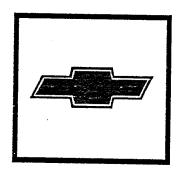
Report of . . .

TCE Emission Testing

performed for . . .







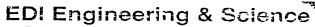
General Motors Corporation CPC Group

Grand Rapids, Michigan

on the . . .

Soil Vapor Extraction System Exhaust

September 21, 1989 21099



Environmental Engineering, Geology, Biology and Chemistry

SOURCE EMISSION TESTING

at

GENERAL MOTORS - CPC

GRAND RAPIDS, MICHIGAN

SOIL VAPOR EXTRACTION SYSTEM EXHAUST

DATE: 9/21/89

EDI Engineering & Science

5555 Glenwood Hills Pkwy, S.E.; GRAND RAPIDS, MI 49508; (616) 942-9600

INTRODUCTION

EDI Engineering & Science was retained by the General Motors Corporation to conduct trichloroethylene (TCE) emission testing on the soil vapor vacuum extraction system located at their CPC facility in Grand Rapids, Michigan. The purpose of the testing was to determine compliance with the special conditions of the MDNR permit to install No. 92-88.

The testing was performed by R. Scott Cargill and Dan J. Madden of EDI on September 21, 1989. Assisting in the test was Mr. Don Veltman of CPC.

TABLE 1

TCE EMISSION RESULTS SOIL VAPOR EXTRACTION SYSTEM EXHAUST GENERAL MOTORS - CPC GRAND RAPIDS, MI SEPTEMBER 21, 1989

Sample 1	<u>Time</u> 14:40- 15:40	Air Flow Rate ⁽¹⁾ <u>DSCFM</u> 109	Temp. o <u>F</u> 91	% <u>Moisture</u> 2.92	TCE Concentrations Mg/M ³ N.D. ⁽²⁾
2	15:44- 16:44				N.D.
3	16:45- 17:45				N.D.

- \cdot (1) Standard temperature and pressure = 70° F and 29.92 in. Hg.
- (2) Non detected at a detection limit of 0.0017 mg/m^3 .

SUMMARY OF EXHAUST GAS PARAMETERS

COMPANY NAME: GENERAL MOTORS - CPC	TEST DATE: 9/21/89
COMPANY LOCATION: GRAND RAPIDS, MICHIGAN	
SOURCE NAME: SOIL VAPOR EXTRACTION SYSTEM EXHAUST	
SAMPLING STAFF: CARGILL / MADDEN	
SAMPLE NUMBER	1
G1. STACK RADIUS, inches	2.0
G2. AREA OF STACK, sq. ft.	0.09
G3. BAROMETRIC PRESSURE, in. HG.	29.34
G4. STATIC PRESSURE IN STACK, in. H2O	0.04
G5. STACK GAS TEMPERATURE, deg. F	91
G6. AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED	0.387
G7. PERCENT MOISTURE AT TEST LOCATION	2.92
G8. PERCENT MOISTURE BEFORE COLLECTOR	2.92
G9. DRY GAS COMPOSITION: % OXYGEN	20.90
% CARBON DIOXIDE	0.00
% CARBON MONOXIDE	0.00
% NITROGEN	79.10
G10. PERCENT EXCESS AIR AT TEST LOCATION	
DENSITY AND MOLECULAR WEIGHT OF STACK GAS:	·
Gll. DRY, @ STP, lbs./cu.ft.	0.0746
G12. WET, @ STP, lbs./cu.ft.	0.0737
G13. WET, @ STACK CONDITIONS, lbs./cu.ft.	0.0696
G14. MOLECULAR WEIGHT, DRY, @ STP, lbs./mole	28.84
G15. AVERAGE GAS VELOCITY, feet/min.	1368
STACK GAS FLOW RATE:	
G16. STACK CONDITIONS, ACFM	119
G17. STANDARD CONDITIONS, SCFM	113
G18. STANDARD CONDITIONS, DRY SCFM	109
·	

STANDARD TEMPERATURE AND PRESSURE (STP) = 29.92 inches HG, 70 deg. F

DISCUSSION OF RESULTS

The results for the TCE emission sampling are found in Table 1. TCE was non detected at a detection limit of 0.0017 mg/m^3 for all three samples. The detection limit is well below the established emission limit of 16.0 mg/m^3 .

SOURCE DESCRIPTION

The source tested was the exhaust of the soil vapor vacuum extraction system. Soil vapor is taken from a 20 foot deep well and passed through a knock out drum then a carbon absorption unit before being emitted to the atmosphere through a four inch I.D. exhaust duct.

SAMPLING PROTOCOL

Sampling was conducted on the four inch I.D. exhaust duct at a distance well beyond the optimum location of eight stack diameters downstream and two stack diameters upstream as stated in U.S. EPA Method 1. The sampling and analysis were performed in accordance with U.S. EPA Reference Method 18. Three one hour samples were collected on the exhaust using carbo-trap sorbent tubes. The TCE was recovered in the laboratory by thermal desorption and analyzed using gas chromatography. Exhaust gas parameters were determined by U.S. EPA Reference Methods 1-4. All quality control and quality assurance requirements prescribed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

David D. Engelhast

David D. Engelhardt

Senior Specialist

Air Quality Services

APPENDIX A

FIELD DATA

PITOT TRAVERSE DATA

COMPANY NAME: GENERAL MOTORS - CPC

TEST DATE: 9/21/89

COMPANY LOCATION: GRAND RAPIDS, MICHIGAN

SOURCE NAME: SOIL VAPOR EXTRACTION SYSTEM EXHAUST

SAMPLING STAFF: CARGILL / MADDEN

RUN NUMBER:

% CARBON DIOXIDE: 0

STACK RADIUS, in.: 2

% OXYGEN:

20.9

GAS TEMPERATURE, Deg F: 91

% CARBON MONOXIDE: 0

STATIC PRESSURE, in. H2O: .04

PITOT FACTOR: .85

BAROMETRIC PRESSURE: 29.34

PT.	POINT LOCATION,_ INCHES	1	VELOCITY PRESSURE, INCHES OF WATER PORT
1	1.00	0.15	
2	3 00	0 15	



Field Data Sheet

Date: 9/21/89	
Client: CPC Grand Rapids	Project#:
Barometric Pressure: 29.34	Ambient Temperature: 87°F
	91°F Stack 79°F WB

Sample Number	Location	Pump Number	Start Time	Elapse Time	Pump Flow Rate
#1 # 2 # 3	TCE Exhaust	SKC#4	2:40m	Gomin	= 100cc/min
# 2	rţ	11	3:41 pm	11	= 100cc/min
# 3	. (Н	4:45pm	11	1(.
	-			-	
				·	

OVA	Begin Oppm End Oppm				
	End Oppm				
		İ			



Date:	9/211	189		
Date:			// -	,
Client:	CPC	612	A Ken	ds
Project N	o:			
•				

Programable Pump Calibration Record

Barometric Pressure 2934

Temperature °F 76.

Desired Flow Rate cc/min_100(50)

Pump Number	Flow Rate cc/min	Average Flow Rate cc/min
SKC #1	1. 110.32	
	2. 103.45	
	3. 98,68	
	4. 49.50	
	5. 101,2	
* , ,	1. 108,2	
* SKC #4.	2: 105.34	
	3. 102.61	103.51 Actual
	4. 99,28	103.51 Actual 100.37 STP
	5. 102 i	6.
	1. 60.3	
5KC#3	2. 52.25	
3867	3. 48,61	
J	4. 52.68	
	5. 51.72	
	1. 4<.94	
CUT HIS	2. 50.50	
	3: 45,35	
	4. 49.86	
	5. 50,21	
	1.	
	2.	
	3.	
	4.	
	1 7	ı

APPENDIX B

CALCULATIONS

TCE CALCULATION

 $ug/l = mg/m^3$

Detection Limit: $.01 \text{ ug/}6.02 \text{ 1} = 0.0017 \text{ mg/m}^3$

CALCULATION FORMULAS

MOISTURE TRAIN CALCULATIONS:

- M1. BAROMETRIC PRESSURE, inches of Mercury
- M2. DURATION OF SAMPLE, minutes
- M3. METER CALIBRATION FACTOR
- M4. AVERAGE METER TEMPERATURE, degrees F
- M5. AVERAGE METER PRESSURE, inches of water
- M6. METER VOLUME, ACTUAL, cubic feet
- M7. METER VOLUME, STP, cubic feet

- M8. LIQUID VOLUME OF WATER CONDENSED, milliliters
- M9. VAPOR VOLUME OF WATER CONDENSED, @ STP, cubic feet

$$M9 = M8 * 0.0474$$

M10. TOTAL GAS SAMPLED, @ STP, cubic feet

$$M10 = M7 + M9$$

M11. PERCENT MOISTURE

$$M11 = \frac{M9}{----} * 100$$

EXHAUST GAS CALCULATIONS:

- G1. STACK DIMENSIONS, inches
- G2. AREA OF STACK, square feet

G2 (ROUND) =
$$\frac{3.14159 * (DIA/2)^2}{144}$$

- G3. BAROMETRIC PRESSURE, inches of Mercury
- G4. STATIC PRESSURE IN STACK, inches of water
- G5. STACK GAS TEMPERATURE, degrees F
- G6. AVG. SQRT VELOCITY PRESSURE OF POINTS SAMPLED
- G7. PERCENT MOISTURE AT TEST LOCATION

$$G7 = \frac{P13}{----} * 100$$

CALCULATION FORMULAS CONTINUED

- G8. PERCENT MOISTURE BEFORE COLLECTOR
- G9. DRY GAS COMPOSITION, %02, %CO2, %CO, %N2
- G10. PERCENT EXCESS AIR AT TEST LOCATION

G11. DENSITY, DRY, @STP, lbs./cu. ft.

G12. DENSITY, WET, @STP, lbs./cu. ft.

G13. DENSITY, WET, @ STACK CONDITIONS, lbs./cu. ft.

G14. MOLECULAR WEIGHT, DRY, 1bs./mole

$$G14 = G11 * 386.9$$

G15. AVERAGE GAS VELOCITY, feet/minute

G16. STACK GAS FLOW RATE, ACFM

$$G16 = G2 * G15$$

G17. STACK GAS FLOW RATE, SCFM

G18. STACK GAS FLOW RATE, DRY, DSCFM

CALCULATION FORMULAS CONTINUED

PARTICULATE TRAIN CALCULATIONS:

- P1. NUMBER OF POINTS SAMPLED
- P2. DURATION OF SAMPLE, minutes
- P3. NOZZLE DIAMETER, inches
- P4. NOZZLE AREA, square feet

$$P4 = \frac{3.14159 * (P3/2)^2}{144}$$

- P5. PITOT CALIBRATION FACTOR
- P6. METER CALIBRATION FACTOR
- P7. AVERAGE FILTER TEMPERATURE, degrees F
- P8. AVERAGE METER TEMPERATURE, degrees F
- P9. AVERAGE METER PRESSURE, inches of water
- P10. METER VOLUME, ACTUAL, cubic feet
- P11. METER VOLUME, @ STP, cubic feet

- P12. LIQUID VOLUME OF WATER CONDENSED, milliliters
- P13. VAPOR VOLUME OF WATER CONDENSED, @ STP, cubic feet

$$P13 = P12 * 0.0474$$

. P14. TOTAL GAS SAMPLED, @ STP, cubic feet

$$P14 = P11 + P13$$

P15. WEIGHT OF GAS SAMPLED, DRY, pounds

$$P15 = P11 * G11$$

P16. WEIGHT OF GAS SAMPLED, WET, pounds

P17. PERCENT ISOKINETICS

CALCULATION FORMULAS CONTINUED

CONCENTRATION CONVERSION FACTORS:

P18. 50 % EXCESS AIR, AFER COLLECTOR

P19. 50 % EXCESS AIR, BEFORE COLLECTOR

P20. MOISTURE BEFORE COLLECTOR

$$P20 = \frac{G14 + 18 * G7/(100 - G7)}{G14 + 18 * G8/(100 - G8)}$$

PARTICULATE EMISSION CALCULATIONS:

- E1. TOTAL WEIGHT PARTICULATE COLLECTED, grams
- E2. LBS. PARTICULATE/1000 LBS. GAS, ACTUAL

E3. LBS. PARTICULATE/1000 LBS. GAS, DRY

$$E3 = E2 * P20$$

E4. LBS. PARTICULATE/1000 LBS. GAS, WET, 50% EA

$$E4 = E2 * P18$$

E5. LBS. PARTICULATE/1000 LBS. GAS, DRY, 50% EA

$$E5 = E2 * P19$$

E6. GRAINS/DRY STANDARD CUBIC FOOT

E7. POUNDS/HOUR

E8. POUNDS/MILLION BTU