17360
J. Quigley

results of . . .

Phase IV-A
Soil Vapor Pilot Study

for. . .

General Motors Corporation
CPC Group
Grand Rapids, Michigan

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20763

EDI Engineering & Science
Environmental Engineering, Geology, Biology and Chemistry
Grand Rapids, MI (616) 942-0970

INTRODUCTION

The Phase III-A Hydrogeological Investigation (March 1987) of the soils around column T-27 indicated TCE contamination of the soils over an area 200 feet in diameter. The deeper soils were more contaminated than near the surface. Because of the location of these soils beneath the plant floor near the center of the building, soil removal would be prohibitatively expensive. An alternative method to remove the TCE in the soils was sought as part of an overall plan to reduce the TCE source. Soil vapor venting offers an excellent potential for removing TCE from the approximately 20 feet of soils between the water table and the plant floor. The twelve inch thick concrete floor capped with two inch wood block was expected to force the soil vapors to be drawn horizontally from outside the contaminated zone to a centrally located vapor recovery well. Because basic data for the design of a system was not available, the Phase IV-A study was constructed as a pilot program.

THEORY

The TCE in the soils beneath the floor of the plant exists in three phases; residual liquids, molecules adsorbed onto soil particles, and as a gas in the soil vapor. The TCE entered the soil in the liquid form and trickled through the soils. The major movement of TCE in the soil was this liquid flow downward. The liquid will not disperse horizontally to any great extent, however multiple entry points through the floor may have created a wider zone of residual liquids in the soils. The residual liquids are the remnants of that downward flow held between the soil particles by surface tension. Any soil particle with which the liquid came in contact also adsorbed TCE. As a percentage, the TCE adsorbed on the soil particles is very small compared to the residual liquids.

Once the TCE is in the soil, another mechanism for movement of TCE is vaporization of the residual liquid and movement by molecular diffusion through the soil pore space. Compared with the rate of mass movement from the downward flow, molecular diffusion is very slow. (Over the time since the liquid has been in the soils molecular diffusion has moved TCE over 200 feet horizontally.) As the TCE in the soil vapor diffuses through the soil pore space, it encounters soil particles which have not been contaminated. The TCE molecules are adsorbed onto these soil particles due to molecular forces.

The equilibrium between the TCE adsorbed on the soil and in the pore space is not well known. However, the ratio is likely to be on the order of ten molecules on the soil for each molecule in

the soil vapor. Thus, the amount of TCE in a given volume of soil is predominantly adsorbed on the soil. The adsorption process is at least partially reversible, or possibly completely reversible.

When air is pulled through the soils to the soil vapor well, the equilibrium between the soil and vapor in the pore space is affected. Cleaner air is pulled into contact with the TCE adsorbed onto the soils. Some or all of the adsorbed TCE will revolatilize into the soil vapor. In the areas where TCE is present in vapor and adsorbed phases only (no residual liquids) the concentration in the soil should fall off relatively fast with continued flow of air through the soils. In addition, concentrations in the soil's pore space should not increase to prior levels when the soil vapor is left stationary for a period of time.

Air pulled through the areas containing residual liquids also changes the equilibrium between the residual liquid and vapor in the pore space, driving TCE into the vapor. The kinetics of the vaporization/diffusion process also influence the equilibrium, lowering the concentration. In these areas, the TCE concentration in the soil vapor should stabilize at a plateau because of a constant driving force from pure liquid to the vapor phase in the flowing air. When the soils are left undisturbed for a period of time, the concentration of TCE in the soil vapor should increase toward saturation of the vapor phase.

Note that when vapor samples are taken from the soil, what is actually being sampled is the soil's pore space. Therefore, a soil vapor sample in and of itself will not distinguish between residual TCE liquids or TCE molecules adsorbed on the soil particles.

3-DAY TESTS

PURPOSE

The purpose of the enhanced volatilization pilot test was to develop the necessary data to design a full scale system. The questions that were addressed in this pilot test were:

- How many air in-take wells are needed and their location.
- Optimum air flow rate.
- How the concentration of trichloroethylene (TCE) in the soils varied with air flow rate.
- What was the origin of the air flow through the soils.
- What effect will cycling the vacuum system (on and off) have on the concentration of TCE in the soils.

Note that the original scope of work was to evaluate the relative contribution of TCE from ambient plant air. However, because concentrations in the vacuum pump discharge were relatively high, and because TCE is no longer in use at the plant, this evaluation

would be more appropriate when a very low concentration in the vacuum pump discharge is evidenced.

DATA

Eight 1/2-inch probes (P1-P8) were installed at various distances and directions from the soil vapor recovery well as shown in Figure 1. The P1 sample depth is 10 feet below the floor. The other seven probes sample 15 feet below the floor. The soil vapor venting system is illustrated in Figure 2.

These three-day trial (#1, #2 and #3) runs of the system were completed at air flows of 38, 52 and 110 cubic feet per minute, respectively. After review of the data from these runs, an additional 30-day trial run at 110 cfm was completed. This additional trial run is discussed separately below. Table 1 summarizes the pump discharge data from all the trial runs. Table 2 summarizes the data from the 1/2-inch probes, P1-P8.

Appendix A contains the vacuum pressures that were collected at each of the 8 sample points, the recovery well, and the vacuum pump discharge for each of the runs. It also contains all the analytical data that was obtained for the vacuum pump discharge and the sample points. Two summaries begin the Appendix. The first summarizes the pressure and TCE concentration data. The second contains the data necessary to calculate the mass of TCE discharged per hour.

Calculations show that the approximate volume of air in the contaminated zone is 200,000 cubic feet (based on a 200' x 200' x 20' volume and a 25% void space). Run #1 evacuated approximately 157,000 cf of air, or approximately 3/4 of a pore volume. Run #2 evacuated approximately 217,000 cf of air, or approximately 1 pore volume. Run #3 evacuated approximately 448,000 cf or just over 2 pore volumes. Approximately four pore volumes were evacuated during the three week test.

Several graphs illustrate the data that was obtained during the three week pilot study at CPC:

Figure 3: TCE recovery (in lb/hr) vs. Time for run #1
Figure 4: TCE recovery (in lb/hr) vs. Time for run #2
Figure 5: TCE recovery (in lb/hr) vs. Time for run #3
Figure 6: Concentration in the pump discharge vs. cumulative run time
Figure 7: Concentration of TCE vs. Time for sample points 1,2,3 & 4
Figure 8: Concentration of TCE vs. Time for sample points 5,6,7 & 8

TABLE 1

CPC PILOT STUDY:
TCE MASS LOADING DATA

DATE	AIR FLOW (CFM)	TCE CONCENTRATION (MG/M^3)
9/8	38	1400
9/9	38	420
9/10	38	800
9/11	38	580
9/15	52	510
9/16	52	530
9/17	52	340
9/18	52	340
9/21	110	300
9/22	110	280
9/23	110	220
9/24	110	130
9/25	110	150
11/3	110	300
11/4	110	320
11/5	110	290
11/6	110	270
11/9	110	320
11/12	110	360
11/16	110	350
11/19	110	340
11/23	110	210
12/1	110	160

TABLE 2

CPC PILOT STUDY:
ANALYTICAL DATA BY SAMPLE POINT

TCE (mg/m^3)

SAMPLE POINT	*DATE* 9/8	9/15	9/18	9/21	9/24	11/3	12/1
P1	300	190	340	190	17	140	7
P2	760	440	310	410	110	300	50
P3	1100	580	550	580	220	520	140
P4	360	200	130	180	22	74	9
P5	260	96	17	14	7	27	4.6
P6	800	490	320	280	120	350	53
P7	840	340	190	130	27	260	16
P8	57	120	15	13	5	23	5
AVERAGE	560	307	234	225	66	212	36

OBSERVATIONS/DISCUSSION

The detection of a vacuum condition in a sample point indicates that air is moving from that area to the recovery well (the vacuum indicates a negative pressure gradient). As data in the appendix indicates, the effect of pulling a vacuum on the air recovery well was detected at all the sample points. (Note: even though a reading was not ***recorded*** for sample points 7 and 8 during the first two runs, there was a ***noticeable***, but not measurable, change in the pressure in these sample points.) As expected, when the airflow rate through the vacuum pump was increased, the pressure at each of the sample points decreased, indicating a greater air flow from that region.

It is important to note that for a majority of the test, the wells that were designated air intake wells (87-1, 87-2, 87-3 and 87-5) were ***not*** open. These wells were opened for the last day of the study to determine what effect they would have on the pressure in the sample points. The opening of these wells ***did not*** affect the pressure in the sample points, indicating that they were not necessary to supply air to the recovery well. The recovery well is drawing air from outside the contaminated area through the contaminated soils to the well. No additional recovery wells are required.

There was a potential that air was short circuiting the soils and travelling through a space between the plant floor and settled soils. (The plant floor was constructed on pilings. The backfilled soils could have settled, forming a headspace.) However, because negative pressures were evidenced in all the sample points (which were at 10' and 15' below grade) at least a portion of the air was moving through the soils at those levels.

An attempt was made to detect and/or measure the air flow rate into the sample points. A smoke source was placed near the inlet of the sample points to allow the detection of air flow. This test did not indicate air flow into the sample points. This seems consistent with the small pressure differences from ambient recorded in the sample points.

Figure 3 illustrates the recovery rate of TCE (in lb/hr) verses time of operation for Run #1 (38 ACFM). As expected, the first data point on this graph is relatively high due to the fact that the vapor in the pore space has had an indefinite period of time to equilibrate. After approximately 30 hours of operation, the recovery rate had decreased as expected. However, it appears that this second data point is artificially low when compared with the recovery rate determined at 50 hours of operation. If the 30 hour data point is excluded from the graph, a steady, more logical, decrease in the recovery rate is evidenced.

Figures 4 and 5 illustrate the recovery rate of TCE for Run #2 (52 ACFM) and Run #3 (110 ACFM). The data presented in these figures indicates a steady decrease in the recovery rate as expected. It is significant to note that the recovery rate for both air flows follows approximately

the same curve; i.e. the recovery rate for an air flow of 110 ACFM is not significantly higher than at an air flow of 50 ACFM.

Figure 6 illustrates the concentration of TCE in the vacuum pump discharge (and hence the concentration of air drawn from the recovery well) versus cumulative run time. As shown in this graph, there was a steady decline in the concentration during the course of the study. It is significant to note two things from this graph:

- The concentration did not appear to level out with time, it was still decreasing when the study was terminated.

- The concentration of TCE in the recovery well did not increase when the system was shut down for a short period between runs. This indicates that from an operating standpoint, it is probably more practical to leave the system operational, than to cycle it on and off. If the system were to be cycled, it would have to be shut down for a period greater than three days.

Figures 7 and 8 illustrate the concentration in the sample points verses sample date. The 9/08 sample was taken at the commencement of the study. The 9/15 and 9/21 samples were taken just prior to the start of Run #2 and Run #3 respectively. After Run #2 and Run #3 were completed, the 9/18 and 9/24 samples were taken respectively.

As Figure 7 illustrates, there was a decrease in concentration of sample points 1-4 during Run #1. This drastic reduction was due to the initial removal of the soil vapor that was saturated with TCE.

The 9/18 sample from P1 appears to be an anomaly. However, because during the "rest period" between runs #2 and #3 the concentration decreased to 200 mg/m^3 (where it was at the beginning of run #2, which follows the pattern of the other sample points in its vicinity), it is logical to conclude that this data point is errant.

Figure 7 also illustrates that the concentration in sample points 3 and 4 did not change significantly during run #2. The fact that the concentration in these sample points did not significantly change is probably due to residual liquids in the area. At the 50 ACFM flow rate, the air moving through the soil had enough time to equilibrate with the residual liquids, and therefore the concentration of the vapors in the soil ***apparently*** stayed the same (even though TCE was removed). However, when the flow rate was increased to 100 ACFM, the residual liquids did not equilibrate with the air, and therefore the concentration apparently decreased.

A further indication that there are residual liquids in this area is the concentration profile of sample point #2. The fact that the concentration at this point significantly increased during the "rest period" indicates that there is a source of TCE in the area. We predict that if the sample points were sampled again (after a longer rest period), the concentration at sample points 1-4 would be close to those seen during run #2. If this in fact happens, this would indicate that there are residual liquids in these areas.

Figure 8 indicates that there was a continual decrease in concentration in sample points 5-8 ***during*** runs 1, 2 and 3. This is an indication that there are no residual liquids in the soils at these locations. If residual liquids were present in these areas, the expected curve would be similar to that for sample points 1-4; no decrease during Run #2.

CONCLUSIONS

The initial three-day trials of this pilot study answered critical questions such as:

- Air intake wells are not necessary due to the porosity of the soils. The fact that negative pressures were evidenced in all the sample points indicates that air was moving through all areas. No additional recovery wells are required.

- The concentration of TCE in the soils, or at least in the soil vapor space, did decrease at the 100 ACFM air flow rate.

- During the 50 ACFM test, the concentrations in sample points 3 and 4 did not decrease possibly due to residual liquids in the area. This indicates that 50 ACFM would be the ***minimum*** air flow that should be used, because at this flow rate, the air in the pore space and TCE in or on the soils were in approximate equilibrium. If a flow rate less than 50 ACFM was used, the expected concentration of the soil vapor would be approximately equal to that evidenced at the 50 ACFM flow rate because the vapors for both flow rates would be at equilibrium; therefore the recovery rate in lb/hr would be lower due to the lower flow rate.

- When all factors are considered (concentration, potential of air controls, length of cleanup time), 50 ACFM may not be the ***optimum*** operating flow rate. At this time there is not sufficient information to optimize the long-term operating flow rate.

- The ultimate origin of the air flow through the soils was not determined in this study. There was however, air flow through the lower portion of the soils (10-15' below grade) because a negative pressure was evidenced during the tests at all the sampling points.

- Cycling of the system (on and off) had no apparent affect on the recovery rate or the concentration of the vacuum pump discharge. The only sample point which it affected was #2. This was probably due to the volatilization of residual liquids in that area. A longer "rest period" should allow the concentrations in the other sample points to also increase.

The following questions remained at the conclusion of the three short-duration pilot tests:

- What is the optimum air flow when the possibility that air controls will be required is considered? This question will be answered by air modeling of the discharge using differing concentration and flow rates. Preliminary estimates from the air quality model indicate that the effects of increasing the air flow from 50-100 cfm at the same discharge concentration will not be drastic. Increased air flow with the same pounds/hour rate will not significantly affect the modeled property line conditions. Estimated discharge for this run is 0.10 lb/hr or less. The estimate for previous runs was 0.15 lb/hr.

- Will there be an "asymptotic" recovery rate be for this system? The recovery rate in all the runs was continuing to decline, i.e. it never reached an asymptotic value. If the recovery rate during a longer run time levels off to a constant value, this would indicate the presence of residual liquids in the soils. If the recovery rate does not level off, but continues to decline, this would indicate there is not a significant amount of residual liquids in the soils, but the TCE is desorbing from the soil particles.

- What effect will blinding off an upper portion of the screen have on the recovery rate? Since TCE vapor is heavier than air, and therefore should settle, the expected recovery rate should increase if the dilution air is limited by blinding off the upper portion of the screen. Blinding off a portion of the screen may decrease the time of clean-up required, and therefore should be investigated.

- What is the length of the cleanup time?

30-DAY TEST

PURPOSE

Because of the questions that remained following the three short-duration pilot tests, an additional 30-day test period was executed.

The air extraction rate for the 30-day pilot test was set at approximately 110 ACFM (the maximum capacity of the vacuum pump). The recovery well was modified slightly by blanking off the top 10 feet of the screen. Soil vapor was extracted only from the lower 10 feet of the recovery well.

DATA

Data obtained during this study phase is contained in Appendix A and summarized in Tables 1 and 2.

Several graphs illustrate the data that was obtained during the 30-day run.

Figure 9: TCE Recovery (in LB/HR) vs. Time
Figure 10: TCE Concentration vs. Cumulative Run Time
Figure 11: TCE Concentration vs. Sample Points 1-4
Figure 12: TCE Concentration vs. Sample Points 5-8

Figures 10, 11 and 12 combine data that was obtained in the 30-day test with the data that was collected in the first three short-duration runs.

OBSERVATIONS/DISCUSSIONS

As Figure 9 indicates, the recovery rate of TCE was fairly constant at 0.13-0.14 lb/hr. for the first 200 hours (two weeks) of the test. However, during the last two weeks of operation, the lb/hr of TCE discharged, and therefore the lb/hr. of TCE removed, decreased.

Based on the results of the first three short-duration tests, a gradual decrease in concentration over the entire length of the pilot study was expected (assuming that all variables remained constant). Over a given area, the concentration of TCE should be greater closer to the water table because the TCE liquids would tend to spread out slightly as they descended through the soils, and because of diffusion of the whole vadose zone, a gradual decrease in the concentration should be expected because the upper portion of the soils would rapidly clean up and then provide relatively clean dilution air. If only the lower portion of the vadose zone is screened, it

should take a greater period of time to see a decline in concentration because the upper portion of the soils does not provide clean dilution air.

This is graphically illustrated by comparing Figures 6 and 9. Figure 6 indicates that there was a continual decrease in TCE concentration during the study. This is in contrast to Figure 9 where the concentration was constant for a period of time, then it started to decrease. As indicated by this comparison, in order to optimize the recovery of TCE, the upper portion of the screen should be blanked off to prevent "dilution air" from entering the system through relatively "clean" soils.

Figure 10 compares the recovery rate during the 30-day test with the recovery rates in the three short-duration tests. As indicated in this figure, the concentration at the end of both runs was approximately 150 mg/m^3 and still declining. Therefore, at this time, it is not possible to predict if there will be an asymtotic concentration or if the concentration will continue to decline. This factor also limits the ability to predict what the length of clean-up time will be.

Figures 11 and 12 illustrate the TCE concentration in the eight sample points. The November 3, 1987 samples were taken just prior to the commencement of the 30-day test. The December 1, 1987 samples were taken just after the end of the 30-day test. As indicated in these figures, the TCE concentration in all the sample points increased during the five-week rest period.

Even though the concentration in the sample points increased, the value of cycling the system at some rate (one month on, one month off) is questionable. As in any equilibrium process, the greater the driving force, the greater the removal. In this case, if the system is allowed to remain at rest, it is decreasing the driving force for removing the TCE from the soils by eliminating the "fresh air flush". The TCE will still vaporize and desorb from the soils, but as the air in the soils becomes more and more concentrated, the driving force decreases. If the air in the soils is continually replaced with "fresh" air, then the driving force will remain constant at a relatively higher rate. Due to this fact, it is anticipated that TCE recovery for a continuously versus cycling the system are approximately the same (the costs of operating a 5 hp motor),and there is little or no value in cycling the system.

The drastic increases in TCE concentration found at the start of the 30-day test,in sample points 1, 2, 3, 4, 6, and 7 indicate that there may be residual liquids in these areas. In most cases, the TCE concentration in the sample point increased to where it was prior to the commencement of run #2. As was previously indicated, this is probably due to the presence of residual TCE liquids in the soils.

CONCLUSIONS

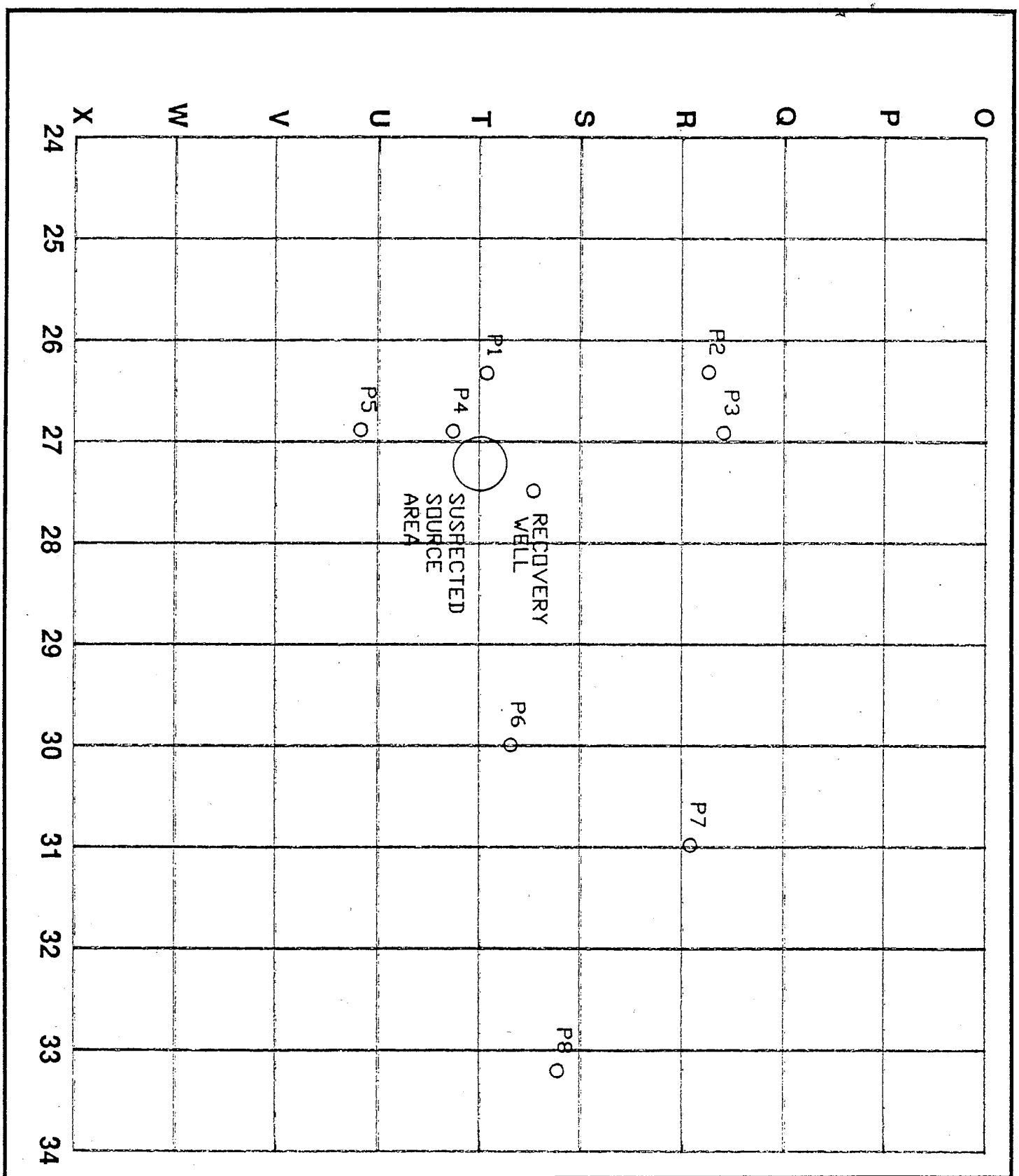
The following conclusions can be drawn from the work that has been accomplished:

- The upper portion of the screen should remain blanked off to enhance TCE recovery.

- The 100 cfm air flow is sufficient for removing the TCE from the soils. There is no apparently economic advantage for increasing the air flow to anything greater than 100 cfm.

- Available data does not allow the prodiction of what an asymtotic concentration will be, and therefore, what the life of the clean-up will be.

- Sufficient data is available to prepare a "Permit to Install" application to the Air Quality Division of the MDNR and, based on the expected concentrations at the property lines, to propose operation of the system without air controls.



SCALE 1" = 50'

Figure 1

Soil Vapor Probe Location

General Motors Corp./CPC Group
Grand Rapids, Michigan

August, 1988 20763

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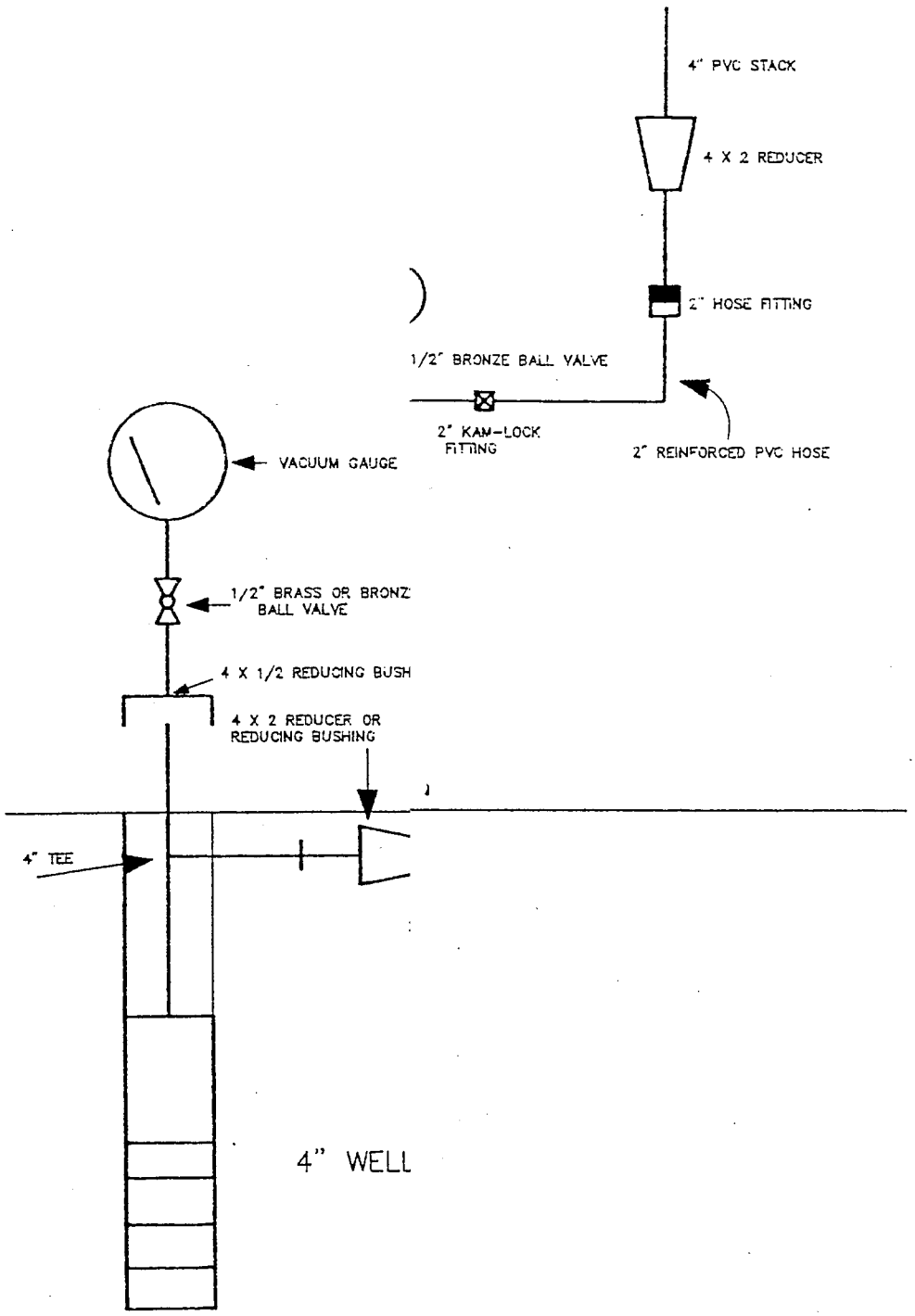


FIGURE 2
CPC - GRAND RAPIDS PLANT
SOIL VACUUM SYSTEM SCHEMATIC

20673 AUGUST, 1988

DATE 08/22/88
PROJECT NO. 20673
SHEET NO.

Figure 3

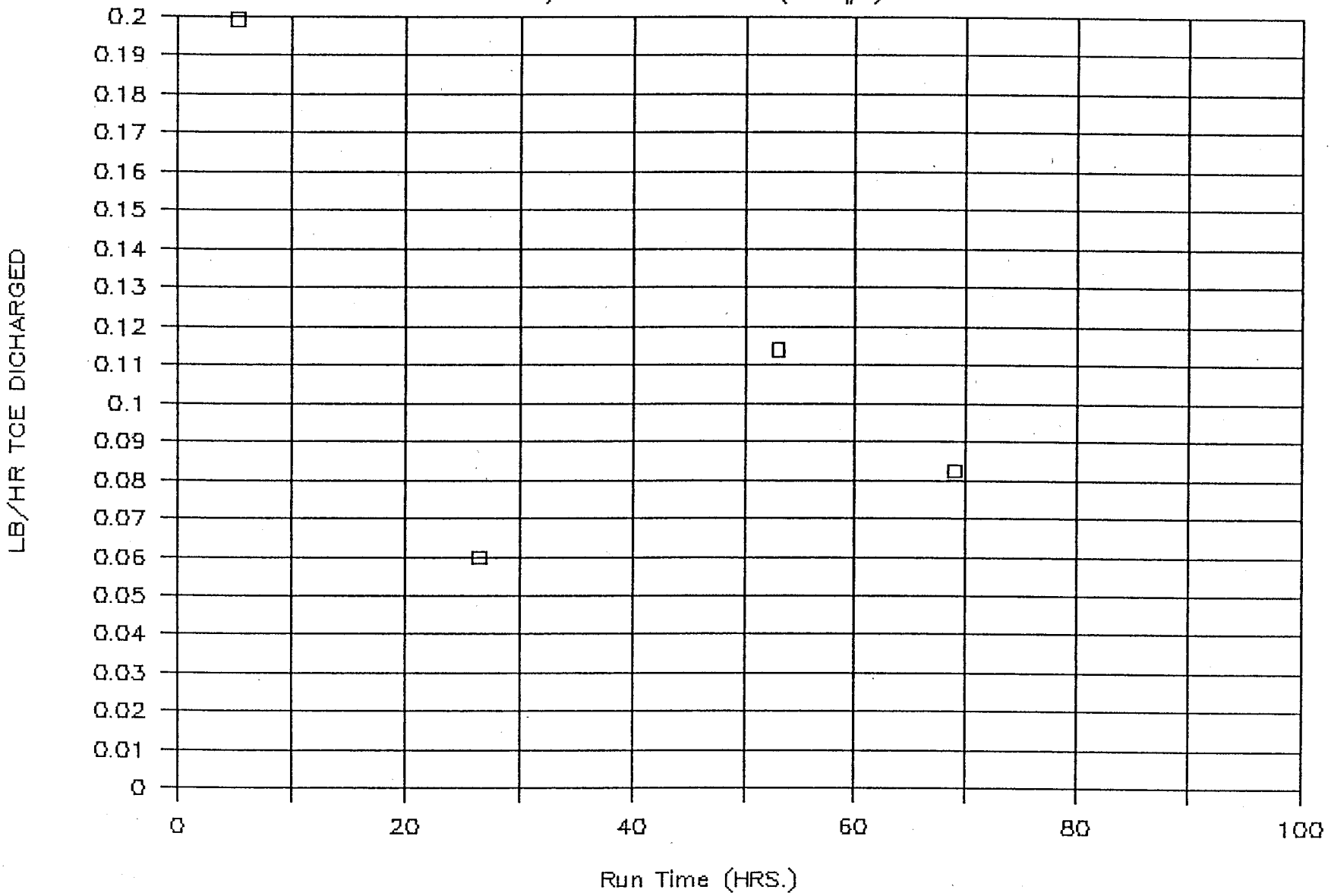

LB/HR vs. RUN TIME (Run #1)
LB/HR TCE DICHARGED
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
Run Time (HRS.)

Figure 4

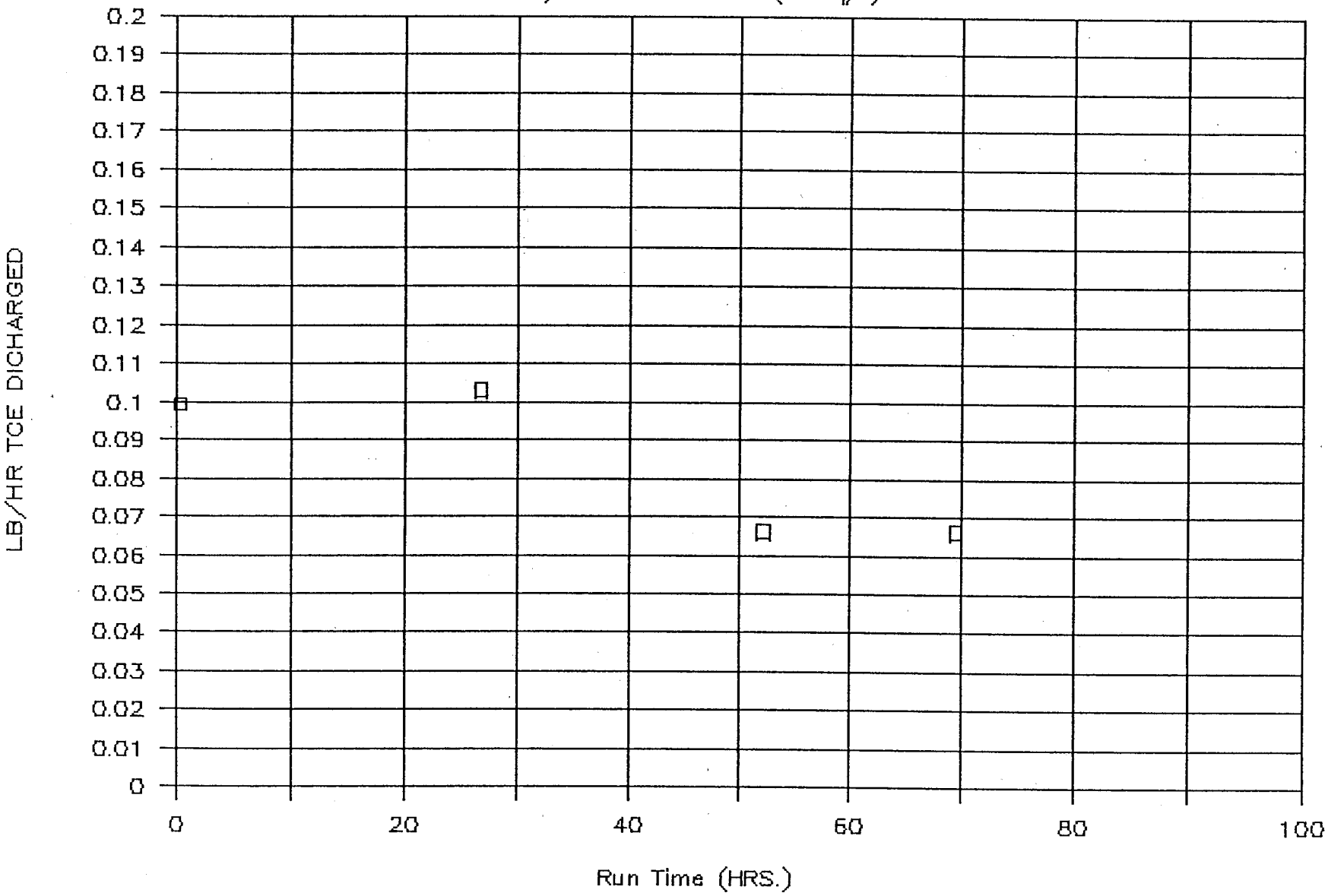

LB/HR vs. RUN TIME (Run #2)
LB/HR TCE DICHARGED
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
Run Time (HRS.)

Figure 5

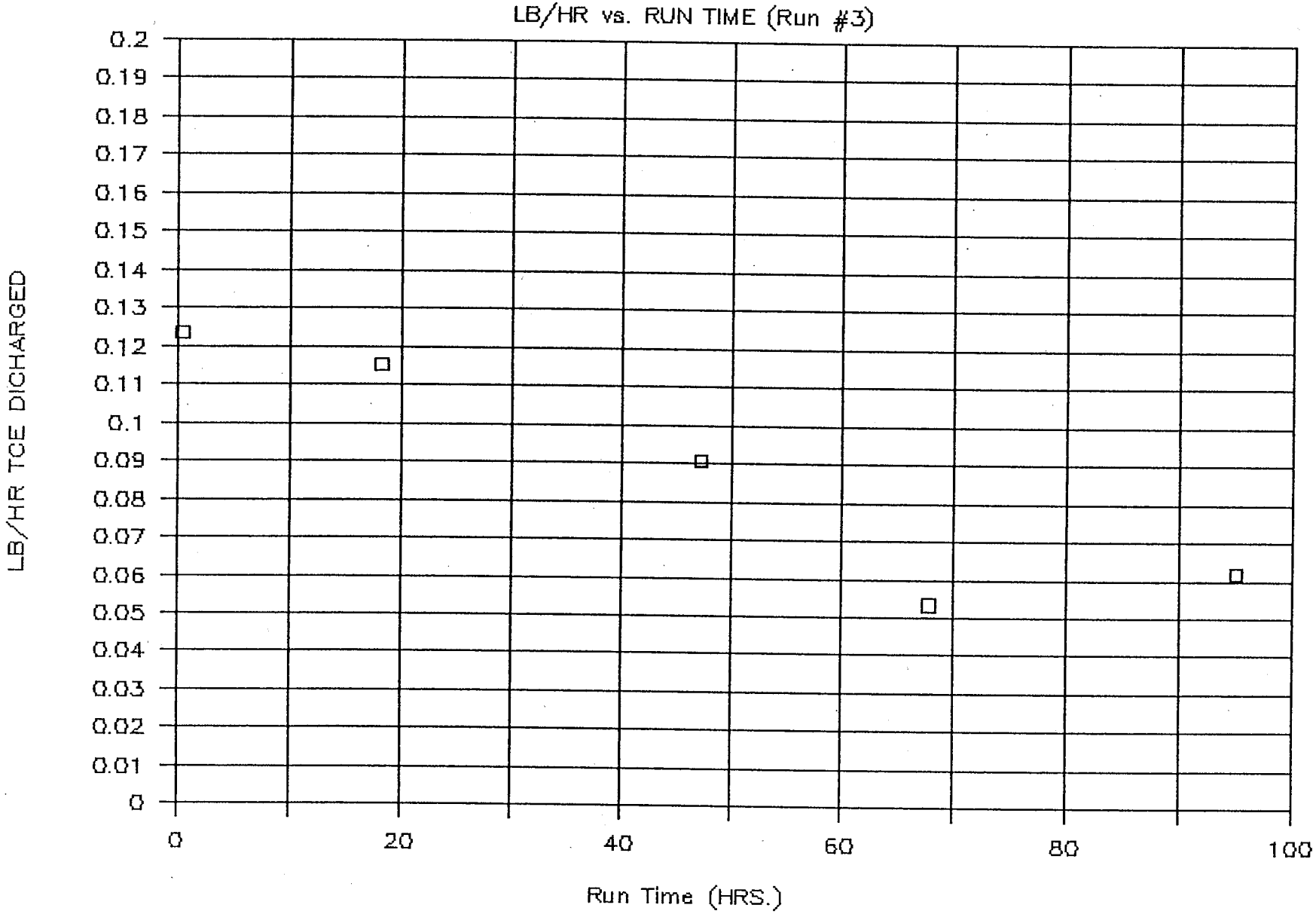

LB/HR vs. RUN TIME (Run #3)
LB/HR TCE DICHARGED
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
Run Time (HRS.)

Figure 6

CONCENTRATION vs. CUMULATIVE RUN TIME

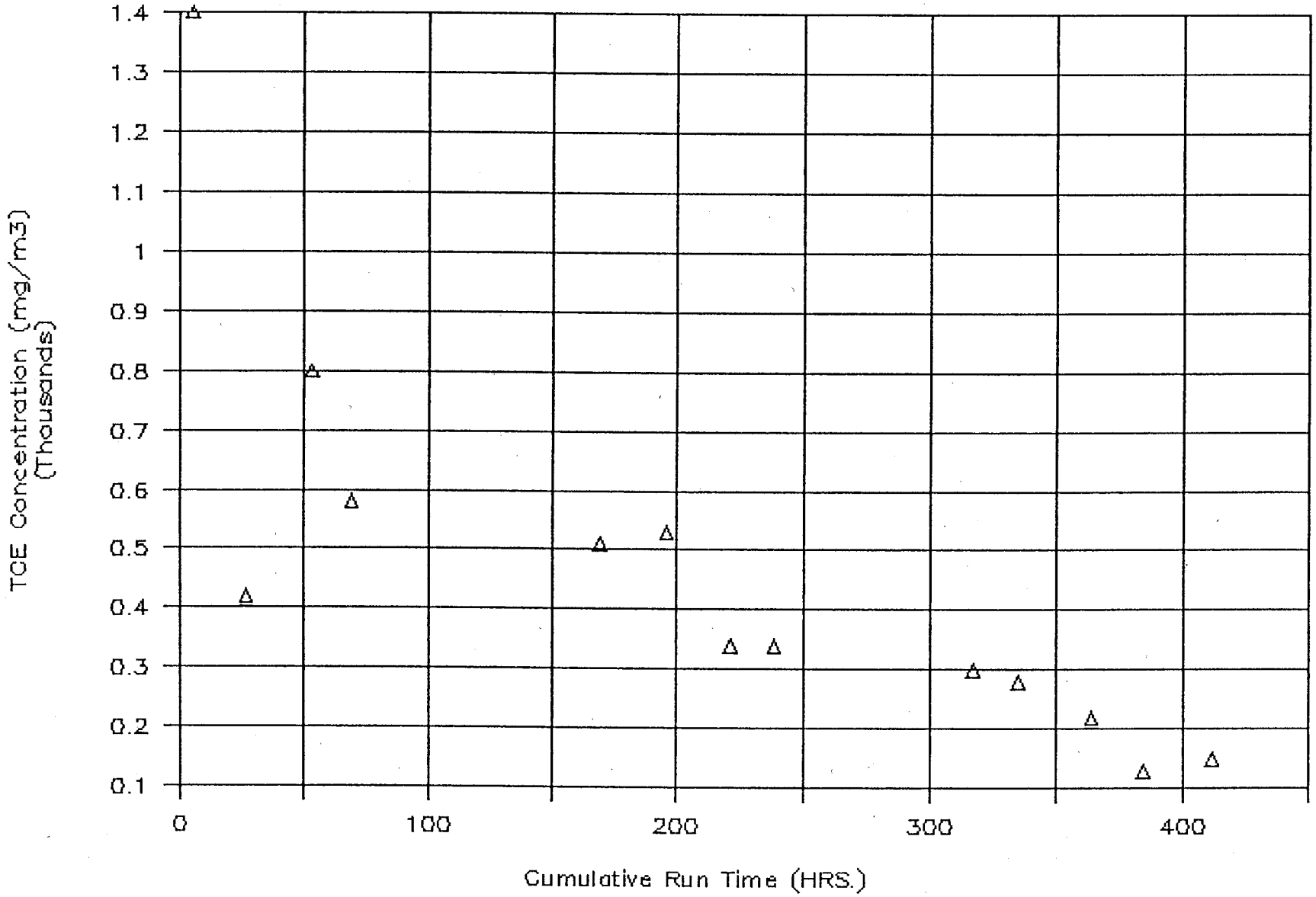


Figure 7

Concentration vs. Sample Point 1,2,3,4

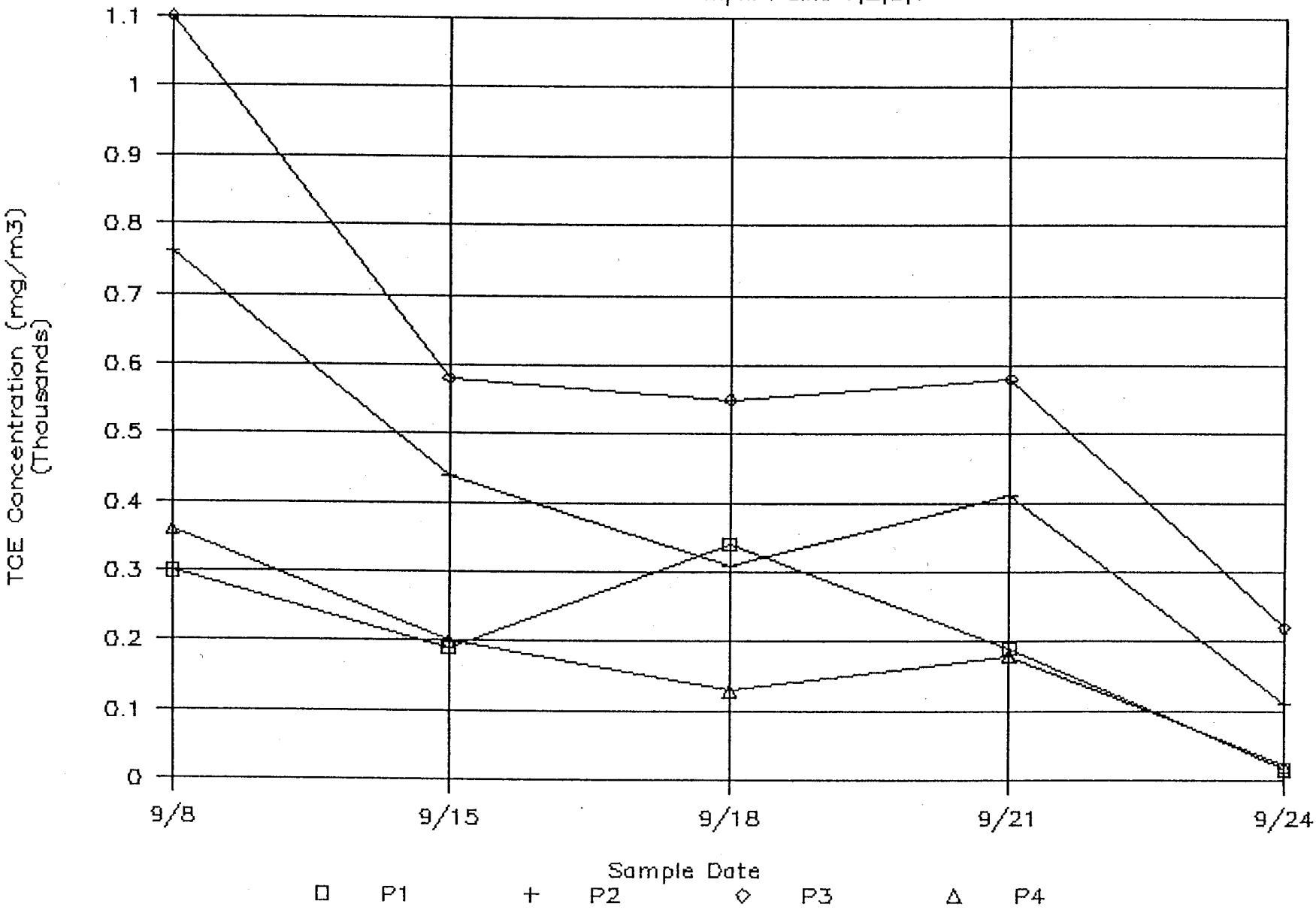


Figure 8

Concentration vs. Sample Point 5,6,7,8

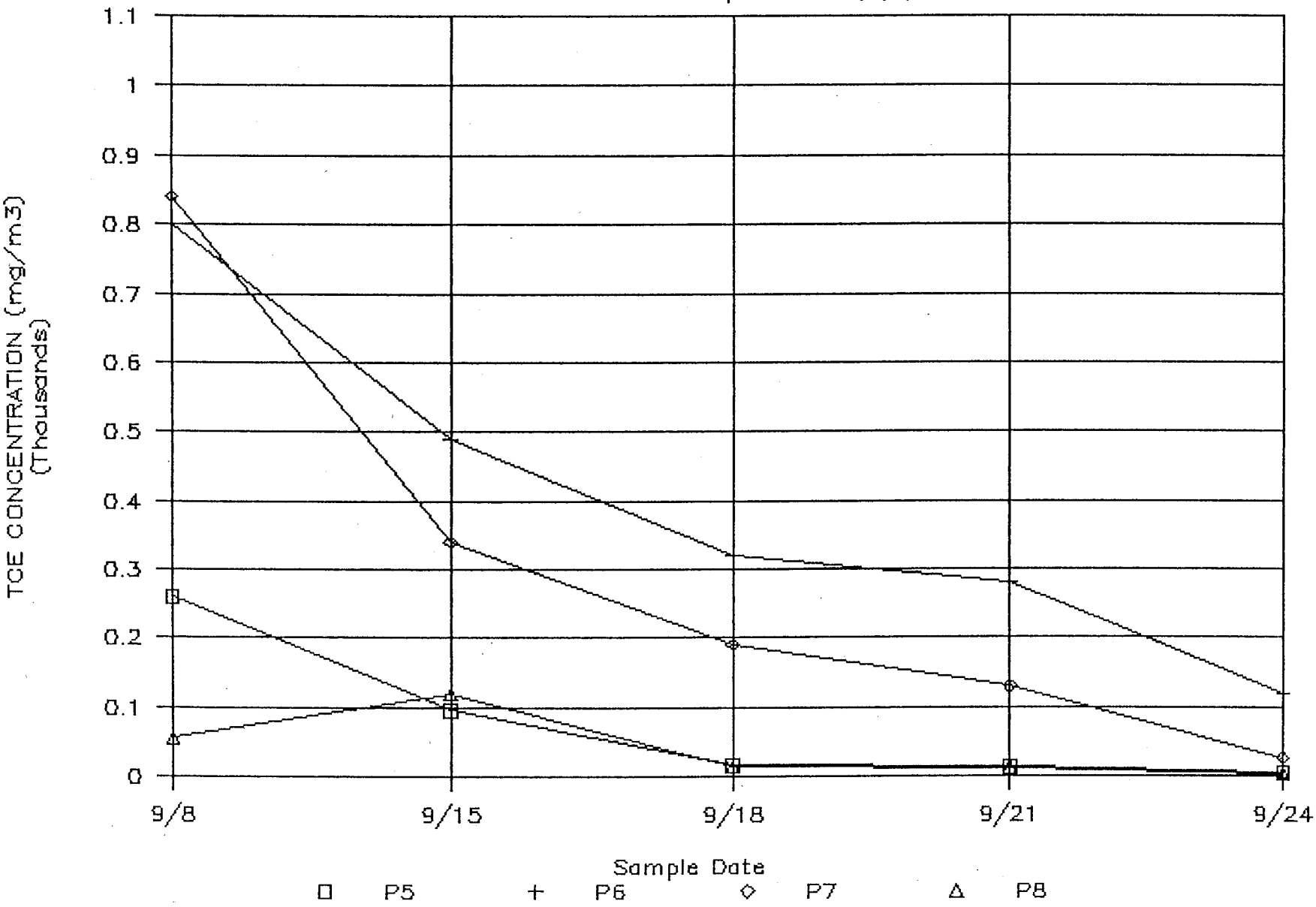


Figure 9

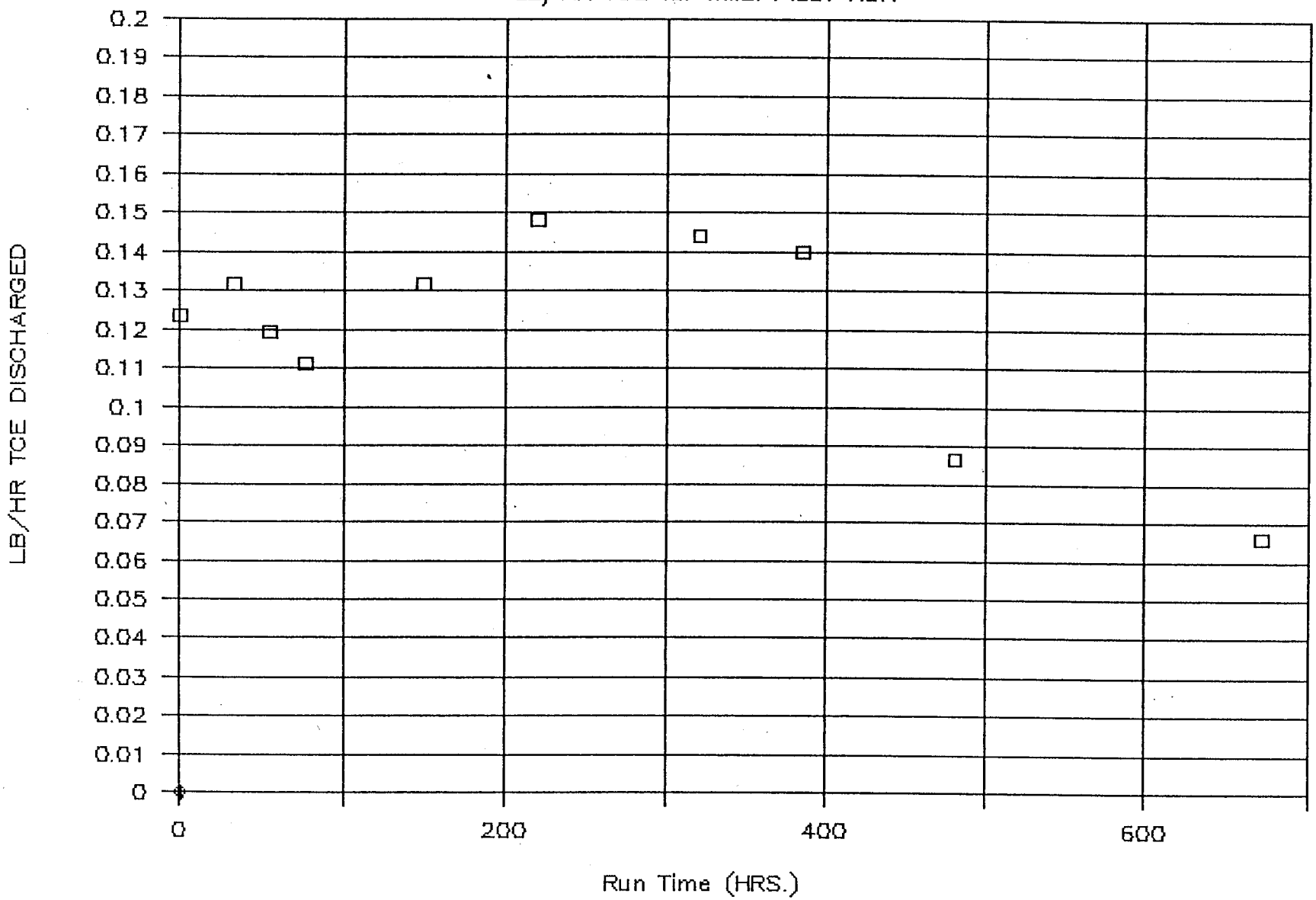

LB/HR TCE vs. TIME: PILOT RUN
LB/HR TCE DISCHARGED
0.2
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
200
400
600
Run Time (HRS.)

Figure 10

TCE CONC. vs CUMULATIVE RUN TIME

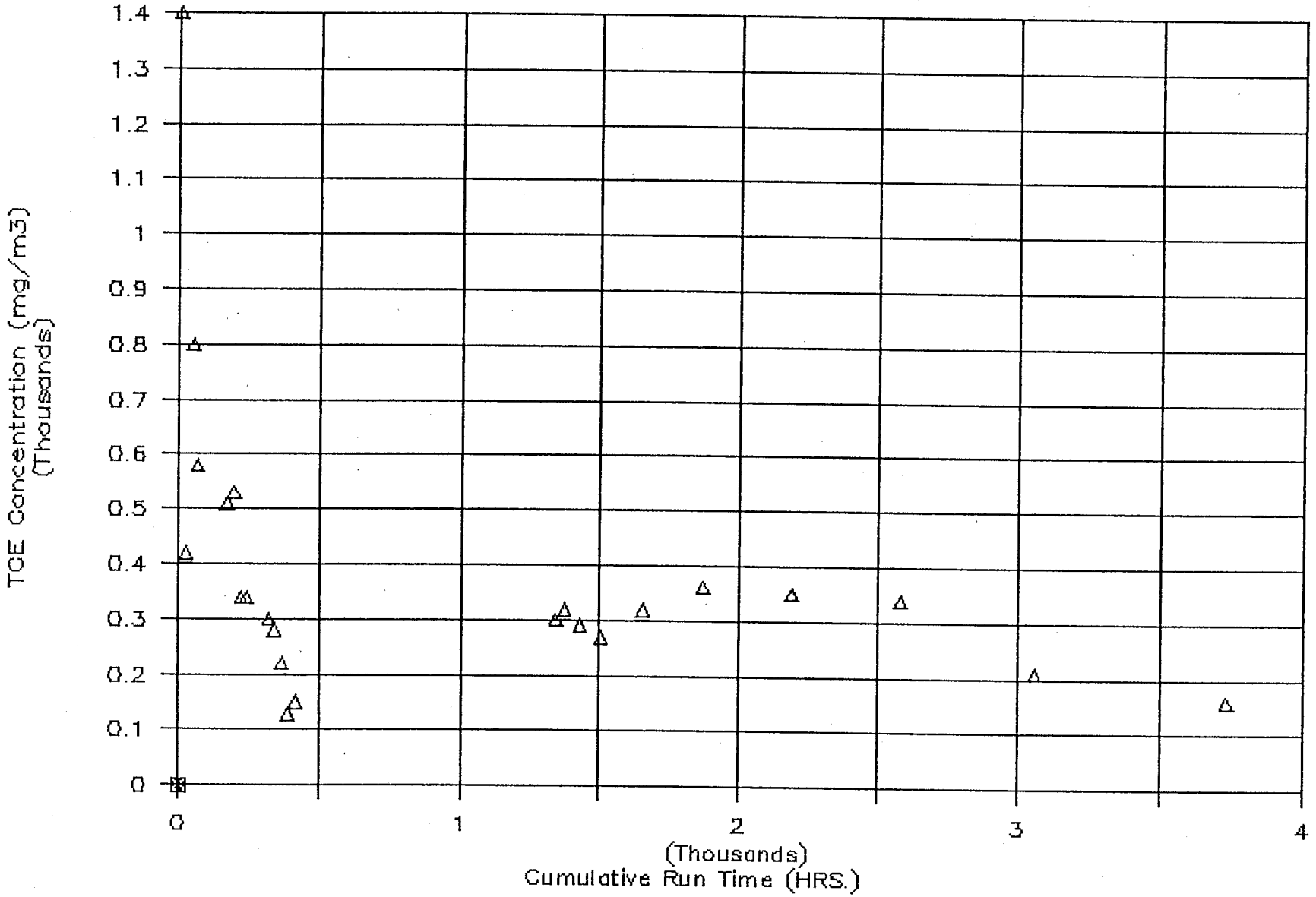


Figure 11

Concentration vs. Sample Point 1,2,3,4

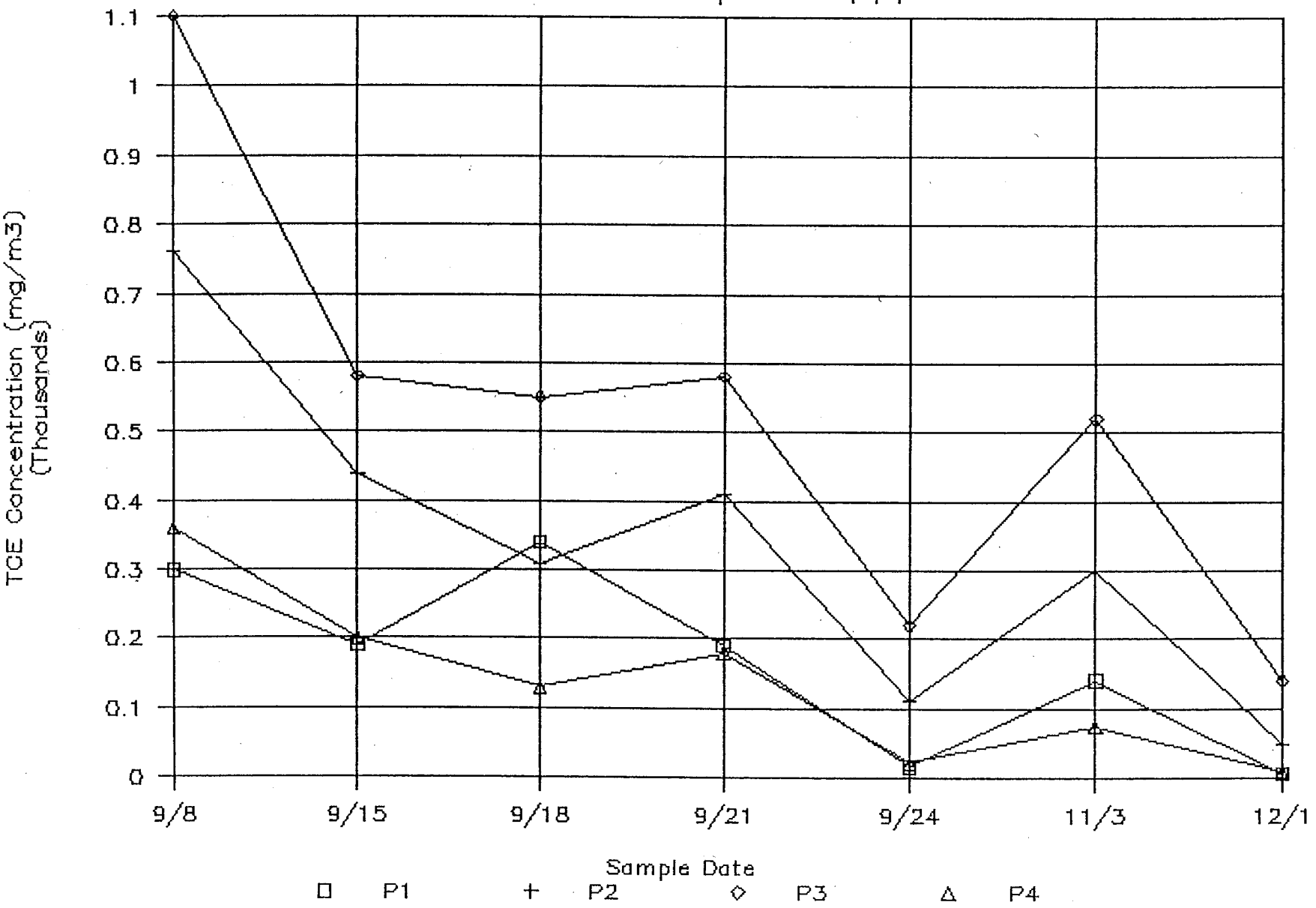
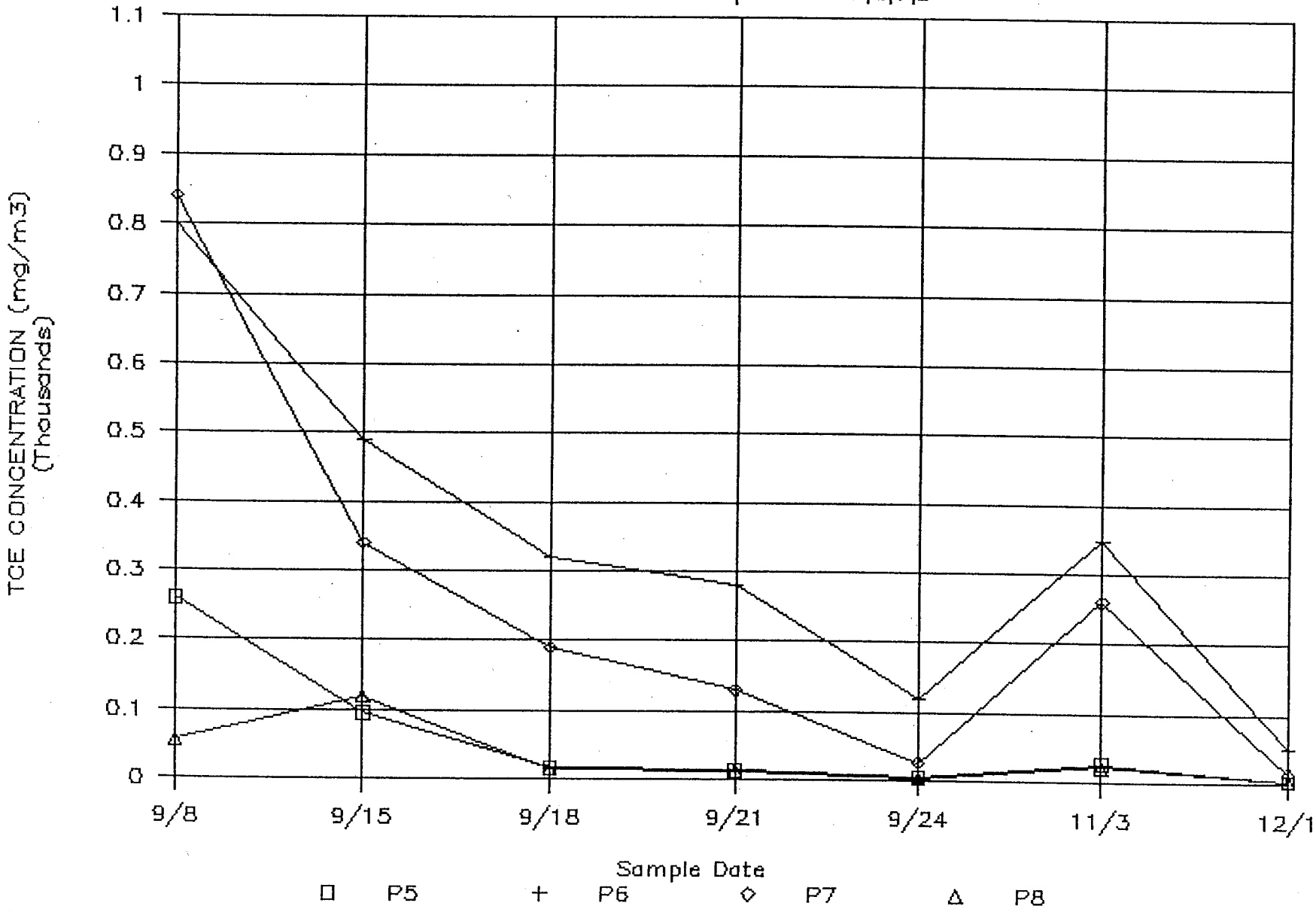


Figure 12

Concentration vs. Sample Point 5,6,7,8



CPC SOIL VAPOR STUDY DATA

RUN #1 : 38 ACFM flow rate

	9/8		9/9		9/10		9/11	
	11-4 p.m.		1:30 p.m.		4 p.m.		8:30 a.m.	
	Temp. = 96'F		Temp. = 110'F		Temp. = 110'F		Temp. = 96'F	
	Flow = 38 ACFM		Flow = 38 ACFM		Flow = 38 ACFM		Flow = 38 ACFM	
Sample Location	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)
Pump Discharge		1400		420		800		580
Well Head	1.1		1		1		1	
P1	0.16	300	0.16		0.16		0.16	
P2	0.16	760	0.16		--		0.16	
P3	0.16	1100	0.16		0.16		0.16	
P4	0.16	360	0.16		0.16		0.16	
P5	0.1	260	0.1		0.1		0.16	
P6	0.1	800	0.1		0.1		0.1	
P7	0	840	0.1		0.1		0.1	
P8	0	57	0		0		0.1	

		560						

RUN #2 : 52 ACFM flow rate

	9/15		9/16		9/17		9/18	
	12-2 p.m.		2-4 p.m.		4 p.m.		8:30 a.m.	
	Temp. = 89'F		Temp. = 82'F		Temp. = 89'F		Temp. = 96'F	
	Flow = 50 ACFM		Flow = 52 ACFM		Flow = 54 ACFM		Flow = 52 ACFM	
Sample Location	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)	Pressure (" WC)	Conc. (mg/m3)
Pump Discharge		510		530		340		340
Well Head	1.6		1.65		1.7		1.75	
P1	0.1	190	0.1		0.1		0.2	340
P2	--	440	0.1		0.15		0.15	310
P3	0.25	580	0.15		0.17		0.2	550
P4	0.15	200	0.2		0.2		0.2	130
P5	0.05	96	0.1		0.05		0.1	17
P6	0.05	490	0.1		0.1		0.2	320
P7	0	340	0.05		0.05		0.1	190
P8	0	120	0		0		0	15
		---						---
		307						234

RUN #3 : 110 ACFM flow rate

Sample Location	9/21 4 p.m. Temp. = 94'F Flow = 114 ACFM Pressure (" WC)	Conc. (mg/m3)	9/22 9-10 a.m. Temp. = 98'F Flow = 115 ACFM Pressure (" WC)	Conc. (mg/m3)	9/23 3-4 p.m. Temp. = 94'F Flow = 110 ACFM Pressure (" WC)	Conc. (mg/m3)	9/24 8:30 a.m. Temp. = 96'F Flow = 52 ACFM Pressure (" WC)	Conc. (mg/m3)	9/25* 2 p.m. Temp. = 96'F Flow = 52 ACFM Pressure (" WC)	Conc. (mg/m3)
Pump Discharge		300		280		220		130		150
Well Head	4		4.1		4.5				4.4	
P1	0.3	190	0.3		0.3			17	0.3	
P2	0.35	410	0.3		0.3			110	0.3	
P3	--	580	0.4		0.35			220	0.35	
P4	--	180	0.4		0.4			22	0.4	
P5	0.2	14	0.2		0.2			7	0.2	
P6	0.25	280	0.25		0.2			120	0.2	
P7	0.2	130	0.2		0.15			27	0.15	
P8	0.1	13	0.1		0.05			5	0.05	
		---						---		*opened 87-1/87-5
		225						66		

30 DAY PILOT RUN

Sample Location	11/3 -4 p.m. Temp. = 94'F Flow = 110 ACFM Pressure (" WC)	Conc. (mg/m3)	11/6 --- Temp. = --'F Flow = --- ACFM Pressure (" WC)	Conc. (mg/m3)	12/1 a.m. Temp. = 96'F Flow = 112 ACFM Pressure (" WC)	Conc. (mg/m3)	
Pump Discharge		300		270		160	SEE MASS LOADING DATA
Well Head	**7.15		**7.4		7.5		FOR ADDITIONAL PUMP
P1	0.3	140	0.3		0.3	7	DISCHARGE SAMPLES.
P2	0.3	300	--		0.3	50	
P3	0.35	520	0.3		0.35	140	
P4	0.4	74	0.4		0.4	9	
P5	0.15	27	0.15		0.15	4.6	
P6	0.2	350	0.2		0.2	53	
P7	0.15	260	0.1		0.1	16	
P8	0.1	23	0.05		0.1	5	
		---				---	
		212				36	

** = 10' of the Well Screen Blinded Off

ANALYTICAL DATA BY SAMPLE POINT

SAMPLE POINT	DATE 9/8	9/15	9/18	9/21	9/24	11/3	12/1
P1	300	190	340	190	17	140	7
P2	760	440	310	410	110	300	50
P3	1100	580	550	580	220	520	140
P4	360	200	130	180	22	74	9
P5	260	96	17	14	7	27	4.6
P6	800	490	320	280	120	350	53
P7	840	340	190	130	27	260	16
P8	57	120	15	13	5	23	5
AVERAGE	560	307	234	225	66	212	36

CPC PILOT STUDY: MASS LOADING DATA

DATE	TIME	DELTA TIME SINCE START (hr.)	CUML. TIME (hr.)	AIRFLOW (cfm)	CONC. (mg/m3)	MASS DISCHARGED (lb/hr)
Run was started at approximately 11:00 a.m.						
9/8	4:15 p.m.	5.25	5.25	38	1400	0.199
9/9	1:30	26.50	26.5	38	420	0.060
9/10	4:00	53.00	53	38	800	0.114
9/11	8.30 a.m.	69.00	69	38	580	0.082
Run was started at 12:00 p.m.						
9/15	12:20 p.m	0.33	169.33	52	510	0.099
9/16	2:45	26.75	195.75	52	530	0.103
9/17	4:15	52.25	221.25	52	340	0.066
9/18	9:25 a.m.	69.42	238.42	52	340	0.066
Run was started at 3:30 p.m.						
9/21	3:55 p.m.	0.42	316.92	110	300	0.123
9/22	9:46 a.m.	18.25	334.75	110	280	0.115
9/23	2:50	47.33	363.83	110	220	0.091
9/24	11:20 a.m	67.83	384.33	110	130	0.054
9/25	2:30	95.00	411.50	110	150	0.062
Run was started at 9:30 a.m. (unit was down for app. 2 days)						
11/3	10:00 a.m	0.50	1342.50	110	300	0.123
11/4	6:15 p.m.	32.75	1375.25	110	320	0.132
11/5	3:05 p.m.	54.58	1429.83	110	290	0.119
11/6	1:56 p.m.	76.50	1506.33	110	270	0.111
11/9	3:05 p.m.	149.50	1655.83	110	320	0.132
11/12	1:00 p.m.	219.5	1875.33	110	360	0.148
11/16	6:00 p.m.	320.5	2195.83	110	350	0.144
11/19	10:30 a.m	385	2580.83	110	340	0.140
11/23	11:00 a.m	481	3061.83	110	210	0.086
12/1	10:00 a.m	672	3733.83	110	160	0.066

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/08/87 TIME:
DATE RECEIVED: 09/09/87 TIME: 7:15 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 1

	P#1	P#2	P#3	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	79916	79917	79918		
TRICHLOROETHYLENE	56	140	210	0.10	ppm
TRICHLOROETHYLENE	300	760	1,100	0.58	mg/m3
TIME SAMPLED:	11:25 AM	12:25 PM	11:40 AM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/08/87 TIME:
DATE RECEIVED: 09/09/87 TIME: 7:15 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 2

	P#4	P#5	P#6	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	79919	79920	79921		
TRICHLOROETHYLENE	68	49	150	0.10	ppm
TRICHLOROETHYLENE	360	260	800	0.58	mg/m3
TIME SAMPLED:	2:15 PM	2:40 PM	3:00 PM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/08/87 TIME:
DATE RECEIVED: 09/09/87 TIME: 7:15 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 3

	P#7	P#8	VAPOR WELL	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	79922	79923	79924		
TRICHLOROETHYLENE	160	11	270	0.10	ppm
TRICHLOROETHYLENE	840	57	1,400	0.58	mg/m3
TIME SAMPLED:	3:45 PM	3:25 PM	4:15 PM		

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EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/09/87 TIME: 1:30 PM
DATE RECEIVED: 09/10/87 TIME: 9:00 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 50

	V. WELL	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80041		
TRICHLOROETHYLENE	80	0.10	ppm
TRICHLOROETHYLENE	420	0.58	mg/m3

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/10/87 TIME: 4:00 PM
DATE RECEIVED: 09/11/87 TIME: 7:00 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 51

		DETECTION LIMIT	UNITS
	VAPOR WELL		
EDI SAMPLE NO:	80042		
TRICHLOROETHYLENE	150	0.10	ppm
TRICHLOROETHYLENE	800	0.58	mg/m3

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: DUDLEY PIERCE
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/11/87 TIME: 8:30 AM
DATE RECEIVED: 09/11/87 TIME: 11:40 AM
DATE COMPLETED: 09/11/87
SCHEDULED COMPLETION: 09/11/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 52

	VAPOR WELL	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80053		
TRICHLOROETHYLENE	110	0.10	ppm
TRICHLOROETHYLENE	580	0.58	mg/m3

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CATHIE COTTON
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/15/87 TIME:
DATE RECEIVED: 09/15/87 TIME: 2:50 PM
DATE COMPLETED: 09/18/87
SCHEDULED COMPLETION: 10/06/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 20

	P-1	P-3	P-4	P-5	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80292	80293	80294	80295		
TRICHLOROETHYLENE	36	110	37	18	0.100	ppm
	190	580	200	96	0.530	mg/m3
TIME SAMPLED:	9:50 AM	10:50 AM	11:05 AM	11:12 AM		

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EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CATHIE COTTON
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/15/87 TIME:
DATE RECEIVED: 09/15/87 TIME: 2:50 PM
DATE COMPLETED: 09/17/87
SCHEDULED COMPLETION: 10/06/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 21

	P-6	P-7	P-8	PUMP DICHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80296	80297	80298	80299		
TRICHLOROETHYLENE	92	64	23	96	0.100	ppm
	490	340	120	510	0.530	mg/m3
TIME SAMPLED:	11:30 AM	11:38 AM	11:55 AM	12:20 PM		

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CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: SAM TAWNEY
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/17/87 TIME: 4:15 PM
DATE RECEIVED: 09/18/87 TIME: 7:15 AM
DATE COMPLETED: 09/19/87
SCHEDULED COMPLETION: 09/18/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 30

	VAC. PUMP	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80423		
TRICHLOROETHYLENE	63	0.100	ppm
	340	0.530	mg/m3

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CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION:

DATE SAMPLED: 09/18/87 TIME:
DATE RECEIVED: 00/00/00 TIME:
DATE COMPLETED: 09/19/87
SCHEDULED COMPLETION: 09/22/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 35

	PUMP DISCHARGE	P1	P2	P3	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80454	80455	80456	80457		
TRICHLOROETHYLENE	63	30	59	103	0.100	ppm
	340	160	310	550	0.530	mg/m3
TIME SAMPLED:	9:25 AM	11:08 AM	12:12 AM	11:16 AM		

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CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION:

DATE SAMPLED: 00/00/00 *TIME:*
DATE RECEIVED: 00/00/00 *TIME:*
DATE COMPLETED: 09/19/87
SCHEDULED COMPLETION: 09/22/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 36

	P4	P5	P6	P7	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80458	80459	80460	80461		
TRICHLOROETHYLENE	24	3.2	61	35	0.100	ppm
	130	17	320	190	0.530	mg/m3
TIME SAMPLED:	11:22 AM	11:32 AM	12:18 PM	12:25 PM		

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EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION:

DATE SAMPLED: 09/18/87 TIME:
DATE RECEIVED: 00/00/00 TIME:
DATE COMPLETED: 09/19/87
SCHEDULED COMPLETION: 09/22/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 37

		DETECTION LIMIT	UNITS
	P8		
EDI SAMPLE NO:	80462		
TRICHLOROETHYLENE	2.8	0.100	ppm
	15	0.530	mg/m3
TIME SAMPLED:	12:38 PM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/21/87 TIME:
DATE RECEIVED: 09/21/87 TIME: 2:20 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 10/12/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 40

	P-1	P-2	P-3	P-4	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80564	80565	80566	80567		
TRICHLOROETHYLENE	35	78	110	34	0.10	ppm
	190	410	580	180	0.53	mg/m3
TIME SAMPLED:	9:40 AM	9:47 AM	9:55 AM	10:03 AM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/21/87 TIME:
DATE RECEIVED: 09/21/87 TIME: 2:20 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 10/12/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 41

	P-5	P-6	P-7	P-8	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80568	80569	80570	80571		
TRICHLOROETHYLENE	2.6	52	25	2.4	0.10	ppm
	14	280	130	13	0.53	mg/m3
TIME SAMPLED:	10:09 AM	10:18 AM	10:28 AM	10:37 AM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION: SOIL VAPER PILOT STUDY

DATE SAMPLED: 00/00/00 TIME:
DATE RECEIVED: 09/23/87 TIME: 4:58 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 09/24/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 60

	PUMP DISCHARGE	PUMP DISCHARGE	PUMP DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80653	80654	80655		
TRICHLOROETHYLENE	56	53	42	0.10	ppm
	300	280	220	0.53	mg/m3
DATE SAMPLED:	09/21/87	09/22/87	09/23/87		
TIME SAMPLED:	3:55 PM	9:48 AM	2:50 PM		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: D.P.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/24/87 TIME:
DATE RECEIVED: 09/24/87 TIME: 7:00 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 09/29/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 7

	P#1	P#2	P#3	P#4	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80756	80757	80758	80759		
TRICHLOROETHYLENE	3.2	20	42	4.2	0.10	ppm
	17	110	220	22	0.53	mg/m3
TIME SAMPLED:	1:30	1:55	2:10	2:15		

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EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CATHIE COTTON
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/02/87 TIME:
DATE RECEIVED: 11/03/87 TIME: 4:10 PM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/05/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 2

	#5	#6	#7	#8	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82586	82587	82588	82589		
TRICHLOROETHYLENE	5.0	65	49	4.3	0.10	ppm
	27	350	260	23	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: D.P.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/24/87 TIME:
DATE RECEIVED: 09/24/87 TIME: 7:00 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 09/29/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 8

	P#5	P#6	P#7	P#8	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80760	80761	80762	80763		
TRICHLOROETHYLENE	1.3	23	5.0	0.97	0.10	ppm
	6.9	120	27	5.2	0.53	mg/m3
TIME SAMPLED:	2:30 PM	2:40 PM	3:00 PM	3:15 PM		

EDI Engineering & Science
Environmental Engineering, Geology, Biology & Chemistry
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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: D.P.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/24/87 TIME:
DATE RECEIVED: 09/24/87 TIME: 7:00 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 09/29/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 9

	V. WELL	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	80764		
TRICHLOROETHYLENE	25	0.10	ppm
	130	0.53	mg/m3
TIME SAMPLED:	11:20		

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: TED L.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 09/25/87 TIME: 2:40 PM
DATE RECEIVED: 09/25/87 TIME: 4:55 PM
DATE COMPLETED: 09/25/87
SCHEDULED COMPLETION: 09/28/87
ANALYST: JE,PT
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 6

		DETECTION LIMIT	UNITS
	PUMP DISCHARGE		
EDI SAMPLE NO:	80909		
TRICHLOROETHYLENE	29	0.10	ppm
	150	0.53	mg/m3

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY:
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 10/15/87 TIME:
DATE RECEIVED: 10/16/87 TIME: 8:00 AM
DATE COMPLETED: 10/21/87
SCHEDULED COMPLETION: 10/17/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 20

	LOC.#2 11:30 AM	LOC.#3 11:40 AM	LOC.#4 2:30 PM	LOC.#7 2:20 PM	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	81815	81816	81817	81818		
TRICHLOROETHYLENE	49	88	30	32	0.10	ppm
	260	470	160	170	0.53	mg/m3

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ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: PUMP DISCHARGE
SAMPLED BY: C.C.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/03/87 TIME: 10:00 AM
DATE RECEIVED: 11/03/87 TIME: 4:55 PM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/05/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 6

	PUMP DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82627		
TRICHLOROETHYLENE	56	0.10	ppm/m3
	300	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36th STREET PLANT
SAMPLED BY: JST
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/04/87 *TIME:* 6:15 PM
DATE RECEIVED: 11/05/87 *TIME:* 8:00 AM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/07/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 3

	VAC PUMP DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82744		
TRICHLOROETHYLENE	60	0.10	ppm
	320	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CC
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/05/87 TIME: 3:05 PM
DATE RECEIVED: 11/05/87 TIME: 4:50 PM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/09/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 7

	PUMP DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82777		
TRICHLOROETHYLENE	55	0.10	ppm
	290	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: T.L.
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/06/87 TIME: 1:56 PM
DATE RECEIVED: 11/06/87 TIME: 3:55 PM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/09/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 30

	PUMP DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82789		
TRICHLOROETHYLENE	50	0.10	ppm
	270	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: CATHIE COTTON
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 11/02/87 TIME:
DATE RECEIVED: 11/03/87 TIME: 4:10 PM
DATE COMPLETED: 11/06/87
SCHEDULED COMPLETION: 11/05/87
ANALYST: WH
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 1

	#1	#2	#3	#4	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	82582	82583	82584	82585		
TRICHLOROETHYLENE	27	57	97	14	0.10	ppm
	140	300	520	74	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY:
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 00/00/00 TIME:
DATE RECEIVED: 11/12/87 TIME: 4:50 PM
DATE COMPLETED: 11/19/87
SCHEDULED COMPLETION: 11/19/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 40

	PUMP 11/9 DISCHARGE	PUMP 11/12 DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	83153	83154		
TRICHLOROETHYLENE	60	67	0.10	ppm
	320	360	0.53	mg/m3

ANALYTICAL SERVICES
EDI LABORATORY REPORT

CLIENT: CPC GRAND RAPIDS
PROJECT NO.: 25554
LOCATION: 36TH STREET PLANT
SAMPLED BY: JOE MAVEY
DESCRIPTION: SOIL VAPOR PILOT STUDY

DATE SAMPLED: 00/00/00 TIME:
DATE RECEIVED: 11/19/87 TIME: 10:30 AM
DATE COMPLETED: 11/19/87
SCHEDULED COMPLETION: 11/24/87
ANALYST: JE
QUALITY CONTROL REVIEW BY: JE
WORKSHEET NO: 20

	PUMP 11/16 DISCHARGE	PUMP 11/9 DISCHARGE	DETECTION LIMIT	UNITS
EDI SAMPLE NO:	83359	83360		
TRICHLOROETHYLENE	65	64	0.10	ppm
	350	340	0.53	mg/m3

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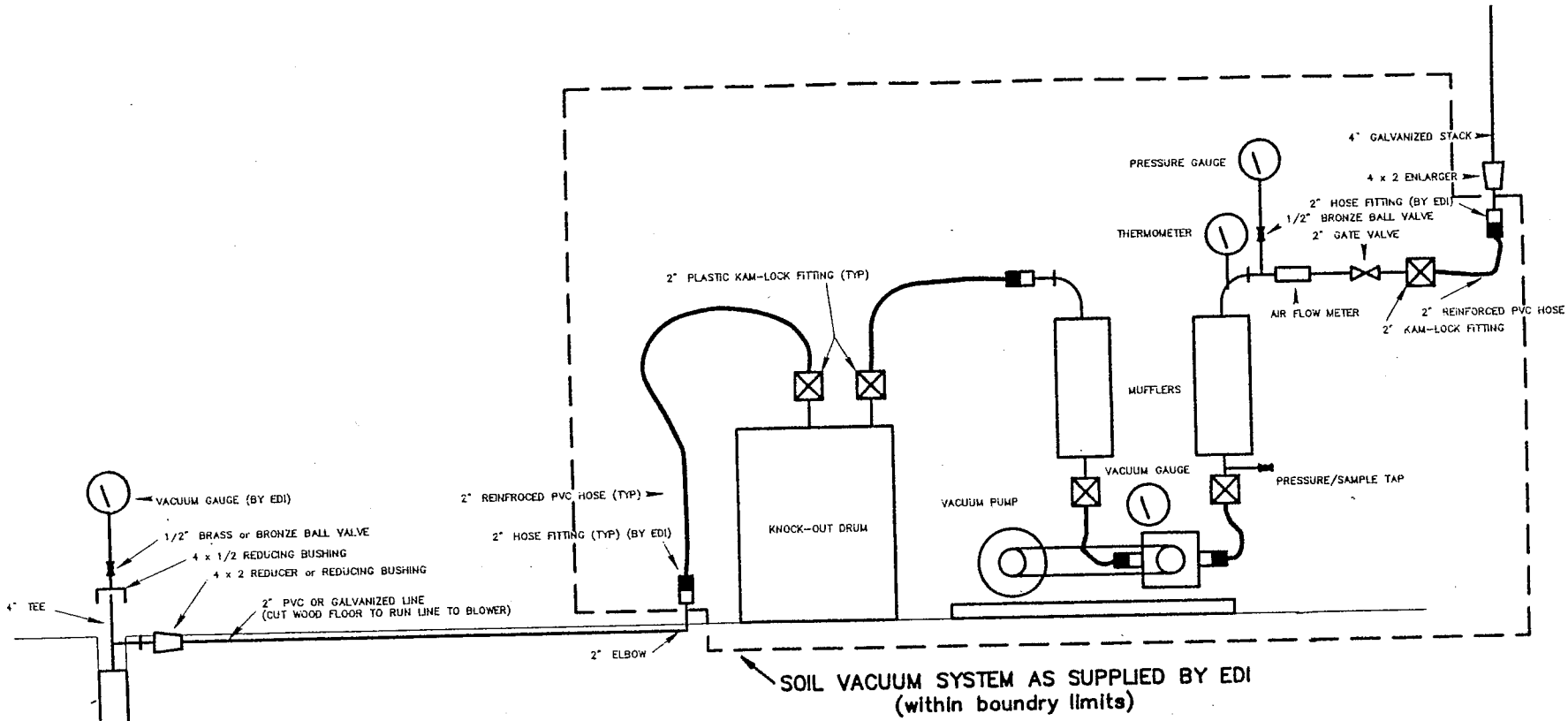

NOTES

1. THE SYSTEM WILL BE SHIPPED TO THE PLANT IN THREE UNITS:
   - THE BLOWER/MUFFLER SYSTEM AND ELECTRICAL CONTROLS
   - THE KNOCK-OUT DRUM
   - HOSES

   SYSTEM ASSEMBLY WILL BE LIMITED TO CONNECTING THE HOSES WITH HOSE CLAMPS OR KAM-LOCK QUICK DISCONNECTS.
2. THE 2" LINE THAT RUNS FROM THE WELL TO THE BLOWER SYSTEM WILL BE INSTALLED BY CPC OR EDI IN THE FIELD.
3. CPC WILL BRING ELECTRICAL POWER TO THE SYSTEM. POWER REQUIREMENTS ARE:
   - 460 V, 3 PHASE FOR THE 5 HP BLOWER MOTOR
   - 120 V, 1 PHASE FOR THE FLOWMETER POWER SUPPLY

CPC - GRAND RAPIDS PLANT

SOIL VACUUM SYSTEM SCHEMATIC

20676 AUGUST, 1987