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MOFFETT FIELD
SSIC NO.5090.3

PRC

December 18, 1991

Mr. Cyrus Shabahari
State of California EPA
Department of Toxic Substances Control 1292
700 Heinz Avenue, Building F
Berkeley, CA 94704

RE: Detection of total xylenes in the A2 hydrologic zone monitoring well samples at Naval Air Station (NAS) Moffett Field Site 9

Dear Mr. Shabahari:

In response to your request for further information on chlorinated solvent concentrations versus xylene quantitation limits, PRC Environmental Management, Inc. (PRC) has reviewed analytical data for IT samples collected from Site 9 monitoring wells during the second quarter of 1991. PRC compared trichloroethene (TCE) concentrations with the detection limits reported for total xylenes. High detection limits for xylenes are present in samples with high concentrations of TCE.

Analytical results for chlorinated solvents and total xylenes for samples from A1 and A2 zone wells are presented in Attachment A. TCE concentrations were plotted against detection limits for total xylenes. Figure 1 illustrates the relationship between TCE concentrations and total xylene detection limits. As TCE concentrations in the samples increase, the detection limits for total xylenes also increase. The interference of TCE with the detection of total xylenes can be explained by examining the procedure used to analyze volatile organic compounds (VOCs).

In general, VOCs in ground water are analyzed by gas chromatographic techniques. A small volume (5 milliliters (ml)) of water is purged with an inert gas and the stripped compounds are trapped on a solid absorbent. The VOCs are desorbed by heating (eluted) and are transferred to a gas chromatograph where a column separates the compounds prior to detection. Detectors used to measure and identify VOCs include flame ionization (FID), photoionization (PID), electron capture (ECD) and mass spectrometer (MS). A recorder provides a chromatogram of peaks corresponding to the relative concentrations of each compound in the sample. Figure 2 presents a schematic diagram of a gas chromatography (GC)system.

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RWQCB - 539 1294
NAS Moffett - 540
WESTDIV - 541 1291

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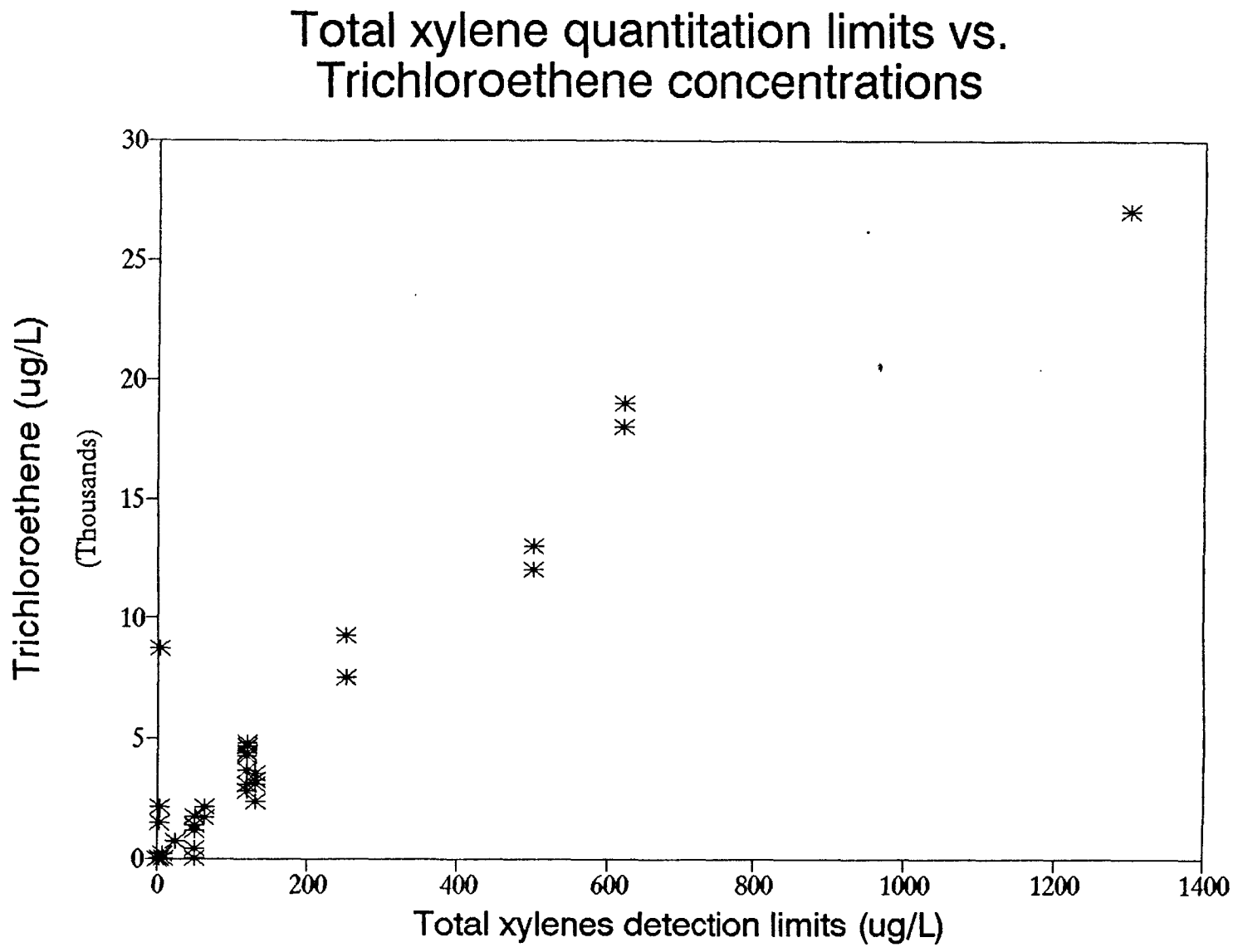

Figure 1 - TCE Concentrations Versus Detection Limits for Total Xylenes in A1 and A2 Wells at Site 9 NAS Moffett Field.

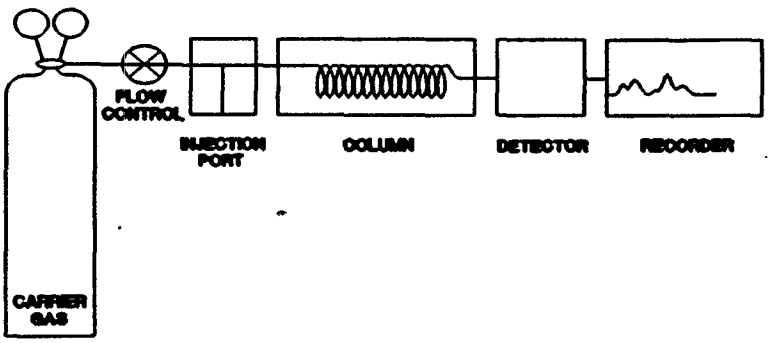

Figure 2 - Schematic Diagram of Gas Chromatography System (after Grob, 1983).

Compounds are detected using GC analysis in the order of their respective volatilities. The most volatile compounds are detected first and less volatile constituents are detected later. Constituents of a mixture are expected to be detected during specific windows of time. Chromatograms are generated when FID, PID or ECD is used for detection. The area under each peak of the chromatogram corresponds to the concentration of each constituent in the sample.

Figure 3 presents a chromatogram illustrating the elution order (in minutes) and the response of some chlorinated and nonchlorinated VOCs, including trichloroethane (TCA), TCE, tetrachloroethene (PCE), and xylenes. Each peak shown reflects a concentration of 4 micrograms per liter (μg/L) in a 5 ml water sample. In contrast, the chromatogram for a ground water sample with a high concentration of TCE (4,000 μg/L) would contain a TCE peak 1,000 times the size of the one pictured at 9.4 minutes in Figure 3. Such a large TCE peak may mask smaller peaks that occur later, including those of xylenes. Figure 4 illustrates a high TCE peak and the interference it would cause to later peaks. The areas under these smaller peaks cannot be accurately calculated because of the presence of high concentrations of TCE. Consequently, the detection limits of total xylenes would be raised.

Interferences from high concentrations of solvents can be reduced by using an MS. Because the MS detects a chemical via a mass spectrum and a retention time, total xylenes can be detected in samples with high solvent concentrations. Samples with solvent concentrations above the calibrated range of the instrument are diluted to reduce the concentrations to within the calibration range. Quantitation limits for all constituents are consequently raised by the factor of the dilution.

To detect low concentrations of total xylenes, samples must not be diluted. This can be a problem when high concentrations of solvents are present in the same samples. High solvent concentrations can saturate the detector, which may cause the MS to terminate the analysis, and subsequently, the instrument may require cleaning or servicing. This leads to wear and tear on the instrumentation, and

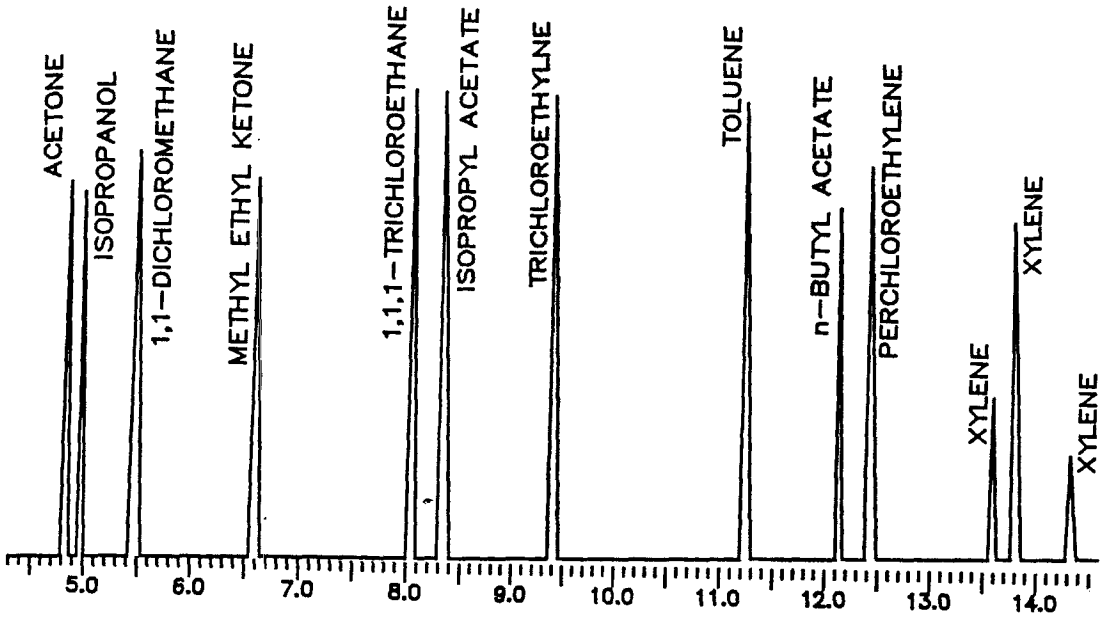

Figure 3 - Hypothetical chromatogram of low concentrations of VOCs in a 5 ml water sample (after Hyver, 1989).

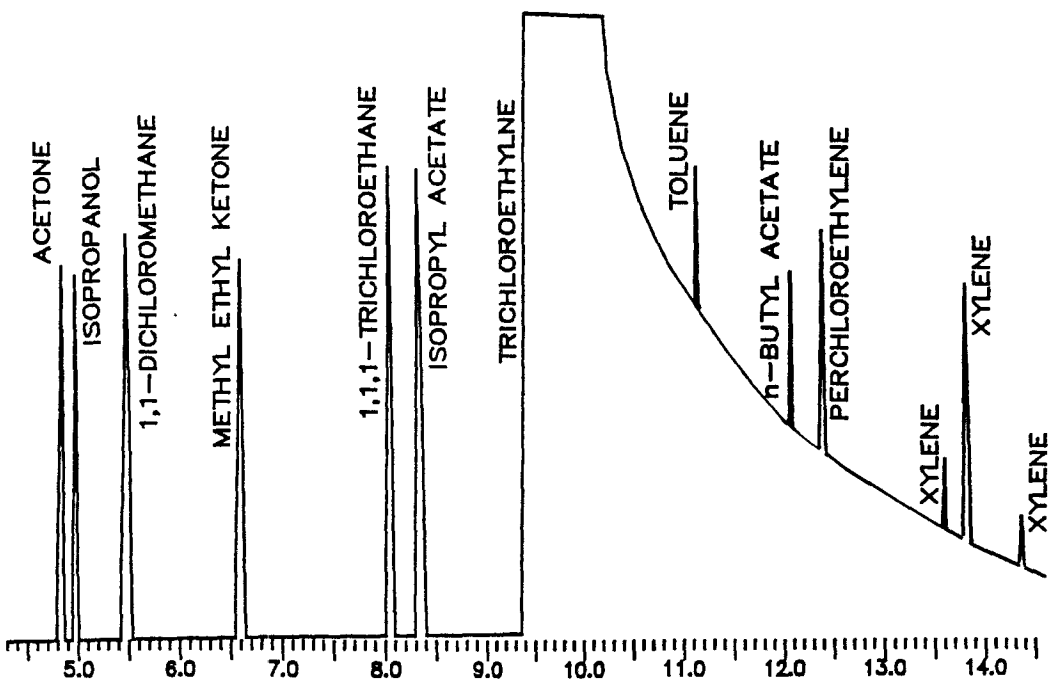

Figure 4 - Hypothetical chromatogram of VOCs in a 5 ml water sample, with a high TCE concentration (after Hyver, 1989).

increased instrument down-time, which laboratories prefer to avoid. Therefore, if previous data lead the laboratories to believe that samples have high concentrations of solvents, they will dilute samples before introducing them into the GC/MS system, and constituents present in lower concentrations will not be detected.

In conclusion, high concentrations of TCE in water samples from the A2 zone wells at Site 9 interfere with the accurate detection of total xylenes in these samples. This is a limitation of the analytical procedure, and the similar volatilities of chlorinated solvents and xylenes. Although the actual concentrations of total xylenes are masked by the presence of high TCE concentrations, xylenes will be removed from the ground water using the procedure designed to eliminate TCE.

Please contact Josh Marvil or me at (303)295-1101 if you have any questions.

Sincerely,

PRC Environmental Management, Inc.

Lynn A. Davies

Lynn A. Davies

LAD/drp

Attachments

cc: Lewis Mitani, EPA – 538
Wilfried Bruhns, RWQCB – 539
Jim Haas, Public works NAS Moffett Field – 540
Stephen Chao, Navy WestDiv – 541
Joe LeClaire, JMM
Josh Marvil, PRC
Tom Adkisson, PRC
PRC File

ADMIN RECORD

REFERENCES

Grob, Robert L., 1983, Chromatographic Analysis of the Environment. Second Edition, Marcel Dekker, Inc., New York.

Hyver, K.J., and P. Sandra, 1989, High Resolution Gas Chromatography. Third Edition, Hewlett Packard.

IT, 1991, Quarterly Report, Second Quarter 1991, Naval Air Station Moffett Field. International Technology Corporation, August, 1991.

ATTACHMENT A

TABLE 1
NAS MOFFETT FIELD SITE 9
SECOND QUARTER, 1991
CHLORINATED SOLVENT AND TOTAL XYLENES CONCENTRATION IN
GROUND WATER MONITORING WELL SAMPLES
(ug/L)

	W09-08(A2)	W09-09(A2)	W09-13(A2)	W09-13(A2)	W09-14(A2)	W09-14(A2)	W09-17(A2)	W09-20(A2)
	10-MAY-91	16-MAY-91	19-APR-91	19-APR-91	19-APR-91	19-APR-91	03-MAY-91	13-MAY-91
				Diluted		Diluted		
Compound								
1,1,1-Trichloroethane	120 U	22 J	34	38 DJ	79	1300 U	250 U	620 U
1,1-Dichloroethane	46 J	33 J	47	39 DJ	65	1300 U	73 J	620 U
1,1-Dichloroethene	100 J	49 J	73	69 DJ	360 E	1300 U	180 J	260 J
1,2-Dichloroethane	120 U	62 U	5 U	130 U	5 U	1300 U	250 U	620 U
1,2-Dichloroethene	78 J	63	73	62 DJ	510 E	480 DJ	720	420 J
Tetrachlorethene	120 U	62 U	5 U	130 U	55	1300 U	250 U	480 J
Trichloroethene	3100	2200	1500 BE	2400 BD	8700 E	27000 BD	9200	18000
Total Xylenes	120 U	62 U	5 U	130 U	5 U	1300 U	250 U	620 U

B = Detected in blank

D = Diluted sample

E = Estimated concentration exceeds calibrated range

J = Concentration estimated

U = Undetected

Source: IT, 1991.

TABLE 1
NAS MOFFETT FIELD SITE 9
SECOND QUARTER, 1991
CHLORINATED SOLVENT AND TOTAL XYLENES CONCENTRATION IN
GROUND WATER MONITORING WELL SAMPLES
(ug/L)
(continued)

	W09-21(A2)	W09-22(A2)	W09-25(A2)	W09-27(A2)	W09-28(A2)	W09-33(A2)	W09-34(A2)	W09-36(A2)
	17-MAY-91	14-MAY-91	15-MAY-91	23-APR-91	14-MAY-91	14-MAY-91	15-MAY-91	13-MAY-91
Compound								
1,1,1-Trichloroethane	30 J	130 U	31 J	5	620 U	250 U	29 J	34 J
1,1-Dichloroethane	30 J	26 J	33 J	8	620 U	56 J	33 J	66 J
1,1-Dichloroethene	130	55 J	56	15	220 J	200 J	85 J	140
1,2-Dichloroethane	120 U	130 U	50 U	5 U	620 U	250 U	120 U	120 U
1,2-Dichloroethene	120 J	160	29 J	130	370 J	410	63 J	690
Tetrachlorethene	310	130 U	50 U	5 U	390 J	250 U	120 U	120 U
Trichloroethene	4400	3300	1800	39	19000	7500	2800	4300
Total Xylenes	120 U	130 U	50 U	5 U	620 U	250 U	120 U	120 U

B = Detected in blank

D = Diluted sample

E = Estimated concentration exceeds calibration range

J = Concentration estimated

U = Undetected

Source: IT, 1991.

TABLE 1
NAS MOFFETT FIELD SITE 9
SECOND QUARTER, 1991
CHLORINATED SOLVENT AND TOTAL XYLENES CONCENTRATIONS IN
GROUND WATER MONITORING WELL SAMPLES
(ug/L)
(continued)

	W09-41(A2)	W09-42(A2)	W09-06-(A1)	W09-07(A1)	W09-07(A1)	W09-16(A1)	W09-18(A1)	W09-19(A1)
	09-MAY-91	03-MAY-91	23-APR-91	22-APR-91	22-APR-91	05-MAY-91	14-MAY-91	09-MAY-91
					Diluted			
Compound								
1,1,1-Trichloroethane	500 U	12 J	5 U	34	33 DJ	8 U	500 U	25 U
1,1-Dichloroethane	500 U	36 J	5 U	57	49 DJ	14	500 U	30
1,1-Dichloroethene	170 J	51	5 U	94	84 DJ	8 J	200 J	20 J
1,2-Dichloroethane	500 U	50 U	4 J	5 U	130 U	8 U	500 U	25 U
1,2-Dichloroethene	880	630	5 U	94	79 DJ	16	1700	60
Tetrachlorethene	500 U	16 J	5 U	5 U	130 U	8 U	240 J	25 U
Trichloroethene	13000	1400	5 U	2200 E	3600 D	180	12000	700
Total Xylenes	500 U	50 U	5 U	5 U	130 U	8 U	500 U	25 U

B = Detected in blank

D = Diluted sample

E = Estimated concentration exceeds calibration range

J = Concentration estimated

U = Undetected

Source: IT, 1991.

TABLE 1
NAS MOFFETT FIELD SITE 9
SECOND QUARTER, 1991
CHLORINATED SOLVENT AND TOTAL XYLENES CONCENTRATIONS IN
GROUND WATER MONITORING WELL SAMPLES
(ug/L)
(continued)

	W09-23(A1)	W09-24(A1)	W09-26(A1)	W09-29(A1)	W09-30(A1)	W09-31(A1)	W09-35(A1)	W09-37(A1)
	14-MAY-91	15-MAY-91	17-MAY-91	03-MAY-91	16-MAY-91	14-MAY-91	13-MAY-91	13-MAY-91
Compound								
1,1,1-Trichloroethane	50 U	10 U	50 U	62 U	50 U	130 U	36 J	41 J
1,1-Dichloroethane	32 J	16	12 J	30 J	82	50 J	53 J	62 J
1,1-Dichloroethene	34 J	6 J	24 J	44 J	75	140	110 J	100 J
1,2-Dichloroethane	50 U	10 U	50 U	62 U	50 U	130 U	120 U	120 U
1,2-Dichloroethene	85	400	1300	580	1200	1000	430	490
Tetrachlorethene	50 U	10 U	50 U	62 U	50 U	130 U	120 J	120 U
Trichloroethene	1200	10 U	13 J	1700	420	3100	4800	3700
Total Xylenes	50 U	10 U	50 U	62 U	50 U	130 U	120 U	120 U

B = Detected in blank

D = Diluted sample

E = Estimated concentration exceeds calibration range

J = Concentration estimated

U = Undetected

Source: IT, 1991.

TABLE 1
NAS MOFFETT FIELD SITE 9
SECOND QUARTER, 1991
CHLORINATED SOLVENT AND TOTAL XYLENES CONCENTRATIONS IN
GROUND WATER MONITORING WELL SAMPLES
(ug/L)
(continued)

	W09-38(A1)	
	09-MAY-91	
Compound		
1,1,1-Trichloroethane	52	J
1,1-Dichloroethane	71	J
1,1-Dichloroethene	74	J
1,2-Dichloroethane	120	U
1,2-Dichloroethene	460	
Tetrachlorethene	120	U
Trichloroethene	4700	
Total Xylenes	120	U

B = Detected in blank

D = Diluted sample

E = Estimated concentration exceeds calibration range

J = Concentration estimated

U = Undetected

Source: IT, 1991.