/2'; no odor

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site: Naval Air Station Corpus Christi			
Task: Geoprobe Investigation			
Soil Boring No. SB-14B	**Drilling Contractor:** Gemini Technical Services, Inc.		
Drill Make and Model: Mobiledrill B-61		**Start Date:** 9/10/96	**Date Completed:** 9/10/96
Drilling Method: direct push/solid flight auger			
Ground Elevation (ft MSL):	**Total Depth (ft):** 18		**Hole Diameter:** 4 in
Logged by: Brent Balusek		**Depth to Water (ft bgs):**	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	6'-8'	100	3,873		clayey sand, grayish green, odor
	8'-10'	100	753		as above with orange mottling
	10'-12'	100	412		as above to 11.0" with orange mottling, 11.0" - sandy clay, grayish green, odor
	12'-14'	100	1,598		as above to 13.5", caliche nodules at 13.5"
	14'-16'	50	1,591		sandy clay, grayish green
	16'-18'	100	20.9		tan clayey sand

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No.	SB-15A	**Drilling Contractor:**	Gemini Technical Services, Inc.
Drill Make and Model:	Mobiledrill B-61	**Start Date:**	9/10/96
Date Completed:	9/10/96		
Drilling Method:	direct push		
Ground Elevation (ft MSL):		**Total Depth (ft):**	6
Hole Diameter:	2 in		
Logged by:	Brent Balusek	**Depth to Water (ft bgs):**	4.5'

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-2'	50%	0		0'-0.5' top soil 0.5'-2' tan sand, no odor, concrete rubble at 2' (small amount)
	2'-4'	65%	0		as above, tan sand
	4'-6'	65%	103		clayey sand with orange mottling (iron staining) water at 4.5'

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi				
Task:	Geoprobe Investigation				
Soil Boring No.	SB-15D		**Drilling Contractor:**	Gemini Technical Services, Inc.	
Drill Make and Model:	Mobiledrill B-61		**Start Date:** 9/11/96	**Date Completed:** 9/11/96	
Drilling Method:	direct push/solid flight auger				
Ground Elevation (ft MSL):			**Total Depth (ft):** 16	**Hole Diameter:** 4 in	
Logged by:	Brent Balusek		**Depth to Water (ft bgs):** 14.5		

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	6'-8'	100	0		tan sand, wet
	8'-10'	100	0		as above
	10'-12'	100	3,240		10'-11' - gray sand, odor, orange mottling 11'-12' - gray clayey sand
	12'-14'	100	1,280		as above
	14'-16'	100	2,616		gray sandy clay 14'-14.5', wet at 14.5' sandy clay with caliche, grayish green

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi				
Task:	Geoprobe Investigation				
Soil Boring No.	**SB-16A**		**Drilling Contractor:**	Gemini Technical Services, Inc.	
Drill Make and Model:	Mobiledrill B-61		**Start Date:**	9/10/96	**Date Completed:** 9/10/96
Drilling Method:	direct push				
Ground Elevation (ft MSL):			**Total Depth (ft):**	3	**Hole Diameter:** 2 in
Logged by:	Claire Meurer		**Depth to Water (ft bgs):**	---	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-3'				no log - gravel

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No.	**SB-16B**	**Drilling Contractor:**	Gemini Technical Services, Inc.
Drill Make and Model:	Mobiledrill B-61	**Start Date:** 9/10/96	**Date Completed:** 9/10/96
Drilling Method:	hollow stem auger, sampling continuously with direct push inside auger		
Ground Elevation (ft MSL):		**Total Depth (ft):** 15	**Hole Diameter:** 8 in
Logged by:	Claire Meurer	**Depth to Water (ft bgs):** 14.5	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-6"	100%			topsoil, gravel/road base at 6"
	6"-3'				augering down past gravel, no sample taken
	3'-5'	80%	87		gray sand with orange mottling to 4'; clayey sand to 5'; gray turning to sandy clay at 5'
	5'-7'	90%	222		odor; gray clayey sand with orange discoloration at 5.5' or 6'
	7'-9'	100%	5,924		odor of hydrocarbon; moist at 8'; gray clayey sand; discoloration smeared on exterior of sample
	9'-11'	100%	7,295		gray clayey sand with more clay at 10'-11'; caliche nodule at 11'; odor; moist
	11'-13'	100%	1,414		odor; gray sandy clay with caliche nodules; moist orange brown stains
	13'-15'	100%	710,000		gray very moist clayey sand with caliche nodules; strong odor; appears saturated at 14.5'; stains

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi				
Task:	Geoprobe Investigation				
Soil Boring No.	SB-17		**Drilling Contractor:**	Gemini Technical Services, Inc.	
Drill Make and Model:	Mobiledrill B-61		**Start Date:**	9/10/96	**Date Completed:** 9/10/96
Drilling Method:	hollow stem auger				
Ground Elevation (ft MSL):			**Total Depth (ft):**	15	**Hole Diameter:** 8 in
Logged by:	Bobby Hill		**Depth to Water (ft bgs):**	13'	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-2'	65%	6		topsoil to about 2", no odor; moist brown sand/gravel at about 1', no odor; moist brown sand
	2'-3'	90%	2		hard, dry tan sand with iron staining, no odor
	3'-5'	65%	296		slightly moist hard tan sand, slight odor at 5'
	5'-7'	75%	1,420		moist greenish tan sand, strong odor
	7'-9'	100%	8,739		same as above with caliche and iron staining, strong odor
	9'-11'	60%	585		moist greenish gray sandy clay, no odor
	11'-13'	60%	10,858		very moist greenish tan sandy clay with iron staining, hydrocarbon odor
	13'-15'	65%	1,832		saturated tan sand, strong hydrocarbon odor and sheen

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No. SB-18		**Drilling Contractor:** Gemini Technical Services, Inc.	
Drill Make and Model: Mobiledrill B-61		**Start Date:** 9/11/96	**Date Completed:** 9/11/96
Drilling Method: direct push/solid flight auger			
Ground Elevation (ft MSL):		**Total Depth (ft):** 17	**Hole Diameter:** 4 in
Logged by: Brent Balusek		**Depth to Water (ft bgs):** 15.5	

Depth below surface (ft) 0	SAMPLE Sample Interval	Recovery (inches)	PID Result (ppm)	Sample I.D. (offsite analysis)	SOIL DESCRIPTION Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)
	0'-2'	100%	18		0'-0.5' - topsoil 0.5'-2.0' - tan sand
	2'-4'	100%	1,480		as above 3.5'-4.0' - tan sand with black streaks, odor
	4'-6'	100%	>19,999		4.0'-4.5' - as above 4.5'-5.5' - gray clayey sand with orange mottling 5.5'-6.0' - gray sand, strong odor
	6'-8'	100%	295		tan sand with gray streaks, odor
	8'-9'	100%	1,350		as above - odor gray sand
	9'-11'	100%	8,770		gray clayey sand with layer of tan sand at 9.5'
	11'-13'	100%	1,720		as above to 12.5' 12.5' - gray sandy clay with orange mottling and caliche
	13'-15'	100%	8,410		as above - gray sand layer at 13.5'
	15'-17'	100%	17,370		as above to 15.5' - wet at 15.5 15.5' - 17.0' - gray sand

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No. SB-19		**Drilling Contractor:** Gemini Technical Services, Inc.	
Drill Make and Model: Mobiledrill B-61		**Start Date:** 9/11/96	**Date Completed:** 9/11/96
Drilling Method: hollow stem auger			
Ground Elevation (ft MSL):		**Total Depth (ft):** 13	**Hole Diameter:** 8 in
Logged by: Bobby Hill		**Depth to Water (ft. bgs):** 7	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-1'	100%	585		Concrete and base material
	1'-3'	100%	>19,999		light gray unconsolidated fine grained sand, odor
	3'-5'	90%	>19,999		3'-4.5' - as above 4.5'-5' - dark gray moist silty clay
	5'-7'	50%	>19,999		5'-6' - sloughed sand 6'-7' - moist to saturated silty clay 7' - black sand, strong hydrocarbon odor
	7'-9'	90%	>19,999		black saturated sand, sheen, strong hydrocarbon odor
	9'-11'	100%	2,060		9'-10.5' - greenish gray silty clay 10.5'-11 - greenish gray clay sand
	11'-13'	100%	322		11'-12' - as above 12'-13' - gray sand

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No. SB-20		**Drilling Contractor:** Gemini Technical Services, Inc.	
Drill Make and Model: Mobiledrill B-61		**Start Date:** 9/11/96	**Date Completed:** 9/11/96
Drilling Method: hollow stem auger			
Ground Elevation (ft MSL):		**Total Depth (ft):** 18	**Hole Diameter:** 8 in
Logged by:	Brent Balusek	**Depth to Water (ft bgs):** 14.5	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-2'	60%	4		0'-0.5' - topsoil 0.5'-2' - tan sand
	2'-4'	100%	375		2'-3.5' - tan sand 3.5'-4' - tannish/orange sand
	4'-6'	60%	3,380		as above
	6'-8'	95%	1,450		6'-6.5' - tan sand, saturated 6.5'-8' - greenish tan clayey sand, odor
	8'-10'	10%	>19,999		9.5 - gray sand, odor
	10'-12'	95%	900		greenish gray clayey sand with orange mottling, odor
	12'-14'	90%	4,559		12'-13.5' - as above 13.5' - caliche layer 2" thick 13.5'-14' - greenish gray clayey sand
	14'-16'	95%	6,096		14'-14.5' - as above 14.5' - saturated, odor, gray clayey sand 15'- 16' - gray sand
	16'-18'	100%	623		16'-17.5' - gray saturated sand 17.5'-18' - greenish gray clayey sand

General Notes:

FIELD DATA SHEET 2
SOIL BORING LOG

Site:	Naval Air Station Corpus Christi		
Task:	Geoprobe Investigation		
Soil Boring No. SB-21	**Drilling Contractor:** Gemini Technical Services, Inc.		
Drill Make and Model: Mobiledrill B-61		**Start Date:** 9/11/96	**Date Completed:** 9/11/96
Drilling Method: solid flight auger			
Ground Elevation (ft MSL):	**Total Depth (ft):** 18		**Hole Diameter:** 4 in
Logged by: Brent Balusek/Bobby Hill		**Depth to Water (ft bgs):** 14.5	

	SAMPLE				SOIL DESCRIPTION
Depth below surface (ft) 0	**Sample Interval**	**Recovery (inches)**	**PID Result (ppm)**	**Sample I.D. (offsite analysis)**	**Description: Name, grain size distribution, color, moisture content, density, unusual observations (staining, odor, etc.)**
	0'-2'	100%	0		0'-6" - sandy loam 6"-2' - tan sand, no odor
	2'-4'	100%	0		brown sand, no odor
	4'-6'	100%	17		same as above, moist at 5.5', no odor
	6'-8'	100%	542		6'-7' - same as above - no odor 7-8' - greenish tan clayey sand, slight hydrocarbon odor
	8'-10'	60%	>19,999		8'-9' - (slough) 9'-9.5' - stiff sandy clay, greenish gray, hydrocarbon odor 9.5'-10' - green-gray, unconsolidated sand
	10'-12'	75%	2,040		10'-10.5' - as above, very moist 10.5'-11' - as above, becoming clayey, consolidated, odor
	12'-14'	75%	308		12'-12.5' - slough 12.5'-13.5' - greenish - gray sandy clay with iron staining, odor
	14'-16'	75%	243		14'-14.5 - slough 14.5'-14.75' - saturated silty sand, odor 14.75'-15.5' - greenish gray sandy clay
	16'-18'	60%	330		as above, odor

General Notes:

APPENDIX C
FLUID LEVEL MEASUREMENTS, SEPTEMBER 16, 1996

Fluid Level Measurements 9/16/96 (2 pages)

FLUID LEVEL MEASUREMENTS

AES Project No. 243-65616-01

Date: 9/16/96

By: BAB

Sheet: 1 of 2

Description/Address: NAS C.C.

Well No.	Casing Elevation (ft.)	Time	Depth to PSH (ft.)	Depth to Water (ft.)	PSH Thickness (ft.)	Corrected Ground Water Elevation (ft.)	Comments
MW-12		11:41	---	7.39	-0-		
MW-8		11:44	---	6.13	-0-		
MW-9		11:48	---	6.74	-0-		
MW-10		11:52	---	6.91	-0-		
MW-3		11:55	---	6.30	-0-		
MW-2		11:58	---	7.23	-0-		
MW-4		12:02	---	9.63	-0-		
MW-7		12:05	---	8.87	-0-		
MW-16		12:09	---	8.95	-0-		
MW-5		12:11	---	10.20	-0-		
MW-28		12:14	---	10.12	-0-		
MW-18		12:17	---	9.26	-0-		
MW-29		12:19	8.24	8.92	.68		
MW-25		12:21	---	11.05	-0-		
MW-27		12:24	---	8.99	-0-		
MW-19		12:26	---	10.09	-0-		
MW-24		12:29	---	11.07	-0-		
MW-20		12:32	9.99	10.19	.20		
RW-2		12:35	10.84	10.88	.04		
MW-13		12:38	10.21	10.94	.73		
RW-1		12:40	---	11.36	-0-		

FLUID LEVEL MEASUREMENTS

AES Project No. 243-85616-01

Date: 9/16/96

By: BAB

Sheet: 2 of 2

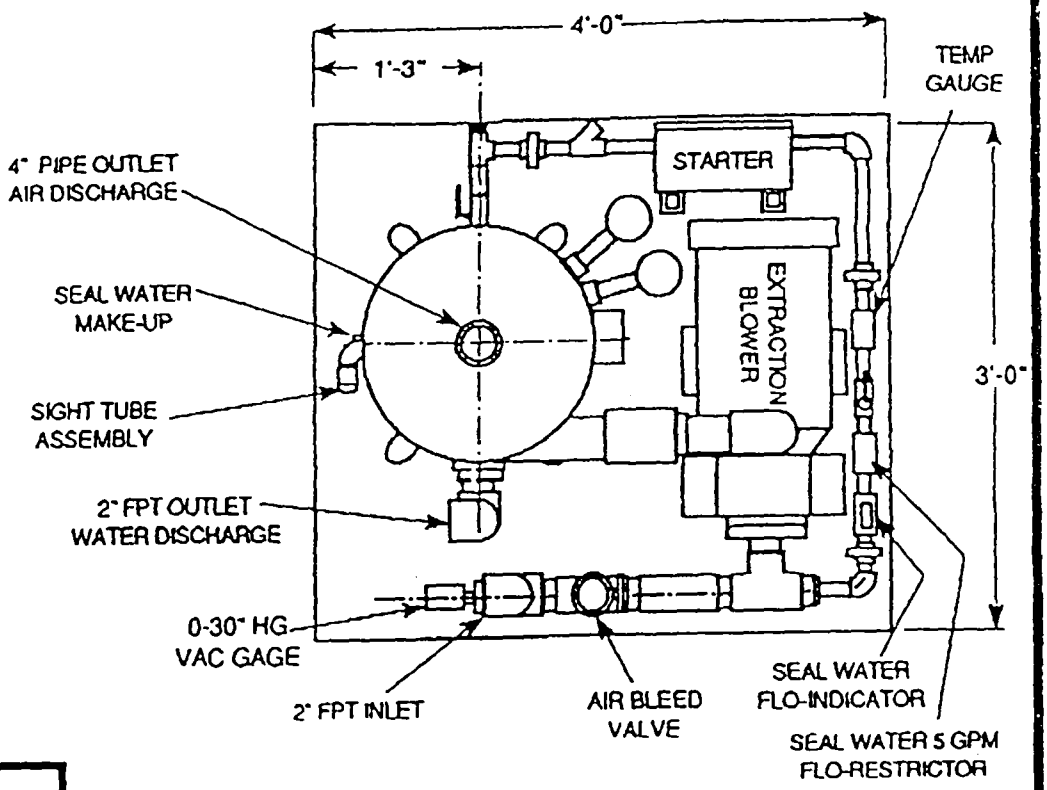
Description/Address: NAS C.C.

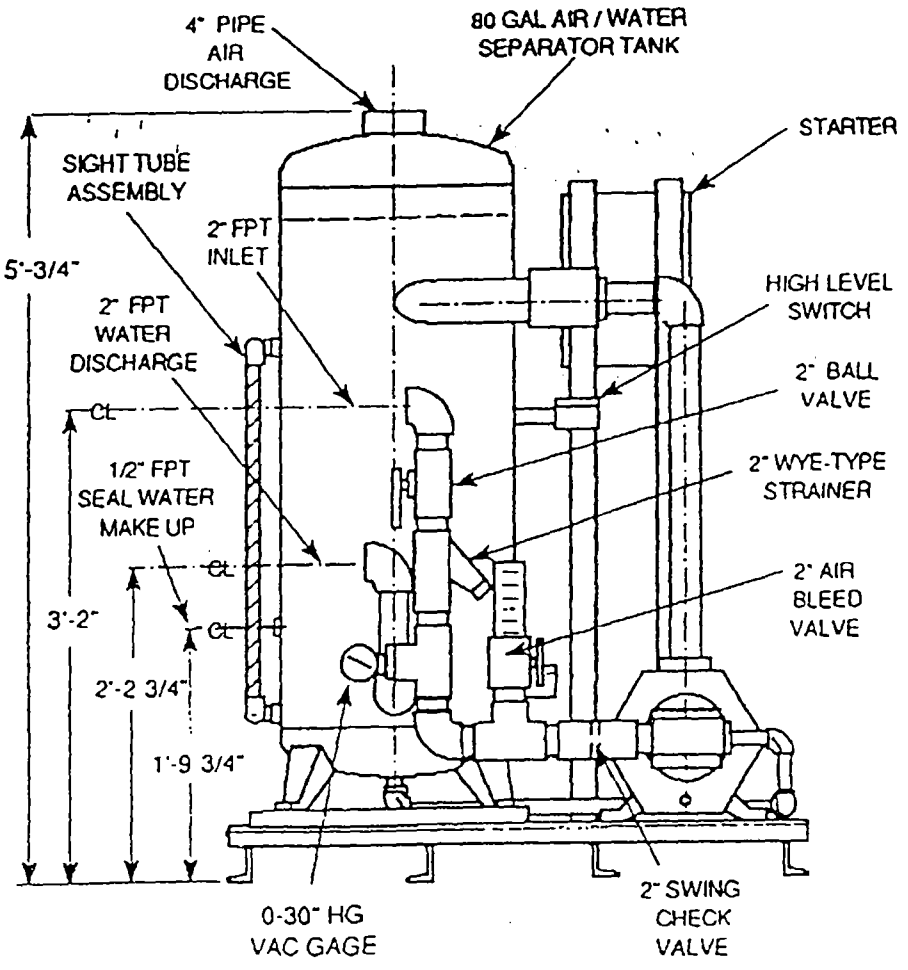
Well No.	* Casing Elevation (ft.)	Time	Depth to PSH (ft.)	Depth to Water (ft.)	PSH Thickness (ft.)	Corrected Ground Water Elevation (ft.)	Comments
MW-14		12:43	8.45	8.72	.27		
MW-3		12:46	8.68	9.56	.88		
MW-21		12:49	8.64	10.24	1.60		
MW-23		12:52	---	8.00	-0-		
MW-22		12:56	10.32	11.97	1.65		
MW-26		12:59	10.28	10.83	.55		
SB-14B	2.39	13:02	---	6.22	-0-		
SB-15D	-0-	13:06	---	8.89	-0-		
SB-21	3.50	13:09	---	11.22	-0-		
SB-18	2.60	13:12	---	12.19	-0-		
SB-16B	5.27	13:17	---	13.18	-0-		
SB-20	2.30	13:22	---	11.07	-0-		
SB-17	2.70	13:31	10.10	10.10	<.01		Heavy Sheen
SB-19	3.59	13:45	7.06	7.06	<.01		Not Measurable W/ IF PROBE But more than Heavy Sheen
	* TOC to Ground of Riser above feet)	Ground	Surface	(i.e. Amount Ground Surface in			

Rev. 10/93

APPENDIX D
RENTED LIQUID RING VACUUM PUMP SYSTEM SCHEMATIC

Multi-phase Extraction System DWG. 3058 (1 page)





CARBTROL ®
CORPORATION

51 RIVERSIDE AVENUE
WESTPORT CONN. 06880
(203) 226-5642

SCALE —
DATE 9-5-96
Wah

MULTI-PHASE EXTRACTION SYSTEM

MPX-75, PILOT UNIT NO.2, GRAVITY DISCHARGE

ARRANGEMENT

S

DWG 3058/0

REV BY DVB

APPENDIX E
LIQUID RING VACUUM PUMP PILOT TEST DATA

Multi-phase Product Recovery Data Sheet 9/21/96 10:13 pm (1 Page)
Multi-phase Product Recovery Data Sheet 9/21/96 10:21 pm (1 Page)
Multi-phase Product Recovery Data Sheet 9/21/96 10:37 pm (1 Page)
Multi-phase Product Recovery Data Sheet 9/21/96 10:22 pm (1 Page)
Multi-phase Product Recovery Data Sheet 9/21/96 10:21 pm (1 Page)
Fluid Level Measurements 9/24/96 (1 pages)
Corpus Christi NAS preliminary design calculations John Broadus 23-Sep-96 (3 pages)
DISTANCE.XLS Spreadsheet (1 pages)
DISTANCE.XLS graphs (1 pages)
SCFM.XLS Spreadsheet (6 page)
SCFM Spreadsheet graphs (1 page)

MULTI-PHASE PRODUCT RECOVERY DATA SHEET

Initial Time *	9/21/96 18:00	*24 hr clock
Vapor Conc - PPMV	13500	Well
Vapor Conc - PPMV	3500	Outlet
Initial Water Gauge		Inches
Initial Product Gauge		Inches

Molecular Weight of Product	96
Specific Gravity of Product	0.80

Product Tank Diameter	22.25	Inches
Water Tank Diameter	98.17	Inches
Well Piping ID	2	Inch
Ambient Piping ID	2	Inch
Oulet Piping ID	2	Inch
Well orifice plate ID	1	Inch

								Orifice Plate Model No.					
								2-8-4fom	2SB0551	Pitot			
Test Well Number	End Time	Ending Concentration Well PPMV	Ending Concentration Outlet PPMV	Tank Water Inches	Tank Product Inches	Vacuum Well (in Hg)	Vacuum Ambient in (wtr)	Pressure Outlet in(wtr)	Differential Pressure Well (In wc)	Differential Pressure Ambient (In wc)	Differential Pressure Outlet (In wc)	Temperature Well (F)	Temperature Ambient (F)	Temperature Outlet (F)
MW-21	9/21/96 18:40	13500	3500			23.5		0.33	1.65		0.33	80		100
	9/21/96 19:30	13500	3500	0.5		22.5		1.15	2.5		0.32	70		100
	9/21/96 20:30	13500	3500	0.75		21		1.1	3		0.25	70		100
	9/21/96 21:40	19000	4000	1.25		23		1.1	0.3		0.13	67		104
	9/21/96 22:40	19000	4000	1.75		23		1.15	0.45		0.22	70		108
	9/21/96 23:45	19000	4000	2.25		22.5		1.08	2.5		0.13	70		108
	9/22/96 0:40	19000	4000	2.5		22.5		1.1	1.65		0.15	70		108
	9/22/96 1:30	19000	4000	3		23		1.08	1.15		0.25	70		110
	9/22/96 2:30	19000	4000	3.5		22.5		1.1	0.65		0.15	70		108
	9/22/96 3:30	19000	4000	4		22		1.2	0.75		0.17	68		110
	9/22/96 4:30	19000	4000	4.5		23		1.15	0.5		0.22	70		108
	9/22/96 5:30	19000	4000	4.75		22.5		1.2	1.1		0.18	70		106
	9/22/96 6:30	19000	4000	5.25		22.5		1.1	0.8		0.19	68		110
	9/22/96 7:00	19000	4000	5.75		22		1.15	0.8		0.3	70		108

MULTI-PHASE PRODUCT RECOVERY DATA SHEET

Well Data				Before Test			After Test			
Observation Well Number	Observation Well Diameter	Observation Well Depth	Distance From Test Well	DTP DTP Feet	DTW DTW Feet	Product Product Feet	DTP DTP Feet	DTW DTW Feet	Product Product Feet	Change in Product Level
MW-26	2		368	10.14	10.53	0.39	10.2	10.6	0.4	-0.01
MW-22	2		190	10.12	11.52	1.4	10.26	11.54	1.28	0.12
MW-23	2		85	7.46	7.46		7.58	7.58		
MW-29	2		168	7.94	8.55	0.61	7.98	8.62	0.64	-0.03
MW-4			358	5.85	5.85		6.18	6.18		
MW-14	2		76	8.18	9	0.82	8.28	9.04	0.76	0.06
MW-2	2		98	5.2	5.2		6.47	6.47		
MW-25	2		134	10.77	10.77		10.85	10.85		
MW-13			212	9.98	10.24	0.26	10.1	10.23	0.13	0.13
MW-20			370	9.84	10.06		9.9	10.18		
RW-3	4		15	8.26	9.1		8.35	9.15		
RW-1	4		152		11.13		11.24	11.24		
GP-6			15							
MW-21	2		0.08	8.2	10.18	1.98	8.71	8.85	0.14	1.84
MW-21*	2			9.6	11.58	1.98	10.13	10.27	0.14	1.84

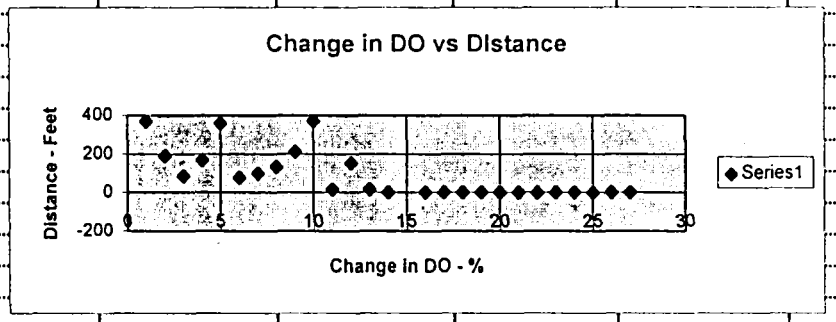
* Top of LRV attachment

MULTI-PHASE PRODUCT RECOVERY DATA SHEET

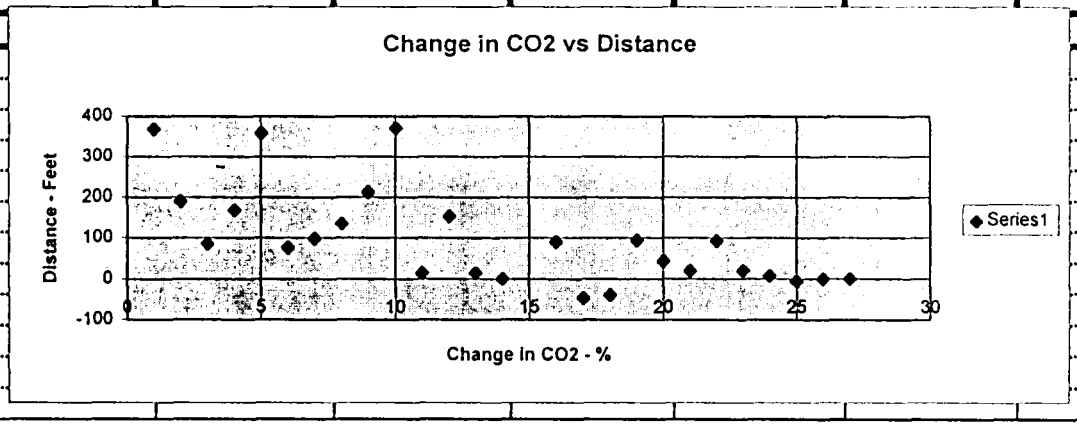
Observation Well Number	Time					
	9/21/96 9:10	9/21/96 9:10	9/22/96 9:10	9/22/96 9:10	Difference	Difference
	CO2	O2	CO2	O2	CO2	O2
GP-1	1.50	13.70	18.00	0.40	-16.50	13.30
GP-2	2.20	8.60	2.90	15.60	-0.70	-7.00
GP-3	25.50	0.10		24.40	25.50	-24.30
GP-4	39.50		52.50	0.60	-13.00	-0.60
GP-5		0.30		1.10		-0.80
GP-6		2.20		17.90		-15.70
Ambient		20.90		24.00		-3.10

MULTI-PHASE PRODUCT RECOVERY DATA SHEET

Observation Well Number	9/21/96 1:10 DO	9/22/96 9:00 DO	Difference DO	DO	DO	DO	DO	DO	DO	DO
MW-26	0.30	0.30								
MW-22	1.10	0.80	0.30							
MW-23	1.00	0.85	0.15							
MW-29	1.40	1.30	0.10							
MW-4										
MW-14	0.80	0.80								
MW-2	0.37	1.20	-0.83							
MW-25	0.50	0.30	0.20							
MW-13	0.80	0.70	0.10							
MW-20	1.00	1.30	-0.30							
RW-3	1.40	1.30	0.10							
RW-1	0.30	0.30								



Observation Well Number	1:10 CO2	9:00 CO2	Difference CO2	CO2
MW-26	450	360	90	
MW-22	380	428	-48	
MW-23	236	276	-40	
MW-29	804	710	94	
MW-4	326	282	44	
MW-14	396	376	20	
MW-2	450	358	92	
MW-25	402	382	20	
MW-13	440	432	8	
MW-20	362	368	-6	
RW-3				
RW-1				



MULTI-PHASE PRODUCT RECOVERY DATA SHEET

Observation Well Number	9/21/96 19.:15 Vacuum w.c.	9/21/96 19:40 Vacuum w.c.	9/21/96 20.40 Vacuum w.c.	9/21/96 21:10 Vacuum w.c.	9/21/96 22:15 Vacuum w.c.	9/21/96 23:15 Vacuum w.c.	9/22/96 0:00 Vacuum w.c.
MW-26							
MW-22				0.02			
MW-23	0.06	0.02	0.02				
MW-29		0.02					
MW-4							
MW-14							
MW-2							
MW-25							
MW-13							
MW-20							
RW-3							
RW-1							
GP-6	0.3	0.33	0.26	0.22	0.25	0.26	0.11
MW-21	244.8	238	244.8	225.76	231.2	225.76	244.8
MW-21*							

APPLIED EARTH SCIENCES, INC.

FLUID LEVEL MEASUREMENTS

AES Project No. 243-05616-01

Date: 9/20/96

By: Bobby Hill

Sheet: 1 of 1

Description/Address: NAS - C.C.

Well No.	Casing Elevation (ft.)	Time	Depth to PSH (ft.)	Depth to Water (ft.)	PSH Thickness (ft.)	Corrected Ground Water Elevation (ft.)	Comments
MW-21		15:25	8.51	9.00	0.49		

Rev. 10/93

23-Sep-96
John H. Broadus, P.E.

Corpus Christi NAS preliminary design Calculations

Flow rate calulations

Average site Barometric pressure =		29.74	in Hg		
Average site temperature =		75.00	F		
Air Density =		0.074	lbs/ft^3		
Use Outlet pressure readings - most stable, least fluctuation, inlet fluctuated due to slugs of water.					
Average outlet differential pressure hv =		0.21	in wtr		
Average line temperature =		106.00	F		
Average line pressure =		1.07	in wtr	0.079	in Hg
From Dwyer Instrument catalog for pitot tubes					
Pb= absolute static pressure in Hg		29.82	in Hg		
T = temp + 460		566.00	Rankin		
d=1.325*(Pb/T)	density of air in pipe	0.07	lbs/ft^3		
V=1096.7*sqrt(hv/d)	velocity of air in pipe	1902.19	ft/min		
Pipe diameter =		2.00	in		
Pipe area A =		3.14	sq in		
		0.02	sq ft		
Flowrate Q = V*A		41.50	scfm		
Average outlet concentration levels		5,837	PPM		
Concerting PPM to mg/m^3					
C = PPM*MW/24					
Assume MW =		96	molecular weight		
Concentration =		23,348	mg/m^3		

Mass recovery = concentration * Q

M = C * Q * 0.000003747 — 3.63 lbs/hr total TPH**
includes unit conversions
**Exceeds state maximum of 1 lb/hr TPH would require off gas treatment

Assuming C and Q remain constant

Mday = M * 24 — 87.14 lbs/day

SG of product = 0.8

weight of water = 8.34 lbs/gal

weight of product = SG * wt of wtr 6.672 lbs/gal

assuming rates remain constant = 13.06 gal/day via volatilization of vapors

compare to product recovery = 3.36 gal in 13 hrs
or 6.20 gal/day via product recovery

Total	19.27	gal/day	product
	449	gal/day	water
	59759	cf	air

Preliminary equipment sizing

Number of wells = 5

Flow rate per well = 41.50 scfm

Total flow rate = 207 scfm
for continuous operation per well
At vacuum pressures of 20 in Hg

Total maximum recovery with such a system assuming no short circuiting

81.33	gal/day	product
2246	gal/day	water
298795	cf	air

Requires A200 liquid ring vacuum pump or larger
15 hp motor
3 ph power required - 440 may be desireable

Single well at a time would only require an A75 or smaller
5 hp motor — 19.27 gal/day product
can run on 220 single or 3 ph — 449.30 gal/day water

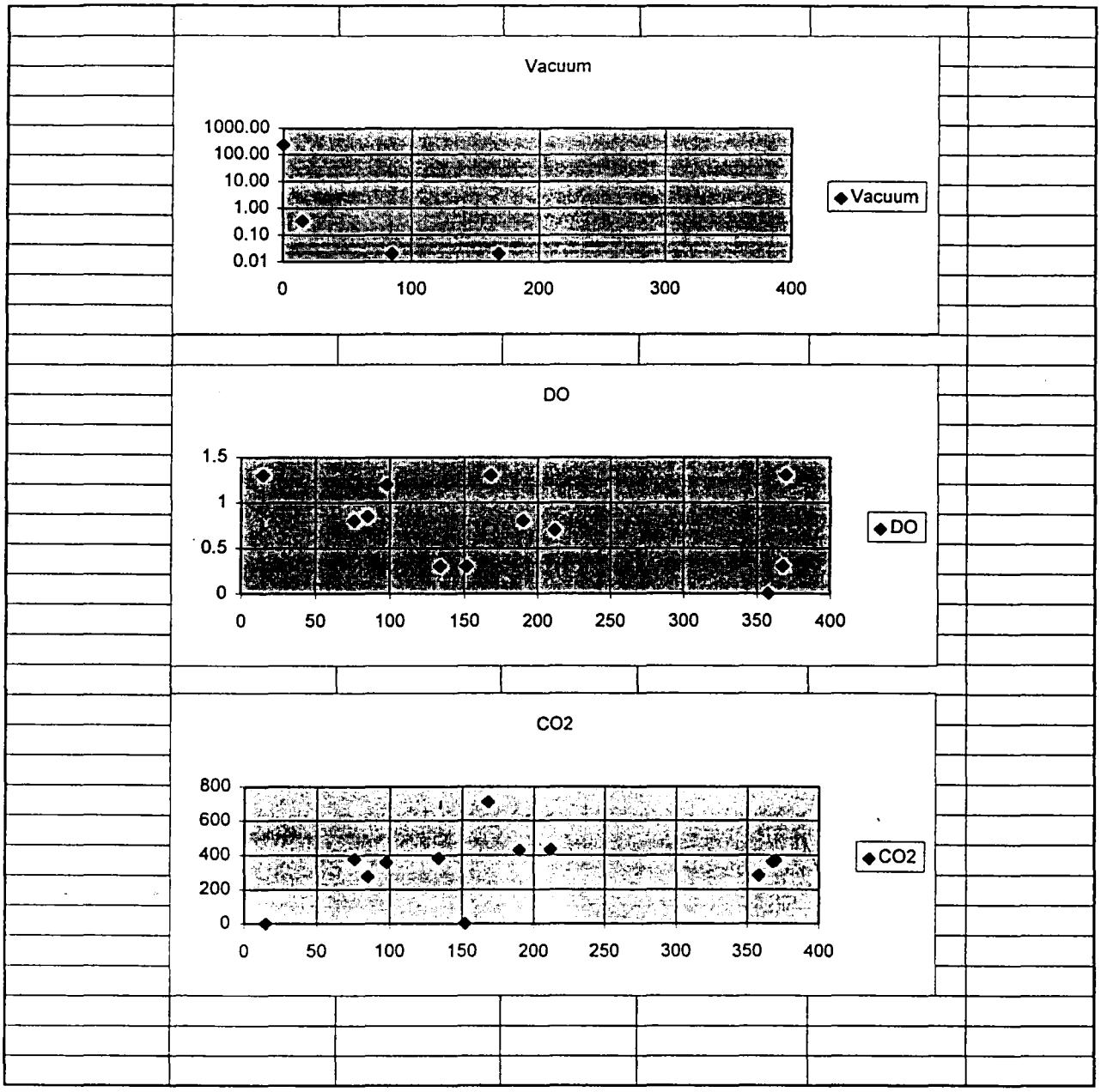
3 ph would be preferred 59759.02 cf air

Separate valving with solenoids would ensure that all wells are fully evacuated during the day.
A single system pulling on all wells at one time would not quarantee all wells are being evacuated during the day

Based on observations in the field, only one observation point appeared to be affected.
Geo probe point GP-6 located 15' from test well MW-21
vacuum pressures of .33 in wtr were observed in this well
a radius of influnce of maybe 20 feet can be inferred from this single well point
This vapor point was set at a depth of 5 feet, indicating that this well was influenced by MW-21, most probably short circuiting through the casing screens at the top of MW-21 into the perched zone at 5 feet

RW-3 also located 15 feet from the test well and screened similar to MW-21 was not affected by the test well. No vacuum was induced in the well and product thicknesses changed only slightly from .84 to .80 feet.

Well Data						
Observation	Observation	Observation	Distance	Vacuum	DO	CO2
Well	Well	Well	From Test	9/21/96 19:40	9/22/96 9:00	9:00
Number	Diameter	Depth	Well	Vacuum w.c.	DO	CO2
MW-26	2	0	368	0.00	0.3	360
MW-22	2	0	190	0.00	0.8	428
MW-23	2	0	85	0.02	0.85	276
MW-29	2	0	168	0.02	1.3	710
MW-4	0	0	358	0.00	0	282
MW-14	2	0	76	0.00	0.8	376
MW-2	2	0	98	0.00	1.2	358
MW-25	2	0	134	0.00	0.3	382
MW-13	0	0	212	0.00	0.7	432
MW-20	0	0	370	0.00	1.3	368
RW-3	4	0	15	0.00	1.3	0
RW-1	4	0	152	0.00	0.3	0
GP-6	0	0	15	0.33		
MW-21	2	0	0.0833333	238.00		
MW-21*	2	0	0	0.00		


Vacuum
1000.00
100.00
10.00
1.00
0.10
0.01
0
100
200
300
400
Vacuum
DO
1.5
1
0.5
0
0
50
100
150
200
250
300
350
400
DO
CO2
800
600
400
200
0
0
50
100
150
200
250
300
350
400
CO2

	Client:	Morrison - Knudsen				
	Facility:	Corpus Christi - NAS				
	Address:	0				
	City:	Corpus Christi				
	State:	Texas				
	AES Project No.:	243-05616-01				
	Date:	35331				
	29.74	inHg				Cc =
						Cv =
	Dens ST	0.075	lb/ft^3	air		
	Dens ST	62.428	lb/ft^3	wtr		
	Well Piping ID		2	Inch	Area =	3.1416
	Ambient Piping ID		2	Inch	Area =	3.1416
	Outlet Piping ID		2	Inch	Area =	3.1416
	Well Orifice Plate ID		1	Inch	Area =	0.7854

				Orifice Plate Model No.		
				2-8-4fom	2SBO551	Pitot
		Time		Differential	Differential	Differential
Test	End	Per	Elapsed	Pressure w.c	Pressure w.c	Pressure w.c
Well	Time	Interval	, Time	Well	Ambient	Outlet
Number	18:00	D H:M	D H:M	(in Hg)	(in Hg)	(in Hg)
MW-21	18:40	0:40	0 0:40	0.12		0.02
	19:30	0:50	0 1:30	0.18		0.02
	20:30	1:00	0 2:30	0.22		0.02
	21:40	1:10	0 3:40	0.02		0.01
	22:40	1:00	0 4:40	0.03		0.02
	23:45	1:05	0 5:45	0.18		0.01
	0:40	0:55	0 6:40	0.12		0.01
	1:30	0:50	0 7:30	0.08		0.02
	2:30	1:00	0 8:30	0.05		0.01
	3:30	1:00	0 9:30	0.06		0.01
	4:30	1:00	0 10:30	0.04		0.02
	5:30	1:00	0 11:30	0.08		0.01
	6:30	1:00	0 12:30	0.06		0.01
	7:00	0:30	0 13:00	0.06		0.02

Corrected for water Air Density Well lb/ft^3	Air Density Ambient lb/ft^3	Air Density Outlet lb/ft^3	Actual Air Velocity Well fpm	Actual Air Velocity Ambient fpm	Actual Air Velocity Outlet fpm	Standard Air Velocity Well sfpm	Standard Air Velocity Ambient sfpm	Standard Air Velocity Outlet sfpm
0.348		0.070	690.46		643.52	1486.81		623.80
0.040		0.071	2508.51		2337.55	1830.14		614.27
0.061		0.071	2217.34		2066.25	6944.89		542.95
0.012		0.070	1604.69		1495.31	2196.17		391.52
0.010		0.070	2094.79		1951.99	2689.74		509.33
0.097		0.070	1610.33		1500.64	6339.78		391.52
0.055		0.070	1729.78		1611.91	5150.47		420.57
0.023		0.069	2237.16		2084.67	4299.85		542.95
0.022		0.070	1729.81		1611.91	3232.67		420.57
0.022		0.069	1844.54		1718.81	3472.44		447.73
0.011		0.070	2094.79		1951.99	2835.24		509.33
0.031		0.070	1891.33		1762.42	4205.34		460.71
0.021		0.069	1950.27		1817.33	3586.32		473.33
0.013		0.070	2446.19		2279.44	3586.32		594.77

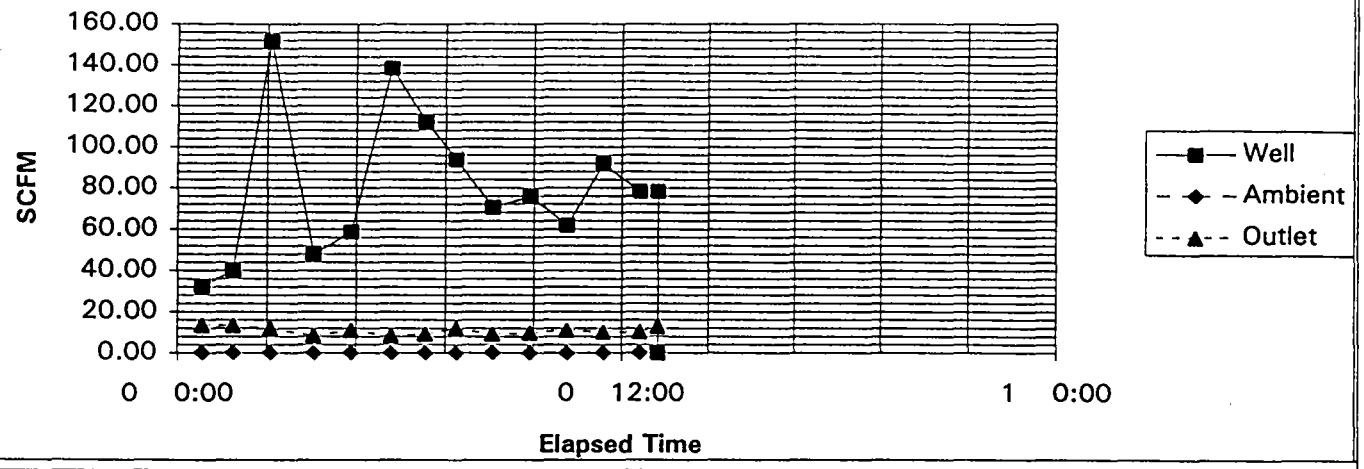
Calculated from EIT Manual						Eclipse-Dungs Table		
Actual Flow Rate Well cfm	Actual Flow Rate Ambient cfm	Actual Flow Rate Outlet cfm	Standard Flow Rate Well scfm	Standard Flow Rate Ambient scfm	Standard Flow Rate Outlet scfm	Standard Flow Rate Well ft^3/min	Standard Flow Rate Ambient ft^3/min	Standard Flow Rate Outlet ft^3/min
15.06		14.04	32.44		13.61	32.43		30.55
54.73		51.00	39.93		13.40	43.59		30.11
48.37		45.08	151.51		11.85	52.57		26.54
35.01		32.62	47.91		8.54	14.28		18.93
45.70		42.59	58.68		11.11	17.52		24.69
35.13		32.74	138.31		8.54	43.59		18.87
37.74		35.17	112.37		9.18	35.26		20.30
48.81		45.48	93.81		11.85	28.29		26.30
37.74		35.17	70.53		9.18	21.91		20.30
40.24		37.50	75.76		9.77	24.41		21.60
45.70		42.59	61.86		11.11	18.48		24.69
41.26		38.45	91.75		10.05	28.66		22.32
42.55		39.65	78.24		10.33	24.40		22.86
53.37		49.73	78.24		12.98	25.18		28.93

Calculated From Rotron Book Using "C" Factor							
Standard	Standard	Standard	Standard	Standard	Standard		
			Flow	Flow	Flow	Air	
Velocity	Velocity	Velocity	Rate	Rate	Rate	Per	Air
Well	Ambient	Outlet	Well	Ambient	Outlet	Interval	Cum
sfpm	sfpm	sfpm	scfm	scfm	scfm	SCF	SCF
4120.15		1842.59	89.89		40.20	1297.49	1297.49
5071.56		1814.46	110.64		39.59	1996.37	3293.86
5555.61		1603.77	121.20		34.99	9090.84	12384.69
1756.84		1156.49	38.33		25.23	3353.90	15738.60
2151.68		1504.47	46.94		32.82	3520.87	19259.46
5071.56		1156.49	110.64		25.23	8990.32	28249.79
4120.15		1242.27	89.89		27.10	6180.12	34429.90
3439.70		1603.77	75.04		34.99	4690.41	39120.31
2586.00		1242.27	56.42		27.10	4231.55	43351.86
2777.81		1322.50	60.60		28.85	4545.42	47897.28
2268.07		1504.47	49.48		32.82	3711.32	51608.60
3364.09		1360.84	73.39		29.69	5504.77	57113.37
2868.91		1398.13	62.59		30.50	4694.49	61807.86
2868.91		1756.84	62.59		38.33	2347.24	64155.10

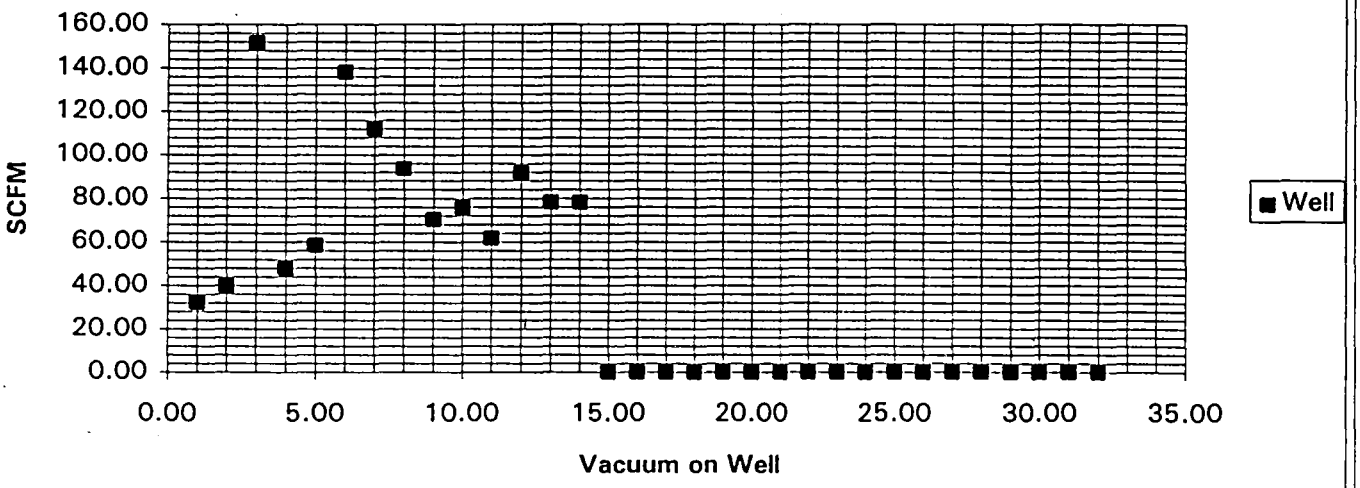
Absolute Vacuum Well (in Hg)	Absolute Vacuum Ambient (in Hg)	Absolute Pressure Outlet (in Hg)	Absolute Temperature Well (F)	Absolute Temperature Ambient (F)	Absolute Temperature Outlet (F)	Air Density Well lb/ft^3
6.24		29.77	539.7		559.7	0.015
7.24		29.83	529.7		559.7	0.018
8.74		29.83	529.7		559.7	0.022
6.74		29.83	526.7		563.7	0.017
6.74		29.83	529.7		567.7	0.017
7.24		29.82	529.7		567.7	0.018
7.24		29.83	529.7		567.7	0.018
6.74		29.82	529.7		569.7	0.017
7.24		29.83	529.7		567.7	0.018
7.74		29.83	527.7		569.7	0.019
6.74		29.83	529.7		567.7	0.017
7.24		29.83	529.7		565.7	0.018
7.24		29.83	527.7		569.7	0.018
7.74		29.83	529.7		567.7	0.019

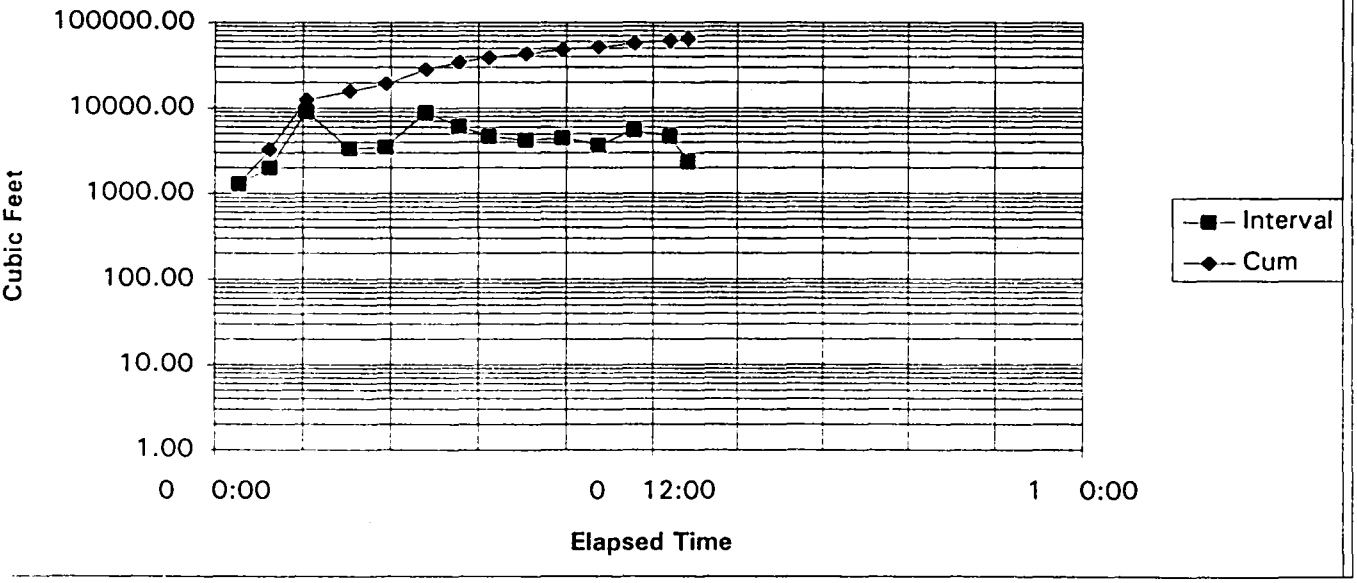
	2.5CO708				
	0.5011				
	3.4605				
Model Orifice Plate	**2-8-4fom**	**2.5CO810**	**2SBO369**	**2SBO448**	**2SBO551**
Slope(log)	0.5109	0.4988	0.5001	0.4909	0.5007
Intercept(log)	2.9570	3.6547	2.8168	2.9048	3.1001
					0.51086349
					2.95695091
			1.25	1000	0.097
			2.6	1500	0.415
			4.65	2000	0.667
			7.3	2500	0.863
			10.5	3000	1.021
			14.1	3500	1.149
			18.5	4000	1.267

SCFM Vs Elapsed Time



Well Vacuum Vs SCFM





APPENDIX F
PILOT TEST RECOVERED VAPOR ANALYSIS

Letter from Core Lab dated 3/25/97, associated data, Chain of custody, and shipping paper (6 pages)

CORELAB

GULF STATES ANALYTICAL

03/25/97

Ms. Claire Meurer
Applied Earth Sciences
Applied Earth Sciences
4455 S. Padre Island Dr., Ste. 28
Corpus Christi, TX 78411

Reference:
Project: 243-05616-01
Date Received: 09/24/96
GSA Group: 23583 Group Report Date: 09/27/96

Dear Ms. Meurer:

Enclosed are the analytical results for your above referenced project. The following samples are included in the report.

Inlet :127385 Outlet :127386

All holding times were met for the tests performed on these samples.

Our A2LA accreditation requires that, should this report be reproduced, it must be reproduced in total.

Enclosed please find the Quality Control Summary. All quality control results for the QC batch that are applicable to this sample(s) are acceptable except as noted in the QC batch reports.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Core Lab - Gulf States Analytical to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

Sincerely yours,

Lora Dunlap
Project Manager

CORELAB

GULF STATES ANALYTICAL

ANALYSIS SUMMARY REPORT

Applied Earth Sciences
Applied Earth Sciences
4455 S. Padre Island Dr., Ste. 28
Corpus Christi, TX 78411

GSA Group: 23583
Date Reported: 09/27/96
Date Received: 09/24/96

Attn: Ms. Claire Meurer
Project: 243-05616-01

Purchase Order:
Project No.:

Test	Analysis	Results as Received	Units	Limit of Quantitation
Sample:127385 - 09/21/96 - Inlet				
8340	Volatiles, TO-14			
	Benzene	2,800	ppbv	500
	Toluene	ND	ppbv	500
	Ethylbenzene	3,280	ppbv	500
	m,p-Xylene	4,350	ppbv	500
	o-Xylene	ND	ppbv	500
CL15	Non Routine Test	709,100	ppbv	
CL15	Non Routine Test	SEE COMMENT	ppbv	(1)
Sample:127386 - 09/21/96 - Outlet				
5	Non Routine Test	SEE COMMENT	ppbv	(2)
8340	Volatiles, TO-14			
	Benzene	218,000	ppbv	5,000
	Toluene	ND	ppbv	5,000
	Ethylbenzene	142,000	ppbv	5,000
	m,p-Xylene	197,000	ppbv	5,000
	o-Xylene	12,800	ppbv	5,000
CL15	Non Routine Test	5,836,800	ppbv	

(1) Fixed Gas Analysis

Parameter	Result	Unit	Detection Limit
Oxygen	21.91	Mol %	0.01
Carbon Dioxide	0.05	Mol %	0.01

(2)

Parameter	Result	Unit	Detection Limit
Oxygen	18.46	Mol %	0.01
Carbon Dioxide	0.94	Mol %	0.01

Test Method Summary:

Applied Earth Sciences GSA Group: 23583

Test Method Summary:
8340 - EPA AIR TOXICS TO-14 CL15 -

ND - Compound was analyzed but not detected.

Respectfully Submitted,
Reviewed and Approved by:

Lora Dunlap
Project Manager

Core Lab-Gulf States Analytical
Daily QC Batching Data
Data Released for Reporting

03/25/97
11:00:14
Group: 23583

A sis Batch Number: 8340 -09/25/96-1195-1
Te Identification : 8340 -Volatiles. TO-14 Units: ppbv Sequence: 092596Q
Number of Samples : 5
Batch Data-Date/Time : 09/26/96 / 07:52:13

BLANK#	ANALYTE	CONC FOUND #	LMT OF QUANTITATION
0-VCBLK	none detected		

CONTROL SAMPLE#	ANALYTE	CONC FOUND	CONC KNOWN	% REC #	QC LIMITS LOWER	QC LIMITS UPPER
0-VCLCS	Benzene	9.7900	10.0000	97.9	40.0	160.0
	Toluene	9.6700	10.0000	96.7	40.0	160.0
	Ethylbenzene	10.3800	10.0000	103.8	40.0	160.0
	m,p-Xylene	21.4400	20.0000	107.2	40.0	160.0
	o-Xylene	10.8700	10.0000	108.7	40.0	160.0

SURG #:65-8340 -A-SU

SAMPLE#	BFB #
SAMPLE 23583-127385	113(A)
SAMPLE 23583-127386	141(A)
SAMPLE 23583-127386	141(A)
SAMPLE 23583-127385	114(A)
SAMPLE 23583-127385	115(A)
BLK 1 0-VCBLK	96
CTL 1 0-VCLCS	101

65) -A-SU - VOLATILE AIR SURROGATE		QC LIMITS	
SRG ABRV	SURROGATE DESCRIPTION	LOWER	UPPER
BFB	p-Bromofluorobenzene	89.5	107.3

---------- Result Footnotes ----------
(A) - Matrix Interference

Groups & Samples

23583-127385 23583-127386

NO. 03921

WESTERN ATLAS

CORE LABORATORIES

CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION
COMPANY: APPLIED EARTH SCIENCES	PROJECT NAME/NUMBER: 243-05616-01
SEND REPORT TO: CLAIRE MEURER	BILLING INFORMATION
ADDRESS: 4455 SOUTH PADRE ISLAND DRIVE	BILL TO: SAME
SUITE 28	ADDRESS:
CORPUS CHRISTI, TX 78411	
PHONE: 512-854-9182	PHONE:
FAX: 512-854-0734	FAX: PO NO.:

LAB JOB NO. 23583

SAMPLE NO.	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	SAMPLE MATRIX	CONTAINER TYPE	PRES.	NUMBER OF CONTAINERS	ANALYSIS REQUEST / METHOD: BTEX, TPH	O2/CO2							REMARKS / PRECAUTIONS
1	INLET	9/21/96	10:35p	GAS	TEDLAR		1	✓	✓							GAS CONTAINS
2	OUTLET	9/21/96	10:30p	GAS	TEDLAR		1	✓								HYDROCARBONS

SAMPLER: CLAIRE MEURER | SHIPMENT METHOD: | AIRBILL NO.:

REQUIRED TURNAROUND:* ☐ SAME DAY ☐ 24 HOURS ☒ 48 HOURS ☐ 72 HOURS ☐ 5 DAYS ☐ 10 DAYS ☐ ROUTINE OTHER

1. RELINQUISHED BY:	DATE	2. RELINQUISHED BY:	DATE	3. RELINQUISHED BY:	DATE
SIGNATURE: Claire P. Meurer	9/22/96	SIGNATURE:		SIGNATURE:	
PRINTED NAME/COMPANY: CLAIRE MEURER, AES	TIME 6:30 PM	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME
1. RECEIVED BY:	DATE	2. RECEIVED BY:	DATE	3. RECEIVED BY:	DATE
SIGNATURE: Deborah Jimenez	9-23-96	SIGNATURE:		SIGNATURE: A. Vargas	9/24/96
PRINTED NAME/COMPANY: D. Jimenez/Core	TIME 0940	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY: Alex Vargas/CORE-GSA	TIME 1016

* RUSH TURNAROUND MAY REQUIRE SURCHARGE

☐ Anaheim, California, 1250 E. Gene Autry Way, Anaheim, California 92805, (714) 937-1094, (800) 404-2673
☐ Long Beach, California, 3700 Cherry Avenue, Long Beach, California 90807, (310) 595-8401, (800) 814-3433
☐ Denver (Aurora), Colorado, 10703 E. Bethany Drive, Aurora, Colorado 80014, (303) 751-1780, (800) 972-2673
☐ Casper, Wyoming, 420 West 1st Street, Casper, Wyoming 82601, (307) 235-5741, (800) 666-0603
☐ Houston, Texas, 8210 Mosely Road, Houston, Texas 77075, (713) 943-9776, (800) 734-2673
☐ Corpus Christi, Texas, 1733 North Padre Island Drive, Corpus Christi, Texas 78408, (512) 289-2673, (800) 548-8228
☐ Lake Charles, Louisiana, 3645 Beglis Parkway, Sulphur, Louisiana 70663, (318) 583-4926, (800) 259-4926

ORIGINAL

CORE LAB / GULF STATES ANALYTICAL
SAMPLE RECEIPT CHECKLIST

CLIENT: AES - Corpus Christi
CONTACT: Claire Maurer
PROJECT: 0243-05616-01
CARRIER: UPS
DATE RECEIVED: 1996 SEP 24 AM 10:16
UNPACKED STAMP: 1996 SEP 24 PM 4:46
DATE SHIPPED: 9-23-96
UNPACKED BY: JE
NUMBER OF KITS RECEIVED: 1
GROUP# 23583 B.O.# —

KIT CHECKLIST

KIT ID	COC PRESENT	CUSTODY TAPE		COOLER TEMP	# OF SAMPLE CONTAINERS
		PRESENT?	INTACT?		
Blue/Wht Client	Yes	C no	no	SX's not on ice	2
		B no	no		
		C			
		B			
		C			
		B			

C = COOLER B= BOTTLES

INCONSISTENCIES

SAMPLE	PARAMETER	INCONSISTENCY
All	All	SXS ~~don't have~~ qty volume is limited. Tedlar bags are somewhat "flat"

PRESERVATIVES CHECKED YES____ NO— SEE ABOVE NOTES____(Water only)
VOLATILE HEAD SPACE CHECKED YES____ NO—

ACTION TAKEN

PERSON CONTACTED:____ DATE:____
RESOLUTION____

CORE / GSA EMPLOYEE____ DATE:____

☐ HNO3 ☐ HCL ☐ H2SO4 ☐ NAOH ☐ Na2S2O3 ☐ NEAT ☐ OT/PRE.

(Water Only)

__VOA
__OTHER

__VOA
__OTHER

Remaining Samples in Group None

Project Manager____

# Cont.	Mtrx.
2	Air
Total 2	

APPENDIX G
PHOTOGRAPHS

TABLE OF CONTENTS

Note: This appendix was not modified from the draft report. The date shown in the footer on pages G-2 through G-16 is 12/17/97 not 1/29/98.

Photograph 1. LRV unit and generator (Pilot test)

Photograph 2. Trailer mounted LRV unit and groundwater storage tank (Pilot test)

Photograph 3 Trailer mounted LRV unit with air/water separator. (Pilot test)

Photograph 4. Test well with drop tube and sanitary seal (Pilot test)

Photograph 5. Air/water separator with gravity feed liquid outlet (Pilot test)

Photograph 6. Test well (Pilot test)

Photograph 7. Vapor phase activated carbon to treat off-gases (Pilot test)

Photograph 8. Excavation for equipment pad and storage tank containment

Photograph 9. Excavation of piping trench to recovery well

Photograph 10. Placement of concrete footer for water storage tank containment area

Photograph 11. Construction of containment walls for water storage tank

Photograph 12. Construction of containment area floor for water storage tank

Photograph 13. Construction of sump in equipment pad with recovery well pipping and drain pipe from storage tank containment area

Photograph 14 Topping base water line

Photograph 15. Pipe stubouts to south of sump in equipment pad (upper three pipe are connected to MW-29, MW-13, and MW-20; lower three pipes are capped and buried for future use)

Photograph 16. Pipe stubouts to north of sump in equipment pad (two pipes are connected to MW-26 and MW-21; remaining four pipes are capped and buried for future use)

Photograph 17. Construction of liquid ring vacuum pump equipment pad

Photograph 18. Water storage tank containment and equipment pad

Photograph 19. LRV control panel, equipment skid, oil/water separator, and water storage tanks

Photograph 20. Recovery well manifold and sump

Photograph 21. Water storage tank (T-6), oil water separator (T-3), product storage tank (T-4), and water transfer tank (T-5)

Photograph 22. LRV Control Panel

Photograph 23. Construction of thermal oxidizer pad

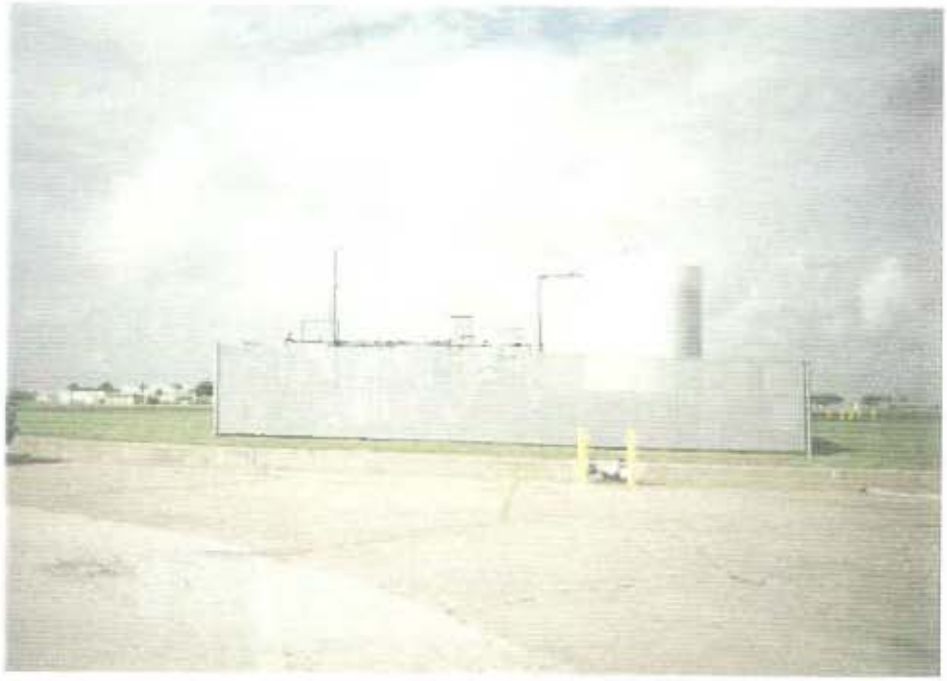
Photograph 24. Thermal oxidizer concrete pad

Photograph 25. Natural gas piping and trench

Photograph 26. Natural gas tap

Photograph 27. Thermal oxidizer

Photograph 28. Thermal oxidizer



Photograph 29. Equipment compound

Photograph 30. Recovery well MW-29.

APPENDIX H
DETAILED START-UP AND OPERATING CHRONOLOGY

Chronology of Events Multi-Phase Product Recovery System, NAS Corpus Christi, Corpus Christi, Texas (14 pages)

CHRONOLOGY OF EVENTS
MULTI-PHASE PRODUCT RECOVERY SYSTEM
NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

6 January 1997	2:30 - 4:00 p.m. Ran unit on all wells manually to test operation.
7 January 1997	10:00 - 11:30 a.m. Ran unit on automatic for MW -26 and MW-29 as a demonstration for the Navy.
8 January 1997	3:20 p.m. Started unit on automatic for all wells and left it on.
9 January 1997	Unit has been on since January 8. High level in T-2 caused unit to shut down at 9:55 a.m. Opened FI/FC-2. Unit restarted on automatic for all wells at 10:10 a.m. and was shut down at 4:30 p.m. Carbon drums (GAC-1 and GAC-2) were replaced at 9:30 a.m. Collected vapor samples for MW-26, MW-29, MW-20, and MW-13.
10 January 1997	Started unit on manual on MW-21 at 4:00 p.m. and collected vapor sample. System is off at 6:30 p.m. Working to get Rotron separator to recover moisture in vapor stream.
13 January 1997	Unit is off. AES is working to get Rotron moisture separator. Cost for freeze protection is provided.
14 January 1997	Material takeoff for installation of Rotron. Unit is off.
15 January 1997	Installing Rotron knockout part and four (4) new carbon drums.
16 January 1997	Unit is off. Installation of Rotron and carbon drums is continuing.
17 January 1997	Unit is off.
20 January 1997	Unit is off; awaiting a smaller orifice meter (GOM-3); researching need for chilled condenser or drier for vapor stream.
21 January 1997	Demobilization from site: removal of rented equipment, etc. Unit is off. New orifice meter (GOM-3) is installed.
22 January 1997	Trailer is removed from the site. System ran manually on all wells form 9:00 a.m. - 10:20 a.m. on full vacuum to get flow rates to size quantity of carbon needed. The city water to the site is shut off to repair a leak.
23 January 1997	Unit is off (no city water?). NAS removed 1,800 gal. from T-6.
24 January 1997	Unit is off. Researching information on driers and chilled condensers.
27 January 1997	Unit is off.
28 January 1997	Unit is off. Decision is made to run unit on partial vacuum to get below air emission limits and not overload carbon.

29 January 1997	Unit ran from 10:45 a.m. - 4:15 p.m. on manual on full and partial vacuum on all wells and took vapor samples to send to lab to determine if below emission limits; unable to measure vapor concentration with FID - too high - ordered dilutor.
30 January 1997	Received FID dilutor probe; ran unit on manual on full and partial vacuum (all wells) and took vapor samples for laboratory; operated from 10:00 a.m. - 4:30 p.m.
31 January 1997	Unit off awaiting laboratory results.
3 February 1997	Ran unit on full vacuum from 3:25 p.m. to 5:15 p.m. on all wells; awaiting results from laboratory.
4 February 1997	Unit is off; received lab results; calculations and graphs to try correlating FID with lab results and determine settings.
5 February 1997	Ran unit on partial vacuum on all wells from 8:00 a.m. to 5:45 p.m.; left system on auto; attempting to get mass recovery less than emission limits and still achieve multi-phase recovery.
6 February 1997	8:00 a.m. Tom on-site; shut system down due to no vacuum, restarted on auto at 11:55 a.m. 3:20 p.m. On auto, shut motor valve for MW-20 off to allow static water level to equilibrate at 4:30 p.m.; left other wells on auto - still trying to achieve low vapor recovery concentration with multi-phase recovery.
7 February 1997	System on auto when arrived at 2:30 p.m. but no vacuum; when restarted, tripped relay in panel for LRVP. Shut unit down at 5:30 p.m.
10 February 1997	Unit off; called NEPCCO for advice, scheduled Johnston Electric for tomorrow.
11 February 1997	8:30 a.m. On-site with Johnston Electric to trouble shoot; determined too much seal water flowing to LRVP; restarted at 10:00 a.m.; collected data, adjusting to get vapor concentration below limit; left on auto.
12 February 1997	Unit on auto on partial vacuum until shut down at 2:45 p.m. due to high level LSHH-5 (actually sump high level triggered during wash down of unit).
13 February 1997	Water and fuel overflowing and leaking from T-1 (reported by John Young at 8:00 a.m.); 8:30 a.m. On-site - cause of overflow was make-up water bleeding into T-2 overflowed and filled T-1 since unit was down; cleaned up spill inside containment area. System run manually on partial vacuum on all wells from 2:30 p.m. to 5:30 p.m.; ordered lower temp. switch to prevent T-2 from running dry; Luis began rust treatment.
14 February 1997	Unit is off. Operation and Maintenance phase of project begins.

15 February 1997	Luis treats rust and touches up paint on unit and installs lower temperature (100° F) switch onto T-2.
16 February 1997	Unit off - T-6 full.
17 February 1997	Federal Holiday; T-6 full - unit off.
18 February 1997	Informed Morrison Knudsen that FID dilution probe calibration and use incorrect - readings should actually be X10; received pressure transducer from NEPCCO that will eliminate T-2 running dry; recommended thermal oxidation unit - MK requests cost; NAS removes 2,300 gal. from tank T-6.
19 February 1997	Working on thermal oxidation unit costs; unit is down pending decision on thermox; returned FID and dilutor to Intek.
20 February 1997	Navy tours unit and sees unit is down and touch up paint peeling, MK tells AES to run unit on MW-21 only immediately with daily attandance at site; reordered FID and dilutor and more carbon; unit run on manual on MW-21 (partial vacuum) from 11:30 a.m. to 1:30 p.m.; then put on automatic on MW-21 only; Luis on-site in afternoon to start repair of paint.
21 February 1997	Unit cycled on MW-21 twice during previous night; on-site at 9:00 a.m.; unit on and running on MW-21 until 10:15 a.m. - left on auto on MW-21 only; received FID and dilutor.
22 February 1997	On-site at 11:00 a.m. Unit off when arrived at 11:00 a.m. due to LSHH-2 high level alarm in T-2; unit restarted on MW-21 and recovered from MW-21 for 35 minutes, then shut down to start installation of pressure transducer PT-1; unit left off.
24 February 1997	On-site at 12:30 p.m. Drained T-2 for installation of PT-1. Ran system on MW-21 manually for 30 minutes. Unit left off.
25 February 1997	On-site at 8:00 a.m. Installed pressure transducer PT-1 and replaced 100°F temperature switch on T-2 with 125°F switch. Ran system manually on MW-21 on partial vacuum from 10:00 a.m. to 10:55 a.m., then left on automatic on MW-21 only; provided cost for thermal oxidation unit to MK.
26 February 1997	On-site at 8:30 a.m. Unit running automatically on MW-21 (partial vacuum); cycled on twice during previous night and once more in morning at 6:55 a.m.; ran MW-21 on partial and full vacuum from 2:25 p.m. to 3:05 p.m.; ran each of other 4 well manually on full vacuum for approximately 30 minutes each to determine which recovery well exhibits highest vapor concentration; MW-26 and MW-13 show highest concentrations; returned system to automatic on MW-21 only at 5:15 p.m.

27 February 1997	System shut down upon arrival at 9:45 a.m. due to high level alarm LSHH-1 on T-1; ran P-1 transfer pump by hand to reduce level; ran system on partial vacuum on MW-21 for 30 minutes; reset system at 10:00 a.m.; manually ran system in MW-26 (full vacuum) for 1 hour and 45 minutes to collect vapor sample in summa canister for laboratory analysis; then ran system on MW-20 at full vacuum from 12:15 p.m. to 12:35 p.m. to confirm vapor concentration; ran system on MW-13 on full vacuum from 12:35 p.m. to 2:00 p.m. to collect vapor sample; ran MW-29 on full vacuum for 15 minutes; left system on automatic on MW-21 (partial vacuum) - cycled on at 2:50 p.m.
28 February 1997	On-site at 2:40 p.m. Unit on automatic on MW-21 only - cycled on once during previous night, once in morning and again in afternoon; product tank T-4 is nearly full; unit left on automatic.
3 March 1997	On-site at 10:00 a.m. Unit still on automatic on MW-21 (partial vacuum); unit left on auto on MW-21 partial vacuum.
4 March 1997	On-site at 8:05 a.m.; unit on automatic on MW-21 only; system reset at 9:40 a.m. on automatic MW-21 only; slow leak from 4" tank penetration (outlet) on T-6 observed - tried to tighten but need to do when tank is near empty; ordered thermal oxidizer.
5 March 1997	On-site at 8:05 a.m.; unit on automatic on MW-21 only; replaced two (2) carbon drums and performed rust-treatment; unit left on automatic on MW-21 only.
6 March 1997	On-site at 7:50 a.m.; unit on automatic on MW-21 only; finished paint touch up; left unit on automatic on MW-21 only.
7 March 1997	On-site at 8:00 a.m.; unit on automatic on MW-21 only; left on automatic on MW-21 only.
10 March 1997	On-site at 8:00 a.m.; unit on automatic on MW-21 only; left on automatic on MW-21 only.
11 March 1997	On-site at 8:00 a.m.; unit on automatic on MW-21 only; tightened fitting at outlet from T-6 to stop slow leak; left unit on automatic on MW-21 only.
12 March 1997	On-site at 8:05 a.m.; unit on automatic on MW-21 only; recorded operating data at full and partial vacuum; replaced two of vapor phase carbon drums; left unit on automatic on MW-21 only.
13 March 1997	On-site at 8:00 a.m.; unit on automatic on MW-21 only; installed guard on sump high level probe (LSHH-6) to prevent accidental activation of high level alarm and shutdown; increased vacuum on MW-21 from 8.5 to 9.5 inches Hg; left unit on automatic on MW-21 only.
14 March 1997	On-site at 8:00 a.m.; unit on automatic on MW-21 only; left unit on automatic on MW-21 only.

17 March 1997	On-site at 7:53 a.m.; unit shutdown due to LSHH-5 (sump high level alarm); drained rainwater from T-6 containment and the sump and taped top hole on sump high level probe guard to prevent rainwater from tripping high level alarm; left unit on automatic on MW-21 only.
18 March 1997	On-site at 7:45 a.m.; unit on automatic on MW-21 only; recorded operating data at full and partial vacuum; increased vacuum on MW-21 from 9 to 10 inches Hg; left unit on automatic on MW-21 only.
19 March 1997	On-site at 7:55 a.m.; unit on automatic on MW-21 only; replaced one activated carbon canister; left unit on automatic on MW-21 only.
20 March 1997	On-site at 7:55 a.m.; unit on automatic on MW-21 only; left unit on automatic on MW-21 only.
21 March 1997	On-site at 8:05 a.m.; unit on automatic on MW-21 only; left unit on automatic on MW-21 only.
24 March 1997	On-site at 8:08 a.m.; unit was shut down due to alarm on LSHH-2; restarted unit and left unit on automatic on MW-21 only.
25 March 1997	On-site at 9:05 a.m.; unit was shut down due to alarm on LSHH-2; flushed city water line and manually operated solenoid valve; replaced one carbon drum; adjusted pressure transducer setting PT-1; restarted unit and left unit on automatic on MW-21 only.
26 March 1997	On-site at 8:55 a.m.; unit was shut down due to alarm on LSHH-2; increased flow at FI/FC-2 to 0.4 gpm; tested unit; when unit is shut off, T-2 refills to just below level of LSHH-2; restarted unit and left unit on automatic on MW-21 only.
27 March 1997	On-site at 9:55 a.m.; unit on automatic on MW-21 only; increased vacuum to 17.0 inches Hg due to low concentration of recovered vapor; left unit on automatic on MW-21 only.
28 March 1997	On-site at 8:35 a.m.; unit on automatic on MW-21 only; adjusted pressure transducer PT-2 to come on at 13" and shut off at 23"; left unit on full vacuum on automatic on MW-21 only
31 March 1997	On-site at 8:20 a.m.; unit was shut down due to alarm on LSHH-2; increased flow at FI/FC-2 to 0.5 gpm; restarted unit on full vacuum and left unit on automatic on MW-21 only.
1 April 1997	On-site at 8:30 a.m.; unit on automatic on MW-21 only at full vacuum; vapor concentrations higher than before probably due to rainfall over the last few days; average concentration still keeps emission less than 1.0 lb/day TPH; left unit on automatic on full vacuum on MW-21 only. Received and signed Change Order No. 2 for thermal oxidizer and returned to MK via overnight mail.
2 April 1997	On-site at 8:15 a.m.; unit on automatic on MW-21 only at full vacuum; replaced one carbon drum; left unit on automatic on MW-21 only. Provided mass recovery calculations for March to MK.

3 April 1997	On-site at 8:20 a.m.; unit off due to high level in the sump (LSHH-6); restarted system at 10:35 a.m. on MW-21 only at full vacuum
4 April 1997	On-site at 8:00 a.m.; unit running on automatic on MW-21 only at full vacuum; NAS transferred 3000 gallons out of T-6.
7 April 1997	Mobilized to site to begin installation of thermal oxidizer; removed part of existing fencing; excavated beams for thermal oxidizer pad and trench for natural gas line.
8 April 1997	Placed forms and reinforcement for oxidizer pad.
9 April 1997	Placed concrete for thermal oxidizer pad
10 April 1997	Removed concrete forms; connected telephone line to automatic dialer in LRV control panel
Friday, April 11, 1997	No work.
14 April 1997	Completion of 60 day Operation and Maintenance phase of contract. Installed new natural gas line to thermal oxidizer pad.
15 April 1997	Installed new PVC piping from T-7 to thermal oxidizer pad.
16 April 1997	No work.
17 April 1997	Received thermal oxidation unit; off loaded and anchored onto concrete pad; connected natural gas piping and influent piping; installed valve box at tap location for natural gas; graded around thermal oxidizer pad
18 April 1997	Connected power to thermal oxidizer and installed control wiring between thermal oxidizer and LRV control panel
21 April 1997	Started up thermal oxidizer; adjusted natural gas flow to oxidizer; ran LRV system manually with thermal oxidizer; oxidizer shut down with high temperature when recovering from MW-26; PLC in LRV control panel has CPU fault and is not operating
22 April 1997	Unable to correct CPU fault on PLC; ordered new PLC; operated LRV system manually with thermal oxidizer successfully with most of the recovery wells on partial vacuum
23 April 1997	Replaced PLC in LRV control panel; made corrections to PLC program to enable oxidizer and LRV system to operate together; tested safety shutdowns
24 April 1997	Installed float switch (LSL/LSH-5) in T-2 and removed the pressure transducer from T-2
25 April 1997	System operated part of day but LSL/LSH-5 does not appear to be operating correctly

28 April 1997	Removed temperature switch in T-2 from service; LRV system now operating correctly; gathered operating data on MW-21, MW-26, and MW-29; operation and maintenance under new one-year O&M contract started.
29 April 1997	High temperature shutdown of thermal oxidizer on MW-26 on partial vacuum of 13 to 18 inches Hg; thermal oxidizer operates satisfactorily with MW-26 on partial vacuum of 10 inches Hg; gathered operating data on MW-13 and MW-20
30 April 1997	On-site at 9:40 a.m. LRV overload breaker tripped; wired temperature switch and float switch in T-2 in series (instead of in parallel as previously wired); restarted unit; thermal oxidizer down with high temperature on MW-26 with partial vacuum of 10 inches Hg; restarted unit and lowered partial pressure on MW-26 to 8.5 to 9.5 inches Hg; MW-26 has high concentration vapor and much higher flow rate than any of the other recovery wells; system dial-out alarm at 1:25 p.m. for LSHH-2; on-site at 2:10 p.m. to restart system and increase FI/FC-2 to 0.9-1.0 gpm; system dial-out alarm at 5:15 p.m. for LSHH-5; system left off until T-6 can be emptied.
1 May 1997	On-site at 9:35 a.m. to restart system; on-site again at 4:30 p.m. to restart system after shutdown of LRV due to electrical overload on LRV breaker.
2 May 1997	Unit shutdown due to high temperature on MW-26; adjusted thermal oxidizer settings and restarted system; repaired motor valves on manifold.
3 May 1997	LRV unit shutdown due to overload of LRV breaker; adjusted back pressure on system, reset breaker, and restarted unit.
4 May 1997	System shut down due to overload of LRV breaker and high level LSHH-2; restarted system and ran manually for about two hours until T-6 was full.
5 May 1997	On-site to start system up after NAS emptied T-6; set FI/FC-2 at 0.75 gpm; high temperature shutdown on MW-26; reduced partial vacuum on MW-26 to 9 inches Hg and restarted system; tested alarm dialout.
6 May 1997	On-site for weekly site visit; collected operating data on MW-26 under full vacuum and then raised the drop tube in MW-26 by 3 feet; thermal oxidizer shut down with high temperature on MW-26; partially closed butterfly valve BFV-1 to reduce vacuum on recovery wells while keeping full vacuum on LRV pump; closed ambient valve for MW-26 on manifold
7 May 1997	Performed remainder of weekly O&M visit tasks

8 May 1997	Received two dialout alarms; when checking unit on-site, determined that system is dialing out when temperature of thermal oxidizer drops below 1400 degrees F and temporarily shuts off LRV; when oxidizer comes back up to normal operating temperature (1410 F), it turns the LRV back on; system up and running.
9 May 1997	System down with high level alarm LSHH-1; pump intake on P-1 appears to be blocked; need to open up T-1 and check pump.
10 May 1997	Removed submersible pump P-1 from T-1; found that sand had accumulated in T-1; unable to locate a trash pump that will fit in access at top of T-1.
12 May 1997	On-site with Eagle Data Control Systems to make changes to PLC program in LRV control panel; eliminated dial-out for low temperature condition on thermal oxidizer, made overload of the LRV breaker a dial-out condition, changed timers for motor valves to make MV-1 the longest cycle and to make the entire cycle an even eight hours, and inserted timer to delay shutdown of LRV by 60 seconds when thermal oxidizer temperature drops below 1400 F to reduce the frequency of the LRV being turned off by the thermal oxidizer when changing wells; also changed low temperature set point on thermal oxidizer from 1395 F to 1360 F
13 May 1997	On-site with vacuum truck to empty sand from T-1 and place in drums; restarted system and performed weekly maintenance tasks.
14 May 1997	On-site to perform monthly maintenance tasks; unit operating correctly.
15 May 1997	Unit down with high level alarm in T-6; after NAS emptied T-6, restarted system; reduced flow through FI/FC-2 from 0.65 gpm to 0.5 gpm. High level alarm on LSHH-2; restarted system and increased from through FI/FC-2 from 0.5 gpm to 0.6 gpm; trying to find lowest flow at which heat build up is removed from T-2 adequately while minimizing usage of makeup water to T-2.
16 May 1997	System down with high level alarm in T-2; restarted system and increased flow through FI/FC-2 from 0.6 to 0.75 gpm; system shut down again with high level in T-2; restarted system and increased flow through FI/FC-2 from 0.75 to 0.9 gpm.
19 May 1997	System down with high level alarm in T-2; restarted system and increased flow through FI/FC-2 from 0.9 gpm to 1.0 - 1.1 gpm.
20 May 1997	System down with high level alarm in T-6; after NAS removed 700 gallons from T-6, restarted system.
21 May 1997	System down with high level alarm in T-6; after NAS emptied T-6, restarted system; collected vapor samples from each well in summa canisters and performed weekly maintenance tasks; system left in operation.

24 May 1997	System shut down with thermal oxidizer alarm; restarted and checked operation of unit; system left in operation.
26 May 1997	System shut down with thermal oxidizer alarm; troubleshooting to determine problem; system restarted and left in operation.
28 May 1997	System shut down with thermal oxidizer alarm; cleaned UV scanner and ignitor; restarted thermal oxidizer but left LRV off; pulled drop tubes from recovery wells to allow fluid levels to equilibrate for quarterly fluid level measurements.
29 May 1997	Thermal oxidizer shut down on flame failure; adjusted natural gas flow rates at direction of ThermTech; performed quarterly maintenance
30 May 1997	Performed weekly maintenance tasks; thermal oxidizer shut down on flame failure; discovered fluid in piping between T-7 moisture separator and thermal oxidizer; drained fluid and restarted system.
31 May 1997	System down due to product tank T-4 full.
2 June 1997	System still down with high level in T-4; pumped water from T-4 into T-5; cleaned emulsion out of oil/water separator and increased flow pressure from P-1 to 60 psi; restarted system
3 June 1997	System down due to high temperature on thermal oxidizer; drained and cleaned oil/water separator; placed sludge from separator into drum on-site; performed weekly maintenance; LRV breaker tripped when ambient valve SV-1 opened when T-1 was full and P-1 pumping; using ammeter, adjusted flow through FI/FC-1 to 2 gpm; collected groundwater sample from SP-7
4 June 1997	Unit in operation; increased high temperature set point on thermal oxidizer to 1550 degrees F; started installation of new piping to allow circulation of water from T-6 back through the LRV to T-2; this should reduce the amount of base water used to keep the LRV cool; unit left in operation.
5 June 1997	System turned off to allow completion of new piping from T-6.
6 June 1997	New piping complete; system left in operation using base makeup water pending confirmation that new solenoid valves operating correctly.
7 June 1997	System down with high level in sump (LSHH-6) due to heavy rainfall; verified correct operation of new solenoid valves; system left in operation using new circulation of water from T-6.
8 June 1997	System shut down due to high temperature on thermal oxidizer; restarted system and closed BFV-1 slightly more; system left in operation.

9 June 1997	System shut down due to high level in T-2; appears to be problem with LSL/LSH-5 in T-2; restarted system and monitored operation; drained water from two drums on-site back into system; less than one drum of water/product/sand/sludge remains on site; system left in operation.
10 June 1997	System shut down due to high level in T-2; replaced defective float switch LSL/LSH-5 in T-2; repaired MV-3 and MV-4; performed monthly maintenance tasks and started weekly maintenance; Steve Travis on-site
11 June 1997	LRV down due to overload on LRV breaker; restarted system and monitored operation; system seems to overload when ambient valve SV-1 opens occasionally; raised oil/water separator skimmer level and increased flow from P-1 to separator to reduce frequency of opening SV-1; completed collection of weekly operating data; increased overload setting on the LRV breaker to 24 amps; Steve Travis on-site.
12 June 1997	LRV shut down due to overload on LRV breaker; restarted system; determined that P-1 not operating correctly causing ambient valve SV-1 to open frequently; opened T-1 and discovered that piping from P-1 to top of T-1 had become disconnected; replaced piping and reassembled; installed check valve above GOM-1 to prevent backflow from T-6 into T-1, ball valve at SV-1 to allow reduction of quantity of ambient air entering system, ball valve below MV-6 to decrease flow of water from sump into T-1, and a union in piping between T-7 and thermal oxidizer to facilitate draining condensate from piping periodically; system left in operation. The P-1 pump had become unscrewed causing T-1 to overfill. The ambient valve opened to allow the pump to catch up, as a result the LRVP circuit breaker tripped. The pump was reattached, Locktite was used on the threads.
17 June 1997	System running since June 12; performed weekly maintenance tasks; Steve Travis on-site; system left in operation.
23 June 1997	The oxidizer control fault alarm, probably caused due to water entering into the oxidizer. The line was drained and the system was restarted.
24 June 1997	Samples were collected for analysis of the sludge that resulted from cleaning of the oil/water separator and the T-1 tank.
27 June 1997	The LRVP was acid-washed to remove scale.

29 June 1997	The system shut down due to a thermal oxidizer shutdown resulting from water entering the oxidizer. Water was drained from the piping leading to the oxidizer. The system was restarted. Vapor samples were collected. Weekly inspections and maintenance were performed. The water level allowed to remain in T-6 was increased to control the flow into the LRVP. Low level in T-6 results in low flow and higher operating temperatures in the LRVP. As a result more water is condensed and carried over to the oxidizer.
1 July 1997	The gas meter was installed.
3 July 1997	The thermal oxidizer shut down due to liquid carry over to the thermal oxidizer. The water was drained, however, the LRVP would not restart. Scale build up prevented restarting the LRVP. The pump was acid washed to remove the scale. The system was restarted. Rust on the skid was treated and painted.
6 July 1997	The system shut down due to T-6 being full.
7 July 1997	The gas line was primed and painted. NAS Corpus Christi drained the tank, and the system was restarted.
8 July 1997	The thermal oxidizer interior was inspected for possible damage. No problems were detected; everything was in proper order in the burner chamber. Weekly inspections, weekly and monthly maintenance were performed.
9 July 1997	The system was restarted after shutting down due to over-amperage on the LRVP pump. The flow rate into the LRVP was further adjusted to lower the operating amps to the pump. The system was restarted.
10 July 1997	The system shut down due to an LRVP amp overload. The amp overload was probably due to scale build up and to fluctuating seal water flow rate. The flow into the LRVP was adjusted from 3 gpm to 2 gpm. The system was restarted.
12 July 1997	The system shut down due to T-6 being full. The system was restarted after NAS emptied the tank.
29 July 1997	The system was operating; however, minimal vacuum was being generated. AES determined that the sediment filter cartridge leading to the LRVP was plugged and required cleaning. The filter cartridge was cleaned and the vacuum was restored. The weekly maintenance procedures were modified to include weekly change-outs of the filter cartridge and weekly cleaning between the change-outs.
30 July 1997	Weekly maintenance was performed. A broken valve stem at MV-5 was also replaced.
2 August 1997	The system shut down due to a high temperature alarm in the thermal oxidizer while operating on MW-20. The system was restarted and the valve at well MW-20 was closed partially to reduce the flow from MW-20.

13 August 1997	The system shut down due to an LRVP amp overload. The amp overload was probably due to scale build up and to fluctuating seal water flow rate. During restart, a high temperature alarm occurred. The GV-1 valve was adjusted to a more closed position.
14 August 1997	The system shut down due to an LRVP amp overload. The amp overload was probably due to scale build up and to fluctuating seal water flow rate. The system was restarted and the water flow into the LRVP was reduced. A flow rotameter was ordered to better monitor water flow into the LRVP.
15 August 1997	The system shut down due to a high temperature alarm in the thermal oxidizer while operating on MW-20. The system was restarted. After restart, the system was observed while on MW-20. The LRVP amps were checked, the readings were high and the vapor temperature was elevated above normal. The high temperature alarm may have been caused by high temperature in the LRVP and resultant vaporization and carry over of liquids to the thermal oxidizer. The system was restarted.
20 August 1997	The LRVP circuit breaker tripped. The LRVP was completely disassembled and cleaned, all scale was removed. A flow rate meter was installed to better control flow through the LRVP.
23 August 1997	The system shut down due to a high level in the T-2 tank. LSH/LSL-5 was not operating properly. A loose part (counter balance weight that had come unglued) was removed from the level switch and the system was restarted
26 August 1997	The system shut down due to continued problems with the T-2 level switch. A replacement switch was ordered. The system was restarted.
30 August 1997	The system shut down due to a high temperature alarm in the oxidizer. The well vacuum was adjusted down and the system was restarted.
2 September 1997	The system shut down due to a high temperature alarm in the oxidizer. Well MW-29 was moved to MV-1 to allow it more time during the cycle. The system was restarted and monitored through an entire cycle.
4 September 1997	LSHH-1 high level alarm in T-1 tank and LSHH-2 high level alarm in T-2 tank. The LSHH 1 and 2 alarms were caused by a damaged wire on the level float switch in T-1 tank. The wire was damaged during painting and was not discovered until the alarm occurred. The wire was fixed and the system was restarted.
7 September 1997	The system shut down due to LSHH-2 high level alarm in T-2 tank. The level control switch problem in T-2 continued. The switch replaced with a temporary replacement until a permanent fix is determined. The level control switch appears to be incompatible with the contaminants in the tank.

7 September 1997	The system shut down due to a high level alarm in the T-2 tank. The level switch in T-2 was inspected, all seemed operational. The system was restarted and monitoring.
9 September 1997	The system shut down due to a high level alarm in the T-2 tank. The level switch in T-2 was inspected, all seemed operational. The system was restarted and monitored. The Temp.switch was suspected of causing problems, however, it was not able to be confirmed.
10 September, 1997	The installation of the particulate filter and chemical feed systems was started. Cleaning of tanks T-5 and T-6 was started. The system was shut off to perform these tasks.
12 September, 1997	The installation of the particulate filter and chemical feed systems was completed and tested. Cleaning of tanks T-5 and T-6 was completed. NAS Corpus, Public works Department removed the residual water from the tanks using a vacuum truck. The system was restarted.
12 September, 1997	Weekly maintenance was performed. A chemical feed system was installed to prevent scale build up.
13 September, 1997	MK performed an engineering evaluation of the system and provided recommendations to improve performance and reliability.
15 September 1997	The inlet water filter for the seal water to the LRV pump was replaced with a "Y" Strainer.
16 September 1997	The system shut down due to a high level alarm in the T-2 tank. The level switch in T-2 was inspected, all seemed operational. The system was restarted and monitoring. The temperature switch was determined to be causing part of problem, it was removed from the circuit. A different type of level control switch was specified, conductivity probes.
18 September 1997	Weekly and monthly maintenance were performed. A GEMS conductivity level switch was ordered to replace the problematic float switch in the T-2 tank.
24 September 1997	Installation of the replacement switch for the T-2 tank began. The LRV pump was cleaned to remove scale that may have accumulated prior to installation of the chemical feed system.
26 September 1997	The installation of the conductivity probes for the level control of the T-2 tank was completed.
30 September 1997	The system shut down on a high level alarm LSHH-1 in tank T-1. The P-1 discharge was blocked. The blockage was cleared and the system was restarted.
30 September 1997	The system shut down on a high level alarm LSHH-2 alarm in the T-2 tank. The cause of the problem was unknown at time, all switches appeared to be fully operational. The system was restarted. Subsequently, the relay board which controls the level switches was replaced for other problems and may have been cause. (see notes 10/14/97)

5 October 1997	The system shut down due to a high level alarm in the T-6 tank. NAS Corpus emptied the tank. The system was left off for moisture separator installation.
6 October 1997	Began moisture separator installation.
9 October 1997	Completed moisture separator installation.
14 October 1997	The system shut down due to a high level alarm in the T-2 tank. During trouble shooting a problem was also detected with the sump probes. The problem was traced to a problem with the relay board controller of sump level switches. Areas of the relay board showed signs of damage possibly by lightning strike. The wiring from sump probes and LSHH-2 were to the same relay board. The system was restarted and allowed to operate while a new board was ordered.
16 October 1997	The system shut down due to high level in T-6 tank.
17 October 1997	The relay board was replaced.
4 November 1997	The system shut down due to a high level alarm on the product tank, T-4. NAS Corpus emptied tank, AES restarted system.
8 November 1997	The system shut down due to a high level alarm in the T-6 tank. NAS Corpus emptied the tank and the system was restarted.
11 November 1997	The impellers to P-1 pump were determined to be severely damaged, probably due to sediment prior to the installation of the particulate filter. The impellers were replaced and the system was restarted upon completion.
14 November 1997	System down due to low Natural gas pressure. NAS Corpus Christi working on Natural gas line. System left off at Navy direction.
	The system was restarted after the natural gas was restored by NAS Corpus.
24 November 1997	The automatic discharge system installation began to prevent high level alarms in the T-6 tank and to eliminate the need for NAS Corpus to empty the tank.
26 November 1997	The automatic discharge system installation was completed.
3 December 1997	The system shut down due to a high level alarm on the product tank, T-4. The water was pumped out of the T-4 tank and was processed back through the system and the system was restarted. The flow rate from T-1 tank was reduced into the T-4 tank.
5 December 1997	The system shut down due to a high level alarm on the product tank, T-4. The water was pumped out of the T-4 tank and was processed back through the system. The oil/water separator was cleaned and the system was restarted. The weekly maintenance was modified to include a partial cleaning of the oil water separator, thorough monthly cleaning was continued.

APPENDIX I
CORRESPONDENCE

Letter from Texas Natural Resource Conservation Commission to John Young dated 1/22/97 (7 pages)

Letter from E. W. Santos to Antonio Penya, Subject Fuel Farm 216 at Naval Air Station Corpus Christi dated 2/3/97 (1 page)

Letter from Claire Meurer to Tom Benson Subject Completion of Construction Subcontract No. 4324-056 Delivery Order 0016, SOW 024 NAS Corpus Christi, Texas AES Project No. 243-05616-01, dated 2/14/97 (1 page)

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

January 22, 1997

Mr. John Young
Engineering Technician
C/O Commanding Officer
Code 189
Naval Air Station Corpus Christi
1101 D Street
Suite 143
Corpus Christi, Texas 78419-5021

Re: Standard Exemption
Registration No. 33805
Fuel Farm 216
Corpus Christi, Nueces County
Account ID No. 93-3805-S

Dear Mr. Young:

This is in response to your request to register the operation of another soil and groundwater remediation pilot test under Standard Exemption 68 at Fuel Farm 216 at Naval Air Station, Corpus Christi, Nueces County. We understand that you will use a carbon adsorption system to abate air emissions during the pilot test. You have indicated that abated emissions of total petroleum hydrocarbons and benzene will not exceed 1.0 and 0.029 pounds per hour, respectively. We further understand that you will locate the emissions point at least 400 feet away from any off-site receptors.

Accordingly, and after evaluating the entirety of your submittal, we have determined that your operation conforms to the criteria of Standard Exemptions 68 and 118, if constructed and operated as described in your application. The Executive Director of the Texas Natural Resource Conservation Commission (TNRCC) authorized these standard exemptions pursuant to 30 TAC Section 116.211 of Regulation VI. We have enclosed copies of the exemptions in effect at the time of this registration. You must operate in accordance with all requirements of those standard exemptions.

Mr. John Young
Page 2
January 22, 1997

Re: Standard Exemption
Registration No. 33805

We remind you that regardless of whether a permit is required, you must maintain these facilities in compliance with all air quality rules and regulations of the TNRCC and of the U.S. Environmental Protection Agency at all times.

We appreciate your cooperation in this matter. If you have any questions concerning this exemption, please contact Mr. Terry Murphy of our Office of Air Quality, New Source Review Permits Division at (512) 239-1587.

Sincerely,

Tammy Villarreal
Manager, Chemical Section
New Source Review Permits Division
Texas Natural Resource Conservation Commission

TV/TM/ms

Enclosures

cc: Mr. Charlie Spiekerman, Air Program Manager, Corpus Christi

Record No. 48193

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

STANDARD EXEMPTION LIST

30 TAC §116.211
Control of Air Pollution By Permits For
New Construction or Modification

ADOPTED MAY 15, 1996
EFFECTIVE JUNE 7, 1996

****

68. Equipment used to reclaim or destroy chemicals removed from contaminated ground water, contaminated water condensate in tank and pipeline systems, or contaminated soil, for the purpose of remedial action, provided all the following conditions are satisfied:

(a) Applicability shall pertain to soil and water remediation at the property where the original contamination of the ground water or soil occurred or at a nearby property secondarily affected by the contamination, but not to any soil or water treatment facility where soils or water are brought in from another property. Such facilities are subject to §116.1, relating to Permit Requirements.

(b) For treating groundwater or soil contaminated with petroleum compounds, the total emissions of petroleum hydrocarbons shall not exceed 1.0 pound per hour (lb/hr), except that benzene emissions also must meet the conditions of Standard Exemption 118(c) and (d). For purposes of this exemption, petroleum is considered to include: (1) liquids or gases produced from natural formations of crude oil, tar sands, shale, coal and natural gas, or (2) refinery fuel products to include fuel additives.

(c) For treating groundwater or soil contaminated with chemicals other than petroleum, emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). If the groundwater or soil is contaminated with both petroleum and other chemicals, the petroleum compound emissions must meet condition (b) of this exemption and the other chemical emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). The emission of any chemical not having a Limit (L) Value in Table 118A of Standard Exemption 118 is limited to 1.0 lb/hr.

(d) The handling and processing (screening, crushing, etc.) of contaminated soil and the handling and conditioning (adding moisture) of remediated soil shall be controlled such that there are no visible emissions with the exception of moisture.

(e) If abatement equipment is used to meet conditions (b) and (c), the equipment must satisfy one of the following conditions:

(1) The vapors shall be burned in a direct-flame combustion device (incinerator, furnace, boiler, heater, or other enclosed direct-flame device) operated in compliance with Standard Exemption 88(b) and (c).

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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(2) The vapors shall be burned in a flare which meets the requirements of Standard Exemption 80 and the requirements of 40 Code of Federal Regulations 60.18 which shall take precedence over Standard Exemption 80 in any conflicting requirements whether or not New Source Performance Standards apply to the flare.

(3) The vapors shall be burned in a catalytic oxidizer which destroys at least 90% of the vapors. An evaluation of oxidizer effectiveness shall be made at least weekly using a portable flame or photoionization detector or equivalent instrument to determine the quantity of carbon compounds in the inlet and outlet of the catalytic oxidizer. Records of oxidizer performance shall be maintained in accordance with condition (g).

(4) The vapors shall be routed through a carbon adsorption system (CAS) consisting of at least two activated carbon canisters that are connected in series. The system shall meet the following additional requirements:

(A) The CAS shall be sampled and recorded weekly to determine breakthrough of volatile organic compounds (VOC). Breakthrough is defined as a measured VOC concentration of 50 parts per million by volume (ppmv) in the outlet of the initial canister. The sampling point shall be at the outlet of the initial canister, but before the inlet to the second or final polishing canister. Sampling shall be performed while venting maximum emissions to the CAS. (Example: during loading of tank trucks, during tank filling, during process venting.)

(B) A flame ionization detector (FID) shall be used for VOC sampling. The FID shall be calibrated prior to sampling with certified gas mixtures (propane in air) of 10 ppmv ± 2.0% and of 100 ppmv ± 2.0%.

(C) When the VOC breakthrough is measured, the waste gas flow shall be switched to the second canister immediately. Within four hours of detection of breakthrough, a fresh canister shall be placed as the new final polishing canister. Sufficient fresh activated carbon canisters shall be maintained at the site to ensure fresh polishing canisters are installed within four hours of detection of breakthrough.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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EFFECTIVE JUNE 7, 1996

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TABLE 118A
LIMIT VALUES (L) FOR USE WITH STANDARD EXEMPTION 118

Values included in this table represent screening levels for determining the applicability of Standard Exemption 118 and other standard exemptions using the Exemption 118 equation. The values are not to be interpreted as acceptable health effects values relative to the issuance of construction permits, special permits, or operating permits under 30 TAC Chapter 116.

Compound	Limit (L) Milligrams Per Cubic Meter
Acetone	590
Acetaldehyde	9
Acetone Cyanohydrin	4
Acetonitrile	34
Acetylene	2662
Adiponitrile	18
Aldrin	0.15
Sec-Amyl Acetate	1.1
Arsenic	0.01
Benzene	3
Beryllium and Compounds	0.0005
Butyl Acrylate	19
Butyl Glycidyl Ether	30
Butyl Mercaptan	0.3
Butyraldehyde	1.4
Butyric Acid	7.3
Butyronitrile	22
Carbon Tetrachloride	12
Chloroform	10
Chlorophenol	0.2
Chloroprene	3.6
Chromic Acid	0.05
Chromium and Compounds	0.025
Coal Tar Pitch Volatiles	0.1
Creosote	0.1
Cresol	0.12
Cumene	43
o-Dichlorobenzene	180
p-Dichlorobenzene	108
1,2-dichloroethylene	79
Dicyclopentadiene	3.1
Diethylaminoethanol	5.5

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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ADOPTED MAY 15, 1996
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(D) Records of the CAS monitoring maintained at the plant site shall include, but are not limited to, the following:

1. sample time and date,
2. monitoring results (ppmv),
3. corrective action taken, including the time and date of the action, and
4. process operations occurring at the time of sampling.

(E) The registration shall include a demonstration that activated carbon is an appropriate choice for control of the organic compounds to be stripped.

(f) Before construction of the facility begins, the facility shall be registered with the Texas Natural Resource Conservation Commission (TNRCC) Office of Air Quality in Austin using Form PI-7. The registration shall contain specific information concerning the basis (measured or calculated) for the expected emissions from the facility. The registration shall also explain details as to why the emission control system can be expected to perform as represented.

(g) Records required by applicable paragraphs of this exemption shall be maintained at the site and made available to personnel from the TNRCC or any local agency having jurisdiction. These records shall be made available to representatives of the TNRCC and local programs upon request and shall be retained for at least two years following the date that the data is obtained.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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ADOPTED MAY 15, 1996
EFFECTIVE JUNE 7, 1996

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TABLE 118A Cont'd.

Compound	Limit (L) Milligrams Per Cubic Meter
Methyl Mercaptan	0.3
Methyl Methacrylate	34
Methyl Propyl Ketone	530
Methyl Sulfide	0.5
Mineral Spirits	350
Naphtha	350
Nickel, Inorganic Compounds	0.015
Nitroglycerine	0.1
Nitropropane	36
Octane	350
Parathion	0.05
Pentane	350
Perchloroethylene	33.5
Petroleum Ether	350
Phenyl Glycidyl Ether	5
Phenylhydrazine	0.6
Phenyl Mercaptan	0.4
Propionitrile	14
Propyl Acetate	281
Propylene Oxide	5
Propyl Mercaptan	0.08
Stoddard Solvent	350
Styrene	21
Succinonitrile	20
Tolidine	0.02
Trichloroethylene	135
Trimethylamine	0.1
Valeric Acid	0.34
Vinyl Acetate	15
Vinyl Chloride	2

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010

5090
Code 1845
3 Feb 1997

Mr. Antonio Penya
Texas Natural Resource and Conservation Commission
Underground Storage Tank Division
P.O. Box 13087, Capitol Station
Austin, TX 78711-3087

Subj: FUEL FARM 216 AT NAVAL AIR STATION CORPUS CHRISTI
(LPST I.D. # 91734)

Dear Mr. Penya,

We now have the "bioslurp" system on line at Fuel Farm 216. I am contacting you in regards to reporting requirements for this system. The following is what we have identified as information that the TNRCC may require; any guidance documents would be greatly appreciated. Please review these and contact me if there are any additions / deletions:

(1) Frequency: Quarterly reports for the first year and then semi-annually thereafter.
(2) Amount of free-product recovered from system.
(3) Amount of groundwater recovered from sytem.
(4) Disposition of groundwater and free-product from the system.
(5) Product and groundwater thickness in monitoring wells not used for recovery with "bioslurp" system (but are a part of fuel farm 216).
(6) Product and groundwater thickness in recovery wells after securing system temporarily for 24 hrs.
(7) Depth of recovery wells (to ensure no significant deposition in wells).
(8) Air monitoring results (the intent here is to show operations below reporting levels; e.g. < 1 lb/hr tph).
(9) System Operations Summary.

Please contact me at (803) 820-5522 if you have any questions.

Sincerely,

E.W. Santos, P.E.,M.E.
Code 1845

copy: NAS Corpus, M&K

C-4324

DIST	1	A	R
PM	✓		
PJM	✓		
PCM			
CAM			
BM			
PURCH			
OCM			
SAFETY			
WILSON	✓		
MILLER	✓		

TOTAL P.05

February 14, 1997

Mr. Tom Benson
Morrison Knudsen Corporation
1500 West 3rd Street
Cleveland, Ohio 44113-1406

Re: **Completion of Construction**
Subcontract No. 4324-056
Delivery Order 0016, SOW 024
NAS Corpus Christ, Texas
AES Project No. 243-05616-01

Dear Mr. Benson:

As required under the General Conditions (GC-30) of the referenced subcontract, Applied Earth Sciences (AES), Inc., would like to notify you that the construction of the multi-phase recovery system constructed at NAS Corpus Christi under the referenced subcontract has been substantially completed. The punch list items listed in the memorandum to you from Mr. Steve Travis of Morrison Knudsen Corporation dated January 10, 1997, have been completed, and startup of the unit is complete. AES is now prepared to provide operations and maintenance services.

Your signature below will indicate your acceptance of the work as installed. If you have any questions, please contact me or Mr. Bobby Hill at (512) 854-9182.

Sincerely,

APPLIED EARTH SCIENCES, INC.

Claire P. Meurer

Claire P. Meurer, P. E.
Project Engineer

MORRISON KNUDSEN CORPORATION

Thomas A. Benson

Thomas A. Benson
Project Engineer

g:\clients\mkcorp\cr970201.wp6

C-4324			
DIST	1	A	R
PM	✓		
PjM			
PCM		✓	
CAM	✓		
BM	✓		
PURCH			
OCM			
SAFETY			
Bullis	✓		
File 11-2.16			

on

APPENDIX J
PERMITS, NOTIFICATIONS, AND CERTIFICATIONS

Texas Natural Resource Conservation Commission Standard Exemption List 30 TAC 116.211 Control of Air Pollution by Permits for New Construction or Modification. Exemption 68 (3 pages)

Texas Natural Resource Conservation Commission Standard Exemption List 30 TAC 116.211 Control of Air Pollution by Permits for New Construction or Modification. Exemption 88 (1 page)

Texas Natural Resource Conservation Commission Standard Exemption List 30 TAC 116.211 Control of Air Pollution by Permits for New Construction or Modification. Exemption 118 (4 pages)

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

STANDARD EXEMPTION LIST

30 TAC §116.211
Control of Air Pollution By Permits For New Construction or Modification

ADOPTED MAY 15, 1996
EFFECTIVE JUNE 7, 1996

****

68. Equipment used to reclaim or destroy chemicals removed from contaminated ground water, contaminated water condensate in tank and pipeline systems, or contaminated soil, for the purpose of remedial action, provided all the following conditions are satisfied:

(a) Applicability shall pertain to soil and water remediation at the property where the original contamination of the ground water or soil occurred or at a nearby property secondarily affected by the contamination, but not to any soil or water treatment facility where soils or water are brought in from another property. Such facilities are subject to §116.1, relating to Permit Requirements.

(b) For treating groundwater or soil contaminated with petroleum compounds, the total emissions of petroleum hydrocarbons shall not exceed 1.0 pound per hour (lb/hr), except that benzene emissions also must meet the conditions of Standard Exemption 118(c) and (d). For purposes of this exemption, petroleum is considered to include: (1) liquids or gases produced from natural formations of crude oil, tar sands, shale, coal and natural gas, or (2) refinery fuel products to include fuel additives.

(c) For treating groundwater or soil contaminated with chemicals other than petroleum, emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). If the groundwater or soil is contaminated with both petroleum and other chemicals, the petroleum compound emissions must meet condition (b) of this exemption and the other chemical emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). The emission of any chemical not having a Limit (L) Value in Table 118A of Standard Exemption 118 is limited to 1.0 lb/hr.

(d) The handling and processing (screening, crushing, etc.) of contaminated soil and the handling and conditioning (adding moisture) of remediated soil shall be controlled such that there are no visible emissions with the exception of moisture.

(e) If abatement equipment is used to meet conditions (b) and (c), the equipment must satisfy one of the following conditions:

(1) The vapors shall be burned in a direct-flame combustion device (incinerator, furnace, boiler, heater, or other enclosed direct-flame device) operated in compliance with Standard Exemption 88(b) and (c).

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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(2) The vapors shall be burned in a flare which meets the requirements of Standard Exemption 80 and the requirements of 40 Code of Federal Regulations 60.18 which shall take precedence over Standard Exemption 80 in any conflicting requirements whether or not New Source Performance Standards apply to the flare.

(3) The vapors shall be burned in a catalytic oxidizer which destroys at least 90% of the vapors. An evaluation of oxidizer effectiveness shall be made at least weekly using a portable flame or photoionization detector or equivalent instrument to determine the quantity of carbon compounds in the inlet and outlet of the catalytic oxidizer. Records of oxidizer performance shall be maintained in accordance with condition (g).

(4) The vapors shall be routed through a carbon adsorption system (CAS) consisting of at least two activated carbon canisters that are connected in series. The system shall meet the following additional requirements:

(A) The CAS shall be sampled and recorded weekly to determine breakthrough of volatile organic compounds (VOC). Breakthrough is defined as a measured VOC concentration of 50 parts per million by volume (ppmv) in the outlet of the initial canister. The sampling point shall be at the outlet of the initial canister, but before the inlet to the second or final polishing canister. Sampling shall be performed while venting maximum emissions to the CAS. (Example: during loading of tank trucks, during tank filling, during process venting.)

(B) A flame ionization detector (FID) shall be used for VOC sampling. The FID shall be calibrated prior to sampling with certified gas mixtures (propane in air) of 10 ppmv ± 2.0% and of 100 ppmv ± 2.0%.

(C) When the VOC breakthrough is measured, the waste gas flow shall be switched to the second canister immediately. Within four hours of detection of breakthrough, a fresh canister shall be placed as the new final polishing canister. Sufficient fresh activated carbon canisters shall be maintained at the site to ensure fresh polishing canisters are installed within four hours of detection of breakthrough.

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(D) Records of the CAS monitoring maintained at the plant site shall include, but are not limited to, the following:

1. sample time and date,
2. monitoring results (ppmv),
3. corrective action taken, including the time and date of the action, and
4. process operations occurring at the time of sampling.

(E) The registration shall include a demonstration that activated carbon is an appropriate choice for control of the organic compounds to be stripped.

(f) Before construction of the facility begins, the facility shall be registered with the Texas Natural Resource Conservation Commission (TNRCC) Office of Air Quality in Austin using Form PI-7. The registration shall contain specific information concerning the basis (measured or calculated) for the expected emissions from the facility. The registration shall also explain details as to why the emission control system can be expected to perform as represented.

(g) Records required by applicable paragraphs of this exemption shall be maintained at the site and made available to personnel from the TNRCC or any local agency having jurisdiction. These records shall be made available to representatives of the TNRCC and local programs upon request and shall be retained for at least two years following the date that the data is obtained.

(d) The oven, furnace, and/or incinerator shall be equipped with an afterburner automatically controlled to operate with a minimum temperature of 1,400°F and a gas retention time of 0.5 second or greater.

(e) Opacity of emissions from the oven, furnace, and/or incinerator shall not exceed 5% averaged over a 5-minute period.

(f) Manufacturer's recommended operating instructions shall be posted at each oven, furnace, and/or incinerator; and each unit shall be operated in accordance with these instructions.

(g) Heat shall be provided by the combustion of sweet natural gas, liquid petroleum gas, or No. 2 fuel oil with no more than 0.5% sulfur by weight; or by electric power.

(h) The emission of any air contaminant shall not exceed 0.5 lb/hr and 2.0 tpy.

88. Direct flame incinerators installed for the purpose of reducing or eliminating non-halogenated VOC vapors and/or aerosols (but not liquids or solids), provided the following conditions are satisfied:

(a) Before construction beings, the facility shall be registered with the appropriate regional office using Form PI-7.

(b) Each direct flame incinerator shall be automatically controlled to maintain a minimum temperature of 1,400°F in the combustion chamber (secondary chamber if dual chambered) and a gas retention time of 0.5 second or greater.

(c) Continuous temperature monitors to record the temperature of the combustion chamber (secondary chamber if dual chambered) shall be installed and maintained. Temperature data shall be maintained on a rolling 2-year retention basis and shall be made available at the request of personnel from the TACB or any local air pollution control program having jurisdiction.

(d) Manufacturer's recommended operating instructions shall be posted at each incinerator and each unit shall be operated in accordance with these instructions.

(e) Opacity of emissions from the incinerator shall not exceed 5% averaged over a 5-minute period.

(f) There shall be no obstructions to stack flow, such as by rain caps, unless such devices are designed to automatically open when the incinerator is in operation. Properly installed and maintained spark arrestors are not considered obstructions.

(g) Heat for the incinerator shall be provided by the combustion of sweet natural gas, liquid petroleum gas, or No. 2 fuel oil with no more than 0.5% sulfur by weight or by electric power.

(h) The gases being incinerated shall contain no halogenated organic compounds.

(i) This standard exemption shall not apply to catalytic incinerators, or direct flame incinerators installed to control emissions from new or modified facilities subject to the requirements of 31 TAC Chapter 116.

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118. Facilities, or physical or operational changes to a facility, provided that all of the following conditions are satisfied:

(a) This exemption shall not be used to authorize construction or any change to a facility specifically authorized in another standard exemption, but not meeting the requirements of that exemption. However, once the requirements of a specific exemption are met, Exemption 118(c) and (d) may be used to qualify the use of other chemicals at the facility.

(b) Emission points associated with the facilities or changes shall be located at least 100 feet from any off-plant receptor*.

(c) New or increased emissions, including fugitives, of chemicals shall not be emitted in a quantity greater than five tons per year nor in a quantity greater than E as determined using the equation E = L/K and the following table.

D, Feet	K
100	326
200	200
300	139
400	104
500	81
600	65
700	54
800	46
900	39
1,000	34
2,000	14
3,000 or more	8

E = maximum allowable hourly emission, and never to exceed 6 pounds per hour.

L = value as listed or referenced in Table 118A.

K = value from the table on this page. (interpolate intermediate values)

D = distance to the nearest off-plant receptor.

(d) Notification must be provided using Form PI-7 within 10 days following the installation or modification of the facilities. The notification shall include a description of the project, calculations, and data identifying specific chemical names, L values, D values, and a description of pollution control equipment, if any.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

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TABLE 118A
LIMIT VALUES (L) FOR USE WITH STANDARD EXEMPTION 118

Values included in this table represent screening levels for determining the applicability of Standard Exemption 118 and other standard exemptions using the Exemption 118 equation. The values are not to be interpreted as acceptable health effects values relative to the issuance of construction permits, special permits, or operating permits under 30 TAC Chapter 116.

Compound	Limit (L) Milligrams Per Cubic Meter
Acetone	590
Acetaldehyde	9
Acetone Cyanohydrin	4
Acetonitrile	34
Acetylene	2662
Adiponitrile	18
Aldrin	0.15
Sec-Amyl Acetate	1.1
Arsenic	0.01
Benzene	3
Beryllium and Compounds	0.0005
Butyl Acrylate	19
Butyl Glycidyl Ether	30
Butyl Mercaptan	0.3
Butyraldehyde	1.4
Butyric Acid	7.3
Butyronitrile	22
Carbon Tetrachloride	12
Chloroform	10
Chlorophenol	0.2
Chloroprene	3.6
Chromic Acid	0.05
Chromium and Compounds	0.025
Coal Tar Pitch Volatiles	0.1
Creosote	0.1
Cresol	0.12
Cumene	43
o-Dichlorobenzene	180
p-Dichlorobenzene	108
1,2-dichloroethylene	79

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Standard Exemption 118
Page 3

TABLE 118A Cont'd.

Compound	Limit (L) Milligrams Per Cubic Meter
Dicyclopentadiene	3.1
Diethylaminoethanol	5.5
Diisobutyl Ketone	140
Dimethyl Aniline	6.4
Dimethylhydrazine	0.15
Dioxane	3.6
Dipropylamine	8.4
Ethyl Acrylate	0.5
Ethylene Dibromide	1
Ethylene Glycol Dinitrate	0.1
Ethylene Oxide	0.18
Ethyl Mercaptan	0.15
Ethyl Sulfide	1.6
Fibrous Glass Dust	5
Gylcolonitrile	5
Heptane	350
Hydrazine	0.04
Hydrogen Chloride	1
Hydrogen Sulfide	1.1
Isoamyl Acetate	13
Isoamyl Alcohol	15
Isobutyronitrile	22
Isophorone Diisocyanate	0.045
Kepone	0.001
Kerosene	100
Malononitrile	8
Mercury, Inorganic	0.05
Mesityl Oxide	40
Methyl Acrylate	1.7
Methyl Amyl Ketone	5.8
Methyl Butyl Ketone	4
Methyl Disulfide	2.2
Methylenebis (Chloroaniline) MOCA	0.003
Methylenebis (Phenyl isocyanate)	0.05
Methylene Chloride	26

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TABLE 118A Cont'd.

Compound	Limit (L) Milligrams Per Cubic Meter
Methylhydrazine	0.08
Methyl Isoamyl Ketone	5.8
Methyl Mercaptan	0.3
Methyl Methacrylate	34
Methyl Propyl Ketone	530
Methyl Sulfide	0.5
Mineral Spirits	350
Naphtha	350
Nickel, Inorganic Compounds	0.015
Nitroglycerine	0.1
Nitropropane	36
Octane	350
Parathion	0.05
Pentane	350
Perchloroethylene	33.5
Petroleum Ether	350
Phenyl Glycidyl Ether	5
Phenylhydrazine	0.6
Phenyl Mercaptan	0.4
Propionitrile	14
Propyl Acetate	281
Propylene Oxide	5
Propyl Mercaptan	0.08
Stoddard Solvent	350
Styrene	21
Succinonitrile	20
Tolidine	0.02
Trichloroethylene	135
Trimethylamine	0.1
Valeric Acid	0.34
Vinyl Acetate	15
Vinyl Chloride	2

APPENDIX K
ANALYTICAL RESULTS

Air samples collected 1/9/97, cover letter from SPL dated 1/17/97 (14 pages)
Air samples collected 1/29/97, cover letter from SPL dated 2/03/97 (14 pages)
Air samples collected 1/30/97, cover letter from SPL dated 2/03/97 (14 pages)
Air samples collected 2/27/97, Analysis by Southwest Laboratory of Oklahoma, Inc.(21 pages)
Air samples collected 5/21/97, cover letter from Core Lab dated 6/10/97 (18 pages)
Air samples collected 6/30/97, cover letter from Core Lab dated 7/14/97 (9 pages)
Air samples collected 8/22/97, cover letter from Core Lab dated 9/02/97 (8 pages)

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

January 17, 1997

Ms. Claire Meurer
Applied Earth Science
4455 S. Padre Island, Suite 28
Corpus Christi, TX 78411

The following report contains analytical results for samples received at Southern Petroleum Laboratories (SPL) on January 14,1997. The samples were assigned to Certificate of Analysis No. 9701491 and analyzed for all parameters as listed on the chain of custody.

There were no analytical problems encountered with this group of samples and all quality control data was within acceptance limits.

If you have any questions or comments pertaining to this data report, please do not hesitate to contact me. Please reference the above Work Order Number during any inquiries.

Again, SPL is pleased to be of service to you. We anticipate working with you in fulfilling all your current and future analytical needs.

Southern Petroleum Laboratories

Siok Hong Chen
Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

SOUTHERN PETROLEUM LABORATORIES, INC.

Certificate of Analysis Number: 97-01-491

Approved for Release by:

Siok Hong Chen, Project Manager — Date: 1/8/97

Greg Grandits
Laboratory Director

Idelis Williams
Quality Assurance Officer

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

****SUMMARY REPORT*****

01/18/97

Company: Applied Earth Sciences
Site:
Project No: 243-05616-01
Project: Air Analysis

ANALYTICAL DATA
NOTE: ND - Not Detected

SPL ID MATRIX	CLIENT ID DATE SAMPLED	BENZENE PQL	TOLUENE PQL	ETHYLBENZ. PQL	XYLENE PQL	TPH-G	TPH-D	LEAD	MTBE
9701491-01 GAS	MW-13 01/09/97	1200 5.0ppm	310 5.0ppm	220 5.0ppm	90 5.0ppm				
9701491-02 GAS	MW-20 01/09/97	980 5.0ppm	320 5.0ppm	23 5.0ppm	160 5.0ppm				
9701491-03 GAS	MW-21 01/10/97	780 5.0ppm	370 5.0ppm	330 5.0ppm	210 5.0ppm				
9701491-04 GAS	MW-26 01/09/97	840 5.0ppm	240 5.0ppm	15 5.0ppm	70 5.0ppm				
9701491-05 GAS	MW-29 01/09/97	860 5.0ppm	320 5.0ppm	250 5.0ppm	270 5.0ppm				

BTEX - METHOD 5030/8020 (Modified)***

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701491-01

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Claire Meurer

DATE: 01/17/97

PROJECT: Air Analysis
SITE:
SAMPLED BY: Applied Earth Science
SAMPLE ID: MW-13

PROJECT NO: 243-05616-01
MATRIX: GAS
DATE SAMPLED: 01/09/97
DATE RECEIVED: 01/14/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	1200	5.0 P	ppm
TOLUENE	310	5.0 P	ppm
ETHYLBENZENE	220	5.0 P	ppm
TOTAL XYLENE	90	5.0 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	1820		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: FAB			
Date: 01/15/97			
Total Petroleum Hydrocarbons	13000	25	ppm
Method Modified 8015A Air***			
Analyzed by: fab			
Date: 01/15/97 01:55:00			

(P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701491-02

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Claire Meurer

DATE: 01/17/97

PROJECT: Air Analysis
SITE:
SAMPLED BY: Applied Earth Science
SAMPLE ID: MW-20

PROJECT NO: 243-05616-01
MATRIX: GAS
DATE SAMPLED: 01/09/97
DATE RECEIVED: 01/14/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	980	5.0 P	ppm
TOLUENE	320	5.0 P	ppm
ETHYLBENZENE	23	5.0 P	ppm
TOTAL XYLENE	160	5.0 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	1483		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: FAB			
Date: 01/15/97			
Total Petroleum Hydrocarbons	19000	25	ppm
Method Modified 8015A Air***			
Analyzed by: fab			
Date: 01/15/97 02:45:00			

(P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701491-03

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Claire Meurer

DATE: 01/17/97

PROJECT: Air Analysis
SITE:
SAMPLED BY: Applied Earth Science
SAMPLE ID: MW-21

PROJECT NO: 243-05616-01
MATRIX: GAS
DATE SAMPLED: 01/10/97
DATE RECEIVED: 01/14/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	780	5.0 P	ppm
TOLUENE	370	5.0 P	ppm
ETHYLBENZENE	330	5.0 P	ppm
TOTAL XYLENE	210	5.0 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	1690		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: FAB			
Date: 01/15/97			
Total Petroleum Hydrocarbons	11000	25	ppm
Method Modified 8015A Air***			
Analyzed by: fab			
Date: 01/15/97 03:18:00			

(P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701491-04

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Claire Meurer

DATE: 01/17/97

PROJECT: Air Analysis
SITE:
SAMPLED BY: Applied Earth Science
SAMPLE ID: MW-26

PROJECT NO: 243-05616-01
MATRIX: GAS
DATE SAMPLED: 01/09/97
DATE RECEIVED: 01/14/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	840	5.0 P	ppm
TOLUENE	240	5.0 P	ppm
ETHYLBENZENE	15	5.0 P	ppm
TOTAL XYLENE	70	5.0 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	1165		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: FAB			
Date: 01/15/97			
Total Petroleum Hydrocarbons	17000	25	ppm
Method Modified 8015A Air***			
Analyzed by: fab			
Date: 01/15/97 03:52:00			

(P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
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HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701491-05

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Claire Meurer

DATE: 01/17/97

PROJECT: Air Analysis
SITE:
SAMPLED BY: Applied Earth Science
SAMPLE ID: MW-29

PROJECT NO: 243-05616-01
MATRIX: GAS
DATE SAMPLED: 01/09/97
DATE RECEIVED: 01/14/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	860	5.0 P	ppm
TOLUENE	320	5.0 P	ppm
ETHYLBENZENE	250	5.0 P	ppm
TOTAL XYLENE	270	5.0 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	1700		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: FAB			
Date: 01/15/97			
Total Petroleum Hydrocarbons	12000	25	ppm
Method Modified 8015A Air***			
Analyzed by: fab			
Date: 01/15/97 04:25:00			

(P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

CHAIN OF CUSTODY

AND

SAMPLE RECEIPT CHECKLIST

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

METHOD 5030/8020 (Modified)

Matrix: Air

Batch Id: HP_P970114023600

Units: ppm

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike Result <1>	Matrix Spike Recovery <4>	Matrix Spike Duplicate Result <1>	Matrix Spike Duplicate Recovery <5>	MS/MSD Relative % Difference	QC Limits(**) (Advisory) RPD Max.	QC Limits(**) (Advisory) Recovery Range
BENZENE	ND	20	17	85.0	19	95.0	11.1	30	20 - 150
TOLUENE	ND	20	13	62.5	15	72.5	14.8	30	20 - 150
ETHYLBENZENE	ND	20	13	65.0	15	75.0	14.3	30	20 - 150
O XYLENE	ND	20	12	60.0	14	70.0	15.4	30	20 - 150
M & P XYLENE	ND	20	13	64.5	15	74.5	14.4	30	20 - 150

Analyst: fab

Sequence Date: 01/14/97

Method Blank File ID:

Sample File ID:

Blank Spike File ID: P_A7076.TX0

Matrix Spike File ID:

Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.

NC = Not Calculated (Sample exceeds spike by factor of 4 or more)

ND = Not Detected/Below Detection Limit

% Recovery = [(<1> - <2>) / <3>] x 100

Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100

(**) = Source: Temporary Limits

SAMPLES IN BATCH(SPL ID): 9701491-01A 9701491-02A 9701491-03A 9701491-04A 9701491-05A

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

METHOD 8015 (Modified)

Matrix: Air

Batch Id: HP_P970114031000

Units: ppm

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike Result <1>	Matrix Spike Recovery <4>	Matrix Spike Duplicate Result <1>	Matrix Spike Duplicate Recovery <5>	MS/MSD Relative % Difference	QC Limits(**) (Advisory) RPD Max.	QC Limits(**) (Advisory) Recovery Range
TPHAIR	ND	200	132	66.0	128	64.0	3.08	30	20 - 150

Analyst: fab

Sequence Date: 01/14/97

Method Blank File ID:

Sample File ID:

Blank Spike File ID: PPA7076.TX0

Matrix Spike File ID:

Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.

NC = Not Calculated (Sample exceeds spike by factor of 4 or more)

ND = Not Detected/Below Detection Limit

% Recovery = [(<1> - <2>) / <3>] x 100

Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100

(**) = Source: Temporary limits

SAMPLES IN BATCH(SPL ID): 9701491-01A 9701491-02A 9701491-03A 9701491-04A 9701491-05A

QUALITY CONTROL

DOCUMENTATION

9701491 SK 1/14/97

APPLIED EARTH SCIENCES, INC.

CHAIN OF CUSTODY

Project No. 243-05616-01 Sampled by: Claire Meurer

Date Results Expected: Verbal _____ Written _____ Surcharge Authorized _____

Send Report To: CLAIRE MEURER

Laboratory Name: SPL

Sample ID	Date/Time Sampled	Type Sample	No. Containers	Analyses Requested (Include Methods)
MW-13	1/9/97	GAS	1	TPH, BTEX
MW-20	1/9/97	GAS	1	TPH, BTEX
MW-21	1/10/97	GAS	1	TPH, BTEX
MW-26	1/9/97	GAS	1	TPH, BTEX
MW-29	1/9/97	GAS	1	TPH, BTEX

COMMENTS:

AES PROJECT NUMBER MUST APPEAR ON ALL REPORTS AND INVOICES!!!

Relinquished by: Sign	Date/Time	Received by: Sign	Date/Time
Claire Meurer	1/13/97 9:25am	FEDEX	
Relinquished by: Sign	Date/Time	Received by: Sign	Date/Time
		J West Ambient	1/14/97 1110
Relinquished by: Sign	Date/Time	Received by: Sign	Date/Time
Received For Laboratory by: Sign	Date/Time	Sample Condition	

4455 South Padre Island Drive, Ste. 28 • Corpus Christi, Texas 78411 • Tel: (512) 854-9182 • Fax: (512) 854-0734

SPL Houston Environmental Laboratory

Sample Login Checklist

Date:	Time:
1/14/97	1110

SPL Sample ID:
9701491

			Yes	No
1	Chain-of-Custody (COC) form is present.		✓	
2	COC is properly completed.		✓	
3	If no, Non-Conformance Worksheet has been completed.			
4	Custody seals are present on the shipping container.		✓	
5	If yes, custody seals are intact.		✓	
6	All samples are tagged or labeled.		✓	
7	If no, Non-Conformance Worksheet has been completed.			
8	Sample containers arrived intact		✓	
9	Temperature of samples upon arrival:		Ambient C	
10	Method of sample delivery to SPL:	SPL Delivery		
		Client Delivery		
		FedEx Delivery (airbill #)	257669172 5	
		Other:		
11	Method of sample disposal:	SPL Disposal	✓	
		HOLD		
		Return to Client		

me:	Date:
S. West	1/14/97

Claire → lab file

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

February 3, 1997

Mr. Bobby Hill
Applied Earth Sciences
4455 S. Padre Island, Ste. 28
Corpus Christi, TX 78411

The following report contains analytical results for samples received at Southern Petroleum Laboratories (SPL) on January 30, 1997. The samples were assigned to Certificate of Analysis No. 9701B76 and analyzed for all parameters as listed on the chain of custody.

There were no analytical problems encountered with this group of samples and all quality control data was within acceptance limits.

If you have any questions or comments pertaining to this data report, please do not hesitate to contact me. Please reference the above Certificate of Analysis No. during any inquiries.

Again, SPL is pleased to be of service to you. We anticipate working with you in fulfilling all your current and future analytical needs.

Southern Petroleum Laboratories

for Siok Hong Chen
Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

SOUTHERN PETROLEUM LABORATORIES, INC.

Certificate of Analysis Number: 97-01-B76

Approved for Release by:

Siok Hong Chen, Project Manager

Date: 2/3/97

Greg Grandits
Laboratory Director

Idelis Williams
Quality Assurance Officer

Southern Petroleum Laboratories
HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

******SUMMARY REPORT*******

02/03/97

Company: Applied Earth Sciences
Site: NAS Corpus Christi
Project No: 243-05616-01
Project: NAS

ANALYTICAL DATA
NOTE: ND - Not Detected

SPL ID MATRIX	CLIENT ID DATE SAMPLED	BENZENE PQL	TOLUENE PQL	ETHYLBENZ. PQL	XYLENE PQL	TPH-IR	TPH-GC	LEAD	MTBE
9701B76-01 AIR	MW-13 01/29/97 15:30:00	ND 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		1700 250ppm		
9701B76-02 AIR	MW-20 01/29/97 15:10:00	120 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		7800 250ppm		
9701B76-03 AIR	MW-21 01/29/97 15:54:00	51 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		2500 250ppm		
9701B76-04 AIR	MW-26 01/29/97 14:10:00	ND 100ppm	ND 100ppm	ND 100ppm	ND 100ppm		5800 500ppm		
376-05 AIR	MW-29 01/29/97 14:45:00	ND 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		3300 250ppm		

BTEX - METHOD 5030/8020 (Modified)***
TPH-GC - Method Modified 8015A Air***

SPL, Inc. - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701B76-01

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: NAS
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-13

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/29/97 15:30:00
DATE RECEIVED: 01/30/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	ND	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	ND		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	1700	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 10:15:00			

ND - Not detected. (P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
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HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701B76-02

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: NAS
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-20

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/29/97 15:10:00
DATE RECEIVED: 01/30/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	120	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	120		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	7800	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 10:50:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701B76-03

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: NAS
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-21

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/29/97 15:54:00
DATE RECEIVED: 01/30/97

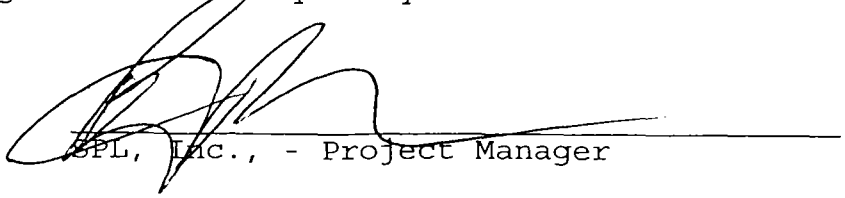
ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	51	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	51		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	2500	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 11:24:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.



SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701B76-04

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: NAS
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-26

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/29/97 14:10:00
DATE RECEIVED: 01/30/97

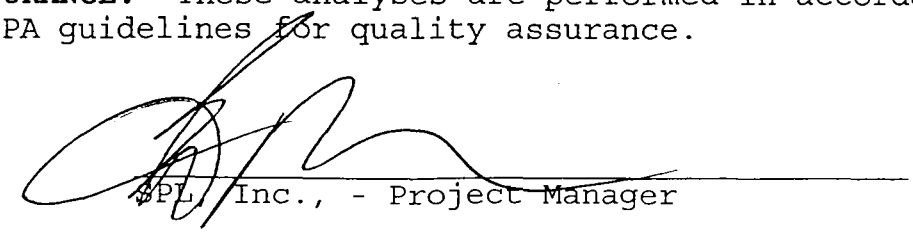
ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	ND	100 P	ppm
TOLUENE	ND	100 P	ppm
ETHYLBENZENE	ND	100 P	ppm
TOTAL XYLENE	ND	100 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	ND		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	5800	500	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 06:47:00			

ND - Not detected. (P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.



SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701B76-05

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: NAS
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-29

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/29/97 14:45:00
DATE RECEIVED: 01/30/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	ND	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	ND		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	3300	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 06:13:00			

ND - Not detected. (P) - Practical Quantitation Limit

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

SPL, Inc., - Project Manager

QUALITY CONTROL

DOCUMENTATION

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

®METHOD 5030/8020 (Modified)

Matrix: Air

Batch Id: HP_P970131024800

Units: ppm

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike Result <1>	Matrix Spike Recovery <4>	Matrix Spike Duplicate Result <1>	Matrix Spike Duplicate Recovery <5>	MS/MSD Relative % Difference	QC Limits(**) (Advisory) RPD Max.	QC Limits(**) (Advisory) Recovery Range
BENZENE	ND	20	17	85.0	15	75.0	12.5	30	20 - 150
TOLUENE	ND	20	13	65.0	13	65.0	0	30	20 - 150
ETHYLBENZENE	ND	20	12	60.0	11	55.0	8.70	30	20 - 150
O XYLENE	ND	20	11	55.0	11	55.0	0	30	20 - 150
M & P XYLENE	ND	20	13	64.5	12	59.5	8.06	30	20 - 150

Analyst: RL

Sequence Date: 01/31/97

Method Blank File ID:

Sample File ID:

Blank Spike File ID: P_A7277.TX0

Matrix Spike File ID:

Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.

NC = Not Calculated (Sample exceeds spike by factor of 4 or more)

ND = Not Detected/Below Detection Limit

% Recovery = [(<1> - <2>) / <3>] x 100

Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100

(**) = Source: Temporary Limits

SAMPLES IN BATCH(SPL ID):

9701B76-04A 9701C50-01A 9701C50-02A 9701C50-03A
9701C50-04A 9701C50-05A 9701B76-01A 9701B76-02A
9701B76-03A 9701C91-01A 9701B85-01A 9701B76-05A

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

®METHOD 8015 (Modified)

Matrix: Air

Batch Id: HP_P970131032200

Units: ppm

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike		Matrix Spike Duplicate		MS/MSD Relative % Difference	QC Limits(**) (Advisory)	
			Result <1>	Recovery <4>	Result <1>	Recovery <5>		RPD Max.	Recovery Range
TPHAIR	ND	200	120	60.0	140	70.0	15.4	30	20 - 150

Analyst: AA

Sequence Date: 01/31/97

Method Blank File ID:

Sample File ID:

Blank Spike File ID: PPB7012.TX0

Matrix Spike File ID:

Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.

NC = Not Calculated (Sample exceeds spike by factor of 4 or more)

ND = Not Detected/Below Detection Limit

% Recovery = [(<1> - <2>) / <3>] x 100

Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100

(**) = Source: Temporary limits

SAMPLES IN BATCH(SPL ID):

9701B76-04A 9701C50-01A 9701C50-02A 9701C50-03A
9701C50-04A 9701C50-05A 9701B76-01A 9701B76-02A
9701B76-03A 9701C75-02A 9701C91-01A 9701B85-01A
9701C75-01A 9701B76-05A

CHAIN OF CUSTODY

AND

SAMPLE RECEIPT CHECKLIST

SPL, Inc.

Analysis Request & Chain of Custody Record

SPL Workorder No: 97-01-B76

H- 12738

page 1 of 1

Client Name: Applied Earth Sciences Inc. Corpus Christi TX. 78411

Address/Phone: 1455 S.P.E.D. #28 (512) 854-9182

Client Contact: Bobby Hill

Project Name: NAS

Project Number: 243.05616-01

Project Location: NAS Corpus Christi

Invoice To: AES Corpus c/o Bobby Hill

SAMPLE ID	DATE	TIME	comp	grab	matrix (W=water S=soil SL=sludge O=other:)	bottle (P=plastic A=amber glass G=glass V=vial)	size (1=1 liter 4=4oz 40=vial 8=8oz 16=16oz)	pres. (1=HCl 2=HNO3 3=H2SO4 O=other:)	Number of Containers	Requested Analysis: BTEX (8020)	Requested Analysis: TPH (8015)
MW-13	1/29/97	15:30		✓	O	TEDLAR BAG			1	1	1
MW-20		15:10		✓	O	"		"	1	1	1
MW-21		15:54		✓	O	"		"	1	1	1
MW-26		14:10		✓	O	"		"	1	1	1
MW-29	1/29/97	14:45		✓	O	"		"	1	1	1

Client/Consultant Remarks:

Laboratory remarks:

Intact? ☑ Y ☐ N

Temp: —

Requested TAT

24hr ☑ 72hr ☐

48hr ☐ Standard ☐

Other ☐ _____

Special Reporting Requirements: Fax Results ☑ Raw Data ☐ Standard QC ☐ Level 3 QC ☐ Level 4 QC ☐

Special Detection Limits (specify): 600 970 876

PM review (initial):

	date	time		date	time
1. Relinquished by Sampler:	1/29/97	17:00	2. Received by:	1-29-97	17:00
3. Relinquished by:	1-29-97	5:30p	4. Received by:	1/30/97	0800
5. Relinquished by:	date	time	6. Received by Laboratory:		

☐ 8880 Interchange Drive, Houston, TX 77054 (713) 660-0901

☐ 500 Ambassador Caffery Parkway, Scott, LA 70583 (318) 237-4775

☐ 459 ghes Drive, Traverse City, MI 49684 (616) 947-5777

☐ 1511 E. Orangethorpe Avenue, Fullerton, CA 92631 4) 447-6868

SPL Houston Environmental Laboratory

Sample Login Checklist

Date:	Time:
1-30-97	0800

SPL Sample ID:
97-01-B76

			Yes	No
1	Chain-of-Custody (COC) form is present.		✓	
2	COC is properly completed.		✓	
3	If no, Non-Conformance Worksheet has been completed.			
4	Custody seals are present on the shipping container.		✓	
5	If yes, custody seals are intact.		✓	
6	All samples are tagged or labeled.		✓	
7	If no, Non-Conformance Worksheet has been completed.			
8	Sample containers arrived intact		✓	
9	Temperature of samples upon arrival:		—	C
10	Method of sample delivery to SPL:	**SPL Delivery**		
		Client Delivery		
		FedEx Delivery (airbill #)		
		Other: Lone Star Overnight	7993704	
11	Method of sample disposal:	SPL Disposal		
		HOLD		
		Return to Client		

Name:	Date:
[signature]	1-30-97

Claire → lab file

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

February 3, 1997

Mr. Bobby Hill
Applied Earth Sciences
4455 S. Padre Island, Suite 28
Corpus Christi, TX 78411

The following report contains analytical results for samples received at Southern Petroleum Laboratories (SPL) on January 31, 1997. The samples were assigned to Certificate of Analysis No. 9701C50 and analyzed for all parameters as listed on the chain of custody.

There were no analytical problems encountered with this group of samples and all quality control data was within acceptance limits.

If you have any questions or comments pertaining to this data report, please do not hesitate to contact me. Please reference the above Certificate of Analysis No. during any inquiries.

Again, SPL is pleased to be of service to you. We anticipate working with you in fulfilling all your current and future analytical needs.

Southern Petroleum Laboratories

Siok Hong Chen
Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

SOUTHERN PETROLEUM LABORATORIES, INC.

Certificate of Analysis Number: 97-01-C50

Approved for Release by:

Siok Hong Chen, Project Manager

Date: 2/3/97

Greg Grandits
Laboratory Director

Idelis Williams
Quality Assurance Officer

Southern Petroleum Laboratories
HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

****SUMMARY REPORT*****

02/03/97

Company: Applied Earth Sciences
Site: NAS Corpus Christi
Project No: 243-05616-01
Project: Air Analysis

ANALYTICAL DATA
NOTE: ND - Not Detected

SPL ID MATRIX	CLIENT ID DATE SAMPLED	BENZENE PQL	TOLUENE PQL	ETHYLBENZ. PQL	XYLENE PQL	TPH-IR	TPH-GC	LEAD	MTBE
9701C50-01 AIR	MW-26 01/30/97 11:30:00	130 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		24000 250ppm		
9701C50-02 AIR	MW-29 01/30/97 13:25:00	150 50ppm	ND 50ppm	65 50ppm	58 50ppm		14000 250ppm		
9701C50-03 AIR	MW-20 01/30/97 14:05:00	160 50ppm	ND 50ppm	60 50ppm	ND 50ppm		14000 250ppm		
9701C50-04 AIR	MW-13 01/30/97 14:30:00	160 50ppm	ND 50ppm	53 50ppm	ND 50ppm		10000 250ppm		
C50-05 AIR	MW-21 01/30/97 14:45:00	66 50ppm	ND 50ppm	ND 50ppm	ND 50ppm		1600 250ppm		

BTEX - METHOD 5030/8020 (Modified)***
TPH-GC - Method Modified 8015A Air***

SPL, Inc., - Project Manager

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701C50-01

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: Air Analysis
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-26

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/30/97 11:30:00
DATE RECEIVED: 01/31/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	130	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	130		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	24000	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 07:22:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701C50-02

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: Air Analysis
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-29

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/30/97 13:25:00
DATE RECEIVED: 01/31/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	150	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	65	50 P	ppm
TOTAL XYLENE	58	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	273		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	14000	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 07:57:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701C50-03

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: Air Analysis
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-20

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/30/97 14:05:00
DATE RECEIVED: 01/31/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	160	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	60	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	220		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	14000	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 08:32:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701C50-04

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: Air Analysis
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-13

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/30/97 14:30:00
DATE RECEIVED: 01/31/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	160	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	53	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	213		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	10000	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 09:06:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

Certificate of Analysis No. H9-9701C50-05

Applied Earth Sciences
4455 S. Padre Island Ste 28
Corpus Christi, TX 78411
ATTN: Bobby Hill

DATE: 02/03/97

PROJECT: Air Analysis
SITE: NAS Corpus Christi
SAMPLED BY: Applied Earth Sciences Inc.
SAMPLE ID: MW-21

PROJECT NO: 243-05616-01
MATRIX: AIR
DATE SAMPLED: 01/30/97 14:45:00
DATE RECEIVED: 01/31/97

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
BENZENE	66	50 P	ppm
TOLUENE	ND	50 P	ppm
ETHYLBENZENE	ND	50 P	ppm
TOTAL XYLENE	ND	50 P	ppm
TOTAL VOLATILE AROMATIC HYDROCARBONS	66		ppm
METHOD 5030/8020 (Modified)***			
Analyzed by: RL			
Date: 01/31/97			
Total Petroleum Hydrocarbons	1600	250	ppm
Method Modified 8015A Air***			
Analyzed by: RL			
Date: 01/31/97 09:41:00			

(P) - Practical Quantitation Limit ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: These analyses are performed in accordance with EPA guidelines for quality assurance.

QUALITY CONTROL

DOCUMENTATION

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

®METHOD 5030/8020 (Modified)

Matrix: Air
Units: ppm

Batch Id: HP_P970131024800

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike Result <1>	Matrix Spike Recovery <4>	Matrix Spike Duplicate Result <1>	Matrix Spike Duplicate Recovery <5>	MS/MSD Relative % Difference	QC Limits(**) (Advisory) RPD Max.	QC Limits(**) (Advisory) Recovery Range
BENZENE	ND	20	17	85.0	15	75.0	12.5	30	20 - 150
TOLUENE	ND	20	13	65.0	13	65.0	0	30	20 - 150
ETHYLBENZENE	ND	20	12	60.0	11	55.0	8.70	30	20 - 150
O XYLENE	ND	20	11	55.0	11	55.0	0	30	20 - 150
M & P XYLENE	ND	20	13	64.5	12	59.5	8.06	30	20 - 150

Analyst: RL
Sequence Date: 01/31/97
Method Blank File ID:
Sample File ID:
Blank Spike File ID: P_A7277.TX0
Matrix Spike File ID:
Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.
NC = Not Calculated (Sample exceeds spike by factor of 4 or more)
ND = Not Detected/Below Detection Limit
% Recovery = [(<1> - <2>) / <3>] x 100
Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100
(**) = Source: Temporary Limits

SAMPLES IN BATCH(SPL ID):

9701B76-04A 9701C50-01A 9701C50-02A 9701C50-03A
9701C50-04A 9701C50-05A 9701B76-01A 9701B76-02A
9701B76-03A 9701C91-01A 9701B85-01A 9701B76-05A

HOUSTON LABORATORY
8880 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

** SPL BATCH QUALITY CONTROL REPORT ** PAGE

®METHOD 8015 (Modified)

Matrix: Air

Batch Id: HP_P970131032200

Units: ppm

B L A N K S P I K E S

S P I K E C O M P O U N D S	Sample Results <2>	Spike Added <3>	Matrix Spike Result <1>	Matrix Spike Recovery <4>	Matrix Spike Duplicate Result <1>	Matrix Spike Duplicate Recovery <5>	MS/MSD Relative % Difference	QC Limits(**) (Advisory) RPD Max.	QC Limits(**) (Advisory) Recovery Range
TPHAIR	ND	200	120	60.0	140	70.0	15.4	30	20 - 150

Analyst: AA

Sequence Date: 01/31/97

Method Blank File ID:

Sample File ID:

Blank Spike File ID: PPB7012.TX0

Matrix Spike File ID:

Matrix Spike Duplicate File ID:

* = Values Outside QC Range. « = Data outside Method Specification limits.

NC = Not Calculated (Sample exceeds spike by factor of 4 or more)

ND = Not Detected/Below Detection Limit

% Recovery = [(<1> - <2>) / <3>] x 100

Relative Percent Difference = |(<4> - <5> | / [(<4> + <5>) x 0.5] x 100

(**) = Source: Temporary limits

SAMPLES IN BATCH(SPL ID):

9701B76-04A 9701C50-01A 9701C50-02A 9701C50-03A
9701C50-04A 9701C50-05A 9701B76-01A 9701B76-02A
9701B76-03A 9701C75-02A 9701C91-01A 9701B85-01A
9701C75-01A 9701B76-05A

CHAIN OF CUSTODY

AND

SAMPLE RECEIPT CHECKLIST

97-01-C50

Environmental Laboratory
8880 Interchange Drive
Houston, Texas 77054
713/660-0901

Analysis Request and Chain of Custody Record

Project No.	Client/Project Name	Project Location
243-05616-01	Applied Earth Sciences-NAS	NAS-Corpus Christi

Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
MW-26	1/30/97 11:30	✓		Tedlar	Air	N/A	TPH (8015), BTEX (8020)	
MW-29	1/30/97 13:25	✓		Tedlar	Air	N/A		
MW-20	1/30/97 14:05	✓		Tedlar	Air	N/A		
MW-13	1/30/97 14:30	✓		Tedlar	Air	N/A		
MW-21	1/30/97 14:45	✓		Tedlar	Air	N/A		

Samplers: (Signature)	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
Bobby Hill	Bobby Hill	Date: 1/30/97 Time: 17:15	Dennis W Rochelle	Date: 1-30-97 Time: 17:15	Intact
Affiliation	Dennis W Rochelle	Date: 1-31-97 Time: 12:00pm	[illegible]	Date: 1/31/97 Time: 700	Intact
AES	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact

SAMPLER REMARKS: Expedited turnaround - Please FAX results by Monday (512) 854-0734

Seal #

Received for laboratory: (Signature) | Date: Time: | Laboratory No.

Data Results to:

SPL Houston Environmental Laboratory

Sample Login Checklist

Date:	Time:
1-31-97	1200

SPL Sample ID:
97-01-C50

			Yes	No
1	Chain-of-Custody (COC) form is present.		✓	
2	COC is properly completed.		✓	
3	If no, Non-Conformance Worksheet has been completed.			
4	Custody seals are present on the shipping container.		✓	
5	If yes, custody seals are intact.		✓	
6	All samples are tagged or labeled.		✓	
7	If no, Non-Conformance Worksheet has been completed.			
8	Sample containers arrived intact		✓	
9	Temperature of samples upon arrival:		— C	
10	Method of sample delivery to SPL:	**SPL Delivery**	✓	
		Client Delivery		
		FedEx Delivery (airbill #)		
		Other:		
11	Method of sample disposal:	SPL Disposal	✓	
		HOLD		
		Return to Client		

ame:	Date:
[signature]	1-31-97

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

MORRISON KNUDSEN CORPORATION
NIK FERGUSON PLAZA
1300 WEST 3RD STREET
CLEVELAND, OH 44113
Attn: ALAN FOSDICK

REPORT: 28655.01

DATE: 03/06/97

SWLO # : 28655.01
SAMPLE #: MW-26
SAMPLE MATRIX : AIR
PROJECT : AIR
LOCATION: MW-26
METHOD REFERENCE: MODIFIED ASTM-D1945

DEPTH FROM : 0.00
DEPTH TO : 0.00
DATE SAMPLED : 02/27/97
DATE RECEIVED : 02/28/97
DATE PREPARED :
DATE ANALYZED : 02/28/97
DILUTION FACTOR: 1.00

NATURAL GAS ANALYSIS
RESULTS REPORT IN %

PARAMETER	RESULTS**	PARAMETER	RESULTS**
OXYGEN	4.81		

* RESULTS REPORTED TO A MAXIMUM OF 3 SIGNIFICANT FIGURES

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

MORRISON KNUDSEN CORPORATION
NIK FERGUSON PLAZA
1300 WEST 3RD STREET
CLEVELAND, OH 44113
Attn: ALAN FOSDICK

REPORT: 28655.01

DATE: 03/06/97

SWLO # : 28655.01
SAMPLE #: MW-26
SAMPLE MATRIX : AIR
PROJECT : AIR
LOCATION: MW-26

DEPTH FROM : 0.00
DEPTH TO : 0.00
DATE SAMPLED : 02/27/97
DATE RECEIVED : 02/28/97

MISCELLANEOUS

PARAMETER	RESULTS**	UNITS	DATE PREPARED	DATE ANALYZED	REFERENCE METHOD
BTU	157	btu	/ /	02/28/97	ASTMD-240

* .SULTS REPORTED TO A MAXIMUM OF 3 SIGNIFICANT FIGURES

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

MORRISON KNUDSEN CORPORATION
NIK FERGUSON PLAZA
1300 WEST 3RD STREET
CLEVELAND, OH 44113
Attn: ALAN FOSDICK

REPORT: 28655.02

DATE: 03/06/97

SWLO # : 28655.02
SAMPLE #: MW-13
SAMPLE MATRIX : AIR
PROJECT : AIR
LOCATION: MW-13
METHOD REFERENCE: MODIFIED ASTM-D1945

DEPTH FROM : 0.00
DEPTH TO : 0.00
DATE SAMPLED : 02/27/97
DATE RECEIVED : 02/28/97
DATE PREPARED :
DATE ANALYZED : 02/28/97
DILUTION FACTOR: 1.00

NATURAL GAS ANALYSIS
RESULTS REPORT IN %

PARAMETER	RESULTS**	PARAMETER	RESULTS**
OXYGEN	4.87		

ESULTS REPORTED TO A MAXIMUM OF 3 SIGNIFICANT FIGURES

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

MORRISON KNUDSEN CORPORATION
NIK FERGUSON PLAZA
1300 WEST 3RD STREET
CLEVELAND, OH 44113
Attn: ALAN FOSDICK

REPORT: 28655.02

DATE: 03/06/97

SWLO # : 28655.02
SAMPLE #: MW-13
SAMPLE MATRIX : AIR
PROJECT : AIR
LOCATION: MW-13

DEPTH FROM : 0.00
DEPTH TO : 0.00
DATE SAMPLED : 02/27/97
DATE RECEIVED : 02/28/97

MISCELLANEOUS

PARAMETER	RESULTS**	UNITS	DATE PREPARED	DATE ANALYZED	REFERENCE METHOD
BTU	205	btu	/ /	02/28/97	ASTMD-240

** RESULTS REPORTED TO A MAXIMUM OF 3 SIGNIFICANT FIGURES

SOUTHWEST LABORATORY OF OKLAHOMA
1700 West Albany, Suite A / Broken Arrow, OK 74012
918-251-2858

SDG NARRATIVE
March 6, 1997

CLIENT:	MKF-OH
EPISODE NO.:	28655
SAMPLE NO.:	28655.01,02
SDG NO.:	28655

The samples were extracted and analyzed by method TO-14.

Both samples required about 2000 fold dilution due to the high levels of benzene.

Jayant Shringarpure, Ph.D. March 6, 1997
Technical Director

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-13

Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.02

Date Received: 02/28/97 Lab File ID: Z3197.D

Date Analyzed: 02/28/97 Dilution Factor: 2010.0

GC Column:DB-624 ID: 0.53 (mm)

CAS NO.	COMPOUND	CONCENTRATION UNITS: PPBV	Q
75-71-8	Dichlorodifluoromethane (F12	2000	U
74-87-3	Chloromethane	2000	U
76-14-2	1,2-DC-1,1,2,2-TFA (F114)	2000	U
75-01-4	Vinyl Chloride	2000	U
74-83-9	Bromomethane	2000	U
75-00-3	Chloroethane	2000	U
75-69-4	Trichlorofluoromethane (F11)	2000	U
67-64-1	Acetone	2000	U
75-35-4	1,1-Dichloroethene	2000	U
76-13-1	1,1,2-TC-1,2,2-TFA (F113)	2000	U
75-09-2	Methylene Chloride	2000	U
75-15-0	Carbon Disulfide	2000	U
156-60-5	trans-1,2-Dichloroethene	2000	U
75-34-3	1,1-Dichloroethane	2000	U
78-93-3	2-Butanone	2000	U
156-59-2	cis-1,2-Dichloroethene	2000	U
67-66-3	Chloroform	2000	U
71-55-6	1,1,1-Trichloroethane	2000	U
107-06-2	1,2-Dichloroethane	2000	U
71-43-2	Benzene	160000	
56-23-5	Carbon Tetrachloride	2000	U
78-87-5	1,2-Dichloropropane	2000	U
79-01-6	Trichloroethene	2000	U
108-10-1	4-Methyl-2-Pentanone	2000	U
10061-01-5	cis-1,3-Dichloropropene	2000	U
10061-02-6	trans-1,3-Dichloropropene	2000	U
108-88-3	Toluene	2000	U
79-00-5	1,1,2-Trichloroethane	2000	U
591-78-6	2-Hexanone	2000	U
106-93-4	1,2-Dibromoethane	2000	U
127-18-4	Tetrachloroethene	2000	U
108-90-7	Chlorobenzene	2000	U
100-41-4	Ethylbenzene	20000	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-13

Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.02

Date Received: 02/28/97 Lab File ID: Z3197.D

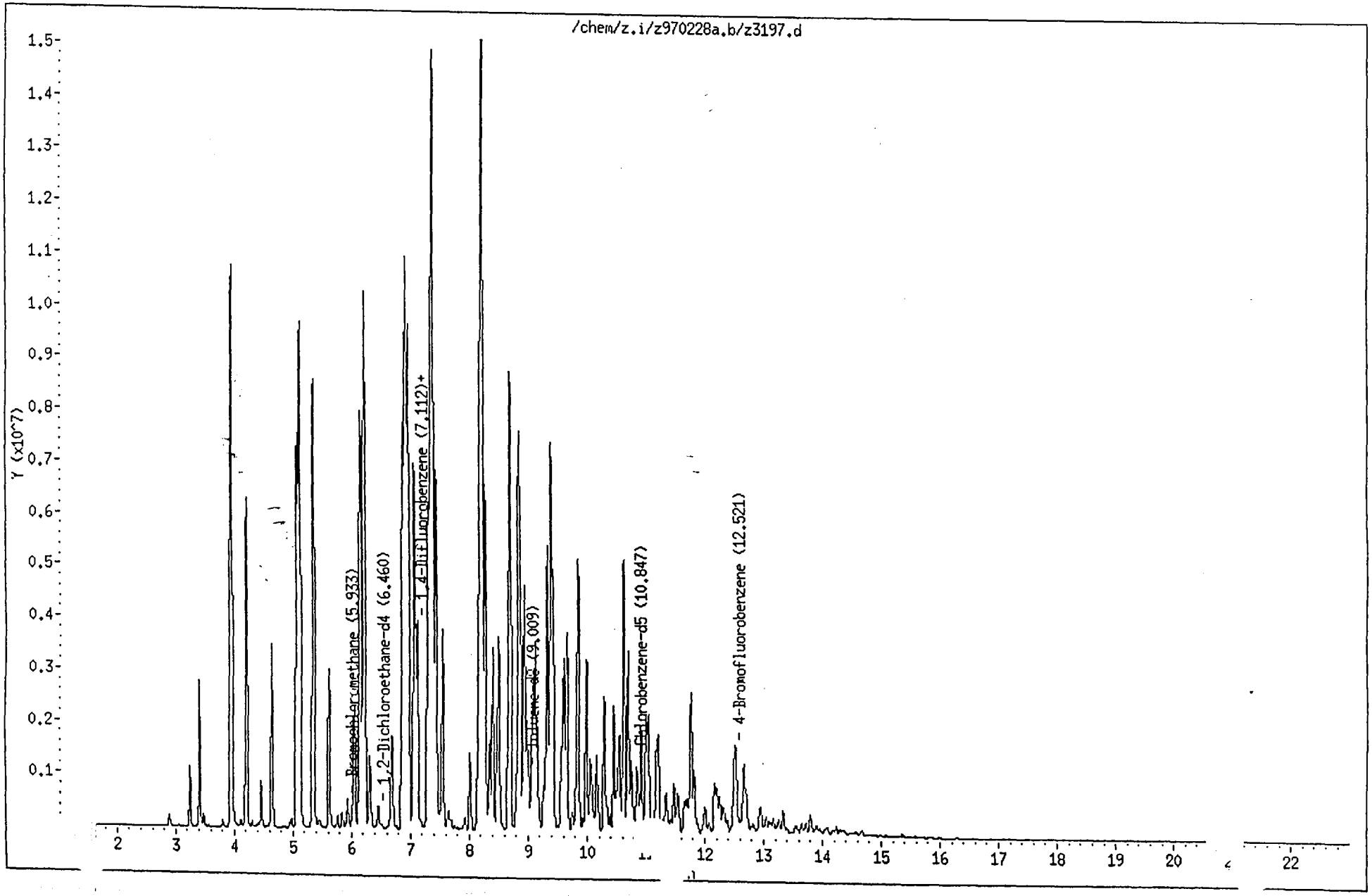
Date Analyzed: 02/28/97 Dilution Factor: 2010.0

GC Column:DB-624 ID: 0.53 (mm)

CAS NO.	COMPOUND	CONCENTRATION UNITS: PPBV	Q
13-302-07	m,p-Xylene	8800	
100-42-5	Styrene	2000	U
95-47-6	o-Xylene	1500	J
79-34-5	1,1,2,2-Tetrachloroethane	2000	U
622-96-8	4-Ethyltoluene	2000	U
108-067-8	1,3,5-Trimethylbenzene	2000	U
95-63-6	1,2,4-Trimethylbenzene	2000	U
541-73-1	1,3-Dichlorobenzene	2000	U
100-44-7	Benzyl Chloride	2000	U
106-46-7	1,4-Dichlorobenzene	2000	U
95-50-1	1,2-Dichlorobenzene	2000	U
120-82-1	1,2,4-Trichlorobenzene	2000	U
87-68-3	Hexachlorobutadiene	2000	U

Data File: /chem/z.i/z970228a.b/z3197.d
Date : 28-FEB-97 16:16
Instrument : z.i
Sample ID : MW-13
Column phase : DB-624
Volume Injected (uL) : 0.0

Column diameter : 0.53



Southwest Laboratory of Oklahoma

VOLATILE QUANT REPORT

Data file : /chem/z.i/z970228a.b/z3197.d
Lab. Id. : 28655.02 Quant Type: ISTD
Inj Date : 28-FEB-97 16:16
Operator : JGW Inst ID: z.i
Smp Info : MW-13
Misc Info : MS499**INST:Z*MKF-OH*28655.02*0.002ML
Comment : 10" TO 5PSIG, 300MLS, CANISTER SWL133
Method : /chem/z.i/z970228a.b/Z_TO14.m
Meth Date : 28-Feb-1997 08:28
Cal Date : 28-FEB-97 07:58 Cal File: z3186.d
Als bottle: 14
Dil Factor: 2010.000 Target Version: Target 3.00
Integrator: HP RTE Compound Sublist: MS414.sub
Sample Type: AIR

	Compounds	QUANT SIG MASS	RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ppbv)	FINAL (ppbv)
*	19 Bromochloromethane	128.00	5.933	(1.000)	122332	10.00	(Q)
$	21 1,2-Dichloroethane-d4	65.00	6.460	(1.089)	260675	7.82	7.82(a)
	2[illegible]nzene	78.00	6.862	(0.965)	4554752	78.31	157415.60
	4-Difluorobenzene	114.00	7.112	(1.000)	623510	10.00	
	Toluene-d8	98.00	9.009	(0.831)	691417	8.98	8.98(aQ)
*	42 Chlorobenzene-d5	117.00	10.841	(1.000)	660284	10.00	
	44 Ethylbenzene	91.00	11.177	(1.031)	1172188	10.07	20251.45
	45 m,p-Xylene	106.00	11.341	(1.046)	181202	4.40	8850.73(Q)
	48 o-Xylene	106.00	11.882	(1.096)	30332	0.72	1463.51(aQ)
$	50 4-Bromofluorobenzene	95.00	12.527	(1.156)	502680	8.17	8.17(a)

QC Flag Legend

a - Target compound detected but, quantitated amount
Below Limit Of Quantitation(BLOQ).
Q - Qualifier signal failed the ratio test.

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-26

Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.01

Date Received: 02/28/97 Lab File ID: Z3198.D

Date Analyzed: 02/28/97 Dilution Factor: 1910.0

GC Column:DB-624 ID: 0.53 (mm)

CAS NO.	COMPOUND	CONCENTRATION UNITS: PPBV	Q
75-71-8	Dichlorodifluoromethane (F12	1900	U
74-87-3	Chloromethane	1900	U
76-14-2	1,2-DC-1,1,2,2-TFA (F114)	1900	U
75-01-4	Vinyl Chloride	1900	U
74-83-9	Bromomethane	1900	U
75-00-3	Chloroethane	1900	U
75-69-4	Trichlorofluoromethane (F11)	1900	U
67-64-1	Acetone	1900	U
75-35-4	1,1-Dichloroethene	1900	U
76-13-1	1,1,2-TC-1,2,2-TFA (F113)	1900	U
75-09-2	Methylene Chloride	1900	U
75-15-0	Carbon Disulfide	1900	U
156-60-5	trans-1,2-Dichloroethene	1900	U
75-34-3	1,1-Dichloroethane	1900	U
78-93-3	2-Butanone	1900	U
156-59-2	cis-1,2-Dichloroethene	1900	U
67-66-3	Chloroform	1900	U
71-55-6	1,1,1-Trichloroethane	1900	U
107-06-2	1,2-Dichloroethane	1900	U
71-43-2	Benzene	110000	
56-23-5	Carbon Tetrachloride	1900	U
78-87-5	1,2-Dichloropropane	1900	U
79-01-6	Trichloroethene	1900	U
108-10-1	4-Methyl-2-Pentanone	1900	U
10061-01-5	cis-1,3-Dichloropropene	1900	U
10061-02-6	trans-1,3-Dichloropropene	1900	U
108-88-3	Toluene	1900	U
79-00-5	1,1,2-Trichloroethane	1900	U
591-78-6	2-Hexanone	1900	U
106-93-4	1,2-Dibromoethane	1900	U
127-18-4	Tetrachloroethene	1900	U
108-90-7	Chlorobenzene	1900	U
100-41-4	Ethylbenzene	8200	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-26

Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.01

Date Received: 02/28/97 Lab File ID: Z3198.D

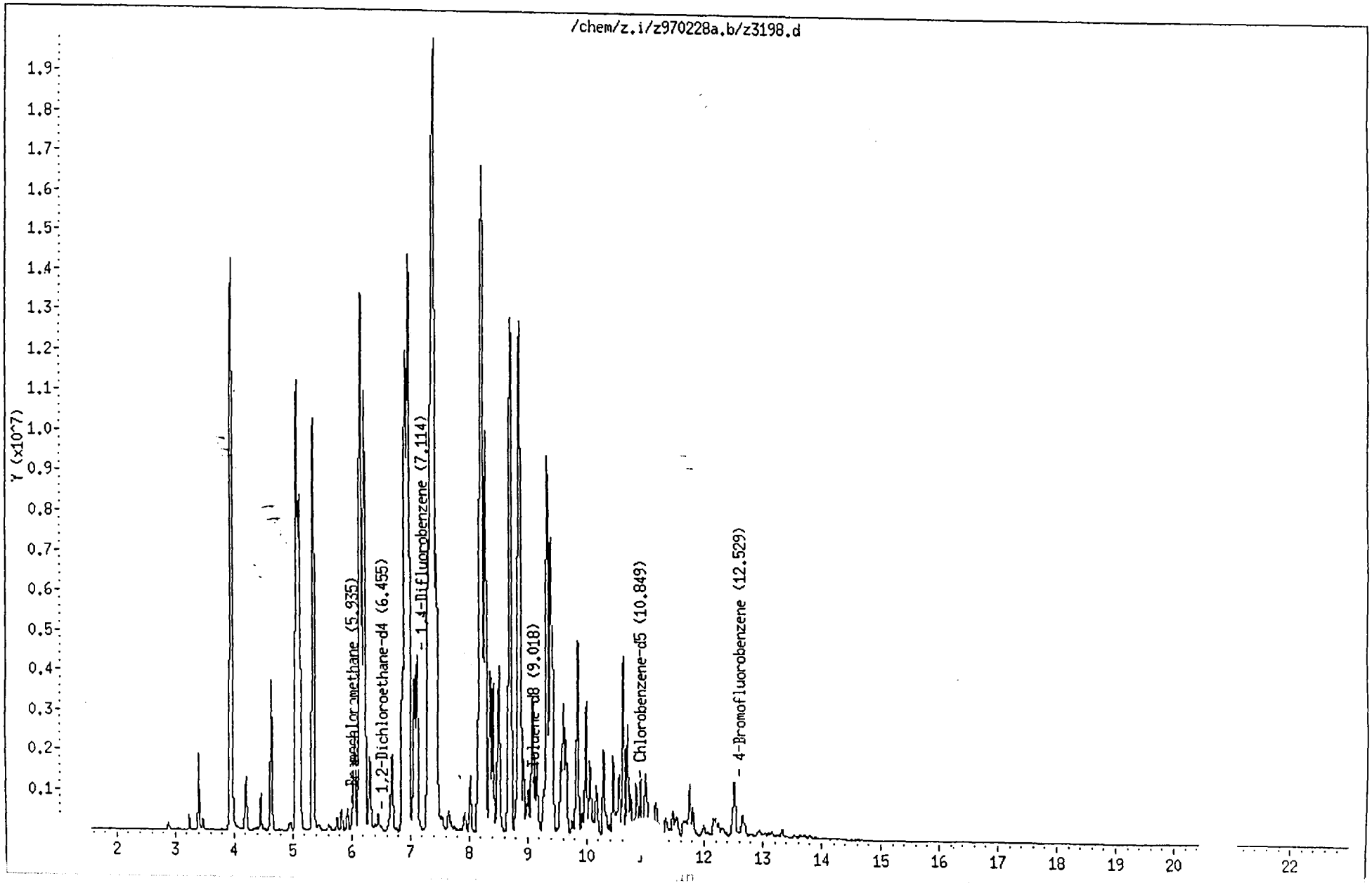
Date Analyzed: 02/28/97 Dilution Factor: 1910.0

GC Column:DB-624 ID: 0.53 (mm)

CAS NO.	COMPOUND	CONCENTRATION UNITS: PPBV	Q
13-302-07	m,p-Xylene	2400	
100-42-5	Styrene	1900	U
95-47-6	o-Xylene	1900	U
79-34-5	1,1,2,2-Tetrachloroethane	1900	U
622-96-8	4-Ethyltoluene	1900	U
108-067-8	1,3,5-Trimethylbenzene	1900	U
95-63-6	1,2,4-Trimethylbenzene	1900	U
541-73-1	1,3-Dichlorobenzene	1900	U
100-44-7	Benzyl Chloride	1900	U
106-46-7	1,4-Dichlorobenzene	1900	U
95-50-1	1,2-Dichlorobenzene	1900	U
120-82-1	1,2,4-Trichlorobenzene	1900	U
87-68-3	Hexachlorobutadiene	1900	U

Data File: /chem/z.i/z970228a.b/z3198.d
Date : 28-FEB-97 16:49
Instrument : z.i
Sample ID : MW-26
Column phase : DB-624
Volume Injected (uL) : 0.0

Column diameter : 0.53



Southwest Laboratory of Oklahoma

VOLATILE QUANT REPORT

Data file : /chem/z.i/z970228a.b/z3198.d
Lab. Id. : 28655.01 Quant Type: ISTD
Inj Date : 28-FEB-97 16:49
Operator : JGW Inst ID: z.i
Smp Info : MW-26
Misc Info : MS499**INST:Z*MKF-OH*28655.01*0.002ML
Comment : 9" TO 5PSIG, 300MLS, SWL100
Method : /chem/z.i/z970228a.b/Z_TO14.m
Meth Date : 28-Feb-1997 08:28
Cal Date : 28-FEB-97 07:58 Cal File: z3186.d
Als bottle: 12
Dil Factor: 1910.000 Target Version: Target 3.00
Integrator: HP RTE Compound Sublist: MS414.sub
Sample Type: AIR

Compounds	QUANT SIG MASS	RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ppbv)	FINAL (ppbv)
* 19 Bromochloromethane	128.00	5.935	(1.000)	123317	10.00	(Q)
$ 21 1,2-Dichloroethane-d4	65.00	6.455	(1.088)	261112	7.77	7.77(a)
24 [illegible]nzene	78.00	6.864	(0.965)	3150524	55.72	106442.00
* [illegible]-Difluorobenzene	114.00	7.114	(1.000)	606085	10.00	
~~1,2-Dichloropropane~~	~~63.00~~	~~7.391~~	~~(1.039)~~	~~90963~~	~~4.10~~	~~7830.09~~
$ 35 Toluene-d8	98.00	9.018	(0.831)	734521	9.18	9.18(aQ)
* 42 Chlorobenzene-d5	117.00	10.849	(1.000)	686200	10.00	
44 Ethylbenzene	91.00	11.179	(1.030)	515929	4.26	8150.16
45 m,p-Xylene	106.00	11.337	(1.045)	52752	1.23	2355.98(Q)
$ 50 4-Bromofluorobenzene	95.00	12.523	(1.154)	507156	7.93	7.93(a)

FP

QC Flag Legend

a - Target compound detected but, quantitated amount
Below Limit Of Quantitation(BLOQ).
Q - Qualifier signal failed the ratio test.

SOUTHWEST LABORATORY OF OKLAHOMA
1700 West Albany, Suite A / Broken Arrow, OK 74012
918-251-2858

SDG NARRATIVE
March 6, 1997

CLIENT:	MKF-OH
EPISODE NO.:	28655
SAMPLE NO.:	28655.01,02
SDG NO.:	28655

Both samples had very high levels of TPH. The TPHs were reported as JP4. The samples were analyzed by modified TO-3.

Jayant Shringarpure, Ph.D. March 6, 1997
Technical Director

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-13

Lab Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.02

Date Received: 02/28/97 Lab File ID: D9485.D

Date Analyzed: 02/28/97 Dilution Factor: 201000

GC Column:DB-624 ID: 0.53 (mm)

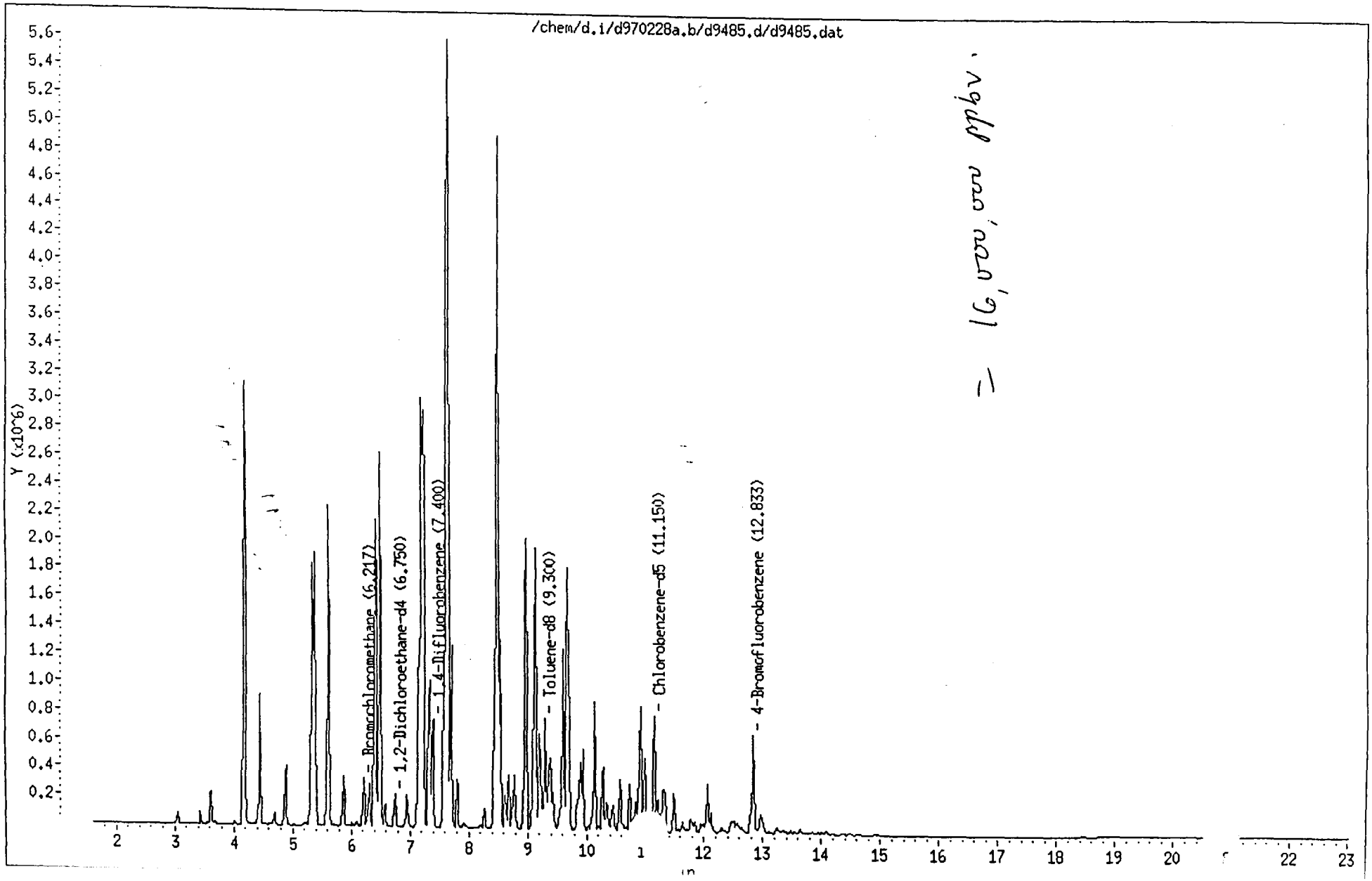
CONCENTRATION UNITS:

2/28/97 METHOD: MODIFIED T03 TOTAL PETROLEUM HYDROCARBON AS JP4	16,000,000 PPBV

FORM I VOA AIR

Data File: /chem/d.i/d970228a.b/d9485.d
Date : 28-FEB-1997 16:05
Instrument : d.i
Sample ID : MW-13
Column phase : DB-624
Volume Injected (uL) : 0.0

Column diameter : 0.53



Southwest Laboratory of Oklahoma

VOLATILE QUANT REPORT

Data file : /chem/d.i/d970228a.b/d9485.d
Lab. Id. : 28655.02 Quant Type: ISTD
Inj Date : 28-FEB-1997 16:05
Operator : JGW Inst ID: d.i
Smp Info : MW-13
Misc Info : MS499**INST:D*MKF-OH*28655.02*0.000249ML
Comment : 10" TO 5 PSIG, 1000X DILUTION, 30MLS
Method : /chem/d.i/d970228a.b/D_TPHAIR.m
Meth Date : 28-Feb-1997 09:25
Cal Date : 28-FEB-97 09:31 Cal File: d9479.d
Als bottle: 0
Dil Factor: 20100.000 Target Version: Target 3.00
Integrator: HP RTE Compound Sublist: all.sub
Sample Type: AIR

	Compounds	QUANT SIG MASS	RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ppbv)	FINAL (ppbv)
M	1 TPH AS JP-4	100.00			6811583	785.01	15778871.98
	2 TPH_1	43.00	5.350	(0.861)	1719256	3708.89	74548772.90(AH)
	3 TPH_2	43.00	5.600	(0.901)	364088	6105.48	122720217.82(AQ)
	H_3	43.00	5.867	(0.944)	116980	414.95	8340519.86(A)
*	Bromochloromethane	128.00	6.217	(1.000)	81140	10.00	(Q)
$	6 1,2-Dichloroethane-d4	65.00	6.750	(1.086)	157488	12.30	12.30(a)
	7 TPH_4	43.00	7.133	(1.147)	410148	617.29	12407633.86(A)
	8 TPH_5 (Benzene)	78.00	7.150	(0.966)	686496	1128.82	22689290.74(A)
	9 TPH_6	43.00	7.333	(1.180)	585984	1012.55	20352258.03(A)
*	10 1,4-Difluorobenzene	114.00	7.400	(1.000)	398900	10.00	
	11 TPH_7	57.00	7.800	(1.054)	92332	172.59	3469109.69
	12 TPH_8	55.00	8.483	(1.365)	2202018	2935.59	59005492.60(A)
$	13 Toluene-d8	98.00	9.300	(0.834)	580584	11.21	11.21(a)
	14 TPH_9 (Toluene)	92.00	9.383	(0.842)	3427	3.31	66714.78(a)
	15 TPH_10	43.00	9.933	(1.598)	191898	171.69	3450960.14(A)
*	16 Chlorobenzene-d5	117.00	11.150	(1.000)	510460	10.00	
	17 TPH_11	43.00	11.333	(1.823)	205652	374.02	7517916.24(A)
	18 TPH_12 (Ethylbenzene)	91.00	11.483	(1.030)	123764	302.87	6087787.55(A)
	19 TPH_13 (m,p-Xylene)	106.00	11.633	(1.043)	14000	49.23	989625.09
	20 TPH_14	43.00	12.067	(1.941)	84928	79.89	1605967.51(AQ)
	21 THP_15 (o-Xylene)	106.00	12.183	(1.093)	1904	9.59	192902.84(aQ)
$	22 4-Bromofluorobenzene	95.00	12.833	(1.151)	305560	8.43	8.43(a)
	23 TPH_16	57.00	14.083	(1.263)	8708	10.77	216645.72

QC Flag Legend

a - Target compound detected but, quantitated amount Below Limit Of Quantitation(BLOQ).
A - Target compound detected but, quantitated amount exceeded maximum amount.
Q - Qualifier signal failed the ratio test.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-26

Lab Name: SWL-TULSA Contract: AIR

Lab Code: SWOK Case No.: MKF-OH SAS No.: SDG No.: 28655

Matrix: AIR Lab Sample ID: 28655.01

Date Received: 02/28/97 Lab File ID: D9484.D

Date Analyzed: 02/28/97 Dilution Factor: 191000

GC Column:DB-624 ID: 0.53 (mm)

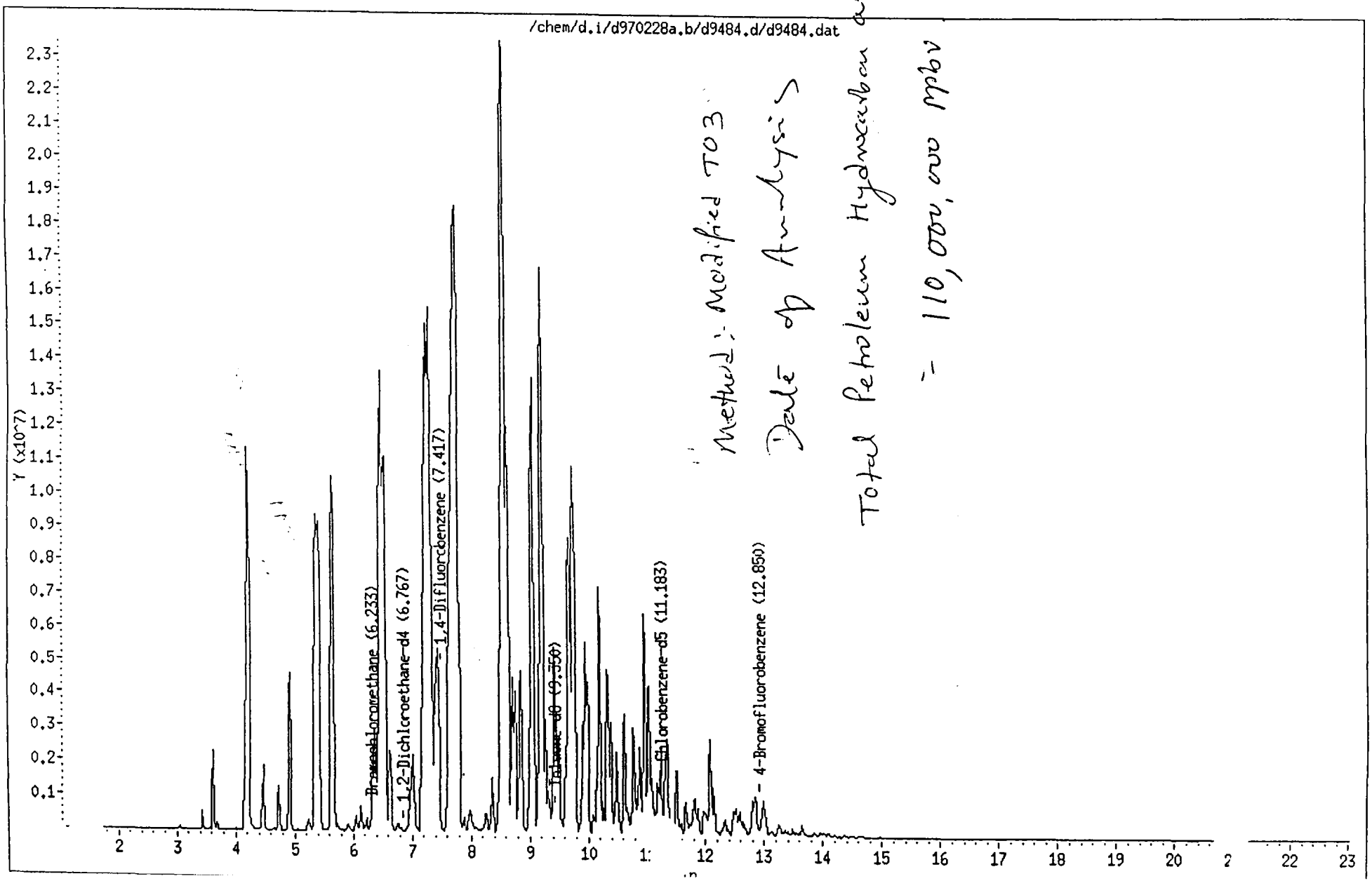
CONCENTRATION UNITS:

2/28/97	METHOD: MODIFIED T03 TOTAL PETROLEUM HYDROCARBON AS JP4	110,000,000 PPBV

FORM I VOA AIR

Data File: /chem/d.i/d970228a.b/d9484.d
Date : 28-FEB-1997 15:21
Instrument : d.i
Sample ID : MW-26
Column phase : DB-624
Volume Injected (uL) : 0.0

Column diameter : 0.53



Method: Modified TO3
Date of Analysis
Total Petroleum Hydrocarbon as JP4
= 110,000 mbv

Southwest Laboratory of Oklahoma

VOLATILE QUANT REPORT

Data file : /chem/d.i/d970228a.b/d9484.d
Lab. Id. : 28655.01 Quant Type: ISTD
Inj Date : 28-FEB-1997 15:21
Operator : JGW Inst ID: d.i
Smp Info : MW-26
Misc Info : MS499**INST:D*MKF-OH*28655.01*0.000262ML
Comment : 9" TO 5 PSIG, 1000X DILUTION, 30MLS
Method : /chem/d.i/d970228a.b/D_TPHAIR.m
Meth Date : 28-Feb-1997 09:25
Cal Date : 28-FEB-97 09:31 Cal File: d9479.d
Als bottle: 0
Dil Factor: 19100.000 Target Version: Target 3.00
Integrator: HP RTE Compound Sublist: all.sub
Sample Type: AIR

			QUANT SIG				CONCENTRATIONS ON-COLUMN	FINAL	
		Compounds	MASS	RT	REL RT	RESPONSE	(ppbv)	(ppbv)	
M	1	TPH AS JP-4	100.00			52451339	5761.43	110043388.80	
	2	TPH_1	43.00	5.350	(0.858)	10104576	20776.10	396823626.86	(AQH)
		TPH_2	43.00	5.633	(0.904)	3166448	50609.05	966632937.53	(AQ)
		H_3	43.00	5.900	(0.947)	77649	262.52	5014144.52	(A)
*		Bromochloromethane	128.00	6.233	(1.000)	85132	10.00		(Q)
$	6	1,2-Dichloroethane-d4	65.00	6.767	(1.086)	158884	11.82	11.82	(a)
	7	TPH_4	43.00	7.000	(1.123)	2670438	3830.69	73166174.33	(AQ)
	8	TPH_5 (Benzene)	78.00	7.167	(0.966)	4933216	8729.63	166735966.75	(A)
	9	TPH_6	43.00	7.300	(1.171)	14216928	23414.16	447210593.88	(A)
*	10	1,4-Difluorobenzene	114.00	7.417	(1.000)	370668	10.00		
	11	TPH_7	57.00	7.883	(1.063)	205614	413.62	7900138.82	(AQH)
	12	TPH_8	55.00	8.567	(1.374)	14077296	17886.97	341641244.39	(A)
$	13	Toluene-d8	98.00	9.350	(0.836)	573952	10.73	10.73	(aQ)
	14	TPH_9 (Toluene)	92.00	9.317	(0.833)	1118	1.04	20024.28	(aQH)
	15	TPH_10	43.00	9.983	(1.602)	664224	566.40	10818412.47	(AQ)
*	16	Chlorobenzene-d5	117.00	11.183	(1.000)	527220	10.00		
	17	TPH_11	43.00	11.350	(1.821)	929344	1610.96	30769505.86	(A)
	18	TPH_12 (Ethylbenzene)	91.00	11.500	(1.028)	1081216	2561.83	48931075.78	(A)
	19	TPH_13 (m,p-Xylene)	106.00	11.650	(1.042)	89236	303.84	5803498.91	(A)
	20	TPH_14	43.00	12.133	(1.947)	179968	161.37	3082198.64	(AQ)
	21	THP_15 (o-Xylene)	106.00	12.200	(1.091)	13776	67.23	1284109.27	
$	22	4-Bromofluorobenzene	95.00	12.850	(1.149)	426024	11.38	11.38	(a)
	23	TPH_16	57.00	14.083	(1.259)	40292	48.28	922269.14	

QC Flag Legend

a - Target compound detected but, quantitated amount Below Limit Of Quantitation(BLOQ).
A - Target compound detected but, quantitated amount exceeded maximum amount.
Q - Qualifier signal failed the ratio test.

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

TM

FIRM: Applied Earth Science | CLIENT CONTACT: Claire Meurer | PHONE NUMBER: 512-307-6535

P.O. or PROPOSAL NUMBER: 2A3-05616 | PROJECT NAME: NAS CORPUS CHRISTI

SAMPLER: (Signature) Claire P Meurer

SAMPLE ID	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	ANALYTICAL TESTS REQUESTED: TO-3	TO-14	Btu	Oxygen					REMARKS
MW-26	2/27/97	12:05p	✓		MW-26	GAS	2	✓	✓	✓	✓					samples shipped in 2 boxes
MW-13	2/27/97	1:55p	✓		MW-13	GAS	2	✓	✓	✓	✓					
															*	24 hour turnaround

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
Claire P Meurer	2/27/97	4:45	

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)
	2/28/97	1020	M. Mclaren

REMARKS:

[SR012-1192-03]

CORELAB

GULF STATES ANALYTICAL

06/10/97

Mr. Alan Fosdick
Morrison Knudsen Corporation
1500 West 3rd Street
Cleveland, OH 44113

Reference:
Project: NAS Corpus Christi / AES
Project No.: 4324-087
Date Received: 05/28/97
GSA Group: 29979 Group Report Date: 06/05/97

Dear Mr. Fosdick:

Enclosed are the analytical results for your above referenced project. The following samples are included in the report.

CCT/VP1010521 :156915	CCT/VP1020521 :156916
CCT/VP1030521 :156917	CCT/VP1040521 :156918
CCT/VP1050521 :156919	CCT/VP1060521 :156920
CCT/VP2010521 :156921	

All holding times were met for the tests performed on these samples.

Our A2LA accreditation requires that, should this report be reproduced, it must be reproduced in total.

Enclosed please find the Quality Control Summary. All quality control results for the QC batch that are applicable to this sample(s) are acceptable except as noted in the QC batch reports.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Core Lab - Gulf States Analytical to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

Sincerely yours,

Randall Wright

Randall Wright
Project Manager

NAS Corpus Christi
Analytical Sample Summary

Sample Date	Sample Identification Number	Description
5/21/97	CCT\VP1010521	Well 20 undiluted, before oxidizer
5/21/97	CCT\VP1020521	Well 29 undiluted, before oxidizer
5/21/97	CCT\VP1030521	Well 21 undiluted, before oxidizer
5/21/97	CCT\VP1040521	Well 13 undiluted, before oxidizer
5/21/97	CCT\VP1050521	Well 26 undiluted, before oxidizer
5/21/97	CCT\VP1060521	Well 26 diluted, before oxidizer
5/21/97	CCT\VP2010521	Well 26 after oxidizer

CORELAB

GULF STATES ANALYTICAL

ANALYSIS SUMMARY REPORT

Morrison Knudsen Corporation
1500 West 3rd Street
Cleveland, OH 44113-1406

GSA Group: 29979
Date Reported: 06/05/97
Date Received: 05/28/97

Attn: Mr. Alan Fosdick
Project: NAS Corpus Christi / AES

Purchase Order:
Project No.: 4324-087

Test	Analysis	Results as Received	Units		Limit of Quantitation
Sample:156915 - 05/21/97 - CCT/VP1010521					
8340	Volatiles, TO-14				
	Benzene	35,900	ppbv		1,000
	Toluene	2,140	ppbv		1,000
	Ethylbenzene	20,100	ppbv		1,000
	m,p-Xylene	27,400	ppbv		1,000
	o-Xylene	4,910	ppbv		1,000
CL15	Non Routine Test	9,810	ppbv	(1)	1,000
Sample:156916 - 05/21/97 - CCT/VP1020521					
8340	Volatiles, TO-14				
	Benzene	105,000	ppbv		6,000
	Toluene	36,700	ppbv		1,000
	Ethylbenzene	33,500	ppbv		1,000
	m,p-Xylene	77,100	ppbv		1,000
	o-Xylene	19,300	ppbv		1,000
CL15	Non Routine Test	15,400	~~ppbv~~		1,000
Sample:156917 - 05/21/97 - CCT/VP1030521					
8340	Volatiles, TO-14				
	Benzene	233,000	ppbv		6,000
	Toluene	22,400	ppbv		1,000
	Ethylbenzene	22,100	ppbv		1,000
	m,p-Xylene	49,000	ppbv		1,000
	o-Xylene	11,700	ppbv		1,000
CL15	Non Routine Test	12,500	~~ppbv~~		1,000
Sample:156918 - 05/21/97 - CCT/VP1040521					
8340	Volatiles, TO-14				
	Benzene	265,000	ppbv		10,000
	Toluene	17,700	ppbv		1,000
	Ethylbenzene	34,700	ppbv		1,000
	m,p-Xylene	62,600	ppbv		1,000
	o-Xylene	13,600	ppbv		1,000
CL15	Non Routine Test	15,100	~~ppbv~~		900
Sample:156919 - 05/21/97 - CCT/VP1050521					
8340	Volatiles, TO-14				
	Benzene	95,000	ppbv		6,000

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1010521

Lab Name: GULF STATES ANALYTICAL Contract: MW-20

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156915

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC005

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 05/29/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	36000	
100-41-4	Ethylbenzene	20000	
----------	m,p-Xylene	27000	
95-47-6	o-Xylene	4900	
----------	Xylenes (total)	32000	
108-88-3	Toluene	2100	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1010521

Lab Name: GULF STATES ANALYTICAL Contract: MW-20

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156915

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC005

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	45000	
100-41-4	Ethylbenzene	25000	
----------	m,p-Xylene	33000	
95-47-6	o-Xylene	5900	
----------	Xylenes (total)	38000	
108-88-3	Toluene	3100	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1020521

Lab Name: GULF STATES ANALYTICAL Contract:

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR MW-29 Lab Sample ID: 156916

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC006

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 05/29/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1300

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	110000	E
100-41-4	Ethylbenzene	33000	
	m,p-Xylene	77000	
95-47-6	o-Xylene	19000	
	Xylenes (total)	96000	
108-88-3	Toluene	37000	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1020521

Lab Name: GULF STATES ANALYTICAL Contract: mw-29

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156916

Sample wt/vol: 0.1 (g/mL) ML Lab File ID: VOC007

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 6500

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	100000	
100-41-4	Ethylbenzene	22000	
----------	m,p-Xylene	49000	
95-47-6	o-Xylene	14000	
----------	Xylenes (total)	63000	
108-88-3	Toluene	29000	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1030521

Lab Name: GULF STATES ANALYTICAL Contract: mw-21

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156917

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC007

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 05/29/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	140000	E
100-41-4	Ethylbenzene	22000	
----------	m,p-Xylene	49000	
95-47-6	o-Xylene	12000	
----------	Xylenes (total)	60000	
108-88-3	Toluene	22000	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1030521

Lab Name: GULF STATES ANALYTICAL Contract: mw-21

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156917

Sample wt/vol: 0.1 (g/mL) ML Lab File ID: VOC008

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 6000

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	230000	
100-41-4	Ethylbenzene	47000	
----------	m,p-Xylene	98000	
95-47-6	o-Xylene	24000	
----------	Xylenes (total)	120000	
108-88-3	Toluene	42000	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1040521

Lab Name: GULF STATES ANALYTICAL Contract: mw-13

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156918

Sample wt/vol: 0.05 (g/mL) ML Lab File ID: VOC009

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 11000

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	260000	
100-41-4	Ethylbenzene	42000	
----------	m,p-Xylene	73000	
95-47-6	o-Xylene	17000	
----------	Xylenes (total)	89000	
108-88-3	Toluene	24000	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1040521

Lab Name: GULF STATES ANALYTICAL Contract: MW-13

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156918

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC008

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 05/29/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1100

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	190000	E
100-41-4	Ethylbenzene	35000	
----------	m,p-Xylene	63000	
95-47-6	o-Xylene	14000	
----------	Xylenes (total)	76000	
108-88-3	Toluene	18000	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1050521

Lab Name: GULF STATES ANALYTICAL Contract: mw-26

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156919

Sample wt/vol: 0.1 (g/mL) ML Lab File ID: VOC010

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 6000

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	95000	
100-41-4	Ethylbenzene	21000	
----------	m,p-Xylene	26000	
95-47-6	o-Xylene	7100	
----------	Xylenes (total)	33000	
108-88-3	Toluene	6300	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1050521

Lab Name: GULF STATES ANALYTICAL Contract: mw-26

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156919

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC009

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 05/29/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	85000	E
100-41-4	Ethylbenzene	23000	
----------	m,p-Xylene	32000	
95-47-6	o-Xylene	8000	
----------	Xylenes (total)	39000	
108-88-3	Toluene	6200	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

1060521

Lab Name: GULF STATES ANALYTICAL Contract: diluted MW-36

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156920

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC011

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	21000	
100-41-4	Ethylbenzene	6600	
----------	m,p-Xylene	9300	
95-47-6	o-Xylene	2600	
----------	Xylenes (total)	12000	
108-88-3	Toluene	2400	

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

2010521

b Name: GULF STATES ANALYTICAL Contract: Effluent

Lab Code: GSAI Case No.: SAS No.: SDG No.: 29979

Matrix: (soil/water) AIR Lab Sample ID: 156921

Sample wt/vol: 0.5 (g/mL) ML Lab File ID: VOC012

Level: (low/med) LOW Date Received: 05/28/97

% Moisture: not dec. _____ Date Analyzed: 06/02/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 1200

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	10000	
100-41-4	Ethylbenzene	2600	
----------	m,p-Xylene	4600	
95-47-6	o-Xylene	1200	J
----------	Xylenes (total)	5800	
108-88-3	Toluene	1600	

SAMPLE 29979	SAMPLE AREA	ADJUSTED SX AREA	AMOUNT INJECTED	STANDARD AREA (800ppbv)	BLANK AREA	ADJUSTED STND AREA	AMOUMT TPH (ppbv)	DILUTION FACTOR	TOTAL TPH (ppmv)
156915	772028711	766983052	0.5	80092900	5045659	75047241	8176.00	1200	9811.20
156916	1148095535	1143049876	0.5	80092900	5045659	75047241	12184.86	1260	15352.92
156917	951302839	946257180	0.5	80092900	5045659	75047241	10087.06	1240	12507.95
156918	1304412556	1299366897	0.5	80092900	5045659	75047241	13851.19	1090	15097.80
156919	1245664661	1240619002	0.5	80092900	5045659	75047241	13224.94	1180	15605.43
156920	284627874	281025942	0.5	84165401	3601932	80563469	2790.60	1170	3265.01
156921	75215104	71613172	0.5	84165401	3601932	80563469	711.12	1230	874.68
LOQ	80092900	75047241	500.0	80092900	5045659	75047241	800.00	1	0.80

SAMPLE DILUTION	
156915	1.2
156916	1.26
156917	1.24
156918	1.09
156919	1.18
156920	1.17
156921	1.23

GULF STATES ANALYTICAL

CORELAB

6310 Rothway, Houston, Texas 77040
(713) 690-4444, Fax (713) 690-5646

Request for Analysis

Company: ❶ Morrison Knudsen Corp.
Address: 1100 West 3rd St. Cleveland, Ohio 44113-1406
Tele #(216) 523-5210
Fax #(216) 523-5201

Reports Sent To: ALAN FOSDICK ~~STEVE TRAVIS~~
P O #:
Project #: 4324.087

Project Name: NAS Corpus Christi/AES
Project Location: Corpus Christi, TX.

Sampler(s) Name: (Signature) Luis Reyna
Courier:

❷ Field Sample ID	❸ Sampling Date	Sampling Time	❹ Matrix: Water	Soil	Sludge	Oil	Other	# of Containers	Haz. Sample (Y/N)
1. CCT/VP101/0521	5/21/97	13:55					✓	1	N
2. CCT/VP102/0521	5/21/97	14:25					✓	1	N
3. CCT/VP103/0521	5/21/97	15:30					✓	1	N
4. CCT/VP104/0521	5/21/97	15:50					✓	1	N
5.							✓	1	N
6.							✓	1	N
7.							✓	1	N
8.									
9.									
10.									
11.									
12.									
13.									

Relinquished by: (Signature) — Date: 5/22/97 — Time: 16:00
Received by: (Signature) — Date: 5/22/97 — Time: 16:00
Relinquished by: (Signature) — Date: 5/22/97 — Time: 16:00
Received by: (Signature) — Date: 5/22/97 — Time: 16:00
Relinquished by: (Signature) — Date: 5/22/97 — Time: 16:00
Received by Laboratory: (Signature) — Date: 5/22/97 — Time: 1600

❻ Remarks:

Requested Turnaround

GSAI Group:

Special Detection Limits

QC Package: (check one)
☐ CLP ☐ Site Specific
☐ Tier 1 ☐ Tier 2 ☐ QC Summary

SOUTHERN LITHOGRAPH, INC. - (713) 780-0400

White Copy to Accompany Samples to Lab — Yellow Copy Retained by Client — Pink Copy Retained by Sampler

GULF STATES ANALYTICAL

CORE LAB

6310 Rothway, Houston, Texas 77040
(713) 690-4444, Fax (713) 690-5646

Company: MORRISON KNUDSEN CORP. **Address:** 1300 WEST 3RD ST. CLEVELAND, OHIO 44113-1406 **Tele #:** (216) 523-5210 **Fax #:** (216) 523-5201

Reports Sent To: ALAN FOSDICK **P O #:** **Project #:** 4324-087

Project Name: NAS CORPUS CHRISTI/AES **Project Location:** CORPUS CHRISTI TX

Sampler(s) Name: (Signature) Luis REYNA Luis Reyna

Courier:

❷ Field Sample ID	❸ Sampling Date	Time	❹ Matrix: Water	Soil	Sludge	Oil	Other	# of Containers	Haz. Sample (Y/N)	❺ Request for Analysis
1. CCT/VP10505 21	5/21/97	16:05					✓	1	N	✓ ✓
2. CCT/VP10605 21	5/21/97	16:10					✓	1	N	✓ ✓
3. CCT/VP20105 21	5/21/97	16:20					✓	1	N	✓ ✓
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										

Relinquished by: (Signature) — Date — Time:

Relinquished by Sampler: (Signature) — 5/22/97 — 16:30

Received by: (Signature) — Date — Time:

Relinquished by: (Signature) — Date — Time:

Received by: (Signature) — Date — Time:

Received by Laboratory: (Signature) — Date — Time:

❻ **Remarks:**

Requested Turnaround

GSAI Group:

Special Detection Limits

QC Package: (check one)
☐ CLP ☐ Site Specific
☐ Tier 1 ☐ Tier 2 ☐ QC Summary

SOUTHERN LITHOGRAPH, INC. - (713) 780-0400 — White Copy to Accompany Samples to Lab — Yellow Copy Retained by Client — Pink Copy Retained by Sampler

CORELAB

GULF STATES ANALYTICAL

ANALYSIS SUMMARY REPORT

Morrison Knudsen Corporation
1500 West 3rd Street
Cleveland, OH 44113-1406

GSA Group: 30957
Date Reported: 07/14/97
Date Received: 07/02/97

Attn: Mr. Alan Fosdick
Project: NAS Corpus Christi / AES

Purchase Order:
Project No.: 4324-087

Test	Analysis	Results as Received	Units		Limit of Quantitation
Sample:161281 - 06/30/97 - CCT\VP1020630					
8340	Volatiles, TO-14				
	Benzene	137,000	ppbv		3,000
	Toluene	3,480	ppbv		3,000
	Ethylbenzene	41,800	ppbv		3,000
	m,p-Xylene	48,300	ppbv		3,000
	o-Xylene	9,750	ppbv		3,000
CL15	Non Routine Test	14,500	ppmv	(1)	2,000
Sample:161282 - 06/30/97 - CCT\VP1030630					
8340	Volatiles, TO-14				
	Benzene	222,000	ppbv		6,000
	Toluene	18,700	ppbv		2,000
	Ethylbenzene	64,100	ppbv		2,000
	m,p-Xylene	110,000	ppbv		2,000
	o-Xylene	21,000	ppbv		2,000
CL15	Non Routine Test	30,900	ppmv		2,000
Sample:161283 - 06/30/97 - CCT\VP1040630					
8340	Volatiles, TO-14				
	Benzene	104,000	ppbv		3,000
	Toluene	70,000	ppbv		3,000
	Ethylbenzene	30,600	ppbv		3,000
	m,p-Xylene	75,600	ppbv		3,000
	o-Xylene	18,800	ppbv		3,000
CL15	Non Routine Test	14,700	ppmv		2,000
Sample:161284 - 06/30/97 - CCT\VP1050630					
8340	Volatiles, TO-14				
	Benzene	28,600	ppbv		3,000
	Toluene	11,200	ppbv		3,000
	Ethylbenzene	17,500	ppbv		3,000
	m,p-Xylene	49,800	ppbv		3,000
	o-Xylene	11,700	ppbv		3,000
CL15	Non Routine Test	4,900	ppmv		2,000
mple:161285 - 06/30/97 - CCT\VP1010630					
40	Volatiles, TO-14				
	Benzene	17,200	ppbv		3,000

Morrison Knudsen Corporation GSA Group: 30957

Test	Analysis	Results as Received	Units	Limit of Quantitation
Sample:161285 - 06/30/97 - CCT\VP1010630				
8340	Volatiles, TO-14			
	Toluene	4,170	ppbv	3,000
	Ethylbenzene	24,500	ppbv	3,000
	m,p-Xylene	47,000	ppbv	3,000
	o-Xylene	10,900	ppbv	3,000
CL15	Non Routine Test	13,500	ppmv	2,000
Sample:161286 - 06/30/97 - CCT\VP2010630				
8340	Volatiles, TO-14			
	Benzene	7,130	ppbv	3,000
	Toluene	ND	ppbv	3,000
	Ethylbenzene	7,550	ppbv	3,000
	m,p-Xylene	14,900	ppbv	3,000
	o-Xylene	3,330	ppbv	3,000
CL15	Non Routine Test	4,400	ppmv	2,000
Sample:161287 - 06/30/97 - CCT\VP3010630				
40	Volatiles, TO-14			
	Benzene	ND	ppbv	1
	Toluene	ND	ppbv	1
	Ethylbenzene	ND	ppbv	1
	m,p-Xylene	ND	ppbv	1
	o-Xylene	ND	ppbv	1
CL15	Non Routine Test	ND	ppmv	1

(1) Cl15 = Total Petroleum Hydrocarbons for all samples.

Test Method Summary:
8340 - EPA AIR TOXICS TO-14 CL15 -

ND - Compound was analyzed but not detected.

Respectfully Submitted,
Reviewed and Approved by:

Randall Wright

Randall Wright
Project Manager

NAS Corpus Christi
Analytical Sample Summary

Sample Date	Sample Identification Number	Description
6/30/97	CCT\VP1010630	Well 26 undiluted, before oxidizer
6/30/97	CCT\VP1020630	Well 13 undiluted, before oxidizer
6/30/97	CCT\VP1030630	Well 20 undiluted, before oxidizer
6/30/97	CCT\VP1040630	Well 29 undiluted, before oxidizer
6/30/97	CCT\VP1050630	Well 21 undiluted, before oxidizer
6/30/97	CCT\VP2010630	Well 26 diluted, before oxidizer
6/30/97	CCT\VP3010630	Well 26 after oxidizer

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

010603

Lab Name: CORE LAB GULF STATES ANAL Contract:

Lab Code: GSA Case No.: SAS No.: SDG No.: 30222

Matrix: (soil/water) WATER Lab Sample ID: 157955

Sample wt/vol: 0.500 (g/ml) ML Lab File ID: X160F

Level: (low/med) LOW Date Received: 06/05/97

% Moisture: not dec. _____ Date Analyzed: 06/09/97

GC Column: DB-624 ID: 0.32 (mm) Dilution Factor: 10.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	100	U
75-01-4	Vinyl Chloride	100	U
74-83-9	Bromomethane	100	U
75-00-3	Chloroethane	100	U
75-35-4	1,1-Dichloroethene	50	U
75-15-0	Carbon Disulfide	50	U
67-64-1	Acetone	100	U
75-09-2	Methylene Chloride	50	U
156-60-5	trans-1,2-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
78-93-3	2-Butanone (MEK)	100	U
156-59-2	cis-1,2-Dichloroethene	50	U
67-66-3	Chloroform	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
107-06-2	1,2-Dichloroethane	50	U
71-43-2	Benzene	580	
79-01-6	Trichloroethene	50	U
78-87-5	1,2-Dichloropropane	50	U
75-27-4	Bromodichloromethane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
10061-02-6	trans-1,3-Dichloropropene	50	U
108-10-1	4-Methyl-2-pentanone	50	U
108-88-3	Toluene	150	
79-00-5	1,1,2-Trichloroethane	50	U
124-48-1	Dibromochloromethane	50	U
75-25-2	Bromoform	50	U
127-18-4	Tetrachloroethene	50	U
591-78-6	2-Hexanone	50	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	580	
108-38-3	m,p-Xylene	1600	
106-42-3	o-Xylene	540	

1A

TPH (DRO) ANALYSIS DATA SHEET

SAMPLE NO.

CCT/TLS010603

b Name:	CORE LAB - GULF STATES ANALYTICAL		Contract:		
Lab Code:	GSA	Case No.:	SAS No.:	SDG No.:	30222
Matrix: (soil/water)	Oil		Lab Sample ID:	157955	
Sample wt/vol:	1010	(g/mL)mL	Date Received:	06/05/97	
% Moisture: not dec.:			Date Extracted:	06/09/97	
Extraction: (SepF/Cont/Sonc)	SepF		Date Analyzed:	06/16/97	
Concentrated Extract Volume:	1000	(uL)	Dilution Factor:	100.0	
Injection Volume:	1	(uL)			

ANALYSIS	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
Total Petroleum Hydrocarbons (Diesel Range Organics)	350000	D

1A

TPH (GRO) ANALYSIS DATA SHEET

SAMPLE NO.

CCT/TLSO10603

Lab Name:	GULF STATES ANALYTICAL			Contract:	
Lab Code:	GSA	Case No.:		SAS No.:	SDG No.: 30222
Matrix: (soil/water)		Oil		Lab Sample ID:	157955
Sample wt/vol:		1.0	(g/mL) g	Lab File ID:	N/A
Level: (low/med)		LOW		Date Received:	06/05/97
% Moisture: not dec.:		NA		Date Analyzed:	06/15/97
GC Column:	Rtx 502.2	ID:	.53 (mm)	Dilution Factor:	1000.0

ANALYSIS	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
Total Petroleum Hydrocarbons (Gasoline Range Organics)	1000	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

010603

Lab Name: CORE LAB GULF STATES ANAL Contract:

Lab Code: GSA Case No.: SAS No.: SDG No.: 30222

Matrix: (soil/water) WATER Lab Sample ID: 157955

Sample wt/vol: 0.500 (g/ml) ML Lab File ID: X160F

Level: (low/med) LOW Date Received: 06/05/97

% Moisture: not dec. _____ Date Analyzed: 06/09/97

GC Column: DB-624 ID: 0.32 (mm) Dilution Factor: 10.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-42-5	Styrene	50	U
630-20-6	1,1,2,2-Tetrachloroethane	50	U

GULF STATES ANALYTICAL

CORELAB

6310 Rothway, Houston, Texas 77040
(713) 690-4444, Fax (713) 690-5646

❺ Request for Analysis

Company: ❶ MORRISON KNUDSEN CORPORATION
Address: 1500 West 3rd St. Cleveland OH 44113
Tele #: 216-523-5210
Fax #: 216-523-3731

Reports Sent To: ALLEN FOSDICK
P O #:
Project #: 4324-087

Project Name: UAS CORPUS CHRISTI / APPLIED EARTH SCIENCES
Project Location:

Sampler(s) Name: (Signature) CLAIRE P. MEURER Claire P Meurer
Courier:

❷ Field Sample ID	❸ Sampling Date	❸ Sampling Time	❹ Matrix: Water	Soil	Sludge	Oil	Other	# of Containers	Haz. Sample (Y/N)	BTEX (8020)	TCLP (1311)
1. CCT\VP102\0630	6/30/97	1525					✓	1		✓	✓
2. CCT\VP103\0630	6/30/97	1545					✓	1		✓	✓
3. CCT\VP104\0630	6/30/97	1600					✓	1		✓	✓
4. CCT\VP105\0630	6/30/97	1630					✓	1		✓	✓
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											

Relinquished by: (Signature) ❼ Claire P Meurer — Date 7/1/97 — Time: 1300
Relinquished by Sampler: (Signature) — Date — Time:
Received by: (Signature) Lone Star — Date 7/1/97 — Time:
Received by Laboratory: (Signature) — Date — Time:

❻ Remarks:

Requested Turnaround

GSAI Group:

Special Detection Limits

QC Package: (check one)
☐ CLP ☐ Site Specific
☐ Tier 1 ☐ Tier 2 ☐ QC Summary

SOUTHERN LITHOGRAPH, INC. - (713) 780-0400

White Copy to Accompany Samples to Lab — Yellow Copy Retained by Client — Pink Copy Retained by Sampler

GULF STATES ANALYTICAL

CORE LAB

6310 Rothway, Houston, Texas 77040
(713) 690-4444, Fax (713) 690-5646

❺ Request for Analysis

Company: ❶ MORRISON KNUDSEN CORPORATION	Address: 1500 West 3rd St. Cleveland OH 44113
Tele #: 216-523-5210	Fax #: 216-523-3731
Reports Sent To: ALLEN FOSDICK	P O #:
Project #: 4374-087	
Project Name: NAS CORPUS CHRISTI / APPLIED EARTH SCIENCES	Project Location:
Sampler(s) Name: (Signature) CLAIRE P. MEURER	
Courier: Lone Star	

❷ Field Sample ID	❸ Sampling Date	Time	❹ Matrix: Water	Soil	Sludge	Oil	Other	# of Containers	Haz. Sample (Y/N)	(8260) BTEX	(8015) TPH
1. CCT\VP1010630	10/30/97	14:40					✓	1		✓	✓
2. CCT\VP2010630	10/30/97	14:50					✓	1		✓	✓
3. CCT\VP3010630	10/30/97	14:50					✓	1		✓	✓
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											

Relinquished by: (Signature)	Date	Time:
❼ Claire P. Meurer	11/1/97	1300
Received by: (Signature) Lone Star	11/1/97	

Relinquished by Sampler: (Signature)	Date	Time:
Claire P. Meurer	11/1/97	1300
Received by: (Signature) Lone Star	11/1/97	

Received by Laboratory: (Signature)	Date	Time:

❻ Remarks:

Requested Turnaround

GSAI Group:

Special Detection Limits

QC Package: (check one)
☐ CLP ☐ Site Specific
☐ Tier 1 ☐ Tier 2 ☐ QC Summary

SOUTHERN LITHOGRAPH, INC. - (713) 780-0400 White Copy to Accompany Samples to Lab Yellow Copy Retained by Client Pink Copy Retained by Sampler

CORE LAB

GULF STATES ANALYTICAL

ANALYSIS SUMMARY REPORT

Morrison Knudsen Corporation
1500 West 3rd Street
Cleveland, OH 44113-1406

GSA Group: 32240
Date Reported: 09/02/97
Date Received: 08/26/97

Attn: Mr. Alan Fosdick
Project: NAS Corpus Christi / AES

Purchase Order:
Project No.:

Test	Analysis	Results as Received	Units		Limit of Quantitation
Sample:167752 - 08/22/97 - CCT\VP2010822					
8340	Volatiles, TO-14				
	Benzene	5,980	ppbv		700
	Toluene	1,110	ppbv		700
	Ethylbenzene	8,340	ppbv		700
	m,p-Xylene	19,900	ppbv		700
	o-Xylene	4,290	ppbv		700
CL15	Non Routine Test	1,130	ppmv	(1)	500
Sample:167753 - 08/22/97 - CCT\VP2020822					
8340	Volatiles, TO-14				
	Benzene	472	ppbv		300
	Toluene	446	ppbv		300
	Ethylbenzene	1,350	ppbv		300
	m,p-Xylene	3,020	ppbv		300
	o-Xylene	675	ppbv		300
CL15	Non Routine Test	374	ppmv		300
Sample:167754 - 08/22/97 - CCT\VP3010822					
8340	Volatiles, TO-14				
	Benzene	ND	ppbv		10
	Toluene	ND	ppbv		10
	Ethylbenzene	ND	ppbv		10
	m,p-Xylene	ND	ppbv		10
	o-Xylene	ND	ppbv		10
CL15	Non Routine Test	ND	ppmv		10
Sample:167755 - 08/22/97 - CCT\VP3020822					
8340	Volatiles, TO-14				
	Benzene	ND	ppbv		10
	Toluene	ND	ppbv		10
	Ethylbenzene	ND	ppbv		10
	m,p-Xylene	ND	ppbv		10
	o-Xylene	ND	ppbv		10
CL15	Non Routine Test	ND	ppmv		10

(1) CL15 = Total Petroleum Hydrocarbons

NAS Corpus Christi
Analytical Sample Summary

Sample Date	Sample Identification Number	Description
8/22/97	CCT\VP2010822	Well 20 diluted, before oxidizer
8/22/97	CCT\VP2020822	Well 26 diluted, before oxidizer
8/22/97	CCT\VP3010822	Well 20 after oxidizer
8/22/97	CCT\VP3020822	Well 26 after oxidizer

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VP1011023

Lab Name: GULF STATES ANALYTICAL Contract:

Lab Code: GSAI Case No.: SAS No.: SDG No.: 33775

Matrix: (soil/water) AIR Lab Sample ID: 175497

Sample wt/vol: 2 (g/mL) ML Lab File ID: VOC009

Level: (low/med) LOW Date Received: 10/27/97

% Moisture: not dec. _____ Date Analyzed: 10/30/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 330

Soil Extract Volume: _____(mL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	6300	
100-41-4	Ethylbenzene	3000	
----------	m,p-Xylene	10000	
95-47-6	o-Xylene	3300	
----------	Xylenes (total)	14000	
108-88-3	Toluene	4900	

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

VP2011023

Lab Name: GULF STATES ANALYTICAL Contract:

Lab Code: GSAI Case No.: SAS No.: SDG No.: 33775

Matrix: (soil/water) AIR Lab Sample ID: 175498

Sample wt/vol: 100 (g/mL) ML Lab File ID: VOC013

Level: (low/med) LOW Date Received: 10/27/97

% Moisture: not dec. _____ Date Analyzed: 10/31/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 6.75

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	7	U
100-41-4	Ethylbenzene	7	U
----------	m,p-Xylene	7	U
95-47-6	o-Xylene	7	U
----------	Xylenes (total)	7	U
108-88-3	Toluene	7	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VP1021023

Lab Name: GULF STATES ANALYTICAL Contract:

Lab Code: GSAI Case No.: SAS No.: SDG No.: 33775

Matrix: (soil/water) AIR Lab Sample ID: 175499

Sample wt/vol: 20 (g/mL) ML Lab File ID: VOC011

Level: (low/med) LOW Date Received: 10/27/97

% Moisture: not dec. _____ Date Analyzed: 10/30/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 33.5

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	400	
100-41-4	Ethylbenzene	420	
----------	m,p-Xylene	1800	
95-47-6	o-Xylene	650	
----------	Xylenes (total)	2400	
108-88-3	Toluene	240	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VP2021023

Lab Name: GULF STATES ANALYTICAL Contract:

Lab Code: GSAI Case No.: SAS No.: SDG No.: 33775

Matrix: (soil/water) AIR Lab Sample ID: 175500

Sample wt/vol: 100 (g/mL) ML Lab File ID: VOC015

Level: (low/med) LOW Date Received: 10/27/97

% Moisture: not dec. _____ Date Analyzed: 10/31/97

GC Column: SPB-5 ID: 0.32 (mm) Dilution Factor: 6.75

Soil Extract Volume:_____(mL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
71-43-2	Benzene	7	U
100-41-4	Ethylbenzene	7	U
----------	m,p-Xylene	7	U
95-47-6	o-Xylene	7	U
----------	Xylenes (total)	7	U
108-88-3	Toluene	7	U

SAMPLE 33775	SAMPLE AREA	ADJUSTED SX AREA	AMOUNT INJECTED	STANDARD AREA (400ppbv)	BLANK AREA	ADJUSTED STND AREA	AMOUMT TPH (ppbv)	DILUTION FACTOR	TOTAL TPH (ppmv)
175497	509872059	502539773	2.0	100590298	7332286	93258012	2155.48	330	711.31
175498	7072162	-260124	100.0	100590298	7332286	93258012	-1.12	6.75	-0.01
175499	571367898	564035612	20.0	100590298	7332286	93258012	2419.25	33.5	81.04
175500	5743674	-1588612	100.0	100590298	7332286	93258012	-6.81	6.75	-0.05
		#VALUE!				#VALUE!	#VALUE!	#VALUE!	#VALUE!
		#VALUE!				#VALUE!	#VALUE!	#VALUE!	#VALUE!
		#VALUE!				#VALUE!	#VALUE!	#VALUE!	#VALUE!
LOQ	7432286	100000	500.0	100590298	7332286	93258012	0.43	1	0.00

SAMPLE DILUTION	
175497	1.32
175498	1.35
175499	1.34
175500	1.35

GULF STATES ANALYTICAL

CORE LAB

6310 Rothway, Houston, Texas 77040
(713) 690-4444, Fax (713) 690-5646

5 Request for Analysis

Company:	Address: 1300 W. 3RD ST. CLEVELAND, OHIO 44113-1406
1 Morrison Knudsen Corp.	Tele #: (216) 523-5697 Fax #: (216) 523-5201
Reports Sent To:	P O #:
Morrison Knudsen Corp. c/o Alan Fosbre	Project #:
Project Name:	Project Location:
NAS Cecil Field / Naval Aviation Depot Services Div.	
Sampler(s) Name: (Signature) Luis Reyna	
Courier: Lone Star Overnight	

2 Field Sample ID	3 Sampling Date	Time	4 Matrix: Water	Soil	Sludge	Oil	Other	# of Containers	Haz. Sample (Y/N)	BTEX (8020)	PAH (8100)
1. CCT/VP2010822	8/22/97	15:31					✓	1		✓	✓
2. CCT/VP2020822	8/22/97	16:27					✓	1		✓	✓
3. CCT/VP3010822	8/22/97	15:34					✓	1		✓	✓
4. CCT/VP3020822	8/22/97	16:27					✓	1		✓	✓
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											

Relinquished by: (Signature) — Date — Time:
Relinquished by: (Signature) — Date: 8/22/97 — Time: 14:00
Relinquished by Sampler: (Signature)
Received by: (Signature) — Date — Time:
Received by: (Signature) — Date — Time:
Received by Laboratory: (Signature) — Date — Time:

6 Remarks:

Requested Turnaround

GSAI Group:

Special Detection Limits

QC Package: (check one)
☐ CLP ☐ Site Specific
☐ Tier 1 ☐ Tier 2 ☐ QC Summary

SOUTHERN LITHOGRAPH, INC. - (713) 780-0400 — White Copy to Accompany Samples to Lab — Yellow Copy Retained by Client — Pink Copy Retained by Sampler

APPENDIX L
OPERATIONAL DATA

Data Tables and Figures (36 pages)

VAPOR PHASE PRODUCT RECOVERED AND DESTROYED
NAS CORPUS CHRISTI

Month Ending	Vapor Phase Product Destroyed			
Date	Total Per Period		Cumulative Total	
	(lb.)	gallons	(lb.)	(gallons)
4/28/97	0	0	0	0
4/30/97	205	29	205	29
5/30/97	2807	396	3012	425
6/30/97	2445	345	5457	770
7/23/97	1938	273	7395	1043
8/22/97	2695	380	10090	1423
9/18/97	902	127	10993	1550
10/23/97	1647	232	12640	1783
10/29/97	689	97	13329	1880
11/7/97	830	117	14159	1997
11/13/97	387	55	14545	2051
11/19/97	62	9	14607	2060
11/28/97	175	25	14782	2085
12/3/97	237	33	15019	2118

The mass removal calculation is based on monthly average concentrations measured with the Flame Ionization Detector on the diluted vapor before it enters the thermal oxidizer. Refer to Table 2 for the calculation used. The estimated operating times shown in Table 6 are used to calculate a weighted average concentraton.

TOTAL VAPOR PHASE MASS RECOVERED CALCULATION
NAS CORPUS CHRISTI

Period Endin	Flow Rate	Pressure	emperatur	MW	Average Concentration (ppmvv)					Total Petroleum Hydrocarbon Mass Removal Rate (lb/hr)				
Date	cfm	psi	°F	lb/lb-mole	MW-26	MW-13	MW-20	MW-29	MW-21	MW-26	MW-13	MW-20	MW-29	MW-21
4/28/97	100	14.6	105	114	0	0	0	0	0	0	0	0	0.0	0.0
4/30/97	100	14.6	107	114	90	4650	15150	4695	880	0.1	7.6	24.9	7.7	1.4
5/30/97	100	14.6	105	114	6996	5288	5494	4695	880	11.5	8.7	9.0	7.7	1.4
6/30/97	100	14.6	115	114	3090	3116	2651	2174	1215	5.0	5.0	4.3	3.5	2.0
7/23/97	100	14.6	114	114	4183	2680	4125	1048	1400	6.8	4.3	6.7	1.7	2.3
8/22/97	100	14.6	109	114	3688	1548	3338	764	1028	6.0	2.5	5.5	1.2	1.7
9/18/97	100	14.6	114	114	3564	696	1955	698	2088	5.8	1.1	3.2	1.1	3.4
10/23/97	100	14.6	103	114	4429	491	859	1373	703	7.3	0.8	1.4	2.3	1.2
10/29/97	100	14.6	97	114	2570	9685	535	3120	1900	4.3	16.2	0.9	5.2	3.2
11/7/97	100	14.6	92	114	4500	6000	500	2360	2150	7.6	10.1	0.8	4.0	3.6
11/13/97	100	14.6	99	114	8160	7785	1870	3660	4410	13.6	13.0	3.1	6.1	7.3
11/19/97	100	14.6	79	114	1205	1520	625	325	215	2.1	2.6	1.1	0.6	0.4
11/28/97	100	14.6	96	114	1765	1248	520	495	438	3.0	2.1	0.9	0.8	0.7
12/3/97	100	14.6	94	114	2325	975	415	1285	660	3.9	1.6	0.7	2.2	1.1

TOTAL VAPOR PHASE MASS RECOVERED CALCULATION
NAS CORPUS CHRISTI

Period Endin	Estimated hours per well					Monthly Mass Removed Per Well (lb.)					Total	Total	Cumulative Total	
Date	MW-26	MW-13	MW-20	MW-29	MW-21	MW-26	MW-13	MW-20	MW-29	MW-21	(lb.)	(Gallons)	(lb.)	(Gallons)
4/28/97						0	0	0	0	0	0	0	0	0
4/30/97	8	6	5	4	2	1	46	124	31	3	205	29	205	29
5/30/97	95	68	65	57	65	1089	591	589	443	95	2807	396	3012	425
6/30/97	217	136	97	47	47	1086	686	414	166	92	2445	345	5457	770
7/23/97	146	88	66	32	32	987	384	440	55	72	1938	273	7395	1043
8/22/97	218	149	152	60	60	1315	377	828	75	101	2695	380	10090	1423
9/18/97	64	37	89	96	30	370	42	281	109	100	902	127	10993	1550
10/23/97	112	56	149	223	56	818	45	212	507	65	1647	232	12640	1783
10/29/97	27	13	36	54	13	116	218	32	281	43	689	97	13329	1880
11/7/97	35	18	47	71	18	268	178	40	281	64	830	117	14159	1997
11/13/97	10	5	13	19	5	131	63	40	118	35	387	55	14545	2051
11/19/97	10	5	13	20	5	21	13	15	11	2	62	9	14607	2060
11/28/97	24	12	32	49	12	72	25	28	40	9	175	25	14782	2085
12/3/97	23	11	30	45	11	88	18	21	97	12	237	33	15019	2118

TOTAL VAPOR PHASE MASS RECOVERED CALCULATION
NAS CORPUS CHRISTI

Density (lb/gal) 7.09

Notes:

Calculation from 9/18 for Well 21	
Average flow rate to oxidizer	100 cfm
Operating pressure entering thermal oxidizer	14.6 psi
Temperature is the average of inlet temperature	114°F
Assumed Molecular weight (octane)	114 lb/lb-mole
MW-21 average concentration based on all FID readings for month	2088 ppmv
Operating hours based on the total operating hours times the fraction for each well	(2257 hours - 1941 hours)*0.75 hours/8 hours
Ideal gas law constant	10.73 ft3 psi/lb-mole deg R

Calculation

$$\frac{14.6 \text{ psi} \times 100 \text{ ft3} \times 114 \text{ lb/lb-mole} \times 2088 \text{ ppm}}{10.73 \text{ ft3 psi/lb-mole R} \times (114 \text{ F} + 459.67 \text{ R}) \times 1{,}000{,}000} = 0.056 \text{ lb/min}$$

$$0.056 \text{ lb/min} \times 60 \text{ min/hr} = 3.4 \text{ lb/hr}$$

$$3.4 \text{ lb/hr} \times 29.6 \text{ hr} = 100 \text{ lb}$$

MASS RECOVERED CALCULATION, BTU VALUES
NAS CORPUS CHRISTI

Date	Thermal Oxidizer Operating Hours (hr)	Gas Meter (CF)	Heat value of Natural gas used (BTU/hr) (Natural gas 1035 BTU/cu. ft.)	Heat value of recovered product (BTU/hr) (Thermal oxidizer uses 240,000 BTU/hr to maintain temperature)	Product Recovered (lb./hr.) (Average heating value of avgas, JP-4, JP-5 18,500 BTU/lb.)	Recovered Product (lb.)	Cumulative Product recovered (Since 7/1/97) (lb.)
7/1/97	935.0	0.0					
7/8/97	1049.6	14000.0	126440	113560	6.1	703	703
7/16/97	1138.7	25900.0	138201	101799	5.5	490	1194
7/23/97	1303.1	51200.0	159308	80692	4.4	717	1911
7/31/97	1489.8	77100.0	143596	96404	5.2	973	2884
8/6/97	1601.1	92300.0	141310	98690	5.3	594	3477
8/13/97	1771.3	117800.0	155068	84932	4.6	781	4259
8/22/97	1941.5	139700.0	133184	106816	5.8	983	5242
8/27/97	1973.7	142800.0	99581	140419	7.6	245	5486
9/3/97	2020.2	147600.0	106862	133138	7.2	335	5821
9/12/97	2136.5	162400.0	131745	108255	5.9	680	6501
9/18/97	2257.0	179100.0	143404	96596	5.2	629	7130
9/25/97	2389.7	196300.0	134132	105868	5.7	760	7890
10/2/97	2550.6	216600.0	130638	109362	5.9	951	8841
10/13/97	2685.8	242000.0	194373	45627	2.5	334	9174
10/23/97	2853.0	259900.0	110831	129169	7.0	1167	10341
10/29/97	2996.5	280900.0	151442	88558	4.8	687	11028
11/7/97	3184.5	308200.0	150247	89753	4.9	912	11941
11/13/97	3236.0	315500.0	146823	93177	5.0	259	12200
11/19/97	3289.9	323300.0	149666	90334	4.9	263	12463
11/28/97	3419.7	341400.0	144348	95652	5.2	671	13134
12/3/97	3539.7	358000.0	143175	96825	5.2	628	13762

WATER TRANSFERRED TO THE POTW FROM TANK T-6
NAS CORPUS CHRISTI

	Water Transferred to POTW	
Date	Quantity Transferred	Cumulative Total
	(Gallons)	(Gallons)
1/6/97	0	0
4/30/97	6000	6000
5/1/97	2700	8700
5/5/97	3600	12300
5/15/97	1800	14100
5/16/97	1800	15900
5/20/97	900	16800
5/21/97	2700	19500
5/23/97	2700	22200
5/27/97	1800	24000
5/30/97	3600	27600
6/5/97	3600	31200
6/9/97	1800	33000
6/13/97	3600	36600
6/16/97	2700	39300
6/20/97	1800	41100
6/23/97	2700	43800
6/26/97	900	44700
7/3/97	900	45600
7/9/97	2700	48300
7/14/97	1700	50000
7/28/97	1800	51800
8/1/97	2700	54500
8/5/97	1800	56300
8/22/97	3600	59900
9/2/97	2700	62600
9/5/97	1800	64400
9/11/97	2700	67100
9/12/97	1800	68900
9/19/97	1800	70700
9/26/97	1800	72500
9/29/97	900	73400
10/3/97	1800	75200
10/6/97	1800	77000
10/10/97	1800	78800
10/14/97	900	79700
10/20/97	3600	83300
10/24/97	3600	86900
10/30/97	1800	88700
11/4/97	3600	92300

Note: Information for this table is provided by NAS Corpus Christi

THERMAL OXIDIZER BURNER EFFICIENCY
NAS CORPUS CHRISTI

Date	Well	Average FID Concentration of Diluted Process Air BV-20 (thermal oxidizer inlet) (ppmv)	FID Concentration of Stack Effluent S-1007 (ppmv)	Burner efficieny based on FID readings	Lab analysis TPH diluted vapor concentration (thermal oxidizer inlet) (ppmv)	Lab analysis TPH vapor concentration (themal oxidizer effluent (ppmv)	Burner efficieny based on Lab Analyses
4/29/97	MW-26	90	0	100.0%			
5/7/97	MW-26	6720	Not measured	Not measured			
5/13/97	MW-26	5700	0	100.0%			
5/21/97	MW-26	12500	0	100.0%	3265	874	73.2%
5/29/97	MW-26	3065	230	92.5%			
6/3/97	MW-26	10250	0	100.0%			
6/11/97	MW-26	1255	Not measured	Not measured			
6/17/97	MW-26	405	Not measured	Not measured			
6/24/97	MW-26	390	1	99.7%			
6/30/97	MW-26	3150	0	100.0%	4400	0	100.0%
7/8/97	MW-26	2650	0	100.0%			
7/17/97	MW-26	5400	20	99.6%			
7/23/97	MW-26	4500	50	98.9%			
7/31/97	MW-26	3375	0	100.0%			
8/6/97	MW-26	3450	20	99.4%			
8/13/97	MW-20	3720	0	100.0%			
8/22/97	MW-20	1130	15	98.7%	1130	0	100.0%
8/22/97	MW-26	4675	Not measured	Not measured	374	0	100.0%
8/27/97	MW-20	2925	0	100.0%			
9/6/97	MW-29	550	0	100.0%			
9/12/97	MW-29	420	0	100.0%			
9/18/97	MW-20	1185	0	100.0%			
9/25/97	MW-29	2750	50	98.2%			
10/2/97	MW-29	1780	10	99.4%			
10/13/97	MW-29	0	Not measured	Not measured			
10/23/97	MW-29	960	0	100.0%			

THERMAL OXIDIZER BURNER EFFICIENCY
NAS CORPUS CHRISTI

Date	Well	Average FID Concentration of Diluted Process Air BV-20 (thermal oxidizer inlet) (ppmv)	FID Concentration of Stack Effluent S-1007 (ppmv)	Burner efficieny based on FID readings	Lab analysis TPH diluted vapor concentration (thermal oxidizer inlet) (ppmv)	Lab analysis TPH vapor concentration (themal oxidizer effluent (ppmv)	Burner efficieny based on Lab Analyses
10/29/97	MW-20	535	0	100.0%			
11/13/97	MW-29	3660	0	100.0%			
11/19/97	MW-29	325	0	100.0%			
12/3/97	MW-29	1285	0	100.0%			

THERMAL OXIDIZER OPERATING PERCENTAGE
NAS CORPUS CHRISTI

Date Period ending	Time	Total Hours Available from previous date	Estimated Scheduled maintenance	Non Maintenance shut downs (See Notes)	Percent Operating	Percent Non Maintenance Shutdowns	Percent scheduled Maintenance	Unscheduled Shut Downs (not including T-6 high level alarms, or power outages)	Notes for Non-Maintenance Down Time
4/29/97	11:30								
5/29/97	18:42	727	42.0	39	46.8%	5.4%	5.8%	15	T-6 Full twice
6/30/97	13:10	763	19.0	26	70.9%	3.4%	2.5%	9	Install T-6 Piping
7/23/97	15:40	554	13.0	107	69.9%	19.3%	2.3%	3	Install Gas meter, T-6 full
8/22/97	14:58	719	20.0	0	88.8%	0.0%	2.8%	6	
9/18/97	11:10	645	42.0	53.25	48.9%	8.3%	6.5%	10	Installed filter and chemical feed, cleaned tanks
10/23/97	11:10	840	13.0	211	70.9%	25.1%	1.5%	4	Two power outages, T-6 full twice, install moisture separator
11/19/97	14:00	651	16.0	129	67.1%	19.8%	2.5%	2	Other shut downs due to T-6 full once and Natural gas shut off once

Notes:
The following times are estimated for scheduled maintenance
3 hours down time per weekly maintenance, adjusted down from 5 hours based on log notes
4 hours down time per monthly maintenance
26 hours down time per quarterly maintenance (system off overnight to allow wells to equalize.
4 hours down time per semi annual and annual maintenance

Non-Maintenance shut downs include shut downs made at Navy requests, Tank T-6 full, and for addiotional equipment installations.

Available operating time equals total operating hours minus estimated scheduled maintenance minus non maintenance shut downs described above.

WEEKLY INSPECTION LOG
NAS CORPUS CHRISTI

Date	Ambient Temp. (deg. F)	550 gallon water tank volume (gal)	5000 gallon water tank T-6 volume (gal)	Pump P-1 Discharge Pressure at PI-8 (psi)	Pump P-2 Discharge Pressure at PI-9 (psi)	Pump P-3 Discharge Pressure at PI-10 (psi)	Pump P-6 Discharge Pressure at PI-11 (psi)	Water Flow Meter from T-2 FI/FC-2 (gpm)	Water Flow Meter to LRVP FI/FC-3 (gpm)	Thermal Oxidizer Operating Hours (hr)	Product Tank, T-4, Depth to Top of Product in T-4 (in)	Product Tank, T-4, Depth to Top of Water T-4 (in)	Discharge Water Flow Totalizer FQ-1 (gal)	Potable Water Flow Totalizer FQ-2 (gal)	Gas Meter (CF)
2/3/97	65			60				0.2		NA			366	609	
4/29/97		120	2900	60	25			0.2	2.0	34.3			9502	6928	
5/7/97	78	250	2400	50	27			0.8	2.0	146.7	10.0	7.3	15716	9280	
5/13/97		315	1650	55	26			0.7	2.0	174.3	10.0	7.3	17810	10325	
5/20/97	85	125	3250	55	25			0.9	3.0	276.9	11.5	9.0	24290	14267	
5/29/97	92	200	2500	50	26			0.9	3.0	374.8	16.0	14.0	34385	18886	
6/3/97	85	150	2750	50	25			1.0	2.0	417.6	9.0	6.5	39000	20940	
6/10/97	90	320	2700	40	26			2.1	2.0	497.6	11.6	10.3	47488	23357	
6/17/97	90	290	1500	33	24			1.2	2.0	657.5	12.3	10.5	58661	23478	
6/24/97	85	125	2000	30	24			1.1	2.0	807.5			71556	23478	
6/30/97	90	325	1250	40	24			0.9	2.0	915.7	12.3	10.5	72905	23532	
7/1/97										935.0	Gas meter installed				0
7/8/97	85	90	3200	56	24			0.6	3.0	1049.6	12.3	10.5	80628	24234	14000
7/16/97	90	160	2475	60	26			1.3	3.0	1138.7	12.3	10.5	87095	24235	25900
7/23/97	90	210	2400	53	26			1.5	3.0	1303.1	13.3	11.0	99676	24245	51200
7/31/97	88	225	2750	55	26			2.0	3.0	1489.8	13.3	12.0	114253	24291	77100
8/6/97	90	200	2600	50	26			2.2	3.0	1601.1	13.3	11.5	126148	24291	92300
8/13/97	92	385	2750	52	25			2.1	3.0	1771.3	13.4	11.8	147077	24291	117800
8/22/97	95	110	2050	52	25			2.0	2.7	1941.5	13.8	12.3	165279	24308	139700
8/27/97	95	210	2750	55	25			2.2	2.3	1973.7	14.5	13.0	170851	24309	142800
9/3/97	90	320	1750	55	25			2.2	2.2	2020.2			180690	24349	147600
9/12/97	90	110	800	55	25			1.8	1.8	2136.5	13.8	12.0	197831	24616	162400
9/18/97	90	290	2850	53	25			1.3	1.5	2257.0	14.0	12.8	208577	24692	179100
9/25/97	85	155	3450	50	25			1.7	3.1	2389.7	14.0	11.0	225396		196300
10/2/97	92	160	3400	52	25			1.8	2.9	2550.6	14.0	11.8	248287	24751	216600
10/13/97				Estimated						2685.8					242000
10/23/97	85	160	2550	50	26			1.9	3.8	2853.0	15.5	12.8	292800	24757	259900
10/29/97	70	295	2750	50	27			1.8	3.9	2996.5	15.8	14.0	314564	24757	280900
11/7/97	65	320	2700	58	28			1.5	4.0	3184.5	5.5	4.0	341648	24767	308200
11/13/97	65	200	700	65	26			1.5	4.0	3236.0	6.0	4.5	350786	24767	315500
11/19/97	60	260	2700	65	26			1.5	4.0	3289.9	6.0	4.5	360665	24767	323300
11/28/97	70	190	2650	62	27	25		1.5	4.0	3419.7	6.8	3.8	374844	24758	341400
12/3/97	68	220	2500	62	27	30	14	1.5	4.0	3539.7	9.5	6.5	382287	24759	358000

WEEKLY INSPECTION LOG
WELL MW-26, NAS CORPUS CHRISTI

Date	Motor Valve #	Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well	Vacuum Pressure at Manifold	Vacuum Pressure at PI-6	Vacuum Pressure at PI-7	Differential Pressure of Vapor Stream		Pressure of Vapor Stream		Vapor Stream Temp. at TI-2 (°F)	Vapor Concentration Measured with FID	Vapor Concentration Measured with FID	Burner Temperature (°F)	Lower Stack Temperature (°F)
			(in Hg)	(in Hg)	(in Hg)	(in Hg)	GOM-3	GOM-3	GOM-3	GOM-3		min (ppmv bv	max (ppmv bv)		
							min (in H_20)	max (in H_20)	min (in H_20)	max (in H_20)					
4/29/97	5	99	13.5	11.5	12.5	13.5	0	0	-3	-3	90	25	110	1,412	1,387
5/7/97	5	94	10	9	11	18	16.9	18.7	58.3	60.7	104	28,200	28,200	1,438	1,414
5/13/97	5	96	8.5	7.5	9	20	14.4	14.4	14.6	17.5	100	72,000	83,100	1,434	1,415
5/21/97	1	100	9.5	13	9.5	21.5	15.8	16.2	44.3	49.2	102	128,000	129,600	1,434	1,408
5/29/97	1	100	8	10	9	21	7.2	11.7	13.3	14.5	98	27,800	31,700	1,476	1,446
6/3/97	1	94	14	15.5	15.5	20	36	37	78	80	100	75,000	90,000	1,416	1,415
6/11/97	1	95	5	8	7	23	3.3	3.3	-2.5	-0.8	110	12,500	20,800	1,411	1,387
6/17/97	1	110	8.5	9	9.5	21	22.5	22.5	35.5	35.5	119	1,370,000	1,370,000	1,409	1,387
6/24/97	1	88	5	7	6	21.5	3	7	2.2	2.4	129	6,700	6,900	1,412	1,388
6/30/97	1	88	7	8	7	22.5	24	24.5	15	21	100	42,000	52,000	1,408	1,379
7/8/97	1	90	7.5	8.5	8	9	46	47	33.5	34.5	128	34,600	35,300	1,408	1,391
7/17/97	1	100	5	6	6.5	6.5	47.1	48.5	27.1	28.9	112	48,500	50,400	1,412	1,387
7/23/97	1	98	9	10	9.5	10.5	61.3	61.3	42.6	42.6	113	44,600	48,740	1,407	1,386
7/31/97	1	106	11	12.5	11.5	13	91.6	91.6	80.2	80.2	103	18,800	23,300	1,410	1,396
8/6/97	1	106	11	12	12	12.5	86.2	86.2	73.5	73.5	104	18,250	18,250	1,409	1,395
8/13/97	2	110	10.5	10.5	11	12	82.1	86	66.5	70.3	102	25,300	25,710	1,390	1,407
8/22/97	2	102	9	9.5	11	12	54.9	54.9	119.5	119.5	108	31,300	31,300	1,413	1,398
8/27/97	2	102	9.5	9	9.5	10.5	73.5	73.5	52.6	52.6	97	23,800	24,000	1,414	1,398
9/6/97	3	108	9.5	12	10.5	11	63.6	63.6	123.6	123.6	103	19,200	19,200	1,412	1,392
9/12/97	3	105	8.5	11.5	9.5	10.5	76.8	76.8	63.3	63.3	101	22,600	22,600	1,415	1,391
9/18/97	3	110	9	11	11	11	70.2	70.2	65.4	65.4	110	19,600	20,200	1,409	1,386
9/25/97	3	100	9.5	13	11.5	12.5	39.4	39.4	102.4	102.4	90	47,000	48,100	1,405	1,395
10/2/97	3	110	8.5	12.5	10	11	41.6	41.6	80.3	80.3	106	45,400	48,200	1,414	1,406
10/13/97	3	110	0	0	0	0						0	0	1,414	1,406
10/23/97	3	100	20	22.5	21.5	23.5	20	20	32.6	32.6	88	11,000	11,800	1,412	1,385
10/29/97	3	94	19	20	20	21.5	6.6	6.9	11.8	12.3	82	36,800	37,400	1,410	1,384
11/7/97	3	90	15.5	20.75	18	20.5	7.2	7.2	7.6	9	82	17,000	17,000	1,413	1,386
11/13/97	3	92	19	26.5	21	23.5	4.3	6	13.1	15.7	89.5	70,500	71,800	1,414	1,387
11/19/97	3	82	17.5	24	23	21	4.2	4.5	5.6	6.3	60	15,000	15,500	1,413	1,387
11/28/97	3	96	18	23	20.5	21	4.9	5.6	20.2	20.8	84	14,900	16,050	1,407	1,382
12/3/97	3	98	16.5	21.5	19.5	20.5	6.2	7.3	9.6	12.4	80	14,800	16,600	1,408	1,383

WEEKLY INSPECTION LOG
WELL MW-26, NAS CORPUS CHRISTI

Date	Differential Pressure Diluted Process Air FI-309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_20)	Vacuum on Process Air PI 302 (in. H_2O)	Pressure on Process Air PI-301(in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501(in. H_2O)	Diluted Process Air Temperature TI 307 (°F)	Average FID Concentration of Diluted Process Air BV-20
4/29/97	0.055	18	10	10	1.35	0.6	109	90
5/7/97	0.07	20	9.4	10	0.1	0.3	105	6720
5/13/97	0.065	20	10	9	0.1	0.35	100	5700
5/21/97	0.07	20	10	35	0.2	0.35	105	12500
5/29/97	0.07	20	10	1	0.1	0.3	102	3065
6/3/97	0.07	20	10	40	0.1	0.32	110	10250
6/11/97	0.075	18.5	10	0	1	0.55	119	1255
6/17/97	0.075	20	10	25	0.5	0.4	115	405
6/24/97	0.07	19	10	0	1	0.55	112	390
6/30/97	0.075	19	10	4	0.5	0.42	116	3150
7/8/97	0.075	18.5	9.6	0	0.3	0.4	114	2650
7/17/97	0.075	18	9	0	1	0.5	117	5400
7/23/97	0.075	18.5	9.2	0	0.3	0.4	115	4500
7/31/97	0.075	18.5	8.8	0	0.5	0.5	107	3375
8/6/97	0.075	19	8.3	10	0.4	0.4	115	3450
8/13/97	0.07	19	9.8	4	0.5	0.4	108	3250
8/22/97	0.07	19	9.2	9	0.4	0.4	95	4675
8/27/97	0.07	18.5	9	0	0.5	0.4	107	5205
9/6/97	0.075	18.5	9	40	0.6	0.45	115	3185
9/12/97	0.07	18.5	9.2	4.5	0.5	0.45	112	3120
9/18/97	0.075	18.5	9.8	9	0.65	0.5	121	2745
9/25/97	0.07	19	10	40	0.3	0.4	105	7620
10/2/97	0.07	18.5	10	40	0.35	0.4	102	7310
10/13/97	0.07						102	0
10/23/97		18	9.8	14.5	1	0.6	105	2785
10/29/97		18	9.8	0	0.9	0.5	97	2570
11/7/97		18	9.8	0	1.2	0.6	92	4500
11/13/97		17.5	9.8	4.05	0.8	0.5	100	8160
11/19/97		18	9.8	3	0.9	0.5	78	1205
11/28/97		18	10	10	1	0.7	95	1765
12/3/97		18	9.8	12	0.8	0.5	95	2325

WEEKLY INSPECTION LOG
WELL MW-13, NAS CORPUS CHRISTI

Date	Motor Valve #	Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well (in Hg)	Vacuum Pressure at Manifold (in Hg)	Vacuum Pressure at PI-6 (in Hg)	Vacuum Pressure at PI-7 (in Hg)	Differential Pressure of Vapor Stream GOM-3 min (in H_2O)	Differential Pressure of Vapor Stream GOM-3 max (in H_2O)	Pressure of Vapor Stream GOM-3 min (in H_2O)	Pressure of Vapor Stream GOM-3 max (in H_2O)	Vapor Stream Temp. at TI-2 (°F)	Vapor Concentration Measured with FID min (ppmv bv)	Vapor Concentration Measured with FID max (ppmv bv)	Burner Temperature (°F)	Lower Stack Temperature (°F)
4/29/97	4	102	19	18	19.5	21.5	0	4.4	-17.5	-9.5	98	1,080,000	1,187,000	1,412	1,388
5/7/97	4	100	18	18	20	20	0	7.4	-11.5	3.7	97	75,000	90,000	1,398	1,413
5/13/97	4	94	19	20	21	23	0	0	-11.9	-4.7	90	77,600	136,000	1,397	1,410
5/21/97	2	106	19	18	21.5	24.5	0.1	0.1	-10.9	-3.8	96	220,000	230,000	1,398	1,404
5/30/97	2	106	17	17	20	25.5	0	0	-12.2	-10	100	12,600	227,000	1,400	1,390
6/3/97	2	105	21	20	23	25	0.5	1.2	-2.8	-6.9	100	375,000	385,000	1,412	1,388
6/11/97	2	98	10	9	12	23	0.2	1.4	23.9	23.9	108	320,000	380,000	1,407	1,385
6/17/97	2	103	12.5	12	17	23	7	7	8	8	119	246,000	246,000	1,410	1,389
6/24/97	2	87	6	8	10	21	4.5	7	-2.2	1.8	129	8,000	9,400	1,411	1,388
6/30/97	2	91	11.5	9.5	12.5	20	0.1	0.8	-11	1.5	116	140,000	150,000	1,408	1,388
7/8/97	2	94	17	16	18	19	35	38	26	27.2	104	35,800	36,300	1,413	1,390
7/17/97	2	98	17	17	19	19.5	21.2	22.4	5.8	9	108	22,300	23,590	1,410	1,385
7/23/97	2	100	19.5	19.5	21	22.5	29.1	30.1	13.9	15.5	100	19,200	19,200	1,413	1,389
7/31/97	2	108	19.5	20	21	22.5	10.7	10.7	1.2	1.2	103	6,520	21,270	1,411	1,388
8/6/97	2	107	20	20	21.75	22.75	24.4	30	16.4	17.5	102	10,200	10,500	1,415	1,390
8/13/97	3	110	20	22	20	21.5	7	7.7	0	1.4	103	50,900	59,400	1,389	1,412
8/22/97	3	112	17.5	18	16	17	11.8	13.5	4.8	7.4	110	3,230	10,280	1,415	1,389
8/27/97	3	104	19.5	20.5	19.5	19	26.8	28.1	11.7	12.5	94	6,100	6,450	1,409	1,385
9/6/97	4	108	20	19	20.5	22	9.8	10.6	7.4	8.1	103	9,450	10,100	1,412	1,387
9/12/97	4	106	18.5	18	20	20.5	18.7	20	8.9	12.6	98	7,640	8,060	1,413	1,387
9/18/97	4	113	18	18	20.5	21	13.5	14.2	6.5	7.8	110	6,590	6,870	1,407	1,382
9/25/97	4	98	15.5	16.5	17	21	13.7	14.8	28.5	31.8	93	5,750	6,310	1,414	1,388
10/2/97	4	108	17	17	18	19.5	8.9	10.4	10.2	10.2	100	26,300	27,850	1,413	1,387
10/13/97	4	110	0	0	0	0						0	0	1,414	1,406
10/23/97	4	100	18	18.5	20.5	22.5	9.2	9.7	8.4	9.1	88	800	840	1,408	1,382
10/29/97	4	99	20	18.5	21	23	4.4	5.6	8	8.5	82	61,500	62,400	1,412	1,387
11/7/97	4	94	22	17	20.5	21	10.1	10.4	6	8	83	30,000	30,000	1,413	1,386
11/13/97	4	85	21.5	18	20	22.5	7.3	7.9	18.8	19.9	89	15,200	16,900	1,411	1,386
11/19/97	4	84	20	17	22.5	19.5	6.1	6.9	24	25.5	63	16,400	17,800	1,410	1,385
11/28/97	4	100	18	16.5	21	21	7.3	7.8	35.6	35.6	84	10,600	12,100	1,413	1,387
12/3/97	4	98	16.5	16	19.5	20.5	6.2	6.8	21.8	22.5	76	4,800	6,400	1,408	1,384

WEEKLY INSPECTION LOG
WELL MW-13, NAS CORPUS CHRISTI

Date	Differential Pressure Diluted Process Air FI 309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_20)	Vacuum on Process Air PI-302 (in. H_2O)	Pressure on Process Air PI-301 (in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501 (in. H_2O)	Diluted Process Air Temperature TI-307 (°F)	Average FID Concentration of Diluted Process Air BV-20
4/29/97	0.055	19	10	-1	1.1	0.65	108	4650
5/7/97	0.07	19	10	10	0.7	0.5	105	9500
5/13/97	0.065	19	10	-1	0.9	0.5	100	4960
5/21/97	0.065	19	10	0	1	0.55	105	2200
5/30/97	0.07	19	10	0	0.8	0.5	115	4490
6/3/97	0.07	19	10		1	0.5	110	6500
6/11/97	0.073	19	10	0	1	0.55	115	3400
6/17/97	0.075	19	10	4	1	0.5	120	432
6/24/97	0.07	18.5	10	0	1.15	0.6	111	1150
6/30/97	0.075	19	10	0	0.8	0.5	116	4100
7/8/97	0.074	18	9.8	0	0.65	0.48	112	4150
7/17/97	0.075	18	9.8	0	0.8	0.6	117	2015
7/23/97	0.07	18	10	0	1.1	0.6	112	1875
7/31/97	0.075	18.5	10	0	0.65	0.5	110	1820
8/6/97	0.075	18	10	0	1	0.6	115	1225
8/13/97	0.07	18.5	10	0	0.8	0.5	107	2215
8/22/97	0.07	18.5	9.8	0	0.8	0.5	108	930
8/27/97	0.07	17.5	10	0	1.3	0.65	107	470
9/6/97	0.07	18	10	0	1.1	0.6	115	700
9/12/97	0.07	17.5	10	0	1	0.6	112	905
9/18/97	0.075	17.5	10	0	1	0.55	121	710
9/25/97	0.07	18	10	0	1.1	0.6	105	640
10/2/97	0.07	18	10	1	1	0.6	103	1240
10/13/97	0.07						102	0
10/23/97		17.5	10	0	1	0.5	106	85
10/29/97		18	10	4.5	0.8	0.5	97	9685
11/7/97		18	9.8	8	0.8	0.55	91	6000
11/13/97		17.5	9.8	8	0.7	0.5	100	7785
11/19/97		18	9.8	18	395	0.5	78	1520
11/28/97		18.5	10	17	0.7	0.5	95	1247.5
12/3/97		18	9.8	16	0.9	0.5	95	975

WEEKLY INSPECTION LOG
WELL MW-20, NAS CORPUS CHRISTI

Date	Motor Valve #	Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well	Vacuum Pressure at Manifold	Vacuum Pressure at PI-6	Vacuum Pressure at PI-7	Differential Pressure of Vapor Stream		Pressure of Vapor Stream		Vapor stream Temp. at TI-2 (°F)	Vapor concentration measured with FID		Burner temperature (°F)	Lower Stack Temperature (°F)
			(in Hg)	(in Hg)	(in Hg)	(in Hg)	GOM-3	GOM-3	GOM-3	GOM-3		min (ppmv bv	max (ppmv bv)		
							min (in H_20)	max (in H_20	min (in H_20)	max (in H_20)					
4/29/97	3	97	16	23	22	22.5	8.5	9.5	0	5.1	104	118,000	125,000	1,414	1,463
5/7/97	3	96	8	21	20	21	13.3	13.3	7.8	16	100	132,000	132,000	1,431	1,415
5/13/97	3	110	13.5	11.5	10	21	1.4	10.5	-11.4	0.2	98	42,700	46,200	1,425	1,411
5/21/97	3	106	8	13.5	14	24	0.9	1.5	-10.8	-7.4	97	20,900	25,700	1,408	1,396
5/30/97	3	110	6	20	15	25	0.8	6.1	-11.2	-6.5	100	66,900	85,300	1,400	1,388
6/3/97	3	104	6	15	14	16.5	13	16	32	33	108	60,000	65,000	1,423	1,434
6/11/97	3	107	6	12	12	24	0	0.6	0.3	1.9	110	160,000	175,000	1,408	1,386
6/17/97	3	96	12	19	18	23	6	6	4	4	119	3,460	3,460	1,409	1,387
6/24/97	3	88	6.5	16.5	13.5	21.5	1.8	2.1	1.8	2.2	132	700	700	1,405	1,382
6/30/97	3	92	5	16	14	19	0	1.2	-9	-8.4	126	2,000	96,000	1,411	1,389
7/8/97	3	93	6	11.5	9.5	10.5	99	101	94	95.5	114	155,000	155,000	1,412	1,449
7/17/97	3	100	12.5	12.5	18	18.5	20.8	21.3	8.7	13.1	110	7,550	9,150	1,410	1,386
7/23/97	3	96	2.5	8	14.5	14.5	18.1	19.2	9.6	12.4	120	119,000	132,360	1,440	1,425
7/31/97	3	104	7	8	10.5	11	88.5	88.5	65.3	65.3	110	105,000	113,000	1,439	1,415
8/6/97	3	104	2.5	8	17	18	16.5	18.3	15.7	18.5	100	52,500	67,850	1,420	1,425
8/13/97	1	108	3.75	6.5	15.5	16	40.4	54.6	36.3	37.5	100	57,500	67,230	1,435	1,418
8/22/97	1	112	2.75	5	5	5	12.6	25.3	20.5	33.1	114	16,600	19,270	1,414	1,388
8/27/97	1	100	5.5	9	8.5	9	88.1	88.1	65.5	65.5	98	14,200	14,200	1,406	1,407
9/6/97	2	110	6	7.5	8.5	9	82	82	121.5	121.5	104	12,300	12,300	1,406	1,383
9/12/97	2	104	5.5	7	8.5	10	82	83.2	69	69.8	100	21,900	22,400	1,406	1,385
9/18/97	2	113	5	6	9	8.5	81.5	81.5	77.5	77.5	109	9,600	9,550	1,410	1,387
9/25/97	2	100	4.5	6.5	8	9	49.5	49.5	138.8	138.8	92	5,370	8,300	1,412	1,389
10/2/97	2	108	6	6	7	8	54.1	54.1	130.3	130.3	100	6130	6,130	1,413	1,389
10/13/97	2	110	0	0	0	0						0	0	1,414	1,406
10/23/97	2	96	18.5	18.75	21.5	23.25	6.9	7.2	23	39	88	5,440	6,550	1,408	1,380
10/29/97	2	98	18	18	21.5	23.5	4.1	4.8	2.8	3.7	74	1,440	1,870	1,408	1,382
11/7/97	2	94	21	21	20	22.5	8.3	8.3	10	10	76	7,300	7,300	1,410	1,385
11/13/97	2	88	15	16.5	19	22	5.6	6.1	12.1	13.3	82	8,890	9,050	1,410	1,384
11/19/97	2	85	16	16	24	22	2.8	3.5	6.5	9.2	63	1,700	2,500	1,411	1,385
11/28/97	2	94	18	14.5	20	20	7.8	7.8	33.8	33.8	83	2,740	3,235	1,408	1,383
12/3/97	2	105	13.5	14.5	19.5	20	6.1	6.8	16.8	17.5	86	3,780	3,970	1,414	1,387

WEEKLY INSPECTION LOG
WELL MW-20, NAS CORPUS CHRISTI

Date	Differential Pressure Diluted Process Air FI-309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_2O)	Vacuum on Process Air PI-302 (in. H_2O)	Pressure on Process Air PI-301 (in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501 (in. H_2O)	Diluted Process Air Temperature TI-307 (°F)	Average FID Concentration of Diluted Process Air BV-20
4/29/97	0.065	20	6.3	1	0.05	0.3	105	15150
5/7/97	0.07	19.5	10	10	0.1	0.3	105	13500
5/13/97	0.065	20	10	-1	0.2	0.3	100	3760
5/21/97	0.065	20	10	0	0.2	0.4	105	1435
5/30/97	0.07	20	10	0	0.2	0.4	115	3280
6/3/97	0.07	20	7	34	0.1	0.3	106	6950
6/11/97	0.075	19	10	0	0.65	0.45	123	3850
6/17/97	0.075	18.5	10.2	-1	1.1	0.6	118	54
6/24/97	0.074	18.1	10	1.5	1.2	0.6	115	205
6/30/97	0.074	19	10	0	0.8	0.5	117	2195
7/8/97	0.085	19	2.4	0	0.05	0.3	111	6615
7/17/97	0.07	17.5	10	0	1.2	0.6	115	135
7/23/97	0.08	19	4.8	0	0.1	0.3	110	5625
7/31/97	0.075	19	8.4	0	0.15	0.3	110	4640
8/6/97	0.075	19	10	0	0.3	0.3	115	3860
8/13/97	0.075	19.5	10	0.5	0.1	0.3	110	3720
8/22/97	0.07	18.5	3	10	0.7	0.5	117	1130
8/27/97	0.07	19	8.4	0	0.15	0.35	107	2925
9/6/97	0.075	19	8.2	40	0.4	0.4	115	1925
9/12/97	0.07	18.5	9	6	0.35	0.4	112	1785
9/18/97	0.075	18.5	9.6	15	0.65	0.45	120	1185
9/25/97	0.07	18.5	9.6	40	0.5	0.4	105	1930
10/2/97	0	18.5	9.6	40	0.6	0.5	102	980
10/13/97	0.07						102	0
10/23/97		17.5	10	0	1.1	0.6	107	525
10/29/97		17.5	10	0	1.2	0.6	97	535
11/7/97		17.5	9.8	5	1.2	0.6	90	500
11/13/97		17.5	9.8	0	1.15	0.55	99	1870
11/19/97		18	9.8	6	1.2	0.55	80	625
11/28/97		18.5	10	15	1	0.6	95	520
12/3/97		18	9.8	17.5	0.9	0.5	95	415

WEEKLY INSPECTION LOG
WELL MW-29, NAS CORPUS CHRISTI

Date	Motor Valve #	Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well	Vacuum Pressure at Manifold	Vacuum Pressure at PI-6	Vacuum Pressure at PI-7	Differential Pressure of Vapor Stream		Pressure of Vapor Stream		Vapor Stream Temp. at TI-2 (°F)	Vapor Concentration Measured with FID		Burner Temperature (°F)	Lower Stack Temperature (°F)
			(in Hg)	(in Hg)	(in Hg)	(in Hg)	GOM-3	GOM-3	GOM-3	GOM-3		min. (ppmv b	max (ppmv bv)		
							min. (in $H_2$0)	max (in $H_2$0	min. (in $H_2$0	max (in $H_2$0)					
4/28/97												60,000	245,000		
5/7/97	2	98	21	19.5	21	21.5	5.8	5.8	11.8	14.9	98	120,000	120,000	1,405	1,410
5/13/97	2	105	21	20	21	22	1.7	3.7	-11.7	-3.2	100	46,000	54,400	1,406	1,410
5/21/97	4	105	18.5	17	18	23.5	0.7	1.2	-9.7	-8.3	92	11,900	13,800	1,401	1,406
5/30/97	4	108	13	12	15	25	1.2	2.5	-9.2	-9.2	98	37,800	49,600	1,417	1,394
6/3/97	4	98	17	16	16.5	20	0	10	-11	7	102	24,700	74,700	1,413	1,390
6/11/97	4	108	11.5	12	13	23	0	1.4	33	37	108	297,000	329,000	1,414	1,391
6/17/97	4	96	15.5	15.5	17	22	6	6	6	6	118	313,000	313,000	1,413	1,389
6/24/97	4	88	6	5.5	6.5	21	2.7	3.3	4.5	4.5	138	17,000	18,500	1,409	1,386
6/30/97	4	102	11.5	8.5	12	19.5	0	1.5	-8	1.2	118	10,000	114,000	1,407	1,381
7/8/97	4	96	15	14	15.5	16	43.5	45.5	30	30.6	117	16,000	17,200	1,407	1,394
7/17/97	4	102	8.5	10	11.5	12.5	29.7	30.3	22.4	23.4	110	3,170	3,230	1,413	1,390
7/23/97	4	96	12	12	12.5	13.5	20.1	21.5	6.4	9.3	120	9,450	10,400	1,407	1,385
7/31/97	4	104	14	14.5	15	16	52.6	52.6	45	45	110	4,980	5,080	1,407	1,387
8/6/97	4	104	16	15.5	16	17	37.5	37.5	29.1	29.1	101	11,500	11,500	1,411	1,392
8/13/97	4	110	15	14.5	15	16	45.5	47	35	35	103	6,150	6,240	1,409	1,387
8/22/97	4	104	9	10	10	11.5	8.7	44.3	0	34.4	104	3,400	3,400	1,414	1,388
8/27/97	4	104	12.5	12	12	13.5	48.3	48.3	31.6	31.6	96	6,150	6,690	1,411	1,388
9/6/97	1	110	10.5	12	12.5	13	52.9	52.9	73.3	73.3	104	6,780	6,780	1,410	1,385
9/12/97	1	106	9.5	9.5	11.5	13	60.2	60.2	48.5	48.5	100	3000	3,250	1,407	1,382
9/18/97	1	106	10	9	11.5	11	57	57	51.7	51.7	120	3,150	6,730	1,408	1,384
9/25/97	1	100	15	14.5	15.5	17	21.9	21.9	48.8	48.8	90	15,600	31,800	1,405	1,390
10/2/97	1	108	12	11.5	12	13	32.5	32.5	70.1	70.1	104	14,300	14,300	1,412	1,392
10/13/97	1	110	0	0	0	0						0	0	1,414	1,406
10/23/97	1	96	21	19	20	22	14.1	14.6	16.9	19.5	90	8,510	8,650	1,414	1,386
10/29/97	1	94	17.5	15	17	18.5	7.8	8.4	21.4	22.8	85	11,800	12,400	1,410	1,385
11/7/97	1	92	21	17.5	19	20.5	11.4	11.4	17.4	17.4	82	37,000	37,000	1,400	1,382
11/13/97	1	91	19	20	21	24	5.8	6.2	7.8	12.4	88	11,800	12,200	1,408	1,380
11/19/97	1	81	18	17	24.5	22	50.8	50.8	8.9	8.9	54	2,570	2,650	1,407	1,385
11/28/97	1	100	18	16	20	20.5	4.6	5.1	14.5	16.8	84	5,700	6,550	1,409	1,383
12/3/97	1	97	18.5	16.5	20	20.5	7.8	8.2	20.5	21.3	90	12,700	13,200	1,414	1,387

WEEKLY INSPECTION LOG
WELL MW-29, NAS CORPUS CHRISTI

Date	Differential Pressure Diluted Process Air FI-309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_20)	Vacuum on Process Air PI-302 (in. H_2O)	Pressure on Process Air PI 301 (in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501 (in. H_2O)	Diluted Process Air Temperature TI-307 (°F)	Average FID Concentration of Diluted Process Air BV-20
4/28/97								
5/7/97	0.07	19	10	10	0.4	0.4	105	11550
5/13/97	0.065	19	10	3	0.5	0.4	105	3420
5/21/97	0.065	19	10	0	0.7	0.5	100	1250
5/30/97	0.06	19	9	0	0.8	0.5	110	2560
6/3/97	0.07	20	10	10	0.2	0.35	108	4150
6/11/97	0.075	19	10	0	0.5	0.5	124	3715
6/17/97	0.075	19	10.2	3	0.6	0.6	119	375
6/24/97	0.07	18.5	10	2	1.2	0.06	112	330
6/30/97	0.073	19	10	3	0.6	0.45	116	2300
7/8/97	0.075	18	9.6	0	0.7	0.5	111	2170
7/17/97	0.08	18	7.8	0	1.4	0.7	115	230
7/23/97	0.075	18.5	10	0	0.75	0.5	113	745
7/31/97	0.075	18	9.8	0	1.1	0.5	112	640
8/6/97	0.075	18.5	9.8	1	0.8	0.5	112	1135
8/13/97	0.07	18.5	10	1	0.9	0.5	105	760
8/22/97	0.07	18	9.8	5	0.9	0.5	110	520
8/27/97	0.07	18	9.6	0	0.85	0.5	107	960
9/6/97	0.075	18.5	9.4	36	0.7	0.5	118	550
9/12/97	0.07	18	9.6	2.5	0.9	0.5	115	420
9/18/97	0.075	18	9.8	10	0.9	0.5	121	860
9/25/97	0.07	19	10	28	0.3	0.4	105	2750
10/2/97	0.065	18.5	10	40	0.4	0.5	100	1780
10/13/97	0.07						102	0
10/23/97		18	9.8	10.5	0.9	0.5	107	960
10/29/97		18	10	22	1.1	0.5	97	3120
11/7/97		18	9.8	15.5	0.45	0.45	95	2360
11/13/97		17.5	9.8	0	1.3	0.6	98	3660
11/19/97		18	9.8	0	0.4	0.45	80	325
11/28/97		18.5	10	15	1	0.5	100	495
12/3/97		18.5	9.8	20	0.9	0.5	95	1285

WEEKLY INSPECTION LOG
WELL MW-21, NAS CORPUS CHRISTI

Date	Motor Valve #	Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well	Vacuum Pressure at Manifold	Vacuum Pressure at PI-6	Vacuum Pressure at PI-7	Differential Pressure of Vapor Stream		Pressure of Vapor Stream		Vapor Stream Temp. at TI-2 (°F)	Vapor Concentration Measured with FID		Burner temperature (°F)	Lower Stack Temperature (°F)
			(in Hg)	(in Hg)	(in Hg)	(in Hg)	GOM-3 min. (in H_2O)	GOM-3 max (in H_2O)	GOM-3 min. (in H_2O	GOM-3 max (in H_2O)		min. (ppmv)	max (ppmv)		
4/28/97												300	30,000		
5/7/97	1	92	22	22.5	22.5	23	0	3.2	-10.6	-3.4	92	750	1,050	1,397	1,409
5/13/97	1	98	22.5	24	22.5	24	0	1.6	-11.7	-9.5	92	1,400	1,680	1,406	1,410
5/21/97	5	103	22.5	21.5	22.5	24.5	0	0	-11.6	-11.4	80	not recorded OVA broke		1,397	1,411
5/30/97	5	106	21	20	20	25	0	0	-0.3	-0.1	102	27,400	33,600	1,408	1,386
6/3/97	5	98	19.5	19	19.5	20	0	6.8	-12	3.8	100	106,000	130,000	1,411	1,386
6/11/97	5	95	17	14	16	23	0	0.9	16	18	110	30,000	36,000	1,411	1,388
6/17/97	5	95	17	15.5	17.5	22	7	7	7	7	119	76,500	76,500	1,410	1,388
6/24/97	5	88	12	9	11.5	20.5	2.2	2.5	2.3	2.6	138	10,400	10,700	1,410	1,385
6/30/97	5	98	12	11.5	14	14	0	0.6	-7.3	-6.9	125	6,700	6,800	1,407	1,385
7/8/97	5	98	17.5	15	16.5	17.5	31	32	19.5	20	120	8,000	8,000	1,409	1,386
7/17/97	5	98	8.5	8.5	8	9	0.5	54.3	0.2	40.3	113	5,300	9,600	1,410	1,385
7/23/97	5	96	14.5	14.5	14.5	15	0	129	0	24.7	115	5,300	98,700	1,423	1,394
7/31/97	5	106	22.5	21	21.5	23	10.3	10.3	1.5	1.5	104	17,700	20,300	1,407	1,385
8/6/97	5	105	23	21.5	22	23.5	14.9	14.9	4.8	5.1	98	13,900	13,900	1,415	1,390
8/13/97	5	110	22.5	21	21	22	5.4	7.2	1.7	3	96	28,200	29,300	1,413	1,388
8/22/97	5	110	19	18	17.5	20	8	42.3	0	26.2	102	1,000	12,390	1,406	1,382
8/27/97	5	104	20	19.5	19.5	21	23.9	24.5	6.5	9.4	94	24,600	25,100	1,410	1,387
9/6/97	5	108	20.5	19	20	21.5	10.9	12.3	10.9	11.6	104	18,500	19,100	1,413	1,388
9/12/97	5	104	19	17.5	18.5	20	9.8	10.7	3.4	4.8	99	30,700	31,100	1,407	1,383
9/18/97	5	108	19	19	20	20.5	8	10.2	3.9	4.8	112	17,800	18,300	1,416	1,389
9/25/97	5	98	19	16.5	17	18.5	16.1	16.1	31.1	31.1	93	9,680	10,400	1,412	1,385
10/2/97	5	112	20.5	19	20	21.5	12.7	13.5	13.5	15.2	97	11,100	13,100	1,407	1,382
10/13/97	5	110	0	0	0	0						0	0	1,414	1,406
10/23/97	5	98	21.25	20	21	22.5	13.5	14.3	14.7	15.3	91	400	460	1,412	1,385
10/29/97	5	98	21	19	20	22	7.6	8.4	18.5	19.5	82	14,000	14,600	1,412	1,386
11/7/97	5	94	20	17.5	21	19	10.6	10.6	18.8	18.8	82	18,500	20,500	1,407	1,382
11/13/97	5	88	21.5	18	20	22.5	7.3	7.9	18.8	19.9	89	15,200	16,900	1,412	1,386
11/19/97	5	82	19.5	16	23	21	0	1.8	6.8	7.8	60	1,570	1,650	1,408	1,382
11/28/97	5	96	18.5	15.5	19	19	7.3	7.8	35.6	35.6	84	1,885	2,050	1,407	1,382
12/3/97	5	92	16.5	15	19	19.5	8	8.8	28	28.4		2,200	2,450	1,410	1,384

WEEKLY INSPECTION LOG
WELL MW-21, NAS CORPUS CHRISTI

Date	Differential Pressure Diluted Process Air FI-309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_20)	Vacuum on Process Air PI-302 (in. H_2O)	Pressure on Process Air PI 301 (in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501 (in. H_2O)	Diluted Process Air Temperature TI-307 (°F)	Average FID Concentration of Diluted Process Air BV-20
4/28/97								
5/7/97	0.07	18	10	10	1.4	0.6	105	620
5/13/97	0.065	18.5	10	-1	1	0.6	104	405
5/21/97	0.065	18.5	10	0	1.1	0.6	100	
5/30/97	0.075	19	8.3	0	1.3	0.6	115	1615
6/3/97	0.07	19	10	0	1	0.5	107	3500
6/11/97	0.075	19	10	0	1.3	0.6	123	1800
6/17/97	0.075	19	10.2	1	1.1	0.6	119	210
6/24/97	0.07	18.5	10	2	1.2	0.6	112	200
6/30/97	0.071	18.5	10	0	1.1	0.6	115	365
7/8/97	0.075	18	9.8	0	1.1	0.65	114	1170
7/17/97	0.075	18	8	0	1.2	0.65	115	700
7/23/97	0.07	18.5	10	0	1	0.6	110	2330
7/31/97	0.07	18.5	10	0	0.8	0.5	112	1210
8/6/97	0.07	18	10	0	1.2	0.6	112	1135
8/13/97	0.07	18	10	0	1.1	0.6	105	940
8/22/97	0.07	18	10	0	0.9	0.5	110	825
8/27/97	0.07	18	10	0	1	0.6	105	3005
9/6/97	0.07	18.5	10	1	0.8	0.5	115	1430
9/12/97	0.07	18.5	10	0	0.8	0.5	110	2150
9/18/97	0.075	18.5	10	0	0.9	0.5	122	1765
9/25/97	0.07	18	10	0	1.3	0.6	105	935
10/2/97	0.065	18	10	0	1	0.6	105	1810
10/13/97	0.07						102	0
10/23/97		17.5	10	0	1.4	0.6	106	65
10/29/97		18	10	11	1.15	0.5	97	1900
11/7/97		18	9.8	9	1	0.55	92	2150
11/13/97		17.5	9.8	4	0.8	0.5	99	4410
11/19/97		18	9.8	0	1.2	0.6	77	215
11/28/97		18	10	25	1.1	0.6	97	437.5
12/3/97		18	10	25	1.3	0.6	92	660

ALARM LOG
NAS CORPUS CHRISTI

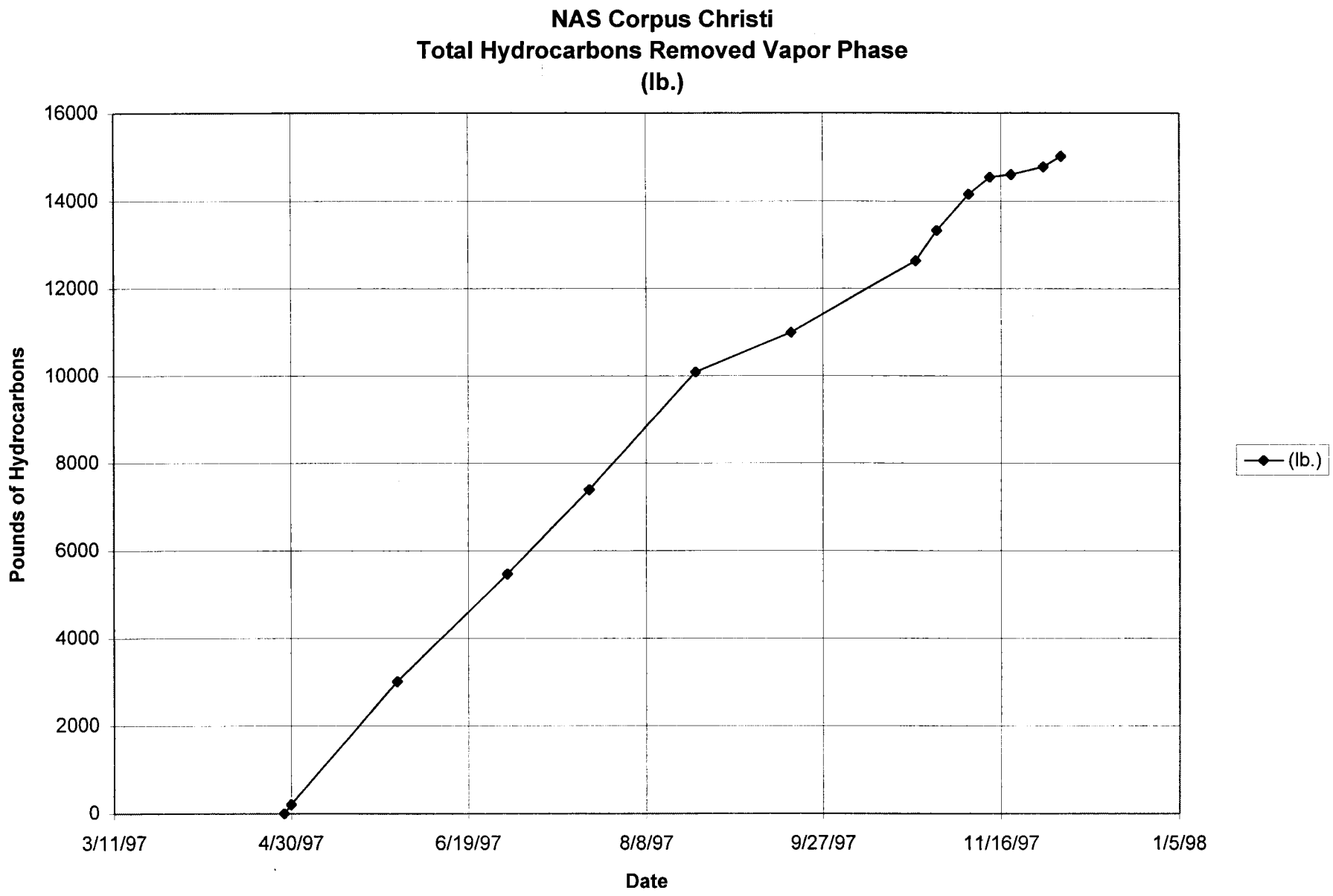
Alarm Date time	Site Arrival Date time	Response time Hours	Alarm Cause	Action Taken Summary
	4/24/97 16:15			Installed replacement float switch in T-2, program problem
	4/25/97 10:00			Reloaded PLC program, system running. Adjusted ambient air to MW-26 to prevent high temp; level control in T-2 not operating system shut down.
	4/28/97 12:40			Rewired level switch in T-2; operating only on level control, temporarily corrected problem. 14:23 system started.
	4/29/97 11:30			Checking operating efficiency; system high temp alarm while on site on MW-26 at full vacuum. At 10 inches Hg no high temp, 16:50 system in automatic.
	4/30/97 9:40			On site to check system, LRVP breaker tripped. Rewired T-2 to allow operation of both temperature and level switch. T-ox high temp while on site. Adjusted vacuum to 8-10 in. Hg at MW-26 11:05 system on.
4/30/97 13:25	4/30/97 14:10	0.75	LSHH-2 high level T-2	Increased flow of water from T-2 to T-1 at FI/FC-2. Flow increased to remove more hot water from T-2, more potable water is used, flow set at 0.9 to 1.0 gpm.
4/30/97 17:15	4/30/97 18:35	1.33	LSHH-5 high level T-6	Unable to restart system until Tank T-6 is emptied. John Young notified
	5/1/97 9:35			John Young emptied Tank T-6, restarted system after 2,700 gallons was removed from T-6
5/1/97 no alarm call	5/1/97 16:30		System checked to verify operation, LRVP circuit breaker tripped	The system was restarted; the problem was believed to have been caused by excessive back pressure; the back pressure on LRVP was reduced to 5.5 psi. The system was restarted.
5/2/97 no alarm call recorded alarm estimated at 23:00	5/2/97 9:30		System checked to verify operation; the system had shut down due to high temperature in the thermal oxidizer.	The inlet flow to the thermal oxidizer was adjusted, and the leaking motor valves were repaired. The leaking motor valves were allowing vapor to be pulled from multiple wells. The system was restarted.
5/3/97 no alarm call	5/3/97 10:30		System checked to verify operation, LRVP circuit breaker tripped	The system was restarted; the problem was believed to have been caused by excessive back pressure; the back pressure on LRVP was reduced. The system was restarted.
5/4/97 no alarm call recorded	5/4/97 9:00		System checked to verify operation; LRVP circuit breaker tripped, and LSHH-2 high level in T-2.	The system was restarted and operated manually; T-6 tank filled during manual operation and shut down system.
	5/5/97 11:40		Restart after T-6 was emptied.	3600 gallons removed from T-6. System restarted; the flow from T-2 to T-1 was adjusted to 0.75 gpm. Manually operated on MW-26, high temperature shut down, adjusted vacuum pressure at well MW-26 to 9-10 inches Hg; system operated; dial out tested
5/5/97 15:39	5/6/97 10:45	19.10	The system was still operating; the alarm was caused by low temperature in thermal oxidizer. LRVP temporarily shuts off until T-ox returns to temp, automatically restarts. (nuisance alarm)	System was operating, adjustments were made to reduce the possibility of high temp alarm on T-ox. The drop tube at MW-26 was raised by 36 inches; vacuum was reduced to 8-10 inches of Hg.
5/7/97 21:40	5/8/97 10:40	13.00	The system was still operating, the alarm was caused by low temperature in thermal oxidizer, LRVP temporarily shuts off until T-ox returns to temp, automatically restarts. (nuisance alarm)	Recommended modifications to PLC, programmer contacted to eliminate call out on low temperature which restarts itself.
5/8/97 5:17	5/8/97 10:40	5.38		
5/8/97 15:16	5/9/97 10:15	18.98	LSHH-1 high level in T-1	The submersible pump in T-1 was not operating properly; a service technician was called to service the pump 5/10/97.
	5/10/97 11:45		System still down due to T-1.	The submersible pump in T-1 was removed; the tank was filled (approx. 25 gallons) with sediment preventing the pump from operating. A vacuum truck was determined to be necessary to clean out T-1. A vacuum truck will be contacted Monday 5/12/97.
	5/12/97 10:10		System still down due to T-1.	Modifications were made to the PLC: prevent alarm call outs on low temperature (auto reset), added an alarm call out if the LRVP circuit breaker trips, and modified the cycle times for the wells complete cycle 8 hours, wells 3, 2, 1.5, 0.75, 0.75 hr.
				A delay was added of 60 sec. before LRVP shut down on low temperature. The low temp shut down set point was changed from 1395 to 1360F.
	5/13/97 10:20		System still down due to T-1.	Pumped out T-1 with vacuum truck, approx. 20-30 gal. sediment and 20-35 gal. liquid was removed and placed into drums. Pump was reinstalled and system restarted.
5/15/97 6:40	5/15/97 9:00	2.33	LSHH-5 high level T-6	System was restarted after T-6 was pumped out. FI/FC-2 was adjusted to 0.5 gpm from 0.65 gpm to reduce the use of potable water.
5/15/97 11:31	5/15/97 13:50	2.32	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.6 gpm from 0.5 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/15/97 15:03	5/16/97 9:30	18.45	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.75 gpm from 0.6 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/16/97 14:29	5/16/97 15:00	0.52	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.9 gpm from 0.75 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/18/97 10:10	5/19/97 9:50	23.67	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 1.0 gpm from 0.9 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/19/97 22:35	5/20/97 14:30	15.92	LSHH-5 high level T-6	500 gal. water pumped out of T-6 by John Young. System restarted. Leaks in motor valves were also repaired. Hoses switched set as follows: MV-1--MW-26, MV-2--MW-13, MV-3--MW-20, MV-4--MW-29, MV-5--MW-21.

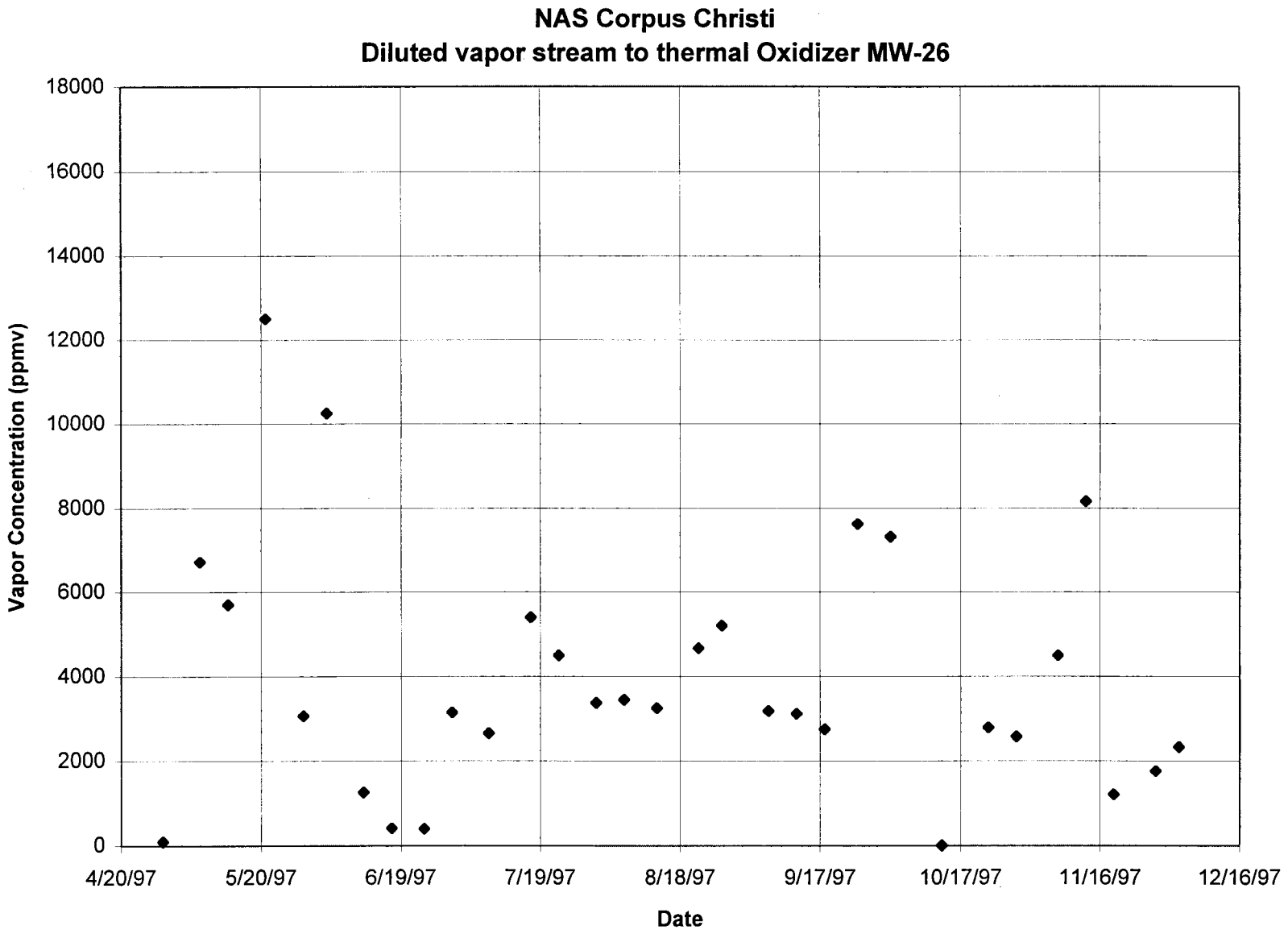
ALARM LOG
NAS CORPUS CHRISTI

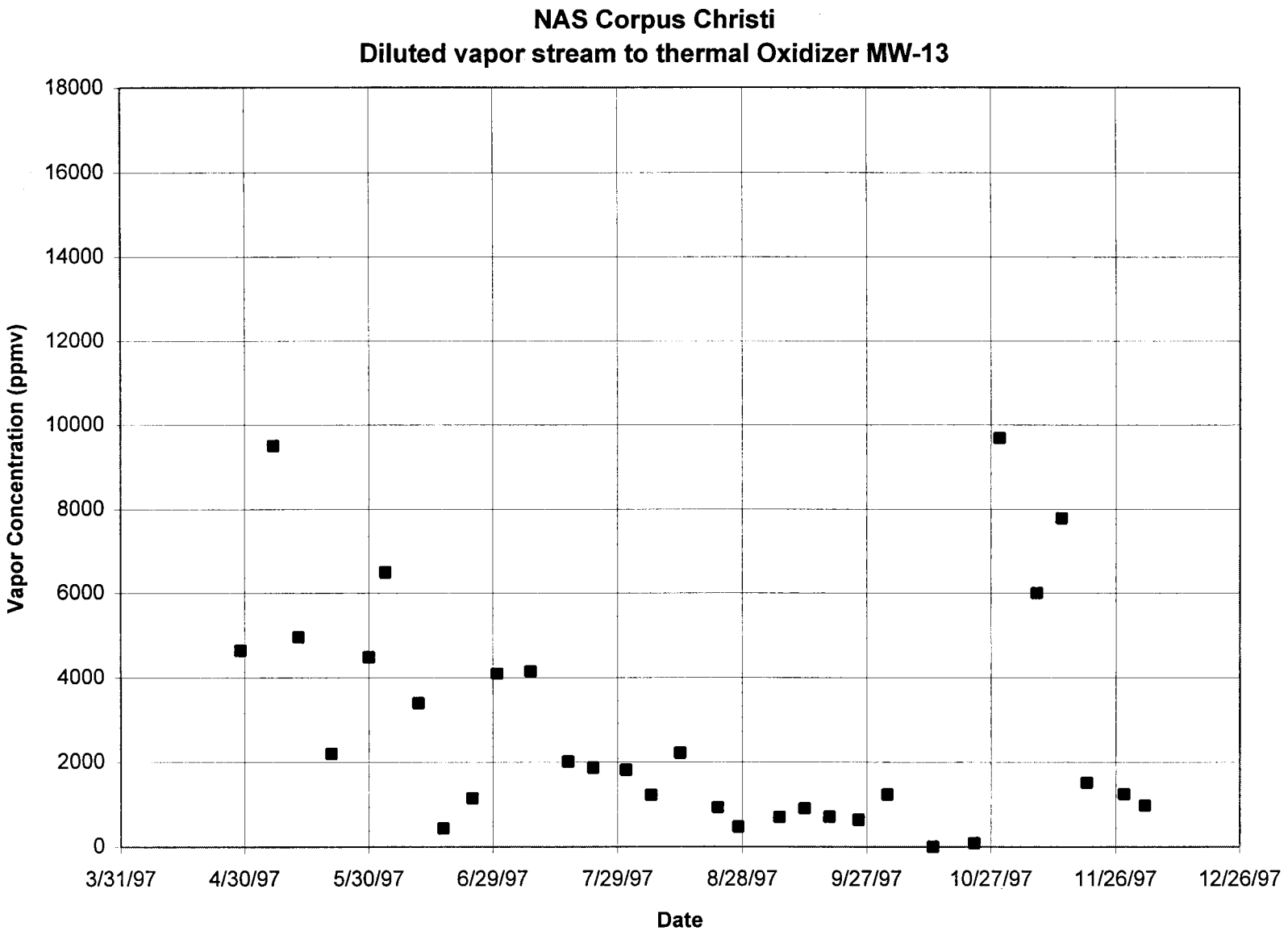
Alarm	Site Arrival	Response time	Alarm Cause	Action Taken Summary
Date time	Date time	Hours		
5/21/97 0:10	5/21/97 11:20	11.17	LSHH-5 high level T-6	2700 gal. water pumped out of T-6 by John Young. System restarted. All wells operated manually; samples collected.
5/23/97 19:55	5/24/97 11:10	15.25	LSHH-1 blinking thermal oxidizer control fault	Cause was suspected of being storm-related; system was restarted and operated properly
5/24/97 18:45	5/26/97 13:00	42.25	At site to check system, LSHH-1 blinking, thermal oxidizer alarm, control fault, unknown cause. 5/24/97 18:45 alarm call not received time estimated from chart	System was restarted, monitored for 1 hour and running fine. LRVP sediment filter cleaned.
5/26/97 14:15	5/27/97 15:30	25.25	At site to check system, LSHH-1 blinking, thermal oxidizer alarm, control fault, unknown cause.	Checked amp draw and fuses; concern over possible lightening damage. PLC program problems suspected, not cause of problem. 16:40 system started operating properly.
5/28/97 11:15	5/28/97 16:15	5.00	At site to check system, LSHH-1 blinking, thermal oxidizer alarm, flame failure control fault.	Contacted ThermTech; oxidizer indicated flame failure. Cleaned UV scanner and restarted oxidizer only. Removed drop tubes for quarterly monitoring of wells.
5/28/97 20:02	5/29/97 11:45	15.72	At site to check system, LSHH-1 blinking, thermal oxidizer alarm, flame failure control fault.	Contacted ThermTech; ThermTech recommended adjusting fuel flow. Restarted system, high temp alarm, adjusted flow restarted and operated.
5/30/97 11:30	5/30/97 11:30	0.00	On-site for maintenance, thermal oxidizer shut down flame failure again.	Contacted ThermTech again; ThermTech suggested checking for water in line leading to thermal oxidizer. Approximately 0.5 gallons of water was drained from line. System restarted 12:25.
5/30/97 13:20	5/30/97 13:20	0.00	LSHH-3 T-4 product tank full	While on site at 13:20, the LSHH-3 alarm indicating full product tank shut system down; John Young emptied tank. System was restarted 14:00, oil skimmer level adjusted, flow rate into tank adjusted, and weekly maintenance completed.
5/31/97 11:15	5/31/97 20:00	8.75	LSHH-3 T-4 product tank full	Oil water skimmer was adjusted 5/30; further adjusted skimmer and pump in T-1 flow rate.
6/1/97 0:00	6/2/97 13:45	37.75	LSHH-3 T-4 product tank full	Water pumped out of T-4 to T-5, increased pressure at valve from T-1 to separator to slow flow rate from 40 to 60 psi.
6/2/97 19:15	6/3/97 12:05	16.83	High temp shut down thermal oxidizer	
6/7/97 0:05	6/7/97 10:40	10.58	LSHH-6 high sump level	Pumped down sump, caused by heavy storm
6/7/97 18:30	6/8/97 8:10	13.67	High temp shut down thermal oxidizer	Adjusted BFV-1
6/8/97 20:28	6/9/97 10:30	14.03	High level alarm in T-2	Restarted system, appears to be intermittent problem with level switch
6/10/97 8:16	6/10/97 9:00	0.73	High level alarm in T-2	Removed LSL/H-5, switch internal broken, switch replaced
6/11/97 18:07	6/12/97 9:00	14.88	Circuit breaker tripped for LRVP	The P-1 pump had become unscrewed causing T-1 to overfill. The ambient valve opened to allow the pump to catch up, as a result the LRVP circuit breaker tripped. Pump was reattached, locktite was used. A throttle valve was installed on ambient valve.
6/23/97 16:00	6/24/97 10:00	18.00	Oxidizer control fault alarm, probable cause due to water into oxidizer	Cause appears to have been moisture, possibly free product into T-ox. Line drained and restarted
6/29/97 20:55	6/30/97 13:10	16.25	Oxidizer control fault alarm, probable cause due to water into oxidizer	Adjusted water level in T-6 to control flow into LRVP. Low level results in low flow and higher temperatures, therefore more water carries over.
7/3/97 21:59	7/4/97 12:45	14.77	Thermal oxidizer shut down due to liquid carry over to the thermal oxidizer	Water drained, LRVP would not restart, acid washed to remove scale
7/6/97 6:00	7/7/97 15:15	33.25	T-6 full	System restarted after NAS emptied tank
7/8/97 17:33	7/9/97 12:05	18.53	LRVP amp overload	Restarted system
7/10/97 11:32	7/10/97 13:00	1.47	LRVP amp overload	Adjusted flow into LRVP from 3 gpm to 2 gpm, restarted system
7/12/97 16:11	7/13/97 10:30	18.32	T-6 full	Called base environmental no response. Contacted ROICC, instructed to wait until tank is verified emptied.
	7/16/97 14:00			Received word that the T-6 tank was empty, restarted the system.
7/29/97 13:45	7/29/97 14:45	1.00	Filter clogged, no vacuum	Filter changed, LRVP restarted
8/2/97 1:10	8/3/97 10:00	32.83	Thermal oxidizer high temp, MW-20	System restarted, closed valve partially observed system while on MW-20
8/13/97 20:38	8/14/97 10:40	14.03	LRVP circuit breaker tripped,	Restarted system, high temp occurred, adjusted GV-1 to more closed position
8/14/97 14:13	8/14/97 16:15	2.03	LRVP circuit breaker tripped,	Restarted system, water flow into LRVP was reduced, a flow rotometer was ordered to better monitor water flow.
8/14/97 17:20	8/15/97 13:05	19.75	Thermal oxidizer high temp, MW-20	System restarted, closed valve partially observed system while on MW-20, LRVP amps checked, continued to read high, LRVP will probably require thorough cleaning, air temp leaving LRVP high resulting from reduced water flow because of scale buildup..
8/20/97 1:53	8/20/97 10:30	8.62	LRVP circuit breaker tripped,	LRVP completely disassembled and cleaned, all scale removed. Flow meter also installed to better control flow through LRVP.
	8/21/97 9:00			Completed installation of flow meter, system restarted.
8/23/97 9:30	8/25/97 16:20	54.83	High level in T-2 tank, LSHH-2, LSH/LSL-5 not operating	Loose part removed from level switch and system restarted
8/25/97 22:00	8/26/97 12:00	14.00		
8/26/97 21:51	8/27/97 16:00	18.15	Continued problem with T-2 level switch, new switch ordered	System restarted
8/30/97 9:53	9/2/97 10:45	72.87	High temperature alarm in oxidizer	Well vacuum adjusted, system restarted
9/2/97 17:33	9/3/97 11:15	17.70	High temperature alarm in oxidizer	Moved well 29 to MV-1, restarted system, monitored through cycle

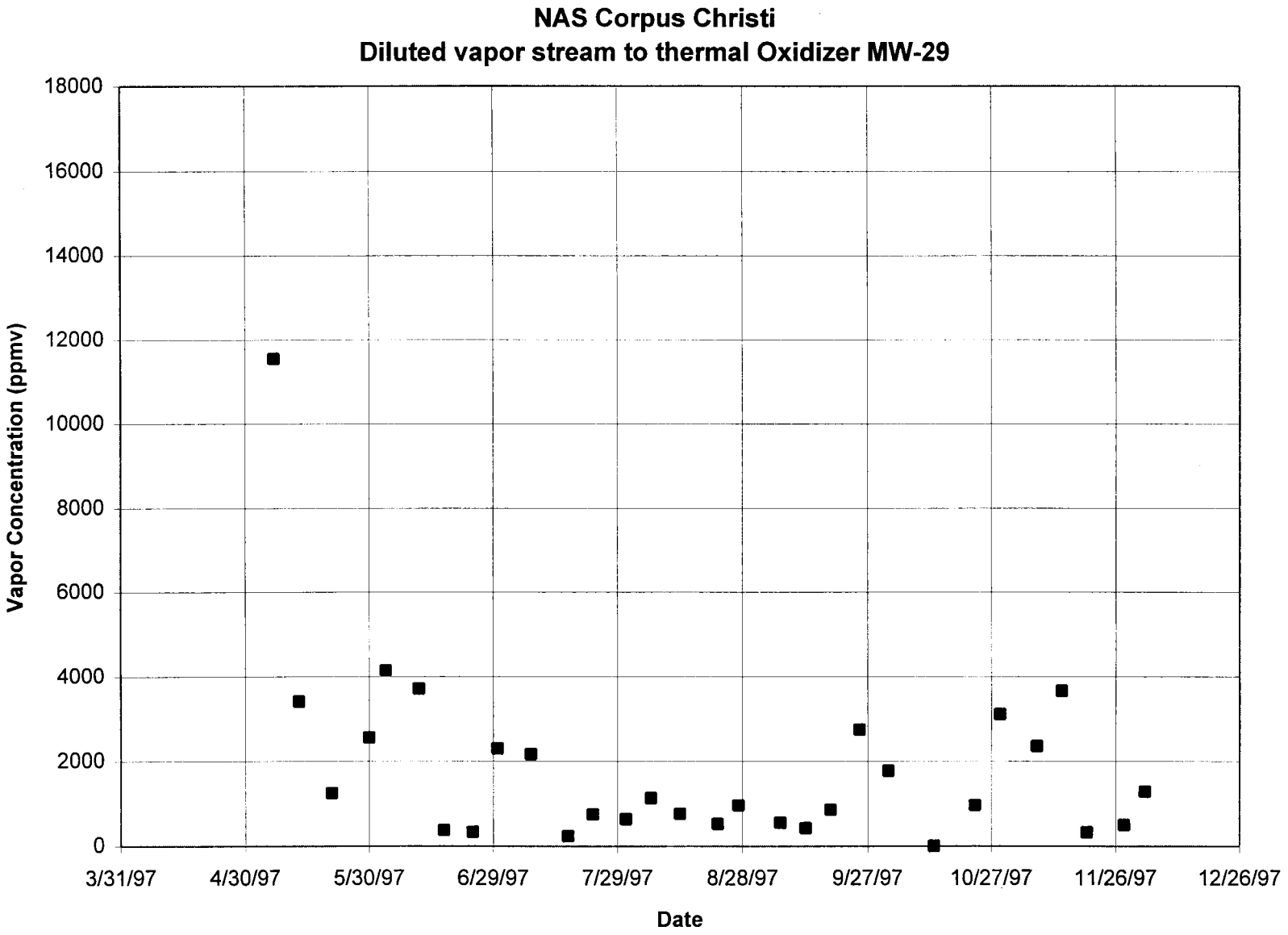
ALARM LOG
NAS CORPUS CHRISTI

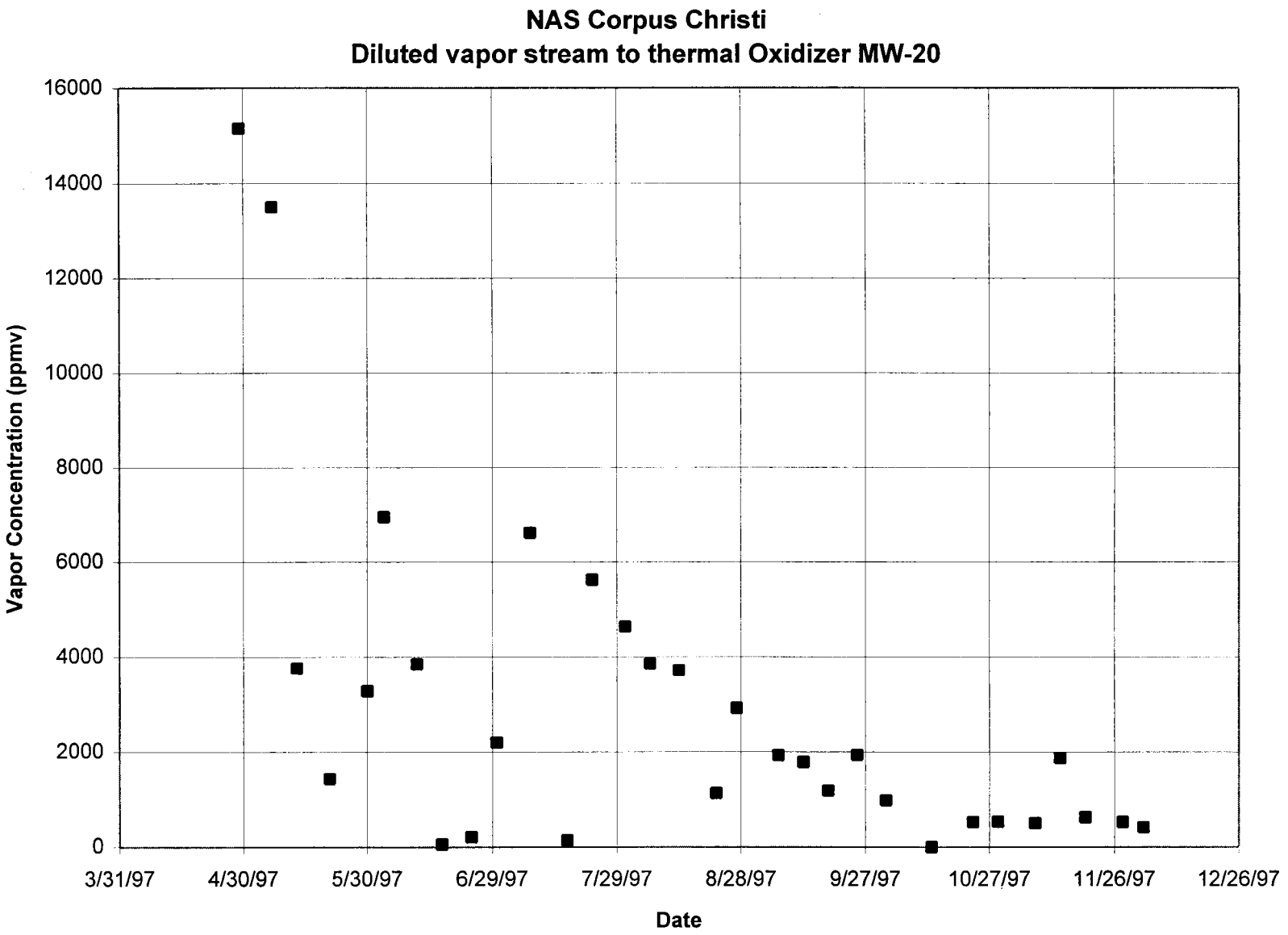
Alarm Date time	Site Arrival Date time	Response time Hours	Alarm Cause	Action Taken Summary
9/4/97 20:08	9/5/97 10:00	13.87	LSHH-1 high level alarm in T-1 tank and LSHH-2 high level alarm in T-2 tank	LSHH 1 and 2 alarm, caused by damaged wire on float switch in T-1 tank, wire fixed system restarted.
9/7/97 13:53	9/7/97 15:00	1.12	LSHH-2 high level alarm in T-2 tank	LSHH-2, level switch problem in T-2 tank, switch replaced with temporary replacement
9/7/97 22:54	9/8/97 12:00	13.10	LSHH-2 high level alarm in T-2 tank	LSHH-2 inspected level switch in T-2, all seemed operational, restarted system, continued monitoring.
9/9/97 14:38	9/10/97 9:30	18.87	LSHH-2 high level alarm in T-2 tank	LSHH-2 inspected level switch in T-2, all seemed operational, restarted system, continued monitoring. Temp. switch suspected of causing problems.
9/16/97 21:53	9/17/97 10:30	12.62	LSHH-2 high level alarm in T-2 tank	Temperature switch determined to be causing part of problem, Temp. switch removed from circuit, level switch was intended to replace temperature switch. Replacement level switch specified.
9/22/97 1:17	9/22/97 11:30	10.22	Power outage	System restarted
9/23/97 16:00	9/24/97 11:30	19.50	Power outage	System restarted
9/26/97 5:30	9/26/97 9:00	3.50	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
9/30/97 7:30	9/30/97 10:30	3.00	LSHH-1 tank T-1 full.	P-1 pump flow blocked, blockage cleared and system restarted.
9/30/97 14:39	9/30/97 17:20	2.68	LSHH-2 alarm, tank T-2 full	Cause of problem unknown at time, system restarted. Subsequently, the relay board which controls the level switches was replaced for other problems and may have been cause. (see notes 10/14/97)
10/5/97 8:57	10/6/97 8:45	23.80	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, system left off for moisture separator installation
10/14/97 20:25	10/15/97 9:20	12.92	LSHH-2 alarm, tank T-2 full	Problem also detected with sump probes while trouble shooting. Relay board replaced. Wiring from sump probes and LSHH-2 were to the same relay board that was determined to be bad.
10/16/97 5:49	10/16/97 9.15	3.43	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
	10/17/97 11:00			Replaced relay board.
11/4/97 11:55	11/5/97 11:40	23.75	T-4 full	NAS Corpus emptied tank, AES restarted system
11/8/97 4:20	11/8/97 9:25	5 08	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
11/11/97 9:20	11/11/97 9:20	0.00	P-1 pump required replacement system down for 48.25 hours	Replaced impellers to P-1 pump.
11/14/97 12:30	11/14/97 13:00	0.50	System down due to low Natural gas pressure.	NAS Corpus Christi working on Natural gas line. System left off at Navy direction.
	11/17/97 9:00			Natural gas was restored by NAS Corpus, AES restarted system
11/21/97 23:48	11/22/97 13:10	13.37		
12/3/97 23:14	12/4/97 12:05	12.85	LSHH-3, high level alarm in T-4, product tank	Pumped water out of product tank back into T-1 tank to be reprocessed by system. Adjusted flow rate from T-1 tank to reduce flow into T-4 tank. Restarted system
12/5/97 18:28	12/6/97 11:30	17.03	LSHH-3, high level alarm in T-4, product tank	Pumped out oil water separator, cleaned unit, refilled oil water separator and restarted system.

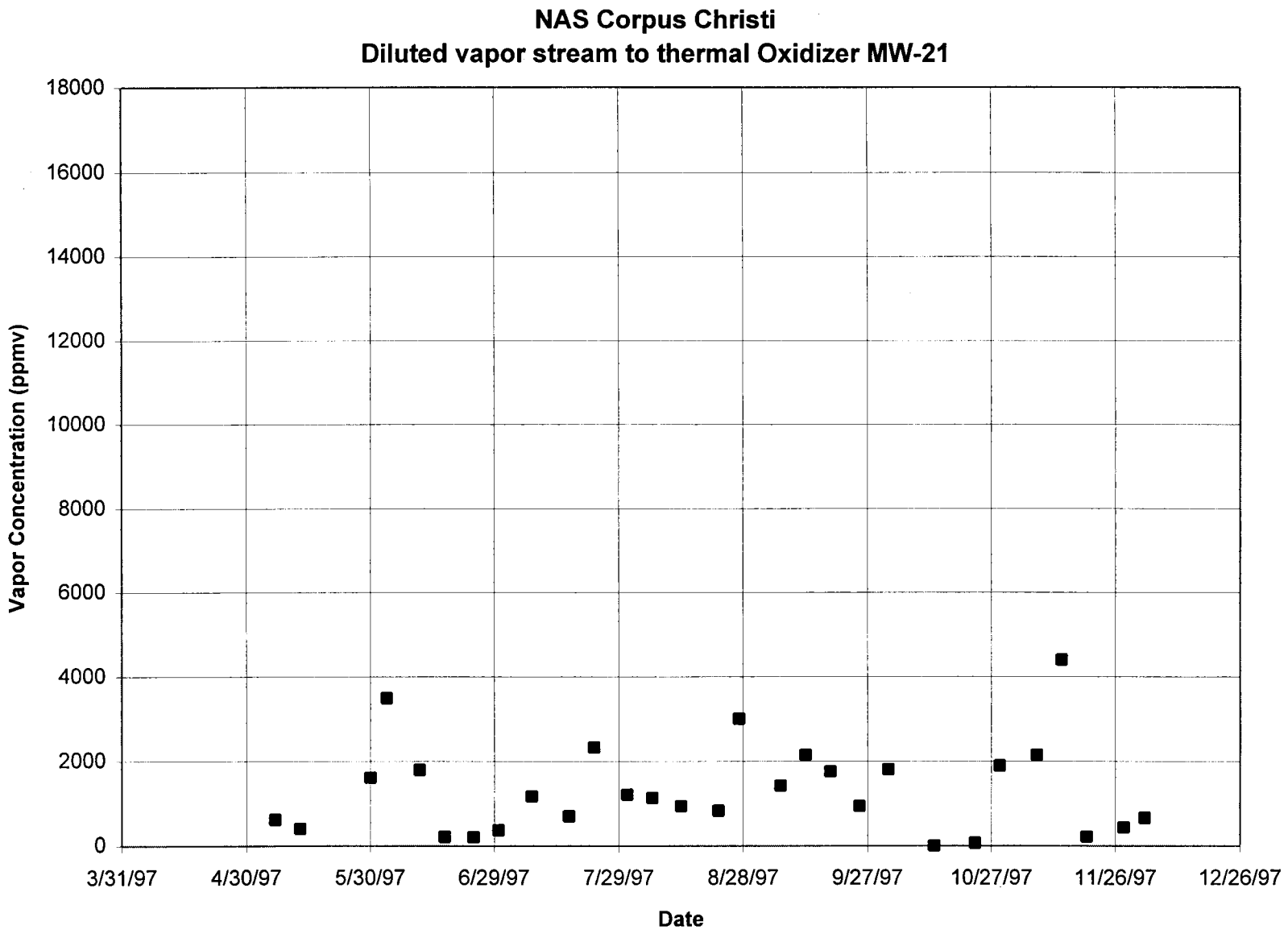

NAS Corpus Christi
Total Hydrocarbons Removed Vapor Phase
(lb.)
16000
14000
12000
10000
8000
6000
4000
2000
0
Pounds of Hydrocarbons
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
(lb.)


NAS Corpus Christi
Diluted vapor stream to thermal Oxidizer MW-26
Vapor Concentration (ppmv)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
4/20/97
5/20/97
6/19/97
7/19/97
8/18/97
9/17/97
10/17/97
11/16/97
12/16/97
Date

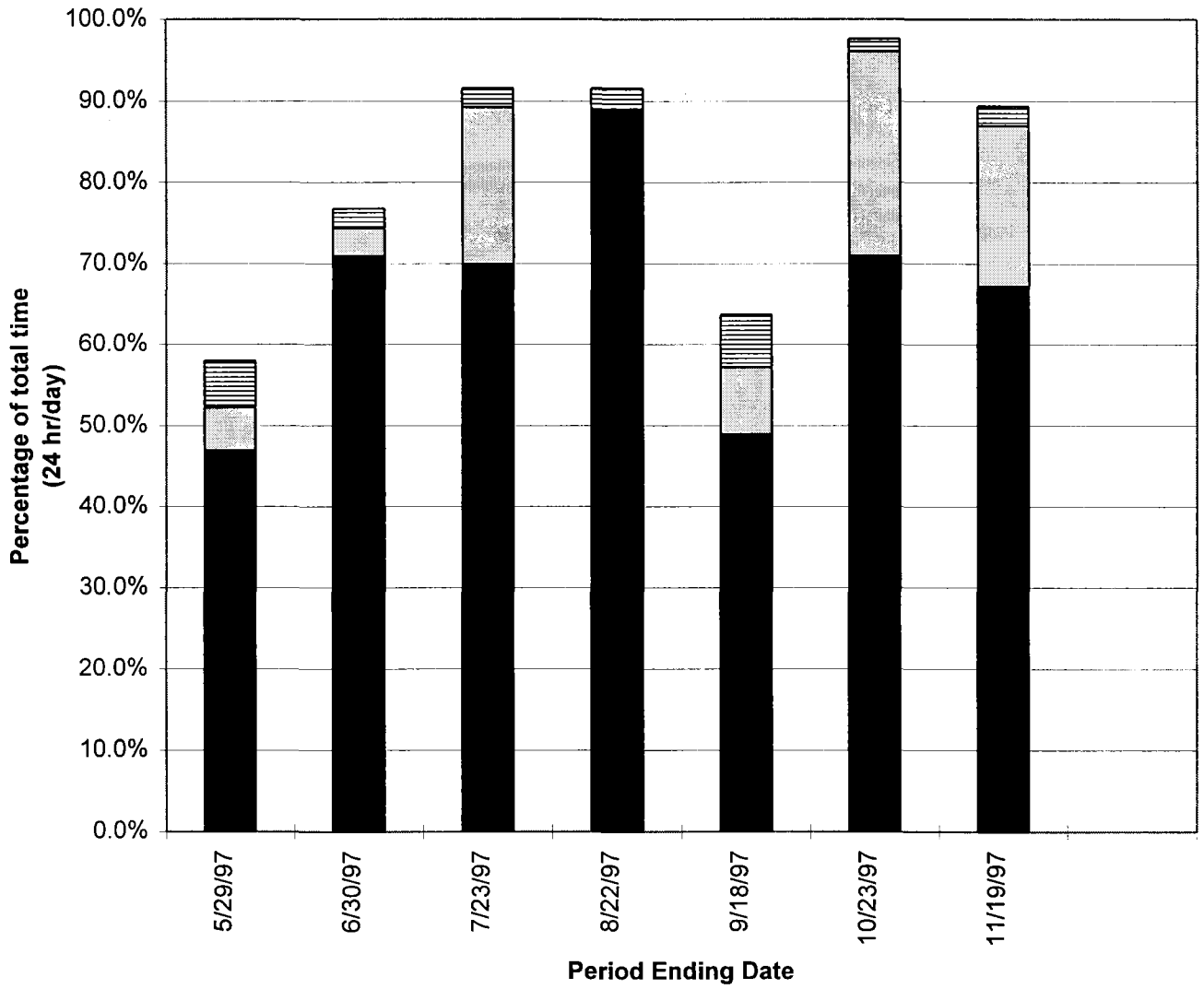

NAS Corpus Christi
Diluted vapor stream to thermal Oxidizer MW-13
Vapor Concentration (ppmv)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
3/31/97
4/30/97
5/30/97
6/29/97
7/29/97
8/28/97
9/27/97
10/27/97
11/26/97
12/26/97
Date


NAS Corpus Christi
Diluted vapor stream to thermal Oxidizer MW-29
Vapor Concentration (ppmv)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
3/31/97
4/30/97
5/30/97
6/29/97
7/29/97
8/28/97
9/27/97
10/27/97
11/26/97
12/26/97
Date


NAS Corpus Christi
Diluted vapor stream to thermal Oxidizer MW-20
Vapor Concentration (ppmv)
16000
14000
12000
10000
8000
6000
4000
2000
0
3/31/97
4/30/97
5/30/97
6/29/97
7/29/97
8/28/97
9/27/97
10/27/97
11/26/97
12/26/97
Date

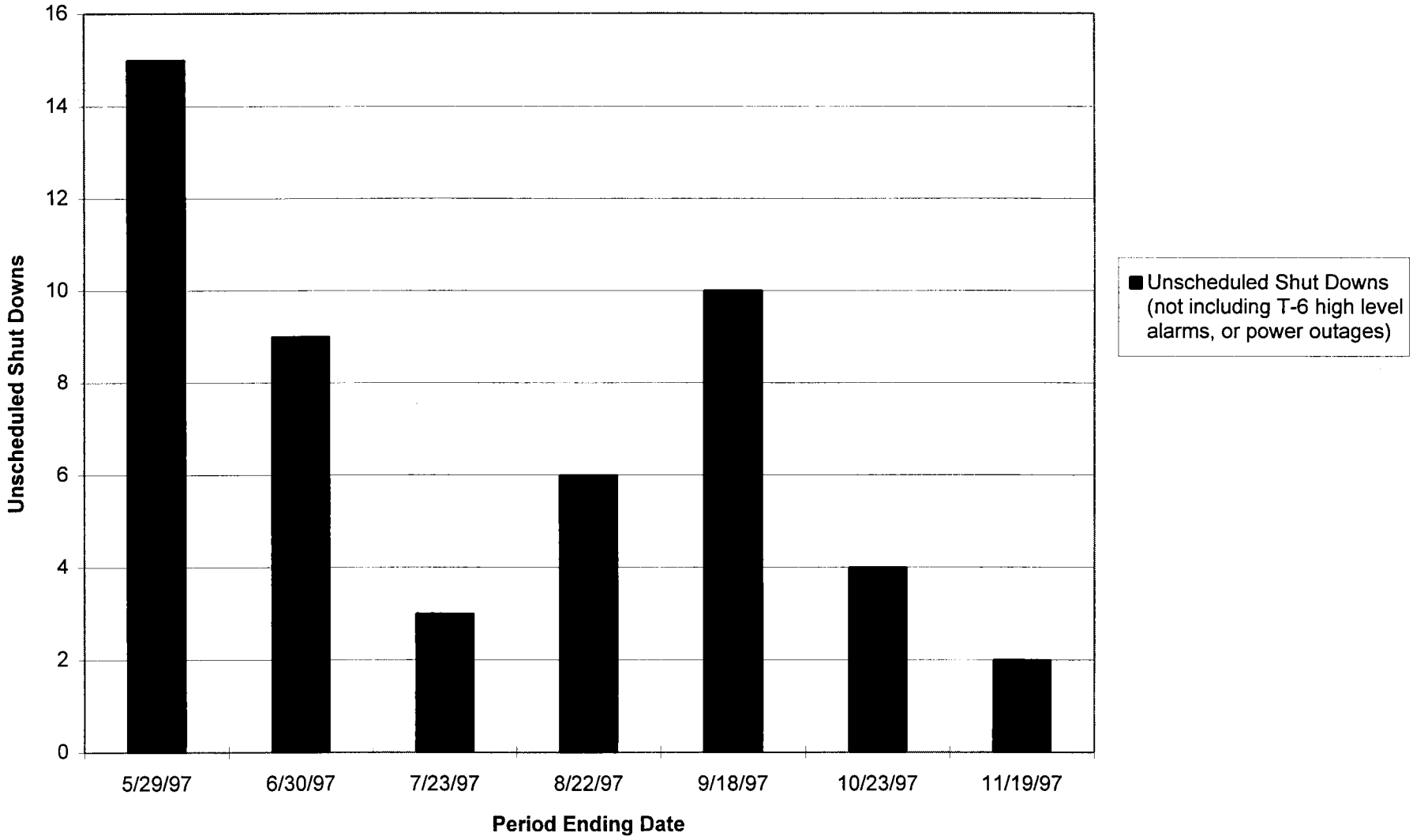

NAS Corpus Christi
Diluted vapor stream to thermal Oxidizer MW-21
Vapor Concentration (ppmv)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
3/31/97
4/30/97
5/30/97
6/29/97
7/29/97
8/28/97
9/27/97
10/27/97
11/26/97
12/26/97
Date

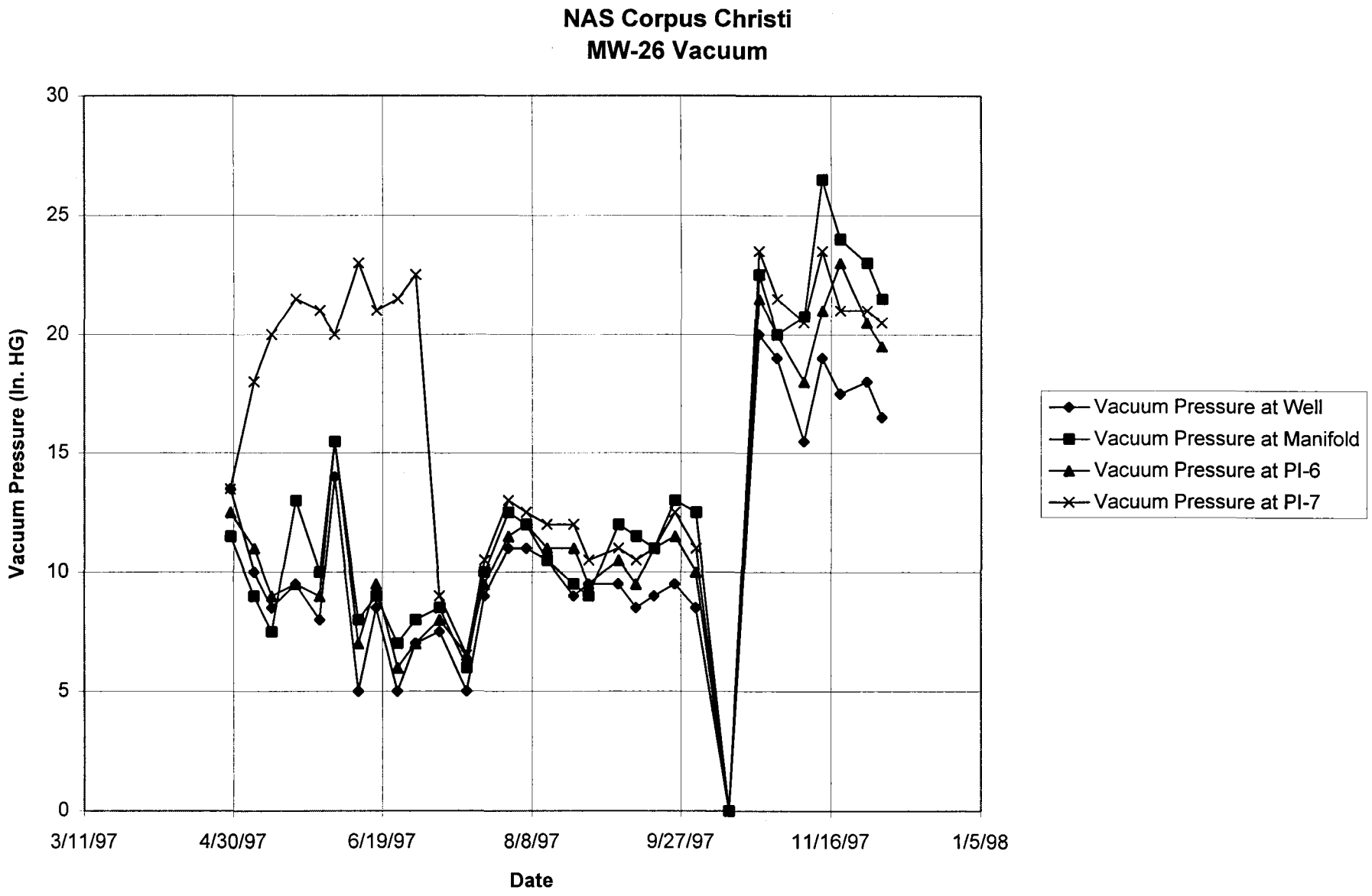
NAS Corpus Christi
System Operation

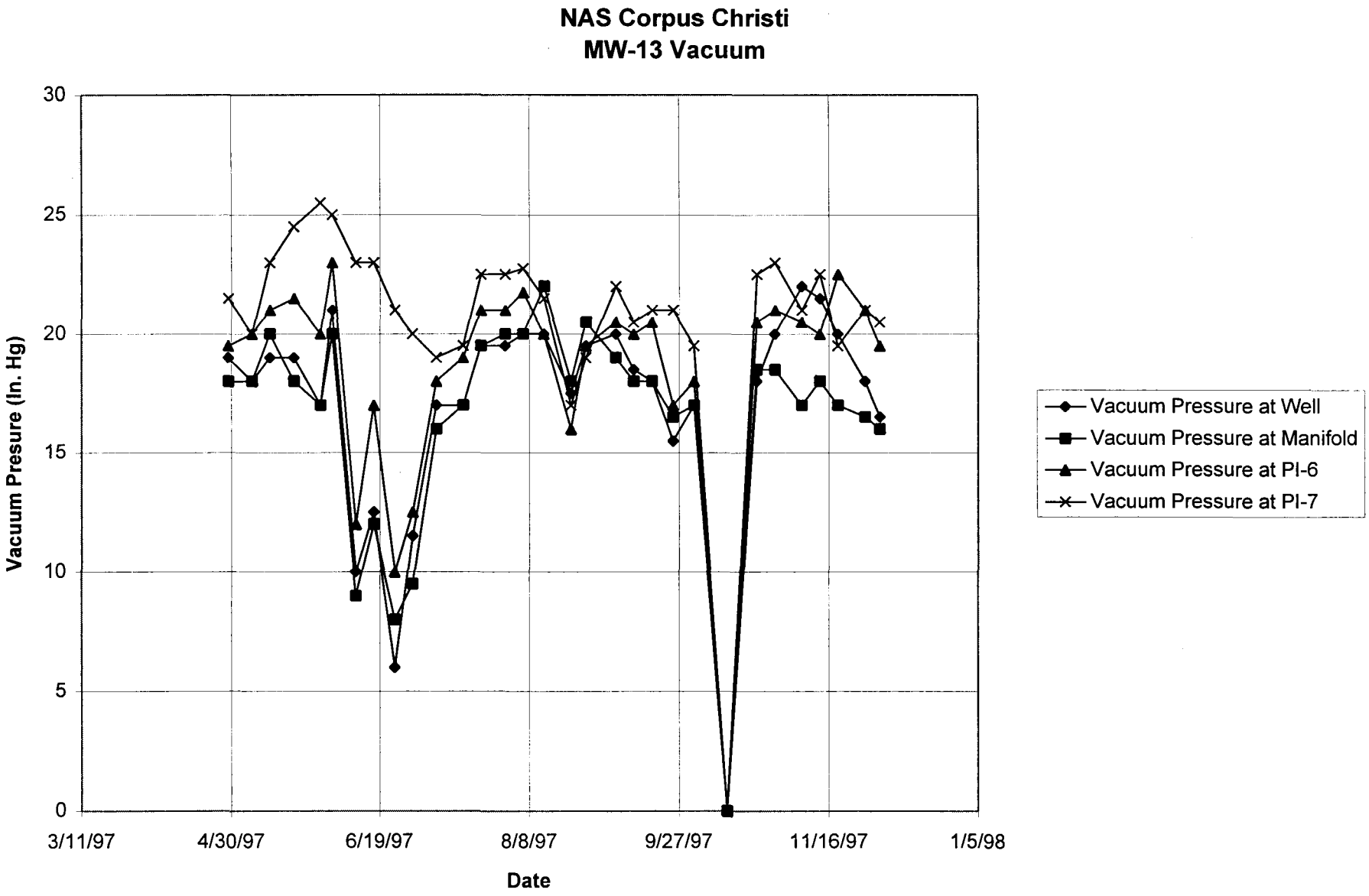


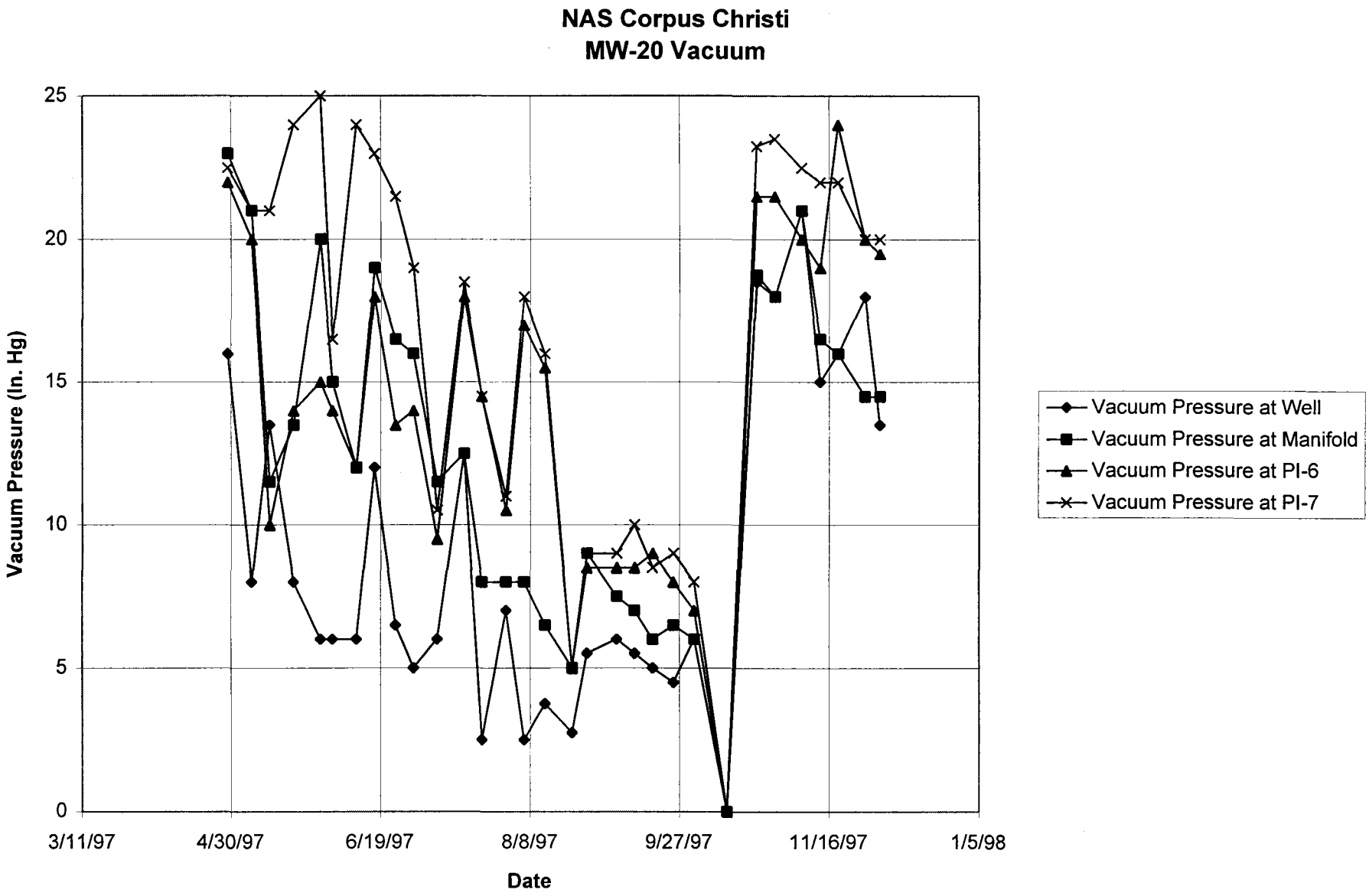
Note:
Operating percentage based on actual thermal oxidizer operation. Non-Maintenance shut downs consist of Shutdowns due to tank T-6 being full, power outages, equipment installations, or other shutdowns at the Navy's request. Scheduled maintenance is based on estimated time to complete. Percentage not accounted for represents unscheduled shut downs.

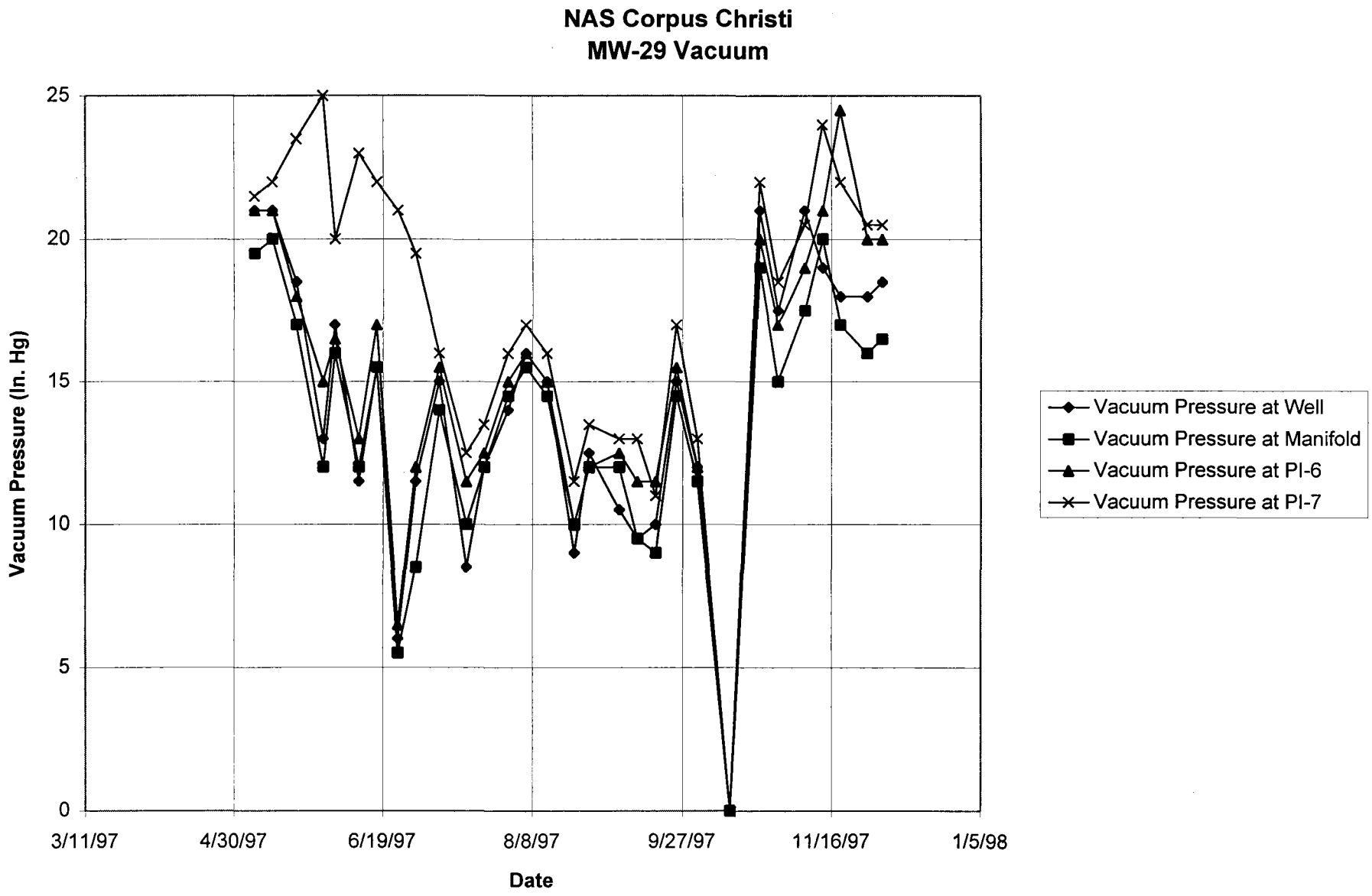
NAS Corpus Christi
Unscheduled Shut Down Frequency

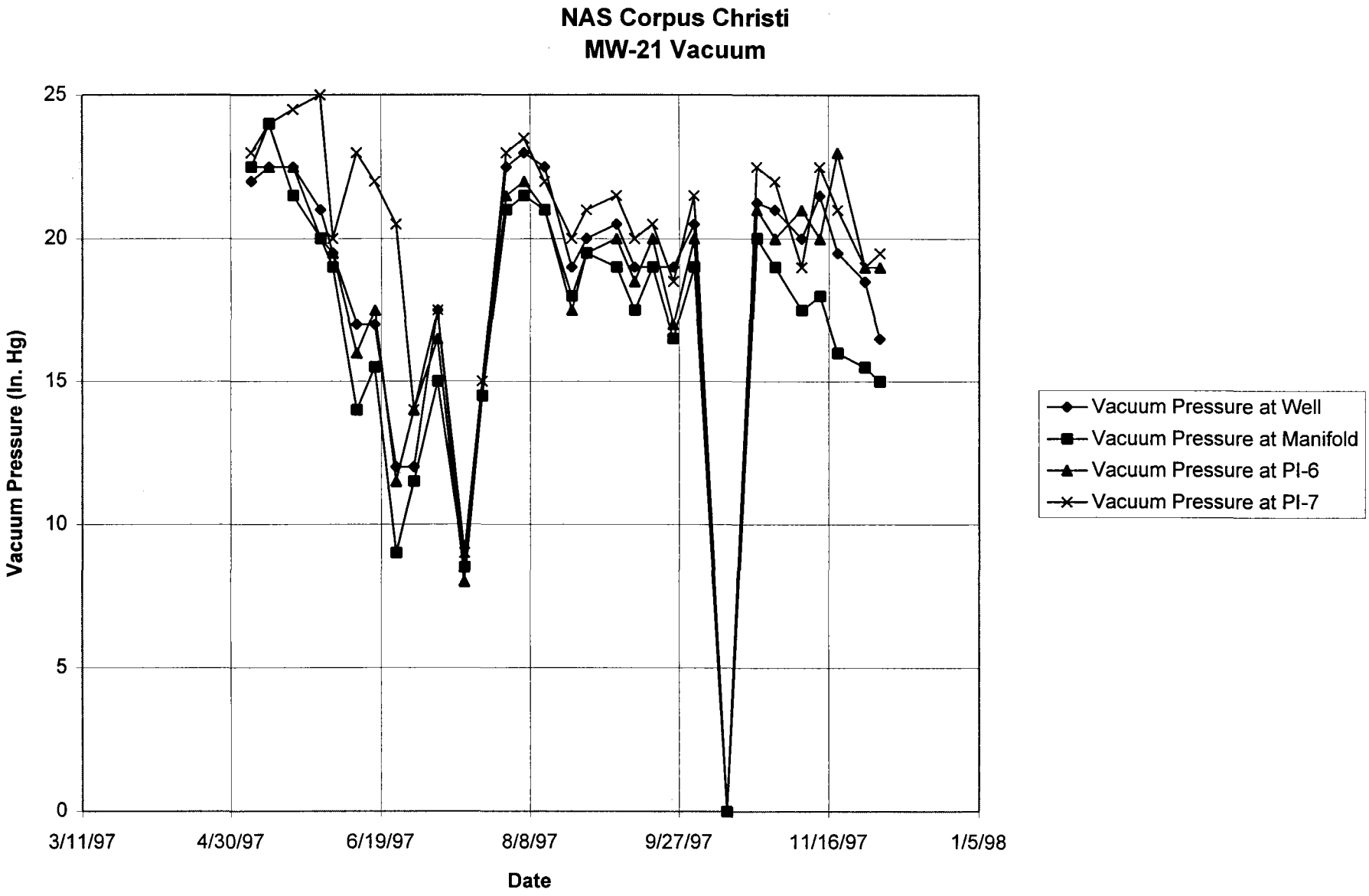



NAS Corpus Christi
MW-26 Vacuum
Vacuum Pressure (In. HG)
30
25
20
15
10
5
0
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
Vacuum Pressure at Well
Vacuum Pressure at Manifold
Vacuum Pressure at PI-6
Vacuum Pressure at PI-7


NAS Corpus Christi
MW-13 Vacuum
Vacuum Presure (In. Hg)
30
25
20
15
10
5
0
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
Vacuum Pressure at Well
Vacuum Pressure at Manifold
Vacuum Pressure at PI-6
Vacuum Pressure at PI-7


NAS Corpus Christi
MW-20 Vacuum
Vacuum Pressure (In. Hg)
25
20
15
10
5
0
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
Vacuum Pressure at Well
Vacuum Pressure at Manifold
Vacuum Pressure at PI-6
Vacuum Pressure at PI-7


NAS Corpus Christi
MW-29 Vacuum
Vacuum Pressure (In. Hg)
25
20
15
10
5
0
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
Vacuum Pressure at Well
Vacuum Pressure at Manifold
Vacuum Pressure at PI-6
Vacuum Pressure at PI-7


NAS Corpus Christi
MW-21 Vacuum
Vacuum Pressure (In. Hg)
25
20
15
10
5
0
3/11/97
4/30/97
6/19/97
8/8/97
9/27/97
11/16/97
1/5/98
Date
Vacuum Pressure at Well
Vacuum Pressure at Manifold
Vacuum Pressure at PI-6
Vacuum Pressure at PI-7