6/12/92

PACIFIC
ENVIRONMENTAL
GROUP, INC.

Barney,
with tears in my eyes
I relinquish this case
over to you Paul

Date June 9, 1992
Project 330-40.03

10600
MacArthur Blvd

To: Mr. Michael Whelan
ARCO Products Company
2000 Alameda de las Pulgas, Suite 218
San Mateo, CA 94402

We have enclosed:

Copies	Description
1	Contingency Plan for ARCO Service Station 276

For your:
- X Use
- ___ Approval
- ___ Review
- ___ Information

Comments: Michael, if you have any questions, please give me a call at 408-984-6536.

Dan Landry

cc: Mr. Joel Coffman, RESNA
Mr. Paul Smith, Alameda County Health Care Services Agency

1601 Civic Center Drive, Suite 202, Santa Clara, California 95050 (408) 984-6536 FAX: (408) 243-3911
620 Contra Costa Boulevard, Suite 209, Pleasant Hill, California 94523 (510) 825-0855 FAX: (510) 825-0882

Contingency Plan

ARCO Service Station 276
10600 MacArthur Boulevard
Oakland, California

Prepared for

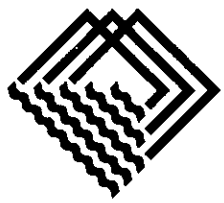
ARCO Products Company

June 9, 1992

Prepared by

Pacific Environmental Group, Inc.
1601 Civic Center Drive, Suite 202
Santa Clara, California 95050

Project 330-40.03



PACIFIC
ENVIRONMENTAL
GROUP, INC.

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1.0 INTRODUCTION

This Contingency Plan for ARCO Service Station 276 was prepared in response to a letter dated March 4, 1992, received by ARCO Products Company from the Alameda County Health Care Services Department. The Plan describes emergency response procedures that will be implemented to minimize and prevent hazards to human health or the environment from system failures or other emergencies at the site. These include fires, explosions, or any unplanned, sudden or non-sudden release of chemicals into the air, soil, or surface water. The Plan applies to both the existing off-site soil vapor extraction system and the proposed, on site additions to the treatment system.

A description of the facility and operations is included in Section 2.0. The treatment system and its built-in safety features are detailed in Section 3.0. Emergency response procedures are included in Section 4.0. Section 5.0 discusses emergency contacts for the site. Documentation of procedures for site operation are included in Appendix A. Manufacturer's literature describing the Anguil soil vapor catalytic oxidation system is included in Appendix B. A report on safety testing of the Anguil system, performed by the American Gas Association Laboratories is included in Appendix C. Emergency response procedures are documented in Appendix D.

2.0 GENERAL FACILITY DESCRIPTION

2.1 Location

The facility in question is located at the following address:

ARCO Service Station 276
10600 MacArthur Boulevard
Oakland, California

A site location map is presented in Figure 1. A site plan showing the existing off-site vapor extraction system is presented in Figure 2. The locations of proposed on-site wells and the proposed piping and trenching layout are also shown in Figure 2.

Remediation at the facility is under the regulatory jurisdiction of the Alameda County Department of Health Services. Operation and maintenance services are provided by Pacific Environmental Group, Inc. (PACIFIC).

2.2 Facility Operation

The facility, a gasoline service station, is currently active and has an AM/PM Mini-Market operating on site. Petroleum hydrocarbons have been found in the soil and groundwater beneath the site.

A soil vapor extraction system has been operating adjacent to the site since June 1991, and is currently utilized to remove petroleum hydrocarbons from off-site soil. On site additions to the treatment system are scheduled to be completed in July 1992. At that time, the treatment system will be used to remove on-site soil vapors as well. Extracted soil vapors are conveyed to a Remedi-Cat catalytic oxidation unit, where they are incinerated, and treated vapors are emitted to the atmosphere. The treatment system operates 24 hours a day.

PACIFIC monitors and performs general maintenance on the treatment facility biweekly. Flame-ionization detector (FID) measurements are collected from well field sampling ports, the treatment system influent and effluent sampling ports, and the vapor probe manifolds. Tedlar bag samples are also collected for laboratory analysis

from these locations. Meter readings are taken for the natural gas service, flame voltage, and gas pressure. Necessary safety precautions are taken and appropriate personal protective equipment are worn during work at the site. System operation and maintenance procedures are described in Appendix A.

2.3 General Safety Features

Emergency telephone numbers are posted in plain sight at the facility on signs reading "In case of emergency call..." Major pipelines are labeled. The site is equipped with an appropriate fire extinguisher. In addition, all structures and systems in operation at the site conform to safety requirements under the Uniform Building Code, the Uniform Plumbing Code, and the Uniform Fire Code. These requirements include anchoring for the Anguil catalytic oxidation unit. All appropriate permits were obtained from the City of Oakland prior to system installation.

3.0 THE ANGUIL CATALYTIC OXIDATION TREATMENT SYSTEM

3.1 Operation

The Anguil Remedi-Cat system is designed to convert, by catalytic oxidation with flame preheat, hydrocarbon vapors extracted from soil into end products of water and carbon dioxide at a destruction rate of 95 percent or greater. The unit is located at the south-east corner of the site, as shown in Figure 2. The physical dimensions of the enclosure are 4 feet, 3 inches wide; 8 feet, 2-1/2 inches high; and 8 feet, 4 inches long. Access for service is through designated doors on the front and side and also through a panel for the Remedi-Catalyst module. Doors are provided with continuous weatherpoof gasketing. System drawings are presented in Figures 2 and 3. Manufacturer's literature describing the system is presented in Appendix B.

The unit consists of a heavy gage, painted steel enclosure, a flue vent termination pipe, an all primary aerated power flame burner utilized for first stage incineration, a stain-less steel rod bundle type heat exchanger, internal piping, a catalytic oxidizing section (Remedi-Catalyst module), system air flow fan and motor, system air and fresh air dampers, and appropriate operational and safety controls.

Power is provided by electricity, and the burner is supplied by natural gas. The blower is a direct-drive, centrifugal fan that conforms to AMCA Class B spark-resistant construction. It is driven by a 3 horsepower, single-phase, totally-enclosed electric motor, powered by a 230-volt, single phase connection to a receptacle box on the right side panel. The Remedi-Cat burner used to incinerate organic compounds is an Eclipse 40-AH-0 burner with a range of firing rates from 13,000 to 325,000 British thermal units. The burner catalytically oxidizes organic compounds with an efficiency of 95 percent or greater before discharging to the atmosphere.

The system has been safety-tested by the American Gas Association Laboratories. Testing covered the basic performance and operational safety criteria applicable to the unit. Emphasis was placed on combustion safety, ignition safety, electrical operation and safety, analysis of emissions, and fire hazard evaluation. A report of test results is included in Appendix C.

3.2 Safety Features

The Anguil Remedi-Cat catalytic converter system includes a number of built-in safety features, including various regulatory sensors and controls, automatic shut-down in the event of system failure, and automatic notification of shut-down. Safety features are detailed in the manufacturer's literature describing the system, included in Appendix B.

3.2.1 Regulatory Controls

The control panel is provided with an electrical disconnect and an on/off push-button. Lights on the panel indicate the status of the burner, catalyst, and safety circuits. A thermocouple, digital controller, and modulating burner maintain the proper air temperature into the catalyst. The burner has a built-in purge cycle and is pilot ignited. A flame rod sensor continuously monitors the combustion cycle.

3.2.2 Flame Arrestor

The unit is also equipped with a flame arrestor. In the event of a fire downstream of the system blower, the flame arrestor would prevent the flames from propagating upstream through the soil vapor piping. Instead, combustion products would be vented harmlessly upward through a relief panel.

3.2.3 Automatic Shut-down

The Remedi-Cat system will automatically shut down if any of the following potentially dangerous situations occur:

- o loss of proper airflow
- o loss of gas pressure
- o interruption of electrical supply
- o high vapor density (LEL)
- o excessive temperature
- o failure of the burner flame

Vapor density is regulated because it affects the explosiveness of the gas. Therefore, an LEL monitor is located at the entrance of the Remedi-Cat. If the concentration of organic compounds in vapor rises above 25 percent of the lower explosive limit (LEL), the system automatically shuts down. The LEL is the vapor density at which the propagation of flame may occur in the gas, given a source of ignition (below the LEL, the mixture is said to be "too lean" to burn).

The Remedi-Cat system is equipped with two high-temperature sensors, which continuously monitor the temperature entering and exiting the catalyst. The system will de-activate if excessive temperatures are detected.

Finally, the system will de-energize and shut down if the flame in the burner fails. This prevents untreated soil vapors from being discharged to the atmosphere.

When necessary, the following steps are automatically taken to de-activate the system: (1) the burner will immediately shut down; (2) the suction pump will shut down; and (3) the outside air bleed-in damper will open, the damper in line with the hydrocarbon laden air will close, and the fan will continue to run cool air to the system.

3.2.4 Automatic Notification of System Failure

System operation is continuously monitored by a sensor in the control panel. If a failure in system operation should occur for any reason, the sensor would immediately activate an automatic dialer to notify PACIFIC operations and maintenance staff. The maximum response time is within 72 hours of notification. Once the cause of failure is established and the problem is corrected, the treatment system can be restarted manually.

3.3 Pipe Failure Scenario

Failure of the system piping would cause clean air surrounding the piping to be drawn into the system, since the soil vapor piping is under vacuum. The influx of relatively clean surface air would dilute the vapors extracted from the soil. Therefore, the only anticipated detrimental effect of a pipe failure is that the burner would require additional fuel to process the diluted vapor flow.

Bi-monthly monitoring of the system vapor extraction well heads will indicate any piping failures by detecting abnormal pressure drops in wells connected to failed piping.

3.4 Security

The catalytic oxidation system is completely self-contained. The unit is enclosed by a 9-foot high chain-link fence with vertical redwood slats. The gate is bolted and locked. Access to the Remedi-Cat incinerator is prevented by a weatherproof, insulated, fully-welded steel cabinet.

4.0 EMERGENCY RESPONSE PROCEDURES

4.1 Auto Dialer

An emergency contact number is posted at every PACIFIC site. Dialing the number accesses an auto-dialing system that records a voice message describing the situation and then continuously dials from a list of site-specific emergency contacts until a PACIFIC emergency response manager (ERM) is notified. After listening to the message, the ERM has the responsibility to call the witness and determine the urgency of the problem, notify the appropriate emergency site personnel, coordinate site response, and contact local authorities if necessary. The ERM is responsible for preparing an incident report within 24 hours of the event. Details are provided in Section 1 of PACIFIC's emergency response system (ERS) manual, included as Appendix D.

4.2 Standard Emergency Response

PACIFIC has implemented a standard emergency response system in order that a responsible PACIFIC employee will be immediately notified in the event of a site emergency. This employee will contact appropriate parties (including the fire department, police department, or county health services department when necessary), address or remediate the problem, and determine the necessary follow-up actions. This system is detailed in the ERS manual.

4.3 Site-Specific Emergency Response

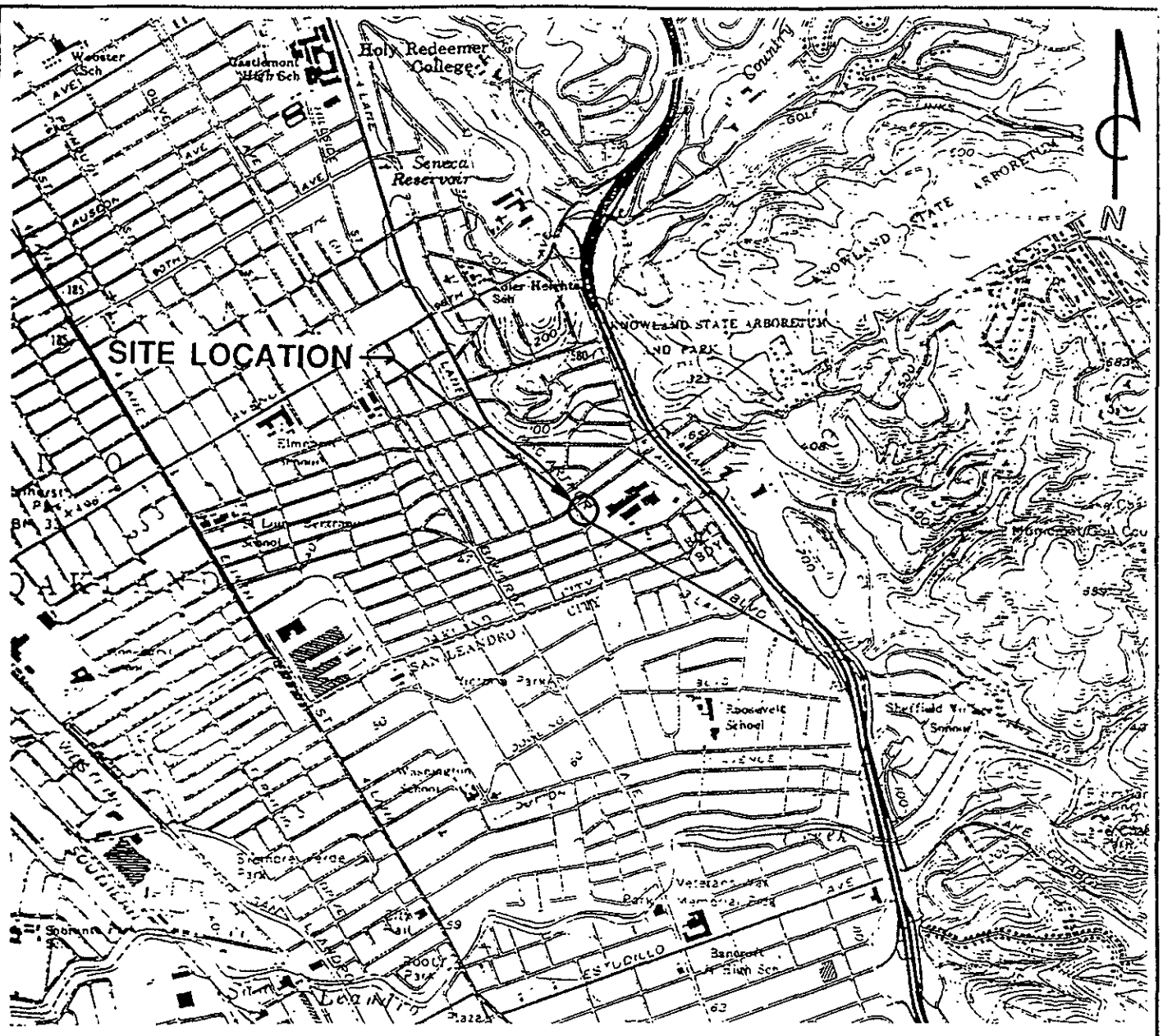
PACIFIC has identified site-specific emergency response procedures for each site. These are described in the ERS manual and are accessible to all concerned parties, including site engineers, technical staff, and on-site employees. At ARCO Service Station 276, the emergency-response procedures are to: (1) turn off the power at the panel or breaker box; (2) turn off the gas at the meter located at the corner of the building; and (3) use the on-site fire extinguisher as necessary. Additionally, in the event of an emergency that cannot be mitigated by these measures alone, telephone numbers for emergency services are easily accessible.

4.4 Emergency and Safety Equipment

The site is equipped with a Class ABC fire extinguisher, which is appropriate for flammable liquids or gases such as gasoline, oil, grease, and alcohol. The fire extinguisher contains a dry chemical compound and is mounted on the fence near the catalytic oxidation unit.

5.0 EMERGENCY CONTACTS

The site-specific emergency response plan provides a list of appropriate emergency contacts. Telephone numbers are included for client representatives, PACIFIC personnel, and municipality contacts (including the appropriate health department, fire department, and police department).



QUADRANGLE LOCATION

REFERENCE:
USGS 7.5 MIN. TOPOGRAPHIC MAP
TITLED: OAKLAND EAST, CALIFORNIA
DATED: 1959 REVISED: 1980
TITLED: SAN LEANDRO, CALIFORNIA
DATED: 1959 REVISED: 1980

SCALE
2000 0 2000 FEET

PACIFIC ENVIRONMENTAL GROUP, INC.

ARCO STATION #0276
10600 MacArthur Boulevard
Oakland, California

SITE LOCATION MAP

FIGURE: 1
PROJECT: 330-40.03

N

106th STREET

SIDEWALK

MacARTHUR BOULEVARD

SIDEWALK

FUEL ISLANDS

RESIDENTIAL

STATION BUILDING

FORMER WASTE OIL TANK

UNDERGROUND STORAGE TANK COMPLEX

STATION COMPRESSOR

MANIFOLD (E)

EQUIPMENT LOCATION WITH CHAIN-LINK FENCE AND REDWOOD SLATS

Property line

PVC PIPE BELOW GRADE TO EQUIPMENT LOCATION (E)

air inlet

DRIVEWAY

SIDEWALK

PARKING LOT

LEGEND

- EXISTING MONITORING WELL TO BE USED AS AN EXTRACTION WELL, 22-27' DEPTH
- VACUUM EXTRACTION PROBES, 1/2" Sch 40 STEEL PIPE, 16-21' DEPTH INTERVAL (E)
- VACUUM EXTRACTION PROBES, 1/2" Sch 40 STEEL PIPE, 25-34' DEPTH INTERVAL (E)
- PROPOSED VAPOR EXTRACTION WELL LOCATION
- TRENCHING AND PIPING LAYOUT FOR SOIL VAPOR EXTRACTION SYSTEM
- SERVICE TRENCH
- (E) EXISTING
- PROPOSED TRENCHING AND PIPING LAYOUT

PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE

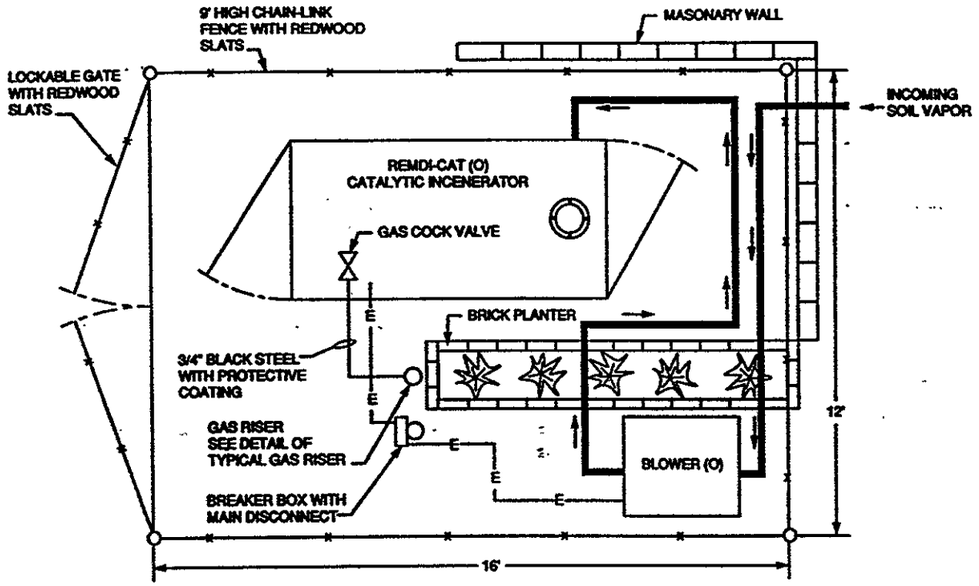
0 30 60 FEET

ARCO SERVICE STATION #0276
10600 MacArthur Boulevard
Oakland, California

SOIL VAPOR EXTRACTION SYSTEM - SITE PLAN

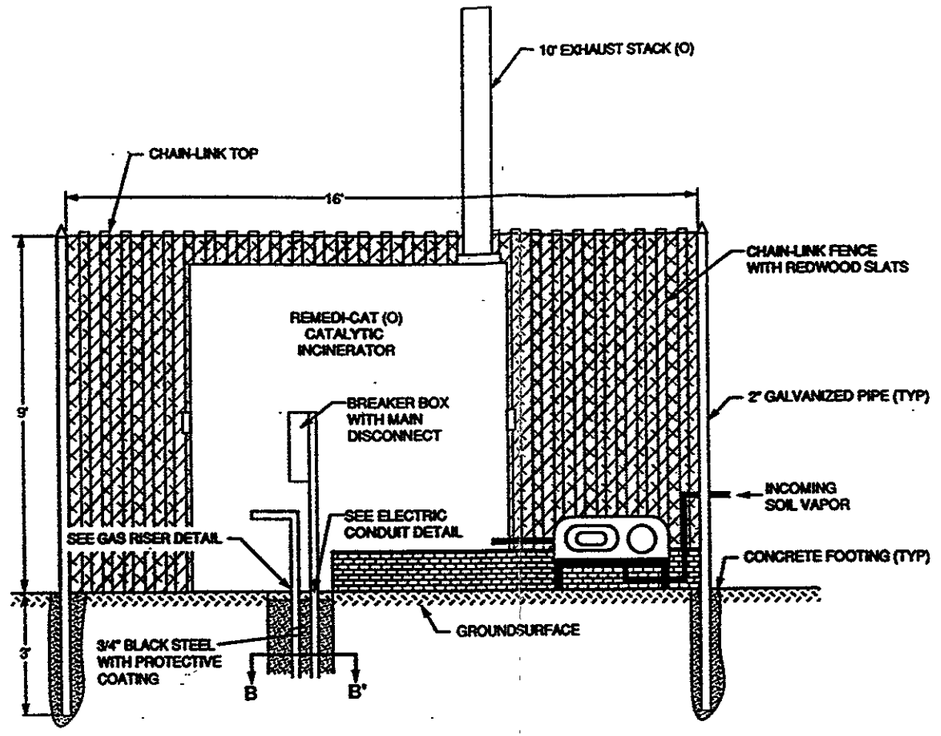
FIGURE: 2

PROJECT: 330-40.03



TREATMENT SYSTEM PLAN

NO SCALE



TREATMENT SYSTEM PROFILE

NO SCALE

PACIFIC ENVIRONMENTAL GROUP INC.

ARCO SERVICE STATION #0276
10600 MacArthur Boulevard at 106th Street
Oakland, California

SOIL VAPOR EXTRACTION SYSTEM - DETAILS

FIGURE: 3
PROJECT: 330-40.03

APPENDIX A

DOCUMENTATION OF SITE OPERATING PROCEDURES

SYSTEM'S OPERATION AND MAINTENANCE PROCEDURE
OAKLAND ARCO 0276

Material/Equipment List

- o 2357 Key
- o Extension Cord
- o Copy of Site Map
- o Vapor Sample Bags
- o Portable Vacuum Pump
- o Sampling Pipe
- o Labels
- o Cooler
- o FID

Procedure

1. Read safety precautions on page 3.

2. Fill in your name, the date, and the time at the top of the maintenance form. All data collected during today's maintenance check should be recorded in the appropriate spaces on this form.

3. Record the value of the natural gas service meter located outside the treatment facility at the front corner of the station building. See the note on how to read service meters at the end of this procedure. A gas meter is read in the same way as an electric meter.

4. Open the gate to the treatment facility. Open the front and rear doors to the Anguil incinerator. The rear door accesses the controls to the unit while the front door accesses the INFL sampling port, blower, and dilution intake.

5. Once a month change the chart paper in the recorder. On the next visit insert a copy of the chart, operation and maintenance (O&M) data, and analytical results to the on-site logbook located in the control panel side of the unit. The permit to operate requires that we do this.

6. Record the flame voltage. The gauge should read steadily at approximately 17 volts. If the flame voltage is fluctuating this normally indicates the dilution intake filter is dirty. If, after cleaning, the voltage fluctuation continues, then consult the engineer on the project. If the unit is not operating correctly consult the operating manual. The unit can usually be returned to operation by pulling the start knob out and waiting several minutes. The intake blower located behind the front door should immediately activate when the knob is pulled. After several minutes the pilot should light the burners and the temperature will increase to the desired set-points. The Anguil is almost totally automatic; there aren't that many manual adjustments that can be made.

7. Record the gas pressure at the low-pressure switch. Reset the switch by pushing in the metal pin on the side of the switch if it has been tripped. Pull out the start knob on the control panel to reactivate the unit and wait several minutes for the flame to ignite.

8. When the temperature of the catalyst bed reaches approximately 500 to 550 degrees the purple catalyst ready light should go on. Turn on the vacuum pump (located beside the incinerator) which pulls vapor from the probe field. There is a small bevel switch on the front, lower, right of the unit which turns it on. The vacuum pump will turn off if the temperature is not correct. When the system reaches equilibrium record the applied vacuum pressure influent to the pump and the positive pressure effluent from the pump.

10. Inspect the filter to the dilution intake behind the front door. Remove any debris in the filter or replace it.

11. Attach the portable sampling pump to the well field sampling port. Use the FID to measure the level of hydrocarbons. Record the result. NOTE: When using the FID or any similar VOC measuring device do not position the probe tip such that the vapor stream is blown directly into the tip. This will produce inaccurate results. Position the tip in the side of the sampling pipe such that it is free to draw in vapors with as little applied pressure as possible. Take a bag sample. Remove the portable pump and allow it to purge for several minutes

12. Attach the portable vacuum pump to the INFL sampling port. Use the FID to measure the level of hydrocarbons. Record the value on the data sheet. Take a bag sample. Remove the portable pump and allow it to purge for several minutes. The INFL bag sample will be taken every 2 weeks.

13. Attach the vacuum pump to the EFFL sampling port and record the FID reading. Take a bag sample. Remove the portable pump and allow it to purge for several minutes. The EFFL bag sample will be taken monthly; take an FID reading of the EFFL during the semi-monthly visit.

14. Remove the covers to the vapor probe manifolds located adjacent to the site in the store parking lot. Using a barbed fitting attach the vacuum pump intake line to one probe line at a time and measure the level of volatile hydrocarbons. Record the reading on the data sheet. Repeat this procedure for each probe line being certain to purge the pump and lines between readings. Consult the engineer and discuss which probe lines to leave open or closed.

15. Close the manifold covers after making the valve adjustments.

16. Repair any defects or leaks in the piping system.

17. Pick up any trash left on site, sweep the enclosure, and secure the doors and gate when you leave.

Safety Precautions

1. Always wear eye protection while performing system's O&M.

2. If replacement of parts is required, secure the power to the system at the electrical distribution panel. The distribution panel is located in the treatment enclosure.

3. Always wear vinyl glove liners when sampling or repairing water hoses or fittings.

4. Always where a safety vest (orange) when performing O&M.

5. Always secure power to system when removal of inside panels in electric control panel is necessary.

How to Read Electric Service Meters

An electric meter typically has 5 spinning pointers which counter-rotate with respect to each other. The basic rule in reading electric meters is to remember that if the pointer is between two numbers, then always choose the lower number. Sometimes it may be difficult to decide if the pointer is between numbers or indicating an exact number. To decide, look at the next gauge to the right. If the pointer on that gauge is between 0 and 1 choose the number the pointer seems to be indicating on the gauge to the left. If the pointer on the right is between 0 and 9 choose the lower number on the gauge to the left. Misreading the far lefthand gauges will result in a significant overpayment for electric service. Misreading the far righthand gauges is not critical, but it is still not desired.

Vapor Extraction System
Oakland ARCO 0276
10600 MacArthur Boulevard
Oakland, California
330-40.03

Name:_____ Date/Time:_____

Soil Vapor Extraction System Measurements

1. Natural gas meter _____
2. Flame voltage _____
3. Natural gas pressure (psi) _____
4. Vacuum pressure from well field (inches of Hg) _____
5. Applied pressure to Anguil unit (psi) _____
6. Flow rate to Anguil unit _____
7. Inlet temperature _____
8. Outlet temperature _____
9. FID readings (ppm)

    Well Field _____
    INFL _____
    EFFL _____

    Soil Probes: (Indicate valve position as C or O)

10. Inspect/replace dilution intake filter (initials) _____
11. Check all piping and gas shutoff valves for leaks (initials) _____
12. Check all wiring and disconnects (initials) _____
13. Sweep enclosure (initials) _____

Comments_____

Distribute a copy of this form to the project supervisor and file the original in the project file.

APPENDIX B

MANUFACTURER'S DESCRIPTION OF THE REMEDI-CATALYST SYSTEM

OPERATION & MAINTENANCE MANUAL

FOR

REMEDI-CAT 5
CATALYTIC FUME INCINERATOR

DECEMBER 19, 1990

MANUFACTURED
BY

ANGUIL ENVIRONMENTAL SYSTEMS, INC.
4927 NORTH LYDELL AVENUE
MILWAUKEE, WI 53217
PHONE(414)332-0230 o FAX(414)332-4375

INDEX

REMEDI-CAT SYSTEM DESCRIPTION

A. PURPOSE

The purpose of the Remedi-Cat catalytic converter system is to destroy organic compound vapors which are pumped from the soil prior to discharging them to the atmosphere. This destruction is accomplished by catalytic oxidation.

B. PRECAUTIONS

It is important to understand the meaning of the term Lower Explosive Limit (LEL), sometimes also referred to as Lower Flammability Limit (LFL).

Lower Explosive Limit: Gases or vapors which form flammable mixtures with air or oxygen have a minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition (LEL). There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur (UFL). These boundary line mixtures of vapor or gas with air, which if ignited will just propagate flame, are known as the "lower and upper flammable or explosive limits", and are usually expressed in terms of percentage by volume of gas or vapor in air. Under the LEL, the mixture is too lean to burn and above the upper flammable limit, is too rich to burn. The LEL is based upon normal atmospheric temperatures and pressures and the general effect of increase of temperature or pressure is to decrease the lower limit and increase the upper limit.

Applicable codes require thermal solvent processing systems to operate no higher than 25% LEL without a LEL monitor and control. Insurance companies may require LEL systems if an incineration system is added to existing machinery.

For further information concerning the maintenance of safe LEL levels, the customer should refer to NFPA Bulletin 86A and FM Loss Prevention Bulletin No. 14.15. These bulletins will delineate how safety interlocks can be implemented in your system.

DANGER: NEVER OPERATE THE REMEDI-CAT CATALYTIC REACTOR AT A CONCENTRATION OF VAPORS GREATER THAN 25% OF THE LEL. EVEN LOW CONCENTRATIONS OF EXTREMELY VOLATILE VAPORS MAY CAUSE AN EXPLOSION WITHIN THE CATALYTIC REACTOR SYSTEM WITH THE POSSIBILITY OF SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

IMPORTANT: THE BURNER MUST BE SHUT OFF WHEN THE CONCENTRATION OF VAPORS EXCEEDS 25% OF THE LEL. IT IS THE RESPONSIBILITY OF THE USER TO PROPERLY MAINTAIN AND CALIBRATE THE LEL MONITOR SYSTEM, WHICH IS SUPPLIED WITH THIS EQUIPMENT, SO THAT IT CAN SHUT OFF THE BURNER IF THE LEL OF THE VAPOR STREAM EXCEEDS 25% LEL.

CAUTION: THE CATALYST SHOULD NOT BE USED IN APPLICATIONS WHERE THE ORGANIC SOLVENTS CONTAIN COMPOUNDS OF SULFUR, HALOGENS, HEAVY METALS OR PHOSPHOROUS. THESE COMPOUNDS ARE DETRIMENTAL TO THE CATALYST AND MAY CAUSE THE CATALYST EFFICIENCY TO DEGRADE.

1. Sites which are being remediated may contain equipment using relatively large quantities of gas, oil, steam, and/or electricity. Any high energy equipment carries with it a potential danger to personnel and property, and must be treated accordingly.

2. All equipment must be installed and operated in accordance with OSHA regulations, all applicable electrical, plumbing, steam boiler and building codes, necessary permits secured, and meet the requirements of your insurance carrier. Unless specified in our proposal, these are areas of customer responsibility.

3. The area should be maintained free from any hazards that would prevent easy movement around the catalytic reactor and electrical control cabinet. No flammable or otherwise hazardous materials should be stored in the immediate vicinity of the catalytic reactor. No work materials, papers or other materials should be placed on the catalytic reactor.

4. Review the operation of the catalytic reactor with your site safety officer before starting the unit. Any suggestions and additions should be included with these instructions.

All those involved in the operation of the system should read and understand the complete operating instructions before starting the unit. Safety meetings of all those involved with the system should be held periodically in conjunction with implementing acceptable maintenance procedures.

5. Any change in process load, temperature, ventilation or other modification should be checked with us in advance to determine equipment capabilities.

6. Determination of catalyst efficiency in hydrocarbon oxidation is made by gas analysis of samples drawn from the system prior to and immediately after the catalyst exit face. In the event the operator suspects any loss of catalytic activity via visual inspection or by observing that the temperature rise across the catalyst has been reduced. Before attempting any corrective measures, contact Anguil Environmental Systems. We will assist in determining corrective action, and if applicable, will provide specific cleaning instructions.

7. It is our desire to provide you with the safest and most productive equipment possible. Revised national safety standards and technological improvements will require you to periodically review your equipment, and may require upgrading for compliance.

C. PROCESS DESCRIPTION

The purpose of this system is to destroy organic vapors from a soil remediation operation. Organic contaminants are drawn via one or more (customer supplied) vent pipes by a (customer supplied) suction pump and delivered to the Remedi-Cat inlet. The organic compounds are then catalytically oxidized with an efficiency of 95% or greater prior to being discharged to atmosphere.

D. SYSTEM BLOWER

The system blower is a direct driven centrifugal fan. It has an efficient air handling wheel and conforms to AMCA Class B spark resistant construction. It is driven by a 3 Hp, single phase, totally enclosed electric motor.

E. FLAME ARRESTOR

The Remedi-Cat has an in-line metal grid type arrestor located downstream of the system blower. In the event that a flammable gas mixture is ignited within the Remedi-Cat, the flame arrestor prevents the flame front from propagating upstream through the inlet vent piping. A relief panel located on the top of the unit allows combustion products to vent harmlessly upward.

F. HEAT EXCHANGER

To utilize the energy content of the solvent vapors from the output of the reactor, a heat exchanger is used to preheat the incoming process air stream. Employment of a heat exchanger reduces total system operating costs.

The heat exchanger is a shell and tube type with two shell passes and one tube pass. It is constructed entirely of type 304 stainless steel. It is fully welded and each weld is individually leak tested to insure zero cross contamination. A flanged connection on the inlet permits access for cleaning of the tubes in the event that they become fouled.

G. BURNER

The incinerator system is equipped with one (1) Eclipse 40-AH-0 burner. The burner has a minimum firing rate of 13,000 BTU's per hour and a maximum firing rate of 325,000 BTU/hour at an inlet pressure of one psi. Pilot gas issues from the same ports as main gas to immediately merge forming a common fire envelope. It can be configured to fire on either natural gas or propane.

H. REACTOR

The reactor vessel holding the catalyst module has an inner liner constructed entirely of stainless steel. The inner liner is covered with six inches of high temperature mineral wool insulation. It has an outer cabinet of 16 gauge hot rolled steel with a structural framework.

I. CONTROLS

Flame Supervision Control

The burner is equipped with a flame safeguard control which monitors the pilot so that the primary gas valves cannot open until the pilot flame has been established and proven. The gas burner piping system consists of pipe train with:

1) Main Gas Valve
2) High and Low Gas Pressure Switches
3) Gas Regulator

An electronic flame safeguard control of the flame rod type shall monitor the flame during the entire burning cycle. This control provides the following sequence:

1) A prepurge of 30 seconds

2) Pilot proving prior to the energizing of the main valve

3) Trial for ignition of main flame for 10 seconds

In the event of flame failure during a firing period, the main fuel valves are de-energized. Manual reset is required at the flame supervision control located in the main control cabinet.

Catalyst Inlet Temperature Control

The unit is equipped with a temperature control system in order to maintain the correct temperature on the inlet of the catalyst. The temperature at the catalyst inlet is sensed by a thermocouple which is connected to a digital temperature controller. The digital temperature controller modulates the burner output via the firing rate actuator.

System Inlet Mixture Control

The system is equipped with two motorized dampers at the fan inlet. One damper is located in the pipe from the soil venting pump and the other admits outside air. These dampers control the concentration of organic compounds in the air stream entering the unit.

Upon start-up, the damper in-line to the venting pump is held closed and the outside air damper is held open.

When the unit is operating, the temperature rise across the catalyst is correlated to the concentration of organic compounds in the inlet air stream. Since the catalyst inlet temperature is held constant by the inlet temperature controller (see above), the catalyst outlet temperature varies as a function of this concentration of organic compounds. A digital controller monitors the temperature at the catalyst outlet. It modulates the two mixture dampers in order to maintain a set temperature at this point.

Incinerator Temperature Control

The Remedi-Cat system is equipped with two (2) high temperature limit controls. These controls continuously monitor the temperature entering and exiting the catalyst. If an excessive temperature is detected at either point, the following occurs:

1. Burner will immediately shut down.
2. Catalyst ready dry contact connected to the soil venting will immediately open, shutting down suction pump.
3. The outside air bleed in damper will open and the damper in line with the solvent laden air will close and the fan will continue to run to cool the system.
4. The system must be shut down and restarted manually.

LEL Monitor

The system is equipped with a solid state electro-chemical LEL monitor. This device monitors the vapor concentration at the Remedi-Cat inlet. If the monitor detects greater than 25% LEL at that point, the following will occur:

1. Burner will immediately shut down.
2. Catalyst ready dry contact connected to the soil venting will immediately open, shutting down the suction pump.
3. The outside air bleed in damper will open, the damper in line with the solvent laden air will close and the fan will continue to run to cool the system.
4. The system must be shut down and restarted manually.

DANGER: IT IS THE CUSTOMER'S RESPONSIBILITY TO MAKE CERTAIN THAT THE CONCENTRATION OF VAPORS ENTERING THE REMEDI-CAT REMAINS LESS THAN 25% OF THE LEL OF THE VAPORS. THE INTERNAL LEL MONITOR CANNOT BE RELIED UPON AS THE SOLE MEANS FOR INSURING SAFE CONCENTRATIONS OF VAPORS ENTERING THE UNIT.

IMPORTANT: VAPORS WITH CONCENTRATIONS OF GREATER THAN 25% OF LEL MUST NOT BE ALLOWED TO ENTER THE REMEDI-CAT WHEN THE BURNER IS ON. EVEN LOW CONCENTRATIONS OF EXTREMELY VOLATILE VAPORS MAY CAUSE AN EXPLOSION WITHIN THE CATALYST REACTOR SYSTEM WITH THE POSSIBILITY OF SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

INSTALLATION INSTRUCTIONS

1) Set the unit on a firm level surface away from any flammable materials.

2) Connect the soil ventilation pump to the system inlet. The pump must be capable of delivering 0 - 500 SCFM at 0 - 5" w.c. of pressure.

3) Connect a propane fuel source capable of delivering 325,000 BTU/hour at 1 - 5 psig pressure to the fuel inlet. For alternate fuel parameters contact Anguil Environmental Systems, Inc.

4) Connect a 230 volt / 20 A single phase grounded power source to the panel.

5) Connect the motor starter coil for the soil venting pump (by others) in series with the catalyst ready dry contact.

NOTE: The soil venting pump must be capable of starting and operating with its discharge shut off entirely. If the pump type selected is not capable of meeting this requirement, then a pressure relief bypass loop must be provided. Contact Anguil Environmental Systems, Inc.

WARNING: THE SYSTEM SHOULD ONLY BE INSTALLED AND OPERATED BY QUALIFIED PERSONNEL WHO UNDERSTAND THE EQUIPMENT. FAILURE TO DO SO COULD CAUSE PROPERTY DAMAGE AND/OR PERSONAL INJURY. IF ANY ASSISTANCE IS REQUIRED, CALL ANGUIL ENVIRONMENTAL SYSTEMS, INC.

OPERATION INSTRUCTIONS

NORMAL START-UP AND RUN

Action	Effect
Engage the disconnect on the system control panel and the manual gas cocks and any disconnects for the soil venting pump.	The electronic controllers will illuminate showing their respective process variables (upper displays) and set points (lower displays).
If previous shut down was due to loss of flame, press the door mounted flame supervision control reset and wait two minutes.	Safety circuits will be activated.
Pull the system run switch.	Power is applied to the system fan. Green system on light will illuminate. Burner will begin a 30 second purge cycle. Flame supervision control will be energized, if previous shut down was due to flame out, manually reset flame supervision control. Flame supervision control will start the following sequence: Spark ignition transformer is energized. Pilot solenoid will open. Pilot will light.

NORMAL START-UP AND RUN (CON'T)

Action	Effect
	Blue pilot on light will illuminate.
	Main fuel valve will be powered.
	Green burner *on* light will illuminate.
	The main flame will light.
	Temperature controller will modulate the firing rate actuator to maintain set point temperature.
	After a time delay of approximately 10 minutes, the following will occur:
	The amber catalyst ready light will illuminate. The soil venting pump (by others) will start.
	NOTE: The soil vent pump must be run and vented to atmosphere during the initial operation of the venting system. The catalytic oxidizer is <u>not</u> designed to handle dirt, sand or debris.
	The fresh air intake valve damper will begin to modulate closed and the soil inlet valve will begin to modulate open, delivering the contaminated air to the unit for destruction.

NORMAL SHUTDOWN

Action	Effect
Push the system run/stop button.	System will immediately shut down and all indicator lights will go off.
Secure the electrical disconnects and manual fuel shut off valves.	

UPSET CONDITIONS

Condition	Effect
Excess LEL detected by LEL monitor.	Burner will immediately shut down. Green burner on light will go off. Green catalyst ready light will go off.
To Restart: Determine cause of excess LEL and remedy. Press the burner reset button.	

UPSET CONDITIONS

Condition	Effect
Loss of electrical power to the control panel.	Burner, fan and soil vent pump (by others) will immediately shut down.
To Restart:	
Determine cause of loss of power and remedy.	
Press the burner reset button.	

Condition	Effect
Loss of proper airflow to the unit.	Burner will immediately shut down.
	Green burner on light will go off.
	Green catalyst ready light will go off.
To Restart:	
Shut unit down by pushing the system run push/pull button.	
Determine the cause of loss of proper airflow and remedy.	
Reset the low gas pressure switch.	
Press the burner reset switch and re-start the unit. (See Start-Up Instructions).	

UPSET CONDITIONS

Condition	Effect
Excessive fuel pressure.	Burner will immediately shut down. Green burner on light will go off. Green catalyst ready light will go off.

To Restart:

Shut unit down by pushing the system run push/pull button.

Determine the cause of loss of fuel pressure and remedy.

Reset the high gas pressure switch.

Press the burner reset switch and restart the unit. (See Start-Up Instructions)

Condition	Effect
Over temperature.	Burner will immediately shut down. Green burner on light will go off. Green catalyst ready light will go off.

To Restart:

Determine the cause of the over temperature and remedy.

Press the burner reset switch and restart the unit. (See Start-Up Instructions)

APPENDIX C

AMERICAN GAS ASSOCIATION LABORATORIES
SAFETY TESTING REPORT

REPORT NO. FT-C-11-91

Report on Equipment Safety Testing by the American Gas Association Laboratories, Cleveland, Ohio on an Anguil Environmental Systems, Inc. catalytic type fume incinerator Model No. Remedi-Cat-5.

TESTING REQUESTED BY:

Mr. Lee Kujawa
Anguil Environmental Systems, Inc.
4927 North Lydell Avenue
Milwaukee, WI 53217

REPORT DATE:

5 March 1991

TEST SITE:

A. Goethel Sheet Metal, Inc.
6209 Industrial Court
Greendale, WI 53129
(Assembly Shop)

PURPOSE:

To test and evaluate from a safety standpoint the unit identified above. Testing was to cover the basic performance and operational safety criteria applicable to the unit. Emphasis on combustion safety, ignition safety, electrical operation and safety, analysis of emissions and fire hazard evaluation was specifically requested. Testing was conducted on a production unit following the manufacturer's production testing and initial checkout firing.

NOTICE:

This report applies to the design in the configuration only as tested at the above location. This report can only be published or issued as a complete entity and no abstracts or abbreviations are permitted. The information provided is intended to assist the user and any code enforcing authorities and others involved in judging acceptance of the product covered by this report.

This published report consists of 34 pages. Contracts for field testing, data and related documentation are on file at the American Gas Association Laboratories, 8501 E. Pleasant Valley Road, Cleveland, Ohio 44131. Material will be retained for a period of ten (10) years from the date of the report shown above.

OVERVIEW:

The unit is designed to convert, by catalytic oxidation with flame preheat, hydrocarbon vapors extracted from soil into end products of water and carbon dioxide.

The unit consists of a heavy gage painted steel enclosure, a flue vent termination pipe, an (Eclipse) all primary aerated power flame burner utilized for first stage incineration, a stainless steel rod bundle type heat exchanger, internal piping, a catalytic oxidizing section, (Remedi-Catalyst module) system air flow fan and motor, system air and fresh air dampers, and appropriate operational and safety controls. See enclosed print on page 16 of this report for schematic of components.

ELECTRICAL SYSTEM:

See page 17 of this report for wiring and controls schematic. Power to the unit is through a 230 volt, 1-phase connection to a receptacle box on the right side panel. Operational and safety controls operate from stepped down voltages of 115 volts or 24 volts. The system fan motor operates at 230 volts. Voltage step down is obtained by utilizing integral transformers.

PHYSICAL DESCRIPTION:

The enclosure is 4 feet 3 inches wide, by 8 feet 2-1/2 inches high, and a 8 feet 4 inches deep. Access for service is through designated doors on the front and side and also through a panel for the Remedi-Catalyst module. Doors are provided with continuous weatherproof gasketing.

A direct drive centrifugal fan system blower is integral to the unit. the air handling wheel conforms to AMAC Class B spark resistant construction requirements. A 3 hp, single phase, 230 volt listed Baldor motor Model No. SZ596484 drives the blower. The motor is approved for hazardous location application.

To utilize the energy content of the solvent vapors from the output of the reactor, a heat exchanger is used to preheat the incoming process air stream.

The heat exchanger is a shell and tube type with two shell passes and one tube pass. It is constructed of type 304 stainless steel.

The heat exchanger is fully welded and each weld is individually leak tested. A flanged connection on the inlet permits access for cleaning of the tubes.

The incinerator system is equipped with one (1) Eclipse 40-AH-0 burner. The burner is manufacturer recommended for a minimum firing rate of 40,000 Btu/hour and a maximum firing rate of 325,000 Btu/hour at an inlet pressure of one psi. Manifold pressure during test was at 6.5 inches w.c. on high fire and 3.8 inches w.c. for low fire on natural gas. For propane fuel high fire manifold pressure was 6 inches w.c. and low fire manifold pressure was 5.0 inches w.c. Pilot gas issues from the same ports as main gas to immediately merge forming a common fire envelope. The unit can be configured to fire on either natural gas or propane without any changes to the burner or regulator.

The Remedi-Cat has an in-line metal grid type flame arrestor located downstream of the system blower. Ignited vapor attempting to pass through the flame arrestor becomes extinguished by action of the grids in the grid assembly absorbing heat from the flame faster than it is developed, thereby lowering the temperature of the flame below its ignition point.

The reactor vessel holding the catalyst module has an inner liner constructed of stainless steel. Six inches of mineral wool insulation surrounded the inner liner.

The burner is equipped with a flame safeguard control which monitors the pilot so that the primary gas valves cannot open until the pilot flame has been established and proven. The gas burner piping system consists of pipe train with:

1) Main Gas Valve

2) Vent Valve

3) Blocking Valve

4) High and Low Gas Pressure Switches

5) Gas Regulator

A safeguard control of the flame rod type monitors the flame during the burning cycle. This control oversees the following operating sequence:

1) A prepurge of 45 seconds

2) Pilot proving prior to the energizing of the main valve

3) Trial for ignition of main flame for 10 seconds

In the event of flame failure during a firing period, the main fuel valves are designed to de-energize. Manual reset is required at the flame supervision control located in the main control cabinet.

The unit is equipped with a temperature control system in order to maintain temperature on the inlet of the catalyst. The temperature at the catalyst inlet is sensed by a thermocouple which is connected to a digital temperature controller. The digital temperature controller modulates the burner output via the firing rate actuator.

The system is equipped with two motorized dampers at the fan inlet. One damper is located in the pipe from the soil venting pump and the other admits outside air drawn from within the enclosure. These dampers act to control the concentration of organic compounds in the air stream entering the unit. Debris screens are utilized on all permanent enclosure openings.

Upon start-up, the damper in-line to the venting pump is held closed and the outside air damper is held open.

During operation, the temperature rise across the catalyst is correlated to the concentration of organic compounds in the inlet air stream. The catalyst inlet temperature is held by the inlet temperature controller. The catalyst outlet temperature varies as a function of this concentration of organic compounds. A digital controller monitors the temperature at the catalyst outlet. It modulates the two mixture dampers in order to maintain a set temperature at this point.

The Remedi-Cat system is equipped with two (2) high temperature limit controls. These controls continuously monitor the temperature entering and exiting the catalyst. If an excessive temperature is detected at either point, the following occurs:

1) Burner will immediately shut down.

2) Catalyst ready dry contact connected to the soil venting will immediately open, shutting down suction pump.

3) The outside air bleed in damper will open and the damper in the line with the solvent laden air will close and the fan will continue to run to cool the system. A manual restart is required following cycling of the high temperature limits.

The system is equipped with a solid state electrochemical LEL monitor. This device monitors the vapor concentration at the Remedi-Cat inlet. If the monitor detects greater than 25% LEL at that point, the following sequences are designed to occur:

1) Burner will immediately shut down.

2) Catalyst ready dry contact connected to the soil venting will immediately open, shutting down the suction pump.

3) The outside air bleed in damper will open, the damper in line with the solvent laden air will close and the fan will continue to run to cool the system. A manual restart is required following tripping of the LEL monitor.

For convenience in handling the unit for movement and transport, four rigging eye holes were integrally provided. Forklift channels also allows the unit to be picked up from either direction.

All operating components of the unit are of appropriate listed parts by recognized agencies such as UL-Underwriters Laboratories, A.G.A.-American Gas Association, CSA-Canadian Standards Association, FM-Factory Mutual.

In addition, all parts utilized were original manufacturer's identified as suitable for application with the gases normally encountered in intended use.

LIST OF STANDARDS:

Testing was conducted utilizing portions of the following American National Standards and Requirements:

NFPA54/ANSI Z223.1-1988 National Fuel Gas Code

Z83.18-1987 Direct Gas-Fired Industrial Air Heaters

Z21.17 Gas Conversion Burners

1-81 A.G.A. Requirement for Vented Catalytic Room Heaters

TESTS CONDUCTED:

- Construction Evaluation from User and Operators Safety Standpoint
- Review of markings, safety labels and instructions
- Burner Operation Characteristics/Natural Gas and Propane Gas
- Air Flow through System
- Combustions; Propane and Natural gas, at rated voltage, maximum and minimum rates, before and after catalyst
- Wire, Component Temperatures, Surface Temperatures, Enclosure Temperatures and Fire Hazard
- Controls Operation
- Failures Mode Simulation - Safety and Operational Controls
- Verifications of Production Testing

TESTS EQUIPMENT AND INSTRUMENTATION:

Testing was conducted by staff of the American Gas Association Laboratories, A.G.A.L., utilizing testing equipment moved to the test site. A partial equipment list includes the following:

- A calibrated pressure gage/ manometer.
- An Enerac No. 2000 portable carbon monoxide, oxygen, carbon dioxide and oxides of nitrogen analyzer.
- A Marlin Thermicator No. 402A potentiometer. Set-up for use with Type J thermocouple wire.
- A calibrated Fluke electrical testing instrument.
- A Model No. Omega HH-30 anemometer.

TEST CONDITIONS:

All test work with the exception of ignition testing was conducted with the Remedi-Cat unit operating under equilibrium conditions as obtained from cold start to equilibrium conditions. See enclosed graphs pages 21 and 22 of this report. Temperatures were set to maintain the catalytic grid at 650°F during the maximum firing rate tests.

TEST RESULTS:

Construction

Construction of the catalytic fume incineration unit meets accepted engineering concepts. Access for use and service did not pose a hazard to service staff and operators when the manufacturer's recommendations for such procedures were followed. Operator's and service persons employing reasonable care were not exposed to hazards from moving parts, electric shock, sharp edges or hot surfaces.

Instructions and Markings

The instruction manuals and parts information material provided by the manufacturer was considered satisfactory. The instructions reviewed are incorporated as pages 23 through 28 of this report. Markings employed for identification, operation and for operator's safety were also evaluated and found acceptable. Sample markings are included as pages 29 through 31 of this report.

Ignition/Burner Operation

Satisfactory test results were obtained from cold and warm starts. The purge time corresponded with the manufacturer's specified 30 seconds. The main

burner ignited within four seconds following ignition of the pilot and the establishing of gas flow to the main burner. Burners did not flash back under maximum or minimum rate. All gas in the burners was ignited and there was no evidence of carboning.

During testing the following manifold pressure readings were obtained at the burner pressure tapping:

Condition	Pressure in Inch w.c.
Maximum Fire Rate-Natural Gas	6.5
Minimum Fire Rate-Natural Gas	3.8
Maximum Fire Rate-Propane Gas	6.0
Minimum Fire Rate-Propane Gas	5.0
Pressure with no Gas Fuel Input but with System Blower Operating	3.0

Air Flow

Air flow was measured at the outlet stack ten feet from the top of the unit. An extension stack of approximately six feet was utilized and coupled with a four foot stack. At maximum firing rate and a 650°F catalyst surface temperature the exhaust gas temperature (re-routed through the heat exchanger) was lowered to 362°F. With fully open fresh air damper, the average air flow velocity exiting the 8 inch diameter stack was 2333.8 feet per minute. The resulting air flow volume was calculated at 814 ft^3/min.

Combustion

The tested unit was operated on natural gas and also on propane gas. Flue products were analyzed for verification of clean, safe and complete combustion of the fuels. Samples were concurrently obtained upstream of the catalyst and downstream. Samples were taken for maximum and minimum firing rates for both fuels. The natural gas fuel used was as provided on site by the local gas utility, Wisconsin Natural Gas Company. Heating value for the gas was determined by the utility through chromatography to be 1011 Btu/ft^3. Propane fuel was commercial grade, rated at 2500 Btu/ft^3. Concentrations of carbon monoxide and unburned

hydrocarbons were not detected for any of the samples downstream of the catalyst. Original data strip charts are included as pages 32 through 34. Original time and catalytic grid temperature data charts for combustion samples are included as page No. 21.
Combustion results were satisfactory based on outlet flue products analysis.

Results of combustion testing are tabulated on the following table.

COMBUSTION - GAS ANALYSIS DATA - NATURAL GAS FIRING

	Maximum Firing Rate		Minimum Firing Rate	
ample Item	Ahead of Catalyzer	After Catalyzer	Ahead of Catalyzer	After Catalyzer
x gen (O_2) Percent	19.70	19.70	20.40	20.30
arbon Dioxide (CO_2) Percent	0.80	0.80	0.40	0.40
bon Monoxide (CO) ppm	20.00	0.00	0.40	0.00
bustible Gases Percent	0.00	0.00	0.00	0.00
xides of Nitrogen ppm	0.00	0.00	0.00	0.00
rection Factor	15.25	15.25	30.50	30.50
ir Free CO ppm	305.00	0.00	1037.00	0.00
Free Combustible Gases %	0.00	0.00	0.00	0.00
Free Oxides/Nitrogen ppm	0.00	0.00	0.00	0.00
ulet Stack Temperature °F	----	362.00	----	250.00
e Temperature-before catalyzer	500	----	312.00	----

COMBUSTION - GAS ANALYSIS DATA - PROPANE GAS FIRING

Sample Item	Maximum Firing Rate		Minimum Firing Rate	
	Ahead of Catalyzer	After Catalyzer	Ahead of Catalyzer	After Catalyzer
Oxygen (O_2) Percent	19.80	19.70	19.90	20.10
Carbon Dioxide (CO_2) Percent	0.80	0.90	0.70	0.60
Carbon Monoxide (CO) ppm	17.00	0.00	22.00	0.00
Combustible Gases Percent	0.00	0.00	0.00	0.00
Oxides of Nitrogen ppm	5.00	0.00	0.00	0.00
Correction Factor	17.50	15.55	20.00	23.33
Air Free CO ppm	297.00	0.00	440.00	0.00
Air Free Combustible Gases %	0.00	0.00	0.00	0.00
Air Free Oxides/Nitrogen ppm	87.50	0.00	0.00	0.00
Outlet Stack Temperature °F	----	351.00	----	310.00
Flue Temperature-before catalyzer	521	----	385.00	----

Notes on Combustion Analysis: Ultimate CO^2 equals stoichiometric limit for CO_2 generation by gas combustion in air: 12.2% for natural gas, 14% for propane gas.

Air Free Sample is defined as sample corrected to ultimate condition (See above). (Sample) x (correction factor).

Correction Factor equals (ultimate CO_2) ÷ (sample CO_2).

ppm equals parts per million concentration.

Combustible gases are defined as unburned hydrocarbons in flue products.

Room ambient temperature during testing 73°F to 78°F.

Background CO during test varied 3 to 9 ppm due to cutting operations smoke and vehicle emissions inside test building and near test site.

Wiring, Component, Enclosures and Surface Temperatures/Fire Hazard

For this test, wiring components, and enclosure temperatures were monitored by use of certified thermocouple wire. The unit was operated on natural gas at maximum rate until equilibrium. The outside surface of the unit also was monitored by a strategically placed section of fire hazard board flush mounted to the skin. The board conformed to ANSI Z21 and Z83 fire hazard boards in construction. It was of wood material, finished in flat black and embedded with temperature recording thermocouples at six inch intervals. Upon reaching ambiency, temperatures were recorded with the unit continuing to operate. The temperatures noted were all acceptable. See chart page 13 of this report for trace of test.

DATA TABLE - WIRE, COMPONENTS, ENCLOSURES, FIRE HAZARDS

tial Start and Intermittent Operation Time 1:03 PM

t Up w/ Uninterrupted Rate Firing on Natural Gas 4:53 PM

rmocouple Point orded Temperature	Time 5:10	5:16	5:23	5:27	5:36	5:46	5:57	6:04	6:14
	Degrees Fahrenheit								
Left Outside Cabinet									<100
Flue Outlet	361		375		373			372	373
Electrical Wiring Box									107
Maxitrol Pilot Regulator			102	105	107	109	109	111	110
Main Enclosure Ambient		62.4	63				98		100
Electric Panel Rear Wall									107
rmored Cable (Closest to Firewall)									91
oom Ambient 5 ft. bove floor	67								76
Room Ambient 3 ft. above floor									74

Controls Operation

Controls were sequentially operated in the intended manner and according to the manufacturer's operating procedures. All controls were found to operate as intended by design.

Failure Modes - Safety and Operational Controls

Gas and electric safety and operation controls were operated to simulate failures. Simulation was by such modes as wire disconnects, or loss of gas by valving or blocking vents. All failure mode simulations resulted in either continued safe operation of the unit or shutdown of the certain operations, (e.g. gas flow to burners). Simulation of hazard modes required a manual restart cycle to re-energize the unit. Satisfactory results were noted on all tests.

Protection Testing Verification

Evidence was provided to our staff through visual verification and review of pertinent documentation that all units undergo a initial firing and operational checkout prior to release. This quality verification includes a chart graph of the operation and a detailed inspector's check off sheet. Any non-compliances encountered during the quality check are corrected before release of the units.

CONCLUSION:

Results of testing on the Remedi-Cat catalytic fume incinerator unit covered in this report indicates that if operated in a normal manner and the manufacturer's recommendations are followed, safe operation can be expected.

REPORT PREPARED BY:

LASZLO J. SZABOLCS
Certification Engineer
A.G.A.L.
Cleveland, Ohio

Date 27 March 1991

LJS/dm

REPORT REVIEWED BY:

RICHARD L. WEISER
Manager, Furnace Certification
A.G.A.L.
Cleveland, Ohio

Date 3-27-91

REMEDI-CAT

The Anguil Environmental Systems, Inc. REMEDI-CAT catalytic reactor system is a portable, self-contained fume incinerator specifically designed to destroy off gas, organic vapor contaminants (VOC) that are discharged from soil vapor extraction and ground water treatment systems during contaminated site clean-ups.

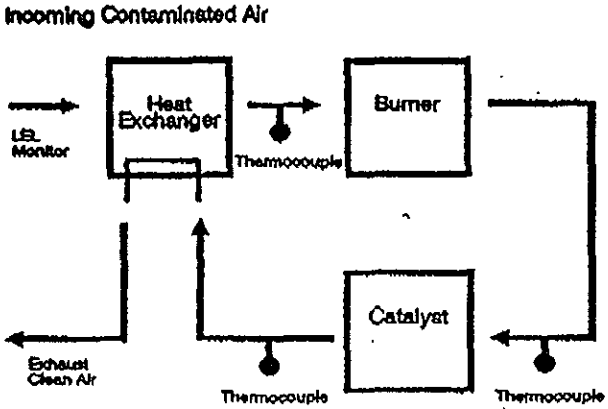
COMPONENTS

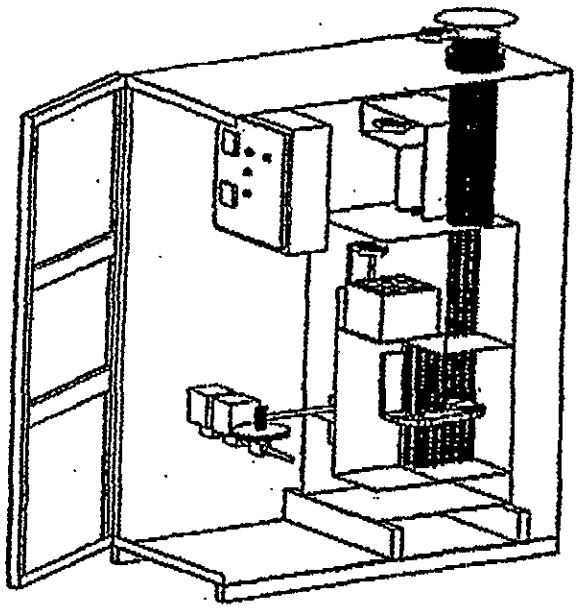
The REMEDI-CAT is shipped fully assembled and tested. It is enclosed in a weatherproof, insulated steel cabinet. Two lockable access doors allow service to all internal parts. A REMEDI-CAT can be configured to process from 100-500 CFM. The basic unit includes a heat exchanger, modulating burner, FM/IRI gas train, catalyst matrix, fan and fresh air bleed in valves, system controls, LEL monitor, strip chart temperature recorder and flame arrestor. Communication interface packages and specialty catalysts are available are as

CONSTRUCTION

The entire inner cabinet is fully welded 304 SS blanketed with high density insulation. The outer skin is weather resistant coated carbon steel. The heat exchanger, which preheats the incoming air stream to reduce operating costs, is a cleanable, shell and tube design, constructed from heavy gauge, type 304L SS. The burner is a proven industrial design and can be configured to operate with either natural gas or propane. The catalyst is a ceramic matrix, bearing a noble metal oxidizing catalyst. The matrix is contained in a removable, stainless steel module for ease of cleaning or replacement.

System Schematic





- **Onsite contaminant destruction**
- **No long term liability**
- **Low operating cost ($.20 min to $.75 max)**
- **Variable airflow**
- **Modular expandable construction**

HOW THE REMEDI-CAT WORKS

Solvent laden air is drawn into the fan, then pushed into the REMEDI-CAT. The air passes through the tube side of the primary heat exchanger and then into the burner section. The burner preheats the air to the catalyzing temperature. The preheated air passes over the catalyst where an exothermic reaction takes place and the VOC's in the air stream are converted to harmless carbon dioxide, water vapor and energy. The hot clean air then passes on the shell side of the heat exchanger where the energy is used to preheat the incoming air. Preheating the air allows the burner to modulate down accordingly and minimize the auxiliary fuel costs. In many cases the system will be self-sustaining. The purified air is then exhausted to atmosphere.

EXPERIENCE

The personnel at Angull Environmental Systems have been bringing incineration expertise to their customers since 1978. Their field proven designs allow them to offer systems with high destruction efficiencies and low operation costs. The REMEDI-CAT not only meets state and federal VOC and air toxic emission standards, but does so less expensively than alternate technologies. Destroying contaminants onsite with a REMEDI-CAT eliminates the chain of custody and other liability issues associated with other control technologies, giving peace of mind to its users.

SAFETY FEATURES

As a result of Angull Environmental's experience, a number of safety features have evolved as an integral part of their design. The control panel is provided with an electrical disconnect and an on/off pushbutton. Lights on the panel indicate the status of the burner, catalyst and safety circuits. A thermocouple, digital controller and modulating burner maintain the proper air temperature into the catalyst. The burner has a built-in purge cycle and is pilot ignited. A flame rod type sensor continuously monitors the combustion cycle. The burner will shut down if any one of the following occur: loss of proper airflow; loss of gas pressure; interruption of electrical supply, high LEL or over temperature. Manual reset is required after any safety shut down. An LEL monitor, circular chart recorder and flame arrestor are provided as part of the system. The communication packages, offered as options, allow for remote system monitoring and fault isolation.

SPECIFICATIONS (500 SCFM SIZE)

Outer Cabinet:	14 GA Coated Steel
Base:	Channel
Internal Construction.:	304 Stainless Steel
Insulation:	High Density Fiberboard
Unit Weight:	3350 lbs
Overall Dimensions:	48"W x 100"H x 95"L
Airflow:	100 - 500 SCFM
Static Pressure:	12" WC (Max Airflow)
Vapor Elimination:	10-20 lbs/hr Depending on Vapor Calorific Value
Aux Fuel Consumption:	40,000 BTU/hour (Maximum VOC Loading)
Aux Fuel Consumption: (No VOC Loading)	150,000 BTU/hour
Burner Capacity:	325,000 BTU/hour
Power Requirements:	230V/1/60
Max Outside Skin Temp:	50° Above Ambient
Catalyst:	Noble Metal/Ceramic Substrate
Inlet Pipe:	4" Diameter
Heat Exchanger:	Up to 70% Heat Recovery, 304L Stainless Steel Construction
Fan:	Type C Spark Proof Construction, 3 Hp, TEFC, Class 1, Division 2, Group D Explosion Proof

OPTIONS

- **Remote monitoring communication package**
- **Chloro-Cat for halogenated remediation systems**
- **Thermal oxidizer or hybrid catalytic/ thermal**
- **Continuous emission monitoring**
- **Larger systems with air volumes up to 50,000 SCFM**

Angull Environmental Systems, Inc., having a policy of continuous product improvement, reserves the right to make changes in design and specification without notice.

ENVIRONMENTAL INSTRUMENTS
2170 Commerce Avenue Unit S
Concord, California 94520
800-648-9355

APPENDIX D

DOCUMENTATION OF PACIFIC'S EMERGENCY RESPONSE SYSTEM

PACIFIC ENVIRONMENTAL GROUP, INC.
EMERGENCY RESPONSE SYSTEM

SECTION 1: BASIC PROCEDURE

EMERGENCY RESPONSE SYSTEM
SECTION 1: BASIC PROCEDURE

This manual has been provided to you as a guidance document in case of a site emergency that requires your involvement. Should an emergency occur, your good judgement is the key element to PACIFIC having a successful outcome.

The purpose of the emergency response system is to: (1) have a PACIFIC employee immediately notified in the event of a site emergency; (2) contact appropriate parties; (3) address or remediate the problem; and (4) determine the necessary follow-up action(s). A sign is posted on each PACIFIC treatment system listing the appropriate emergency response phone numbers.

Procedures

1. The PACIFIC emergency response system is activated when a witness dials the emergency number provided at the site. The witness records a message on the machine.

2. The phone system will notify the appropriate PACIFIC group and will continue to call the contact people until someone answers the phone and enters the password.

3. When an emergency response call is received, enter the password to access the message.

4. The person who receives the call and accesses the message (the emergency response manager or ERM) has the responsibility to:

   - Check the site information in the binder to get an understanding of the treatment system parameters (see site descriptions in Section 2).
   - Call the witness and ask questions to gain more information regarding the incident. The following are examples of questions to ask the witness:

1. When did the situation occur?
2. Are you still in the vicinity?
3. What is happening now?
4. Have the authorities been notified?
5. Is there any action being taken?
6. Was anyone injured?
7. Can you stay until someone gets there?

5. The ERM determines the urgency of the problem and, if necessary, contacts appropriate emergency site personnel (ESP), typically an O&M person in the vicinity of the site, and gives them applicable information, such as:

    1. The nature of the incident.
    2. Special equipment that may be required.
    3. Whether additional staff will be required.
    4. The Health & Safety concerns that are present.
    5. Who is present at the site (if anyone).
    6. What authorities have been called (such as the fire department).
    7. The type of reporting required when they get to the site.

6. Should the situation require an emergency response crew to handle a clean up or related issue, the PACIFIC ERM coordinates the site response.

7. If appropriate, the ERM should also contact local authorities to make them aware of the situation and PACIFIC's involvement.

8. Depending on the immediacy of the situation, the PACIFIC principal in charge of that client's work should be notified (see phone listing in section 3). The client should be notified by the ERM once problem is assessed (see phone listing in Section 3).

9. An incident report should be prepared by the ERM with the assistance of the ESP and submitted to the PACIFIC Safety Officer within 24 hours of the event.

10. A post-incident meeting with all parties involved should be conducted to discuss or determine the following:

    o Why and what caused the incident to take place?

- Did the emergency response system operate satisfactorily; if not, what changes are appropriate?
- What follow-up actions are necessary to remediate the problem?

Emergency Response Package

In addition to these procedures, the following sections contain information about the sites, contact names, and phone numbers that may be required to manage an incident. The three lists are divided as follows:

- **Section 2: Site Descriptions** - a listing of what you need to know about the systems to understand the situation.
- **Section 3: Client Specific Contacts** - a listing of PACIFIC engineers and geologists that manage these sites, the PACIFIC principal managers for the specific clients, and a listing of client personnel to be contacted once the incident is assessed.
- **Section 4: Municipality Specific Contacts** - a listing of municipalities and their local emergency phone numbers. Also listed for each municipality are technical staff people living in the area and contact phone numbers.