TRIAD
ENGINEERING
INCORPORATED

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October 16, 1995

Mr. Ron Dilahunt
Wisconsin Department of Natural Resources
Southeast District Office
2300 North Dr. Martin Luther King, Jr. Drive
P.O. Box 12436
Milwaukee, WI 53212

Dear Mr. Dilahunt:

RE: Air Emissions Calculations for Soil and Groundwater Remediation Systems and additional Treatment Application Forms for two Soil Remediation Systems Chrysler Corporation, Kenosha Main Plant Triad Engineering Project No. W943324.16

This letter was prepared to summarize air emissions from existing soil and groundwater treatment systems and to present application forms to operate two additional soil vapor extraction (SVE) systems at the Chrysler Corporation (Chrysler) Main Plant property located in Kenosha, Wisconsin. Based on the calculated emissions rates, the five active remediation systems are within WDNR air emissions requirements for the site. The following table summarizes air emission sources, groundwater or SVE system locations, general site locations and areas, and the approximate starting date of each treatment system.

Kenosha Main Plant Soil and Groundwater Remediation Systems

Air Emission Source	Recovery Location(s)	General Site Location and Area	Starting Date
Air Stripper	Sump 4 & 5	North Area	4/94
Air Stripper	Sumps 6	North Area	4/94
Air Stripper and SVE System	Sump 9	North Area	3/95
Air Stripper	Sumps 7, 8, 14, & 15	Area 2 (South Area)	3/95
Air Stripper	Sumps 10, 11, 12, & 13	Area 3 (South Area)	3/95
SVE System	Sumps 11 & 12 SVE wells 1 through 6, 10, 11, & 13	Area 3 Remediation Building (South Area)	9/95 (anticipated)
SVE System (Trailer)	Sump 10, SVE wells 7, 8, 9, & 12	Area 3 Remediation Trailer (South Area)	9/95 (anticipated)

The locations listed above are presented on Figure 1. Calculations are enclosed for estimated air emissions from the four operating groundwater treatment systems and one soil/groundwater treatment system (Sump 9, North Area). A Wisconsin Department of

Natural Resources (WDNR) application (Form 4400-120) to operate two additional soil treatment systems (anticipated start date: September 1995) is also enclosed.

This letter is organized in the following manor. A summary of total estimated hourly volatile organic compound (VOC) and yearly benzene emission rates from the five operating treatment systems is provided in Attachment 1. Attachment 2 presents the data used to estimate the emissions for the five groundwater treatment systems. Attachment 3 summarizes the analytical data for air samples collected from March through August 1995 from the Sump 9 soil vapor extraction (SVE) system exhaust. Attachment 4 includes air emissions calculations for the Sump 9 SVE system. Attachment 5 includes the WDNR Form 4400-120 application for the proposed Area 3 Soil Treatment System (two additional SVE systems). Soil data summaries, pilot test results, and system design information for the new Area 3 SVE systems are also included in Attachment 5. Additional detail is provided below.

I. EXISTING TREATMENT SYSTEMS

A. North Area.

Two groundwater treatment systems (two air strippers; one connected to Sumps 4 and 5 and one connected to Sump 6) are located in the North Area of the Chrysler Kenosha Main Plant site (Figure 1). Triad Engineering Inc. (Triad) submitted a performance monitoring letter report (December 20, 1994) to you for these systems. Updated tables (Tables 1 and 2) showing emission calculations for the latest groundwater sampling events (March and June) at these two systems are included in Attachment 2.

One additional North Area groundwater and soil treatment system consists of an air stripper and SVE unit connected to Sump 9. Air emissions from the Sump 9 air stripper and SVE unit were calculated using groundwater influent and effluent monitoring data and air sample analytical data. Table 3 (Attachment 2) shows the emission calculations for the air stripper. Attachments 3 and 4 show the analytical results for the air samples collected at the SVE exhaust and the corresponding calculations.

B. South Area.

Two treatment systems are located in the South Area of the Kenosha Main Plant site. These include the Area 3 air stripper connected to Sumps 10, 11, 12, and 13; and the Area 2 air stripper connected to Sumps 7, 8, 14, and 15. Air emissions for the Area 2 air stripper were calculated using groundwater influent and effluent monitoring data. Table 4 (Attachment 2) presents the emissions calculations for this air stripper. Air emissions for the Area 3 air stripper were calculated using groundwater influent and effluent monitoring data. Table 5 (Attachment 2) presents the emission calculations results for this system's air stripper.

II. NEW TREATMENT SYSTEMS

An SVE system consisting of 16 extraction points, one skid-mounted SVE system, and one trailer-mounted SVE system was installed in Area 3 (Figure 1). The Area 3 SVE Form 4400-120 application, along with pertinent soil, pilot test, and design information, is included as Attachment 5. The new SVE system is anticipated to start operation in September 1995. Air samples will be collected during start-up at the following frequency: one sample per day for the first three days, one sample per week for the next 3 weeks, and one sample per month for three additional months. Air samples will be collected on a quarterly basis thereafter. Extraction rates will be monitored and adjusted so total site emissions do not exceed WDNR discharge limits for total VOCs and benzene.

III. SCHEDULE, OPERATION AND MONITORING

Based on the calculated emission rates, the five active treatment systems are within WDNR air emissions requirements for the site. Air emissions are also anticipated to stay within WDNR limits after the Area 3 SVE system begins operation. Remedial system sampling will continue and include collecting one monthly air sample from the SVE system discharge. The air samples will be analyzed for VOCs (601/602 compounds) using analytical method AM4.02. In addition, one influent water sample from each sump and one effluent water sample from each of the air stripper systems will be collected on a quarterly schedule. The water samples will by analyzed for VOCs (EPA Method 8021), gasoline range organics (GRO; WDNR Modified GRO Method), and diesel range organics (DRO; WDNR Modified DRO Method).

Any required system modifications or additional sampling will be completed, if necessary, based on future calculated emission rates. Air emission reports for the treatment systems will be submitted to the WDNR.

If you have any questions or need additional information, please do not hesitate to contact either of the undersigned at (414) 291-8840.

Sincerely,

TRIAD ENGINEERING INC.

Jeanne M. Ramponi
Hydrogeologist

TRIAD ENGINEERING INC.

Ross M. Creighton
Hydrogeologist

jmr/mao:W943324\943324.16\943324-B
attachments
c: Mr. Curtis Chapman/Chrysler Environmental and Energy Affairs
Mr. John Bugno/Chrysler Kenosha Main Plant
Ms. Pam Mylotta/WDNR
Mr. Richard Binder/Triad

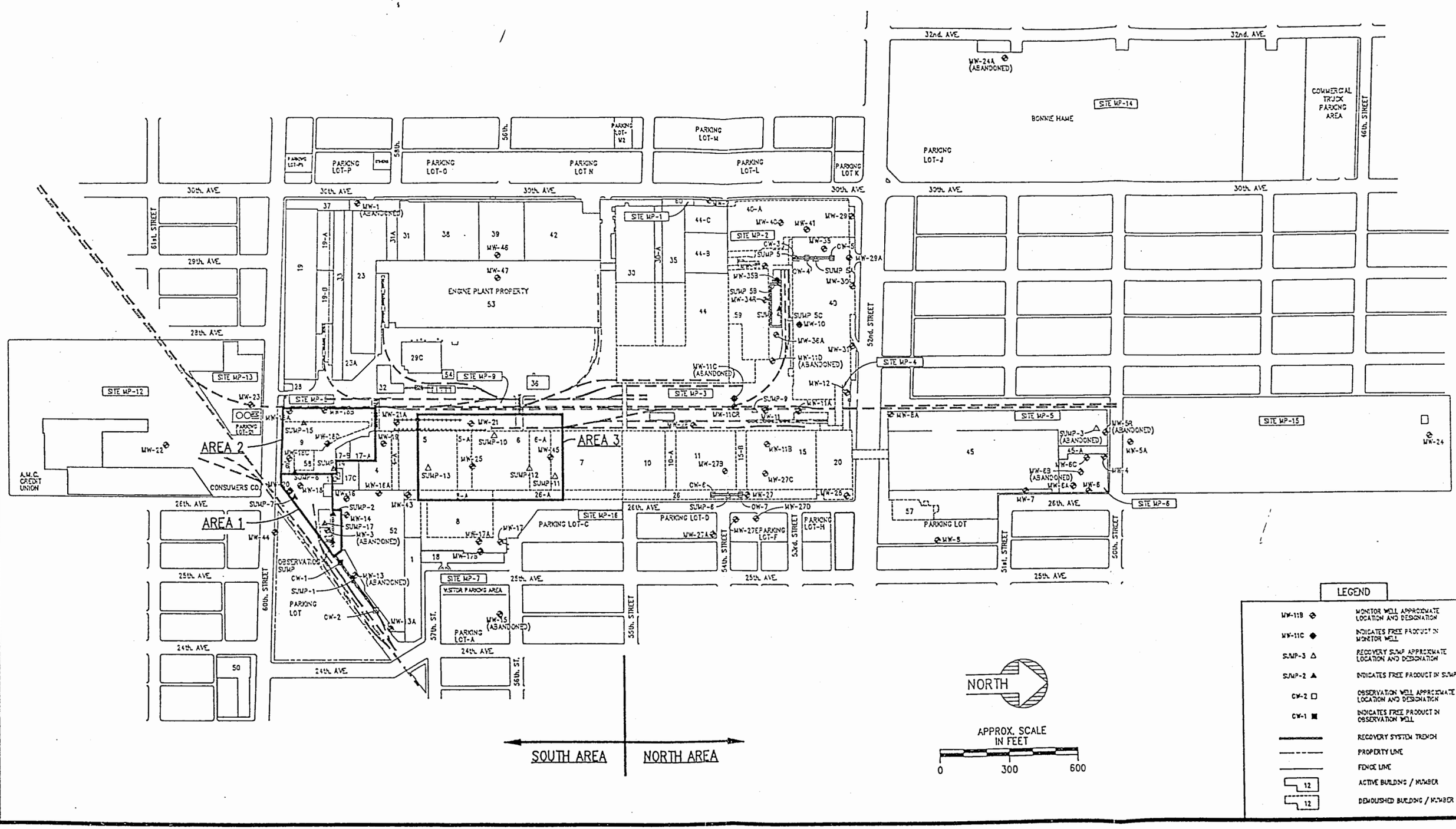

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FIGURE 1
CHRYSLER KENOSHA MAIN PLANT
FACILITY LAYOUT

ATTACHMENT 1

ATTACHMENT 1
SUMMARY OF ESTIMATED AIR EMISSIONS
FOR CHRYSLER CORPORATION
KENOSHA MAIN PLANT

	VOC EMISSIONS lbs/hr		BENZENE EMISSIONS lbs/yr	
	March 1995 Data	June 1995 Data	March 1995 Data	June 1995 Data
Sumps 4 & 5 Air Stripper	0.026	0.026	27.0	23.8
Sump 6 Air Stripper	0.0068	0.0062	0.20	0.24
Sump 9 SVE/Air Stripper	0.014	0.012	46.8	35.5
Sumps 7, 8, 14, 15 Area 2 - Air Stripper	0.004	0.004	0.14	0.16
Sumps 10, 11, 12, 13 Area 3 - Air Stripper	0.020	0.024	61.6	86.0
TOTAL (for 5 Treatment Systems)	**0.071**	**0.072**	**135.8**	**145.7**
WDNR Discharge Limit	**5.7**		**300**	

NOTE:

Sumps 4 & 5 and Sump 6: The air emissions are average values from the system groundwater influent and effluent monitoring data collected since system start-up.

Sump 9, Area 2 (Sumps 7, 8, 14, 15) and Area 3, (Sumps 10, 11, 12, 13): The air emissions are average values from monitoring data collected from the air strippers since system start-up (March 6, 1995).

ATTACHMENT 2

ATTACHMENT 2

Table 1
Chrysler Corporation
Kenosha Main Plant
Sumps 4 and 5 Groundwater Remediation System

Date	Sump 4					Sump 5				
	Influent		Flow			Influent		Flow		
	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)
04/21/94	Started the System									
04/22/94	7.300	16.650	9,081	6.31	9,081	0.006	1.600	34,973	24.29	34,973
06/07/94	5.700	15.860	82,656	1.25	91,737	5.400	14.920	78,799	1.19	113,772
08/24/94	3.940	11.230	166,298	1.48	258,035	0.035	17.360	154,158	1.37	267,930
12/08/94	3.180	7.455	228,826	1.50	486,861	2.550	7.326	171,096	1.12	439,026
03/15/95	2.657	5.946	125,374	0.90	612,235	0.044	36.633	141,180	1.01	580,206
06/23/95	2.657	5.946	134,016	0.93	746,251	0.044	36.633	202,862	1.41	783,068

Notes: The system was down from 4/22/94 to 5/5/94, until the initial sampling results were received.
VOC = Volatile Organic Compounds
No influent samples were collected on 6/23/95. Influent concentrations are assumed to be the same as detected during previous sampling event.

ATTACHMENT 2

Table 1
Chrysler Corporation
Kenosha Main Plant
Sumps 4 and 5 Groundwater Remediation System

Sumps 4 and 5 Composite											
Sump 4&5 Weighted Average		Flow			Effluent		Percent Removal		Benzene Emissions (lbs)		VOC Emiss
Benzene mg/L	Total VOCs mg/L	Flow for the Period (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Benzene	Total VOCs	For Reporting Period	Cumulative	For Reporting Period (lbs/hr)
1.5095	4.7023	44,054	30.59	44,054	0.150	0.460	90.06%	90.22%	0.499	0.499	0.065
5.5536	15.4012	161,455	2.44	205,509	0.017	0.087	99.69%	99.44%	7.455	7.955	0.019
2.0613	14.1789	320,456	2.85	525,965	0.069	0.403	96.65%	97.16%	5.325	13.279	0.020
2.9105	7.3998	399,922	2.62	925,887	0.159	0.528	94.54%	92.86%	9.177	22.456	0.009
1.2730	22.1993	266,554	1.91	1,192,441	0.436	4.372	65.75%	80.31%	1.861	24.317	0.017
1.2730	22.1993	336,878	2.34	1,529,319	0.002	0.011	99.84%	99.95%	3.571	27.888	0.026

ATTACHMENT 2

Table 2
Chrysler Corporation
Kenosha Main Plant
Sump 6 Groundwater Remediation and Treatment System

Date	Influent		Flow			Effluent		Percent Removal		Benzene Emissions (lbs)		VOC Emiss
	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Benzene	Total VOCs	For Reporting Period	Cumulative	For Reporting Period (lbs/hr)
04/21/94	Started the System											
04/22/94	0.0005	2.28	21,213	14.73	21,213	0.0005	0.0952	0.00%	95.82%	0.000	0.000	0.016
06/07/94	0.0005	4.48	211,108	3.19	232,321	0.0015	0.1249	ERR	97.21%	ERR	0.000	0.007
08/24/94	0.0012	2.44	365,734	3.26	598,055	0.0006	0.0047	50.00%	99.81%	0.002	0.002	0.004
12/06/94	0.0005	1.25	672,113	4.49	1,270,168	0.0005	0.0127	0.00%	98.98%	0.000	0.002	0.003
03/15/95	0.025	1.35	886,333	6.22	2,156,501	0.0005	0.0293	98.00%	97.83%	0.181	0.183	0.004
06/21/95	0.019	1.449	647,414	4.59	2,803,915	0.000375	0.002275	98.03%	99.84%	0.101	0.283	0.003

Note: The system was down from 4/22/94 to 5/5/94, until the initial sampling results were received.
The percent removal of benzene for the sample collected 6/7/94 is shown as an error because the detected effluent concentration was higher than the detected influent concentration.
Benzene was not detected during the 6/21/95 event; the reported influent and effluent concentrations are one-half the reported detection limits.
VOC = Volatile Organic Compounds

ATTACHMENT 2

Table 3
Chrysler Corporation
Kenosha Main Plant
Sump 9 Groundwater
Treatment System

Date	Influent		Flow			Effluent		Percent Removal		Benzene Emissions (lbs)		VOC Emiss
	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Benzene	Total VOCs	For Reporting Period	Cumulative	For Reporting Period (lbs/hr)
03/06/95	Started the System											
03/16/95	2.31	7.67	6,810	0.47	6,810	0.744	2.281	67.79%	70.26%	0.089	0.089	0.001
06/23/95	2.31	7.67	36,789	0.26	43,599	0.27	0.649	88.31%	91.54%	0.626	0.715	0.001

Note: No influent samples were collected on 6/23/95. The influent concentrations are assumed to be the same as detected in the 3/16/95 samples.
VOC = Volatile Organic compound.

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ATTACHMENT 2

Table 4
Chrysler Corporation
Kenosha Main Plant
Sumps 7, 8, 14, 15 Groundwater Remediation System

Date	Sump 7					Sump 8					Sump 14				
	Influent		Flow			Influent		Flow			Influent		Flow		
	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)
03/06/95	Started the System														
03/14/95	0.005	0.267	6,480	0.56	6,480	0.050	4.315	6,154	0.53	6,154	0.003	3.417	18,046	1.57	18,046
06/23/95	0.005	0.267	160,017	1.10	166,497	0.050	4.315	90,012	0.62	96,166	0.003	3.417	122,360	0.84	140,406

Note: The system was down from 4/22/94 to 5/5/94, until the initial sampling results were received.
VOC = Volatile Organic Compounds
No influent samples collected on 6/23/95. Influent concentrations are assumed to be the same as detected on 3/14/95.

ATTACHMENT 2

Table 4
Chrysler Corporation
Kenosha Main Plant
Sumps 7, 8, 14, 15 Groundwater Remediation System

Sump 15					Sumps 7, 8, 14, 15 Composite											
Influent		Flow			Sumps 7,8,14,15 Wgt. Ave.		Flow			Effluent		Percent Removal		Benzene Emissions (lbs)		VOC Emiss
Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow for the Period (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Benzene	Total VOCs	For Reporting Period	Cumulative	For Reporting Period (lbs/hr)
0.0005	0.423	1,250	0.11	1,250	0.0121	2.8336	31,930	2.77	31,930	0.0005	0.0058	95.86%	99.80%	0.003	0.003	0.004
0.0005	0.423	30,315	0.21	31,565	0.0140	2.1407	402,704	2.77	434,634	0.0004	0.0107	97.13%	99.50%	0.046	0.049	0.003

Note: The system was down from 4/22/94 to 5/5/94, until the initial sampling results were received.
VOC = Volatile Organic Compounds
No influent samples collected on 6/23/95. Influent concentrations are assumed to be the same as detected on 3/14/95.

ATTACHMENT 2

Table 5
Chrysler Corporation
Kenosha Main Plant
Sumps 10, 11, 12, 13 Groundwater Remediation System

Date	Sump 10					Sump 11					Sump 12				
	Influent		Flow			Influent		Flow			Influent		Flow		
	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)
03/06/95	Started the System														
03/16/95	0.416	4.094	51,840	3.60	51,840	1.790	3.483	52,724	3.66	52,724	1.670	3.850	29,184	2.03	29,184
06/23/95	0.416	4.094	646,958	4.54	698,798	1.790	3.483	869,353	6.10	922,077	1.670	3.850	364,583	2.56	393,767

Note: VOC = Volatile Organic Compounds
No influent samples collected 6/23/95. Influent concentrations assumed to be the same as on 3/16/95.

ATTACHMENT 2

Table 5
Chrysler Corporation
Kenosha Main Plant
Sumps 10, 11, 12, 13 Groundwater Remediation System

Sump 13					Sumps 10, 11, 12, 13 Composite											
Influent		Flow			Sumps 10, 11, 12, 13 Wgt. Ave.		Flow			Effluent		Percent Removal		Benzene Emissions (lbs)		VOC Emiss
Benzene mg/L	Total VOCs mg/L	Flow (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Flow for the Period (Gallons)	Average Flow Rate (GPM)	Cumulative Flow (Gallons)	Benzene mg/L	Total VOCs mg/L	Benzene	Total VOCs	For Reporting Period	Cumulative	For Reporting Period (lbs/hr)
0.9890	2.093	38,089	2.65	38,089	1.1776	3.4216	171,837	11.93	171,837	0.0005	0.00801	99.96%	99.77%	1.687	1.687	0.020
0.9890	2.093	549,363	3.85	587,452	1.2252	3.3865	2,430,257	17.05	2,602,094	0.003	0.006	99.76%	99.82%	24.771	26.458	0.029

Note: VOC = Volatile Organic Compounds
No influent samples collected 6/23/95. Influent concentrations assumed to be the same as on 3/16/95.

ATTACHMENT 3

ATTACHMENT 3

Chrysler Corporation
Kenosha Main Plant
Sump 9, SVE Air Effluent Sample Results

DATE	3/14/95	3/15/95	3/16/95	3/23/95	3/30/95	4/6/95	5/8/95	6/7/95	7/17/95
SAMPLE NO.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Trans-1,2 DCE (ppmv)	0.37	0.25	0.31	0.37	0.67	0.21	0.42	NA	NA
(mg/l)	0.00147	0.00099	0.00123	0.00147	0.00266	0.00083433	0.001669	0.0013	0.0007
1,1 DCA (ppmv)	0.41	0.38	0.41	0.31	0.42	0.36	0.23	NA	NA
(mg/l)	0.00166	0.00154	0.00166	0.00125	0.0017	0.00146	0.000933	0.00073	0.00124
1,1,1 TCA (ppmv)	0.005	—	—	0.010	0.010	0.010	0.029	NA	NA
(mg/l)	0.00003	—	—	0.00005	0.0005	0.0005	0.000159	0.00016	0.00038
Benzene (ppmv)	0.97	0.80	1.70	1.28	1.01	1.17	0.067	NA	NA
(mg/l)	0.0031	0.0026	0.0054	0.0041	0.0032	0.0037	0.000215	0.0017	0.003
Toluene (ppmv)	1.05	0.44	0.67	0.71	0.62	0.7	0.69	NA	NA
(mg/l)	0.00396	0.00166	0.0025	0.0027	0.0023	0.0026	0.002605	0.0026	0.0032
Ethylbenzene (ppmv)	0.2	—	0.16	0.16	0.15	0.18	0.09	—	—
(mg/l)	0.00087	—	0.0007	0.0007	0.00065	0.00078	0.000392	NA	0.0003
1,2-Dichloroethane	—	—	—	—	—	—	0.03	—	—
(mg/l)	—	—	—	—	—	—	0.000122	NA	NA
Total VOCs (mg/l)	0.01109	0.00679	0.01149	0.01027	0.01101	0.00987433	0.006093	0.00649	0.00882

Vacuum = 1.6 inches.
Flow Rate = 360 cfm

ATTACHMENT 4

ATTACHMENT 4

Chrysler Corporation
Kenosha Main Plant
Sump 9 SVE Emission Calculations

Benzene Emission Rates (lbs/hr)

Sample No. 1,[3.747 x 10^{-3}(min xlbsx L)/(hr x ft^3 x mg)] (360 cfm)(0.0031 mg/l)

	=	0.00420 lbs/hr
No. 2	=	0.00350 lbs/hr
No. 3	=	0.0073 lbs/hr
No. 4	=	0.0055 lbs/hr
No. 5	=	0.0943 lbs/hr
No. 6	=	0.0050 lbs/hr
No. 7	=	0.0003 lbs/hr
No. 8	=	0.00229 lbs/hr
No. 9	=	0.0041 lbs/hr
Average	=	0.0140 lbs/hr

Benzene Emission Rates (lbs/yr)

Sample No. 1, [32.82(min x lbs x L)/(year x ft^3 x mg)] (360 cfm)(0.0031 mg/l)

	=	36.63 lbs/yr
No. 2	=	30.72 lbs/yr
No. 3	=	63.80 lbs/yr
No. 4	=	48.44 lbs/yr
No. 5	=	37.81 lbs/yr
No. 6	=	43.72 lbs/yr
No. 7	=	2.54 lbs/yr
No. 8	=	20.08 lbs/yr
No. 9	=	35.44 lbs/yr
Average	=	35.46 lbs/yr

Total VOCs Emission Rate (lbs/hour)

Sample No. 1, [3.747 x 10^{-3}(min xlbsx L)/ (hr x ft^3 x mg)] (360 cfm)(0.0111 mg/l)

	=	0.01497 lbs/hr
No. 2	=	0.00916 lbs/hr
No. 3	=	0.0155 lbs/hr
No. 4	=	0.0139 lbs/hr
No. 5	=	0.0143 lbs/hr
No. 6	=	0.0127 lbs/hr
No. 7	=	0.0051 lbs/hr
No. 8	=	0.00875 lbs/hr
No. 9	=	0.0120 lbs/hr
Average	=	0.0118 lbs/hr

NOTE: Calculations are based on concentrations presented in Attachment 3.

ATTACHMENT 5

APPLICATION TO TREAT OR DISPOSE OF PETROLEUM CONTAMINATED SOIL

Form 4400-120

...s form is required by the Department of Natural Resources for leaking underground storage tank sites to ensure that petroleum ...taminated soil is treated or disposed of in compliance with NR 500-540, NR 158 and NR 419, Wis. Adm. Code. Failure to comply ...h applicable statutes and administrative rules may lead to violations of subchapters III and IV of ch. 144, Wis. Stats. and may result in forfeitures of not less than $10 or more than $25,000 for each violation, pursuant to ss. 144.426(1), 144.74 (1), and 144.99, Wis. Stats., fines of not less than $100 or more than $150,000 or imprisonment for not more than 10 years, or both, pursuant to s. 144.74 (2), ...s. Stats. Each day of a continuing violation constitutes a separate violation. Department approval of this form is required prior to site remediation, except for soils to be buried in landfills.

...RECTIONS: 1) Complete part I. 2) Select the treatment option in part II. Pretreatment approval is required for ...y treatment other than landfill burial. Submit this form to the DNR project manager for approval. 3) If your treatment option is landfill burial, complete part III before submitting the ORIGINAL form to the project manager. 4) ...soil will be used as cover at a landfill, first submit this form for approval and then, after part III has been completed, ...submit the ORIGINAL to the project manager.

4/91:2.29

ALL SITES MUST COMPLETE PART I.

Part I. Source of Soil

Site/Facility Name: Chrysler Corporation-Kenosha Main Plant (Area 3)

Site I.D. # (for DNR use only):

Site Address: 5555 30th Avenue

Contact Name: Jack Bugno

City, State, Zip Code: Kenosha, WI 53144

1/4, 1/4, Section, Township, and Range: SW, SE, 36, 2, 22E

...e information on this form is accurate to the best of my knowledge.
NOTE: Soil generators responsible for waste disposed of in landfills may incur future liability.

Signature of Soil Generator

Telephone Number (include area code): (414)658-6000

Consulting Firm: Triad Engineering, Inc

Contact: Richard J. Binder

Telephone Number: (414)291-8840

Estimated Volume Contaminated Soil: 13,400 Tons/(cubic yards) (circle one)

Soil Type (USCS)
- X sand (SP, SW)
- X silty/clayey sands (SM, SC)
- ___ silt (ML, MH, OL)
- X clay (CL, CH, OH)
- ___ gravel (GC, GM, GP, GW)
- ___ peat (PT)

Type of Petroleum Contamination (Circle):

(Gasoline) Diesel Fuel/#2 Fuel Oil

Other Chlorinated Solvents

Distance to Nearest Residence/Business 500 ft

Contaminant concentration:

One screened sample for each 15 yds³ and one laboratory analysis for each 300 yds³ of contaminated soil when the field instrument *registers contamination* OR one laboratory analysis for each 100 yds³ when the field instrument *does not register contamination* on soil shown to be contaminated during the site investigation/excavation or stockpiling. PLEASE ATTACH A TABLE LISTING RESULTS OF BOTH FIELD SCREENING AND LAB ANALYSES, AND INCLUDE SUPPORTING LAB REPORTS, IN ADDITION TO THE TPH AND BENZENE INFORMATION REQUESTED BELOW. NOTE: DILHR requires a minimum of 3 laboratory samples on excavated soil for PECFA claims.

Total Benzene in soil to be remediated (attach calculations) 6.8 lbs

Total Petroleum Hydrocarbons(TPH) in soil to be remediated (attach calculations) 19,400 lbs

Total TPH as GRO+DRO

ATTACH EMISSIONS CALCULATIONS

(a/1,000,000) x (2,800 lbs/yd³) x b = benzene emission in lbs., where a = benzene concentration of soil sample in ppm or mg/kg dry weight basis, and b = amount of contaminated soil in yds³. NOTE: This calculation can also be used to estimate TPH emissions by substituting TPH concentration (ppm or mg/kg) for "a". It may also be used to calculate VOCs.

COMPLETE ONLY THOSE SECTIONS OF PART II THAT PERTAIN TO YOUR SITE

Part II: Proposed method of treatment

1. SOIL VENTING/VACUUM EXTRACTION

Note: This option may require an air pollution control permit. An activated carbon unit or similar treatment system to strip VOCs from the blower discharge will be required if emissions exceed limits established by Air Management. System design and monitoring information must be included.

Contact responsible for system maintenance Jack Bugno

Telephone Number (include area code) (414)658-6000 Anticipated start date 9/95

Total VOC discharge rate from Pilot testing ~~or calculations~~ 0.51 lbs/hr at 100 scfm (per well)

Benzene Discharge Rate from Pilot testing or calculations ——— lbs/hr at 100 scfm — Estimated Project Total Benzene was not detected during pilot test.

2. ANY METHOD OF REMEDIATION NOT LISTED IN PART II (NOTE: For thermal treatment, use Form 4400-149.)

Attach narrative and drawing(s) to describe the remediation method to be used. A final report is required. At a minimum, the information submitted should include the following applicable items:

a. proposed treatment method
b. location/size of remediation site
c. distance to nearest residence/business
d. field sampling methods
e. protective covering and curbing techniques
f. volume estimate and soil thickness needing remediation
g. method of turning/mixing soil
h. highest estimated hourly/daily VOC emissions
i. highest estimated daily/total benzene emissions
k. anticipated startup and completion dates.
l. proposed verification method of contaminant content
m. project contact person
n. final destination of soil

LEAVE BLANK - DEPARTMENT OF NATURAL RESOURCES USE ONLY

Application Concurrence:

Air Management _____ Date _____

Project Manager _____ Date _____

Comments:

3. DISPOSAL OF CONTAMINATED SOILS AT A SANITARY LANDFILL-NR 500

NOTE: Contaminant concentrations must meet Solid Waste guidelines and analytical results must be submitted within 30 days of disposal.

PLEASE COMPLETE PART III BELOW AFTER LANDFILL BURIAL IS COMPLETED.

THIS SECTION IS TO BE COMPLETED BY THE DISPOSAL FACILITY ACCEPTING THE CONTAMINATED SOIL

Part III

Transporter Name. Transporter License Number.

Name of landfill License No.

Actual Volume of soil landfilled _____ Indicate yds³ or tons ___ cover soil ___ buried

Date received at landfill Accumulated Benzene emissions to date _____

Signature of landfill facility representative _____

PART II. Proposed Treatment Method.

Other remediation systems exist or may be proposed on this site: X yes
___ no

If yes, list the other systems and indicate if they have been reviewed:
Sumps 4+5 (Air Stripper) X yes ___ no date _____
Sump 6 (Air Stripper) Area 3 (Air Stripper)
Area 2 (Air stripper)
Sump 9 (SVE/Air stripper)

1. Soil Vacuum Extraction/Groundwater Remediation. Attach lab reports.

Pilot Test Data (for soil remediation only). Attach calculations.

Date	10/5/94
Duration of test	5.6 hours
Flow rate	100 scfm
Total VOC discharge rate	0.51 lbs/hour
Benzene discharge rate	— lbs/hour (Not detected)

Proposed Operation. Attach calculations. Department approval must be obtained prior to changing operation parameters.

Proposed start date	9/95
Estimated duration of remediation	24 months
Number of extraction/recovery wells	16
Number of emission points	2
Maximum equipment flow rate	56 (scfm)/gpm (circle one)
Total VOC discharge rate*	4.9 lbs/hour
Benzene discharge rate*	— lbs/hour
	— lbs/year
Estimated benzene project total	— lbs

If maximum TVOC or benxene discharge rates exceed 5.7 lbs/h or 3001bs/y, respectively, I will accept an enforceable operating restriction of 35 scfm/gpm to avoid an air pollution control permit.

* Base estimations on pilot test data for soil vacuum extraction, and on recovery well samples for groundwater remediation systems.

2. Other Non-Thermal Remediation Techniques (for thermal remediation use Form 4400-149). Check and attach project description.

___ passive aeration
___ bioremediation
___ landfill (burial) Landfill name _____
___ landfill (cover) Landfill name _____
___ _____

3. Maintenance of Proposed System.

Contact responsible _____ Title _____
Telephone number (include area code) _____

ATTACHMENT TO FORM 4400-120
AIR EMISSIONS CALCULATIONS
AREA 3 SVE PILOT TEST

Emission rate equation:

$$56.1 \frac{ft^3}{min} \times (\_\_) \frac{mg}{L} \times 1440 \frac{min}{day} \times 28.32 \frac{L}{ft^3} \times 10^{-6} \frac{kg}{mg} \times 2.205 \frac{lbs}{kg} = \frac{lbs}{days}$$

The emissions rate calculated from the average concentrations of VOCs analyzed during the pilot test:

$$\left[1.358 \frac{mg}{L} \right]$$

$$= 6.83 \frac{lbs}{day} = 0.284 \frac{lbs}{hr}$$

The emissions rate calculated from the maximum concentrations of VOCs analyzed during the pilot test:

$$\left[1.776 \frac{mg}{L} \right]$$

$$= 8.96 \frac{lbs}{day} = 0.373 \frac{lbs}{hr}$$

The calculated values of emissions rates are based on one extraction well.

Emission Calculations (Soil Only)

Average Concentrations

Benzene	= 0.18 mg/kg
DRO	= 91 mg/kg
GRO	= 427 mg/kg

Compound emissions in lbs = (compound concentration mg/kg) x 10^{-6} x 2,800 lbs/yd^3 x Amount of impacted soils in yd^3.

Amount of impacted soil = Amount of soil influenced by the SVE system.

Assuming a radius of influence of 30' and depth of impacts as 8'

Volume of right circulation cylinder = $\pi r^2 h$

ATTACHMENT TO FORM 4400-120 (Continued)
AIR EMISSIONS CALCULATIONS
AREA 3 SVE PILOT TEST

$$\textit{Amount of impacted soil} = 3.14 \times (30\ ft)^2 \times 8\ ft \times \frac{1\ yd^3}{27\ ft^3} \times 16$$

$\simeq$ 13,400 yd^3

Benzene Emissions = 0.18 mg/kg x 10^{-6} x 2800 lbs/yd^3 x 13,400 yd^3
6.8 lbs

GRO = 427 mg/kg x 10^{-6} x 2800 lbs/yd^3 x 13,400 yd^3
16,000 lbs

DRO = 91 mg/kg x 10^{-6} x 2800 lbs/yd^3 x 13,400 yd^3
3,400 lbs

Total GRO and DRO = **19,400 lbs**

I-HHH 3 SVL [redacted]\ OB[redacted]ATION [redacted] SO[redacted]

SUMMARY OF DETECTED ORGANIC COMPOUNDS

CHRYSLER CORPORATION, KENOSHA MAIN PLANT

SAMPLE I.D.	DATE COLLECTED	U.S. EPA METHOD	LAB IDENTIFICATION(1)	SAMPLE RESULTS (micrograms per kilogram)																				(milligrams per kilogram)	
				BENZENE	n-BUTYLBENZENE	sec-BUTYLBENZENE	tert-BUTYLBENZENE	1,1-DICHLOROETHANE	ETHYL BENZENE	ISOPROPYLBENZENE	p-ISOPROPYLTOLUENE	n-PROPYL BENZENE	TETRACHLOROETHENE	TOLUENE	1,2,3-TRICHLOROBENZENE	1,2,4-TRICHLOROBENZENE	1,1,1-TRICHLOROETHANE	1,1,2-TRICHLOROETHANE	TRICHLOROETHENE	1,2,4-TRIMETHYLBENZENE	1,3,5-TRIMETHYLBENZENE	m & p-XYLENE	o-XYLENE	DRO	GRO
OP9-03/6-8'	5/2/95	8260	50503001	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<8.4	<17	<8.4	12	<10
OP11-02/4-6'	5/2/95	8260	50503002	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<8.3	<17	<8.3	26	21
OP13-02/4-6'	5/2/95	8260	50503003	<8.8	310	430	<8.8	<8.8	3900*	1800*	580*	<8.8	<8.8	<8.8	<8.8	<8.8	<8.8	<8.8	<8.8	6200*	1700*	6700*	<8.8	31	2400
SVE7-03/6-8'	5/2/95	8260	50503004	<8.2	72	890*	280	<8.2	1100*	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	<8.2	150	<8.2	20	1300
MEOH BLANK	5/2/95	WDNR	50503005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10
SVE2-02/6-8'	5/3/95	8260	50504004	<5	<5	<5	<50	<50	<50	<50	<50	<50	<50	50	620	220	,50	<50	<5	11	<50	<10	<50	<10	18
OP14-02/5-7	5/3/95	8260	50504005	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	200	<5	<5	<5	<5	<5	<5	<10	<10
MEOH BLANK	5/3/95	WDNR	50504006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10
SVE6-02/4-6'	5/4/95	8260	50505001	<5	20	<5	<5	<5	16	<5	<5	22	<5	<5	<5	<5	82	<5	570	99	24	44	<5	<10	19
SVE8-02/4-6'	5/4/95	8260	50505002	<5	210	200	<5	<5	670*	490*	190	420*	<5	<5	<5	<5	<5	<5	<5	820*	480*	1300*	<5	13	500
OP7-02/4-6'	5/4/95	8260	50505003	7.6	200	170	<5	<5	34	180	120	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	11	340
SB1-02/4-6'	5/4/95	8260	50505004	<5	83	90	<5	<5	120	280	88	260	<5	<5	<5	<5	<5	<5	<5	130	<5	<10	<5	12	740
OP15-02/4-6'	5/4/95	8260	50505005	<5	<5	100	92	<5	390*	290*	83	250*	<5	<5	<5	<5	<5	<5	<5	590*	300*	800*	<5	<10	2200
MEOH BLANK	5/4/95	WDNR	50505006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10
OP8-02/4-6'	5/9/95	8260	50510021	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	140	14	<5	<5	<10	<5	42	180
SVE9-02/4-6'	5/9/95	8260	50510022	<5	93	<5	<5	<5	2600*	670*	220	<5	<5	<5	<5	<5	<5	<5	<5	1200*	1400*	2900*	<5	<10	2200
OP16-02/4-6'	5/9/95	8260	50510023	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	<10	<10
SB3-02/4-6'	5/9/95	8260	50510024	<5	15	<5	42	<5	<5	250	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	17	710
SB2-02/4-6'	5/9/95	8260	50510025	<5	<5	<5	<5	<5	<5	<5	<5	<5	11	<5	<5	<5	12.0	<5	<5	<5	<5	<10	<5	<10	<10
OP10-02/4-6'	5/9/95	8260	50510026	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	<10	<10
MEOH BLANK	5/9/95	WDNR	50510027	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10
OP4-01/5-7'	5/10/95	8260	50512049	570*	<5	750*	250	<5	890*	540*	1300*	<5	<5	52	<5	<5	<5	<5	<5	5800*	7100*	1700*	2100*	130	1000
SVE4-01/4-6'	5/10/95	8260	50512050	<5	310*	190	<5	<5	240*	300*	410*	<5	<5	<5	<5	<5	<5	<5	<5	480*	380*	<10	<5	81	640
MEOH BLANK	5/10/95	WDNR	50512051	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10
OP7A-02/4-6'	5/10/95	8260	50512052	<5	270*	180	<5	51	440*	290*	280*	<5	<5	<5	<5	<5	<5	<5	<5	710*	130	<10	<5	40	660
OP5-01/5-7'	5/10/95	8260	50512053	1200*	320*	<5	<5	<5	<5	310*	630*	<5	<5	<5	<5	<5	<5	<5	<5	630*	570*	<10	<5	2400	760
OP12-02/4-6'	5/10/95	8260	50512054	<5	94	140	<5	<5	<5	410*	75	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	64	460
SVE5-01/4-6'	5/10/95	8260	50512055	<5	17	16	<5	<5	<5	<5	16	<5	<5	11	67	12	<5	<5	<5	25	<5	<10	<5	<10	<10
OP6-02/4-6'	5/11/95	8260	50512017	<5	140	100	<5	<5	180	140	150	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	26	480
SVE12-02/4-6'	5/11/95	8260	50512018	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<10	<5	<10	480
SB4-02/3-5'	5/11/95	8260	50512019	300*	290*	120	<5	<5	360*	220*	390*	<5	<5	<5	<5	<5	<5	<5	<5	350*	1300*	300*	<5	<10	380
SVE13-03/5-7'	5/11/95	8260	50512020	240	400*	240	<5	<5	350*	320*	380*	<5	<5	<5	<5	<5	<5	<5	<5	370*	310*	68	<5	220	960
MEOH BLANK	5/11/95	WDNR	50512021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10

* The analyte concentration was found to be outside of the established linear range of quantitation for this compound. The reported value is an approximation only.

(1) Analysis Performed by Midwest Analytical Services, Inc., (MAS), Metropolitan Center for High Technology, 2727 Second Avenue, Detroit, Michigan 48201 (WDNR Lab Id No. 999941580).

NA - Not Analyzed

AREA 3 CHARACTERIZATION AND BIOFEASIBILITY DATA
SUMMARY OF DETECTED METALS
CHRYSLER CORPORATION, KENOSHA MAIN PLANT

SAMPLE I.D.	DATE COLLECTED	LAB IDENTIFFCATION[1]	TOTAL METALS (milligrams per kilogram)										
			ANTIMONY	ARSENIC	BERYLLIUM	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	NICKEL	SILVER	ZINC
45H/4-6'	9/22/94	8766	41	11	1	5	30	29	14400	43	22	7	51
BT3-1/2-4'	9/22/94	8767	16	3.1	0.5	4	13	19	14300	18	13	5	46
BT3-1/8-10'	9/22/94	8768	11	3.6	0.5	1	11	9	3950	11	5	5	18
45J/4-6'	9/22/94	8769	41	3.4	0.9	5	23	15	12900	32	16	8	44
45I/2-4'	9/22/94	8770	56	4.2	1.2	6	31	24	18200	45	26	8	56
BT3-2/4-6	9/20/94	8624	44	2.6	1.1	7	31	31	24100	44	26	6	26
BT3-2/8-10'	9/20/94	8625	11	3.5	0.4	2	11	10	6460	15	9	4	39
BT3-3/4-6'	9/20/94	8626	42	3.3	0.9	5	27	20	15900	39	19	5	42
BT3-3/10-12'	9/20/94	8627	14	2.9	0.5	2	14	14	7280	18	10	5	58
BT3-4/4-6'	9/20/94	8629	48	12.7	1.1	6	29	18	17700	40	21	6	39
BT3-4/6-8'	9/20/94	8628	12	1.3	0.4	2	10	10	6220	14	8	4	44
Method			6010	7060	6010	6010	6010	6010	6010	6010	6010	6010	6010
Method Detection Limit			4	0.2	0.1	1	1	1	55	5	1	2	1

(1) Analysis Performed by Swanson Environmental Inc.

[illegible] 3 CH[illegible]RIZATI[illegible] BIC[illegible]ILITY [illegible]
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
CHRYSLER CORPORATION, KENOSHA MAIN PLANT

SAMPLE I.D.	DATE COLLECTED	U.S. EPA METHOD	LAB IDENTIFICATION[1]	RESULTS (MG\KG)																												
				BENZENE	n-BUTYLBENZENE	sec-BUTYLBENZENE	tert-BUTYLBENZENE	CHLOROETHANE	CHLOROFORM	1,1-DICHLOROETHANE	1,2-DICHLOROETHANE	1,1-DICHLOROETHENE	CIS-1,2-DICHLOROETHENE	TRANS-1,2-DICHLOROETHEN	ETHYL BENZENE	ISOPROPYLBENZENE	p-ISOPROPYLTOLUENE	METHYLENE CHLORIDE	NAPHTHALENE	n-PROPYL BENZENE	STYRENE	TOLUENE	1,1,1-TRICHLOROETHANE	TRICHLOROETHENE	1,2,4-TRIMETHYLBENZENE	1,3,5-TRIMETHYLBENZENE	VINYL CHLORIDE	m & p-XYLENE	o-XYLENE	DRO	GRO
45H/4-6'	9/22/94	8021	8766	<0.003	0.002J	<0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.004	0.004	<0.003	<0.003	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	0.027	<0.005	<0.003	<0.003	<0.003	0.005	<10	35
BT3-1/2-4'	9/22/94	8021	8767	<0.003	0.128	<0.004	<0.003	<0.003	0.011	<0.003	<0.003	<0.003	<0.003	<0.004	0.023	<0.003	0.01	0.15	<0.003	0.01	<0.003	0.009	<0.003	<0.003	<0.005	0.14	<0.003	<0.003	0.015	<10	74
BT3-2/8-10'	9/22/94	8021	8788	3.68E	<0.003	<0.004	<0.003	<0.003	<0.003	0.001J	0.002J	<0.003	0.013	0.016	0.023	0.003	<0.003	0.09	<0.003	<0.003	<0.003	0.118	<0.003	<0.003	0.005	<0.003	<0.003	0.472E	0.067	<10W1	330
45J/4-6'	9/22/94	8021	8769	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<10WB	64
45I/4-6'	9/22/94	8021	9038	0.033	<0.003	<0.004	<0.003	0.094NJ	<0.003	0.178	<0.003	<0.003	<0.003	<0.004	0.029	0.005	<0.003	0.05	<0.003	<0.003	<0.003	0.013	0.002J	<0.003	<0.005	0.004	<0.003	<0.003	0.004	NA	NA
BT3-2/4-6	9/20/94	8021	8624	<0.3X	17.2X	16.8X	7.47X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	10.4X	1.97X	1.7X	<1.00	2.1X	13.2X	6.58X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<0.3X	<10W1	1230X
BT3-1/8-10'	9/20/94	8021	8625	0.023Q	<0.003	0.071	0.054	0.008	0.006	<0.003	0.004	<0.003	0.019	0.016	0.195	0.025	0.019	0.443	0.024Q	0.101	<0.003	0.015BQ	<0.003	0.017	<0.005	<0.003	<0.003	0.009	0.052	<10W1	14
BT3-3/4-6'	9/20/94	8021	8626	0.077X	0.025	0.008	<0.003	<0.003	0.011	<0.003	<0.003	<0.003	<0.003	<0.004	0.295	<0.003	0.02	0.033	<0.003	0.034	<0.003	0.115BQ	<0.003	0.004	<0.005	0.023	<0.003	0.044	0.042	<10	14
BT3-3/10-12'	9/20/94	8021	8627	0.045	0.375B	<0.040	<0.030	<0.030	0.013J	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.065	<0.030	1.58	<0.040	<0.030	<0.030	0.098	<0.030	<0.030	<0.050	<0.030	<0.030	0.053	<0.030	<10	<5
BT3-4/4-6'	9/20/94	8021	8629	0.1	<0.030	<0.040	<0.030	<0.030	0.05	<0.030	<0.030	<0.030	1.08	0.13	<0.030	0.06	<0.030	1.57	<0.030	0.16	0.22	0.09	<0.030	0.16	<0.050	0.16	<0.030	0.05	<0.030	<10	<5
BT3-4/6-8'	9/20/94	8021	8628	<0.003	<0.003	<0.004	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	9.16D	1.95D	<0.003	<0.003	<0.003	0.037	<0.003	<0.003	<0.003	<0.003	<0.003	0.493	<0.005	<0.005	1.43E	<0.003	<0.003	<10	<5

B: Compound detected in method blank
D: Compound quantitated in analysis at second dilution factor.
E: Compound concentration more than 10% outside calibration range.
J: Estimated value; compound detected below PQL.
NA - Not Analyzed
W1: Peaks before DRO retention time window.
WB: Baseline rise at end of DRO retention time window.
X: Sample confirmation run past hold-time.
Q: QC results outside acceptance limits for this compound.

AREA 3 TREATABILITY AND SVE WELL\ OBSERVATION PROBE SOIL
AVERAGE BENZENE, DRO, AND GRO CONCENTRATIONS
CHRYSLER CORPORATION, KENOSHA MAIN PLANT

SAMPLE RESULTS (milligrams per kilogram)				
SAMPLE I.D.	DATE COLLECTED	BENZENE	DRO	GRO
OP9-03/6-8'	5/2/95	0.0082	12	10
OP11-02/4-6'	5/2/95	0.0083	26	21
OP13-02/4-6'	5/2/95	0.0088	31	2400
SVE7-03/6-8'	5/2/95	0.0082	20	1300
MEOH BLANK	5/2/95	NA	NA	10
SVE2-02/6-8'	5/3/95	0.005	10	18
OP14-02/5-7	5/3/95	0.005	10	10
MEOH BLANK	5/3/95	NA	NA	10
SVE6-02/4-6'	5/4/95	0.005	10	19
SVE8-02/4-6'	5/4/95	0.005	13	500
OP7-02/4-6'	5/4/95	0.0076	11	340
SB1-02/4-6'	5/4/95	0.005	12	740
OP15-02/4-6'	5/4/95	0.005	10	2200
MEOH BLANK	5/4/95	NA	NA	10
OP8-02/4-6'	5/9/95	0.005	42	180
SVE9-02/4-6'	5/9/95	0.005	10	2200
OP16-02/4-6'	5/9/95	0.005	10	10
SB3-02/4-6'	5/9/95	0.005	17	710
SB2-02/4-6'	5/9/95	0.005	10	10
OP10-02/4-6'	5/9/95	0.005	10	10
MEOH BLANK	5/9/95	NA	NA	10
OP4-01/5-7'	5/10/95	0.57	130	1000
SVE4-01/4-6'	5/10/95	0.005	81	640
MEOH BLANK	5/10/95	NA	NA	10
OP7A-02/4-6'	5/10/95	0.005	40	660
OP5-01/5-7'	5/10/95	1.2	2400	760
OP12-02/4-6'	5/10/95	0.005	64	460
SVE5-01/4-6'	5/10/95	0.005	10	10
OP6-02/4-6'	5/11/95	0.005	26	480
SVE12-02/4-6'	5/11/95	0.005	10	480
SB4-02/3-5'	5/11/95	0.3	10	380
SVE13-03/5-7'	5/11/95	0.24	220	960
MEOH BLANK	5/11/95	NA	NA	10
45H/4-6'	9/22/94	0.003	10	35
BT3-1/2-4'	9/22/94	0.003	10	74
BT3-2/8-10'	9/22/94	3.68	10	330
45J/4-6'	9/22/94	NA	10	64
45I/4-6'	9/22/94	0.033	NA	NA
BT3-2/4-6	9/20/94	0.3	10	1230
BT3-1/8-10'	9/20/94	0.023	10	14
BT3-3/4-6'	9/20/94	0.077	10	14
BT3-3/10-12'	9/20/94	0.045	10	5
BT3-4/4-6'	9/20/94	0.1	10	5
BT3-4/6-8'	9/20/94	0.003	10	5
AVERAGE		0.1813	90.7	427.

NA - Not Analyzed

SOIL VAPOR EXTRACTION (SVE) PILOT TEST
AREA 3, CHRYSLER CORPORATION
KENOSHA MAIN PLANT PROPERTY

1.0 SVE PILOT TEST OBJECTIVES

An SVE pilot test was performed to evaluate the feasibility of expediting site remediation activities by SVE techniques. The information obtained enabled the flow characteristics of SVE to be assessed for design and operation. Specific data needs and objectives included evaluation of the following:

- Radius of influence of the applied vacuum to evaluate if the existing well spacing is adequate to achieve coverage of the impacted area;
- Chemical analysis of the off-gas to evaluate permitting and treatment needs, to estimate the duration of remedial system operation, and to establish appropriate monitoring requirements; and
- Groundwater recovery rates, with and without an applied vacuum, to evaluate if water handling practices are required.

2.0 SVE PILOT TEST PROCEDURES

On October 5, 1994, a 6 1/2 hour SVE pilot test was conducted by connecting a portable blower system to the extraction well and inducing a vacuum at that point. McCloskey Environmental Services, Inc. (MES) of Sylvania, Ohio performed the test. During the pilot test SVE-1 was used as the extraction well, and observation probes OP-1, OP-2 and OP-3, and groundwater monitoring well MW-45 were used as observation wells. The locations of the wells are shown on Figure 1. The extraction well was connected to the blower using a series of pipe fittings. A list of equipment used for the pilot test is found in Attachment 5-1.

Prior to initiating the test, background pressure measurements were collected at the extraction well and observation wells utilizing a hand-held digital manometer. Upon start-up of the blower, air-flow rates, air-stream temperature and pressure measurements at the extraction and observation wells were recorded at specified time intervals throughout the duration of the pilot test. Pressure measurements collected at the observation wells were used to evaluate the approximate zone of influence of the applied vacuum.

Prior to start-up a photoionization detector (PID) (Model 580B OVM) was used to measure the relative volatile organic compound (VOC) concentration of air inside each well casing at each location to establish a baseline. PID readings were also recorded at specified time intervals throughout the duration of the pilot test at each well location. The PID readings recorded during the test were compared to the baseline readings to evaluate if the induced vacuum influenced the relative VOC concentrations.

A pump placed in the extraction well was used to pump groundwater during the pilot test. Prior to start-up of the blower, 3 feet of water was measured in the extraction well. The pump needed at least 3 feet of water in order to operate. Therefore, very little water was pumped before or during the pilot test. Water levels at the observation wells were also recorded at specified time intervals.

A total of seven effluent air samples were collected by MES personnel at specified time intervals during the pilot test. For a complete discussion of air sampling methodology, quality control, sample results and a discussion of the results refer to McCloskey Environmental Services, Inc. report, dated October 11, 1994, Attachment 5-2.

3.0 SVE PILOT TEST RESULTS

Data collected during the pilot test are presented on Tables 1 and 2. Table 1 lists the vacuum measurements recorded at the extraction well and observation wells. Table 2 lists the water levels and PID readings recorded at the observation wells. During the pilot test, SVE-1 was used as the extraction well. The baseline vacuum reading at the extraction well was 0 pounds per square inch (psi). At the observation wells, the baseline vacuum was 0 inches of water column (in W.C.). The blower was started at 9:35 a.m., and the measured air flow at 9:40 a.m. was 98.9 standard cubic feet per minute (scfm). Measured air flow at the extraction well ranged from between 97.9 and 99.9 scfm throughout the duration of the test. Vacuum readings at the extraction well ranged from 0.17 psi, initially, to 0.10 psi. The change (drop) in vacuum readings (and necessary adjustments to the air flow) were likely due to different periods of vacuum development.

The data for vacuum measurements at the observation wells indicate that complete vacuum development did not occur. This is evident in the variable vacuum readings observed during the pilot test at OP-1 and OP-2. These results may indicate continued vacuum propagation, and/or short circuiting due to the presence of a nearby trench (4 feet deep, located approximately 35 feet to the south and east of the extraction well. The induced vacuum readings recorded at OP-1 (the observation well closest to SVE-1) ranged from 1.31 to 1.20 in W.C. The initial vacuum reading, five minutes after start-up of the blower was 1.21 in W.C. The induced vacuum readings recorded at OP-2 ranged from 0.23 to 0.46 in W.C. The initial vacuum reading was 0.42 in W.C. Initial vacuum readings, 5 minutes after start-up, at MW-45 and OP-3 (the observation well farthest from SVE-1), were 0.13 and 0.05 in W.C., respectively. The vacuum measurements at these two observation wells were relatively constant during the last 1.5 hours of testing.

PID readings at each observation well were recorded prior to start-up of the blower, to establish baseline VOC concentrations. Five minutes after start-up PID readings at OP-1, OP-2 and OP-3 dropped from 400 to 4 instrument units (i.u.) (OP-1); 321 to 7 i.u. (OP-2); and from 349 to 87 i.u. (OP-3). However, at MW-45, the PID reading increased from 436 to 889 i.u. The PID readings at OP-1 and OP-2 were constant (low) for the duration of the test. The PID readings at OP-3 (the observation well farthest from SVE-1) continued to decrease until approximately 115 to 180 minutes into the test, when the readings began to increase (Table 2). Additionally, PID readings at MW-45 (next farthest observation well from SVE-1) began to decrease after the five minute reading, until approximately 90 to 115 minutes into the test when the readings increased. These PID readings for observation wells OP-3 and

MW-45 indicate that the vacuum was continuing to propagate, and that different periods of vacuum development were likely to have occurred.

Photographs taken during the pilot test are found in Attachment 5-3.

4.0 SYSTEM DESIGN

4.1 Radius of Influence.

Based on the pilot test data, it was graphically estimated (see Figure 2) that the radius of influence at this site is approximately 22 to 30 feet. This was achieved at a flow rate of approximately 100 scfm at an applied vacuum of approximately 0.17 psi (4.7" W.C.) at the extraction well. The actual system should be operating at a higher, vacuum (approximately 30 to 40 inches of W.C.) to compensate for any heterogeneity in the site or other vacuum losses in the system (pipe losses and function losses in the air/cooler separator, air filter, and other system components).

Based on this radius of influence, approximately 15 to 20 extraction wells are required to treat the estimated area of impacts.

4.2 Flow Rate Calculation.

The flow rates that can be achieved from a vapor extraction well can be calculated by using the following equation for steady-state, isotropic conditions (Johnson et al).

$$\frac{Q}{H} = \Pi \frac{K}{\mu} Pw \frac{[1-(Patm/Pw)^2]}{\ell n(Rw/Rl)}$$

After unit conversions, the above equation takes the form below:

$$\frac{Q}{H} = \frac{6.424 * 10^{-4} * \pi * K * Pw[1-(Patm/Pw)^2]}{\mu \ln (Rw/Rl)}$$

where,

Q	=	Flow rate (cfm)
H	=	Feet of screen
K	=	Soil Permeability to air flow, darcy.
μ	=	Viscosity of air = $1.8 * 10^{-4}$ g/cm-sec.
Patm	=	Absolute ambient pressure, 1 atm.
Pw	=	Absolute pressure at extraction well, atm.
Rw	=	Radius of extraction well, feet.
R_l	=	Radius of influence vapor extraction well, feet.

4.3 Applicability of Flow Rate (Johnson et al) Equation.

Pilot Test Data

Q observed $\simeq$ 100 cfm
H $\simeq$ 10' (screen depth)
Q/H = 10 cfm/ft
Rw = 0.333' (4")
R_I = 30' observed
P_w = 0.9884 atm = 0.17 psig.

Based on the above information, and assuming that K_{air} = 0.005 darcy (from observed geology of the site, $K_{water} \simeq 10^{-3}$ darcy). The calculated Q/H = $2.91 * 10^{-4}$ cfm/ft.

This value is very low, indicating that the geology at the SVE well location is significantly different than the geology observed at the rest of the site. The SVE pilot test location (SVE well and observation locations) is more permeable than observed at other locations of the Chrysler Kenosha Main Plant. Taking Q/H as 10 cfm/ft (observed during pilot test) and back calculating for K_{air}, K_{air} is 172 darcy. This suggests that the soil near the SVE well and the observation wells is either highly permeable, like silty sands to clean sand, or highly variable. Variance is evident from previous field observations of subsurface construction debris and sub-structures.

Because the subsurface at Area 3 is not isotropic, the flow rate equation cannot be used for this site. It is more appropriate to design the SVE system based on pilot test results, observations, air emission standards, and previous experience at similar sites.

4.4 System Design.

A flow rate of approximately 100 cfm was achieved from the vapor extraction well during the pilot test. Also, it is anticipated that approximately 15 to 20 wells are required. The maximum air VOC concentration obtained during the pilot test was 1776.48 μg/L (1.78 mg/L). Under the above conditions the total VOC emission rate would be 10.0 to 13.3 lbs/hr. This exceeds NR 445.04, WAC, air emission standards of 5.7 lbs/hr (see Section 4.5) air emissions. It would be appropriate to reduce the flow rates from each extraction well to keep the emissions below 5.7 lbs/hr, thus avoiding the added costs of air emissions treatment controls. Adopting a safety factor of 1.25, a flow rate of 35 cfm from each well should keep the emissions below 5.7 lbs/hr.

Summary of System Design.

Radius of Influence	=	30'
No of wells required to capture the plane	=	15 to 20
SVE Unit Vacuum	=	30' to 40" of W.C.
Flow Rate per Well	=	35 cfm
Total Flow Rate	=	525 cfm to 700 cfm

4.5 Emission Calculations.

Emission Rate in lbs/hr

= (flow rate in cfm) (60 min/hr) (10^{-6} kg/mg) (2.205 lbs/kg)(concentration in mg/L)(28.32 L/ft^3)

= $3.747 * 10^{-3}$ (flow in cfm)(concentration in mg/L)

Emission Rate in lbs/day

= $3.747 * 10^{-3} * 24$ (flow in cfm)(concentration in mg/L)

= $89.928 * 10^{-3}$ (flow in cfm)(concentration in mg/L)

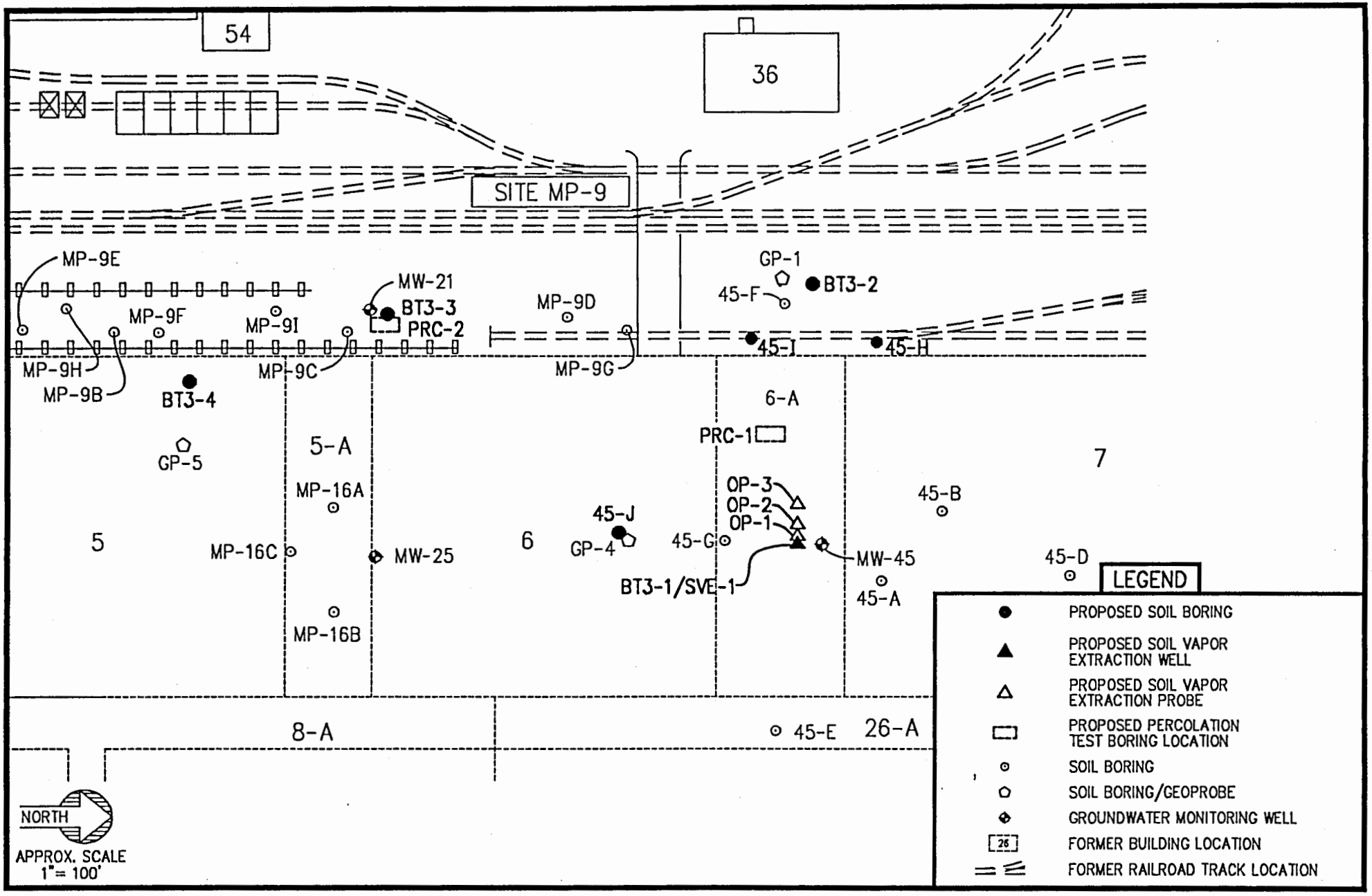
Emission Rate in lbs/year

= $89.928 * 10^{-3} * 365$ (flow in cfm)(concentration in mg/L)

= 32.82 (flow in cfm)(concentration in mg/L)

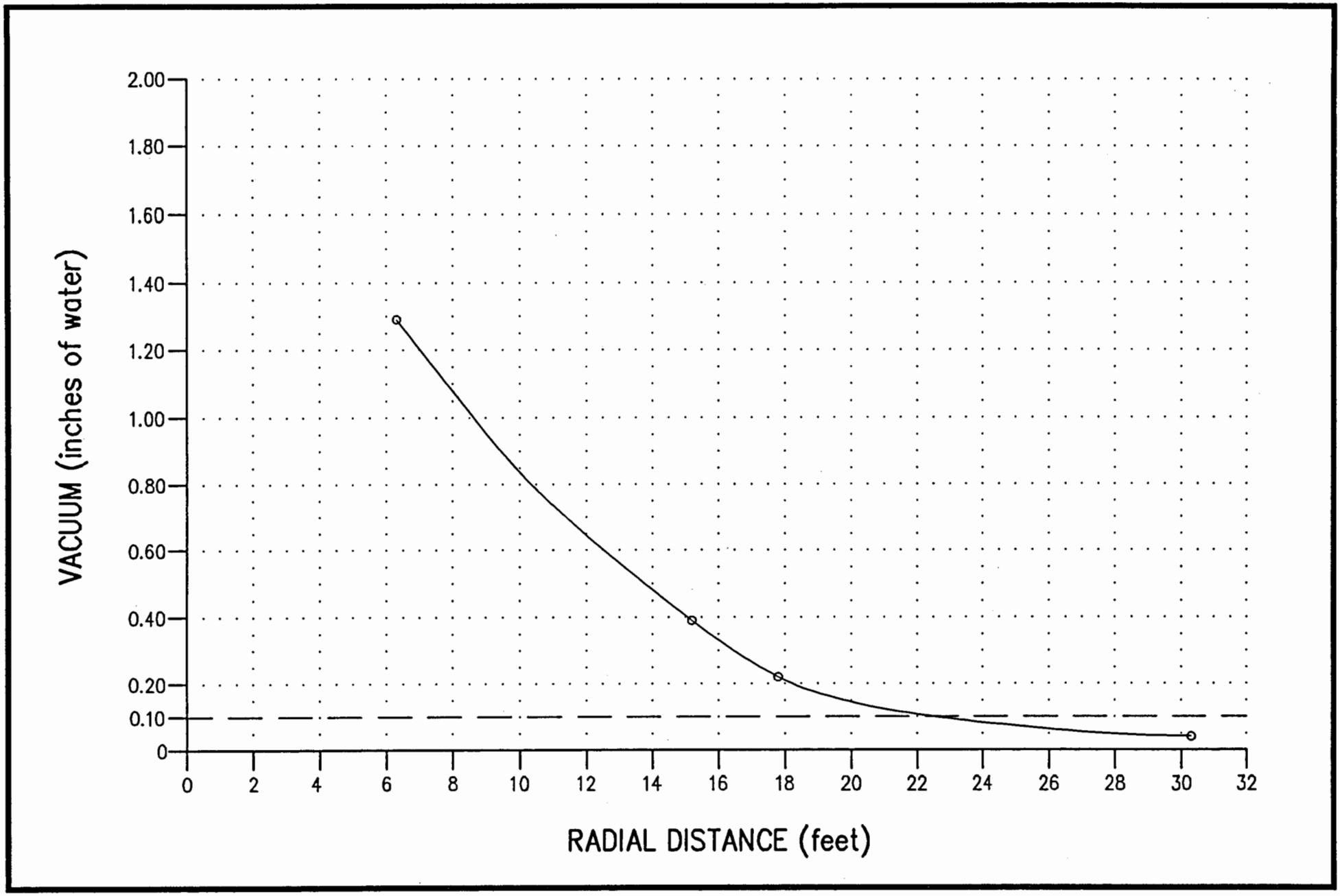
FIGURES

43324388
10-3-94



TRIAD ENGINEERING INCORPORATED

FIGURE 1
CHRYSLER KENOSHA MAIN PLANT
AREA 3 PRE-DESIGN
INVESTIGATION LOCATIONS



TRIAD ENGINEERING INCORPORATED

FIGURE 2
CHRYSLER KENOSHA MAIN PLANT
SVE PILOT TEST
RADIUS OF INFLUENCE ESTIMATION

TABLES

TABLE 1
VACUUM MEASUREMENTS
SVE PILOT TEST
AREA 3

Start Time: 9:35 a.m. Date: 10/05/94

Time	Air Flow (scfm)	Air Stream Temp (°F)	Notes	Vacuum				
				SVE-1 (psi)[1]	OP-1	OP-2 (inches of W.C)[2]	OP-3	MW-45
Distance from Extraction Well (ft)				--	6.3	15.2	30.3	17.8
Screened interval (ft) bgs				3-13	6-16	6-16	6-16	6-16
8:30 a.m.	0	--	--	0	0	0	0	0
9:40 a.m.	98.9	63.1	Air Sample #1	0.17	-1.21	-0.42	-0.05	-0.13
9:45 a.m.	98.2	62.5		0.17	-1.21	-0.37	-0.03	-0.13
9:50 a.m.	97.9	63.0		0.16	-1.21	-0.46	-0.04	-0.13
10:00 a.m.	98.4	62.9	Air Sample #2 (9:57)	0.16	-1.23	-0.42	-0.03	-0.18
10:10 a.m.	98.5	63.1	Air Sample #3 (10:13)	0.135	-1.23	-0.45	-0.04	-0.18
10:25 a.m.	98.9	63.1	PSI up slightly may be pulling sand or water	0.17 (recalibated)	-1.20	-0.36	-0.01	-0.18
10:40 a.m.	98.6	63.3	PID Offgas 38	0.16	-1.22	-0.36	-0.05	-0.19
10:50 a.m.	98.9	63.6		0.155	-1.26	-0.45	-0.05	-0.16
11:00 a.m.	98.8	63.6		0.145	-1.22	-0.38	-0.04	-0.17

TABLE 1 (cont'd)
VACUUM MEASUREMENTS
SVE PILOT TEST
AREA 3

Time	Air Flow (scfm)	Air Stream Temp (°F)	Notes	Vacuum				
				SVE-1 (psi)[1]	OP-1	OP-2 (inches of W.C)[2]	OP-3	MW-45
11:10 a.m.	98.8	63.9	Air Sample #4	0.11	-1.22	-0.38	-0.04	-0.22
11:20 a.m.	99.0	64.0		0.10	-1.23	-0.36	-0.01	-0.22
11:35 a.m.	99.3	63.7		0.13	-1.22	-0.37	-0.01	-0.23
12:05 p.m.	99.6	63.5	Air Sample #5 (12:10)	0.165	-1.24	-0.39	-0.04	-0.30
12:25 p.m.	99.3	64.1		0.10	-1.24	-0.44	-0.04	-0.19
12:45 p.m.	99.2	64.0		0.125	-1.23	-0.38	-0.03	-0.20
1:05 p.m.	99.8	64.2	Air Sample #6 (1:10)	0.135	-1.26	-0.23	-0.03	-0.22
1:35 p.m.	99.9	64.3		0.15	-1.31	-0.40	-0.04	-0.23
2:05 p.m.	99.6	64.3	Air Sample #7 (2:10)	0.14	-1.29	-0.39	-0.03	-0.22
2:35 p.m.	99.9	64.5		0.14	*	-0.38	-0.04	*

Notes:
1. Pounds per square inch - psi
2. Water column - WC
* Not measured, compressor failed at 2:36 p.m.

TABLE 2
WATER LEVEL/PID READINGS
SVE PILOT TEST
AREA 3

Start Time: 9:35 a.m. Date: 10/05/94

Time	Volume Purged (gallons)	Notes	Water Level/PID Readings			
			OP-1	OP-2	OP-3	MW-45
8:15 a.m.	0		WL: 12.91[a]	13.23	12.91	11.06
			PID: 400(4)[b]	321(6)	349(5)	436 (8)
8:40 a.m.	1		WL: 12.92	13.24	12.91	11.07
9:15 a.m.	4.5	9:20 a.m. SVE-1 water level = 10.125 bgs (3 ft of water left)	WL: 12.92	13.24	12.91	11.06
9:40 a.m.	5	9:40 a.m. Air sample #1				
			PID: 4(3)	7(5)	87(6)	889(5)
9:55 a.m.	5	9:57 a.m. - Air sample #2	WL: 12.91	13.24	12.91	11.07
			PID: 6(6)	7(7)	15(9)	757(6)
10:05 a.m.	5.5	10:13 a.m. - Air sample #3 PID-61(7)	WL: 12.91	13.24	12.92	11.07
			PID: 5(4)	6(5)	12(7)	712(7)
10:30 a.m.	8					
			PID: 2(2)	2(2)	3(2)	265(3)
10:40 a.m.	8.5		WL: 12.92	13.25	12.925	11.11
			PID: 2(1)	3(2)	3(2)	155(3)
11:05 a.m.	9.5	11:10 a.m. - Air sample #4	WL: 12.93	13.25	12.925	11.11
			PID: 0.4(0)	0(0)	5(4)	350(0)
11:30 a.m.	10.5					
			PID: 2(1)	2(2)	16(1)	819(1)

TABLE 2 (cont'd)
WATER LEVEL/PID READINGS
SVE PILOT TEST
AREA 3

Time	Volume Purged (gallons)	Notes	Water Level/PID Readings			
			OP-1	OP-2	OP-3	MW-45
12:10 p.m.	12	12:10 p.m. - Air sample #5	WL: 12.93	13.245	12.92	11.07
			PID: 2(2)	2(2)	4(2)	234(2)
12:35 p.m.	12.5					
			PID: 4(3)	6(4)	59(4)	308(2)
12:55 p.m.	13.5		WL: 12.94	13.26	12.925	11.09
			PID: 1(4)	2(1)	76(2)	179(1)
1:15 p.m.	14.5	1:10 p.m. - Air sample #6				
			PID: 4(2)	6(2)	435 + (2.3)	397 (3)
1:45 p.m.	15.5		WL: 12.925	13.24	12.93	11.10
			PID: 5(4)	7(6)	421 + (5)	147(4)
2:15 p.m.	16.5	2:10 p.m. - Air sample #7				
			PID: 3(3)	6(5)	479 + (3)	348(3)
2:40 p.m.	17.5	Compressor failed at 2:36 p.m. Testing stopped.				

Notes:
WL = Water level, PID - photoionization detector.
a Water level measurements are feet from top of riser.
b PID readings are instrument units. Numbers in parenthesis represents background at time of reading.

ATTACHMENT 5-1

ATTACHMENT 5-1

Subcontractor:	McCloskey Environmental, Sylvania, Ohio
Blower:	FCI Fluid Components, Inc. Operating Pressure 250 PSIG Max 115/220 or 24 VDC Reading SCFM, Degrees °F
Observation Well Manometer:	Dwyer Series 475 Mark II Digital Manometer Inches of Water Column Positive/Negative Pressure Range 0-19.99 inches W.C. Max Pressure 11 PSI
Extraction Well Manometer:	Dwyer Series 475 Mark II Digital Manometer PSI, Positive/Negative Pressure
Pump Flow Meter:	SMC Filter Regulator KGF/CM^2 QED Environmental Systems, Inc.
Power:	Ingersol Rand Trailer Generator plus power

ATTACHMENT 5-2

MES REPORT

MCCLOSKEY ENVIRONMENTAL SERVICES, INC.

Environmental Testing and Remediation

5952 Alexa Lane
Sylvania, Ohio 43560
1-800-385-3228

October 11, 1994

Ms. Jeanne Ramponi
Hydrogeologist
Triad Engineering, Inc.
325 E. Chicago Street
Milwaukee, Wisconsin 53202

RE: Results of Soil Vapor Extraction Testing and GC/FID Analysis
Kenosha, Wisconsin Site

Dear Jeanne:

McCloskey Environmental Services, Inc. (MES), Sylvania, Ohio is pleased to present Triad Engineering, Inc. with the results of the analytical testing performed on Tedlar bag vapor samples collected from this site. These seven vapor samples were collected by MES personnel during the operation of a soil vapor extraction pilot study conducted by Triad Engineering at the Chrysler plant in Kenosha, Wisconsin on Tuesday, October 5, 1994.

Collection of Vapor Samples

Beginning just five minutes after the initiation of soil vapor extraction pilot study operations, MES personnel collected a sample of recovered wellhead vapors using a zero-grade air blanked Tedlar bag, vacuum pump, desicator, and copper tubing and Swagelok fittings. The collection of process vapor was made possible by evacuating a laboratory desicator using the vacuum pump, which then inflates the Tedlar bag with wellhead vapor due to the reduced atmospheric pressure within the desicator. When the vacuum pump is shut off, the air within the desicator is returned to atmospheric pressure and pressure is equalized between the Tedlar bag contents and atmosphere. Since the Tedlar bag contents are now at atmospheric pressure (and close to standard conditions), the concentrations of the target chemicals in the Tedlar bag can be directly tied to the recovery air flow rate expressed in standard cubic feet per minute, without the need for laborious pressure and vacuum conversions. Subsequent sample collections occurred at six other times during the pilot study using other Tedlar bags supplied by MES.

Following the conclusion of the pilot test, MES's equipment operator demobilized the pilot equipment from the Kenosha site. The seven Tedlar bags were then transported to MES's mobile laboratory already in operation at a project site in Chicago, Illinois.

Quality Control Procedures

The purpose of this Tedlar bag sampling methodology was to determine the identity and concentration of VOCs in the air removed from the SVE test wellhead. Using a list of VOCs already known to exist either in soils or waters at this site, MES obtained neat standards of each of these target compounds to aid in the identification of the chemicals.

The list of target compounds included the following:

1,1-dichloroethylene (1,1-DCE), cis 1,2-dichloroethylene (cis 1,2-DCE), methylene chloride, trans 1,2-dichloroethylene (trans 1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), trichloroethylene (TCE), perchloroethylene (PCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), sec-butylbenzene, n-butylbenzene, t-butylbenzene, isopropylbenzene, 1,2,4-trimethylbenzene (1,2,4-TMB), 1,3,5-TMB, benzene, toluene, ethylbenzene, m,p-Xylenes, o-Xylene, and napthalene

Initial quality control procedures were conducted prior to the injection of either chemical standards or actual samples in order to demonstrate that the gas chromatograph as well as all gas-tight injection syringes were contamination-free. These quality control procedures included hexane cleaning and oven drying of all method glassware, injection of zero-grade air syringe blanks, and gas chromatograph blanks.

Over several injections to the gas chromatograph, MES's chemical engineer injected one microliter of each chemical compound into the gas chromatograph and documented the range of residence times before each compound eluted from the capillary column. This procedure was repeated for each of the target compounds listed above and yielded residence times ranging from less than one minute for methylene chloride and 1,1-DCE to over five minutes for the higher-boiling, less-volatile aromatic compounds such as 1,2,4-TMB and 1,3,5-TMB.

Next, dedicated syringes were used to transfer four microliters of each of the neat liquid compounds into 500-ml glass sampling bulbs. After warming the glass sampling bulbs to volatilize the liquid components, a 10-ml aliquot from the 500-ml bulb was transferred to a smaller 250-ml glass sampling bulb. Smaller, 50 to 100 microliter injections of vapor from the glass sampling bulbs were then injected into the gas chromatograph to further document residence times and allow for the calculation of compound response factors.

Benzene, toluene, ethylbenzene, m,p-xylenes, and o-xylene (BTEX) quality control injections to the gas chromatograph were made using a commercially-prepared gaseous solution of 10 parts per million (ppm v/v) of each of the BTEX compounds. Similarly, a 10-ml aliquot of the BTEX standard was injected into a 250-ml glass sampling bulb prior to the injection of a 50 or 100 microliter sample of the standard into the gas chromatograph.

Following the preparation of the working vapor chemical standards solutions and injection of glass-bulb aliquots, all data was entered into a computer spreadsheet program. From a plot of mass of compound injected versus chromatographic area, a response factor was calculated for each target compound. When an injection of an actual field sample produces a peak eluting at the residence time of a chemical standard, the response factor was used to calculate the concentration of that compound in the actual sample.

Sample Injection

Beginning with the Tedlar bag vapor sample collected just five minutes after startup of the pilot system, 100-microliters of vapor were injected into the gas chromatograph. The results of the sample injection were plotted on the Hewlett-Packard 3396 Integrator as each compound eluted from the capillary column within the gas chromatograph. Peak residence times were compared with those of the chemical standards which resulted in an identification of target compounds that were present in the Tedlar bag sample. The remaining six Tedlar bag vapor samples were handled and injected in a similar manner to arrive at an identification and quantification of target compounds within each sample. The injection of all seven vapor samples was completed that same evening. Detection limits less than 20 ug/l were achievable for chlorinated compounds; aromatic compounds can generally be quantifed to less than five ug/l in air.

Sample Results

Over a runtime duration of 335 minutes, MES identified that many of the target compunds were present in vapors recovered from the test wellhead. These compounds identified included 1,1-DCE, cis 1,2-DCE, 1,1,1-TCA, toluene, ethylbenzene, m,p-xylenes, and o-xylene (see attached table). Some higher-boiling compounds did appear to be present in the Tedlar bag samples in a boiling-point range indicative of the six higher-boiling target compounds (IPB, sec-BB, n-BB, t-BB, 1,2,4-TMB, and 1,3,5-TMB). Overall, their combined concentration was less than 10 ug/l in each of the Tedlar bag samples and as such were not entered into the spreadsheet table attached to this letter. Please note that the designation #N/A on the spreadsheet table indicates that a peak residence time for that particular chemical compound was not detected by the gas chromatograph, leading us to conclude that the chemical compund was not present in the test sample. Other target compounds such as trans 1,2-DCE, methylene chloride, 1,1-DCA and others are not listed on the spreadsheet table since they were never graphically identifed in the Tedlar bag samples. However, their presence in site soils and ground water would suggest that some partitioning into the vapor space would occur during SVE pilot operations. The presence of any of these other target compounds were either masked by co-eluting compounds or too low in concentrations to be detected by the gas chromatograph.

MES has included a plot of each of the target compound concentrations over the progression of the pilot study as attachments to this letter. It is our opinion that the concentration plots indicate two probably periods of vacuum development, one lasting

approximately 100 minutes and the other continuing through the termination of the pilot study. Several periods of vacuum development are often found from a soil vapor extraction pilot study and show that vacuum propagation is continuing to occur away from the point of vacuum application (the wellhead). Generally, investigators would expect wellhead VOC concentrations to increase as long as vacuum propagation continues away from the vacuum wellhead under similar soil and contamination conditions. Once a wellhead's full radius of influence has been achieved at a given applied wellhead vacuum, concentrations of VOCs begin to drop off at a rate dependent upon the individual VOC, air flow and soil porosity, and soil type. The data suggests that full vacuum propagation did not occur as a result of the second vacuum development period since concentrations did not peak.

Calculation of Exhaust VOC Rate

Since both the FCI thermal dispersion air flow meter and target compound concentrations are expressed in units close to standard temperature and pressure, the calculation equating compound concentration to a mass flow rate is relatively straight-forward and proceeds as follows:

Total Exhaust Rate, pounds of total VOCs/day =

(Concentration of Total VOCs, ug/l) X (Air Flow Rate, standard cubic ft/minute) X (7.48 gallons/cubic feet) X (3.785 liters/gallon) X (1 mg/1000 ug/) X (1 pound/454 g) X (1 g/1000 mg) X 1440 minutes/day)

Taking an air flow of 100 scfm, for instance using C = 1776.48 ug/l

Total Exhaust Rate, pounds of total VOCs/day =

(1776.48 ug/l) X (100 scfm) X (7.48 gal/cubic feet) X (3.785 liter/gal) X (.001) X (.0022) X (.001) X (1440)

= 15.93 pounds per day total VOCs

This same calculation can be applied to specific chemical compounds be substituting in the compound concentration for the total VOC concentration. The result is pounds of compound exhausted per continuous 24-hour day of operation.

Discussion of Results

During the analysis of each Tedlar bag, MES detected other VOCs eluting from the capillary column. In order to quantify these other VOCs, MES has assigned a response factor that represents an average of the known target compounds. The values listed in the "Other VOCs" column of the spreadsheet table are indicative of the sum of the peak areas

for these other VOCs, and then equated to a concentration in ug/l using the average response factor. As an example, the 1410 hrs sample showed a total area of 46,312 for other VOCs. A total area of 38,075 of this 46,312 (82.2%) of these compounds have a boiling point temperature lower than that of o-xylene, suggesting that these unknown compunds also appear amenable to SVE methods. The remaining 17.8 % have a boiling point temperature higher than o-xylene and while they probably exhibit volatility, will take longer to remove from site soils than the known VOCs.

Overall, the analytical results prepared from the seven Tedlar bag samples suggests that the soil vapor extraction pilot study was successfull in demonstrating the removal of VOCs from the test soils. Clearly, elevated concentrations of target VOC compounds are apparent in the table of results, which indicates that significant concentrations of VOCs exist in the vicinity of the test well. Overall, we conclude that this technology is well-suited for the removal of VOCs from site soils and should be examined further to determine the cost-effectiveness versus other remedial measures.

Cleanup Timeframe

Based upon the analytical results, vacuum propagation, observed air flow extraction rates, and our experience with similar sites, MES believes that a full-scale SVE remediation system could probably remediate the target volatile chlorinated compounds to part-per-million soil concentration levels in a period of one to three years assuming full vacuum propagation and continuous ground water recovery. Similarly, we expect that startup total VOC wellhead concentrations may exceed 2 mg/l for a period of several weeks to months while the ground water table is depressed to expose any smear zones to air flow. The potential exhausting of 50-75 pounds per day of VOCs from three to four wells may require vapor-phase carbon adsorption of the wellhead vapors; the potential vacuum drop over these canisters will need to be considered during the design of the full-scale remedial system.

Please contact us if we can be of any further assistance with this application. Thank you again for utilizing the services of McCloskey Environmental Services, Inc.

Sincerely,

Matthew J. McCloskey, P.E.
President

Attachments
Enclosure: 3.5" disk

Triad Engineering Services, Inc.
SVE Pilot Study of 10/05/94
Chrysler Plant, Kenosha, Wisconsin

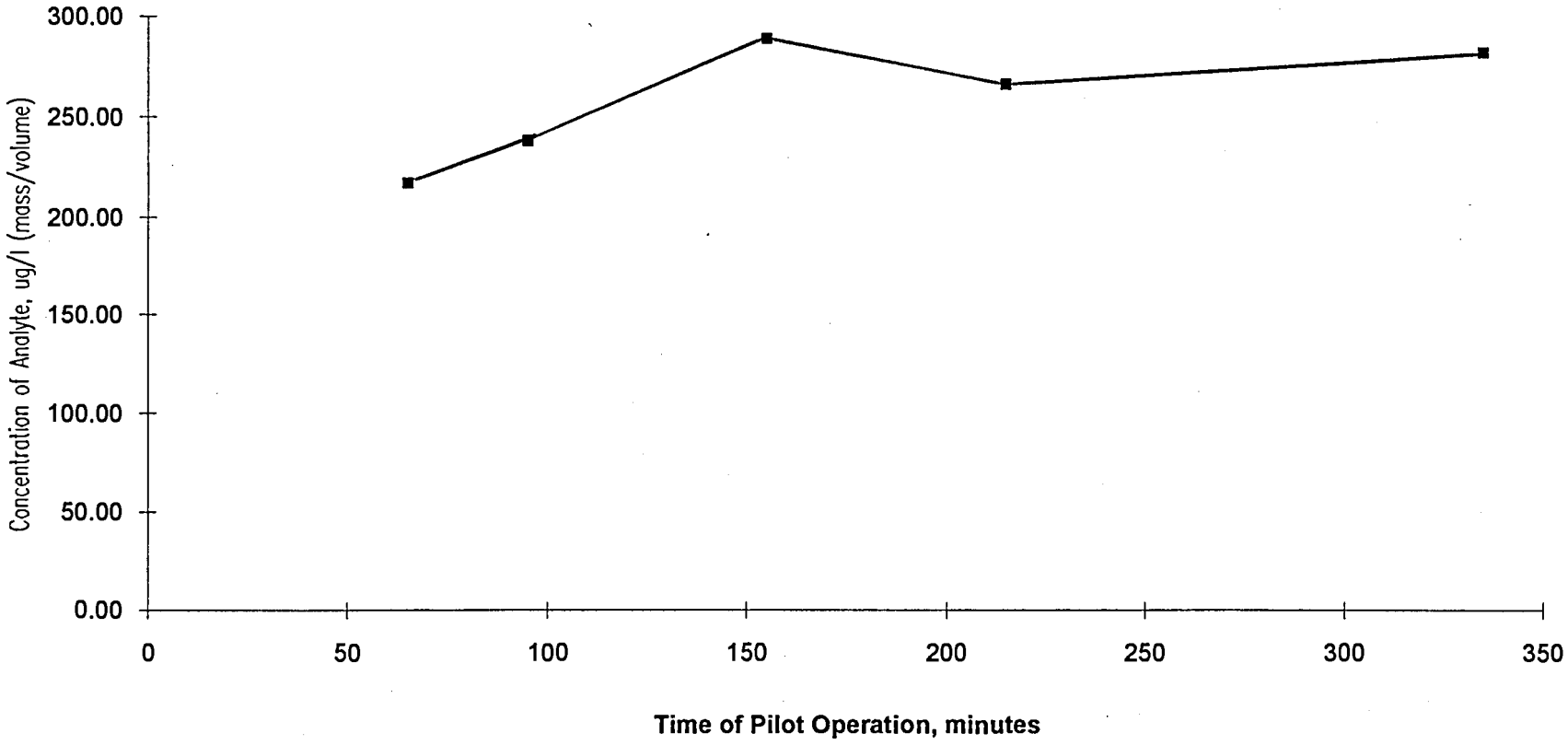
Start 0835hr 0835=0hr

CONCENTRATION OF ANALYTE IN RECOVERED AIR, UG/L

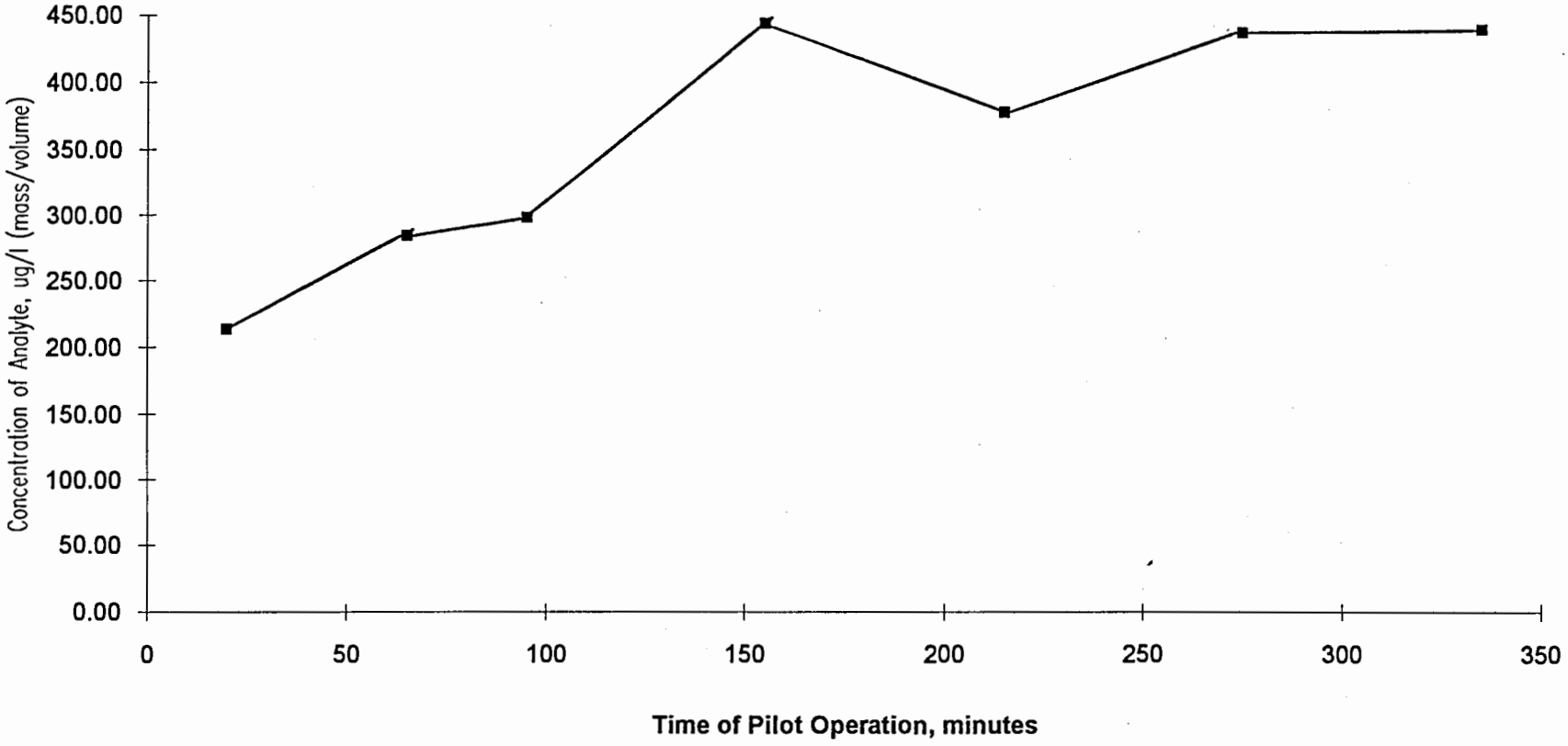
Runtime (MINUTES)	1,1-DCE	cis 1,2-DCE	1,1,1-TCA	Toluene	Ethylbenzene	m,pXylene	o-Xylene	TCE	Other VOCs	Total VOCs
20	#N/A	213.63	#N/A	8.61	2.55	5.17	4.36	68.69	471.59	774.60
65	217.15	283.94	#N/A	10.50	2.48	4.68	4.53	97.94	446.03	1067.25
95	238.08	297.98	104.58	17.39	13.26	19.98	13.26	171.27	900.68	1776.48
155	288.70	443.74	#N/A	16.92	4.31	5.67	4.85	199.05	647.43	1610.67
215	265.84	377.50	#N/A	14.44	3.28	4.87	4.06	150.46	532.55	1353.00
275	#N/A	436.54	#N/A	17.41	4.07	6.35	4.91	177.76	646.59	1293.63
335	281.67	439.24	#N/A	17.67	4.62	6.21	5.50	180.98	694.68	1630.57

#N/A DENOTES THAT A PEAK RESIDENCE TIME FOR THAT ANALYTE WAS NOT DETECTED BY THE GAS CHROMATOGRAPH ON THAT RUN

Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of 1,1-Dichloroethylene Removal

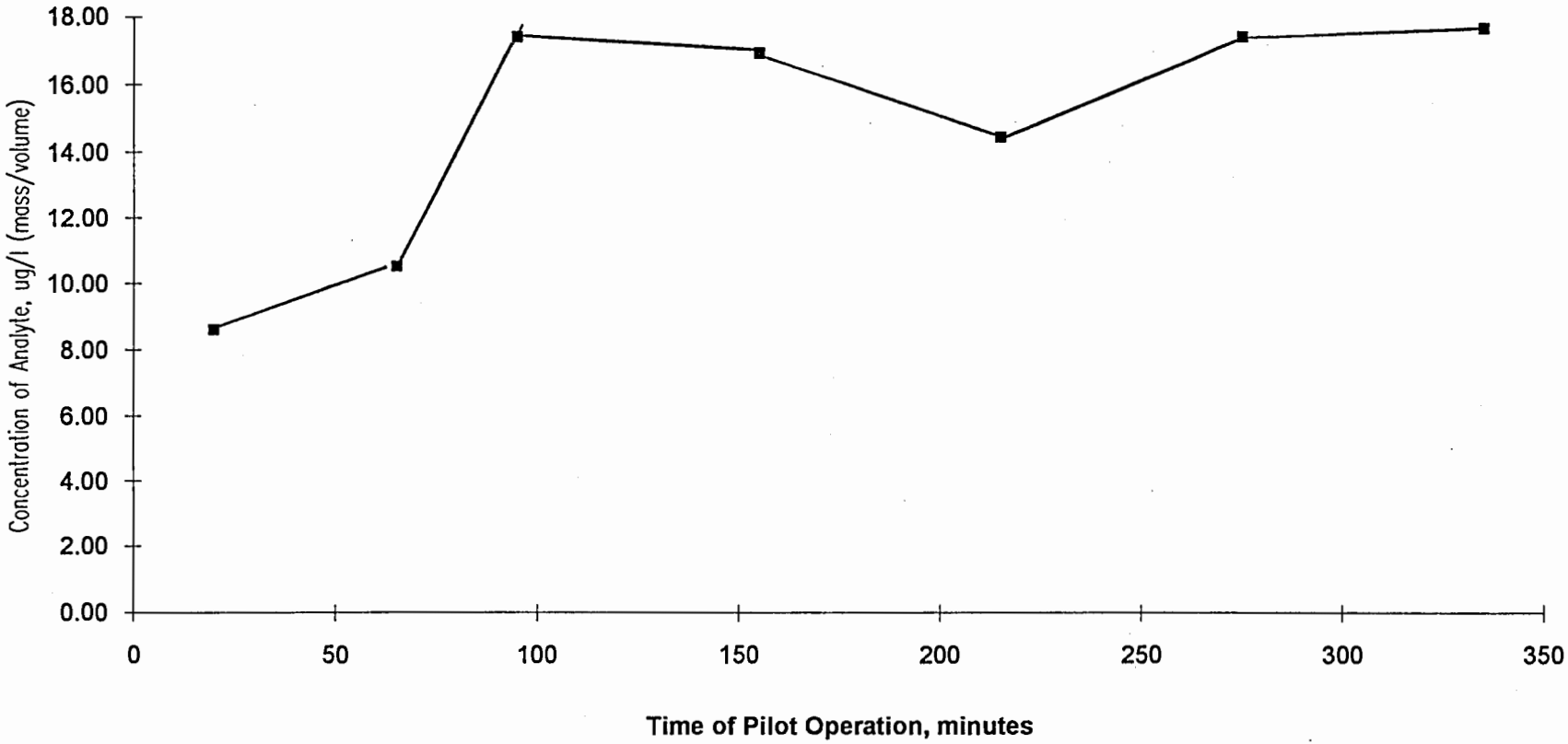


Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of cis 1,2-Dichloroethylene Removal

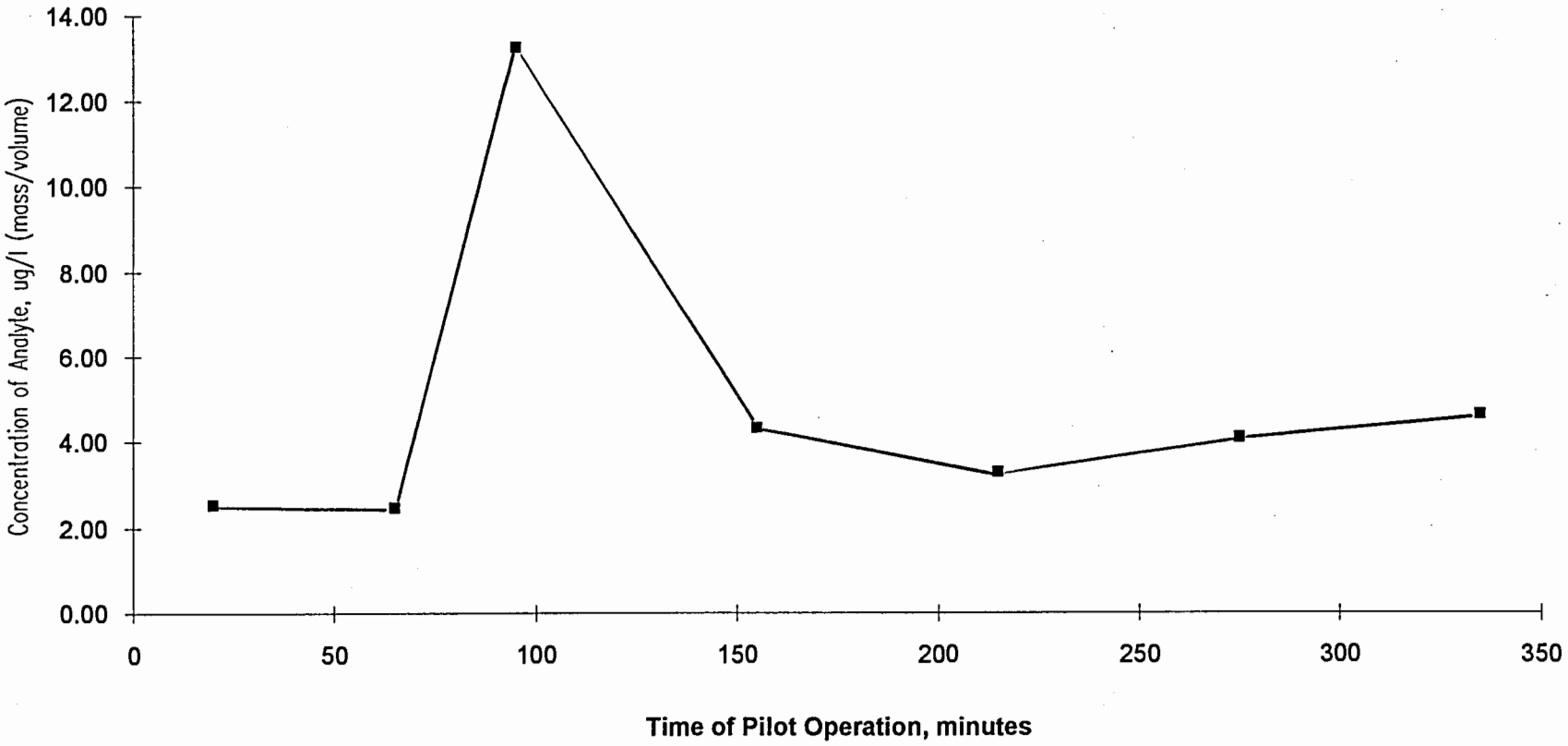


TRIADTOL.XLC

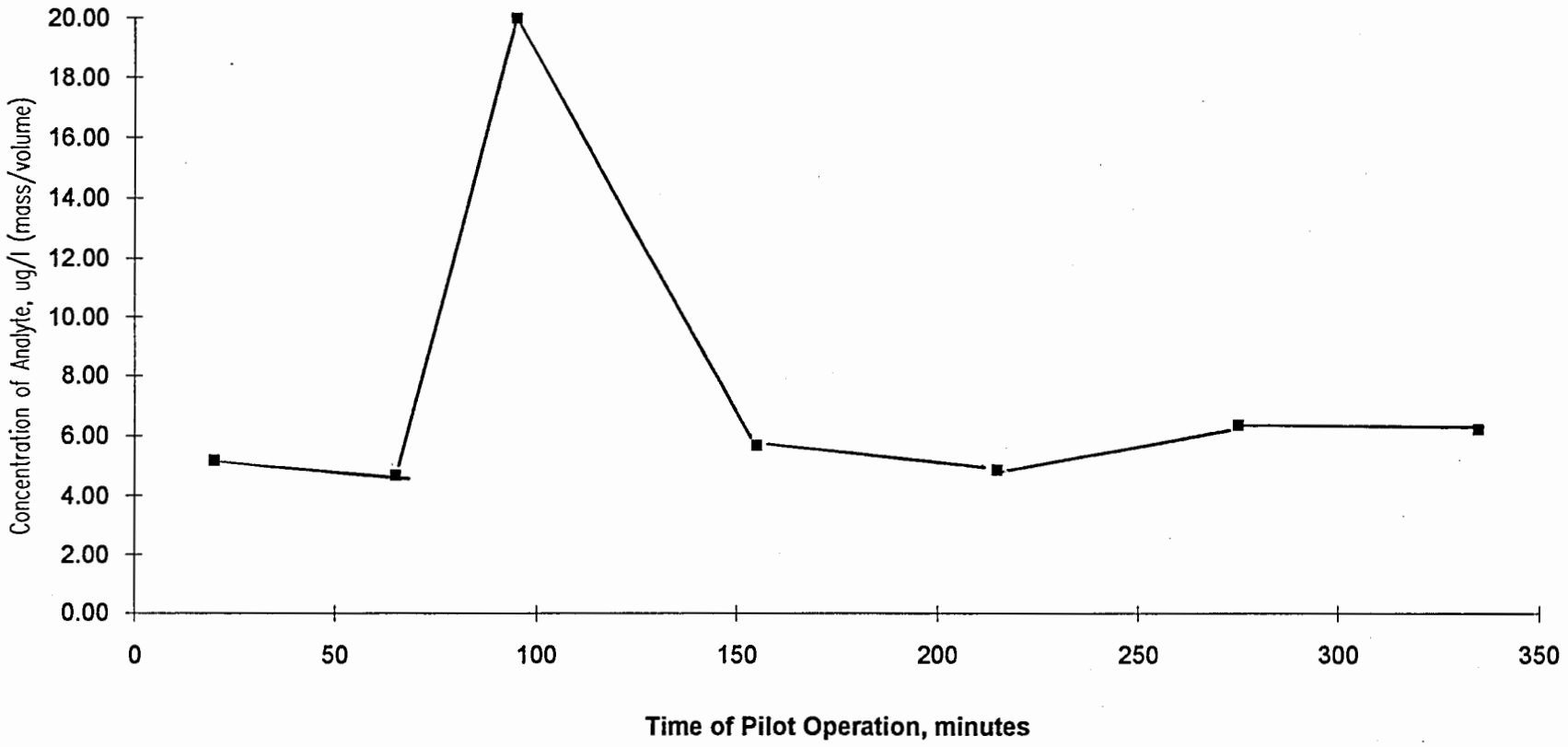
Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of Toluene Removal



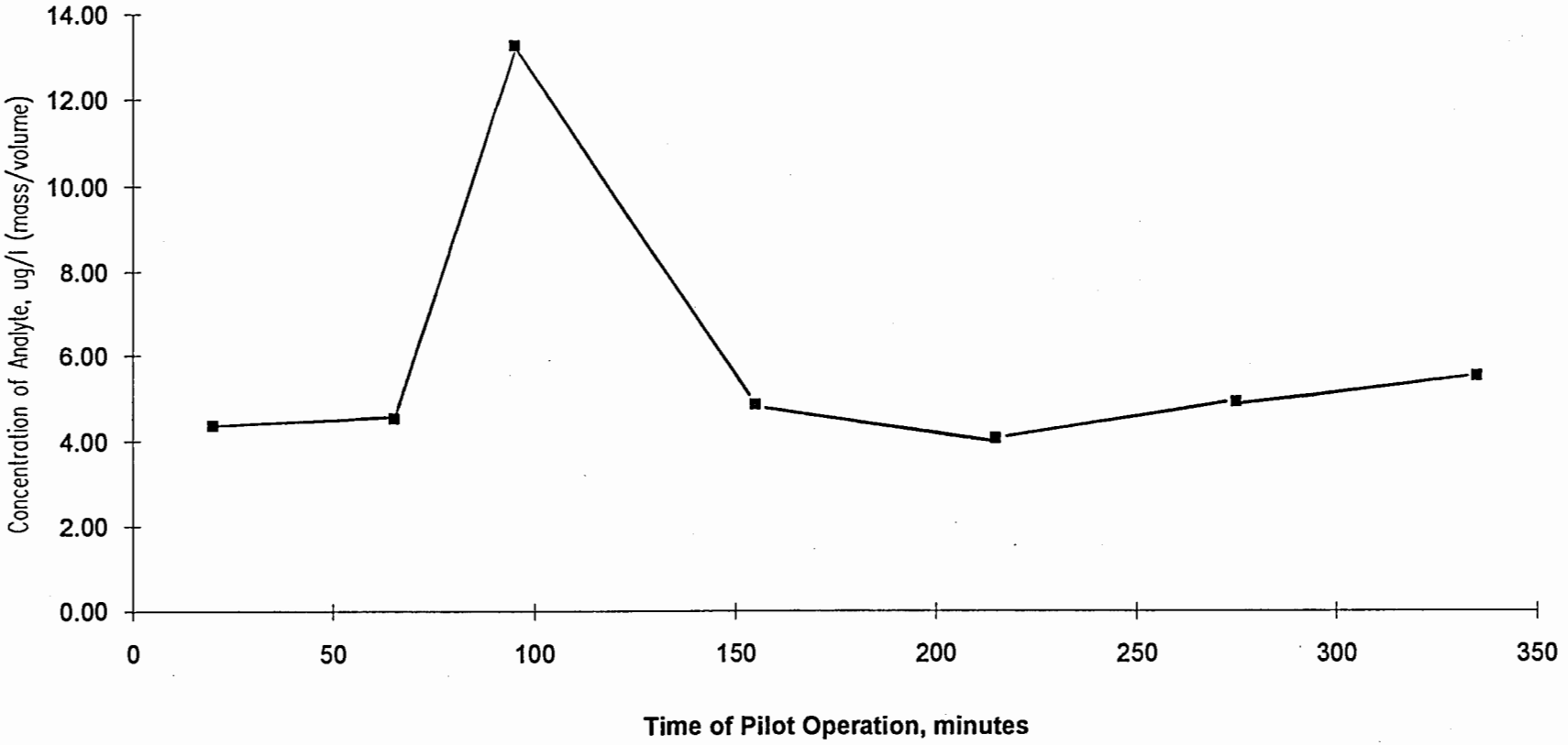
Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of Ethylbenzene Removal



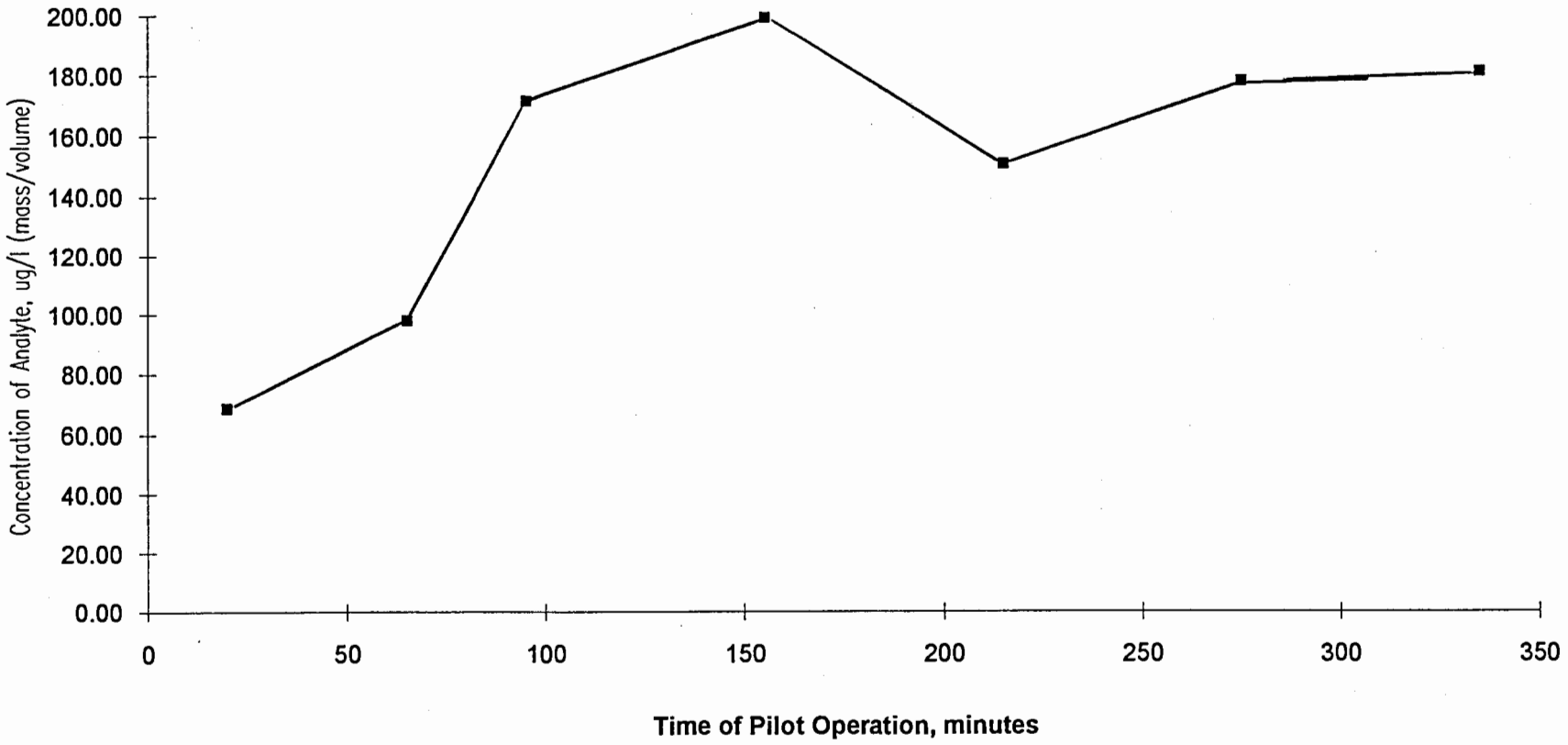
Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of m,p-Xylene Removal



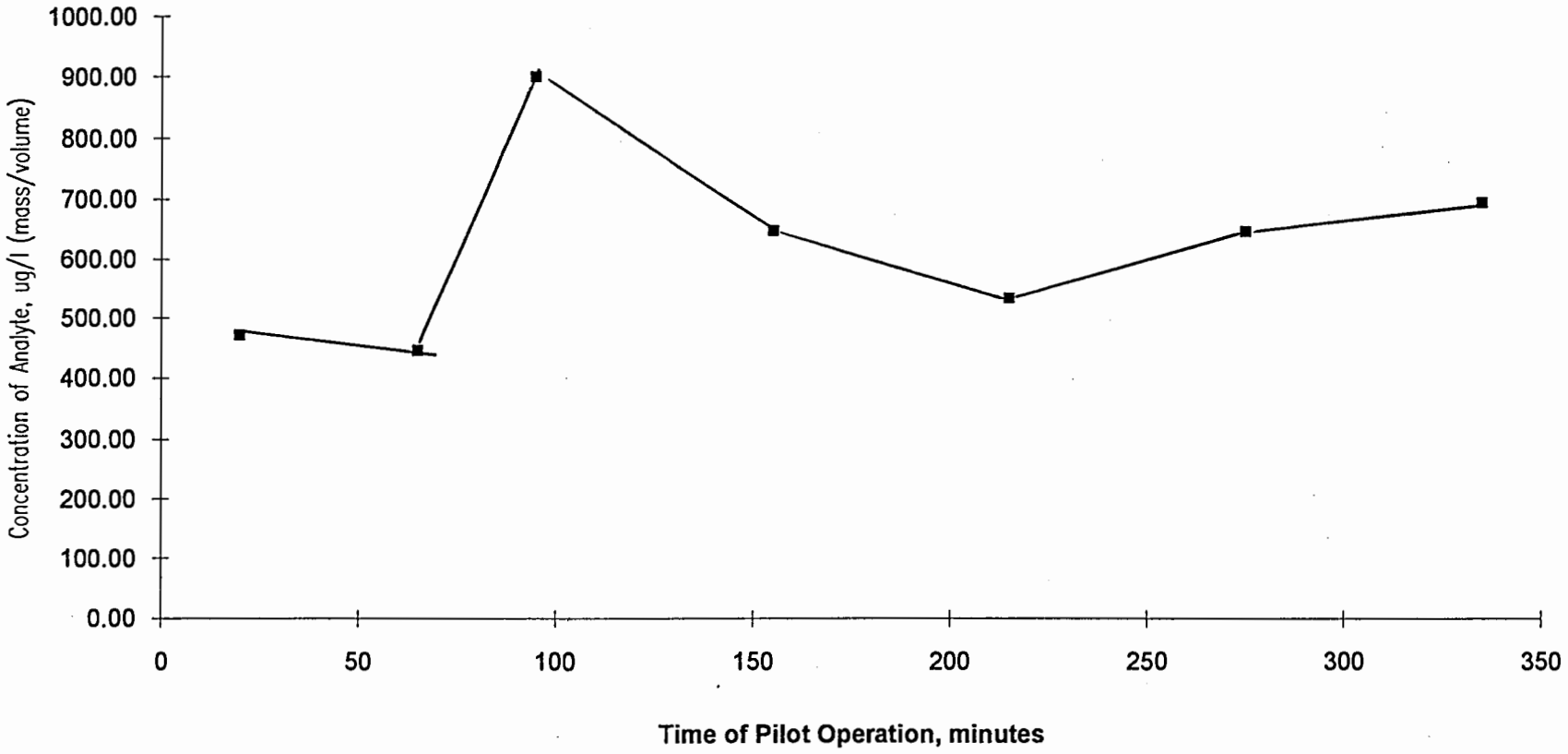
Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of o-Xylene Removal



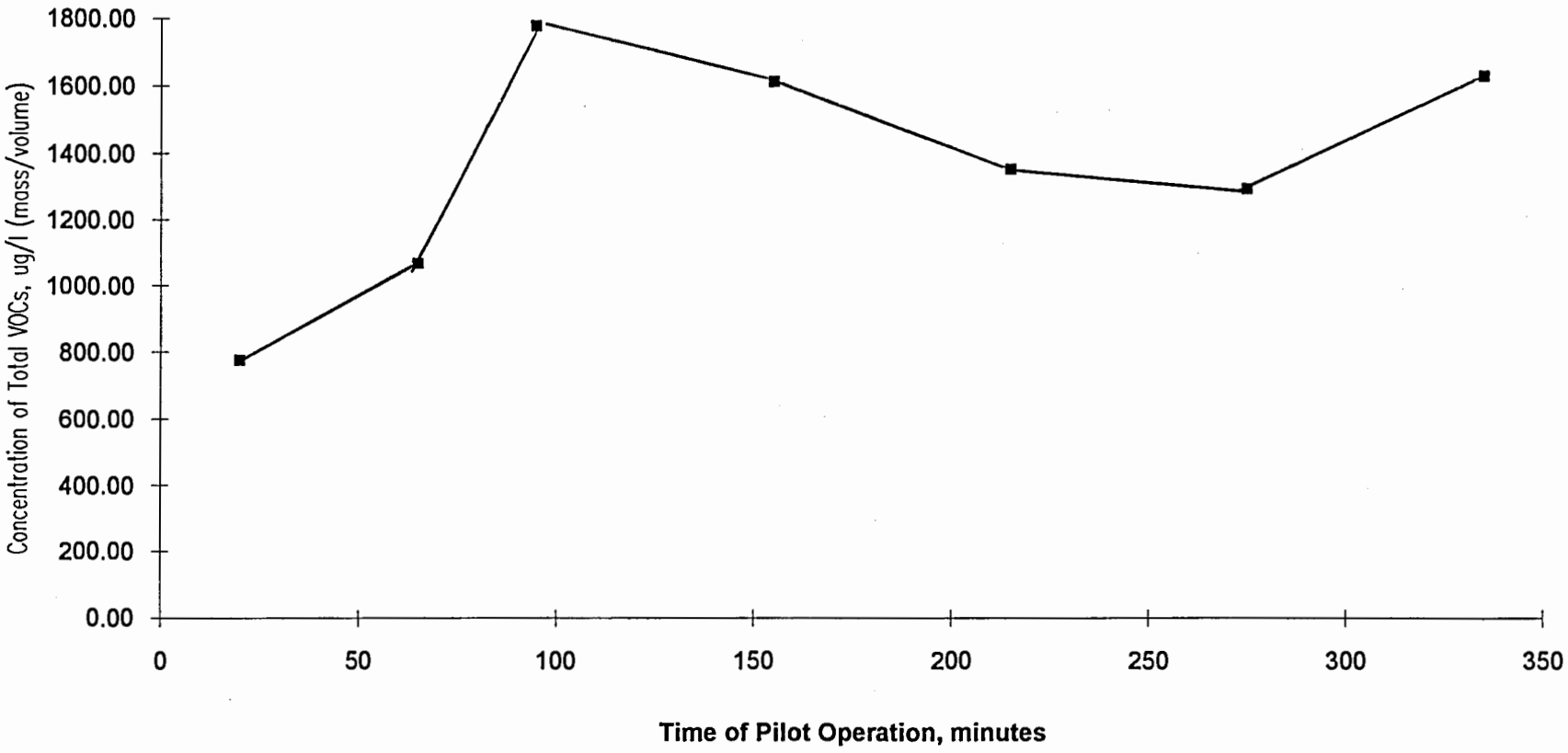
Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of Trichloroethylene Removal



Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of Other VOCs Removed



Triad Engineering SVE Pilot Study
Chrysler Plant, Kenosha, Wisconsin
Graph of Total VOCs Removed



ATTACHMENT 5-3

SVE PILOT TEST PHOTOGRAPHY LOG SHEETS

TRIAD FIELD PHOTOGRAPHY LOG SHEET

Project: **Chrysler Corporation,** Kenosha Wisconsin
Project No: W943324.3

Date: 10/5/94
Photo # 1

Photo Description: Photograph looking southeast. Extraction well in background, and observation wells, OP–1, OP–2, and OP–3.

Date: 10/5/94
Photo # 2

Photo Description: Photograph looking east. Extraction well with pipe connections and pump inside well. OP–1 is in the foreground.

TRIAD FIELD PHOTOGRAPHY LOG SHEET

Project: **Chrysler Corporation**
Kenosha, Wisconsin

Project No: W943324.3

Date: 10/5/94
Photo # 3

Photo Description: Photograph looking West. Air sampling equipment, vacuum pump, tedlar bags, desicator, copper tubing.

Date: 10/5/94
Photo # 4

Photo Description: Photograph looking north. Extraction well with pipe connections to blower. MW-45 is in the background.