II. #3500 LABORATORY EVALUATION

B. Toluene and mixture of Toluene, Isobutyl Alcohol, Acetone, and Perchloroethylene.

The Technical Research Center of Finland ran controlled laboratory comparisons of the #3500 vs. standard charcoal tubes and calibrated, low flow pumps. The compounds studied were Toluene, a mixture of Toluene and Iso Butyl Alcohol, Acetone, and Perchloroethylene. Chamber concentrations were checked by Miran IA infrared and by direct GC analysis.

Agreement with the reference methods are excellent except in the case where exposure time was less than the recommended fifteen minutes or deliberate overload conditions were chosen. In Overload conditions, the 3500 more closely estimated the concentration than the tube.

TOLUENE

TECH. RESEARCH CENTER OF FINLAND

SAMPLE TIME - 4 hrs.

RESULTS - PPM

	TEST #1	TEST # 2
MIRAN, IA	288	89
GC	289	86
3500 #1	297	86
#2	287	87
#3	-	87
#4	-	85
#5	-	88
#6	-	88
#7	-	87
#8	-	89
TUBE #1	283	85
TUBE #2	-	85

TOLUENE

TECH RESEARCH CENTER OF FINLAND

RESULTS - PPM

	SHORT TERM SAMPLING		
	Test #1	Test #2	Test #3
Sample Time (min.)	20	15	10
Miran, IA	560	560	560
GC	544	544	544
#3500 #1	550	600	503
#3500 #2	542	530	529

MIXTURE TEST

TECHNICAL RESEARCH CENTER OF FINLAND

MONITOR - 3M #3500

RESULTS - PPM

SAMPLE TIME:

TUBES 1 & 2 - 66 min.

TUBES 3 & 4 - 30 min.

#3500 - 220 min.

	ISO BUTYL ALCOHOL	TOLUENE
Miran, IA	144	180
G. C.	143	175
Tube 1	150	164
Tube 2	138	168
Tube 3	138	169
Tube 4	130	169
#3500 1	138	166
2	148	178
3	144	176
4	142	165
5	146	180
6	144	170
Tube	139 $\pm$ 8.2	168 $\pm$ 2.4
#3500	144 $\pm$ 3.5	173 $\pm$ 6.4

ACETONE

TECH RESEARCH CENTER OF FINLAND

RESULTS - PPM

	Test #1	Test #2*	Test #3
Sample time (min.)	65	240	240
Miran, IA	1070	1555	385
GC #1	1066	1538	380
GC #2	-	1560	-
#3500 #1	1043	1338	373
#3500 #2	1063	1210	400
Tube #1	-	1018	377
Tube #2	-	1007	400

* Deliberate Overload Condition

PERCHLOROETHYLENE

TECH RESEARCH CENTER OF FINLAND

SAMPLE TIME - 4 hrs.

RESULTS - PPM

	TEST #1	TEST #2
Miran, IA	120	42
GC #1	121	40
GC #2	125	42
#3500 #1	124	41
#3500 #2	121	42
Tube	122	-

I. LABORATORY EVALUATION

D5. Stability of Samples using Dichloromethane, 1, 2 Dichloroethane, Tetrachloroethylene, Heptane.

The following data shows that the #3500 is gas tight. The data relate storage time to recovery coefficients (Desorption Efficiency). This data are valid only when the compound is stable.

Recovery Coefficients may drop due to decomposition, polymerization, etc. over extended storage time.

Methyl Ethyl Ketone is an example of decaying recoveries over time.

Reliability of samples are not assured if the captured volatile compound can escape during storage.

Storage Life

	Test	Days	Recovery $\pm 2\sigma$
Dichloromethane	1	1	.02 ± .02
	2	3	.93 ± .06
	3	10	.91 ± .02
	4	14	.90 ± .01
	5	31	.90 ± .01
1,2-Dichloroethane	1	1	.99 ± .01
	2	3	.98 ± .03
	3	10	.97 ± .01
	4	14	.96 ± .02
	5	31	.96 ± .01
Tetrachloroethylene	1	1	1.00 ± .05
	2	3	1.02 ± .01
	3	10	1.00 ± .08
	4	14	1.02 ± .02
	5	31	1.01 ± .03
Heptane	1	1	1.04 ± .06
	2	81	1.05 ± .02
	3	132	1.03 ± .04
	4	237	1.04 ± .03

I. #3500 LABORATORY EVALUATION

E. Enflurane

A study at an eastern U.S. university was carried out comparing the #3500, Miran 1A and Charcoal Tube (C.T.) to a known concentration in an exposure chamber. The Miran sampled continuously with readings taken at fifteen minute intervals. Velocity scans were taken along with pressure and temperature to insure uniformity of exposure conditions.

The #3500 correlated well with the tank concentration and had excellent coefficient of variance. The regression slope of #3500 versus tank concentration was 0.95.

ENFLURANCE

LABORATORY STUDY

CORRELATION COEFFICIENTS

LINEAR REGRESSION

3500 - Tank	0.960
3500 - C. T.	0.970
3500 - Miran	0.963

LINEAR REGRESSION (FIT THROUGH ZERO)

3500 - Tank	0.990
3500 - C. T.	0.993
3500 - Miran	0.990

COEFFICIENTS OF VARIATION

TANK CONC. (PPM)	3500	MIRAN	C.T.
5	0.08	0.10	0.11
10	0.06	0.07	0.27
20	0.16	0.03	0.25

ENFLURANE

LAB STUDY

RESULTS - PPM

TANK	3500	C.T.	MIRAN
5	5.6	5.2	4.4
	4.8	5.2	4.4
	4.6	4.6	4.2
	4.6	4.6	4.2
	4.6	5.0	4.2
	4.6	5.0	4.2
10	9.2	10.4	8.8
	9.7	10.4	8.8
	8.2	8.5	7.8
	9.2	8.5	7.8
	9.7	8.9	8.0
	9.7	8.9	8.0
20	19.4	19.7	15.9
	19.4	19.7	15.9
	18.1	19.3	15.3
	17.6	19.3	15.3
	19.1	20.9	15.9
	27.5	20.9	15.9
	19.1	19.2	15.9
	19.4	19.2	15.9

II. FIELD EVALUATION

A. Complex Mixtures

A U.S. chemical company ran a field comparison between a 600 mg. charcoal tube and the #3500 in a complex mixture. Agreement is good for all cases except acetone, where it appears the #3500 samples are high.

In fact, the #3500 is more closely estimating the true valve. In these conditions, it is believed that acetone is subject to displacement and is more readily swept from the tube. A diffusional system has no flow of air, only organic vapor, and suffers less from displacement losses.

MIXTURES

SAMPLE TIME: 6 hrs.

RESULTS - PPM

TUBE - 600 mg.

	#3500	Pump & Tube
MIBK	8.5	4.6
TOLUENE	16.5	13.8
N-BUTYL ACETATE	2.3	2.5
XYLENE	0.4	0.3
MEK	ND	ND
ACETONE	264	115
METHYLEDE CHLORIDE	0.5	0.3
TRICHLOROETHYLENE	0.6	0.4
PERCHLOROETHYLENE	0.5	0.3
ACETONE	66.7	45.2
METHYLENE CHLORIDE	11.3	9.2
TRICHLOROETHYLENE	0.1	0.1
PERCHLOROETHYENE	0.6	0.4
ACETONE	35.4	17.0

II. FIELD EVALUATION

D. 1,1,2-Trichloroethylene

3M Company Industrial Hygiene ran comparison personal samples in a 3M plant. Samples were run for four hours and converted to TLV-TWA. Correlation was good between the two methods.

1,1,2 TRICHLOROETHYLENE

3M PLANT

SAMPLE TIME: 4 hrs.

RESULTS - PPM

CORRELATION COEFFICIENT = 0.991

#3500	PUMP & TUBE
0.8	0.8
0.7	0.6
7.3	8.5
5.1	5.9
4.2	3.9
2.2	2.0
4.0	4.6
3.4	4.9
1.0	0.9
1.4	1.1
9.8	11.9
7.6	9.6
0.4	0.2
3.0	3.4
1.6	1.8
3.1	2.8