REMEDIATION SYSTEM INSTALLATION

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FORMER Y-PAY MORE DRY CLEANERS

Federal Way, Washington

Prepared for

Northwest Building Corporation

11-07883-08

October, 1993

RZA AGRA, Inc. Engineering & Environmental Services



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11-7883

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1.0 INTRODUCTION

This report documents RZA AGRA Inc's (RZA AGRA) activities concerning remediation at the former Y-Pay-Mor dry cleaners in Federal Way, Washington. The report consists of the following sections: (1) Introduction; (2) Pre-Remediation Field Activities; (3) Remediation System Installation; (4) Remediation System Monitoring and (5) Conclusions.

1.1 Background

The former Y-PAY-MOR dry cleaners is located at 2210 S. 320th Street in Federal Way, Washington, in the eastern extreme of the Best Shopping Mall. Figure G-1, the Site Location Map, shows the approximate location of the site and the surrounding vicinity.

Site topography is generally flat-lying with an increasing topographic gradient to the east rising approximately 18 feet to 23rd Avenue South from the former dry cleaner. The inside area of the former dry cleaner is paved with a concrete slab which is on a average seven inches thick.

Washington State Department of Ecology (Ecology) documented release of tetrachloroethylene (PCE) at the subject site on 4 October 1991 and 8 August 1991. Total volume of documented release reported by Ecology was estimated to be 6 gallons of tetrachloroethylene and an unreported volume of tetrachloroethylene "waste product". Estimates for total volume of PCE released range from a minimum of approximately 11 gallons to an unknown maximum volume. Unsaturated zone soils consisting of fill in the west-central area of the former dry cleaner exhibited residual and vapor phase components in the areas surveyed, consisting mainly of tetrachloroethylene, and lesser amounts of trichloroethylene, acetone, and cis-1,2 dichloroethene to an approximate depth of 6.5 feet. This depth roughly corresponds to the fill/native boundary. Concentrations of tetrachloroethylene detected in soil samples exceeded Ecology's Model Toxics Control Act (MTCA) Method A cleanup levels (for residential and industrial/commercial sites) and appear to occur adjacent to the former equipment drain line in the drain line backfill. Soil samples in the vicinity of the former equipment drain contained concentrations of tetrachloroethylene which exceeded MTCA Method A cleanup levels.

2.0 PRE-REMEDIATION FIELD ACTIVITIES

This section briefly describes pre-remediation field activities at the subject site. The pre-remediation field activities included subsurface drilling/characterization, soil gas survey, vapor injection well installation, and ambient air monitoring.

2.1 Subsurface Drilling/Characterization

Subsurface characterization through utilizing boring/drilling techniques was conducted at the subject site during three events. These events occurred in June, August and October 1992. The analytical test results indicated that PCE had impacted the shallow fill soils mainly in the west central portion of the former dry cleaners.

2.2 Soil Gas Survey

Two soil gas surveys were conducted at the subject site in order to delineate the approximate area impacted by PCE and its related breakdown products. The first soil survey was conducted in September 1992. Four soil vapor points were advanced in the vicinity of the former equipment drain in the west central area of the site.

The second soil vapor survey was conducted in April 1993. Twelve soil vapor points were advanced in the southwestern, central and northwestern portions of the site. Appendix A contains the location, analytical test result summaries of soil gas collected from the respective soil vapor points, and analytical testing laboratory certificates of soil vapor analyses.

2.3 Vapor Extraction Point Installation

Figure C1, located at the end of this report shows the approximate location of the vapor extraction points which were installed at the subject site.

Stainless steel (.010 inch, slotted) vapor extraction well points were installed in borings BW-2 (former monitoring well MW-1), B-6, B-7, B-8, B-9, and B-10. The well points were installed to approximately 7.5 feet at the approximate fill/native soil contact. The 7.5 foot depth was selected as the depth to which qualitative and quantitative concentrations of volatile organic compounds decreased markedly. Note that this depth corresponds to the fill/native soils boundary. Figure C2 illustrates the details and section of the soil vapor points.

A 4-inch (ID) air injection/vapor extraction well, designated VP-7 was installed in the southwestern portion of the subject site in May 1993. Figure C1 shows the approximate location of the well. A detail and section view of the well is contained in Figure C2.

2.4 Ambient Air Monitoring

RZA AGRA performed ambient air sampling within the former dry cleaner and in the adjacent aerobics facility. The aerobics facility and the former dry cleaner share a common wall (western wall). Air monitoring and testing was conducted from April 1993 through May 1993 in order to assess the presence, if any, of fugitive air emissions from the vapor well sites and the impacted soils beneath the former dry cleaners.

Appendix B contains the laboratory methodology, analytical test result summaries and analytical test certificates of our ambient air monitoring program.

2.5 Puget Sound Air Pollution Control Agency Permitting

Permitting application requirements for Puget Sound Air Pollution Control Agency (PSAPCA) were completed in May 1993. The PSAPCA issued a permit on 21 May 1993. Appendix C contains PSAPCA's permit and a copy of RZA AGRA's notice of construction and application for the PSAPCA permit.

3.0 REMEDIATION SYSTEM INSTALLATION

This section describes the remediation system installation for the former dry cleaner.

3.1 System Description

Figures C1, C2 and M1, located at the end of the text, detail the remediation system layout, vapor extraction well details, and the remediation compound, respectively. The volatile organic compounds are removed from several soil-vapor extraction wells using a vacuum blower. The air stream will first be treated by passing it through a steel moisture knockout tank to remove water, and possible liquid phase compounds. The air stream exits the tank and enters the suction of a regenerative vacuum blower and discharges to an activated carbon unit. The contaminant-free air exits the carbon units via a passive 4-inch diameter vent, measuring approximately 30 feet in height.

The system is also designed to allow for air injection into the subsurface through well VP-7 (see Section 2.3). Well VP-7 is a combination 4" (ID) vapor extraction and air injection well. All other wells used for remediation system are two-inch stainless steel, 0.010-inch slotted, vapor extraction wells (VP-1, VP-2, VP-3, VP-4, VP-5, VP-6). VP-7 is a four-inch, 0.010-inch slotted, stainless steel well, with a two-inch insert "drop" pipe, placed in the lower section of the well and sealed with an inflatable packer. Air is injected to the

subsurface using a high pressure regenerative blower located in the treatment compound, to the lower portion of the well. The air permeates through the vadose zone to enhance vapor partitioning and control migration of DNAPLS.

3.2 Installation

In May of 1993 RZA AGRA with Beck Environmental Contracting installed a soil vapor extraction remediation system at the subject site. The system installation procedures were as follows:

- Concrete floor slab was sawcut by Cascade Sawcutting services, including all trenching areas and outside access holes for pipe termination in the treatment compound located on the northern end of building.
- Concrete was removed and stockpiled for testing and subsequent removal to landfill and/or recycling.
- Sand bedding and HPDE piping was placed in the trenches. All piping for air distribution line was thermally fused together at all joints and elbows.
- All vapor wells were manifolded into the piping network and terminated at the northern (outside) portion of the building in the treatment compound.
- Wells VP-2, VP-6, VP-1 were manifolded on one header as circuit VES-3. Wells VP-3, VP-4,
 VP-5 are manifolded on one header as circuit VES-2. Independent vapor extraction and air injection lines were manifolded to VP-7 as VES-1 and Air, respectively (see Trench Details).
- VP-7 was installed by Beck Environmental Contracting. Piping was connected by RZA
 AGRA after fabrication of special adapters and fittings (see Well Details).
- The piping was covered with a sand bedding and cover and finished to existing slab grade with concrete.

- A steel platform was designed and built to hold remediation equipment. The platform was
 designed to place equipment on a level surface in the treatment compound area north of
 the building and west of the existing loading dock.
- Concrete finishing work was performed to satisfy contract agreements and to facilitate the use of the surface for flooring activities.
- Equipment for the air system was installed in the treatment compound and secured by a fenced enclosure. All wiring and power supply was installed and permitted by a licensed electrical contractor, Megara Electric Contractors.
- A controller with a gas monitoring unit was installed for safety and on-site display of emission levels. Independent motor starters for blowers were installed with all controls in weather-proof enclosures.

The vapor extraction system is designed to operate on a continuous basis. System overload and alarm protection are installed for complete system shut-down and manual reset. All components are weather-proof and designed for outside locations.

The following is a summary of equipment installed at the site:

Quantity	Description							
1	Control panels: 230V, 50 amp, 1-phase							
. 1	Steel Moisture Knockout Tank: 77 Gallon Capacity							
1	Regenerative Vacuum Blower: 2HP, 230V, 1-phase							
2	Activated Carbon Units: 1,000 lbs. carbon capacity							
1	MSA Model 5100 Emissions Monitoring System							
1	Regenerative High Pressure Blower: 1.5 HP, 230V, 1-phase							
1	Power Meter/Distribution Panel							
10 X 18	Fenced Enclosure with 2 gates							

NOTE: See Figure M1

On 17 June 1993, after all equipment was placed and installation activities completed, the vapor extraction system was started. Each piping network for air extraction was equipped with vacuum pressure gauges and valves to balance the system flow. Initial system testing included system wiring check, equipment calibration and leak detection for vapors in the equipment compound area.

The system was engaged and readings were taken from influent and effluent sample ports. No air injection was applied to the subsurface at the initial startup. The following is a summary of initial system readings and operating conditions.

Description	Reading
Total System Vacuum	37 inches W.C.
VES-2	25 inches W.C.
VES-3	25 inches W.C.
OVM Readings Influent	170 ppm
OVM Readings Effluent	0 ppm
MSA 5100 Effluent	0 % LEL

Noted — OVM readings are of total organics, not differentiated by species.

The vapor extraction system incorporates a carbon adsorption unit in the process. This unit is for the extraction of chlorinated hydrocarbons in the air stream which may impact the surrounding ambient air environment. This adsorption process was employed to minimize the risk of potential adverse toxic emission impacts, if these emission were to be vented directly into the air.

4.0 REMEDIATION SYSTEM MONITORING

RZA AGRA has periodically monitored the related efficiency of the remediation system since system startup on 17 June 1993. This periodic monitoring is necessary in order to assess the efficiency of

tetrachloroethylene vapor recovery, the efficiency of the carbon filtration system, and to calculate equivalent mass recovery of vapor phase PCE.

4.1 Influent/Effluent Monitoring, Sampling and Results

All emissions from the vapor extraction unit are monitored and sampled at sample ports before (influent) and after (effluent) the carbon units (Figure M1). To date, a total of five influent and effluent vapor samples have been collected and analyzed for PCE concentration by EPA Methods 8010 and 8015 per Washington Department of Ecology Guidelines.

Influent vapor PCE concentrations at system startup were approximately 130 µL PCE/L at the time of system startup on 17 June 1993. Vapor PCE concentration levelled to approximately 4.2 µL PCE/L on subsequent monitoring conducted on 2 July 1993, 15 July 1993, and 26 August 1993. Appendix D contains a graph of influent concentrations for PCE vapors for the time period 70 days after system startup (26 August 1993).

Effluent PCE vapor concentrations are monitored via a sample port located behind the carbon units. Effluent PCE vapor concentrations should be at or near detection limits ($<0.1 \,^{\mu L}/L$ ppm V) in order to comply with PSAPCA permitting requirements. Our 7 July 1993 monitoring and subsequent analytical test results indicated that approximately 3.0 $^{\mu L}/L$ of PCE was bypassing the remediation systems carbon scrubbers. The bypassing problem was traced to back pressure caused by a 2-inch (ID) piping restriction between the carbon scrubbers and the effluent stack. The back pressure initially was reduced by decreasing total system vacuum pressures and most recently by installing a 4-inch (ID) line between the carbon scrubbers and the effluent stack.

Effluent PCE vapor concentrations were reported at <0.1 μ L/ $_{L}$ on 26 August 1993. Appendix D contains a graph of effluent concentrations for PCE vapors for the time period 70 days after system startup (26 August 1993).

4.2 Equivalent PCE Mass Removal Calculations

In order to assess the efficacy of PCE contaminant removal, RZA AGRA has calculated the equivalent PCE mass removal for the subject site remediation system. The equivalent mass removal calculations indicate that approximately 2.03 pounds of total PCE mass have been recovered in the seventy day period from

system startup up on 17 why 1993 to 26 August 1993. Appendix D contains our PCE recovery calculations and assumptions.

5.0 CONCLUSIONS

Clean up or remediation is defined by Washington Department of Ecology (WDOE) as generally meaning, "... that a contaminated site is cleaned up to the point that the contamination at the site no longer poses an unacceptable threat to human health and the environment" (Model Toxics Control Act, Chapter 173-340 WAC).

RZA AGRA strives in all independent remediation designs and operating systems to use the best available technology to clean up a contaminated site to levels where the contamination no longer poses an unacceptable threat to human health and the environment. However, many fiscal, physical, and chemical variables affect the ability of RZA AGRA's remediation efforts to meet clean up goals, including, but not limited to: (1) undiscovered contamination; (2) inherent physical and chemical variability of subject site soils and groundwater; (3) inherent physical and chemical characteristics of subject site contaminant(s); (4) project budget constraints; (5) subject site physical surface and physical subsurface infrastructure; (6) magnitude and subsurface aerial extent of contamination; (7) historical knowledge of the residence time of the contaminant(s) released; (8) historical documentation of the subject site contaminant types, source, use and volume estimates of contaminants released or potentially released to the subsurface or the environment; and (9) specific technology employed for clean up.

5.1 Estimated Duration of Remediation

Based on our equivalent mass calculations and remediation results for the seventy day period 17 June 1993 to 26 August 1993, the estimated duration of the VES remediation at the subject site should be less than 1 year. Note that this estimate should not be interpreted to imply that the subsurface contamination will be entirely removed in a 1 year period. The estimate is offered in order to cost effectively pursue site closure through well documented remediation system operation and resultant subsurface mass removal calculations.

We appreciate the opportunity to offer our remediation services to Northwest Building Corporation. If you have any questions or comments concerning the contents of this report, please do not hesitate to call at your earliest convenience.

Respectfully submitted,

RZA AGRA, Inc.

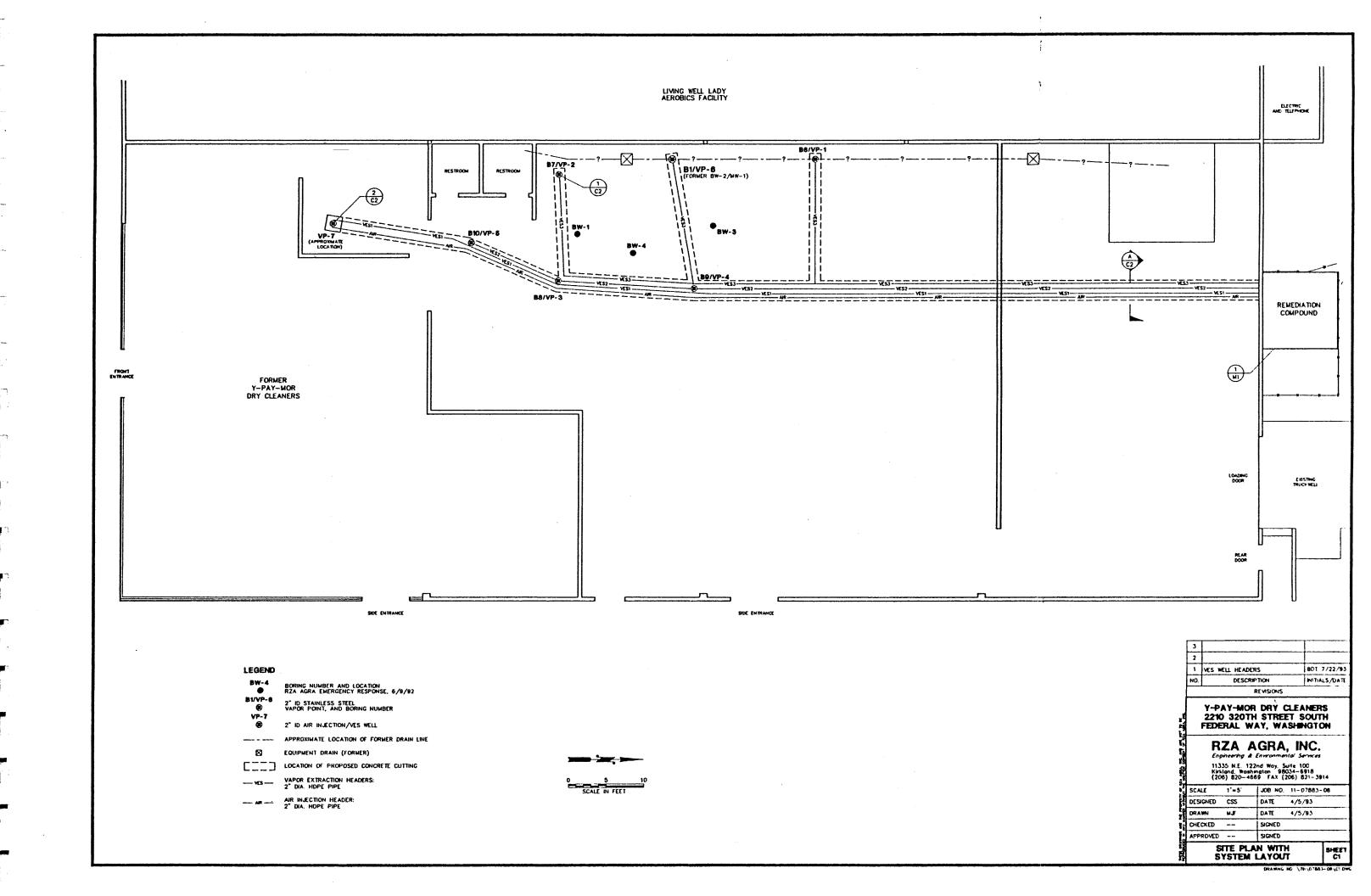
Dale A. Kramer, M.Sc., R.P.G.

Project Scientist

Steven M. Marczewski, P.E.

Associate Environmental Engineer

DAK/



Y-PAY-MOR DRY CLEANERS 2210 320TH STREET SOUTH FEDERAL WAY, WASHINGTON

IN-SITU VAPOR EXTRACTION SYSTEM AS-BUILT DESIGN PLANS

INDEX OF DRAWINGS

SHEET NUMBER

DESCRIPTION

GENERAL

LOCATION MAP AND INDEX OF DRAWINGS

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SITE PLAN WITH SYSTEM LAYOUT DETAILS AND SECTIONS

MECHANICAL

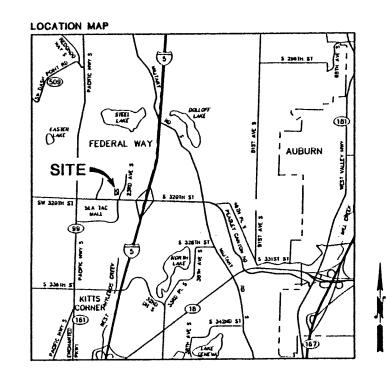
COMPOUND LAYOUT

OWNER

NORTHWEST BUILDING CORPORATION 1300 NORTON BUILDING 801 SECOND AVENUE SEATTLE, WASHINGTON 98104 ATTN: JOHN BICKLEY

ENVIRONMENTAL SUPERVISOR

RZA AGRA, INC. (CONSULTANT)
11335 N.E. 122ND WAY, SUITE 100
KIRKLAND, WASHINGTON 98034
(206) 820-4669
ATTN: DALE KRAMER



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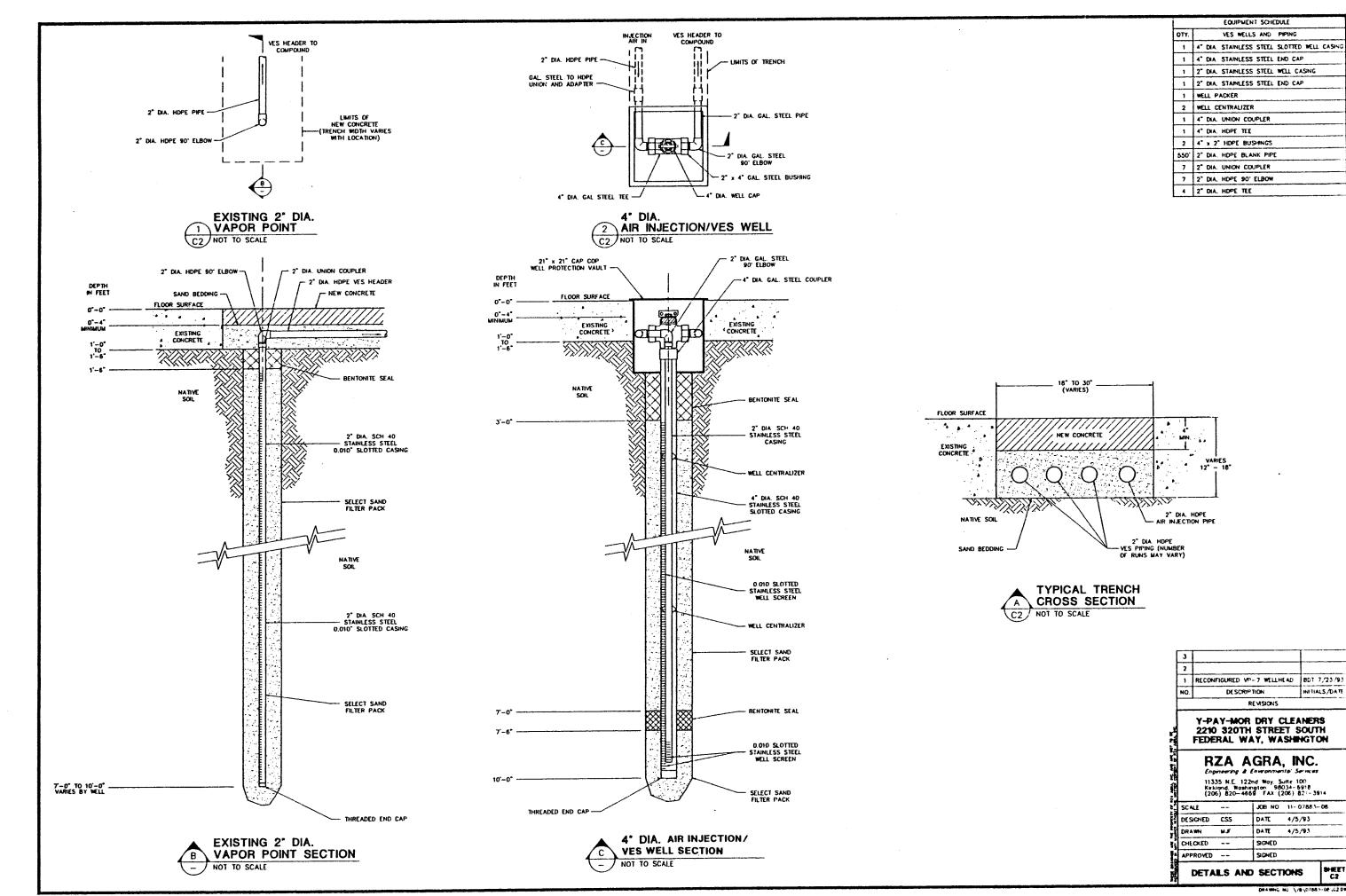
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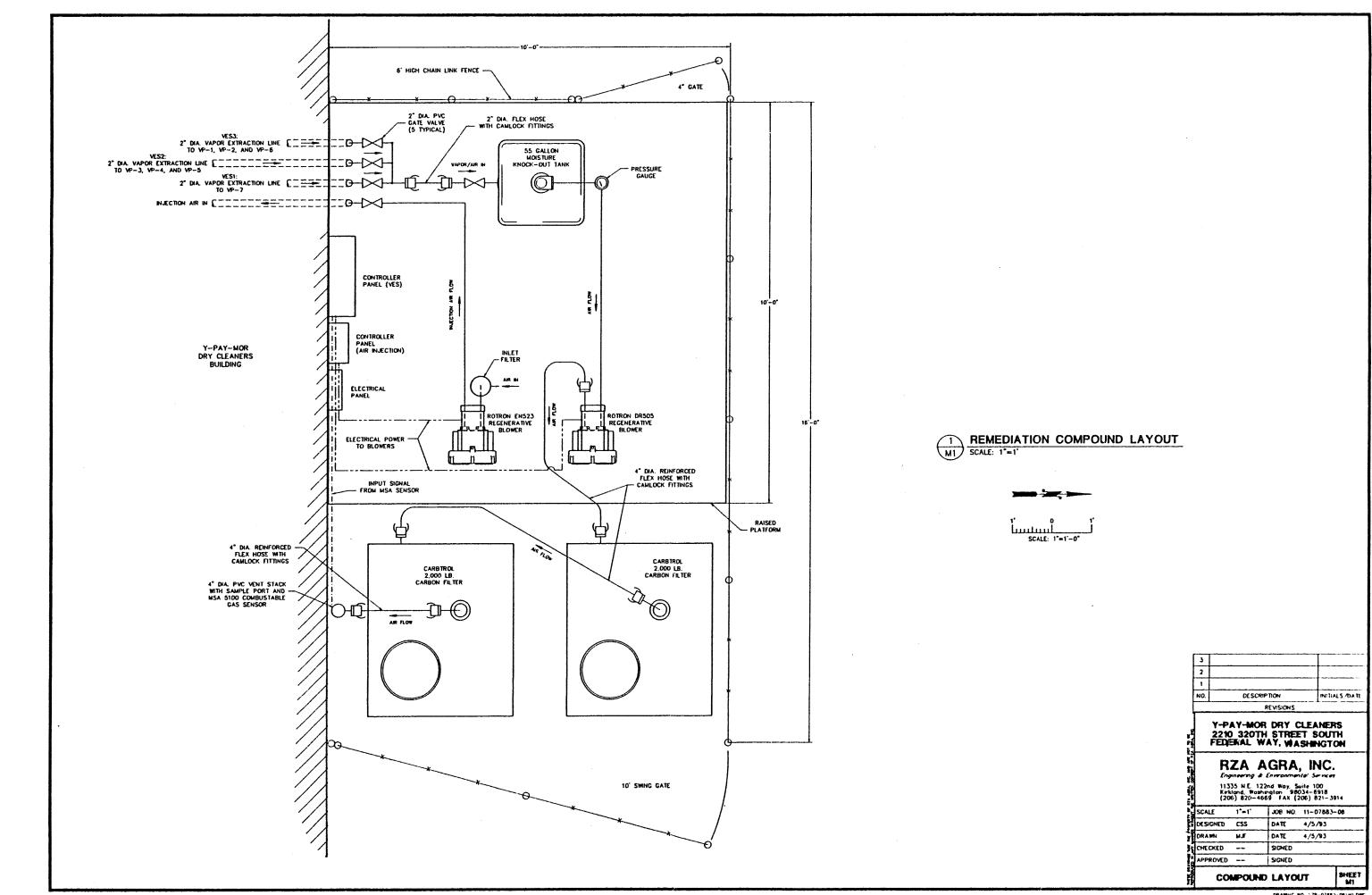
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LOCATION MAP AND INDEX OF DRAWINGS

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APPENDIX A
SOIL VAPOR SURVEY
11-07883-08

APPENDIX A SOIL VAPOR SURVEY ANALYTICAL RESULTS FORMER Y-PAY-MOR DRYCLEANERS W-7883-08

SOIL VAPOR SAMPLE	SAMPLE DATE	PCE (PPMv)	TCE (PPMv)	ACETONE (PPMv)	V.C. (PPMv)	PID READING (PPM)
SVS-5	4/13/93	<1.0	<1.0	<1.0	1.0	0
SVS-6	4/13/93	<1.0	<1.0	<1.0	<1.0	. 0
SVS-7	4/13/93	7.0	<1.0	<1.0	<1.0	0
SVS-8	4/13/93	5.0	<1.0	<1.0	<1.0	0
SVS-9	4/13/93	<1.0	<1.0	<1.0	<1.0	0
SVS-10	4/16/93	<1.0	<1.0	<1.0	<1.0	0
SVS-11	4/16/93	1.0	<1.0	<1.0	<1.0	0
SVS-12	4/16/93	<1.0	<1.0	<1.0	<1.0	0
SVS-13	4/21/93	<1.0	<1.0	<1.0	<1.0	0
SVS-14	4/21/93	<1.0	<1.0	<1.0	<1.0	0
SVS-15	4/21/93	<1.0	<1.0	<1.0	<1.0	0
SVS-16	4/21/93	<1.0	<1.0	<1.0	<1.0	0

DEFINITIONS: PCE - Tetrachloroethylene

TCE - Trichloroethylene V.C. - Vinyl Chloride

NOTES:

PID used contained an 11.8 eV ionization potential lamp. PID vapor reading was taken from soil vapor effluent immediately after

withdrawing soil vapor sample.

	svs.	(J——?- SVS-13	<u>)</u> svs-15	0 SVS-16
		SVS-14		
	VP-7 (APPROXIMATE LOCATION)			
FRONT ENTRANCE	SVS-11 FORMER			
١	Y-PAY-MOR RY CLEANERS			
				LOADING DOOR
	ŭ			REAR DOOR
LEGEND				
BW-4 ●	BORING NUMBER AND RZA AGRA EMERGENO			
B1/VP-6 ® VP-7	2" ID STAINLESS STE VAPOR POINT, AND E			•
VP-7 ເ⊗ svs-16	2" ID AIR INJECTION,			
373-10	SOIL GAS SURVEY PO			
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[]	EQUIPMENT DRAIN (F	SOIL	GAS SURVEY LO	
<u> </u>			DRAWING NO. \7B\07	FIGURE 1

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#### **ENVIRONMENTAL CHEMISTS**

Date of Report: April 15, 1993 Date Received: April 14, 1993 Project: W-7883-8, Y Pay Mor

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES

# USING EPA METHODS 8015 (MODIFIED) AND 8010 Results Reported as µg gas/liter volume (ppm)

Sample ID	SVS-5	<u>SVS-6</u>	<u>SVS-7</u>	<u>SVS-8</u>
Analyte:				
Vinyl Chloride	1	<1	<1	<1
cis-Dichloroethylene	1	<1	<1	<1
t-Dichloroethylene	<1	<1	<1	<1
Trichloroethylene	<1	<1	<1	<1
Tetrachloroethylene	<1	<1	7	5
Acetone	<1	<1	<1	<1

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: April 15, 1993 Date Received: April 14, 1993 Project: W-7883-8, Y Pay Mor

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES

USING EPA METHODS 8015 (MODIFIED) AND 8010
Results Reported as µg gas/liter volume (ppm)
Quality Assurance

Sample ID	<u>Blank</u>
Analyte:	
Vinyl Chloride	<1
cis-Dichloroethylene	<1
t-Dichloroethylene	<1
Trichloroethylene	<1
Tetrachloroethylene	<1
Acetone	<1

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## **ENVIRONMENTAL CHEMISTS**

Date of Report: April 21, 1993 Date Received: April 19, 1993 Project: 11-07883-08, Y-Pay-More

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES

# USING EPA METHODS 8015 (MODIFIED) AND 8010 Results Reported as µl gas/liter volume (ppm)

Sample ID	SVS-10	<u>SVS-11</u>	<u>SVS-12</u>
Analyte:			
Vinyl Chloride	<1	<1	<1
Acetone	<1	<1	<1
t-Dichloroethylene	<1	<1	<1
cis-Dichloroethylene	<1	<1	<1
Trichloroethylene	<1	<1	<1
Tetrachloroethylene	<1	1	<1

## **ENVIRONMENTAL CHEMISTS**

Date of Report: April 21, 1993 Date Received: April 19, 1993 Project: 11-07883-08, Y-Pay-More

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES

USING EPA METHODS 8015 (MODIFIED) AND 8010 Results Reported as µl gas/liter volume (ppm) Quality Assurance

Sample #	<u>Blank</u>
Analyte:	
Vinyl Chloride	<1
Acetone	<1
t-Dichloroethylene	<1
cis-Dichloroethylene	<1
Trichloroethylene	<1
Tetrachloroethylene	<1

RZA-AGRA Environmental & Engineering Services 11005 Northwest 100md Way	5	Nº	01	QΛ	Ω		(	Ch	nai	n	of	Cı	us	tod	yb	Re	eco	ord	//	٩na	aly	⁄si	s	Re	qı	ıes	it
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## **ENVIRONMENTAL CHEMISTS**

Date of Report: April 26, 1993 Date Received: April 21, 1993

Project: W-7883-8

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES USING EPA METHODS 8015 (MODIFIED) AND 8010 per Washington DOE Guidelines Results Reported as µl gas/liter volume (ppm)

Sample #	SVS-13	SVS-14	SVS-15	<u>SVS-16</u>
Analyte:				
Vinyl Chloride	<1	<1	<1	<1
$t ext{-} ext{Dichloroethylene}$	<1	<1	<1	<1
cis-Dichlorethylene	<1	<1	<1	<1
Trichloroethylene	<1	<1	<1	<1
Tetrachloroethylene	<1	<1	<1	<1
Acetone	<1	<1	<1	<1

## **ENVIRONMENTAL CHEMISTS**

Date of Report: April 26, 1993 Date Received: April 21, 1993

Project: W-7883-8

# RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES USING EPA METHODS 8015 (MODIFIED) AND 8010 per Washington DOE Guidelines

per Washington DOE Guidelines Results Reported as µl gas/liter volume (ppm) Quality Assurance

Sample #	<u>Blank</u>
Analyte:	
Vinyl Chloride	<1
t-Dichloroethylene	<1
cis-Dichlorethylene	<1
Trichloroethylene	<1
Tetrachloroethylene	<1
Acetone	<1

# SAMPLE CHAIN OF CUSTODY

¥ 4502-1 4-21-93

Report To:  Appany R DA  Address 11335  City, State, Zip Kick Ice  Phone # 325	AURA -	Γ		COSTODY		
(ddress 11335	NF 122 01	NAU	Conta	d		
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				PROJE	CT LOCATION	
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APPENDIX B

AMBIENT AIR MONITORING

11-07883-08

11 August 1993 Y-Pay-Mor

Attention: Dale Kramer

Regarding: Ambient Testing at Y-Pay-Mor.

RZA-AGRA personnel performed ambient sampling for air health and safety concerns at two site locations. Site 1 was at Y-Pay-Mor. Site 2 was at living Well Lady. The two sites share a common wall near the remediation site. Sampling was performed in conjunction with soil remediation being conducted at Y-Pay-Mor (dry cleaners). Air testing was performed to determine if the remediation activities caused any fugitive air emission from the well sites. Monitoring was conducted on a regular basis (when the remediation unit was operating) to insure personnel safety at the two sites.

Job Number: 11-07889-03

VINYL CHLORIDE: The air quality was monitored routinely for vinyl chloride. Air quality samples were taken at Y-Pay-Mor and at Living Well Lady. Sampling was conducted with a personal size sample pump and air samples were drawn though a coconut shell charcoal tube at a rate of 1.0 L/min for no less than 1 hour. Sampling and analysis was conducted according to NIOSH Method 1007. Sample recovery was performed in the field, packed on ice and shipped to Friedman & Bruya, Inc. for analysis by gas chromatography (FID). The reported sample concentration is in ppmv.

TETRACHLOROETHYLENE: Monitoring for tetrachloroethylene (PCE) was conducted on a regular basis in both Living Well Lady and Y-Pay-Mor. Sampling for PCE was conducted with the use of passive badges packed with coconut shell charcoal and sampled from 1 to 2 hours. The testing and analysis was conducted per NIOSH Method 1003 and analyzed by Friedman & Bruya, Inc. by gas chromatography (FID). The reported results are ppm.

FIELD LOGS: All Testing at the two site were documented in a field log. Each field log outlines the activities conducted at the site on that date. All field logs generated on this project are submitted within this report.

#### 11 August 1993 Y-Pay-Mor

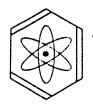
DISCUSSION: The remediation activities at Y-Pay-Mor thus far have shown little to no fugitive air emissions detected at Y-Pay-Mor or at Living Well Lady. The remediation unit used at the site is design with the intake vacuum slightly higher than the amount of air pressure being force into the soil. With the presence of this condition, the remediation site is under a constant vacuum. Due to the presence of a vacuum on the area under the concrete slab, ambient air is drawn into the soil from other sources (crack, joints, or cuts) in the concrete preventing the emission of fugitive gases. With the continued monitoring of this current remediation configuration the need to monitor air quality has ceased. However, if the current subsurface pressure changes, air monitoring air quality should be sampled.

<u>SUMMARY OF ANALYTICAL REPORTS</u>: listed below is a summary of the air sampling results. The results are in ppm and listed in weekly order.

SAMPLE DATE	VINYL CHLORIDE (ppm average)	TETRACHLOROETHYLENE (ppm average)
4/26-27/93 Y-Pay-Mor (YPM) Living Well Lady (L	0.013 WL) (0.013	< 0.30 1.66
5/17/93 YPM LWL	< 0.01 < 0.01	< 0.01 < 0.01
6/7/93 YPM LWL	< 0.01 < 0.01	< 0.01 < 0.01
6/25/93 (a) YRM LWL	- -	
7/15/93 YPM LWL	< 0.006 < 0.006	0.05 < 0.02
7/22/93 YPM LWL	< 0.006 < 0.006	0.025 < 0.02
7/29/93 YPM	< 0.01	⟨ 0.04

⁽a) Remediation activities were on hold prior to sampling, Samples were taken but not analyzed.

# LABORATORY ANALYSIS



# Itek Enviro Services, Inc.

Industrial Hygiene and Environmental Laboratory

4/30/93

Mr. Dale Kramer RZA AGRA, Inc. 11335 Northeast 122 nd Way #100 Kirkland, WA 98034-6918

Client PO#: 6464-12 Project #: 6464-12

Survey #:

# LABORATORY RESULTS

Date Sampled: 04/27/93

Analyzed: 04/30/93

Matrix: SKC Badges

Lab Job #: 93376

Date Received: 04/29/93

Reported: 04/30/93

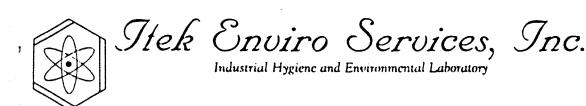
Method: Halogenated Hydrocarbons (NIOSH 1003, DL=0.01 mg)

Vinyl Chloride (NIOSH 1007, DL=0.001 mg)

Lab#	Smpl. ID	Air Vol.	For		Concentra mg/m3	ation ppm	
376-01 TETRAC	LWC-1 HLOROETHYLENE	4.32	0.0	029	6.710	0.989	
376-02 TETRAC	LWC-2 HLOROETHYLENE	4.26	0.0	068	16.000	2.360	
Lab#	Smpl. ID	Air Vol. (lt)	Front mg	Back mg	Total mg	Concent mg/m3	ration ppm
376-03 VINYL	VC-2 CHLORIDE	30.0	<0.001	<0.001	<0.001	<0.033	<0.013

This report has been reviewed and approved for release

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4/29/93

Mr. Kelly David RZA AGRA, Inc. 11335 Northeast 122 nd Way #100 Kirkland, WA 98034-6918

Client PO#:

Project #: Y-PAY MORE

Survey #:

# LABORATORY RESULTS

Date Sampled: 04/26/93

Lab Job #: 93370

Analyzed: 04/28/93

Date Received: 04/28/93

Matrix: SKC Badges, anasorb tube

Reported: 04/29/93

Method: Halogenated Hydrocarbons (NIOSH 1003, DL=0.01 mg)

Vinyl Chloride (NIOSH 1007, DL=0.001 mg)

Lab# Smpl. ID	Air Vol.	Four mg		centration p	on pm
370-01 PB1 TETRACHLOROETHYLENE	4.9	<0.0	10 <2.0	40 <0	.301
370-02 PB2 TETRACHLOROETHYLENE	4.9	<0.0	10 <2.0	)40 <0	.301
370-03 PB3 TETRACHLOROETHYLENE	4.97	<0.0	10 <2.0	)10 <0	.296
370-05 KGO1 TETRACHLOROETHYLENE	2.71	<0.0	10 <3.6	90 <0	.544
Lab# Smpl. ID	Air Vol.	Front mg	Back mg	Total mg	Concentration mg/m3 ppm
370-04 VC1 VINYL CHLORIDE	30.0	0.001	<0.001	0.001	0.033 0.013

This report has been reviewed and approved for release

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## **ENVIRONMENTAL CHEMISTS**

Date of Report: May 24, 1993 Date Received: May 18, 1993 Project: 6464-12, Y-Pay-More

Date Extracts Analyzed: May 19, 1993

# RESULTS FROM THE ANALYSIS OF PASSIVE SAMPLER BADGE SAMPLES

FOR TETRACHLOROETHYLENE Results Reported as uL gas/Liter volume (ppm)

Sample ID	<u>Tetrachloroethylcne</u>	Internal Standard (% Recovery)
Y-1	<0.01	99%
L-1	<0.01	103%
L-2	<0.01	98%
KGD-2	<0.01	85%
Quality Assurance		
Blank	<0.01	115%
L-2 (Replicate)	<0.01	104%
Spike Blank % Recovery	91%	95%
Spike Level	0.2	

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: May 24, 1993 Date Received: May 18, 1993 Project: 6464-12, Y-Pay-More

Date Samples Extracted: May 18, 1993 Date Extracts Analyzed: May 19, 1993

# RESULTS FROM THE ANALYSIS OF THE CHARCOAL TUBE SAMPLES FOR VINYL CHLORIDE

Results Reported as µL gas/Liter volume (ppm)

Sample ID	Vinyl Chloride	Internal Standard (% Recovery)
L-A	<0.01	114%
Y-A	<0.01	1,500% ^a
KGD-1	<0.01	na
Quality Assurance		
Blank	< 0.01	92%
L-A (Replicate)	<0.01	105%
Spike Blank % Recovery	94%	88%
Spike Level	0.1	

^a The value reported fell outside of the control limits due to the presence of PCE in the sample at a level of roughly 0.7 ppm.

na The analyte indicated was not added to the sample.

#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044 July 15, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on July 8, 1993 from Project W-7883-8, Y Pay More.

The values reported for both vinyl chloride in the charcoal tubes and tetrachloroethylene in the passive badges were calculated using the following exposure information:

#### Charcoal tube samples:

6464-1, 1 L/min. for 60 min. 6462-2, 1 L/min. for 60 min. 6463-3, 1 L/min. for 60 min.

Passive badge samples:

6464-4, 2 hours, 30 min.

6464-5, 2 hours, 30 min.

6464-6, 2 hours, 30 min.

6464-7, 2 hours, 30 min.

6464-8, 2 hours, 30 min.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Stephen D. Zappone

Chemist

SDZ/dp

**Enclosures** 

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 15, 1993 Date Received: July 8, 1993 Project: W-7883-8, Y Pay More

Date Samples Extracted: July 9, 1993 Date Extracts Analyzed: July 9, 1993

# RESULTS FROM THE ANALYSIS OF CHARCOAL TUBE SAMPLES FOR VINYL CHLORIDE

# per Washington DOE Guidelines

Results Reported as  $\mu$ l gas/liter volume (ppm)

Sample ID	Vinyl Chloride
6464-1	< 0.01
6464-2	<0.01
6464-3	<0.01
Quality Assurance	
Blank	<0.01

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 15, 1993 Date Received: July 8, 1993 Project: W-7883-8, Y Pay More

Date Samples Extracted: July 9, 1993 Date Extracts Analyzed: July 9, 1993

# RESULTS FROM THE ANALYSIS OF PASSIVE BADGE SAMPLES FOR TETRACHLOROETHYLENE

per Washington DOE Guidelines Results Reported as µl gas/liter volume (ppm)

Sample ID	<u>Tetrachloroethylene</u>	Internal Standard % Recovery
6464-4	<0.02	105%
6464-5	<0.02	88%
6464-6	<0.02	107%
6464-7	<0.02	90%
6464-8	<0.02	93%
Quality Assurance		
Blank	<0.02	117%
Spike Blank % Recovery	106%	na
Spike Level	10	

na The analyte indicated was not added to the matrix spike sample.

#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044

July 29, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on July 16, 1993 from Project 7883-8, Y Pay-More.

The values reported for both Vinyl Chloride in the charcoal tubes and TCE in the passive badges were calculated using the following exposure information.

Charcoal tube samples:

7883-1, 1 L/min. for 60 min.

7883-4, 1 L/min. for 60 min.

7883-8, 1 L/min. for 60 min.

Passive badge samples:

7883-2, 2 hours

7883-3, 2 hours

7883-5, 2 hours

7883-6, 2 hours

7883-7, 2 hours

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

Elaine K. Zamora

Chemist

EKZ/dp

Enclosures

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 29, 1993 Date Received: July 16, 1993 Project: 7883-8, Y Pay-More

Date Samples Extracted: July 23, 1993

# RESULTS FROM THE ANALYSIS OF CHARCOAL TUBE SAMPLES FOR TRICHLOROETHYLENE AND TETRACHLOROETHYLENE USING EPA METHOD 8010

Results Reported as µL gas/Liter volume (ppm)

Sample #	Trichloroethylene	<u>Tetrachloroethylene</u>
7883-2	<0.02	0.04
7883-3	< 0.02	0.06
7883-5	<0.02	<0.02
7883-6	<0.02	<0.02
7883-7	<0.02	<0.02
Quality Assurance		
Blank	<0.02ª	<0.02ª
10 ppm Continuing Calibra % Recovery	tion 98%	89%

^a Assuming same volume of gas was extracted.

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 29, 1993 Date Received: July 16, 1993 Project: 7883-8, Y Pay-More

Date Samples Extracted: July 23, 1993

# RESULTS FROM THE ANALYSIS OF CHARCOAL TUBE SAMPLES

FOR VINYL CHLORIDE USING EPA METHOD 8010

Results Reported as µL gas/Liter volume (ppm)

Sample #	er relati	Vinyl Chloride
7883-1		<0.006
7883-4		<0.006
7883-5		<0.006
•		
Quality Assurance		
Blank		<0.1
1,000 ppm Continuing Calibration % Recovery		100%
10 ppm Continuing Calibration % Recovery		99%

#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044

July 29, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on July 26, 1993 from Project 7883-8, Y-Pay-More.

The values reported for both Vinyl Chloride in the charcoal tubes and TCE in the passive badges were calculated using the following exposure information.

Charcoal tube samples: 7883-14 LWL, 1 L/min. for 60 min.

7883-15 YPM, 1 L/min. for 60 min. 7883-16 Blank, 1 L/min. for 60 min.

Passive badge samples: 7883-9 Blank, 120 minutes

7883-10 1 LWL, 120 minutes 7883-11 2 LWL, 120 minutes 7883-12 1 YPM, 120 minutes 7883-13 2 YPM, 120 minutes

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

Elaine K. Zamora

Elame Zam

Chemist

EKZ/dp

Enclosures

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 29, 1993 Date Received: July 26, 1993 Project: 7883-8, Y-Pay-More

# RESULTS FROM THE ANALYSIS OF PASSIVE BADGE SAMPLES FOR TRICHLOROETHYLENE AND TETRACHLOROETHYLENE USING EPA METHOD 8010

Results Reported as µL gas/Liter volume (ppm)

Sample #	Trichloroethylene	<u>Tetrachloroethylene</u>
7883-9 Blank	<0.02	<0.02
7883-10 1 LWL	<0.02	<0.02
7883-11 2 LWL	<0.02	<0.02
7883-12 1 YPM	<0.02	0.02
7883-13 2 YPM	<0.02	0.03
Quality Assurance		
Blank	<0.02ª	<0.02ª
10 ppm Continuing Calibra % Recovery	tion 96%	89%

^a Assuming the same volume of gas was extracted.

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 29, 1993 Date Received: July 26, 1993 Project: 7883-8, Y-Pay-More

# RESULTS FROM THE ANALYSIS OF CHARCOAL TUBE SAMPLES FOR VINYL CHLORIDE

**USING EPA METHOD 8010** 

Results Reported as  $\mu L$  gas/Liter volume (ppm)

Sample #	Vinyl Chloride
7883-14 LWL	<0.006
7883-15 YPM	<0.006
7883-16 Blank	<0.006
Quality Assurance	
Blank	<0.006a
10 ppm Continuing Calibration % Recovery	99%

^a Assuming the same volume of gas was extracted.

#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044

August 9, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on August 2, 1993 from Project 7883, Y-Pay-More.

The results reported were calculated based on the following exposure information.

Both charcoal tubes:

Flow rate: 1 L/minute for 70 minutes

Both Badges:

Exposure time: 70 minutes

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

Stephen D. Zappone

Chemist

SDZ/dp

Enclosures

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: August 9, 1993 Date Received: August 2, 1993 Project: 7883, Y-Pay-More

Date Samples Extracted: August 3, 1993 Date Extracts Analyzed: August 5, 1993

# RESULTS FROM THE ANALYSIS OF THE CHARCOAL FILTER SAMPLES FOR VINYL CHLORIDE USING EPA METHOD 8010

Results Reported as  $\mu L$  gas/Liter volume (ppm)

Sample #	<u>Vinyl Chloride</u>
7883-1	<0.01
7883-4	<0.01
Quality Assurance	
Blank	<0.01
Spike Blank % Recovery	72%
Spike Level	100

#### **ENVIRONMENTAL CHEMISTS**

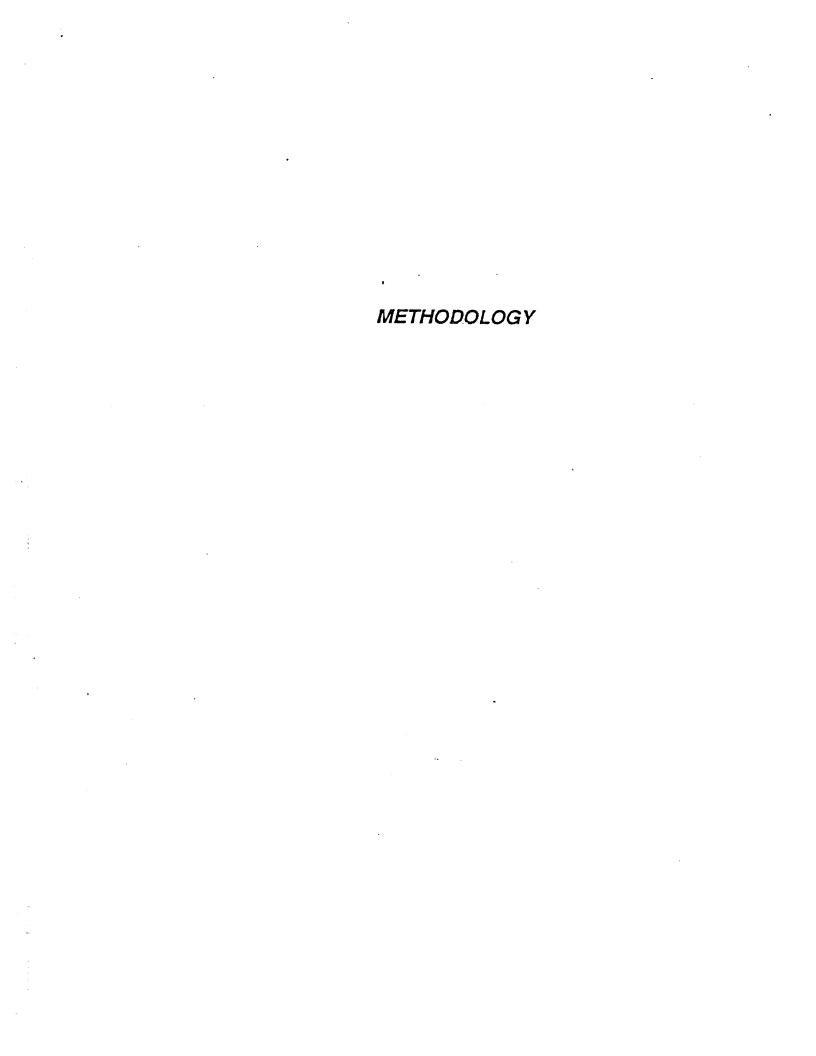
Date of Report: August 9, 1993 Date Received: August 2, 1993 Project: 7883, Y-Pay-More

Date Samples Extracted: August 3, 1993 Date Extracts Analyzed: August 5, 1993

# RESULTS FROM THE ANALYSIS OF PASSIVE BADGE SAMPLES FOR TRICHLOROETHYLENE AND TETRACHLOROETHYLENE USING EPA METHOD 8010

Results Reported as µL gas/Liter volume (ppm)

Sample #	<u>Trichloroethylene</u>	<u>Tetrachloroethylene</u>
7883-2	<0.04	<0.04
7883-3	<0.04	<0.04
Quality Assurance		
Blank	<0.04	<0.04
Spike Blank % Recovery	81%	83%
Spike Level	1	1 .



VINYL CHLORIDE

1007 METHOD:

ISSUED: 2/15/84

OSHA: 1 ppm; C 5 ppm

PROPERTIES: BP -14 °C; vapor density 2.2 (air = 1)

!TECHNIQUE: GAS CHROMATOGRAPHY, FID

IDESORPTION: 1 mL carbon disulfide; 30 min

!COLUMN: stainless steel, 6.1 m x 3.2 mm, 10% SE-30 on 80/100 mesh Chromosorb W

!ANALYTE: vinyl chloride

!INJECTION ALIQUOT: 5 µL

(AN-DMCS)

NIOSH: minimum measurable

FORMULA: CH2=CHC1; C2H3C1

.M.W.: 62.50

ACGIH: 5 ppm (human carcinogen) [1]  $(1 ppm = 2.56 mg/m^3 @ NTP)$ 

SYNONYMS: chloroethylene; chloroethene; CAS #75-01-4.

#### MEASUREMENT SAMPLING

SAMPLER: SOLID SORBENT TUBE

(2 tandem tubes, each with 150 mg

activated coconut charcoal)

FLOW RATE: 0.05 L/min

VOL-MIN: 0.7 L

-MAX: 5 L

SHIPMENT: separate primary and backup tubes

**ACCURACY** 

BIAS: -6% of calculated concentration [2]

and cap each

SAMPLE STABILITY: 10 days @ 25 °C

RANGE STUDIED: 1 to 64 mg/m3 [2]

BLANKS: 2 to 10 field blanks per set

!CARRIER GAS: He, 40 mL/min

!TEMPERATURE-INJECTOR: 230 °C

-DETECTOR: 230 °C

-COLUMN: 60 °C

!CALIBRATION: solutions of vinyl chloride in CS2

!RANGE: 0.002 to 0.2 mg per sample [2]

!ESTIMATED LOD: 0.00004 mg per sample [2]

OVERALL PRECISION (s_r): 0.06 [2] !PRECISION (s_): not determined

APPLICABILITY: The working range is 0.4 to 40 mg/m³ (0.16 to 16 ppm) for a 5-L air sample.

The method is applicable to 15-min samples at concentrations of 1 ppm or higher.

INTERFERENCES: Other than the possibility of loss of sample upon storage of two weeks or more at room temperature, none have been noted.

OTHER METHODS: This is a revision of P&CAM 178 [3].

#### REAGENTS:

- Carbon disulfide,* chromatographic quality.
- Vinyl chloride,*, 99.9%, in lecture bottle fitted with valve and septum.
- Calibration stock solution,
   0.26 mg/mL.
  - a. Insert the tip of a gas syringe containing 1 mL vinyl chloride gas under the surface of 5 mL CS₂ in a 10-mL volumetric flask.
  - b. Open the valve of the syringe and withdraw the plunger to pull CS₂ into the barrel. (As vinyl chloride dissolves, a vacuum will be created, pulling CS₂ into the syringe.)
  - c. Push the solution from the syringe into the flask. Rinse the syringe twice with 1-mL portions of CS₂ and add the washings to the flask.
  - d. Dilute to the mark with CS2.
- 4. Helium, purified.
- 5. Hydrogen, purified.
- 6. Air, filtered.

*See Special Precautions.

#### **EQUIPMENT:**

 Sampler: two tandem glass tubes, 7 cm long, 6 mm OD, 4 mm ID, flame-sealed ends, each containing 150 mg of 20/40 mesh activated (600 °C) coconut shell charcoal. A silylated glass wool plug precedes the charcoal beds and a 3-mm urethane foam plug follows the charcoal beds. Plastic caps are included for sealing after use. Pressure drop across each tube at 1 L/min airflow must be less than 3.4 kPa.

NOTE: A pair of two-section (100 mg/50 mg) tubes may be used.

- 2. Personal sampling pump, 0.05 L/min, with flexible connecting tubing.
- 3. Gas chromatograph, flame ionization detector, integrator and column (page 1007-1).
- 4. File.
- 5. Bent wire for removing plugs from sampling tube.
- Vials, 2-mL, glass with PTFE-lined septa and crimp-on seals.
- Volumetric flasks, 10-mL, with polyethylene stoppers.
- 8. Pipettes, delivery, 1.0-mL, graduated in 0.1-mL increments, 2- and 5-mL, with pipet bulb.
- 9. Air sampling bags, Tedlar, 10-L.
- 10. Gas syringe, with gas-tight valve, 0.1- and 1-mL.
- 11. Syringe, 10-µL, with 0.1-µL graduations.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and an acute fire and explosion hazard (flash point = -30 °C); work with it only in a hood.

Vinyl chloride is a human carcinogen [1].

#### SAMPLING:

- 1. Calibrate each personal sampling pump with a representative sampler in line.
- 2. Break the ends of the tubes immediately before sampling. Attach two tubes, with ends touching, with a short piece of tubing. Label one tube as the back tube and insert the back tube into the flexible tubing attached to the personal sampling pump.
- 3. Sample at 0.05 L/min for 15 to 100 min. Do not sample more than 5 L of air.
- 4. Separate the primary and backup tubes and cap each tube for shipment.

#### SAMPLE PREPARATION:

- 5. Add 1.0 mL CS₂ to an empty vial. Loosely cap the vial.
- Score each sampler tube with a file in front of the glass wool plug. Break the tube at the score line.

- 7. Transfer the charcoal from the front and back tubes to separate vials. Discard the glass wool and foam plugs. Seal the vials with septum caps immediately.
- 8. Allow to stand for 30 min, with occasional agitation. Analyze the sample within the next 30-min period.

## CALIBRATION AND QUALITY CONTROL:

- 9. Calibrate with at least five working standards covering the range 0.0002 to 0.2 mg per sample.
  - a. Add known amounts of calibration stock solution to CS2 in 10-mL volumetric flasks and dilute to the marks, using serial dilution as appropriate. NOTE: Working standards can be stored at -20 °C for at least three days.
  - b. Analyze together with samples and blanks (steps 12 and 13).
  - c. Prepare calibration graphs of peak area vs. quantity (mg) of vinyl chloride per tube and peak area vs. quantity (ng) per injection.
- 10. Determine desorption efficiency (DE) at least once for each lot of charcoal used in the calibration range (step 9). Prepare three tubes at each of five levels plus three media blanks.
  - a. Prepare three atmospheres of vinyl chloride in air by injecting 0.01, 0.08, and 0.2 mL vinyl chloride gas into 10 L air in Tedlar bags. The resulting concentrations are approximately 2.6, 21 and 52 mg/m³.
  - b. Following steps 1 through 4, sample these atmospheres according to the following scheme:

Concentration in Bag (mg/m³)	Volume Sampled (L)	Quantity of Vinyl Chloride (mg)
	0.8	0.002
2.6	2.2	0.006
23	0.8	0.017
21	2.2	0.046
52	2.5	0.13

Obtain three samples at each level.

- c. Desorb (steps 6 through 8) and analyze together with working standards (steps 12 and 13). No vinyl chloride should be found on the back tubes.
- d. Analyze the atmospheres in the bags (steps 12 and 13) using 1-mL gas samples. Read from the calibration graph the quantity (ng) per injection, which for a 1-mL injection of gas is numerically equal to the concentration in  $mg/m^3$ .
- e. Calculate DE from the mass (mg) of vinyl chloride on the front tube ( $W_f$ ), the average blank (B), the concentration of vinyl chloride in the synthetic atmospheres ( $C_s$ ,  $mg/m^3$ ), and the volume of air sampled (V, L):

$$DE = \frac{(W_f - B) \cdot 10^3}{(C_S)(V)}$$

f. Prepare a graph of DE vs. mass found ( $W_f$  - B).

11. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

1007-3

#### **MEASUREMENT:**

12. Set the gas chromatogrph according to manufacturer's instructions and to conditions given on page 1007-1. Inject sample aliquot manually using solvent flush technique or with autosampler. The retention time of vinyl chloride is about 1.7 min. NOTE: If peak area is above the linear range of the working standards, dilute with CS2,

reanalyze and apply the appropriate dilution factor in calculations.

13. Measure peak area.

#### CALCULATIONS:

14. Determine the mass, mg (corrected for DE) of vinyl chloride found in the sample front (W_f) and back (W_D) tubes, and in the average media blank (B).
NOTE: If W_D > W_f/10, report breakthrough and possible sample loss.

15. Calculate concentration, C, of vinyl chloride in the air volume sampled, V (L):

$$C = \frac{(W_f + W_D - 2B) \cdot 10^3}{V} \cdot mg/m^3$$

#### **EVALUATION OF METHOD:**

The method was evaluated using single 150-mg sampling tubes with 100-mg front beds and 50-mg back beds [2]. At four concentrations between 1 and 64 mg/m³, the pooled relative standard deviation was 0.06 and the measurements averaged 94% of the concentrations calculated from the volumes of vinyl chloride and air used for the atmospheres sampled; samples at the 3- $\mu$ g level showed no loss of vinyl chloride when stored for 12 days at room temperature or 19 days at -20 °C. There may be significant loss of vinyl chloride from samples stored for 14 days at room temperature [4]. The 1% breakthrough capacity for a 150-mg bed of coconut charcoal challenged at 100 mL/min with vinyl chloride in air at 16 mg/m³ and a relative humidity of 70% was 4.6 L [5].

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METHOD REVISED BY: A. W. Teass, Ph.D., NIOSH/DPSE.

HYDROCARBONS, HALOGENATED

METHOD: 1003

ISSUED: 2/15/84

REVISION #1: 8/15/87

COMPOUNDS: benzyl chloride

bromoform (synonyms

FORMULA: Table 1

M.W.: Table 1

in Table 1) carbon tetrachloride

chlorobenzene

chlorobromomethane 1,1-dichloroethane

chloroform

!TECHNIQUE: GAS CHROMATOGRAPHY, FID

!DESORPTION: 1 mL CS2, stand 30 min

methylchloroform 1,2-dichloroethylene tetrachloroethylene

o-dichlorobenzene ethylene dichloride 1,1,2-trichloroethane p-dichlorobenzene hexachloroethane

1,2,3-trichloropropane

SAMPLING

**MEASUREMENT** 

SAMPLER: SOLID SORBENT TUBE

(coconut shell charcoal, 100 mg/50 mg)!

FLOW RATE: 0.01 to 0.2 L/min

VOL-MIN: Table 2 -MAX: Table 2

SHIPMENT: routine

SAMPLE STABILITY: not determined

FIELD BLANKS: 10% of samples

!TEMPERATURES: Table 3

!RANGE: Table 3

!INJECTION VOLUME: 5 µL

!ANALYTE: compounds above

!CARRIER GAS: No or He, 30 mL/min

!COLUMN: Table 3; alternates are SP-2100,

SP-2100 with 0.1% Carbowax 1500

or DB-1 fused silica capillary column

**ACCURACY** 

!CALIBRATION: standard solutions of analyte in CS2

RANGE STUDIED: see EVALUATION OF METHOD [1]

BIAS: not significant [1]

OVERALL PRECISION (s,): see EVALUATION OF

METHOD [1]

!ESTIMATED LOO: 0.01 mg per sample [2]

!PRECISION (sp): see EVALUATION OF METHOD [1]

APPLICABILITY: See Table 2 for working ranges. This method can be used for simultaneous determination of two or more substances suspected to be present by changing gas chromatographic conditions (i.e., temperature program). High humidity during sampling will prevent organic vapors from being trapped efficiently on the sorbent and greatly decreases breakthrough volume.

INTERFERENCES: None identified. The chromatographic column or separation conditions may be changed to circumvent interferences.

OTHER METHODS: This method combines and replaces P&CAM 127 [3], \$101 [4], \$110 [5], \$113 [6], 5114 [7], 5115 [8], 5122 [9], 5123 [10], 5126 [11], 5133 [12], 5134 [13], 5135 [14], 5281 [15], S314 [16], S328 [17], S335 [18], S351 [19], and Method 1003 (dated 2/15/84).

#### REAGENTS:

- Carbon disulfide, chromatographic quality.*
- 2. Analyte, reagent grade.
- 3. Calibration stock solutions:
  - a. benzyl chloride, 10 mg/mL in n-heptane.
  - b. bromoform, 10 mg/mL in n-hexane.
  - c. o-dichlorobenzene, 200 mg/mL in acetone.
  - d. p-dichlorobenzene, 300 mg/mL in acetone.
  - e. hexachloroethane, 25 mg/mL in toluene.
- 4. Decane, <u>n</u>-undecane, octane or other internal standards (see step 6).
- 5. Nitrogen or helium, purified.
- 6. Hydrogen, prepurified.
- 7. Air, filtered.

*See SPECIAL PRECAUTIONS.

#### **EQUIPMENT:**

- Sampler: glass tube, 7 cm long, 6 mm OD, 4 mm ID, flame-sealed ends with plastic caps, containing two sections of 20/40 mesh activated (600 °C) coconut shell charcoal (front = 100 mg; back = 50 mg) separated by a 2-mm urethane foam plug. A silylated glass wool plug precedes the front section and a 3-mm urethane foam plug follows the back section. Pressure drop across the tube at 1 L/min airflow must be less than 3.4 kPa. Tubes are commercially available (e.g., SKC #226-01).
- 2. Personal sampling pump, 0.01 to 0.2 L/min, with flexible connecting tubing.
- Gas chromatograph, FID, integrator and column (see Table 3).
- 4. Yials, 2-mL, glass, PTFE-lined septum crimp caps.
- 5. Volumetric flasks, 10-mL.
- 6. Syringes, 10-µL, readable to 0.1 µL.
- 7. Pipet, TD, 1-mL, with pipet bulb.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and a serious fire and explosion hazard (flash point  $\pm$  -30 °C); work with it only in a hood. Several of the analytes are suspect carcinogens (Table 1). <u>n</u>-Heptane, <u>n</u>-hexane, and acetone are fire hazards.

#### SAMPLING:

- 1. Calibrate each personal sampling pump with a representative sampler in line.
- 2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
- 3. Sample at an accurately known flow rate between 0.01 and 0.2 L/min for a total sample size between the limits shown in Table 2.
- 4. Cap the samplers. Pack securely for shipment.

#### SAMPLE PREPARATION:

- Place the front and back sorbent sections of the sampler tube in separate vials. Discard the glass wool and foam plugs.
- 6. Add 1.0 mL CS2 to each vial. Cap each vial.
  - NOTE: A suitable internal standard, such as decame [16], n—undecame [6,19], or octame [9,13,17] at 0.1% (v/v) may be added at this step and at step 8.
- 7. Allow to stand 30 min with occasional agitation.

#### CALIBRATION AND QUALITY CONTROL:

- 8. Calibrate daily with at least five working standards over the appropriate range (Table 3).
  - a. Add known amounts of neat analyte or calibration stock solution to CS₂ in 10-mL volumetric flasks and dilute to the mark.
  - b. Analyze with samples and blanks (steps 11 and 12).
  - c. Prepare calibration graph (peak area vs. mg analyte).
- Determine desorption efficiency (DE) at least once for each lot of charcoal used for sampling in the range of interest. Prepare three tubes at each of five levels plus three media blanks.

- a. Remove and discard back sorbent section of a media blank sampler.
- b. Inject a known amount (2 to 20  $\mu$ L) of pure analyte, or calibration stock solution (see REAGENTS, 3.), directly onto front sorbent section with a microliter syringe.
- c. Cap the tube. Allow to stand overnight.
- d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
- e. Prepare a graph of DE vs. mg analyte recovered.
- 10. Analyze three quality control blind spikes and three analyst spikes to insure that the calibration graph and DE graph are in control.

#### **MEASUREMENT:**

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1003-1 and in Table 3. Inject sample aliquot manually using solvent flush technique or with autosampler.

NOTE: If peak area is above the linear range of the working standards, dilute with CS₂, reanalyze and apply the appropriate dilution factor in calculations.

12. Measure peak area.

#### CALCULATIONS:

13. Determine the mass, mg (corrected for DE), of analyte found in the sample front ( $W_F$ ) and back ( $W_D$ ) sorbent sections and in the average media blank front ( $W_F$ ) and back ( $W_D$ ) sorbent sections.

NOTE: If  $H_{\rm b} > H_{\rm f}/10$ , report breakthrough and possible sample loss.

14. Calculate concentration, C, of analyte in the air volume sampled, V (L):

$$c = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, mg/m^3$$
.

#### EVALUATION OF METHOD:

Laboratory testing was performed with spiked samples and generated atmospheres using SKC Lot 105 coconut shell charcoal [1]. Results were:

	Range,	Sample	Precis	ion (s _r )	Description	
Compound	mg/m³	Size	Overall	Measurement	Efficiency	Ref.
Benzyl chloride	2–8	10 L	0.096	0.031	0.90 @ 0.03-0.1 mg	[8]
Bromoform	3-10	10 L	0.071	0.043	0.80 @ 0.025 mg	[7]
Carbon tetrachloride	65-299	15 L	0.092	0.037	0.96 @ 1.3-4.8 mg	[16]
Chlorobenzene	183-736	10 L	0.056	0.025	0.91 @ 1.8-7.1 mg	[12]
Chlorobromomethane	640-2655	5 L	0.061	0.051	0.94 @ 3.3-13 mg	[6]
Chloroform	100-416	15 L	0.057	0.047	0.97 € 1.8-7.4 mg	[19]
o-Dichlorobenzene	150-629	3 L	0.068	0.013	0.86 @ 0.5-1.9 mg	[14]
p_Dichlorobenzene	183-777	3 L	0.052	0.022	0.91 @ 0.7-2.7 mg	[15]
1,1-Dichloroethane	212-838	10 L	0.057	0.011	1.01 € 1.9-8 mg	[10]
1,2-Dichloroethylene*	475-1915	3 L	0.052	0.017	1.00 @ 2.4-9.5 mg	[5]
Ethylene dichloride	195-819	3 L	0.079	0.012	0.96 @ 0.6-2.5 mg	[9]
Hexach]oroethane	5-25	10 L	0.121	0.014	0.98 @ 0.05-0.2 mg	[4]
Methyl chloroform	904-3790	3 L	0.054	0.018	0.99 @ 2.9-11 mg	[17]
Tetrachloroethylene	655-2749	3 L	0.052	0.013	0.96 @ 2.1-8 mg	[18]
1,1,2-Trichloroethane	26-111	10 L	0.057	0.010	0.97 @ 0.3-1.2 mg	[13]
1,2,3—Trichloropropane	163-629	10 L	0.068	0.027	0.95 @ 1.5-6 mg	[11]

^{*}isomer used (i.e., cis- or trans-) in evaluation unknown.

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METHOD REVISED BY: G. D. Foley; Y. T. Gagnon; and K. J. Williams, WIOSH/DPSE; methods originally validated under NIOSH Contract CDC-99-74-45.

Table 1. General information.

Compound	<u>M.W.</u>	mg/m³ = 1 ppm @ NTP	Synonyms	OSHA/NIOSH/ACGIH (ppm)
Benzyl chloride* (C ₆ H ₅ CH ₂ Cl)	126.58	5.17	(chloromethyl) benzene; a-chlorotoluene; CAS #100-44-7	1/ <u>_</u> /1 [20,23]
Bramoform (CHBr ₃ )	252.75	10.33	tribromomethane; CAS #75-25-2	0.5/—/0.5 (skin) [20]
Carbon tetrachloride* (CCl _A )	153.84	6.29	tetrachloromethane; CAS #56-23-5	10, C 25/C 2/5 (skin) [20,24]
Chlorobenzene (C ₆ H ₅ Cl)	112.56	4.60	monochlorobenzene; phenyl chloride; CAS #108-90-7	75/—/75 [20]
Chlorobromomethane (CH ₂ BrCl)	129.39	5.29	bromochloromethane; Halon 1011; CAS #74-97-5	200/—/200, STEL 250 [20]
Chloroform* (CHCl ₃ )	119.39	4.88	trichloromethane; CAS #67-66-3	c 50/c 2/10 [20,25]
o-Dichlorobenzene (1,2-C ₆ H ₄ Cl ₂ )	147.00	6.01	1,2-dichlorobenzene; CAS #95-50-1	50/—/c 50 [20]
p-Dichlorobenzene (1,4-C ₆ H ₄ Cl ₂ )	147.00	6.01	1,4—dichlorobenzene; CAS #106—46—7	75/—/75, STEL 110 [20]
1,1-Dichloroethane (CH ₃ CHCl ₂ )	<b>98.96</b>	4.05	ethylidene chloride; CAS #75-34-3	100/100/200, STEL 250 [20,21]
1,2-Dichloroethylene (C1CH=CHC1)	96.94	3. <del>9</del> 6	acetylene dichloride; 1,2-dichloroethene; CAS #540-59-0	200/—/200, STEL 250 [20]
Ethylene dichloride* (C1CH ₂ CH ₂ C1)	98.96	4.05	1,2-dichloroethane; CAS #107-06-2	50, c 100/5, c 15/10 [20,21,26]
Hexachloroethane* (CC1 ₃ CC1 ₃ )	236.74	9.68	perchloroethane; CAS #67-72-1	1 (skin)/—/10 [20,21]
Methylchloroform (CH ₃ CCl ₃ )	133.42	5.45	<pre>1,1,1-trichloroethane; CAS #71-55-6</pre>	350/C 350/350, STEL 450 [20,21,27]
Tetrachloroethylene (Cl ₂ C=CCl ₂ )	165.83	6.78	perchloroethylene; CAS #127-18-4	100, C 200, P 300/—/ 50, STEL 200 [20,28]
1,1,2—Trichloroethane (Cl ₂ CHCH ₂ Cl)	133.41	5.45	vinyl trichloride; CAS #7900-5	10 (skin)/—/10 (skin) [20,21]
1,2,3-Trichloropropane (CH ₂ ClCHClCH ₂ Cl)	147.43	6.03	<pre>allyl trichloride; glycerol trichlorohydrin; CAS #96-18-4</pre>	50/—/50, STEL 75 [20]

^{*}Suspect carcinogen [20,21,22].

Table 2. Sampling limits.

	Air Sample	. Volume	(L)	Working Range, ppm,
Compound	Min	Max	Target	at Max Sample Volume
Benzyl chloride	6 @ 1 ppm	50	10	0.6 to 5.8
Bromoform	4 @ 0.5 ppm	70	10	0.2 to 4
Carbon tetrachloride	3 # 10 ppm	150	15	2 to 105
Chlorobenzene	1.5 <b>∉</b> 75 ppm	40	10	10 to 430
Chlorobromomethane	0.5 @ 200 ppm	8	5	18 to 450
Chloroform	1 <b># 50 ppm</b>	- 50	15	2 to 190
o_Dichlorobenzene	1 @ 50 ppm	60	3	16 to 1100
p_Dichlorobenzene	1 @ 75 ppm	10	3	27 to 330
1,1-Dichloroethane	0.5 @ 100 ppm	15	10	4 to 250
1,2-Dichloroethylene	0.2 @ 200 ppm	5	3	16 to 560
Ethylene dichloride	1 @ 50 ppm	50	3	16 to 1320
Hexachloroethane	3 <b>@</b> 1 ppm	70	. 10	0.3 to 8.3
Methylchloroform	0.1 @ 350 ppm	8	3	18 to 1450
Tetrachloroethylene	0.2 @ 100 ppm	40	3	9 to 1900
1,1,2-Trichloroethane	2 @ 10 ppm	60	10	1.8 to 64
1,2,3—Trichloropropane	0.6 @ 50 ppm	60	10	3 to 310

Table 3. Measurement parameters.

Compound	<u>Column</u> *	t (°C) Column/Injector/Detector	Range (mg per sample)
Benzyl chloride	A	160/170/210	0.02 to 0.15
Bromoform	A	130/170/210	0.02 to 0.15
Carbon tetrachloride	В	60/155/200	0.2 to 7
Chlorobenzene	A	105/190/250	0.4 to 10
Chlorobromomethane	A	80/170/210	0.5 to 15
Chloroform	B	75/155/200	0.4 to 11
o-Dichlorobenzene	ε	140/225/250	0.1 to 3
p_Dichlorobenzene	A	140/225/275	0.2 to 4
1,1-Dichloroethane	A	50/100/175	0.4 to 12
1,2-Dichloroethylene	<b>A</b> ·	60/170/210	0.2 to 7
Ethylene dichloride	С	70/225/250	0.1 to 4
Hexach1oroethane	D	110/170/210	0.02 to 0.3
Methylchloroform	· c	70/225/250	0.6 to 17
Tetrachloroethylene	С	90/225/250	0.4 to 12
1,1,2-Trichloroethane	C	70/250/225	0.05 to 2
1,2,3-Trichloropropane	E	160/180/230	0.3 to 9

 $[*]A = 3 \text{ m} \times 3 \text{ mm}$  00 stainless steel, 10% SP-1000 on 80/100 mesh Chromosorb WHP.

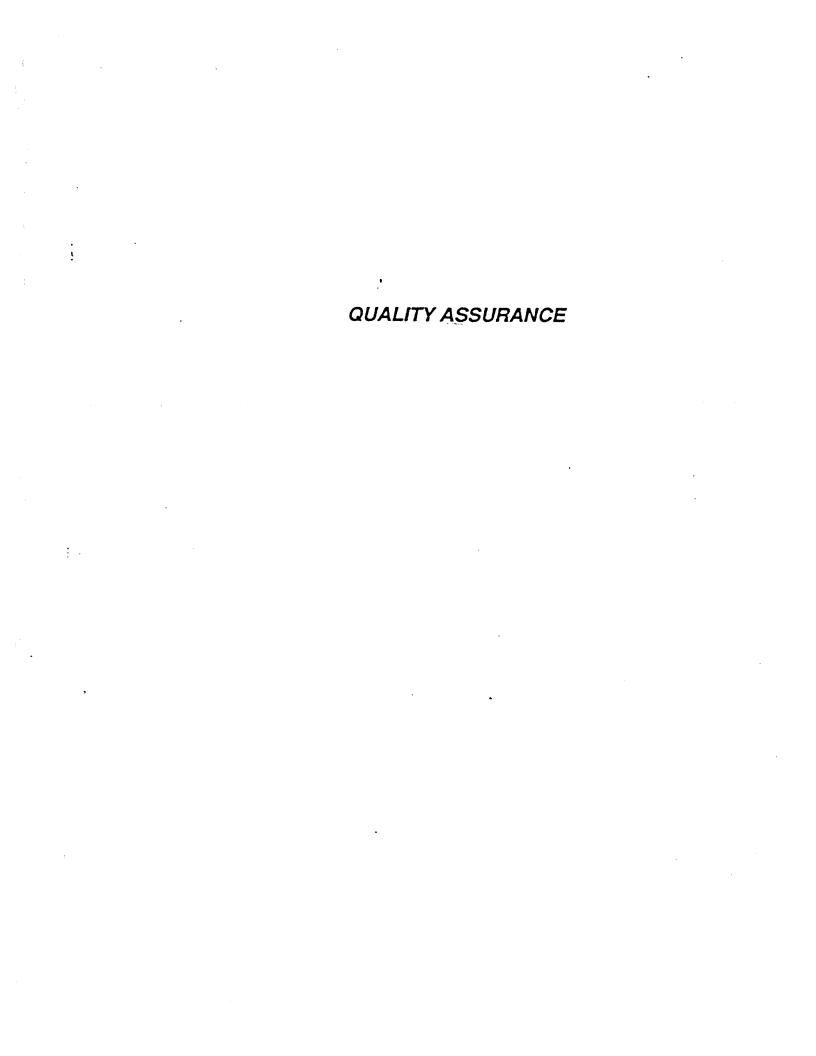
 $B = 6 \text{ m} \times 3 \text{ mm}$  00, otherwise same as A.

 $C = 3 \text{ m} \times 3 \text{ mm}$  00 stainless steel, 10% OV-101 on 100/120 mesh Chromosorb WHP.

D = 3 m x 6 mm 00 glass, 3% SP-2250 on 80/100 mesh Chromosorb WHP.

 $E = 3 \text{ m} \times 3 \text{ mm}$  00 stainless steel, 10% FFAP on 80/100 mesh Chromosorb WHP.

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Form 100A

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Form 100B

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# PERSONAL MONITORING PUMP CALIBRATION

Pump I.D. # Ametek 3058	_	Date: 6/4/93	
Temp.: 62	_	mp. (std): <u>68</u>	
Pbar: 29.87	PI	bar (std): 29.92	
	M7 2-4-1964		
mils	sec.	mils/min	
100	5.99	1001.7	
100	5.97	1005.0	
100	5.98	1003.3	
100	6.01	998.3	
200	12.05	995.9	
200	12.05	995.9	
200	11.98	1001.7	
200	11.99	1000.8	
250	14.98	1001.3	
250	15.04	997.3	
	13.07	501.0	
	Average FI	ow Rate: 1000	mils/min
	-		
temp. and	pressure co	orrection: 1.01	]
Calibrated By: Com 12	ds	stdL/min.: 1.01	L/min
Equations:			
L/min=(volume/sec)*60	~ !DL	. 83	
Temp./Pbar Cor.=((Temp. std/Temp.)*		sta))	
dstdL/min=Average Flow Rate*Temp 8	Krbar Corr.		

RZA-AGRA 1993

# PERSONAL MONITORING PUMP CALIBRATION

Pump I.D. # Ametek 3058 Temp.: 72 Pbar: 30.27	Date: 7/7/93 Temp. (std): 68 Pbar (std): 29.92
mils 100	sec. mils/min 5.97 1005.0
100 100	6.03 995.0 6.01 998.3
100	5.98 1003.3 12.12 990.1
200 200	11.96 1003.3 11.97 1002.5
200 250	12.02 998.3 14.99 1000.7
250	14.96 1002.7
	Average Flow Rate: 1000 mils/min
tem	p. and pressure correction: 1.00
Calibrated By:	dstdL/min.: 1.00 L/min
Equations:	
L/min=(volume/sec)*60 Temp./Pbar Cor.=((Temp. std/Ted) dstdL/min=Average Flow Rate*T	

RZA-AGRA 1993

#### PERSONAL MONITORING PUMP CALIBRATION

Pump I.D. # Ametek 3058	_	Date: 7/21/93	
Temp.: 69	Temp. (std): 68		
Pbar: 30.19	P	bar (std): 29.92	
	or and he		
mils	sec.	mils/min	
100	6.00	1000.0	
100	6.05	991.7	
100	6.02	996.7	
100	5.98	1003.3	
200	11.98	1001.7	
200	11.99	1000.8	
200	12.00	1000.0	
200	12.04	996.7	
250	15.02	998.7	
250	14.99	1000.7	
	Average F	low Rate: 999	mils/min
	_		_
temp. and	pressure c	orrection: 1.01	]
Calibrated By:	_ d	stdL/min.: 1.01	]L/min
Equations:			
L/min=(volume/sec)*60			
Temp./Pbar Cor.=((Temp. std/Temp.)*(	Pbar/Pbar	std))	
dstdL/min=Average Flow Rate*Temp &	Pbar Corr.		

RZA-AGRA 1993

#### PERSONAL MONITORING PUMP CALIBRATION

Pump I.D. # Ametek 3058 Temp.: 72 Pbar: 30.21	Date: 7/23/93 Temp. (std): 68 Pbar (std): 29.92
mils 100 100 100 100 200 200 200 200 200 250	sec.     mils/min       5.98     1003.3       5.99     1001.7       5.96     1006.7       6.02     996.7       12.03     997.5       12.05     995.9       11.97     1002.5       11.98     1001.7       14.93     1004.7       14.97     1002.0
	Average Flow Rate: 1001 mils/min pressure correction: 1.00
Calibrated By:	pressure correction: 1.00 dstdL/min.: 1.00 L/min
Equations:  L/min=(volume/sec)*60  Temp./Pbar Cor.=((Temp. std/Temp.)*( dstdL/min=Average Flow Rate*Temp 8	

RZA-AGRA 1993

#### PERSONAL MONITORING PUMP CALIBRATION

Pump I.D.#	Ametek 3058	Date:	8/2/92
Temp.:	85	Temp. (std):	68
Pbar:	31.19	Pbar (std):	29.92

mils	sec.	mils/min	
100	6.02	996.7	
100	6.03	995.0	
100	6.01	998.3	
100	5.99	1001.7	
200	12.00	1000.0	
200	11.99	1000.8	
200	12.01	999.2	
200	12.00	1000.0	
250	14.99	1000.7	
250	15.02	998.7	

Average Flow Rate: 999 mils/min
temp. and pressure correction: 1.01
Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibrated By: Calibr

Equations:

L/min=(volume/sec)*60

Temp./Pbar Cor.=((Temp. std/Temp.)*(Pbar/Pbar std))

dstdL/min=Average Flow Rate*Temp &Pbar Corr.

RZA-AGRA 1993

# APPENDIX C NOTICE OF CONSTRUCTION AND APPLICATION FOR APPROVAL, VAPOR EXTRACTION SYSTEM FOR REMEDIATION 11-07883-08

## Puget Sound Air Pollution Control Agency

Registration No. 17706

Notice of

Construction No. 4968

Date MAY 2 1 1993

## HEREBY ISSUES AN ORDER OF APPROVAL TO CONSTRUCT, INSTALL, OR ESTABLISH

Vapor Extraction System including a Rotron EN505 Regenerative Blower at 160 cfm, and two Carbon Adsorption units (1,000 lbs. each).

DAVID WASSERMAN, PE

RZA-AGRA

11335 NE 122ND WY, SUTTE 100

KIRKLAND

WA 98034-6918

O NORTHWEST BUILDING CORPORATION

N_801 2ND AVE

R SEATTLE

WA 98104

#### INSTALLATION ADDRESS

NORTHWEST BUILDING CORPORATION, 2210 S 320TH ST, FEDERAL WAY, WA, 98003

#### THIS ORDER IS ISSUED SUBJECT TO THE FOLLOWING RESTRICTIONS AND CONDITIONS

- Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Air Pollution Control Agency to the applicant to install or
  establish the equipment, device or process described hereon at the INSTALLATION ADDRESS in accordance with the plans and specifications on file in
  the Engineering Division of PSAPCA.
- 2. Compliance with this ORDER and its conditions does not relieve the owner or operator from the responsibility of compliance with Regulations I, II or III, RCW 70.94 or any other emission control requirements, nor from the resulting liabilities and/or legal remedies for failure to comply. Section 5.05(e) of Regulation I requires that the owner or operator must develop and implement an operation and maintenance (O&M) plan to assure continuous compliance with Regulations I, II, and III.
- 3. This approval does not relieve the applicant or owner of any requirement of any other governmental agency.
- 4. Northwest Building Corporation shall not cause of allow the operation of the vapor extraction if there is breakthrough of hydrocarbons from the carbon adsorption system as determined through weekly collection of gas samples.

MAGGIEL. CORBIN Reviewing Engineer JAY M. WILLENBERG Reviewing Engineer ANITA J. FRANKEL
Air Pollution Control Officer

MEJ

### RZA AGRA, Inc.

Engineering & Environmental Services

03: 10F 127900 Cav State 100 Cakland, WA 98034 6918 (206) 820 4669 FAX (206) 821 3914

7 May 1993

W-7883-8

Puget Sound Air Pollution Control Agency 110 Union Street, Suite 500 Seattle, Washington 98101

Attention:

Mr. Dave Lenington

Subject:

Notice of Construction and Application for Approval

Northwest Building Corporation

2210 S. 320th Street Federal Way, Washington

Dear Mr. Lenington:

Enclosed please find a completed Notice of Construction and Application for Approval for a vapor extraction system to be located at the above-referenced address. Also enclosed is a check in the amount of \$150 for the permit application fee.

Please do not hesitate to contact David Wasserman at 820-4669 if you have any questions regarding this application or need further information.

Sincerely,

RZA AGRA, Inc.

David Wasserman, PE

**Associate** 



## PUGET SOUND AIR POLLUTION CONTROL AGENCY

ENGINEERING DIVISION
200 WEST MERCER, RODM 205, SEATTLE, WASHINGTON 98116-3958
(206) 296-7334

## Notice of Construction and Application for Approva

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Shor	oping Cen	ter Mana	gement		Vapor	Extraction System	n	
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12. NO.	INCINER	RATORS	16)	PAINT BAKING	(b)	BULK CONVEYOR	ID)	RE VERBERAT DRY
OF UNITS	(Complete	Form \$-B)	10	PLASTIC CURING	(c)	CLASSIFIER	(c)	ELECTRIC INDUCAREST
10)	1		16	LITHO COATING OVEN	10;	STORAGE BIN	161	CRUCIBLE
13. NO.	OTHER S	YSTEMS	(8)	DRYER	(e)	BAGGING	(e)	CUPDLA
DF UNITS			1112	ROASTER	(1)	DUTSIDE BULK STORAGE	111	ELECTRIC ARC
1	DEGREASING, S		101	KILN	(D)	LOADING OF UNLOADING	(E)	SWEAT
16;	ABRASIVE BLAS		[m]	HEAT-TREATING	(h)	BATCHING	(h)	DTHER METALLIC
1	DTHER - SYST	En	(°)	OTHER	"'	MIXER ISOLIDS)	(1)	GLASS
(E)	<u> </u>		1411		101)	DTHER	(11)	DTHER NON METALLIC
17. NO. DF UNITS	GENERAL D	PER. EQUIP.	17. NC.	GENERALOPER.EQUIP.	17. NO.	GENERAL OPER. EQUIP.	18. NC. OF UNITS	OTHER EQUIPMEN
(2)	CHEMICAL MI	LLING	(1)	GALVANIZING	(K)	ASPHALT BLOWING	10.	SPRAY PAINTING GUN
(6)	PLATING		15:	IMPREGNATING	(I)	CHEMICAL COATING	ID:	SPRAY BOOTH OF ROD
15)	DIGESTER		(r	MIXING OR FORMULATING	·	COFFEE ROASTER	16:	FLOW COATING
1	DRY CLEANIN		(i)	i - ·	,	SAWS & PLANERS	10:	FIBERGLASSING
10;	IFDRMING OF	MOLDING	lu:	STILL	10)	STORAGE TANK	1e: X	DIHER Blower &
		CONTRO	L DEVICES	COMPLETE A FORM		DUIPMENT IN SPACES IN H ENTRY.)	COLUMNS.	carbon unit
15. NC. DF UNITS	CONTRO	L DEVICE	20. ND. DF UNITS	CONTROL DEVICE	21. NC. OF UNITS	CONTROL DEVICE	DF UNITS	CONTROL DEVIC
10,	SPRAY CURTA	in	10:	AIR WASHER	100	AESDRRER	101	DEMISTER
(0)	CYCLONE		10:	WET COLLECTOR	10) <u>Y</u>	. ADSDABER Carbon	(b)	BAGHOUSE
	MULTIPLE CY		(5)	VENTURI SCRUBBER	161	FILTER PADS	10)	ELEC. PRECIPITATOR
	INERTIAL CO				10)	AFTERBURNER	(6)	DTHEF
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## PUGET SOUND AIR POLLUTION CONTROL AGENCY

ENSINEERING DIVISID

200 MEST MERCER STREET

SEATTLE, WASHINGTON 92119

(206) 296-7334

## Notice of Construction and Application for Approv

FOR BASIC PROCESS EDUIPMENT FORM S PLEASE CONSULT INSTRUCTION SHEET BEFORE FORWARDING D COMPANY IDE DWNERI INSTALLATION ADDRESS EDMPLETE THE SECTIONS INDICATED 7 E 9 10 11 12 2210 S. 320th Street Federal Way, WA COMPANY IOR OWNERS NAME RZA AGRA, inc. Northwest Building Corporation

• PREPARED BY: (North and 1996) E PHONE PREPARED BY (Signature) 820-466 David Wasserman. Associate E Dimensions (Laward) / Mant and Model PROCESS EQUIPMENT RZA AGRA Design Vapor Extraction System I. Connected To E. AUXHINY EQUIPMENT E. NO. DI UNITE, FATEC CADACITY Blower (Vacuum) Carbon Units 2 - 1000 lb. Cap. ea In Connected To E. Epuipment C. MAIRO CADACILY ( Make and Model I. Type of burner fuel BURNER DATA to Connected To: p. CFM Exhausted (Temperature) e. No. of units, ipnition method c. Dimensions b. Type of Vent STACKS, VENTS AND 30 feet 2" I.D. EXHAUST OPENINGS Stack r. Connected To p. CFM. Exhauster (Temperature) E. No. 01 vents. Material of construction Carbon Units PVC n. Surface Area (5c F1.) E. Dimensions (Latvam) in inches Type of Tank, Material € TANKS AND KETTLES ► 77 gallon Diosed Diber. Condensate Trap p. Auxiliary Equipment r. Connectes To E. No. of sanks; Material of CONSTIUCTION E. MOID! Date L. Make and Model 2. Type of Fan (Designate Biabe) EPM 2 FAN DATA Rotron EN505 Regenerative Blower r. Connectes To G. CFN' Exhausted (Temperature) e. No. of tans, Material C' construction Carbon Units 1 Aluminum C Rates Capacity L. Make and Model Type of Oven or furnace OVERS AND FURNACES t. Connected To E. CEN. Exhausted (Temperature) E. NO. D1 OVERS, Material D1 2. Operating Scheoule (Normal) E. MODE D' Doctations Type D' Operation & DPERATIONAL DATA > SHIFTS DAY DY DO DO I Commous p. Daily Number of Barches e. Duration of Batch (mrs/Batch) (Max) .. MALE AND MODE C. CADACITY Type of Conveyor CONVEYOR DATA Pheumatic 5011 6. No of Fire ups the of Discharge fis n. Connected to e. Sumenioni (Laward) E TEMPERATURE PFI C. SCFM (Rep 1 Stendard) E. ACTUAL CEM GAS FLOW 160 (max) HILL AND DUTILLY POSTUTANT e PRESSURE DROP EFFICIENCY 99% for Carbon Units X ATTACH EMISSION EST X ATTACH PLANS SPICS ATTACH PROCHURE ADDITIONAL DATA HISTORIC CARCUIPTIONS 2774(# 4 SI-11.11 I DONE WENT NOTE . X SUBMIT NAPEATINE DESCRIPTION OF PROCESS SUENT SOURCE TEST DATA MODEL CAFACITY

### NOTICE OF CONSTRUCTION AND APPLICATION FOR APPROVAL NARRATIVE SUPPLEMENT

#### Introduction

Dry cleaning solvent impacted soils have been identified at Northwest Building Corporation's Best Shopping Mall, located at 2201 S. 320th Street, Federal Way, Washington. The site, situated in the eastern portion of the Mall, was formerly occupied by Y-Pay-Mor drycleaners. Soil and air contaminant concentrations of tetrachloroethylene (TCE or PERC) have been identified (see Figure 1, Site and Exploration Plan). RZA AGRA, Inc., on behalf of Northwest Building Corporation, is proposing to install and operate a soils vapor extraction system (SVES), in conjunction with a activated carbon unit, to remediate the soils at the site. The design of this vapor extraction system is complete and construction is in progress. An accurate projected duration of this project is unknown; however, we anticipate that it could be in operation for as long as one year.

#### **Process Description**

The vapor extraction process, as proposed for the Best Shopping Mall site, involves the removal of volatile hydrocarbons (tetrachloroethylene) from the impacted soil (see Figure 2, Schematic Flow Diagram). This approach requires vapor extraction processes utilizing vapor extraction wells and a vacuum blower to create the negative pressure which is intended to extract the hydrocarbons from the soil. A negative pressure environment created in the sub-surface will enhance the volatilization and migration of the volatile hydrocarbons to the wellbores. The rate of volatile hydrocarbon removal will be dependant upon the downhole temperature, pressure, soil characteristics, and the vapor pressure of the chlorinated hydrocarbon.

The vapor extraction system will also incorporate a carbon adsorption unit in the process. This unit is proposed for the extraction of chlorinated hydrocarbons in the air stream which may impact the surrounding ambient air environment. This adsorption process will be employed to minimize the risk of potential adverse toxic emission impacts if these emission were to be vented directly into the air. Activated carbon processes, as one method of adsorption, attract the airborne hydrocarbon compounds to the surface of the carbon particles by physical, or chemical, forces. The proposed carbon adsorption unit will serve as the applicable control technology to effectively remove the known toxic air contaminant (TAC).

#### **System Description**

The volatile chlorinated hydrocarbons will be removed from several soil-vapor extraction wells using a vacuum blower. The air stream will first be treated by passing it through an steel moisture knockout tank to remove water, and possibly liquid phase hydrocarbons, which may have condensed at the surface. The tank also serves as a mechanism to remove particulates, if any. The air stream exists the tank and enters the suction of a regenerative vacuum blower and discharges to two (2) activated carbon units. The carbon units are situated in series and contain 1,000 lbs. of carbon each. The hydrocarbon-free air then exists the units via a passive 2 inch diameter vent, measuring approximately 30 feet in height. No chemicals are used in this process.

The following is a list of equipment proposed for the system:

Control panels: 240V, 50 amp, 3-phase

Steel Moisture Knockout Tank: 77 Gallon Capacity

Regenerative Vacuum Blower: 2 HP, 230V, 1-phase (160 ACFM) Activated Carbon Units (2): 1,000 lbs. carbon capacity each

MSA Model 5100 Emissions Monitoring System

Refer to Appendix A for the manufacturer's data which presents the detailed features and design data for this equipment.

#### Quantification of Emissions

Quantification of process toxic air contaminate (TAC) emissions were conducted on a "worst case" scenario by utilizing maximum equipment throughput rates and worst case air analysis results from the site (See Appendix B for report of air analysis). The intent of this calculation methodology is to quantify TAC emissions and determine the emission impacts associated with this type of technology. Table 1 summarizes the estimated emissions data. Pre-treatment estimates appeared to indicate that tetrachloroethylene concentrations may exceed the Acceptable Source Impact Levels (ASILs) as defined by Washington State Air Toxics Regulation (WAC 173-460); consequently, activated carbon was incorporated into the process as an applicable air emission control technology device. The effects from the addition of a carbon unit to the process flow is reflected as uncontrolled and controlled emission rate values in Table 1.

#### Sample Calculation

Uncontrolled Tetrachloroethylene (TCE) Emission Rate

35 ppm X 160 Actual FT³ X 1440 Minutes X 365 Day X 165.8 Lbm X LbMol = 1288 Lb TCE/Year 10⁶ Minute Day Year LbMol 379 FT³

Controlled Tetrachloroethylene (TCE) Emission Rate

Control Efficiency of Carbon Units: 99%

1288 Lb TCE X (100 - 99) = 12.88 Lb TCE/Year Year 100

TABLE 1

**Estimated Emissions Data** Northwest Building Corp. (Y-Pay-Mor Drycleaners) 2210 S. 320th St., Federal Way, WA

2210 01 02011 0111 0 1001 11 11 11 11		<b>VOLATILE HYDROCARBONS</b>
	UNITS	(TETRACHLOROETHYLENE)
Measured Concentration	ppm	35,0000
Emission Rate	grams/sec	0.0185
Emission Rate(Uncontrolled) - Inlet to Carbon Unit	lb/year	1287.6229
Emission Rate(Controlled) - Carbon Unit Discharge	lb/year	12,8762

Referneces/Notes

Measured Concentrations - Friedman & Bruya, Inc., Air Samples for Soil Gases, EPA 8015M/8010 (ppm), 4-9-93

Emission Rate based on system design parameters

System Flowrate (ACFM)	160.00
Stack Height (FT)	30.00
Stack Diameter (INCH)	0.1666
Stack Area (FT2)	0.0218
Stack Flowrate (FT/SEC)	122.33

#### Compliance Provision

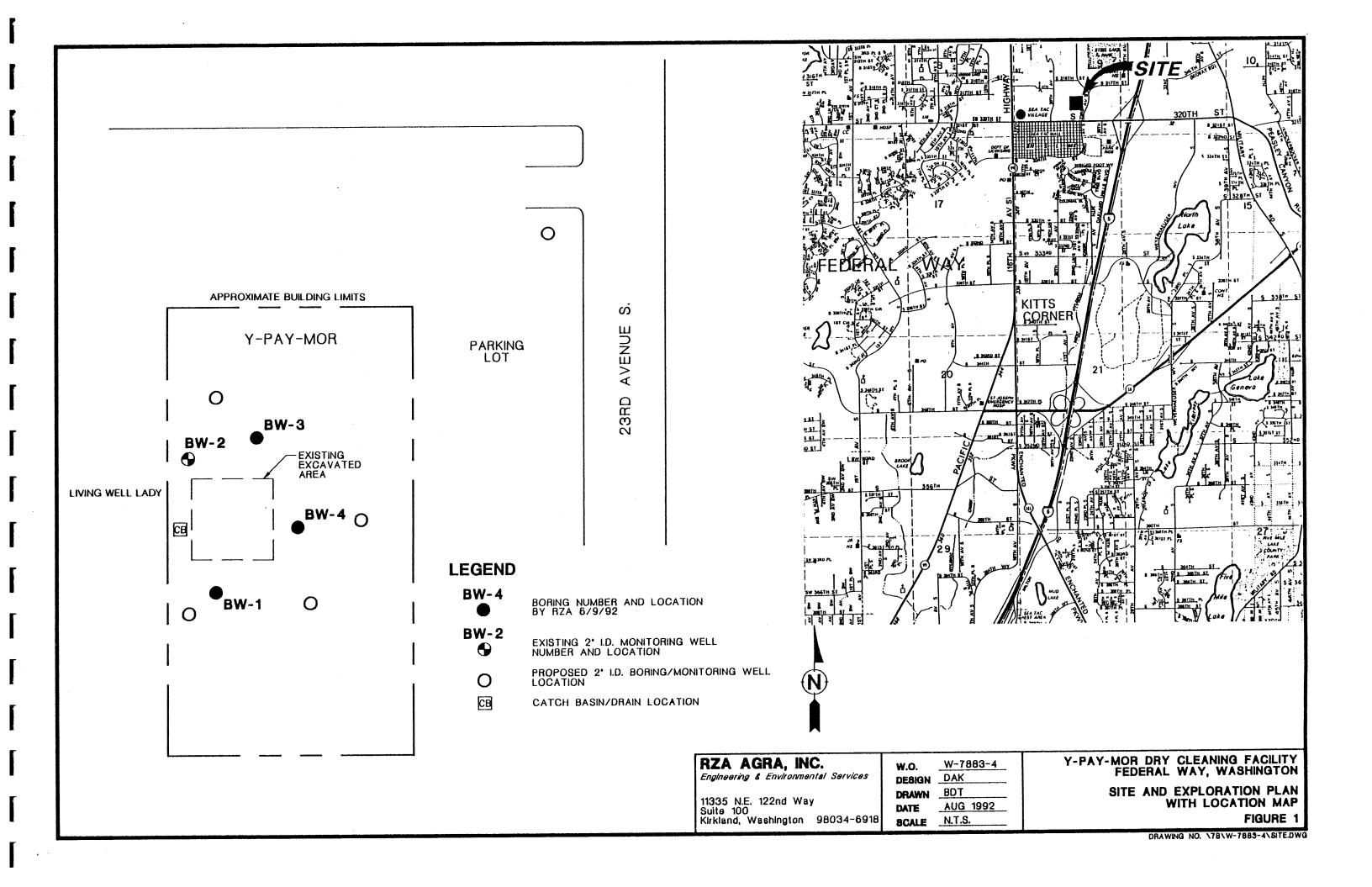
In an effort to demonstrate system performance and observe that the insignificant emission levels are maintained, the Owner proposes to (1) install a MSA Combustible Gas Indicator (CGI), and (2) collect gas samples on a regular basis.

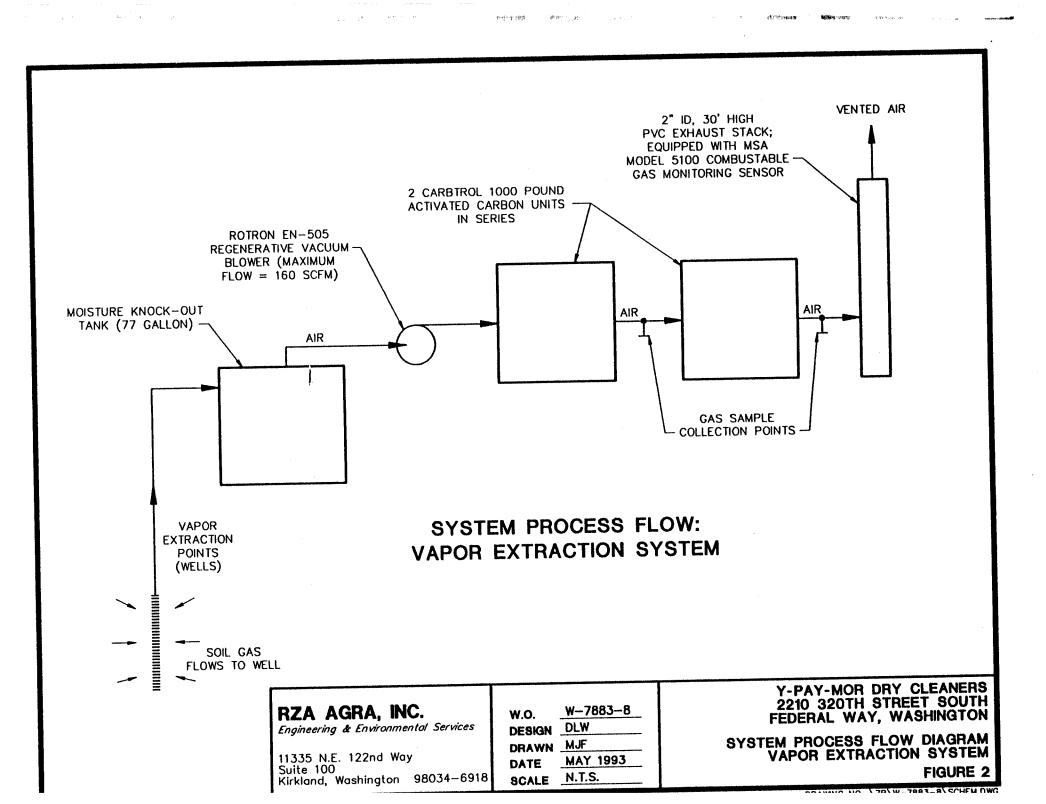
Appendix C describes in detail the design and operational specifications of this device. The primary function of the CGI to provide a system shut-down feature in the event that stack hydrocarbon emission rates exceed 20 % Lower Explosive Limit (LEL). The device will provide an automatic system shut-down if stack concentrations and operational parameters are considered unacceptable (over 20% LEL). The system can only be re-started by manual procedures.

The collection of gas samples will be executed on a weekly basis and analyzed for hydrocarbon vapors. Samples will be recovered from the discharge of each carbon vessel to observe proper control efficiencies are maintained for the system. All analytical results and system operational performance (LEL data) documentation shall be the responsibility of the system Operator and will be provided to PSAPCA compliance inspection personnel when required.

#### Operations & Maintenance

Northwest Building Corporation is designated as the Owner of this system and RZA AGRA, Inc. will be responsible for the system's operation and maintenance.





## EN 505 Explosion-Proof Regenerative Blower

#### **FEATURES**

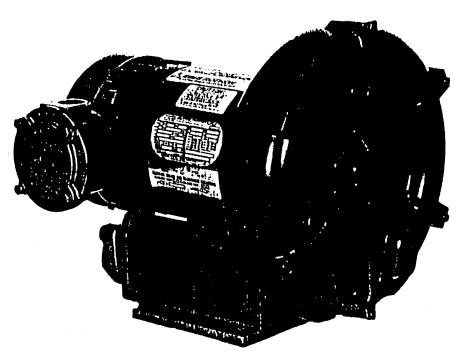
- Manufactured in the USA
- Maximum flow: 160 SCFM
- Maximum pressure: 62" WG
- Maximum vacuum: 60" WG
- Standard motor: 2.0 HP
- Blower construction cast aluminum housing, cover, impeller & manifold; cast iron flanges
- UL & CSA approved motors for Class I, Group D atmospheres
- Sealed blower assembly
- Quiet operation within OSHA standards

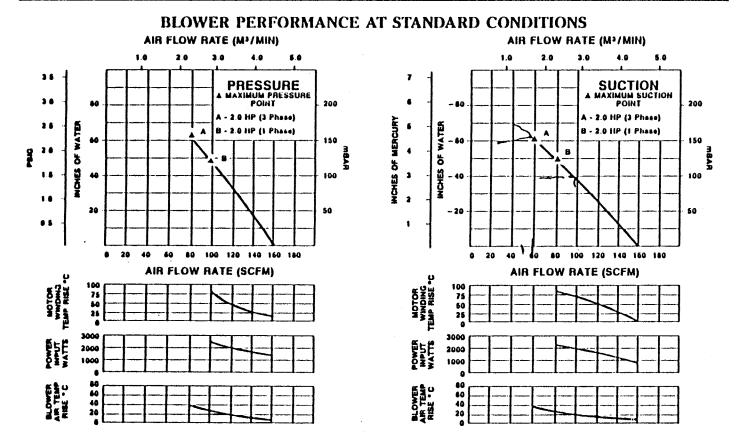
#### **OPTIONS**

- TEFC motors
- 50 Hz motors
- International voltages
- Other HP motors
- Corrosion resistant surface treatments
- Remote drive (motorless) models

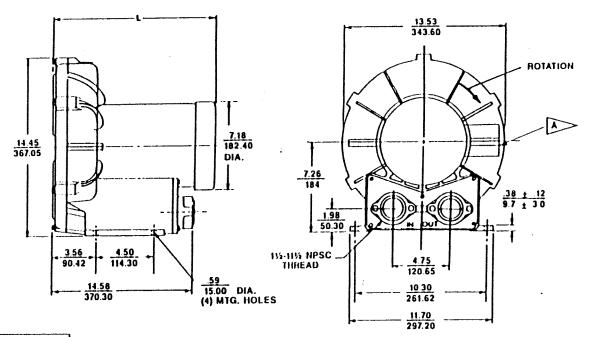
#### **ACCESSORIES**

- Moisture separators
- Explosion-proof motor starters
- Inline & Inlet filters
- Vacuum & pressure gauges
- Rollef valves
- External mufflers





## EN 505 Explosion-Proof Regenerative Blower



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DIMENSIONS: IN MM
TOLERANCES: .XX ± .08
.XXX ± .030
.XXX ± .030
(UNLESS OTHERWISE NOTED)

0

MODEL	L (IN)±.30	L (MM)±8
EN505AX72ML	16.72	425
EN505AX5BML	17.50	447

0.75° NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

#### **SPECIFICATIONS**

MODEL	EN505AX58ML		EN505/	AX72ML
Part No.	038	1177	038	1178
Motor Enclosure Type	Explosi	on-proof	Explosion-proof	
Horsepower	2.0		2	.0
Phase — Frequency	Single — 60 Hz		Three	60 Hz
Voltage	115	230	230	460
Motor Nameplate Amps	18.8	9.4	6.2	3.1
Maximum Blower Amps¹	22.0	11.0	6.2	3.1
Inrush Amps	138	69	35	17
Starter Size	1	0	0	0
Service Factor	1.0		1	0
Thermal Protection	Pilot Duty		Pilot	Duty
Bearing Type	Sealed, Ball		·	d, Ball
Shipping Weight	94 lb (	(43 kg)	85 lb (	39 kg)

#### BLOWER LIMITATIONS

Min, Flow @ Max. Suction	80 SCFM @ -50" WG	60 IWG @ -60" WG
Min. Flow @ Max. Pressure	100 SCFM @ 50" WG	80 SCFM @ 62" WG

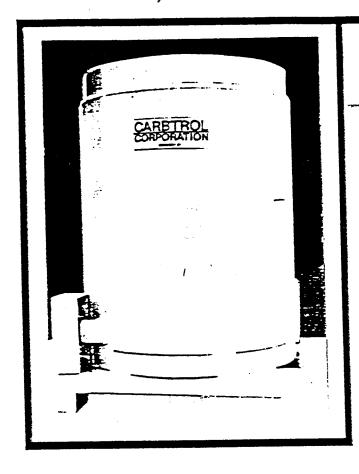
*Corresponds to the performance point at which the blower and/or motor temperature rise reaches the limit of the thermal protection in the motor.

Specifications subject to change without notice. Please contact factory for specification updates.

## **CARBTROL**®

## AIR PURIFICATION ADSORBERS

1,000 LB. ACTIVATED CARBON G-4 1,800 LB. ACTIVATED CARBON G-6



#### **FEATURES**

- Low pressure drop at 400 CFM
   G-4 9" water pressure
   G-6 12" water pressure
- · High activity carbon.
- Fork lift fittings for easy handling.
- 4" Ø periorated inlet distributor.
- DOT rated. Acceptable for transport of hazardous waste.

#### **SPECIFICATIONS**

G-4

CARBON:

1,000 lbs.

DIMENSIONS: 45-1/2" Ø x 66-1/2" height

SHIPPING WT: 1,500 lbs.

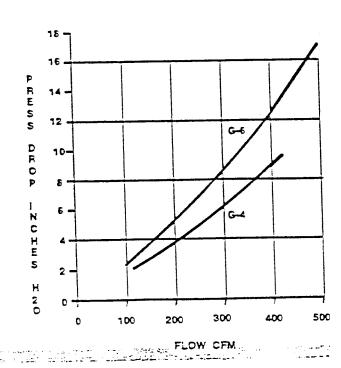
G-6

CARBON:

1,800 lbs.

DIMENSIONS: 45-1/2" Ø x 90" overall ht.

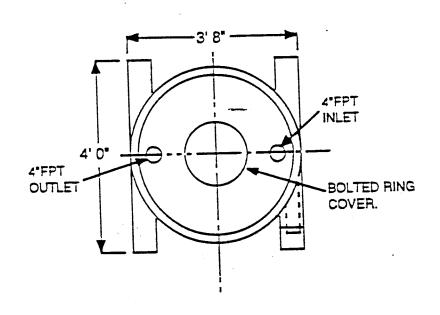
SHIPPING WT: 2,400 lbs.

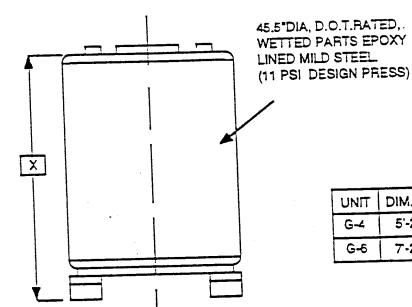


## **CARBTROL®**

## AIR PURIFICATION ADSORBERS

1,000 LB. ACTIVATED CARBON 1,800 LB. ACTIVATED CARBON G-4 G-6





DIM. "X" UNIT G-4 5'-2" G-6 7-2

#### FRIEDMAN & BRUYA, INC.

#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044

April 9, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on April 6, 1993 from Project W-7883-8, Y Paymor.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

Stephen D. Zappone

Chemist

SDZ/dp

Enclosures

#### FRIEDMAN & BRUYA, INC.

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: April 9, 1993 Date Received: April 6, 1993 Project: W-7883-8, Y Paymor

## RESULTS FROM THE ANALYSIS OF THE AIR SAMPLES FOR SOIL GASES USING EPA METHODS 8015 (MODIFIED) AND 8010 Results Reported as µl gas/L volume (ppm)

Sample ID	VES-1
Analyte:	
Vinyl Chloride	<1
t-Dichloroethylene	<1
cis-Dichloroethylene	<1
Trichloroethylene	<1
Tetrachloroethylene	35
Acetone	<1

SPECIFICATION: MODEL 5100 GAS MONITOR SYSTEM

USER INSTRUCTIONS FOR THE MODEL 5100 GAS MONITOR SYSTEM

To completely customize the specifications to your exact application, modifications to the following paragraphs are necessary:

- 1. Change the first digit of the paragraph number to correspond with the correct number for your overall specification.
- Paragraph 1.2 Fill in the desired number of sensors. Cross out the unused ones.
- 3. Paragraph 1.3 Select the desired sensors and sensor capability. Cross out the unnecessary ones and renumber the paragraphs.
- Paragraph 1.4.1 Fill in the number of monitors.

REV 2 486928 spe5100.rv2 SPECIFICATION FOR THE MODEL 5100 GAS MONITOR SYSTEM 030192

- 1.0 Gas Monitor Specification Paragraphs 1.1 through 2.0 detail the specification for the Gas Monitoring System.
- 1.1 General The Gas Monitoring System shall measure and display gas concentration. The system shall provide audio and visual alarms when preset limits are exceeded. Relay outputs for alarms and analog signals representing gas concentrations shall be provided.
- 1.2 Number and Types of Monitoring Points The number and type of monitoring points shall be as follows:

NUMBER

1.2.1 The following number of sensors are required:

1 1/1/1	102/102	1101110011
GAS	SCALE	OF SENSORS
Combustible Gas	0-100% LE	L
Carbon Monoxide-(CO)	0-100 p	om
Carbon Monoxide-(CO)	0-500 p	om
Hydrogen Sulfide-(H2S)	0-50 ppm	)
Hydrogen Sulfide-(H2S)	0-100 pp	m
Oxygen-(O2)	0-25%	
Oxygen-(O2)	0-10%	
Nitrogen Dioxide-(NO2)	0-10 ppm	

RANGE/FULL

Sultur Dioxide Chlorine-(Cl2)	
Hydrogen Cy	anide-(HCN) 0-50 ppm
Hydrogen Ch	loride-(HCI) 0-100 ppm
1.2.2 The number	of types of each external sensor shall be:
	SAMPLE
	DIFFUSION SENSORS DRAW SENSORS
Gas	Calibration Mode Stdr. Nonintrusive Stdr. Nonintrusive
Combustible Gas Carbon Monoxide- Hydrogen Sulfide- Oxygen-(O2) Nitrogen Dioxide-( Sulfur Dioxide-(SO Chlorine-(Cl2) Hydrogen Chloride Hydrogen Cyanide	NO2)
1.2 shall be in	accordance with Paragraphs 1.3.1 through 1.3.4.
	ion Combustible Sensor - The diffusion combustible sensor shall be in accordance aragraphs 1.3.1.1 through 1.3.1.11.
1.3.1.1	The combustible gas sensor shall be the catalytic bead type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur gases (Hydrogen Sulfide).
1.3.1.2	The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.
1.3.1.3	The combustible sensor shall be in an enclosure sultable for location in Class I, Division 1, Groups C & D classified areas. The sensor units shall have provisions for mounting to a wall or similar structure.
1.3.1.4	Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format.
1.3.1.5	Operating Voltage - The voltage supplied to sensor shall not exceed 14 VDC.
1.3.1.6 The sensor units shall be capable of being located remote from monitor/readout unit by up to 4000 feet. Sensor units shall receive power from send signal corresponding to gas values to the monitor/readout unit.	

- 1.3.1.7 Sensor to have FM (Factory Mutual), UL (Underwriters Laboratory), or CSA (Canadian Standards Agency) listing.
- 1.3.1.8 Sensing Element Warranty All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.
- 1.3.1.9 The manufacturer shall be able to provide a kit that when outfitted with the combustible sensor will be able to monitor ducts or vents for combustible gas. The duct mounted combustible gas sensor shall be able to monitor gas flow rates in a duct up to sixty (60) miles per hour. The vent mounted combustible gas sensor shall be provided with a four (4) inch saddle clamp.

#### 1.3.1.10 Dual Condulet Capability

- 1.3.1.10.1 The combustible sensor shall be capable of being able to be remotely mounted from the calibration electronics. The separate sensor enclosure shallbe able to be mounted fifty (50) feet from the calibration electronics.
- 1.3.1.10.2 The sensor housing shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.
- 1.3.1.10.3 The sensor housing and the calibration electronics shall be connected by not more than a three conductor cable.

#### 1.3.1.11 Nonintrusive Calibration Capability

- 1.3.1.11.1 The combustible sensor shall be capable of being calibrated without opening any enclosures.
- 1.3.1.11.2 There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).
- 1.3.1.11.3 Calibration shall be by means of a nonintrusive calibration system. Using a hand held wireless remote control unit held less than 1 foot from the sensor, the calibration values, zero and span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a transmitter which employs an infrared light beam.
- 1.3.1.11.4 The combustible sensor shall not be affected by: ambient light either natural or man made.
- 1.3.1.11.5 The combustible sensor shall be capable of being mounted in a separate condulet as described above.
- 1.3.2 Sample Draw Combustible Sensor The sample draw combustible sensor shall be in accordance with Paragraphs 1.3.2.1 through 1.3.2.13.

1.3.2.1	The combustible gas sensor shall be the catalytic bead type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur gases (Hydrogen Sulfide).			
1.3.2.2	The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.			
1.3.2.3	The sensor units shall be capable of being located remote from the monitor/readout unit by up to 4000 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.			
1.3.2.4	of the e door. T	Enclosure Type - The enclosure shall be rated NEMA 4X type. Access to the inside of the enclosure and wiring connections shall be through a front facing, full length door. The door shall have a shatterproof window of sufficient size to allow the viewing of the flow meter.		
1.3.2.5		Enclosure Size - The enclosure shall be less than 12 inches in any dimension (mounting provisions excluded).		
1.3.2.6		Mounting Provisions - Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided.		
1.3.2.7	Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format.			
1.3.2.8	Operati	ing Voltage - The voltage supplied to the sensor shall not exceed 14 VDC.		
1.3.2.9	The combustible sensor enclosure shall have a pump or an air aspirator to draw a gas sample to the combustible sensor.			
1.3.2.10	The combustible sensor enclosure shall have a flow meter in the gas sample to show the flow rate of the sample gas.			
1.3.2.11	Sensing Element Warranty - All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.			
1.3.2.12	The pump type combustible sensor enclosure shall have a flow switch which will activate when the gas sample falls below the acceptable flow rate to the sensor.			
1.3.2.13	Nonint	rusive Calibration Capability		
	1.3.2.13.1	The combustible sensor shall be capable of being calibrated without opening any enclosures.		
	1.3.2.13.2	There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).		

Calibration shall be by means of a nonintrusive calibration system. Using a hand held wireless remote control unit held less than 1 foot from the

1.3.2.13.3

sensor, the calibration values, zero and span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a transmitter which employs an infrared light beam.

- 1.3.2.13.4 The combustible sensor shall not be affected by: ambient light either natural or man made.
- 1.3.3 Diffusion Toxic Gas Sensor The diffusion toxic gas sensor (Carbon monoxide, hydrogen sulfide, oxygen,nitrogen dioxide, sulfur dioxide, hydrogen cyanide, chlorine and hydrogen chloride) shall be in accordance with Paragraphs 1.3.3.1 through 1.3.3.9.
  - 1.3.3.1 The toxic gas sensor shall be the electrochemical type. The sensor shall not require the periodic addition of reagents. The oxygen sensor shall be the electrochemical fuel cell type. The sensor shall not require the periodic addition of reagents.
  - 1.3.3.2 Sensing Element Warranty All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.
  - 1.3.3.3 The interconnect wiring from the sensor to the instrument shall be 2 wire shielded cable.
  - 1.3.3.4 Sensor Configuration As a minimum, the sensor shall be enclosed in NEMA 12 enclosures.
  - 1.3.3.5 Signal To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format.
  - 1.3.3.6 Operating Voltage The voltage supplied to the sensor shall not exceed 14 VDC.
  - 1.3.3.7 The sensor units shall be capable of being located remote from the monitor/readout unit by up to 3200 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.
  - 1.3.3.8 Dual Condulet Capability
    - 1.3.3.8.1 The toxic gas sensor shall be capable of being remotely mounted from the calibration electronics. The separate sensor enclosure shall be able to be mounted fifty (50) feet from the calibration electronics.
    - 1.3.3.8.2 The sensor housing shall be in an enclosure suitable for location in Class I. Division 1, Groups C & D classified areas.
    - 1.3.3.8.3 The sensor housing and the calibration electronics shall be connected by not more than a three conductor cable.
  - 1.3.3.9 Nonintrusive Calibration Capability

1.3.3.9.1	The toxic gas sensor shall be capable of being calibrated without opening any enclosures.	
1.3.3.9.2	There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).	
1.3.3.9.	Calibration shall be by means of a nonintrusive calibration system. Using a hand held wireless remote control unit held less than 1 foot from the sensor, the calibration values, zero and span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptablemethod uses a transmitter which employs an infrared lightbeam.	
1.3.3.9.	he toxic gas sensor shall not be affected by: ambient light either natural or man made.	
1.3.3.9.	The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.	
1.3.3.9.	The toxic gas sensor shall be capable of being mounted in a separate condulet as described above.	
	e Draw Toxic Gas Sensor - The sample draw toxic gas sensor shall be in accordance aragraphs 1.3.4.1 through 1.3.4.12.	
1.3.4.1	The toxic gas sensor shall be the electrochemical type. The sensor shall not require the periodic addition of reagents.	
	The oxygen sensor shall be the electrochemical fuel cell type. The sensor shall not require the periodic addition of reagents.	
1.3.4.2	The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.	
1.3.4.3	The sensor units shall be capable of being located remote from the monitor/readout unit by up to 3200 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.	
1.3.4.4	4.4 Enclosure Type - The enclosure shall be rated NEMA 4X type. Access to the in of the enclosure and wiring connections shall be through a front facing, full led door. The door shall have a shatterproof window of sufficient size to allow viewing of the flow meter.	
1.3.4.5	Enclosure Size - The enclosure shall be less than 12 inches in any dim- (mounting provisions excluded).	
1.3.4.6	Mounting Provisions - Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided.	

1.3.4

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1.3.4.7	Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format.		
1.3.4.8	Operatir	Operating Voltage - The voltage supplied to the sensor shall not exceed 14 VDC.	
1.3.4.9	The toxic gas sensor enclosure shall have a pump or an air aspirator to draw a gas sample to the toxic gas sensor.		
1.3.4.10	The toxic gas sensor enclosure shall have a flow meter in the gas sample to show the flow rate of the sample gas.		
1.3.4.11	The pump type toxic gas sensor enclosure shall have a flow switch which will activate when the gas sample falls below the acceptable flow rate to the sensor.		
1.3.4.12	Nonintr	usive Calibration Capability	
1.3.4.1	12.1	The toxic gas sensor shall be capable of bein calibrated without opening any enclosures.	
1.3.4.1	12.2	There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).	
1.3.4.1	12.3	Calibration shall be by means of a nonintrusive calibration system. Using a hand held wireless remote control unit held less than 1 foot from the sensor, the calibration values, zero and span, can be set without opening the enclosure or declassification of the area. Use of fiashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a transmitter which employs an infrared light beam.	
1.3.4.	12.4	The toxic gas sensor shall not be affected by: ambient light either natural or man made.	
		The sector decise shall conform to Remarks 1.4 through 2.0. Deviations	

System Configuration - The system design shall conform to Paragraphs 1.4 through 2.0. Deviations 1.4

are not acceptable.

- Description The system shall consist of a monitor/readout unit and separate gas sensor 1.4.1 units. The sensor units shall be capable of being located remote from the monitor/readout unit by up to 5000 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit. The gas monitor system shall consist of (No.) monitor/readout units and separate gas sensor units.
- Monitor/Readout Configuration The monitor/readout shall be the enclosed wall mount 1.4.2 type. It shall conform to Paragraphs 1.4.2.1 through 1.4.2.6.
  - Number of Sensor per Enclosure Each monitor/readout shall have the capability 1.4.2.1 of monitoring two sensors as described in Paragraph 1.2.

- 1.4.2.2 Enclosure Type The enclosure shall be suitable for NEMA 4X type areas. Access to the inside of the enclosure, monitor front panel and wiring connections shall be through a front facing, full length door. The door shall have a shatterproof window of sufficient size to allow the viewing of the meters and indicator lights. The enclosure shall not be mounted in a hazardous location as defined by the NEC (National Electrical Code).
- 1.4.2.3 Enclosure Size The enclosure shall be less than 14 inches in any dimension (mounting provisions excluded).
- 1.4.2.4 Mounting Provisions Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided.
- 1.4.2.5 External Controls A sealed switch (switches) accessible from the outside of the enclosure shall be provided for the purpose of alarm relay reset and audible alarm sliencing.
- 1.4.2.6 The monitor/readout unit must have UL (Underwriters Laboratory) and FM (Factory Mutual) approval or certification.

#### 1.5 Monitor Unit Requirements

- 1.5.1 Readout Displays A separate three digit LED readout shall be provided for the purpose of displaying the gas value from each sensor. The value displayed shall be a direct reading of concentration as specified in Paragraph 1.2. The readout must also be able to be configured to read any value between 0-999 or 0-99.9.
- 1.5.2 Visual Alarm Indicators The monitor shall have a separate indicating light for caution, warning and alarm for each gas sensor. The lights shall be color coded. Blue, Green or White shall not be used.
- 1.5.3 Alarm Set Point Levels Three separate alarm set point levels shall be provided for each sensor. The set points shall be independently adjustable for any value in the readout range. The set points shall provide drive signals to user interface relays. At least two of the three alarm set points per sensor shall have the capability of providing the user a selection of latching or non-latching mode.
- 1.5.4 Relay Outputs The alarm set point drive signals shall activate user relays as specified in Paragraphs 1.5.4.1 through 1.5.4.4.
  - 1.5.4.1 Number of Relays As a minimum, one relay for each set point level shall be provided.
  - 1.5.4.2 Contact Rating All relays shall be Form C, single pole, double throw. Contacts shall be rated for 5 amps resistive at 120 VAC.
  - 1.5.4.3 Contact Selection The contacts shall be capable of being selected normally open or normally closed and normally energized or normally de-energized.
  - 1.5.4.4 Set Point Drive Deselect Buttons shall be provided to allow the user to deselect both set point drive signals from activating a relay for a maximum of two hours.
- 1.5.5 Malfunction Indication System trouble indication shall be provided in accordance with

#### Paragraphs 1.5.5.1 and 1.5.5.2.

- 1.5.5.1 Trouble Relay A relay shall be provided to indicate trouble when any of the following conditions exist:
  - a. System power loss
  - b. Signal loss from any sensor
  - c. Signal 15% of full scale or greater lower than zero
  - d. Within 30 seconds of applying power
  - e. Control module malfunction
- 1.5.5.2 Display Indication The readout display described in Paragraph 1.5.1 shall display a separate unique character when an over range or greater than 10% under range condition exists.
- 1.5.6 Audible Alarm A 75 db audible hom, buzzer or tone shall be provided when a latching alarm condition occurs. The audible hom, buzzer or tone will not sound when an alarm condition occurs on a non-latching set point.
- 1.5.7 Output Signals A 4-20 mA signal representing the gas concentration shall be provided for each gas sensor in the system. The signal shall be a sourcing type capable of driving a 250 ohm load.
- 1.5.8 Controls Controls shall be provided as specified in Paragraphs 1.5.8.1 and 1.5.8.2.
  - 1.5.8.1 Operating Modes and Parameters Selection -The selections listed in this paragraph shall be accomplished by the use of switches, jumpers or other means that does not involve the use of tools.
    - a. display range value
    - b. latching or non-latching mode for at least two alarm set point drivers
    - c. removing any point from service
    - d. increasing or decreasing alarm action for at least two alarm set points
  - 1.5.8.2 Front Panel Controls The functions listed in this paragraph shall be accomplished using push button type controls readily accessible on the front panel.
    - a. display of alarm set point level on the readout display described in Paragraph 1.5.1
    - b. resetting any alarm set point
    - disabling any specific sensor from affecting the system for two hours
    - d. silencing of audible alarm
    - e. resetting any latching relay if alarm condition is cleared
    - f. lamp test
- 1.5.9 Sensor Input Signal The sensor input signal shall be a digital or frequency type.

- 1.6 System Power Requirements The system shall operate on 115 or 220 VAC, 50 or 60 Hz. Power shall not exceed 100 VA.
- 1.7 Maximum System Maintenance Requirements The system shall require no periodic maintenance other than periodic checking of sensor unit function. Periodic sensor checking or actual adjustment of the sensor units shall be capable of being accomplished by one person at the sensor unit location.

#### 1.8 Approvals

- 1.8.1 As a minimum, the following parts of the system shall have approval by UL (Underwriters Laboratory):
  - a. all primary AC components including connectors
  - b. all user relays
  - c. all remote sensor unit enclosures
- 1.8.2 The monitor/readout unit must have FM (Factory Mutual) certification.
- 1.9 Manufacturer Capability Requirements As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
  - a. be capable of supplying all equipment used to check or calibrate the sensor units
  - b. be capable of providing on site service with factory trained personnel
  - c. be capable of providing on site training for owner/operator
- 2.0 Gas Monitoring System shall be a Mine Safety Appliances Company Model 5100 Gas Monitor or equal.

SPECIFICATION: MSA 4 to 20mA GAS SENSOR/TRANSMITTER

USER INSTRUCTIONS
FOR THE
MSA 4 to 20mA GAS SENSOR/TRANSMITTER

The user must modify and customize the specification to make it functional. The following should be addressed:

- 1. Paragraph 1.2 Fill in the total number of sensor/transmitters necessary.
- 2. Paragraph 2.0 Fill in the type of gas sensor/transmitters.
- Paragraph 1.3 Select the appropriate paragraphs outlining the sensor/transmitters capabilities needed. Cross out the unnecessary ones.

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spe420ma.gas SPECIFICATION FOR THE MSA 4 to 20mA GAS SENSOR/TRANSMITTER

- 1.0 Gas Sensor/Transmitter System Specification Paragraphs 1.1 through 1.5 detail the specification for the Gas Sensor/Transmitter System.
- 1.1 General The Gas Sensor/Transmitter System shall measure and optionally display a single gas concentration. The sensor/transmitter shall provide 4 to 20mA DC current into at least 250 ohms.
- 1.2 Number of sensor/transmitter monitoring points shall be as follows:
  - 1.2.1 The following number of sensor/transmitters are required:

R/	ANGE/FULL	NUMBER OF
GAS	SCALE	SENSOR/TRANSMITTERS
Combustible Gas	0-100% l	EL
Carbon Monoxide-(CC		ppm
Carbon Monoxide-(CC		ppm
Hydrogen Sulfide-(H29	S) 0-50 pp	om
Oxygen-(O2)	0-25%	
Nitrogen Dioxide-(NO2	2) 0-10 pp	m
Suffur Dioxide-(SO2)	0-25 ppm	1
Chlorine-(Cl2)	0-10 ppm	
Hydrogen Cyanide-(H		
Hydrogen Chloride-(H	a) 0-100 p	

1.2.2 The number of types of each sensor/transmitter shall be:

#### SAMPLE

**DIFFUSION SENSORS** 

saddle clamp.

**DRAW SENSORS** 

Calibration Mode Calibration Mode Strd. Nonintrusive Strd. Nonintrusive Gas Combustible Gas Carbon Monoxide-(CO) Hydrogen Sulfide-(H2S) Oxygen-(O2) Nitrogen Dioxide-(NO2) Sulfur Dioxide-(SO2) Chlorine-(Cl2) N/A Hydrogen Cyanide-(HCN) N/A Hydrogen Chloride-(HCI) N/A N/A Sensor/Transmitter Unit Requirements - Sensors used as part of the gas monitoring system 1.3 specified in Paragraph 1.2 shall be in accordance with Paragraphs 1.3.1 through 1.3.4. Diffusion Combustible Sensor/Transmitter - The diffusion combustible sensor/transmitter 1.3.1 shall be in accordance with Paragraphs 1.3.1.1 through 1.3.1.10. The combustible gas sensor shall be the catalytic bead type. The sensor must 1.3.1.1 have a demonstrated resistance to degradation by silicones and reduced sulfur gases (Hydrogen Sulfide). The interconnect wiring from the sensor/transmitter to the monitoring instrument 1.3.1.2 shall be 3 wire shielded cable. The combustible sensor/transmitter shall be in an enclosure suitable for location 1.3.1.3 in Class I, Division 1, Groups C & D classified areas. The sensor/transmitter units shall have provisions for mounting to a wall or similar structure. Signal - The signal from the sensor/transmitter to the monitoring instrument shall 1.3.1.4 be 4 to 20mA. It shall be a sourcing type of signal capable of operating into a 250 ohm load. Operating Voltage - The sensor/transmitter shall be able to operate on voltage up 1.3.1.5 to 35 VDC. The sensor/transmitter units shall be capable of being located remote from the 1.3.1.6 monitor/readout unit by up to 2000 feet. Sensing Element Warranty - All sensing elements (sensors) shall have a minimum 1.3.1.7 useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement. The manufacturer shall be able to provide a kit that when outfitted with the 1.3.1.8 combustible sensor/transmitter will be able to monitor ducts or vents for

combustible gas. The duct mounted combustible gas sensor/transmitter shall be able to monitor gas flow rates in a duct up to sixty (60) miles per hour. The vent mounted combustible gas sensor/transmitter shall be provided with a four (4) inch

1.3.1.9	Dual Condulet Capability
1.3.1.9.1	The combustible sensor portion of the sensor/transmitter unit shall be capable of being able to be remotely mounted from the calibration electronics. The separate sensor enclosure shall be able to be mounted fifty (50) feet from the calibration electronics.
1.3.1.9.2	The sensor housing shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.
1.3.1.9.3	The sensor housing and the calibration electronics shall be connected by not more than a three conductor cable.
1.3.1.10 Nonint	rusive Calibration Capability
1.3.1.10.	The combustible sensor/transmitter shall be capable of being calibrated without opening any enclosures.
1.3.1.10	There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor/transmitter enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).
1.3.1.10	Calibration shall be by means of a nonintrusive calibration system. By means of a hand held wireless remote control unit, the calibration values, zero span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a transmitter which employs an infrared light beam.
1.3.1.10	.4 The combustible sensor/transmitter shall not be affected by: ambient light either natural or man made.
1.3.1.10	The combustible sensor portion of the combustible sensor/transmitter shall be capable of being mounted in a separate condulet as described above.
1.3.2 Sample sensor/	Draw Combustible Sensor/Transmitter - The sample draw combustible transmitter shall be in accordance with Paragraphs 1.3.2.1 through 1.3.2.13.
1.3.2.1	The combustible gas sensor shall be the catalytic bead type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur

The interconnect wiring from the sensor/transmitter to the monitoring instrument

The sensor/transmitter units shall be capable of being located remote from the

gases (Hydrogen Sulfide).

shall be 3 wire shielded cable.

monitor/readout unit by up to 2000 feet.

1.3.2.2

1.3.2.3

1.3.2.4	Enclosure Type - The enclosure shall be rated NEMA 4X type. Access to the inside of the enclosure and wiring connections shall be through a front facing, full length door. The door shall have a shatterproof window of sufficient size to allow the viewing of the flow meter.	
1.3.2.5	Enclosure Size - The enclosure shall be less than 12 inches in any dimension (mounting provisions excluded).	
1.3.2.6	Mounting Provisions - Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided.	
1.3.2.7	Signal - The signal from the sensor/transmitter to the monitoring instrument shall be 4 to 20mA. It shall be a sourcing type of signal capable of operating into a 250 ohm load.	
1.3.2.8	Operating Voltage - The sensor/transmitter shall be able to operate on voltage up to 35 VDC.	
1.3.2.9	The combustible sensor/transmitter enclosure shall have a pump or an air aspirator to draw a gas sample to the combustible sensor/transmitter.	
1.3.2.10	The combustible sensor/transmitter enclosure shall have a flow meter in the gas sample to show the flow rate of the sample gas.	
1.3.2.11	Sensing Element Warranty - All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.	
1.3.2.12	The pump type combustible sensor/transmitter enclosure shall have a flow switch which will activate when the gas sample falls below the acceptable flow rate to the sensor/transmitter.	
1.3.2.13 Non	intrusive Calibration Capability	
1.3.2.1	The combustible sensor/transmitter shall be capable of being calibrated without opening any enclosures.	
1.3.2.	There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor/transmitter enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).	

1.3.2.13.3

1.3.2.13.4

Calibration shall be by means of a nonintrusive calibration system. By

means of a hand held wireless remote control unit, the calibration values, zero span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a

The combustible sensor/transmitter shall not be affected by: ambient ligh

transmitter which employs an infrared light beam.

either natural or man made.

- 1.3.3 Diffusion Toxic Gas Sensor/Transmitter The diffusion toxic gas sensor/transmitter (Combustible gas, carbon monoxide, hydrogen sulfide, oxygen, nitrogen dioxide, sulfur dioxide, chlorine, hydrogen cyanide and hydrogen chloride) shall be in accordance with Paragraphs 1.3.3.1 through 1.3.3.9.
  - 1.3.3.1 The toxic gas sensor/transmitter shall be the electrochemical type. The sensor shall not require the periodic addition of reagents. The oxygen sensor shall be the electrochemical fuel cell type. The sensor shall not require the periodic addition of reagents.
  - 1.3.3.2 Sensing Element Warranty All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.
  - 1.3.3.3 The interconnect wiring from the sensor/transmitter to the instrument shall be 2 wire shielded cable.
  - 1.3.3.4 Sensor/Transmitter Configuration As a minimum, the sensor/transmitter shall be enclosed in NEMA 12 enclosures.
  - 1.3.3.5 Signal The signal from the sensor/transmitter to the monitoring instrument shall be 4 to 20mA. It shall be a sourcing type of signal capable of operating into a 250 ohm load.
  - 1.3.3.6 Operating Voltage The sensor/transmitter shall be able to operate on voltage up to 35 VDC.
  - 1.3.3.7 The sensor/transmitter units shall be capable of being located remote from the monitor/readout unit by up to 2000 feet. Sensor/transmitter units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.

#### 1.3.3.8 Dual Condulet Capability

- 1.3.3.8.1 The toxic gas sensor/transmitter shall be capable of being able to be remotely mounted from the calibration electronics. The separate sensor enclosure shall be able to be mounted fifty (50) feet from the calibration electronics.
- 1.3.3.8.2 The sensor housing shall be in an enclosure sultable for location in Class I, Division 1, Groups B, C & D classified areas.
- 1.3.3.8.3 The sensor housing and the calibration electronics shall be connected by not more than a three conductor cable.

#### 1.3.3.9 Nonintrusive Calibration Capability

- 1.3.3.9.1 The toxic gas sensor/transmitter shall be capable of being calibrated without opening any enclosures.
- 1.3.3.9.2 There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor/transmitter enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all

### Puget Sound Air Pollution Control Agency

200 West Mercer Street, Room 205 Seattle, Washington 98119-3958 Telephone: (206) 296-7330 1-800-552-3565

Facsimile: (206) 296-7431

Date: May 6, 1993

Proponent: R7A AGRA, Inc.

Project, Brief Title: Soil Remediation

2210 S. 320th Street Federal Way, WA ENVIRONMENTAL CHECKLIST

#### Purpose of Checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

#### Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

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-CARD OF DIRECTORS

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Petr Kinch, Mayor Ever

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#### Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered *does not apply.* IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic areas," respectively.

#### TO BE COMPLETED BY THE APPLICANT

#### A. BACKGROUND

· · · · · · · · · · · · · · · · · · ·		
	per of applicant and contact person:	
Name:	Title:	
	Telephone:	
City/State/Zip:		
	ist:	
	ule (including phasing, if applicable):	
		<del></del>
	r future additions, expansion, or further activity relat	

### Puget Sound Air Pollution Control Agency

200 West Mercer Street, Room 205 Seattle, Washington 98119-3958 Telephone: (206) 296-7330 1-800-552-3565

Facsimile: (206) 296-7431

Date: May 6, 1993

Proponent: R7A AGRA, Inc.

Project, Brief Title: Soil Remediation

2210 S. 320th Street Federal Way, WA

**ENVIRONMENTAL CHECKLIST** 

#### Purpose of Checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

#### Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all pans of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

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Li: pr	st any environmental information you know about that has been prepared, or will be epared, directly related to this proposal.
<u>Pı</u>	eliminary Remedial Investigation: Movember 1992
D pi	by you know whether applications are pending for governmental approvals of other oposals directly affecting the property covered by your proposal? If yes, explain.
<u>N</u>	one to our knowledge.
<u>-</u>	
L	st any government approvals or permits that will be needed for your proposal, if known.
P	SAPCA Air Permit
_	
_	
_	
C	live brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers or his page.
2 / i	We propose to install and operating a soil vapor extraction system, in conjunction with a activated carbon unit, to remediate contaminated soils. Vapor extraction involves tulizing apor extraction wells and a vacuum blower to create the negative pressure which is intended to ectract the hydrocarbons from the soils. The proposed carbon adsorption unity ill serve as teh applicable control technology to effectively remove the known accontaminat (tetrachloroethylene).
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ACLANCE SECTION

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12.	location and rate bound topograthe ad	on of the proposal. Give sufficient information for a person to understand the precise on of your proposed project, including a street address, if any, and section, township, nge, if known. If a proposal would occur over a range of area, provide the range or aries of the site(s). Provide a legal description, site plan, vicinity map, and raphic map, if reasonably available. While you should submit any plans required by lency, you are not required to duplicate maps or detailed plans submitted with any applications related to this checklist.
	North	west Building Corp's Best Shopping Mall
	2201 \$	a Way, Washington
	recen	a way, washington
ENVI	RONMEN	ITAL ELEMENTS
1.	Earth	
	a.	General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other: Fully developed.
	b.	What is the steepest slope on the site (approximate percent slope)? 1 %
	C.	What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.
		Sandy silts with clay.
	d.	Are there surface indications or history of unstable solls in the immediate vicinity? If so, describe.
		No
	e.	Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.
		Shallow trench will be excavated to install vaopr extraction lines to the Vapor extraction/carbon dsoption unit, requiring minor amounts of backfill. Source of fill will be native soils and clean sand.
	f.	Could erosion occur as a result of clearing, construction or use? If so, generally describe.
		No: the site flooring is concrete and the trenches would be shallow and narrow.
	g.	About what percent of the site will be covered with impervious surface after project construction (for example, asphalt or buildings)?
		100%; same as existing site.

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	h.	Proposed measures to reduce or control erosion, or other impacts to the earth, it any:
		None required.
2.	Air	
	a.	What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial, wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.
		No emissions during construction; minor emissions of volatile organic compounds (tetrachloroehlylene) during operation of the system.
	b.	Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
		No.
	C.	Proposed measures to reduce or control emissions or other impacts to air, if any:
		Carbon adsorption unit control air emissions to 99% efficieny, air.
3.	Water	
	a.	Surface:
		1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
		No.
		2) Will the project require any work over, in, or adjacent to (within 200 feet the described waters? If yes, please describe and attach available plans
		No.
		Estimate the amount of fill and dredge material that would be placed in content of the surface water or wetlands and indicate the area of the state that would be affected. Indicate the source of fill material.
		N/A

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	4)	Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.
		No.
	5)	Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.
		No.
	6)	Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
		Approximately 30 gallons/day of groundwater to the sanitary sewer.
b.	Groui	nd:
	1)	Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose and approximate quantities if known.
		N/A.
	2)	Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the systems, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.
		N/A.
C.	Wate	r Runoff (including storm water):
	1)	Describe the source of runoff (including storm water) and method o collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.
		None.

		<ol> <li>Could waste material enter ground or surface waters? If so, generally describe.</li> </ol>
		No.
	d.	Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:
		N/A.
4.	Plants	
	<b>a</b> .	Check or circle types of vegetation found on the site:
		deciduous tree: alder, maple, aspen, other
		evergreen tree: fir, cedar, pine, other
		shrubs
		grass
		pasture
		crop or grain
		wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
		water plants: water lily, eelgrass, milfoll, other
		other types of vegetation
	b.	What kind and amount of vegetation will be removed or altered?
		None.
	C.	List threatened or endangered species known to be on or near the site.
		None known.
	d.	Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
		None.
5.	Anima	ds .
	a.	Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:
		None known.
		Birds: hawk, heron, eagle, songbirds, other:

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		Mammais: deer, bear, elk, beaver, other:
		None.
		Fish: bass, salmon, trout, herring, shellfish, other:
		None.
	b.	List any threatened or endangered species known to be on or near the site.
		None known.
	C.	Is the site part of a migration route? If so, explain.
		No, not to our knowledge.
	d.	Proposed measures to preserve or enhance wildlife, if any:
		None necessary.
6.	Energy	y and Natural Resources
	a.	What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
		Electricity will be used to power the vacuum blower.
	b.	Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
		No.
	C.	What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, it any:
		None.

#### 7. Environmental Health

risk o	Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.		
proje	lle organic compounds will be emitted from the carbon unit: however, the cted emission rates are below acceptable levels (PSAPCA Guideline levels for chloroethylene).		
1)	Describe special emergency services that might be required.  None likely		
2)	Proposed measures to reduce or control environmental health hazards, if any:		
	The carbon unit shall be equipped with a combustible gas indiactor for system shut-down if stack concentrations and operational parameters are considered unacceptable (over 20% LEL).		
Nois	e		
1)	What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?		
	None.		
2)	What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic construction, operation, other)? Indicate what hours noise would come from the site.		
	None.		
3)	Proposed measures to reduce or control noise impacts, if any:		
	N/A.		

8. Land and Shoreline use What is the current use of the site and adjacent properties? 8. Vacant building site Adjacent properties: commercial Has the site been used for agriculture? If so, describe. b. Describe any structures on the site. C. Commercial buildings. d. Will any structures be demolished? If so, what? No. What is the current zoning classification of the site? e. Commercial What is the current comprehensive plan designation of the site? f. Commercial (non-industrial). If applicable, what is the current shoreline master program designation of the site? g. Not applicable.

	so, specify.
	No.
•	Approximately how many people would reside or work in the completed project?
	None.
	Approximately how many people would the completed project displace?
	None.
	Proposed measures to avoid or reduce displacement impacts, if any:
	Not applicable.
	Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:
	Not applicable.
ou	sing
	Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.
	Not applicable.
•	Approximately how many units, if any, would be eliminated? Indicate whether high middle, or low-income housing.
	Not applicable.
	Proposed measures to reduce or control housing impacts. If any:

9.

		Not applicable.
10.	Aesth	
	<b>a</b> .	What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?
		The treatment compound is approximately 10'x 10' at the base and 6' high.
	b.	What views in the immediate vicinity would be altered or obstructed?
		None.
	C.	Proposed measures to reduce or control aesthetic impacts, if any:
		None required.
11.	Light	t and Glare
	a.	What type of light or glare will the proposal produce? What time of day would it mainly occur?
		None/24 hours/day
	b.	Could light or glare from the finished project be a safety hazard or interfere with views?
		No.
	C.	What existing off-site sources of light or glare may affect your proposal?
		None.

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	d.	Proposed measures to reduce or control light and glare impacts, if any:
		Not applicable.
12.	Recre	pation
	<b>a</b> .	What designated and informal recreational opportunities are in the immediate vicinity?
		None.
	b.	Would the proposed project displace any existing recreational use? If so, describe.
		No.
	C.	Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
		Not applicable.
13.	Histo	ric and Cultural Preservation
	a.	Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.
		None known.
	b.	Generally describe any landmarks or evidence of historic, archaeological, scientific
	D.	or cultural importance known to be on or next to the site.
		Not applicable.

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	C.	Proposed measures to reduce or control impacts, if any:
		Not applicable.
14.	Trans	sportation
	a.	Identify public streets and highways serving the site, and describe proposed access to the existing street system. Shown on site plans, if any:
		Not applicable.
	b.	Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?
		Not applicable.
	C.	How many parking spaces would be completed project have? How many would the project eliminate?  Not applicable.
	d.	Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).
		No.
	e.	Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.
		No.
	f.	How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.
		None.

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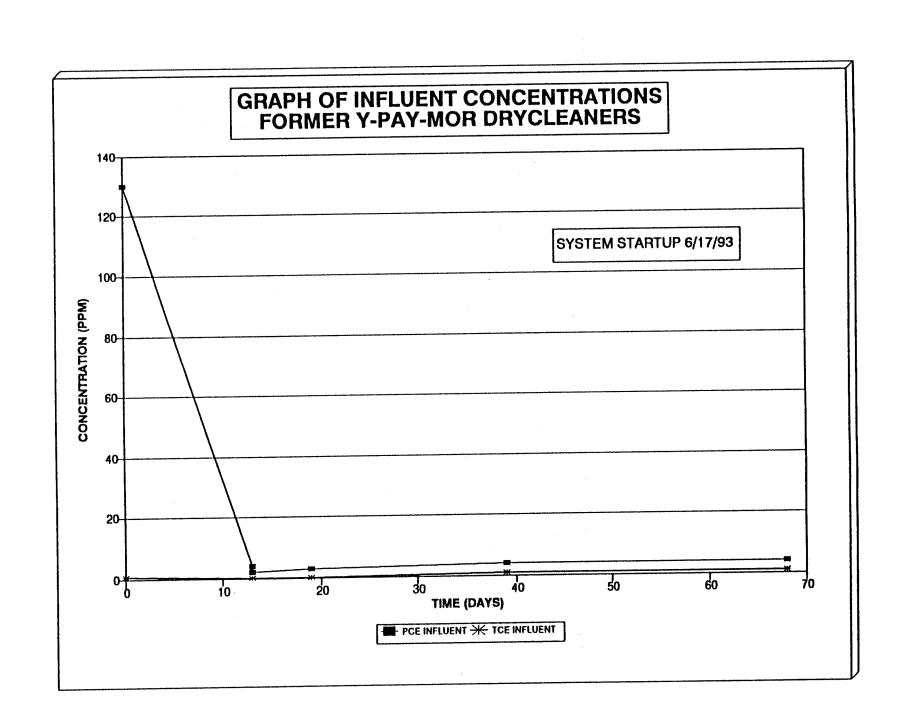
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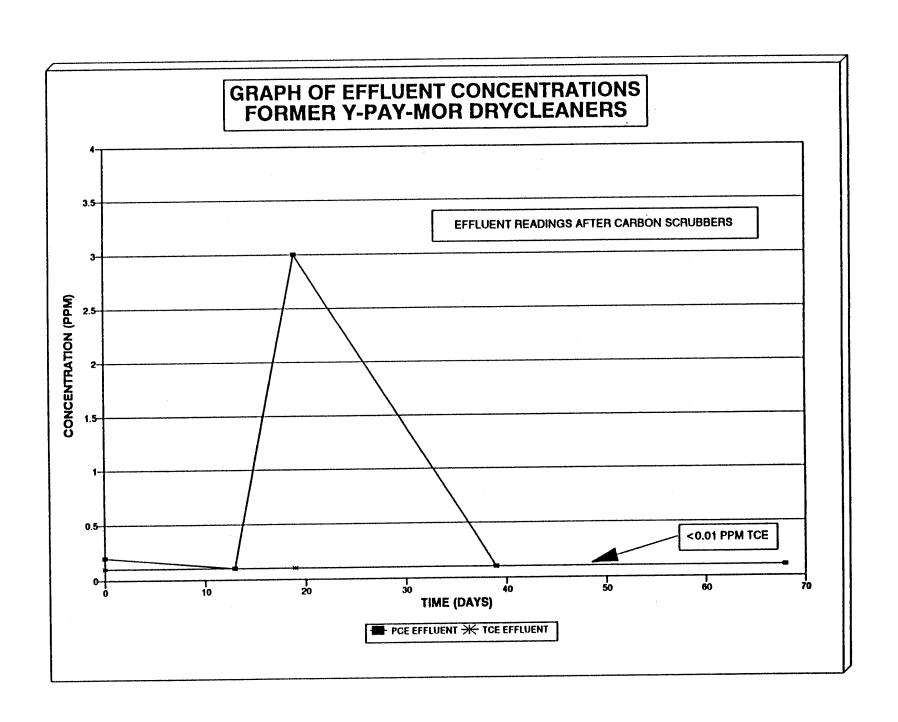
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	g.	Proposed measures to reduce or control transportation impacts, if any:
		Not applicable.
		·
15.	Public	Services
	a.	Would the project result in an increased need for public services (for example, fire protection, police protection, health care, schools, other)? If so, generally describe.
		No.
	b.	Proposed measures to reduce or control direct impacts on public services, if any.
		Not applicable.
16.	Utilitie	es es es es es es es es es es es es es e
	a.	Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.
	b.	Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
		Electric.
SIGN	ATURE	
		swers are true and complete to the best of my knowledge. I understand that the lead ring on them to make its decision.
Signa	iture:	Jand Nameman

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# APPENDIX D GRAPHS OF TIME VS. INFLUENT CONCENTRATIONS TETRACHLOROETHYLENE EQUIVALENT MASS RECOVERY CALCULATIONS 11-07883-08





# Tetrachloroethylene (PCE) Recovery Calculations Former Y-Pay-Mor Dry Cleaners Federal Way, Washington

#### Assumptions:

- Mass of contaminant spilled 6-40 gallons
- Contaminant comprised of 100% PCE
- 40% of volume spilled is unrecoverable
- Vapor Recovery System continues to operate under current configuration
- Concentration of PCE in the effluent of the system equilibrates at 4 ppm.
- Density of PCE is 1.63 g/cm³
- 24L of gas at STP = 1 mol
- Air flow rate in system = 117 cfm (331 L/min)
- 70 days of operation (=100800 min)

#### **EQUIVALENT MASS OF PCE IN SUBSURFACE**

6 gallons - 81.7 lbs

15 gallons - 204 lbs

40 gallons - 544 lbs

Example Calculation:

1 gallon =  $3.785 \times 10^{-3} \text{ m}^3 = 3785 \text{ cm}^3$ 

Density of PCE = 1.63 g/cm³

1 gallon PCE = 6169.55 g = 13.6 lbs

#### **EQUIVALENT MASS RECOVERED TO DATE**

Mass PCE Removed/Unit Volume Air Removed

 $4 \mu g_{PCE}/g_{air} = 27.6 \mu g_{PCE}/L_{air}$ 

Example Calculation  $\underline{1\mu g_{PCE}}$  165.83  $\underline{g_{PCE}}$   $\underline{1 \text{ mol}_{PCE}}$  = 6.9  $\mu g_{PCE}/L_{air}$   $\underline{g_{air}}$   $\underline{mol}_{PCE}$  24  $L_{air}$ 

Mass PCE Removed/Unit Time of System Operation

 $27.6 \ \mu g_{PCE}/L_{air} \ @ \ 331 \ L/min = 9.13X10^{-3}g_{PCE}/min$ 

Total Mass PCE Recovered to Date

For 100800 minutes @  $9.13X10^{-3}$   $g_{PCE}/min = 0.92$  kg/(=2.03lbs)

#### PROJECTED TIME FOR REMEDIATION

82 lbs = 7.74 yrs; for 60% recovery 4.6 yrs

204 lbs = 19.3 yrs; for 60% recovery 11.5 yrs

544 lbs = 51.4 yrs; for 60% recovery 30.8 yrs

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: June 23, 1993 Date Received: June 17, 1993 Project: W-7883-8, Why Pay Mor

Date Samples Extracted: June 18, 1993 Date Extracts Analyzed: June 18, 1993

### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR SOIL GASES USING EPA METHODS 8020 AND 8015

#### per Washington DOE Guidelines Results Reported as µL gas/liter volume

Sample ID	VES Influent	VES Effluent
Analyte:		
Vinyl Chloride	<1 4	<1
Acetone	<1	<1
t-Dichloroethylene	<1	<1
cis-DCE	<1	<1
Trichloroethylene	0.6	<0.1
Tetrachloroethylene	130	0.2

AFFENDIY

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RZA-AGRA Sample ID	Lab Samp ID	Date Collected	Time Callected	Matrix (S=soil, W=water, A=air)		L Glass /	oz Gless /	14 Bag		CHILL	P(E 72 E 02																Hold for Further Analysis	AUSH (see below)
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#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 14, 1993 Date Received: July 2, 1993 Project: W-7883-8, Why Pay Mor

Date Samples Extracted: July 2, 1993 Date Extracts Analyzed: July 2, 1993

#### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR VOLATILE ORGANIC COMPOUNDS USING EPA METHODS 8010 AND 8015

per Washington DOE Guidelines Results Reported as µl gas/liter volume (ppm)

Sample ID	<u>VES-1</u>	VES-2
Analyte:		
Vinyl Chloride	<1	<1
Acetone	<1	<1
t-Dichloroethylene	<1	<1
cis-Dichloroethylene	<1	<1
Trichloroethylene	<0.1	<0.1
Tetrachloroethylene	4	2

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 14, 1993 Date Received: July 2, 1993 Project: W-7883-8, Why Pay Mor

Date Samples Extracted: July 2, 1993 Date Extracts Analyzed: July 2, 1993

#### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR VOLATILE HALOGENATED ORGANIC COMPOUNDS USING EPA METHODS 8010 AND 8015

per Washington DOE Guidelines

Results Reported as  $\mu$ l gas/liter volume (ppm) Quality Assurance

Sample #	Blank	Spike <u>Blank</u>	Spike <u>Level</u>
Analyte:		•	
Vinyl Chloride	<1	na	
Acetone	<1	na	
t-Dichloroethylene	<1	76%	100
cis-Dichloroethylene	<1	na	
Trichloroethylene	<0.1	71%	100
Tetrachloroethylene	<0.1	70%	100

na The analyte indicated was not added to the matrix spike sample.

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#### **ENVIRONMENTAL CHEMISTS**

Andrew John Friedman James E. Bruya, Ph.D. (206) 285-8282 3008-B 16th Avenue West Seattle, WA 98119 FAX: (206) 283-5044

July 14, 1993

Dale Kramer, Project Manager RZA - AGRA 11335 NE 122nd Way, Suite 100 Kirkland, WA 98034

Dear Mr. Kramer:

Enclosed are the results from the testing of material submitted on July 2, 1993 from Project W-7883-8, Why Pay Mor.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

Stephen D. Zappone

Chemist

SDZ/dp

**Enclosures** 

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 15, 1993 Date Received: July 7, 1993 Project: W-7883-8, Y Pay Mor?

Date Extracts Analyzed: July 7, 1993

#### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR VOLATILE ORGANIC COMPOUNDS USING EPA METHODS 8010 AND 8015

per Washington DOE Guidelines Results Reported as µl gas/liter volume (ppm)

Sample #	<u>VES-1</u>	VES-2
Analyte:		
Vinyl Chloride	<1	<1
Acetone	<1	<1
t-Dichloroethylene	<1	<1
cis-Dichloroethylene	<1	<1
Trichloroethylene	<0.1	<0.1
Tetrachloroethylene	3	3

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 15, 1993 Date Received: July 7, 1993 Project: W-7883-8, Y Pay Mor?

Date Extracts Analyzed: July 7, 1993

#### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR VOLATILE ORGANIC COMPOUNDS USING EPA METHODS 8010 AND 8015 per Washington DOE Guidelines

Results Reported as µl gas/liter volume (ppm)
Quality Assurance

Sample #	<u>Blank</u>	VES-2 ( <u>Duplicate</u> )
Analyte:		
Vinyl Chloride	<1	<1
Acetone	<1	<1
t-Dichloroethylene	<1	<1
cis-Dichloroethylene	<1	<1
Trichloroethylene	<0.1	<0.1
Tetrachloroethylene	<0.1	3

#### **ENVIRONMENTAL CHEMISTS**

Date of Report: July 15, 1993 Date Received: July 7, 1993 Project: W-7883-8, Y Pay Mor?

Date Extracts Analyzed: July 7, 1993

#### RESULTS FROM THE ANALYSIS OF AIR SAMPLES FOR VOLATILE ORGANIC COMPOUNDS USING EPA METHODS 8010 AND 8015

per Washington DOE Guidelines Results Reported as % Recovery Quality Assurance

Sample #	Spike Blank	Spike <u>Level</u>
Analyte:		
Vinyl Chloride	na	
Acetone	na	
t-Dichloroethylene	102%	10
cis-Dichloroethylene	na	
Trichloroethylene	113%	10
Tetrachloroethylene	99%	10

na The analyte indicated was not added to the matrix spike sample.

RZA-AGRA Environmental & Engineering Servi	ces		NIO	0.4	0.4	7			CI	nai	n	of	Cı	us	toc	yt	Re	ec	or	<b>/</b> t	Ar	nal	ysi	s F	Rec	ļue	est
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#### **ENVIRONMENTAL CHEMISTS**

Date of Report: August 31, 1993 Date Received: August 26, 1993 Project: 11-07883-08, Y-Pay-Mor

Date Samples Extracted: August 26, 1993 Date Extracts Analyzed: August 26, 1993

## RESULTS FROM THE ANALYSIS OF THE AIR SAMPLES FOR TETRACHLOROETHYLENE USING EPA METHOD 8010

Results Reported as  $\mu L/L$  (ppm)

<u>Analyte</u>	<u>Tetrachloroethylene</u>
Sample #:	
VES-INF	4.2
VES-EFF	<0.1
Quality Assurance	
Blank	<0.1
VES-INF (Duplicate)	4.0
VES-EFF (Duplicate)	<0.1

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