DETERMINATION OF VOLATILE ORGANIC COMPOUNDS IN SOILS USING EQUILIBRIUM HEADSPACE ANALYSIS AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY

EVALUATION OF THE TEKMAR 7000 HA ANALYZER

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FOREWORD

Environmental measurements are required to determine the quality of ambient waters and the character of waste effluents. The Environmental Monitoring Systems Laboratory - Cincinnati (EMSL-Cincinnati) conducts research to:

- Develop and evaluate analytical methods to identify and measure the concentration of chemical pollutants in drinking waters, surface waters, groundwaters, wastewaters, sediments, sludges, and solid wastes.

- Investigate methods for the identification and measurement of viruses, bacteria and other microbiological organisms in aqueous samples and to determine the responses of aquatic organisms to water quality.

- Develop and operate a quality assurance program to support the achievement of data quality objectives in measurements of pollutants in drinking water, surface water, groundwater, wastewater, sediment and solid waste.

- Develop methods and models to detect and quantify responses in aquatic and terrestrial organisms exposed to environmental stressors and to correlate the exposure with effects on chemical and virological indicators.

This report, "Determination of Volatile Organic Compounds In Soils Using Equilibrium Headspace Analysis and Capillary Column Gas Chromatography/ Mass Spectrometry," presents methodology which is more accurate and precise in determining volatile organics in soils than any existing methodology. It addresses several problems including preserving the integrity of the sample from collection to analysis, and efficiently extracting a broad spectrum of volatile compounds. EMSL-Cincinnati is pleased to provide this report and believes it will be of value to public and private laboratories involved in soil analysis.

ABSTRACT

Existing methods for determination of volatile organic compounds (VOCs) in soil matrices using the purge and trap technique with gas chromatography/ mass spectrometry (GC/MS) have several problems, which include preserving sample integrity from collection to analysis and efficiently extracting a broad spectrum of VOCs from the soil matrix. This investigation was undertaken using the Tekmar 7000 headspace autosampler to evaluate its ability to resolve these problems. The objective of this study was to optimize analytical conditions and then to study the efficiency of the headspace technique to extract VOCs from soils. Variations of sample preparation procedures were studied, and method analytes were identified and measured using internal standard calibration GC/MS. Using these data, relative standard deviations and percent recoveries are reported for 59 analytes in four different types of soil matrices: sand, clay, garden soil, and hazardous waste landfill soil. The most accurate and precise results are obtained with sand. Method detection limits (MDLs), ranging from 0.2 to 7.9 µg/kg, were calculated for all analytes (Table 47), using results of replicate analyses of sand, the matrix that had the least matrix effect. It is concluded that the 7000-HA headspace analyzer can be used to determine VOCs in soils.

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DETERMINATION OF VOLATILE ORGANIC COMPOUNDS IN SOILS USING EQUILIBRIUM HEADSPACE ANALYSIS AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY

INTRODUCTION

An accurate and precise procedure is needed to effectively remove volatile organic compounds (VOCs) from soils for identification and measurement using gas chromatography/mass spectrometry (GC/MS). Ten years ago, the number of VOCs that could be determined by GC/MS was limited by packed column GC technology. The least volatile compounds included toluene and ethyl benzene. Currently, with capillary column capabilities, the scope of VOCs in aqueous samples has been expanded for a single column analysis to include non-polar compounds with boiling points ranging from -30°C to >220°C. Heated purge and trap methodology has also been applied to soil samples utilizing capillary column technology (1). The results illustrated that many compounds currently determined in water matrices can be included in the list of compounds determined in soil matrices. However, the method was subjected to matrix effects, particularly for those compounds with high boiling points.

In this work, we evaluated the capability of the Tekmar 7000 Headspace Autosampler (7000-HA) to effectively introduce VOCs partitioned from soil matrices into a fused silica capillary column using the static headspace technique. The integral features of the procedure evaluated include sample fortification, different 7000-HA extraction parameters for a wide variety of volatile compounds, and the quantitative capabilities of the method using different soil matrices and different internal standards.

The 7000-HA was chosen for evaluation because of its potential to include the VOCs contained in the headspace of the sample collection vials and extract VOCs from a soil into the gas volume above the sample, as well as its ability to permit analysis with a minimal amount of sample preparation. The analytes used for the evaluation and their characteristic ions are listed in Table 1. The results of this evaluation are discussed in the following sections of this report.

CONCLUSIONS

The following conclusions were made from evaluation of study results.

1. The accuracy and precision of the 7000-HA were acceptable when used to determine VOCs in water, the matrix modifying solution (MMS), and sand. The 7000-HA produced somewhat lower recoveries from other tested soil matrices. However, these lower recoveries were not due to inefficient headspace analysis, but to stronger adsorption capacity of soil. This is the matrix effect. The results obtained with the 7000-HA are equivalent or better than current methodology for volatiles in soil.

2. The matrix fortifying procedure was found to be reproducible for all the compounds evaluated.

3. Comparing recoveries obtained in the different experiments for different matrices, indicated a definite matrix effect.

4. In an attempt to correct for the matrix effect, seven internal standards were evaluated. Results suggest that the use of one internal standard improved data quality but did not completely overcome the matrix effect problem. Adding additional internal standards with chemical and physical properties similar to those of the problem compounds helped resolve this problem.

5. The less volatile compounds, such as trichlorobenzenes, did not appear to be good candidates for accurate measurement using the headspace technique with a single internal standard.

6. Headspace volume had a definite effect on the sensitivity of the method. When headspace volume is decreased, sensitivity increases. This effect is greater as the volatility of the compound decreases.

7. The amount of the matrix modifying solution added to the matrix had little effect on analyte recovery. The percent difference between experiments was within the experimental error.

8. This work pointed out the definite need to develop a mechanism to collect an exact predetermined sample size and establish the hermetic seal in the field. Until this is done, this method cannot be used to its fullest potential.

RECOMMENDATIONS

The linear dynamic range of this method extends from the MDL of each analyte to approximately 1000 x the MDL. Because vial contents cannot be diluted or sub-sampled after the vial is sealed without losing headspace, for high concentration samples multiple static headspace analysis techniques (2) should be investigated to complement the single headspace evaluations reported here. The 7000-HA has the capacity to perform this type of analysis, and further investigation is encouraged. Moreover, work must continue on developing multiple internal standard methods to correct for matrix effects in soil.

MATERIALS AND CONDITIONS

Apparatus and Equipment

Tekmar 7000 Equilibrium Headspace Autosampler and Tekmar 7050 Carousel (Tekmar Company, 7143 East Road Cincinnati, OH 45249).

Soil vials - 20-mL clear Tekmar vials with crimp-seal open-top septum cap (14-4440-024).

Gas Chromatograph - Carlo Erba HRGC Mega Series (Carlo Erba Instruments, 123 McClellan Dr., Pittsburgh, PA 15236) equipped with cryogenic cooling capable of maintaining subambient temperatures.

GC Column - J&W Scientific, DB-624, Megabore, fused silica, 3 μm thickness, 0.53 mm ID, 75 m length.

Mass Spectrometer - Finnigan MAT Ion Trap Detector 700, updated to 800 series (Finnigan MAT, 355 River Oaks Parkway, San Jose, CA 95134) equipped with an open split interface.

Reagents

Methyl alcohol, sodium sulfate (Na_2SO_4), sodium phosphate dibasic (Na_2HPO_4), potassium phosphate monobasic (KH_2PO_4), calcium chloride ($CaCl_2$) and phosphoric acid (H_3PO_4) - ACS Reagent Grade

Standards

Standard materials were obtained in flame sealed ampules containing 150, 1000, 2000, 5000 or 10000 μg of pure compound per ml of methanol from Supelco, Inc., Supelco Park, Bellefonte, PA 16823-0048 or NSI Environmental Solutions, Research Triangle Park, NC 27709.

Reagent Water

Reagent water was generated using a Standard 4-Bowl Milli-Q System including an Organex Cartridge (Millipore Corp., 34 Maple St., Milford, MA 01757).

Matrix Modifying Solution (MMS)

The MMS was prepared by adding 120 g of Na_2SO_4, 0.75 g of Na_2HPO_4, and 4.8 g of KH_2PO_4 to 300 mL of pH 2 reagent water which was prepared by adding phosphoric acid to reagent water until a pH of 2 was measured by a pH meter.

Samples

Inert Sand - Approximately 30 mesh sand, rinsed with reagent water and allowed to air dry.

Clay - Soil obtained from a shallow excavation at the EPA facilities in Cincinnati was used as collected without any processing.

Garden Soil - Top soil obtained from Springdale, OH, and air dried.

Horizon-C Soil - An integrated core sample, primarily clay, collected between 5 and 10 feet below the surface uphill from a hazardous waste landfill, used as collected without further processing.

Gas Chromatographic Conditions

The helium gas flow was adjusted to 9.6 mL/min. The column temperature program was started at 25°C, held for 8 min from injection, ramped to 200°C at 10°C/min, and then held for 10 min. Each total analyses time was approximately 35 min.

Mass Spectrometer Conditions

The ion trap detector (ITD) was scanned from 49 to 300 amu each second with 6 microscans per scan. The electron multiplier voltage was varied from 1550 to 2050 volts depending on ITD tuning. The transfer line between the gas chromatograph and the ITD was maintained at 250°C, the open-split interface and the exit nozzle approximately 240°C and the trap manifold approximately 220°C. The characteristic ions used are listed in Table 1.

EXPERIMENTAL PROCEDURES

Each sample was prepared by adding 5.0 g of a soil matrix to a 20-mL 7000-HA crimp-seal glass headspace vial. In rapid succession, each soil sample was fortified with the target analytes in methanol, the matrix modifier solution (MMS) was added, and the vial was sealed. The purpose of the matrix modifier solution was to increase the efficiency of the headspace analysis by providing a salting-out effect and to minimize dehydrohalogenation reactions through pH adjustment (2). The vials were placed in the autosampler carousel and maintained at room temperature. Approximately 1 h prior to analysis, the individual vials were moved to a heating zone and allowed to equilibrate for 50 min at 85°C. The sample was then mixed by mechanical vibration for 8 min while the temperature was maintained at 85°C. The autosampler then raised the vial causing a stationary needle to puncture the septum and pressurize the vial with helium at 7.5 psi. The vial was allowed to pressure equilibrate for a 0.10 min to ensure complete mixing of the pressurization gas with the vial headspace. The pressurized headspace was then vented through a 2 mL sample loop to the atmosphere for 15 sec. In this manner, a representative volume of headspace was isolated within the loop. Finally the carrier gas, at a flow rate of 9.5 mL/min, backflushed the sample loop, sweeping the sample through the heated transfer line into the GC/MS system for separation, identification, and measurement of the method analytes.

Precision of the Tekmar 7000 Headspace Autosampler

To determine the precision of the Tekmar 7000 HA, the following experiment was performed.

All operational parameters on the headspace analyzer were set within manufacturer's recommendations. Six 10-mL reagent water samples in 20-mL glass vials were sequentially adjusted to pH 2 with 85% phosphoric acid, fortified with 5 μL of a 5 ng/μL solution containing all analytes in Table 2, and sealed. This aqueous standard preparation procedure has been demonstrated to be accurate and precise for purge and trap methods (3). The vials were placed in the 7000-HA and automatically submitted to the entire analytical procedure. After each analysis, analyte peak integration areas were recorded to determine precision.

Preliminary work demonstrated that significant losses of the halogenated alkanes occurred during sample equilibration periods when the pH was maintained at 7 (1). These losses were due to dehydrohalogenation reactions which occur readily at elevated temperatures with haloalkanes at a pH of 7 or higher. Further results showed that these losses were avoided when the sample pH was reduced to 2. Therefore, all matrices studied in this work were adjusted to a pH of 2.

Selection of the Matrix Modified Solution

Two experiments were performed to determine an appropriate matrix modifier solution which is a salt solution that would help optimize accuracy and precision of test compound determinations in a variety of soils. The first MMS contained an acidified saturated solution of Na_2SO_4 and the second contained an acidified saturated solution of $CaCL_2$. Ten mL of the MMS were added to vials, each fortified with 5 μL of a solution of 5 ng/μL of analytes in Table 3, sealed and submitted to the experimental procedure. These experiments were carried out in an attempt to shift the equilibrium of the analytes to the gas phase in order to improve sensitivity without sacrificing precision and to determine if the MMS can be fortified and sealed before losses occur. Addition of the MMS will also compensate for the varying salt content that may be encountered in solid samples.

Verification of the Fortifying Procedure

To verify reproducible fortification of solid samples, five 5.0 g portions of sand were placed into individual vials. Each was then fortified with 5 μL of a 5 ng/μL solution containing the analytes, and followed by the addition of the selected MMS, Na_2SO_4. The Na_2SO_4 MMS was chosen because it showed the better performance (see results). The vials were sealed, placed in the 7000-HA and submitted to the analysis as previously described. Sand was chosen over other solid matrices because it was believed that shifts of equilibrium of the volatile analytes to the gas phase should be higher in this relatively low surface area matrix.

Assessment of Analyte Recoveries Using the Matrix Modifying Solution

These experiments were performed to measure the increase in analyte recoveries, based on analyte absolute integrated peak areas, when the MMS was added to the same matrix. Experiments were carried out comparing recoveries from the different matrices using a constant headspace volume. Five 10 mL reagent water samples in individual vials at pH 2 were fortified with 5 μL of a 5 ng/μL solution containing all the method analytes. They were sealed immediately, and submitted to the analysis previously described.

Five 10 mL pH 2 Na_2SO_4 MMS samples in individual vials were fortified with 5 μL of a 5 ng/μL solution containing all the method analytes, and sealed. The vials were submitted to the analysis previously described.

Five 5.0 g samples of sand were placed in individual vials, and fortified as above. It was independently determined that 5 g of sand displaces approximately 2 mL of water. Therefore, an 8.0 ml aliquot of pH 2 reagent water was added to each in order to maintain a constant headspace volume for all samples in the experiment. The vials were sealed, and the samples were analyzed as described.

Four 5.0 g sample of sand were treated as above, this time adding 8.0 mL of the MMS instead of water.

Analyte Recoveries From Various Soil Matrices

These experiments were carried out to compare analyte recovery, based on analyte absolute integrated peak areas, when the MMS is added to different types of soil matrices. Three 10-mL Na_2SO_4 MMS samples were fortified in vials with 5 μL of the 5 ng/μL analyte fortification solution, sealed, and analyzed as described. These samples were used as the control samples.

Three 5.0 g samples of sand, three 5.0 g samples of clay, three 5.0 g samples of garden soil, and three 5.0 g samples of horizon-c soil were placed in individual vials, fortified as above, 8-mL of Na_2SO_4 MMS added and analyzed as described previously.

Analyte Recoveries From Various Soil Matrices Utilizing Internal Standard Calibration

These experiments were carried out to determine the percent recoveries of the method analytes from the different matrices using different internal standards (IS). The ISs evaluated were: fluorobenzene, benzene-d6, toluene-d8, chloroform-d, 2-bromo-1-chloropropane-d6, bromobenzene-d5 and bromochloromethane-d2.

Three individual 10-mL Na_2SO_4 MMS samples were fortified with 5, 25 and 50 ng of each analyte and 25 ng of each IS. These standards were analyzed to create a concentration calibration curve for each analyte. Three different sets of three samples each were prepared using sand, clay and garden soil. The horizon-c soil sample was discarded for this experiment because it was contaminated with the test analytes. Each sample was fortified with 25 ng of each analyte, 25 ng of each IS and 8-mL of the Na_2SO_4 MMS. The vials were sealed and submitted to the complete analysis. These samples were used to calculate the percent recovery.

Different Headspace Volume Recovery Experiment

To evaluate the effect of the headspace volume on the method sensitivity, the following experiments were performed.

Three 10 mL aliquots of MMS were fortified with 5 μL of a 5 ng/μL solution containing each analyte. The vials were sealed and analyzed as described previously.

To vary the headspace volume, three more vials were filled with 5 mL of 5 mm diameter glass beads (enough glass beads to fill a 5 mL graduated cylinder) and 10 mL of MMS. These were fortified as described, sealed and analyzed. In exactly the same manner, two additional experiments were carried out, filling the vials with 10 mL of the Na_2SO_4 MMS and 15 mL of the beads, respectively.

Different MMS Volume at Constant Headspace Volume Recovery Experiments

To determine if the MMS volume affected analyte recovery, three experiments were carried out with constant headspace volume.

First, three 10-mL MMS samples at pH 2 were fortified in vials with 5 μL of the 5 ng/μL analyte fortification solution. The vials were immediately sealed and analyzed as described above.

In a second experiment three vials were filled with 5 mL of the glass beads described above. Then an exact volume of MMS was added to each vial so that exactly the same headspace volume would be contained in all vials as compared with the previous experiment. The samples were fortified as above, sealed and submitted to the entire analysis procedure. A third experiment was performed adding 10-mL of glass beads instead of 5 mL and the Na_2SO_4 MMS to the vials.

RESULTS AND DISCUSSION

Precision of the Tekmar 7000 Headspace Autosampler

Six replicate samples of fortified reagent water acidified to pH 2 were analyzed to determine the reproducibility of the 7000-HA. Reagent water was used so that results from headspace analysis could be compared to those obtained using standard purge and trap technology. This would demonstrate whether the headspace analyzer methodology could generate data of equal quality to current EPA methodology (3). Only one relative standard deviation (RSD) of all listed in Table 2 was greater than 13%. These RSDs were comparable to purge and trap methodology utilizing similar matrices (1,3).

Selection of the Matrix Modifier Solution

Results from the experiments to evaluate the use of a matrix modifier solution to improve the precision and sensitivity of the headspace analysis are listed in Tables 3 and 4. Saturated solutions of pH adjusted Na_2SO_4 and $CaCl_2$ were used in this study. The RSDs calculated from the analyte integrated peak areas obtained with Na_2SO_4 solution (Table 3) ranged from 2% to 22% with a mean of 8%. The RSDs for the $CaCl_2$ solution (Table 4) ranged from 4% to 66% with a mean of 13%, indicating that the Na_2SO_4 solution was a suitable matrix modifier solution. Comparison of the average areas in Tables 2, 3, and 4 indicated that addition of salt to a sample matrix significantly improves recoveries of the higher boiling compounds. The poor recoveries and precision associated with the $CaCl_2$ solution may indicate that volatility losses were significant before the vials could be sealed when using the $CaCl_2$ MMS. At this point in the study, it was decided to discontinue the use of $CaCl_2$, and use only the Na_2SO_4 solution as the modifier.

The data in Tables 2, 3, and 4 appear in the same chronological order as the analyses were carried out. The storage time for each successive sample was approximately 60 min or longer than its predecessor; therefore, if dehydrohalogenation reactions were occurring, they should be apparent by the systematic loss of the haloalkanes and the corresponding increase of the alkenes. Comparison of the areas of the alkanes (tetrachloroethane, 1,1,1-

trichloroethane, and 1,1-dichloroethane) most prone to dehydrohalogenation reactions and their corresponding products (1,1,2-trichloroethene, 1,1 dichloroethene, and chloroethene) indicated that no reactions were occurring which could significantly affect the quality of the data.

Verification of the Fortifying Procedure

Having established the precision capabilities of the 7000-HA when analyzing a simple aqueous matrix, an experiment was carried out to evaluate the precision of the soil matrix fortifying procedure. Results from the analyses of five replicate samples were compared, and RSDs of the integrated analyte peak areas were calculated. RSDs from this experiment (Table 5) ranged from 3% to 13% with a mean of 8% for all analytes. The similarity of these RSDs to those in Table 2 indicated acceptable precision and a reproducible fortifying procedure.

Assessment of Analyte Recoveries Using the Matrix Modifying Solution

Experiments were performed to measure the increase in analyte recoveries, comparing the analyte absolute integrated peak areas when the MMS was added to the soil matrices. In these experiments, the headspace volume was controlled by adjusting the volume of the liquid added to the vial. Analyte peak areas from reagent water, Na_2SO_4 MMS, water/sand, and MMS/sand are presented in Tables 6, 7, 8 and 9, respectively. Table 10 compares the data in the four previous tables. It indicates that the Na_2SO_4 MMS was successful in increasing the shift of the analytes to the gas phase, and produced higher recoveries for almost all analytes when compared to the recoveries from reagent water. In addition, when the recoveries from reagent water/sand and the MMS/sand samples were compared recoveries increased with addition of the MMS. Clearly, the matrix modifying solution will increase analyte recoveries. The data in Tables 6 - 9 also indicate no significant losses within experimental error due to dehydrohalogenation reactions.

When matrix modifier solution results were compared with MMS/sand results analyte recoveries decreased slightly in the samples with sand. This indicates some matrix effect from the sand and inhibits removal of the analytes from that matrix.

Analyte Recoveries From Various Soil Matrices

These experiments were performed to compare analyte recoveries, based on analyte absolute integrated peak areas, when the MMS is added to a variety of matrices and to assess the degree of matrix effect caused by each matrix.

Four different kinds of soil were studied: sand, clay, garden soil, and horizon-c soil. The results obtained from the fortified control solution (10 mL of MMS) were used to establish baseline recoveries. Tables 11, 12, 13, and 14 show those results obtained with sand, clay, garden soil, and horizon-c soil, respectively. Table 15 summarizes the results showing the relative percent recovery obtained from each matrix. This relative percent recovery was obtained by dividing the peak area of each analyte in the soil samples by the respective analyte peak area in the fortified MMS sample, and multiplying by 100. High ratios are indicative of high recoveries. Analyte relative percent recoveries were higher for sand samples, followed by horizon-c and

clay samples, and finally garden soil samples. These data indicated that serious matrix effects can be experienced from one sample type to another. With fortified clay samples containing a high percentage of large particles (i.e., 20 mesh) recovery and precision is better than with fortified clay samples containing mainly fine particles (i.e., <20 mesh).

Analyte Recoveries From Various Soil Matrices Utilizing Internal Standard Calibration

Seven different commonly used purge and trap internal standards (IS) were tested with sand, clay, and garden soil matrices. Tables from 16 to 36 show the results based on internal standard calibration for each matrix.

It can be concluded by observing these tables of data that, regardless of the internal standard compound evaluated, analyte recoveries were highest for sand, the matrix demonstrating little or no matrix effects. For sand, the average percent recoveries for the seven internal standards were all >80%, except for bromobenzene-d5 at 74%. Fluorobenzene is the internal standard of choice in other analytical methods (1,3) used to determine VOCs in other matrices, and produced similar results in this method as the internal standard.

The results of the experiment utilizing garden soil indicated matrix effects could be minimized if internal standards that have similar chemical and physical properties to the target compound are added to the sample prior to extraction. Table 37 demonstrates the use of multiple internal standards in garden soil. The internal standards benzene-d6, toluene-d8, and bromobenzene-d5 were observed to enhance the recoveries of most of the analytes to near 100%. Due to the volatile nature of chloroethane and the reactivity of styrene and dichloroethene, the recoveries for these analytes were low with all the internal standards. Bromobenzene-d5 produced low recoveries for the dichloro and trichlorobenzenes; however, 1,2-dichlorobenzene-d4 could be used to enhance the recoveries of these compounds to near 100%. The background concentration of toluene in garden soil was well in excess of the fortified concentration; thus even though the toluene response was corrected for the background contamination, its recovery was still in excess of 100%.

Different Headspace Volume Recovery Experiments

Results of the studies to assess the effect of the headspace volume on the method sensitivity are listed in Tables 38, 39, 40, and 41. The volume of headspace was varied by adding glass beads to the sample vials as discussed in the experimental section. Table 42 summarizes the previous three tables.

For this method, headspace volume was controlled by the volume of the vial, the volume of MMS and the volume of solids added to the vial. Both the volume of the vial and the volume of the MMS added can be accurately maintained in the analytical laboratory and in the field. However, it is extremely difficult to accurately sample a constant volume of a solid, especially considering that the longer the soil sample is exposed to the air the more significant the errors become because of volatility losses. The data in Table 42 indicates the magnitude of the error that may be encountered if the volume of sample added to the vial is not held constant. If the method

specified a volume of sample equivalent to 10 mL of glass beads (Table 43), then the headspace volume would be 6.8 mL. Decreasing the headspace volume by approximately 2.6 mL (Table 42, column 4) would increase the recovery by an average of 37%. In addition, increasing the headspace volume by 2.6 mL (Table 42, column 2) would decrease the recovery by an average of 11%.

Figure 1 illustrates results obtained for selected compounds chosen to represent the complete method analyte list. Figure 1 demonstrates that decreasing the sample headspace volume, while maintaining a constant MMS volume, will increase the concentration of the analyte in the gas phase, and therefore introduce error into the method if the headspace volume is not held constant. Figure 1 also shows that the increase in response due to decreased headspace volume is much more pronounced for the less volatile compounds. The samples containing the largest volume of glass beads and therefore the smallest headspace volume showed proportionally higher recoveries for 1,3,5-trimethylbenzene than for dichlorodifluoromethane.

Different MMS Volume at Constant Headspace Volume Recovery Experiments

These experiments were performed to study the effect of varying the volume of MMS on the recoveries of the analytes from the matrix. Tables 43, 44, and 45 show the results obtained using a different volume of MMS, and table 46 summarizes them.

The responses of six selected compounds, in order of their increasing boilup point are depicted in Figure 2. It appears that 7 mL of the MMS produced the optimum response, however, ±3 mL on either side of the optimum MMS volume has only a slight effect (average % difference of 12) on the response of the selected compounds.

The volume of the MMS added to the sample is not as determinant as the headspace volume of it. This indicates that the 7000 HA will only work consistently if sample sizes are collected the same and therefore the headspace column kept constant.

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TABLE 1

MOLECULAR WEIGHTS AND CHARACTERISTIC IONS

Compound	Molecular Weight	Quantitation Ions
Internal Standards		
FLUOROBENZENE	96	96
BROMOCHLOROMETHANE-d2	130	51
CHLOROFORM-d	119	84
BENZENE-d6	84	84
TOLUENE-d8	100	98
2-BROMO-1-CHLOROPROPANE-d6	163	82
BROMOBENZENE-d5	162	82
Surrogates		
4-BROMOFLUOROBENZENE	174	95
1,2-DICHLOROBENZENE-d4	150	150
Analytes		
BENZENE	78	78
BROMOBENZENE	157	77
BROMOCHLOROMETHANE	128	49
BROMODICHLOROMETHANE	162	83
BROMOFORM	250	173
BROMOMETHANE	94	94
n-BUTYLBENZENE	134	91
sec-BUTYLBENZENE	134	105
tert-BUTYLBENZENE	134	119
CARBON TETRACHLORIDE	152	117
CHLOROBENZENE	112	77
CHLOROETHANE	64	49
CHLOROFORM	118	83
CHLOROMETHANE	50	50
2-CHLOROTOLUENE	126	91
4-CHLOROTOLUENE	126	91
DIBROMOCHLOROMETHANE	206	129
1,2-DIBROMO-3-CHLOROPROPANE	234	75
1,2-DIBROMOMETHANE	186	107
DIBROMOMETHANE	172	93
1,2-DICHLOROBENZENE	146	146
1,3-DICHLOROBENZENE	146	146
1,4-DICHLOROBENZENE	146	146
DICHLORODIFLUOROMETHANE	120	85
1,1-DICHLOROETHANE	98	63
1.2-DICHLOROETHANE	98	62
1,1-DICHLOROETHENE	96	61
cis-1,2-DICHLOROETHENE	96	61
trans-1,2-DICHLOROETHENE	96	61
1,2-DICHLOROPROPANE	112	63
1,3-DICHLOROPROPANE	112	76
2,2-DICHLOROPROPANE	112	77
1,1-DICHLOROPROPENE	110	75
ETHYLBENZENE	106	91
HEXACHLOROBUTADIENE	258	225
ISOPROPYLBENZENE	120	105
4-ISOPROPYLTOLUENE	134	119
METHYLENE CHLORIDE	84	49
NAPHTHALENE	128	128
n-PROPYLBENZENE	120	91
STYRENE	104	104
1,1,1,2-TETRACHLOROETHANE	166	131
1,1,2,2-TETRACHLOROETHANE	166	83
TETRACHLOROETHENE	164	129
TOLUENE	92	91
1,2,3-TRICHLOROBENZENE	180	180
1,2,4-TRICHLOROBENZENE	180	180
1,1,1-TRICHLOROETHANE	132	97
1,1,2-TRICHLOROETHANE	132	83
TRICHLOROETHENE	130	95
TRICHLOROFLUOROMETHANE	136	101
1,2,3-TRICHLOROPROPANE	146	75
1,2,4-TRIMETHYLBENZENE	120	105
1,3,5-TRIMETHYLBENZENE	120	105
VINYL CHLORIDE	62	62
o-XYLENE	106	91
p-XYLENE	106	106

TABLE 2
DETERMINATION OF AUTOSAMPLER PRECISION
25 ng ANALYTE RESPONSE IN REAGENT WATER

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	Sample 5 Area	Sample 6 Area	AVG Area	RSD (%)
VINYL CHLORIDE	2026	2264	2052	1901	1950	1682	1979	9
TRICHLOROFLUOROMETHANE	2215	2306	2156	2214	2404	2052	2225	5
1,1-DICHLOROETHENE	1125	1321	1126	1267	1292	1091	1204	8
METHYLENE CHLORIDE	3237	3506	3214	3399	3535	2964	3309	6
trans-1,2-DICHLOROETHENE	809	716	729	749	802	692	750	6
1,1-DICHLOROETHANE	3189	3403	3170	3088	3435	2963	3208	5
cis-1,2-DICHLOROETHENE	971	1116	1016	915	1046	945	1002	7
BROMOCHLOROMETHANE	1233	1253	1294	1251	1441	1169	1274	7
CHLOROFORM	3140	3699	3239	3482	3820	2989	3395	9
1,1,1-TRICHLOROETHANE	3351	3597	3252	3221	3553	2815	3298	8
CARBON TETRACHLORIDE	2792	2918	2939	2724	3009	2544	2821	6
BENZENE	4296	5309	4749	5016	5299	4360	4838	8
TRICHLOROETHYLENE	1162	1238	1084	1108	1327	1012	1155	9
1,2-DICHLOROPROPANE	1609	1649	1555	1464	1781	1457	1586	7
DIBROMOMETHANE	1321	1441	1254	1328	1356	1256	1326	5
BROMODICHLOROMETHANE	2171	2052	1927	1770	2434	1787	2024	11
TOLUENE	5808	6179	6114	5632	6975	5073	5964	10
1,1,2-TRICHLOROETHANE	1006	916	971	875	924	739	905	9
TETRACHLOROETHYLENE	1070	1087	993	1058	1161	830	1033	10
1,3-DICHLOROPROPANE	2337	2213	2273	2166	2482	2069	2257	6
DIBROMOCHLOROMETHANE	889	844	885	879	1075	731	884	11
CHLOROBENZENE	2478	2579	2464	2377	2898	2275	2512	8
1,1,1,2-TETRACHLOROETHANE	1237	1046	1216	925	1223	937	1097	12
ETHYL BENZENE	6813	6557	6501	5847	7761	5528	6501	11
p-XYLENE	6252	6106	5813	5489	6527	5567	5959	6
o-XYLENE	6156	5082	4585	5132	6180	4585	5287	12
STYRENE	2655	2673	2581	2395	2703	1879	2481	12
BROMOFORM	390	399	333	361	474	337	382	12
ISOPROPYLBENZENE	7724	8169	7403	7145	7337	6009	7298	9
p-BROMOFLUOROBENZENE	2400	2575	2250	2478	3206	2027	2489	15
BROMOBENZENE	928	939	802	903	907	854	889	5
1,1,2,2-TETRACHLOROETHANE	1501	1953	1935	1468	1451	1555	1644	13
1,2,3-TRICHLOROPROPANE	1309	1346	1274	1209	1594	1259	1332	9
n-PROPYL BENZENE	11768	10588	9143	10098	11607	9266	10412	10
2-CHLOROTOLUENE	1204	1093	982	1141	1127	774	1054	13
4-CHLOROTOLUENE	1182	1181	962	1080	1186	936	1088	10
1,3,5-TRIMETHYLBENZENE	7476	7610	6739	6917	7269	6256	7045	7
sec-BUTYL BENZENE	10657	10862	8835	9836	10943	9212	10058	8
1,2,4-TRIMETHYLBENZENE	2006	1954	1583	1768	2122	1595	1838	11
1,3-DICHLOROBENZENE	1875	1834	1588	1672	1970	1732	1779	7
p-ISOPROPYL TOLUENE	6668	6520	5737	5454	7022	5893	6216	9
1,4-DICHLOROBENZENE	1919	1876	1695	1672	2034	1636	1805	8
1,2-DICHLOROBENZENE-d4	1633	1620	1349	1461	1857	1451	1562	11
1,2-DICHLOROBENZENE	1525	1477	1477	1386	1545	1282	1449	6
n-BUTYL BENZENE	9584	10564	8057	8734	10159	8776	9312	9
1,2,4-TRICHLOROBENZENE	1011	1063	903	892	1226	870	994	13
HEXACHLOROBUTADIENE	1335	1204	1199	1174	1270	972	1192	9
NAPHTHALENE	1969	1766	1953	1826	1895	1755	1861	5
1,2,3-TRICHLOROBENZENE	922	968	781	821	922	719	856	10

TABLE 3

EVALUATION OF THE MATRIX MODIFYING SOLUTION
25 ng ANALYTE RESPONSE IN SODIUM SULFATE SOLUTION

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	AVG Area	RSD (%)
VINYL CHLORIDE	731	952	857	1148	922	17
TRICHLOROFLUOROMETHANE	1748	1783	1522	1806	1715	7
1,1-DICHLOROETHENE	955	804	844	893	874	6
METHYLENE CHLORIDE	5343	4722	4762	4427	4814	7
trans-1,2-DICHLOROETHENE	691	767	614	623	674	9
1,1-DICHLOROETHANE	3974	3928	3790	3321	3753	7
cis-1,2-DICHLOROETHENE	1340	1229	1164	1080	1203	8
BROMOCHLOROMETHANE	2840	2770	2481	2316	2602	8
CHLOROFORM	3674	3731	3597	3116	3530	7
1,1,1-TRICHLOROETHANE	3144	3056	2949	2509	2915	8
CARBON TETRACHLORIDE	2219	1962	2105	2223	2127	5
BENZENE	5421	5268	4860	4290	4960	9
TRICHLOROETHYLENE	1134	1169	1048	1128	1120	4
1,2-DICHLOROPROPANE	2561	2431	2415	2070	2369	8
DIBROMOMETHANE	3330	3267	3061	2496	3039	11
BROMODICHLOROMETHANE	3397	3426	3195	2653	3168	10
TOLUENE	6924	6613	6731	5871	6535	6
1,1,2-TRICHLOROETHANE	1706	1832	1551	1299	1597	12
TETRACHLOROETHYLENE	875	793	705	660	758	11
1,3-DICHLOROPROPANE	5006	4871	5528	4340	4936	9
DIBROMOCHLOROMETHANE	1862	1927	1770	1664	1806	5
CHLOROBENZENE	3381	3058	3151	2786	3094	7
1,1,1,2-TETRACHLOROETHANE	1335	731	1367	1153	1147	22
ETHYL BENZENE	5936	6285	6079	5940	6060	2
p-XYLENE	5951	6099	5834	5930	5954	2
o-XYLENE	5091	5353	4574	5069	5022	6
STYRENE	2702	2668	2522	2817	2677	4
BROMOFORM	1182	1245	1096	1110	1158	5
ISOPROPYLBENZENE	6212	5248	5701	5571	5683	6
p-BROMOFLUOROBENZENE	2717	3514	2895	2881	3002	10
BROMOBENZENE	1313	844	1308	974	1110	19
1,1,2,2-TETRACHLOROETHANE	3232	3949	3317	3453	3488	8
1,2,3-TRICHLOROPROPANE	3151	3904	3373	3596	3506	8
n-PROPYL BENZENE	8237	9359	8567	9407	8893	6
2-CHLOROTOLUENE	1107	1029	1154	1070	1090	4
4-CHLOROTOLUENE	1194	1434	1169	1051	1212	11
1,3,5-TRIMETHYLBENZENE	6289	5415	6149	5348	5800	7
sec-BUTYL BENZENE	8151	7241	8137	7330	7715	6
1,2,4-TRIMETHYLBENZENE	1851	1927	1948	1788	1879	3
1,3-DICHLOROBENZENE	2234	2079	2228	2026	2142	4
p-ISOPROPYL TOLUENE	4993	5156	4648	4361	4790	6
1,4-DICHLOROBENZENE	2234	2340	2474	2444	2373	4
1,2-DICHLOROBENZENE-d4	2423	2270	2207	2084	2246	5
1,2-DICHLOROBENZENE	2080	2047	2150	2070	2087	2
n-BUTYL BENZENE	6476	7898	6424	7622	7105	9
1,2,4-TRICHLOROBENZENE	1620	1492	1389	1192	1423	11
HEXACHLOROBUTADIENE	932	971	778	858	885	8
NAPHTHALENE	5626	5925	5898	5016	5616	7
1,2,3-TRICHLOROBENZENE	1510	1547	1537	1398	1498	4

TABLE 4
EVALUATION OF THE MATRIX MODIFYING SOLUTION
25 ng ANALYTE RESPONSE IN CALCIUM CHLORIDE SOLUTION

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	Sample 5 Area	AVG Area	RSD (%)
VINYL CHLORIDE	978	547	821	923	889	832	18
TRICHLOROFLUOROMETHANE	1200	1133	1171	1204	1276	1197	4
1,1-DICHLOROETHENE	806	510	735	364	639	611	26
METHYLENE CHLORIDE	3553	2988	2674	2853	3014	3016	10
trans-1,2-DICHLOROETHENE	519	489	487	514	461	494	4
1,1-DICHLOROETHANE	2916	2541	2315	2676	2726	2635	8
cis-1,2-DICHLOROETHENE	930	873	610	803	748	793	14
BROMOCHLOROMETHANE	1486	1383	1134	1251	1313	1313	9
CHLOROFORM	2677	2434	2235	2565	2614	2505	6
1,1,1-TRICHLOROETHANE	2234	2110	1865	2182	2225	2123	6
CARBON TETRACHLORIDE	2189	1903	1855	1819	1972	1948	7
BENZENE	3736	3511	2996	3528	3618	3478	7
TRICHLOROETHYLENE	1039	950	907	975	1031	980	5
1,2-DICHLOROPROPANE	1426	1385	1173	1107	1355	1289	10
DIBROMOMETHANE	1384	1255	1081	1173	1326	1244	9
BROMODICHLOROMETHANE	2339	1934	2010	1952	1879	2023	8
TOLUENE	2156	1901	1652	1839	1959	1901	9
1,1,2-TRICHLOROETHANE	688	565	636	573	581	609	8
TETRACHLOROETHYLENE	735	772	695	760	735	739	4
1,3-DICHLOROPROPANE	2397	2024	2041	1945	2031	2088	8
DIBROMOCHLOROMETHANE	1407	1372	1025	1151	1196	1230	12
CHLOROBENZENE	2465	2586	1872	2443	2868	2447	13
1,1,1,2-TETRACHLOROETHANE	708	1042	644	959	964	863	18
ETHYL BENZENE	4837	4275	3833	4531	4497	4395	8
p-XYLENE	4628	3838	3554	3458	3595	3815	11
o-XYLENE	4525	4013	4012	3589	4309	4090	8
STYRENE	1217	469	261	225	530	540	66
BROMOFORM	1385	1114	781	942	889	1022	21
ISOPROPYLBENZENE	5477	5488	4403	6074	6028	5494	11
p-BROMOFLUOROBENZENE	2091	1478	1326	1467	1580	1588	17
BROMOBENZENE	832	780	757	798	851	804	4
1,1,2,2-TETRACHLOROETHANE	1676	1408	1142	1156	1173	1311	16
1,2,3-TRICHLOROPROPANE	1636	1524	1171	1151	1106	1318	17
n-PROPYL BENZENE	6488	5437	5442	6387	6545	6060	8
2-CHLOROTOLUENE	864	1007	797	1066	1009	949	11
4-CHLOROTOLUENE	614	763	727	952	1070	825	20
1,3,5-TRIMETHYLBENZENE	3674	3176	2433	4627	6152	4012	32
sec-BUTYL BENZENE	6593	7285	5237	7946	8870	7186	17
1,2,4-TRIMETHYLBENZENE	1135	1243	943	1328	1780	1286	22
1,3-DICHLOROBENZENE	1505	1446	1098	1552	1704	1461	14
p-ISOPROPYL TOLUENE	4081	4228	3133	4177	5090	4142	15
1,4-DICHLOROBENZENE	1789	1643	1098	1552	1739	1564	16
1,2-DICHLOROBENZENE-d4	1446	1317	1173	1481	1589	1401	10
1,2-DICHLOROBENZENE	1227	1153	987	1365	1413	1229	12
n-BUTYL BENZENE	6458	5456	5814	5308	6136	5834	7
1,2,4-TRICHLOROBENZENE	863	831	798	720	735	789	7
HEXACHLOROBUTADIENE	687	677	603	612	798	675	10
NAPHTHALENE	2530	2475	1961	1918	1909	2159	13
1,2,3-TRICHLOROBENZENE	1045	758	671	556	418	690	31

TABLE 5
VERIFICATION OF FORTIFYING PROCEDURE
25 ng ANALYTE RESPONSE IN SAND

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Aera	Sample 4 Area	Sample 5 Area	AVG Area	RSD (%)
VINYL CHLORIDE	1610	1746	1774	1686	1670	1697	3
TRICHLOROFLUOROMETHANE	1975	1904	1970	2136	2243	2046	6
1,1-DICHLOROETHENE	1277	1340	1594	1568	1599	1476	9
METHYLENE CHLORIDE	7647	8437	8722	9153	9798	8751	8
trans-1,2-DICHLOROETHENE	1098	1160	1325	1121	1241	1189	7
1,1-DICHLOROETHANE	5532	5936	6189	6600	7277	6307	9
cis-1,2-DICHLOROETHENE	2134	2265	2206	2435	2746	2357	9
BROMOCHLOROMETHANE	3931	4481	4397	4618	4931	4472	7
CHLOROFORM	5477	6498	6402	7016	7260	6531	9
1,1,1-TRICHLOROETHANE	4239	4769	5061	4922	5564	4911	9
CARBON TETRACHLORIDE	3475	3787	4325	4068	4793	4090	11
BENZENE	8817	8966	9244	10993	10033	9611	8
TRICHLOROETHYLENE	1859	2041	2067	2115	2380	2092	8
1,2-DICHLOROPROPANE	3378	3846	4037	4133	4381	3955	8
DIBROMOMETHANE	4602	5189	5313	5319	5360	5157	5
BROMODICHLOROMETHANE	5000	5624	5496	5729	5562	5482	5
TOLUENE	11974	12766	13745	15946	14852	13857	10
1,1,2-TRICHLOROETHANE	2491	2719	2781	2820	2947	2752	5
TETRACHLOROETHYLENE	1492	1319	1626	1596	1626	1532	8
1,3-DICHLOROPROPANE	9496	9821	9671	11693	9882	10113	8
DIBROMOCHLOROMETHANE	2878	3017	3095	3406	3447	3169	7
CHLOROBENZENE	5594	6285	6113	6565	6398	6191	5
1,1,1,2-TETRACHLOROETHANE	2894	2848	2808	2867	3282	2940	6
ETHYL BENZENE	13857	16503	13259	15808	14342	14754	8
p-XYLENE	12852	13419	12651	14986	12365	13255	7
o-XYLENE	12224	13593	11178	14658	14149	13160	10
STYRENE	2401	2251	2520	2165	1854	2238	10
BROMOFORM	1723	1969	1733	2038	1917	1876	7
ISOPROPYLBENZENE	11758	11532	11208	13739	11974	12042	7
p-BROMOFLUOROBENZENE	5337	6182	5793	6114	5657	5817	5
BROMOBENZENE	2118	2354	2157	2935	2374	2388	12
1,1,2,2-TETRACHLOROETHANE	5812	6249	6407	8103	7868	6888	13
1,2,3-TRICHLOROPROPANE	7339	8454	6432	8923	7452	7720	11
n-PROPYL BENZENE	18223	20182	18641	21490	17960	19299	7
2-CHLOROTOLUENE	1932	2594	2406	2688	2331	2390	11
4-CHLOROTOLUENE	2136	2229	2161	2710	2311	2309	9
1,3,5-TRIMETHYLBENZENE	11177	13723	11797	13208	12225	12426	7
sec-BUTYL BENZENE	12405	16124	13677	16185	13063	14291	11
1,2,4-TRIMETHYLBENZENE	3145	3985	3227	4171	3985	3703	12
1,3-DICHLOROBENZENE	3508	4195	3759	4809	4195	4093	11
p-ISOPROPYL TOLUENE	7989	8985	8822	10411	8985	9038	9
1,4-DICHLOROBENZENE	3772	4355	4404	4809	4355	4339	8
1,2-DICHLOROBENZENE-d4	3894	4826	4265	5007	4826	4564	9
1,2-DICHLOROBENZENE	3351	4013	3888	4367	4013	3926	8
n-BUTYL BENZENE	12550	13891	14133	14168	13891	13727	4
1,2,4-TRICHLOROBENZENE	1868	2401	1784	2309	2401	2153	13
HEXACHLOROBUTADIENE	1005	1202	987	1092	1202	1098	8
NAPHTHALENE	7649	9800	8636	9603	9800	9098	9
1,2,3-TRICHLOROBENZENE	1797	2226	2032	2232	2226	2103	8

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TABLE 6
25 ng ANALYTE RESPONSE IN REAGENT WATER

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	Sample 5 Area	AVG Area	RSD (%)
VINYL CHLORIDE	2416	2333	2265	2205	2149	2274	4
TRICHLOROFLUOROMETHANE	4002	3984	4054	3967	3770	3955	2
1,1-DICHLOROETHENE	1570	1631	1633	1544	1622	1600	2
METHYLENE CHLORIDE	2770	2781	2803	2812	2828	2799	1
trans-1,2-DICHLOROETHENE	1443	1400	1525	1460	1372	1440	4
1,1-DICHLOROETHANE	3505	3542	3686	3648	3665	3609	2
cis-1,2-DICHLOROETHENE	1300	1337	1277	1244	1326	1297	3
BROMOCHLOROMETHANE	1513	1464	1442	1629	1493	1508	4
CHLOROFORM	3929	3856	3851	3737	3824	3839	2
1,1,1-TRICHLOROETHANE	3715	3452	3559	3500	3508	3547	3
CARBON TETRACHLORIDE	3336	3248	3510	3321	3368	3357	3
BENZENE	5422	5575	5897	5459	5589	5588	3
TRICHLOROETHYLENE	1469	1501	1583	1488	1542	1517	3
1,2-DICHLOROPROPANE	1671	1651	1765	1607	1720	1683	3
DIBROMOMETHANE	801	869	848	903	851	854	4
BROMODICHLOROMETHANE	2398	2276	2253	2151	2105	2237	5
TOLUENE	6838	6898	6854	6568	6483	6728	3
1,1,2-TRICHLOROETHANE	692	700	674	698	737	700	3
TETRACHLOROETHYLENE	1251	1237	1265	1329	1216	1260	3
1,3-DICHLOROPROPANE	1312	1393	1310	1417	1428	1372	4
DIBROMOCHLOROMETHANE	917	953	1028	995	994	977	4
CHLOROBENZENE	2891	2955	3079	3073	3153	3030	3
1,1,1,2-TETRACHLOROETHANE	1126	1310	1277	1267	1271	1250	5
ETHYL BENZENE	7933	7883	7742	7682	7632	7774	1
p-XYLENE	11999	12653	11334	12379	12284	12130	4
o-XYLENE	5358	5511	5328	5785	5677	5532	3
STYRENE	2475	2526	2579	2636	2835	2610	5
BROMOFORM	435	451	496	419	466	453	6
ISOPROPYLBENZENE	7218	7502	8399	7228	8550	7779	7
p-BROMOFLUOROBENZENE	1922	1646	2140	2336	2575	2124	15
BROMOBENZENE	NI	NI	NI	NI	NI	-	-
1,1,2,2-TETRACHLOROETHANE	1369	1484	1485	1511	1366	1443	4
1,2,3-TRICHLOROPROPANE	482	667	442	440	510	508	16
n-PROPYL BENZENE	9839	10928	10681	10793	10347	10518	4
2-CHLOROTOLUENE	1373	1370	1395	1356	1401	1379	1
4-CHLOROTOLUENE	1306	1392	1343	1346	1271	1332	3
1,3,5-TRIMETHYLBENZENE	7202	7495	7792	7780	8217	7697	4
sec-BUTYL BENZENE	9589	9864	10863	10126	11470	10382	7
1,2,4-TRIMETHYLBENZENE	2728	2719	2921	2798	3091	2851	5
1,3-DICHLOROBENZENE	2151	2199	2117	2253	2195	2183	2
p-ISOPROPYL TOLUENE	6746	6926	6881	7146	7329	7006	3
1,4-DICHLOROBENZENE	2317	2052	2328	2158	2227	2216	5
1,2-DICHLOROBENZENE-d4	1764	1726	1628	1772	1804	1739	3
1,2-DICHLOROBENZENE	1792	1810	1862	1759	1777	1800	2
n-BUTYL BENZENE	8916	9342	10769	9347	9728	9620	7
1,2,4-TRICHLOROBENZENE	1228	1332	1242	1404	1377	1317	5
HEXACHLOROBUTADIENE	1286	1254	1431	1278	1375	1325	5
NAPHTHALENE	2229	2205	2188	2394	2424	2288	4
1,2,3-TRICHLOROBENZENE	1000	1096	1098	1092	1074	1072	3

NI=not included

TABLE 7
25 ng ANALYTE RESPONSE IN THE MMS SOLUTION

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	Sample 5 Area	AVG Area	RSD (%)
VINYL CHLORIDE	2374	2372	2559	2492	2161	2392	6
TRICHLOROFLUOROMETHANE	3721	3810	4013	3840	3460	3769	5
1,1-DICHLOROETHENE	1680	1806	1829	1871	1621	1761	5
METHYLENE CHLORIDE	4672	4958	4934	5110	4697	4874	3
trans-1,2-DICHLOROETHENE	1885	1978	2126	2038	1889	1983	5
1,1-DICHLOROETHANE	5432	5635	5827	5889	5288	5614	4
cis-1,2-DICHLOROETHENE	1974	2068	2161	2065	2028	2059	3
BROMOCHLOROMETHANE	2991	3136	3156	3084	3098	3093	2
CHLOROFORM	NI	5311	5347	5464	5078	5300	3
1,1,1-TRICHLOROETHANE	3837	4140	4647	4695	3822	4228	9
CARBON TETRACHLORIDE	3399	3550	4038	4185	3516	3738	8
BENZENE	7875	7881	8068	7938	7863	7925	1
TRICHLOROETHYLENE	1897	2109	2238	2263	2001	2102	7
1,2-DICHLOROPROPANE	2880	3177	3222	3248	3118	3129	4
DIBROMOMETHANE	1777	1801	1845	1935	1788	1829	3
BROMODICHLOROMETHANE	6279	4189	4235	4102	4113	4584	19
TOLUENE	9204	9436	10049	9961	9193	9569	4
1,1,2-TRICHLOROETHANE	1635	1648	1660	1736	1704	1677	2
TETRACHLOROETHYLENE	1303	1289	1581	1541	1304	1404	9
1,3-DICHLOROPROPANE	3060	3224	3384	3273	3226	3233	3
DIBROMOCHLOROMETHANE	2958	2143	2117	2269	2175	2332	14
CHLOROBENZENE	4791	4431	4920	4724	4263	4626	5
1,1,1,2-TETRACHLOROETHANE	1837	1908	1966	2016	1746	1895	5
ETHYL BENZENE	9228	9453	9984	10548	9200	9683	5
p-XYLENE	15815	18263	18872	17803	15756	17302	7
o-XYLENE	7278	8749	9138	9702	8318	8637	9
STYRENE	4365	4581	4765	4910	4487	4622	4
BROMOFORM	1304	1217	1282	1271	1194	1254	3
ISOPROPYLBENZENE	8861	9550	9248	9826	7879	9073	7
p-BROMOFLUOROBENZENE	3865	4212	4201	4469	4113	4172	5
BROMOBENZENE	NI	NI	NI	NI	NI	-	-
1,1,2,2-TETRACHLOROETHANE	3628	4040	3885	3900	3845	3860	3
1,2,3-TRICHLOROPROPANE	3416	3566	3385	3819	3388	3515	5
n-PROPYL BENZENE	11930	12270	13191	13047	11189	12325	6
2-CHLOROTOLUENE	1811	1858	2023	1921	1668	1856	6
4-CHLOROTOLUENE	1950	1959	2001	2084	1840	1967	4
1,3,5-TRIMETHYLBENZENE	8000	8922	10053	9845	8452	9054	9
sec-BUTYL BENZENE	10779	11491	11774	11046	9911	11000	6
1,2,4-TRIMETHYLBENZENE	3295	3698	3701	3517	3187	3480	6
1,3-DICHLOROBENZENE	3494	3576	3452	3279	3243	3409	4
p-ISOPROPYL TOLUENE	8403	7341	8703	8317	7547	8062	7
1,4-DICHLOROBENZENE	3563	3755	3922	3807	3623	3734	3
1,2-DICHLOROBENZENE-d4	3200	3224	3247	3244	2927	3168	4
1,2-DICHLOROBENZENE	3316	3222	3351	3216	3119	3245	3
n-BUTYL BENZENE	10840	12244	12373	11640	9894	11398	8
1,2,4-TRICHLOROBENZENE	2328	2475	2634	2589	2300	2465	5
HEXACHLOROBUTADIENE	1294	1465	1594	1712	1483	1510	9
NAPHTHALENE	7057	7428	8050	7694	7518	7549	4
1,2,3-TRICHLOROBENZENE	2186	2385	2507	2332	2316	2345	4

NI=not included

TABLE 8
25 ng ANALYTE RESPONSE IN WATER/SAND

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	Sample 5 Area	AVG Area	RSD (%)
VINYL CHLORIDE	993	1157	1080	980	1011	1044	6
TRICHLOROFLUOROMETHANE	1862	2376	2280	2213	2266	2199	8
1,1-DICHLOROETHENE	924	1107	1136	1077	1015	1052	7
METHYLENE CHLORIDE	1940	2503	2476	2410	2367	2339	9
trans-1,2-DICHLOROETHENE	946	1147	1228	1161	1194	1135	9
1,1-DICHLOROETHANE	2519	3147	3108	3268	3211	3051	9
cis-1,2-DICHLOROETHENE	888	1205	1197	1223	1233	1149	11
BROMOCHLOROMETHANE	1219	1558	1554	1454	1491	1455	9
CHLOROFORM	2781	3627	3647	3532	3637	3445	10
1,1,1-TRICHLOROETHANE	2078	2748	2774	2746	2818	2633	11
CARBON TETRACHLORIDE	1917	2389	2539	2443	2578	2373	10
BENZENE	4225	5298	5340	5759	5149	5154	10
TRICHLOROETHYLENE	1384	1314	1267	1264	1347	1315	4
1,2-DICHLOROPROPANE	1301	1579	1655	1589	1640	1553	8
DIBROMOMETHANE	705	864	808	904	837	824	8
BROMODICHLOROMETHANE	1717	2293	2275	2255	2151	2138	10
TOLUENE	4969	7011	6859	6820	7116	6555	12
1,1,2-TRICHLOROETHANE	729	758	735	763	802	757	3
TETRACHLOROETHYLENE	1043	1050	1080	1082	1101	1071	2
1,3-DICHLOROPROPANE	1194	1509	1517	1501	1429	1430	9
DIBROMOCHLOROMETHANE	815	1005	1034	1025	1069	990	9
CHLOROBENZENE	2220	2694	2785	2832	2759	2658	8
1,1,1,2-TETRACHLOROETHANE	999	1118	1163	1152	942	1075	8
ETHYL BENZENE	5852	7500	7522	7011	7053	6988	9
p-XYLENE	8732	11018	11404	11574	11866	10919	10
o-XYLENE	4513	5578	5846	5417	5635	5398	9
STYRENE	1976	2225	2084	1885	2035	2041	6
BROMOFORM	390	516	522	467	543	488	11
ISOPROPYLBENZENE	5075	6509	6925	6408	6516	6287	10
p-BROMOFLUOROBENZENE	1576	2269	1942	1928	2145	1972	12
BROMOBENZENE	NI	NI	NI	NI	NI	-	-
1,1,2,2-TETRACHLOROETHANE	1285	1595	1647	1749	1608	1577	10
1,2,3-TRICHLOROPROPANE	947	1266	1354	1121	1489	1235	15
n-PROPYL BENZENE	7358	9181	9488	9741	9470	9048	10
2-CHLOROTOLUENE	987	1309	1262	1273	1053	1177	11
4-CHLOROTOLUENE	1000	1291	1365	1294	1338	1258	10
1,3,5-TRIMETHYLBENZENE	5573	6299	6603	6409	6669	6311	6
sec-BUTYL BENZENE	6718	8228	8085	7615	8663	7862	8
1,2,4-TRIMETHYLBENZENE	2159	2666	2508	2529	2749	2522	8
1,3-DICHLOROBENZENE	1665	2219	2018	1992	1991	1977	9
p-ISOPROPYL TOLUENE	4944	6195	5719	5685	5859	5680	7
1,4-DICHLOROBENZENE	1680	2183	2194	2039	2185	2056	10
1,2-DICHLOROBENZENE-d4	1419	1932	1771	1560	1824	1701	11
1,2-DICHLOROBENZENE	1487	1877	1892	1625	1833	1743	9
n-BUTYL BENZENE	6947	8217	7838	7849	9014	7973	8
1,2,4-TRICHLOROBENZENE	897	1301	1274	1326	1467	1253	15
HEXACHLOROBUTADIENE	863	1159	1135	1112	1315	1117	13
NAPHTHALENE	2207	2761	2817	2694	2909	2678	9
1,2,3-TRICHLOROBENZENE	956	1216	1135	1082	803	1038	14

NI=not included

TABLE 9
25 ng ANALYTE RESPONSE IN MMS/SAND

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	Sample 4 Area	AVG Area	RSD (%)
VINYL CHLORIDE	1602	1652	1636	1448	1585	5
TRICHLOROFLUOROMETHANE	2648	2831	2863	2580	2731	4
1,1-DICHLOROETHENE	1358	1408	1336	1288	1348	3
METHYLENE CHLORIDE	4188	4110	4147	4193	4160	1
trans-1,2-DICHLOROETHENE	1120	1541	1613	1563	1459	14
1,1-DICHLOROETHANE	4475	4507	4732	4724	4610	3
cis-1,2-DICHLOROETHENE	1793	1785	1733	1843	1789	2
BROMOCHLOROMETHANE	2824	2798	2924	2755	2825	2
CHLOROFORM	4377	4448	4615	4605	4511	2
1,1,1-TRICHLOROETHANE	3318	3481	3570	3688	3514	4
CARBON TETRACHLORIDE	2863	3162	3144	3085	3064	4
BENZENE	6811	7059	7150	7470	7123	3
TRICHLOROETHYLENE	1595	1646	1722	1781	1686	4
1,2-DICHLOROPROPANE	2646	2690	2647	2845	2707	3
DIBROMOMETHANE	1864	1789	1771	1825	1812	2
BROMODICHLOROMETHANE	3596	3671	3802	3880	3737	3
TOLUENE	8994	9243	9736	9725	9425	3
1,1,2-TRICHLOROETHANE	1539	1566	1683	1754	1636	5
TETRACHLOROETHYLENE	1237	1331	1300	1266	1284	3
1,3-DICHLOROPROPANE	3162	3199	3204	3135	3175	1
DIBROMOCHLOROMETHANE	1922	1985	2010	1963	1970	2
CHLOROBENZENE	4443	4203	4156	4456	4315	3
1,1,1,2-TETRACHLOROETHANE	1761	1638	1669	1711	1695	3
ETHYL BENZENE	8607	8766	9223	10278	9219	7
p-XYLENE	13736	14974	15156	16326	15048	6
o-XYLENE	7716	8008	7921	8058	7926	2
STYRENE	2977	2525	2605	2740	2712	6
BROMOFORM	1193	1150	1282	1270	1224	4
ISOPROPYLBENZENE	8118	8545	8271	8475	8352	2
p-BROMOFLUOROBENZENE	3466	3366	3812	3605	3562	5
BROMOBENZENE	NI	NI	NI	NI	-	-
1,1,2,2-TETRACHLOROETHANE	3788	3713	4027	4014	3886	4
1,2,3-TRICHLOROPROPANE	3695	3695	3311	3731	3608	5
n-PROPYL BENZENE	11040	11275	10941	11411	11167	2
2-CHLOROTOLUENE	1678	1563	1633	1595	1617	3
4-CHLOROTOLUENE	1681	1685	1728	1743	1709	2
1,3,5-TRIMETHYLBENZENE	8018	7819	8068	7763	7917	2
sec-BUTYL BENZENE	9557	9984	9953	9985	9870	2
1,2,4-TRIMETHYLBENZENE	3259	3431	3391	3309	3348	2
1,3-DICHLOROBENZENE	2872	2710	3096	2793	2868	5
p-ISOPROPYL TOLUENE	6939	6951	7287	7113	7073	2
1,4-DICHLOROBENZENE	3056	3351	3227	3326	3240	4
1,2-DICHLOROBENZENE-d4	2810	2897	2824	2838	2842	1
1,2-DICHLOROBENZENE	2869	2834	2698	2908	2827	3
n-BUTYL BENZENE	9601	9961	10031	10724	10079	4
1,2,4-TRICHLOROBENZENE	1916	1885	2020	2178	2000	6
HEXACHLOROBUTADIENE	1290	1370	1492	1547	1425	7
NAPHTHALENE	6229	6642	6843	7807	6880	8
1,2,3-TRICHLOROBENZENE	1750	1801	2070	2080	1925	8

NI=not included

TABLE 10
COMPARISON OF FOUR FORTIFIED MATRICES

ANALYTE	REAGENT WATER Area AVG	RSD	MMS Area AVG	RSD	%DIFF(1)	WATER/SAND Area AVG	RSD	MSS/SAND Area AVG	RSD	%DIFF(2)
VINYL CHLORIDE	2274	4	2392	6	5	1044	6	1587	5	41
TRICHLOROFLUOROMETHANE	3955	2	3769	5	5	2188	8	2731	4	22
1,1-DICHLOROETHENE	1600	2	1761	5	10	1052	7	1348	3	25
METHYLENE CHLORIDE	2799	1	4874	3	54	2339	9	4160	1	56
trans-1,2-DICHLOROETHENE	1440	4	1983	5	32	1135	9	1459	14	25
1,1-DICHLOROETHANE	3609	2	5614	4	44	3051	9	4610	3	34
cis-1,2-DICHLOROETHENE	1297	3	2059	3	45	1159	11	1789	2	43
BROMOCHLOROMETHANE	1508	4	3093	2	70	1455	9	2825	2	64
CHLOROFORM	3839	2	5300	3	32	3445	10	4511	2	27
1,1,1-TRICHLOROETHANE	3547	3	4228	9	18	2633	11	3514	4	29
CARBON TETRACHLORIDE	3357	3	3738	8	11	2373	10	3064	4	25
BENZENE	5588	3	7925	1	35	5154	10	7123	3	32
TRICHLOROETHYLENE	1517	3	2102	7	32	1315	4	1686	4	25
1,2-DICHLOROPROPANE	1683	3	3129	4	60	1553	8	2707	3	54
DIBROMOMETHANE	854	4	1829	3	73	824	8	1812	23	74
BROMODICHLOROMETHANE	2237	5	4584	19	70	2138	10	3737	3	54
TOLUENE	6728	3	9569	4	30	6555	12	9425	3	36
1,1,2-TRICHLOROETHANE	700	3	1677	2	82	757	3	1636	5	73
TETRACHLOROETHYLENE	1260	3	1404	9	12	1071	2	1284	3	18
1,3-DICHLOROPROPANE	1372	4	3233	3	81	1430	9	3175	1	76
DIBROMOCHLOROMETHANE	977	4	2332	14	82	990	9	1970	2	66
CHLOROBENZENE	3030	3	4626	5	42	2658	8	4315	3	48
1,1,1,2-TETRACHLOROETHANE	1250	5	1895	5	41	1075	8	1695	3	45
ETHYL BENZENE	7774	1	9683	5	22	6988	9	9219	7	28
p-XYLENE	12130	4	17302	7	35	10919	10	15048	6	32
o-XYLENE	5532	3	8637	9	44	5398	9	7926	2	38
STYRENE	2610	5	4622	4	56	2041	6	2712	6	28
BROMOFORM	453	6	1254	3	94	488	11	1224	4	86
ISOPROPYLBENZENE	7779	7	9073	7	15	6287	10	8352	2	28
p-BROMOFLUOROBENZENE	2124	15	4172	5	65	1972	12	3562	5	57
BROMOBENZENE	NI	-	NI	-	-	NI	-	NI	-	-
1,1,2,2-TETRACHLOROETHANE	1443	4	3869	3	91	1577	10	3806	4	84
1,2,3-TRICHLOROPROPANE	508	16	3515	5	149	1235	15	3608	5	98
n-PROPYL BENZENE	10518	4	12325	6	16	9048	10	11167	2	21
2-CHLOROTOLUENE	1379	1	1856	6	30	1177	11	1617	3	31
4-CHLOROTOLUENE	1332	3	1967	4	38	1258	10	1709	2	30
1,3,5-TRIMETHYLBENZENE	7697	4	9054	9	16	6311	6	7917	2	23
sec-BUTYL BENZENE	10382	7	11000	6	6	7862	8	9870	2	23
1,2,4-TRIMETHYLBENZENE	2851	5	3480	6	20	2522	8	3348	2	28
1,3-DICHLOROBENZENE	2183	2	3409	4	44	1977	9	2868	5	37
p-ISOPROPYL TOLUENE	7006	3	8062	7	14	5680	7	7073	2	22
1,4-DICHLOROBENZENE	2216	5	3734	3	51	2056	10	3240	4	45
1,2-DICHLOROBENZENE-d4	1739	3	3168	4	58	1701	11	2842	1	50
1,2-DICHLOROBENZENE	1800	2	3245	3	57	1743	9	2827	3	47
n-BUTYL BENZENE	9620	7	11398	8	17	7973	8	10079	4	23
1,2,4-TRICHLOROBENZENE	1317	5	2465	5	61	1253	15	2000	6	46
HEXACHLOROBUTADIENE	1325	5	1510	9	13	1117	13	1425	7	24
NAPHTHALENE	2288	4	7549	4	107	2678	9	6880	8	84
1,2,3-TRICHLOROBENZENE	1072	3	2345	4	74	1038	14	1925	8	60

NI=not included
(1) FIRST TWO COLUMS
(2) LAST TWO COLUMNS

TABLE 11
25 ng ANALYTE RESPONSE IN MMS/SAND

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	82	258	151	164	44
CHLOROMETHANE	852	668	806	775	10
VINYL CHLORIDE	1688	1822	1459	1656	9
BROMOMETHANE	223	72	150	148	42
CHLOROETHANE	589	566	645	600	6
TRICHLOROFLUOROMETHANE	4083	3656	3543	3761	6
1,1-DICHLOROETHENE	6739	6309	5729	6259	7
METHYLENE CHLORIDE	7643	7563	7500	7569	1
trans-1,2-DICHLOROETHENE	6551	5755	5698	6001	6
1,1-DICHLOROETHANE	9769	9366	8685	9273	5
2,2-DICHLOROPROPANE	4931	3963	3816	4237	12
cis-1,2-DICHLOROETHENE	7150	7058	6946	7051	1
BROMOCHLOROMETHANE	5329	5737	5349	5472	3
CHLOROFORM	8750	8086	8325	8387	3
1,1,1-TRICHLOROETHANE	6805	6446	6341	6531	3
1,1-DICHLOROPROPENE	6132	5805	5789	5909	3
CARBON TETRACHLORIDE	5708	5335	5605	5549	3
BENZENE	15299	14146	14784	14743	3
1,2-DICHLOROETHANE	9308	8752	9493	9184	3
TRICHLOROETHYLENE	6421	5939	6528	6296	4
1,2-DICHLOROPROPANE	5349	4496	4561	4802	8
DIBROMOMETHANE	3556	3495	3548	3533	1
BROMODICHLOROMETHANE	7622	7117	7190	7310	3
TOLUENE	20397	18327	19708	19477	4
1,1,2-TRICHLOROETHANE	4181	3969	3800	3983	4
TETRACHLOROETHYLENE	4209	4035	3255	3833	11
1,3-DICHLOROPROPANE	7154	6112	6162	6476	7
DIBROMOCHLOROMETHANE	5908	5462	5351	5574	4
1,2-DIBROMOETHANE	4657	4937	4583	4726	3
CHLOROBENZENE	10430	11200	11595	11075	4
1,1,1,2-TETRACHLOROETHANE	5368	5265	5319	5317	1
ETHYL BENZENE	25995	26912	25798	26235	2
p-XYLENE	18675	18564	16626	17955	5
o-XYLENE	23613	22728	21699	22680	3
STYRENE	9049	8307	7687	8348	7
BROMOFORM	3662	3420	3003	3362	8
ISOPROPYLBENZENE	9882	9517	8603	9334	6
p-BROMOFLUOROBENZENE	NI	NI	NI	-	-
BROMOBENZENE	18570	16084	18089	17581	6
1,1,2,2-TETRACHLOROETHANE	8175	7677	8213	8022	3
1,2,3-TRICHLOROPROPANE	7252	9097	6120	7490	16
n-PROPYL BENZENE	27842	28635	24844	27107	6
2-CHLOROTOLUENE	27058	24574	22656	24763	7
4-CHLOROTOLUENE	20708	21099	20823	20877	1
tert-BUTYLBENZENE	20485	22875	19601	20987	7
1,3,5-TRIMETHYLBENZENE	25626	30146	24768	26847	9
sec-BUTYL BENZENE	33823	31628	29868	31773	5
1,2-DIBROMO-3-CHLOROPROPANE	4594	4131	4102	4276	6
1,2,4-TRIMETHYLBENZENE	27528	24130	26971	26210	6
1,3-DICHLOROBENZENE	8868	7822	7855	8182	6
p-ISOPROPYL TOLUENE	23443	20637	21930	22003	5
1,4-DICHLOROBENZENE	9325	9273	8473	9024	4
1,2-DICHLOROBENZENE-d4	NI	NI	NI	-	-
1,2-DICHLOROBENZENE	10059	7476	7009	8181	16
n-BUTYL BENZENE	27842	28635	24844	27107	6
1,2,4-TRICHLOROBENZENE	4914	5318	5528	5253	5
HEXACHLOROBUTADIENE	4157	3938	3560	3885	6
NAPHTHALENE	17748	15066	15512	16109	7
1,2,3-TRICHLOROBENZENE	4770	4708	4444	4641	3

NI= not included

TABLE 12
25 ng ANALYTE RESPONSE IN MMS/CLAY

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLOROFLUOROMETHANE	935	702	623	753	18
CHLOROMETHANE	911	910	834	885	4
VINYL CHLORIDE	1746	1700	1633	1693	3
BROMOMETHANE	42	92	110	81	35
CHLOROETHANE	420	444	367	410	8
TRICHLOROFLUOROMETHANE	2435	2227	2268	2310	4
1,1-DICHLOROETHENE	4191	4003	4938	4377	9
METHYLENE CHLORIDE	4877	4746	5829	5151	9
trans-1,2-DICHLOROETHENE	3575	3368	4165	3703	9
1,1-DICHLOROETHANE	4880	4882	6409	5390	13
2,2-DICHLOROPROPANE	1912	1425	2251	1863	18
cis-1,2-DICHLOROETHENE	3892	3732	5001	4208	13
BROMOCHLOROMETHANE	2994	3074	4052	3373	14
CHLOROFORM	3983	3823	5579	4462	18
1,1,1-TRICHLOROETHANE	2791	2300	3780	2957	21
1,1-DICHLOROPROPENE	2702	2220	3637	2853	21
CARBON TETRACHLORIDE	2387	1862	3023	2424	20
BENZENE	5992	5820	8162	6658	16
1,2-DICHLOROETHANE	4625	4688	6394	5236	16
TRICHLOROETHYLENE	2536	2009	3448	2664	22
1,2-DICHLOROPROPANE	2165	2213	3508	2629	24
DIBROMOMETHANE	1597	1808	2355	1920	17
BROMODICHLOROMETHANE	3347	2995	5005	3782	23
TOLUENE	6159	4481	9570	6737	31
1,1,2-TRICHLOROETHANE	1786	1582	2707	2025	24
TETRACHLOROETHYLENE	983	500	1354	946	37
1,3-DICHLOROPROPANE	2998	2931	4653	3527	23
DIBROMOCHLOROMETHANE	1894	1682	3213	2263	30
1,2-DIBROMOETHANE	1743	1679	2753	2058	24
CHLOROBENZENE	3191	2021	5169	3460	38
1,1,1,2-TETRACHLOROETHANE	1565	1026	2404	1665	34
ETHYL BENZENE	5712	3003	8463	5726	39
p-XYLENE	3149	1635	4521	3102	38
o-XYLENE	4594	2671	7057	4774	38
STYRENE	2328	1087	2603	2006	33
BROMOFORM	996	865	1716	1192	31
ISOPROPYLBENZENE	2135	888	2381	1801	36
p-BROMOFLUOROBENZENE	NI	NI	NI	-	-
BROMOBENZENE	4301	2806	7049	4719	37
1,1,2,2-TETRACHLOROETHANE	3002	2563	5185	3583	32
1,2,3-TRICHLOROPROPANE	3507	3078	5840	4142	29
n-PROPYL BENZENE	6037	1989	7072	5033	44
2-CHLOROTOLUENE	4570	1742	6124	4145	44
4-CHLOROTOLUENE	3746	1500	5279	3508	44
tert-BUTYLBENZENE	3310	1135	3989	2811	43
1,3,5-TRIMETHYLBENZENE	4100	1483	4899	3494	42
sec-BUTYL BENZENE	4197	1262	4106	3188	43
1,2-DIBROMO-3-CHLOROPROPANE	1519	958	2576	1684	40
1,2,4-TRIMETHYLBENZENE	4667	2097	5901	4222	38
1,3-DICHLOROBENZENE	1439	514	1845	1266	44
p-ISOPROPYL TOLUENE	2965	958	2937	2287	41
1,4-DICHLOROBENZENE	1530	484	1960	1325	47
1,2-DICHLOROBENZENE-d4	NI	NI	NI	-	-
1,2-DICHLOROBENZENE	1386	507	2014	1302	47
n-BUTYL BENZENE	3644	1083	3274	2667	42
1,2,4-TRICHLOROBENZENE	642	154	624	473	48
HEXACHLOROBUTADIENE	317	68	143	176	59
NAPHTHALENE	2980	1089	3843	2637	44
1,2,3-TRICHLOROBENZENE	634	137	613	461	50

NI=not included

TABLE 13
25 ng ANALYTE RESPONSE IN MMS/GARDEN SOIL

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	154	126	203	161	20
CHLOROMETHANE	577	210	420	402	37
VINYL CHLORIDE	530	453	455	479	7
BROMOMETHANE	33	141	33	69	74
CHLOROETHANE	44	209	56	103	73
TRICHLOROFLUOROMETHANE	2218	2154	2214	2195	1
1,1-DICHLOROETHENE	2875	2671	2974	2840	4
METHYLENE CHLORIDE	4411	4194	4386	4330	2
trans-1,2-DICHLOROETHENE	1819	1491	1844	1718	9
1,1-DICHLOROETHANE	4188	3246	4439	3958	13
2,2-DICHLOROPROPANE	2830	1917	3501	2749	24
cis-1,2-DICHLOROETHENE	819	521	2238	1193	63
BROMOCHLOROMETHANE	1285	932	1309	1175	15
CHLOROFORM	3440	2441	3824	3235	18
1,1,1-TRICHLOROETHANE	3524	2763	3873	3387	14
1,1-DICHLOROPROPENE	2273	1693	2191	2052	12
CARBON TETRACHLORIDE	3065	2062	3258	2795	19
BENZENE	5556	4812	5556	5308	7
1,2-DICHLOROETHANE	1891	1267	2058	1739	20
TRICHLOROETHYLENE	2187	1526	1941	1885	14
1,2-DICHLOROPROPANE	1904	1364	1951	1740	15
DIBROMOMETHANE	852	502	881	745	23
BROMODICHLOROMETHANE	2479	1600	2736	2272	21
TOLUENE	6718	5343	7404	6488	13
1,1,2-TRICHLOROETHANE	1206	699	1416	1107	27
TETRACHLOROETHYLENE	1144	810	1205	1053	16
1,3-DICHLOROPROPANE	1158	657	1479	1098	31
DIBROMOCHLOROMETHANE	1330	652	1441	1141	31
1,2-DIBROMOETHANE	609	584	958	717	24
CHLOROBENZENE	1192	803	1628	1208	28
1,1,1,2-TETRACHLOROETHANE	1285	720	1123	1043	23
ETHYL BENZENE	4499	2923	4703	4042	20
p-XYLENE	2866	1970	3066	2634	18
o-XYLENE	4600	2963	4450	4004	18
STYRENE	1199	572	35	602	79
BROMOFORM	534	353	661	516	24
ISOPROPYLBENZENE	2427	1586	2342	2118	18
p-BROMOFLUOROBENZENE	NI	NI	NI	-	-
BROMOBENZENE	2353	614	1577	1515	47
1,1,2,2-TETRACHLOROETHANE	2147	1303	2256	1902	22
1,2,3-TRICHLOROPROPANE	1555	885	1692	1377	53
n-PROPYL BENZENE	3916	2525	4291	3577	21
2-CHLOROTOLUENE	2497	191	2995	1894	64
4-CHLOROTOLUENE	1569	735	1507	1270	30
tert-BUTYLBENZENE	3010	1993	3658	2887	24
1,3,5-TRIMETHYLBENZENE	3522	2658	3514	3231	13
sec-BUTYL BENZENE	4034	2575	3694	3434	18
1,2-DIBROMO-3-CHLOROPROPANE	733	56	873	554	64
1,2,4-TRIMETHYLBENZENE	4747	4230	5409	4795	10
1,3-DICHLOROBENZENE	495	289	482	422	22
p-ISOPROPYL TOLUENE	2521	1533	2434	2163	21
1,4-DICHLOROBENZENE	653	392	647	564	22
1,2-DICHLOROBENZENE-d4	NI	NI	NI	-	-
1,2-DICHLOROBENZENE	400	379	420	400	4
n-BUTYL BENZENE	2607	1408	2203	2073	24
1,2,4-TRICHLOROBENZENE	77	-	73	75	47
HEXACHLOROBUTADIENE	123	92	62	92	27
NAPHTHALENE	1455	915	1826	1399	27
1,2,3-TRICHLOROBENZENE	80	35	148	88	53

NI= not included

TABLE 14
25 ng ANALYTE RESPONSE IN MMS/HORIZION-C SOIL

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	51	109	122	94	33
CHLOROMETHANE	590	357	416	454	22
VINYL CHLORIDE	1484	1237	1269	1330	8
BROMOMETHANE	45	60	54	53	12
CHLOROETHANE	531	639	258	476	34
TRICHLOROFLUOROMETHANE	2973	3093	2841	2969	3
1,1-DICHLOROETHENE	5147	5031	4904	5027	2
METHYLENE CHLORIDE	6503	5884	5933	6107	5
trans-1,2-DICHLOROETHENE	5280	5537	4748	5188	6
1,1-DICHLOROETHANE	7717	7269	6967	7318	4
2,2-DICHLOROPROPANE	4395	4423	4075	4298	4
cis-1,2-DICHLOROETHENE	6128	5708	6097	5978	3
BROMOCHLOROMETHANE	4175	4627	4462	4421	4
CHLOROFORM	7101	6989	6790	6960	2
1,1,1-TRICHLOROETHANE	5921	5410	5214	5515	5
1,1-DICHLOROPROPENE	4732	5131	4552	4805	5
CARBON TETRACHLORIDE	4630	4799	4288	4572	5
BENZENE	10914	11000	10217	10710	3
1,2-DICHLOROETHANE	6530	6537	6075	6381	3
TRICHLOROETHYLENE	5060	5309	4769	5046	4
1,2-DICHLOROPROPANE	4185	4071	3745	4000	5
DIBROMOMETHANE	2758	2692	2772	2741	1
BROMODICHLOROMETHANE	6084	5828	5761	5891	2
TOLUENE	13064	13635	11979	12893	5
1,1,2-TRICHLOROETHANE	2976	3217	3242	3145	4
TETRACHLOROETHYLENE	2425	2922	2464	2604	9
1,3-DICHLOROPROPANE	5192	4580	4607	4793	6
DIBROMOCHLOROMETHANE	4098	4592	4018	4236	6
1,2-DIBROMOETHANE	3919	3831	3963	3904	1
CHLOROBENZENE	8585	8665	6767	8006	11
1,1,1,2-TETRACHLOROETHANE	3772	3986	3629	3796	4
ETHYL BENZENE	19342	21042	17337	19240	8
p-XYLENE	14265	10995	8888	11383	19
o-XYLENE	20980	20474	15554	19003	13
STYRENE	9547	9390	6149	8362	19
BROMOFORM	2866	2868	2478	2737	7
ISOPROPYLBENZENE	7193	6592	5527	6437	11
p-BROMOFLUOROBENZENE	NI	NI	NI	-	-
BROMOBENZENE	12040	12678	12464	12394	2
1,1,2,2-TETRACHLOROETHANE	6324	6308	5747	6126	4
1,2,3-TRICHLOROPROPANE	5271	4510	6852	5544	18
n-PROPYL BENZENE	23135	23635	15424	20731	18
2-CHLOROTOLUENE	18909	18283	13328	16840	15
4-CHLOROTOLUENE	14206	13295	10874	12792	11
tert-BUTYLBENZENE	16483	12383	9723	12863	22
1,3,5-TRIMETHYLBENZENE	17519	16803	11909	15410	16
sec-BUTYL BENZENE	20807	17706	11795	16769	22
1,2-DIBROMO-3-CHLOROPROPANE	3514	3016	3163	3231	6
1,2,4-TRIMETHYLBENZENE	20414	16938	11426	16259	23
1,3-DICHLOROBENZENE	5902	5478	4115	5165	15
p-ISOPROPYL TOLUENE	13820	11720	8749	11430	18
1,4-DICHLOROBENZENE	6307	5594	4390	5430	15
1,2-DICHLOROBENZENE-d4	NI	NI	NI	-	-
1,2-DICHLOROBENZENE	6359	5707	4312	5459	16
n-BUTYL BENZENE	16294	12648	9039	12660	23
1,2,4-TRICHLOROBENZENE	3503	2639	1919	2687	24
HEXACHLOROBUTADIENE	1958	1762	1131	1617	22
NAPHTHALENE	10866	9007	6559	8811	20
1,2,3-TRICHLOROBENZENE	3290	2899	1770	2653	24

NI= not included

TABLE 15
RELATIVE ANALYTE RECOVERIES FOR FOUR MATRICES

ANALYTE	MMS/SAND AVG Area	MMS/SAND RSD (%)	MMS/SAND RECOVERY (%)	MMS/GARDEN AVG Area	MMS/GARDEN RSD (%)	MMS/GARDEN RECOVERY (%)	MMS/HORIZON-C AVG Area	MMS/HORIZON-C RSD (%)	MMS/HORIZON-C RECOVERY (%)	MMS/CLAY AVG Area	MMS/CLAY RSD (%)	MMS/CLAY RECOVERY (%)
DICHLORODIFLUOROMETHANE	164	44	33	161	20	33	94	33	19	753	18	39
CHLOROMETHANE	775	10	65	402	37	34	454	22	38	885	4	35
VINYL CHLORIDE	1656	9	67	479	7	19	1330	8	54	1693	3	44
BROMOMETHANE	148	42	89	69	74	42	53	12	32	81	35	43
CHLOROETHANE	600	6	65	103	73	11	476	34	52	410	8	48
TRICHLOROFLUOROMETHANE	3761	6	71	2195	1	42	2969	3	56	2310	4	42
1,1-DICHLOROETHENE	6259	7	78	2840	4	35	5027	2	62	4377	9	47
METHYLENE CHLORIDE	7569	1	85	4330	2	49	6107	5	67	5151	9	65
trans-1,2-DICHLOROETHENE	6001	6	81	1718	9	23	5188	6	70	3703	9	48
1,1-DICHLOROETHANE	9273	5	87	3958	13	37	7318	4	69	5390	13	54
2,2-DICHLOROPROPANE	4237	12	73	2749	24	48	4298	4	74	1863	18	40
cis-1,2-DICHLOROETHENE	7051	1	77	1193	63	13	5978	3	66	4208	13	54
BROMOCHLOROMETHANE	5472	3	94	1175	15	20	4421	4	76	3373	14	67
CHLOROFORM	8387	3	88	3235	18	34	6960	2	73	4462	18	55
1,1,1-TRICHLOROETHANE	6531	3	89	3387	14	46	5515	5	75	2957	21	47
1,1-DICHLOROPROPENE	5909	3	84	2052	12	29	4805	5	68	2853	21	46
CARBON TETRACHLORIDE	5549	3	87	2795	19	44	4572	5	71	2424	20	43
BENZENE	14743	3	87	5308	7	31	10710	3	63	6658	16	59
1,2-DICHLOROETHANE	9184	3	89	1739	20	17	6381	3	62	5236	16	82
TRICHLOROETHYLENE	6296	4	81	1885	14	24	5046	4	65	2664	22	47
1,2-DICHLOROPROPANE	4802	8	90	1740	15	33	4000	5	75	2629	24	57
DIBROMOMETHANE	3533	1	98	745	23	21	2741	1	76	1920	17	68
BROMODICHLOROMETHANE	7310	3	87	2272	21	27	5891	2	70	3782	23	59
TOLUENE	19477	4	164	6488	13	16	12893	5	119	6737	31	48
1,1,2-TRICHLOROETHANE	3983	4	100	1107	27	28	3145	4	79	2025	24	64
TETRACHLOROETHYLENE	3833	11	90	1053	16	25	2604	9	61	946	37	32
1,3-DICHLOROPROPANE	6476	7	89	1098	31	15	4793	6	66	3527	23	69
DIBROMOCHLOROMETHANE	5574	4	98	1141	31	20	4236	6	74	2263	30	61
1,2-DIBROMOETHANE	4726	3	91	717	24	14	3904	1	75	2058	24	69
CHLOROBENZENE	11075	4	83	1208	28	9	8006	11	60	3460	38	43
1,1,1,2-TETRACHLOROETHANE	5317	1	92	1043	23	18	3796	4	66	1665	34	51
ETHYL BENZENE	26235	2	85	4042	20	13	19240	8	62	5726	39	40
p-XYLENE	17955	5	103	2634	18	15	11383	19	65	3102	38	33
o-XYLENE	22680	3	80	4004	18	14	19003	13	67	4774	38	39
STYRENE	8348	7	48	602	79	3	8362	19	48	2006	33	24
BROMOFORM	3362	8	89	516	24	14	2737	7	72	1192	31	63
ISOPROPYLBENZENE	9334	6	87	2118	18	20	6437	11	60	1801	36	27
p-BROMOFLUOROBENZENE	NI	-	-	NI	-	-	NI	-	-	NI	-	-
BROMOBENZENE	17581	6	93	1515	47	8	12394	2	65	4719	37	42
1,1,2,2-TETRACHLOROETHANE	8022	3	95	1902	22	22	6126	4	72	3583	32	57
1,2,3-TRICHLOROPROPANE	7490	16	80	1377	53	15	642	126	59	4142	29	67
n-PROPYL BENZENE	27107	6	87	3577	21	9	20731	18	53	5033	44	25
2-CHLOROTOLUENE	24763	7	87	1894	64	7	16840	15	59	4145	44	29
4-CHLOROTOLUENE	20877	1	95	1270	30	6	12792	11	58	3508	44	25
tert-BUTYLBENZENE	20987	7	95	2887	24	13	12863	22	58	2811	43	21
1,3,5-TRIMETHYLBENZENE	26847	9	90	3231	13	11	15410	16	52	3494	42	20
sec-BUTYL BENZENE	31773	5	94	3434	18	10	16769	22	49	3188	43	17
1,2-DIBROMO-3-CHLOROPROPANE	4276	6	92	554	64	12	3231	6	70	1684	40	62
1,2,4-TRIMETHYLBENZENE	26210		95	4795	10	17	16259	23	59	4222	38	25
1,3-DICHLOROBENZENE	8182	6	80	422	22	4	5165	15	50	1266	44	23
p-ISOPROPYL TOLUENE	22003	5	86	2163	21	8	11430	18	45	2287	41	18
1,4-DICHLOROBENZENE	9024	4	91	564	22	6	5430	15	55	1325	47	23
1,2-DICHLOROBENZENE-d4	NI	-	-	NI	-	-	NI	-	-	NI	-	-
1,2-DICHLOROBENZENE	8181	16	86	400	4	4	5459	16	57	1302	47	25
n-BUTYL BENZENE	27107	6	87	2073	24	7	12660	23	41	2667	42	16
1,2,4-TRICHLOROBENZENE	5253	5	75	75	47	1	2687	24	38	473	48	13
HEXACHLOROBUTADIENE	3885	6	87	92	27	2	1617	22	36	176	59	9
NAPHTHALENE	16109	7	77	1399	27	7	8811	20	42	2637	44	24
1,2,3-TRICHLOROBENZENE	4641	3	70	88	53	1	2653	24	40	461	50	13

NI= not included

TABLE 16
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD FLUOROBENZENE

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	9.8	11.2	8.3	9.8	11.9	39.1
CHLOROMETHANE	10.1	13.0	10.5	11.2	11.2	44.8
VINYL CHLORIDE	10.4	13.9	10.7	11.7	13.7	46.7
BROMOMETHANE	NF	13.7	6.9	10.3	33.1	41.2
CHLOROETHANE	11.7	15.3	10.4	12.5	16.8	49.8
TRICHLOROFLUOROMETHANE	11.3	16.3	11.8	13.2	17.2	52.6
1,1-DICHLOROETHENE	11.4	11.6	10.8	11.2	2.8	45.0
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	15.7	16.3	15.4	15.8	2.4	63.1
1,1-DICHLOROETHANE	16.5	17.0	16.9	16.8	1.3	67.3
2,2-DICHLOROPROPANE	23.4	24.4	26.5	24.8	5.1	99.1
cis-1,2-DICHLOROETHENE	18.0	19.1	19.3	18.8	3.2	75.2
BROMOCHLOROMETHANE	16.5	17.2	17.2	17.0	1.9	67.9
CHLOROFORM	19.9	21.5	20.6	20.7	3.3	82.6
1,1,1-TRICHLOROETHANE	19.8	21.7	20.8	20.8	3.8	83.1
1,1-DICHLOROPROPENE	20.0	21.1	20.1	20.4	2.5	81.6
CARBON TETRACHLORIDE	20.6	20.7	20.6	20.6	0.2	82.4
BENZENE	25.9	27.5	26.8	26.7	2.5	106.9
1,2-DICHLOROETHANE	24.3	26.8	26.5	25.9	4.4	103.4
TRICHLOROETHYLENE	22.0	23.4	22.6	22.7	2.4	90.6
1,2-DICHLOROPROPANE	21.3	23.8	23.3	22.8	4.7	91.2
DIBROMOMETHANE	19.6	22.9	21.4	21.3	6.3	85.2
BROMODICHLOROMETHANE	23.2	26.3	25.6	25.0	5.3	100.1
TOLUENE	27.3	30.4	28.6	28.8	4.4	115.1
1,1,2-TRICHLOROETHANE	23.3	25.3	25.5	24.7	4.0	98.8
TETRACHLOROETHYLENE	25.4	27.5	27.5	26.8	3.7	107.2
1,3-DICHLOROPROPANE	24.2	28.0	28.0	26.7	6.6	106.9
DIBROMOCHLOROMETHANE	22.3	24.6	24.7	23.9	4.6	95.5
1,2-DIBROMOETHANE	21.4	23.7	22.8	22.6	4.3	90.5
CHLOROBENZENE	25.1	28.0	27.4	26.8	4.6	107.3
1,1,1,2-TETRACHLOROETHANE	27.9	33.0	31.7	30.9	6.9	123.4
ETHYL BENZENE	32.1	35.7	34.3	34.1	4.3	136.2
p-XYLENE	31.0	34.8	34.9	33.6	5.4	134.3
o-XYLENE	29.6	32.7	32.7	31.7	4.6	126.7
STYRENE	22.1	22.6	20.4	21.7	4.2	86.8
BROMOFORM	24.0	26.1	28.0	26.0	6.2	104.1
ISOPROPYLBENZENE	30.2	34.1	33.2	32.5	5.1	129.8
p-BROMOFLUOROBENZENE	28.3	30.3	29.5	29.4	2.7	117.4
BROMOBENZENE	20.6	23.3	31.1	25.0	17.8	100.0
1,1,2,2-TETRACHLOROETHANE	20.9	22.9	29.3	24.4	14.6	97.4
1,2,3-TRICHLOROPROPANE	31.6	34.7	33.5	33.3	3.9	133.0
n-PROPYL BENZENE	22.1	24.3	24.4	23.6	4.4	94.4
2-CHLOROTOLUENE	21.6	23.9	23.6	23.0	4.5	92.2
4-CHLOROTOLUENE	24.1	26.7	26.4	25.7	4.4	102.9
tert-BUTYLBENZENE	22.0	24.2	23.8	23.4	4.2	93.5
1,3,5-TRIMETHYLBENZENE	20.8	23.5	23.4	22.6	5.5	90.4
sec-BUTYL BENZENE	21.8	24.1	23.9	23.2	4.5	93.0
1,2-DIBROMO-3-CHLOROPROPANE	17.3	18.7	18.9	18.3	4.0	73.2
1,2,4-TRIMETHYLBENZENE	21.3	23.5	23.4	22.7	4.5	90.8
1,3-DICHLOROBENZENE	21.1	24.0	23.7	23.0	5.6	91.8
p-ISOPROPYL TOLUENE	21.5	23.9	23.8	23.1	4.7	92.2
1,4-DICHLOROBENZENE	20.6	23.6	23.3	22.5	6.0	90.1
1,2-DICHLOROBENZENE-d4	14.3	17.4	15.3	15.7	8.3	62.7
1,2-DICHLOROBENZENE	21.1	23.1	23.6	22.6	4.8	90.4
n-BUTYL BENZENE	20.8	22.8	22.5	22.0	4.1	88.1
1,2,4-TRICHLOROBENZENE	20.7	22.5	21.9	21.7	3.3	86.8
HEXACHLOROBUTADIENE	19.7	22.2	20.6	20.8	5.0	83.4
NAPHTHALENE	21.2	23.3	23.3	22.6	4.5	90.4
1,2,3-TRICHLOROBENZENE	18.9	21.1	19.9	20.0	4.6	79.9

NF=not found
NI=not included

TABLE 17
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD FLUOROBENZENE

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	14.8	13.4	14.3	14.2	4.1	56.6
CHLOROMETHANE	26.6	21.1	30.4	26.0	14.6	104.2
VINYL CHLORIDE	19.0	17.5	19.6	18.7	4.7	74.9
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	19.9	19.3	18.5	19.3	2.9	79.2
TRICHLOROFLUOROMETHANE	22.3	19.0	17.8	19.7	9.7	78.8
1,1-DICHLOROETHENE	15.7	12.2	7.7	11.9	27.3	47.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	18.9	14.8	16.1	16.6	10.3	66.5
1,1-DICHLOROETHANE	22.8	16.9	20.0	19.9	12.1	79.5
2,2-DICHLOROPROPANE	21.9	21.2	23.6	22.2	4.6	88.9
cis-1,2-DICHLOROETHENE	23.1	18.1	20.1	20.4	10.0	81.7
BROMOCHLOROMETHANE	26.3	19.2	23.1	22.9	12.6	91.5
CHLOROFORM	26.4	21.2	22.9	23.5	9.2	93.9
1,1,1-TRICHLOROETHANE	23.2	17.7	21.0	20.7	11.0	82.6
1,1-DICHLOROPROPENE	19.4	16.0	17.3	17.6	8.0	70.4
CARBON TETRACHLORIDE	17.8	15.8	15.3	16.3	6.7	65.3
BENZENE	29.2	22.7	25.7	25.9	10.2	103.5
1,2-DICHLOROETHANE	37.4	29.6	32.4	33.1	9.7	132.6
TRICHLOROETHYLENE	21.2	18.7	18.3	19.4	6.6	77.5
1,2-DICHLOROPROPANE	30.2	23.6	26.6	26.8	10.1	107.2
DIBROMOMETHANE	32.9	25.2	29.5	29.2	10.7	116.8
BROMODICHLOROMETHANE	30.8	26.3	29.5	28.8	6.5	115.4
TOLUENE	23.6	22.8	22.2	22.9	2.6	91.5
1,1,2-TRICHLOROETHANE	34.0	28.1	35.2	32.5	9.6	129.9
TETRACHLOROETHYLENE	15.2	16.1	15.9	15.7	2.6	62.9
1,3-DICHLOROPROPANE	32.7	29.3	32.1	31.4	4.8	125.5
DIBROMOCHLOROMETHANE	26.8	24.5	26.8	26.0	4.2	104.1
1,2-DIBROMOETHANE	28.4	24.5	26.4	26.4	6.0	105.6
CHLOROBENZENE	17.0	19.1	18.4	18.2	4.9	72.6
1,1,1,2-TETRACHLOROETHANE	22.1	23.4	22.8	22.8	2.2	91.1
ETHYL BENZENE	17.3	20.1	19.5	18.9	6.4	75.7
p-XYLENE	16.9	20.5	18.5	18.7	7.8	74.6
o-XYLENE	17.2	19.2	18.6	18.3	4.6	73.3
STYRENE	2.2	3.1	2.5	2.6	13.7	10.4
BROMOFORM	26.3	26.3	27.2	26.6	1.4	106.5
ISOPROPYLBENZENE	11.6	14.9	13.4	13.3	10.1	53.2
p-BROMOFLUOROBENZENE	15.3	16.8	17.3	16.5	5.3	65.8
BROMOBENZENE	17.4	20.3	20.9	19.5	7.8	78.2
1,1,2,2-TETRACHLOROETHANE	28.8	26.9	30.4	28.7	4.9	114.8
1,2,3-TRICHLOROPROPANE	39.6	18.3	43.2	33.7	32.6	134.8
n-PROPYL BENZENE	9.1	12.9	11.7	11.2	14.0	44.8
2-CHLOROTOLUENE	11.1	15.5	13.7	13.4	13.5	53.6
4-CHLOROTOLUENE	12.4	17.3	12.4	14.0	16.7	56.1
tert-BUTYLBENZENE	8.1	11.0	10.9	10.0	13.5	40.0
1,3,5-TRIMETHYLBENZENE	9.3	12.1	10.9	10.8	10.8	43.1
sec-BUTYL BENZENE	7.1	9.4	8.5	8.3	11.1	33.3
1,2-DIBROMO-3-CHLOROPROPANE	22.3	22.0	29.9	24.7	14.7	98.9
1,2,4-TRIMETHYLBENZENE	12.1	14.7	14.2	13.7	8.1	54.7
1,3-DICHLOROBENZENE	7.6	12.2	9.8	9.9	18.8	39.6
p-ISOPROPYL TOLUENE	6.7	8.3	8.6	7.9	10.7	31.4
1,4-DICHLOROBENZENE	7.5	12.0	9.7	9.7	18.8	38.9
1,2-DICHLOROBENZENE-d4	4.0	5.8	4.5	4.8	16.2	19.1
1,2-DICHLOROBENZENE	8.9	10.9	11.5	10.5	10.6	41.9
n-BUTYL BENZENE	5.4	6.5	6.5	6.1	8.6	24.5
1,2,4-TRICHLOROBENZENE	2.8	5.6	4.1	4.2	26.6	16.7
HEXACHLOROBUTADIENE	1.5	3.0	3.6	2.7	32.6	10.9
NAPHTHALENE	7.8	9.8	10.9	9.5	13.4	37.9
1,2,3-TRICHLOROBENZENE	2.7	5.3	4.4	4.1	26.3	16.5

NF=not found
NI=not included

TABLE 18
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD FLUOROBENZENE

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	20.7	24.9	24.4	23.4	8.1	93.4
CHLOROMETHANE	23.4	28.0	29.9	27.1	10.0	108.4
VINYL CHLORIDE	19.6	26.5	26.5	24.2	13.4	96.8
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	2.4	10.4	16.3	9.7	58.7	38.7
TRICHLOROFLUOROMETHANE	25.3	33.5	33.2	30.6	12.4	122.6
1,1-DICHLOROETHENE	18.7	22.5	23.0	21.4	9.0	85.6
METHYLENE CHLORIDE	NI	NI	NI	NI	-	-
trans-1,2-DICHLOROETHENE	10.1	13.8	13.5	12.5	13.7	49.8
1,1-DICHLOROETHANE	22.5	29.9	27.4	26.6	11.5	106.4
2,2-DICHLOROPROPANE	36.5	44.5	41.3	40.7	8.1	163.0
cis-1,2-DICHLOROETHENE	17.1	23.1	20.6	20.3	12.1	81.1
BROMOCHLOROMETHANE	13.6	19.9	15.0	16.1	16.7	64.6
CHLOROFORM	21.6	32.8	25.5	26.6	17.5	106.5
1,1,1-TRICHLOROETHANE	33.1	41.6	35.3	36.7	9.8	146.6
1,1-DICHLOROPROPENE	17.9	25.7	22.1	21.9	14.6	87.6
CARBON TETRACHLORIDE	21.6	27.5	23.8	24.3	10.0	97.1
BENZENE	21.9	32.9	24.6	26.5	17.7	105.9
1,2-DICHLOROETHANE	19.2	29.1	21.6	23.3	18.1	93.1
TRICHLOROETHYLENE	14.9	20.1	17.4	17.5	12.2	69.9
1,2-DICHLOROPROPANE	22.7	35.2	24.9	27.6	19.8	110.3
DIBROMOMETHANE	13.3	20.4	15.0	16.2	18.8	65.0
BROMODICHLOROMETHANE	17.1	23.3	19.0	19.8	13.0	79.2
TOLUENE	23.0	38.7	22.2	28.0	27.2	111.8
1,1,2-TRICHLOROETHANE	17.0	25.3	20.8	21.0	16.1	84.1
TETRACHLOROETHYLENE	16.4	21.5	19.1	19.0	10.9	76.1
1,3-DICHLOROPROPANE	12.4	18.2	14.3	14.9	16.2	59.8
DIBROMOCHLOROMETHANE	11.0	15.0	11.6	12.5	14.0	50.1
1,2-DIBROMOETHANE	9.0	12.3	9.1	10.1	15.3	40.4
CHLOROBENZENE	6.7	8.5	6.0	7.1	15.3	28.2
1,1,1,2-TETRACHLOROETHANE	22.5	23.4	22.0	22.6	2.6	90.5
ETHYL BENZENE	16.4	21.5	15.0	17.7	15.8	70.6
p-XYLENE	16.2	22.0	13.4	17.2	20.8	68.8
o-XYLENE	13.0	17.4	10.5	13.6	21.0	54.5
STYRENE	4.9	3.5	2.8	3.7	23.6	15.0
BROMOFORM	9.9	13.3	10.1	11.1	14.1	44.4
ISOPROPYLBENZENE	13.9	16.7	12.4	14.3	12.4	57.2
p-BROMOFLUOROBENZENE	4.8	7.2	5.9	6.0	17.0	23.8
BROMOBENZENE	5.7	6.9	6.2	6.2	7.6	25.0
1,1,2,2-TETRACHLOROETHANE	17.2	21.1	16.3	18.2	11.5	72.8
1,2,3-TRICHLOROPROPANE	20.7	21.0	16.9	19.5	9.6	78.1
n-PROPYL BENZENE	8.8	12.7	8.8	10.1	18.3	40.2
2-CHLOROTOLUENE	13.1	16.6	12.1	13.9	13.6	55.7
4-CHLOROTOLUENE	14.7	18.5	13.6	15.6	13.5	62.5
tert-BUTYLBENZENE	12.2	11.9	12.5	12.2	1.9	48.8
1,3,5-TRIMETHYLBENZENE	12.0	13.5	11.5	12.3	6.7	49.3
sec-BUTYL BENZENE	12.5	13.4	9.8	11.9	12.9	47.6
1,2-DIBROMO-3-CHLOROPROPANE	16.8	17.5	11.6	15.3	17.2	61.3
1,2,4-TRIMETHYLBENZENE	13.9	16.2	7.0	12.4	31.5	49.4
1,3-DICHLOROBENZENE	4.0	5.0	2.9	4.0	22.5	15.9
p-ISOPROPYL TOLUENE	9.6	12.5	8.6	10.2	16.4	40.9
1,4-DICHLOROBENZENE	4.0	5.0	3.7	4.2	12.5	16.9
1,2-DICHLOROBENZENE-d4	1.8	1.7	1.2	1.6	16.8	6.2
1,2-DICHLOROBENZENE	4.3	4.6	3.8	4.2	7.3	17.0
n-BUTYL BENZENE	8.2	10.9	6.1	8.4	23.5	33.6
1,2,4-TRICHLOROBENZENE	4.8	6.3	3.5	4.8	23.5	19.3
HEXACHLOROBUTADIENE	1.5	3.2	1.9	2.2	33.1	8.9
NAPHTHALENE	9.9	12.2	9.5	10.5	11.3	42.2
1,2,3-TRICHLOROBENZENE	1.0	3.9	1.9	2.3	52.4	9.0

NF=not found
NI =not included

TABLE 19
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANTARD BENZENE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	10.3	11.5	8.7	10.2	11.0	40.6
CHLOROMETHANE	13.1	15.5	12.7	13.8	8.8	55.0
VINYL CHLORIDE	11.3	8.8	11.0	10.4	11.1	41.5
BROMOMETHANE	17.3		8.0	12.6	37.0	50.4
CHLOROETHANE	12.1	15.6	10.8	12.8	15.8	51.3
TRICHLOROFLUOROMETHANE	12.6	17.1	12.9	14.2	14.2	56.8
1,1-DICHLOROETHENE	12.0	12.0	11.5	11.9	2.1	47.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	16.6	16.9	16.3	16.6	1.3	66.5
1,1-DICHLOROETHANE	17.4	17.6	17.9	17.6	1.1	70.5
2,2-DICHLOROPROPANE	24.2	24.9	27.3	25.5	5.3	101.9
cis-1,2-DICHLOROETHENE	18.8	19.7	20.3	19.6	3.1	78.5
BROMOCHLOROMETHANE	17.5	17.8	18.2	17.8	1.7	71.3
CHLOROFORM	21.1	22.3	21.9	21.8	2.3	87.0
1,1,1-TRICHLOROETHANE	20.8	21.3	21.9	21.3	2.2	85.3
1,1-DICHLOROPROPENE	21.0	21.8	21.2	21.3	1.5	85.3
CARBON TETRACHLORIDE	21.9	21.6	22.0	21.8	0.8	87.2
BENZENE	27.0	28.1	28.0	27.7	1.9	110.9
1,2-DICHLOROETHANE	25.4	27.5	27.8	26.9	4.0	107.5
TRICHLOROETHYLENE	23.1	24.0	23.7	23.6	1.6	94.3
1,2-DICHLOROPROPANE	22.4	24.4	24.5	23.8	4.2	95.1
DIBROMOMETHANE	20.6	23.5	22.6	22.2	5.5	88.9
BROMODICHLOROMETHANE	24.3	27.0	26.8	26.0	4.7	104.1
TOLUENE	28.5	31.1	30.0	29.9	3.6	119.4
1,1,2-TRICHLOROETHANE	24.4	25.9	26.8	25.7	3.8	102.9
TETRACHLOROETHYLENE	26.6	28.2	28.8	27.8	3.4	111.4
1,3-DICHLOROPROPANE	25.4	28.6	29.3	27.8	6.2	111.1
DIBROMOCHLOROMETHANE	23.3	25.2	25.9	24.8	4.4	99.2
1,2-DIBROMOETHANE	22.4	24.4	24.0	23.6	3.6	94.2
CHLOROBENZENE	26.3	28.6	28.7	27.9	4.1	111.4
1,1,1,2-TETRACHLOROETHANE	29.2	33.6	33.2	32.0	6.2	128.1
ETHYL BENZENE	33.4	36.3	35.7	35.1	3.6	140.5
p-XYLENE	32.4	35.7	36.6	34.9	5.1	139.7
o-XYLENE	30.8	33.4	34.0	32.7	4.3	130.8
STYRENE	23.1	23.2	21.5	22.6	3.4	90.5
BROMOFORM	25.0	26.7	29.2	27.0	6.3	107.9
ISOPROPYLBENZENE	31.4	34.7	34.6	33.6	4.5	134.3
p-BROMOFLUOROBENZENE	29.5	30.9	30.8	30.4	2.1	121.6
BROMOBENZENE	21.6	24.0	32.5	26.0	18.0	104.0
1,1,2,2-TETRACHLOROETHANE	22.0	23.5	30.6	25.4	14.8	101.4
1,2,3-TRICHLOROPROPANE	32.8	35.3	34.9	34.3	3.2	137.3
n-PROPYL BENZENE	23.2	24.9	25.5	24.5	4.1	98.2
2-CHLOROTOLUENE	22.6	24.6	24.8	24.0	4.1	96.0
4-CHLOROTOLUENE	25.2	27.4	27.6	26.7	4.0	107.0
tert-BUTYLBENZENE	23.1	24.9	25.1	24.3	3.7	97.4
1,3,5-TRIMETHYLBENZENE	21.8	24.1	24.5	23.5	5.2	93.9
sec-BUTYL BENZENE	22.8	24.7	25.1	24.2	4.1	96.8
1,2-DIBROMO-3-CHLOROPROPANE	18.0	19.2	19.8	19.0	3.9	76.1
1,2,4-TRIMETHYLBENZENE	22.2	24.0	24.5	23.6	4.3	94.4
1,3-DICHLOROBENZENE	22.2	24.7	24.9	23.9	5.2	95.6
p-ISOPROPYL TOLUENE	22.6	24.5	25.0	24.0	4.4	96.1
1,4-DICHLOROBENZENE	21.6	24.3	24.5	23.5	5.6	93.9
1,2-DICHLOROBENZENE-d4	15.7	18.3	16.9	17.0	6.4	67.9
1,2-DICHLOROBENZENE	22.1	23.8	24.7	23.5	4.7	94.1
n-BUTYL BENZENE	21.8	23.5	23.7	23.0	3.6	91.9
1,2,4-TRICHLOROBENZENE	21.7	23.1	23.0	22.6	2.8	90.4
HEXACHLOROBUTADIENE	20.7	22.8	21.7	21.7	4.1	86.9
NAPHTHALENE	22.2	23.9	24.5	23.5	4.2	94.1
1,2,3-TRICHLOROBENZENE	19.8	21.7	20.9	20.8	3.8	83.1

NF=not found
NI=not included

TABLE 20
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD BENZENE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	14.2	13.4	13.4	13.7	2.7	54.8
CHLOROMETHANE	25.6	21.1	28.5	25.1	12.1	100.2
VINYL CHLORIDE	18.5	17.4	16.9	17.6	3.7	70.4
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	18.9	19.1	17.1	18.3	4.9	73.4
TRICHLOROFLUOROMETHANE	21.5	19.0	16.8	19.1	10.2	76.5
1,1-DICHLOROETHENE	15.1	12.3	7.3	11.6	27.8	46.2
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	18.1	14.9	15.0	16.0	9.3	64.0
1,1-DICHLOROETHANE	21.9	16.9	18.8	19.2	10.7	76.9
2,2-DICHLOROPROPANE	21.3	21.2	22.6	21.7	3.0	86.9
cis-1,2-DICHLOROETHENE	22.3	18.1	19.0	19.8	9.0	79.1
BROMOCHLOROMETHANE	24.9	19.2	21.4	21.8	10.8	87.4
CHLOROFORM	24.6	21.0	20.8	22.2	7.9	88.6
1,1,1-TRICHLOROETHANE	22.3	17.7	19.7	19.9	9.4	79.6
1,1-DICHLOROPROPENE	18.7	16.1	16.2	17.0	7.0	67.9
CARBON TETRACHLORIDE	17.3	15.9	14.4	15.9	7.4	63.5
BENZENE	27.9	22.6	24.0	24.8	8.9	99.3
1,2-DICHLOROETHANE	35.4	29.4	30.0	31.6	8.6	126.3
TRICHLOROETHYLENE	20.4	18.7	17.2	18.8	6.9	75.0
1,2-DICHLOROPROPANE	28.7	23.5	24.6	25.6	8.7	102.4
DIBROMOMETHANE	31.2	25.1	27.3	27.9	9.0	111.5
BROMODICHLOROMETHANE	29.3	26.1	27.4	27.6	4.7	110.4
TOLUENE	22.6	22.6	20.6	21.9	4.3	87.7
1,1,2-TRICHLOROETHANE	32.3	27.9	32.4	30.9	6.8	123.4
TETRACHLOROETHYLENE	14.6	16.2	14.9	15.2	4.3	61.0
1,3-DICHLOROPROPANE	31.1	24.4	29.7	28.4	10.2	113.7
DIBROMOCHLOROMETHANE	25.7	24.4	25.1	25.1	2.2	100.3
1,2-DIBROMOETHANE	27.1	24.4	24.6	25.4	5.0	101.5
CHLOROBENZENE	16.4	19.1	17.2	17.6	6.5	70.3
1,1,1,2-TETRACHLOROETHANE	21.1	23.2	21.1	21.8	4.6	87.3
ETHYL BENZENE	16.7	20.1	18.2	18.3	7.6	73.3
p-XYLENE	16.3	20.5	17.3	18.0	9.9	72.1
o-XYLENE	16.6	19.2	17.5	17.7	6.0	71.0
STYRENE	2.1	3.1	2.3	2.5	16.2	10.0
BROMOFORM	25.4	26.2	25.5	25.7	1.5	102.8
ISOPROPYLBENZENE	11.2	15.0	12.6	12.9	11.9	51.7
p-BROMOFLUOROBENZENE	14.8	16.8	16.3	15.9	5.4	63.8
BROMOBENZENE	16.8	20.3	19.6	18.9	7.9	75.5
1,1,2,2-TETRACHLOROETHANE	27.5	26.8	28.2	27.5	2.1	110.0
1,2,3-TRICHLOROPROPANE	37.8	18.2	40.2	32.1	30.8	128.3
n-PROPYL BENZENE	8.8	12.9	11.0	10.9	15.3	43.7
2-CHLOROTOLUENE	10.7	15.5	12.9	13.0	15.1	52.2
4-CHLOROTOLUENE	12.0	17.4	11.6	13.7	19.2	54.7
tert-BUTYLBENZENE	7.9	11.1	10.2	9.7	14.1	38.9
1,3,5-TRIMETHYLBENZENE	9.0	12.2	10.2	10.5	12.6	42.0
sec-BUTYL BENZENE	6.9	9.5	8.0	8.1	12.7	32.5
1,2-DIBROMO-3-CHLOROPROPANE	21.4	21.9	27.6	23.6	11.8	94.5
1,2,4-TRIMETHYLBENZENE	11.7	14.8	13.3	13.3	9.3	53.1
1,3-DICHLOROBENZENE	7.4	12.3	9.3	9.7	20.6	38.7
p-ISOPROPYL TOLUENE	6.5	8.4	8.1	7.7	10.8	30.6
1,4-DICHLOROBENZENE	7.3	12.1	9.1	9.5	20.7	38.0
1,2-DICHLOROBENZENE-d4	3.9	6.0	4.2	4.7	19.1	18.8
1,2-DICHLOROBENZENE	8.7	11.0	10.9	10.2	10.5	40.8
n-BUTYL BENZENE	5.2	6.5	6.2	6.0	9.2	23.9
1,2,4-TRICHLOROBENZENE	2.8	5.6	3.9	4.1	28.6	16.4
HEXACHLOROBUTADIENE	1.5	3.0	3.4	2.7	31.9	10.6
NAPHTHALENE	7.6	9.9	10.2	9.2	12.8	36.9
1,2,3-TRICHLOROBENZENE	2.6	5.4	4.2	4.0	27.7	16.2

NF=not found
NI=not included

TABLE 21
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD BENZENE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	21.4	25.1	24.4	23.7	6.7	94.6
CHLOROMETHANE	23.8	28.1	29.8	27.2	9.3	108.9
VINYL CHLORIDE	19.9	26.6	26.5	24.3	12.9	97.2
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	2.4	11.5	16.1	10 0	56.8	40.0
TRICHLOROFLUOROMETHANE	25.6	33.5	33 0	30.7	11.7	122.8
1,1-DICHLOROETHENE	19.1	22.7	23.0	21.6	8.3	86.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	10.4	14.1	13.6	12.7	13.0	50.7
1,1-DICHLOROETHANE	22.9	30.0	27.4	26.7	10.9	106.9
2,2-DICHLOROPROPANE	36.7	44.6	41.2	40.9	7.9	163.4
cis-1,2-DICHLOROETHENE	17.5	23.3	20.7	20.5	11.6	81.9
BROMOCHLOROMETHANE	13.9	20.1	15.1	16.4	16.3	65.5
CHLOROFORM	21.9	32.6	25.3	26.6	16.7	106.4
1,1,1-TRICHLOROETHANE	33.5	41.8	35.2	36.8	9.7	147.4
1,1-DICHLOROPROPENE	18.3	25.9	22.1	22.1	14.0	88.3
CARBON TETRACHLORIDE	22.2	28.1	24.2	24.8	9.9	99.4
BENZENE	22.2	33.1	24.6	26.6	17.6	106.5
1,2-DICHLOROETHANE	19.6	29.2	21.6	23.5	17.6	93.8
TRICHLOROETHYLENE	15.2	20.3	17.5	17.7	11.7	70.8
1,2-DICHLOROPROPANE	23.0	35.1	24.9	27.6	19.1	110.6
DIBROMOMETHANE	13.6	20.6	15.1	16.5	18.4	65.8
BROMODICHLOROMETHANE	17.5	23 5	19.1	20.0	12 7	80.0
TOLUENE	23.2	38.8	22.1	28.1	27 2	112.3
1,1,2-TRICHLOROETHANE	17.3	25.4	20.9	21.2	15.6	84.9
TETRACHLOROETHYLENE	16.6	21 6	19.1	19.1	10.6	76 4
1,3-DICHLOROPROPANE	12.7	18.4	14.4	15.2	15.8	60.6
DIBROMOCHLOROMETHANE	11.3	15.2	11.7	12.7	13.7	51.0
1,2-DIBROMOETHANE	9.2	12.5	9.2	10.3	15.1	41.2
CHLOROBENZENE	6.7	8.6	6.0	7.1	15.4	28.4
1,1,1,2-TETRACHLOROETHANE	22.9	23.6	22.0	22.8	2.8	91.2
ETHYL BENZENE	16.6	21.6	15.0	17.8	15.9	71.0
p-XYLENE	16.5	22.1	13.3	17.3	21.0	69.2
o-XYLENE	13.1	17.5	10 5	13.7	21.2	54.8
STYRENE	5 0	3.6	2.8	3.8	24.2	15.1
BROMOFORM	10.1	13.5	10.3	11.3	14.0	45.2
ISOPROPYLBENZENE	14.1	16.8	12.3	14.4	12.6	57.6
p-BROMOFLUOROBENZENE	4.9	7.4	6.0	6.1	16 7	24.4
BROMOBENZENE	5.9	7.0	6.3	6.4	7.3	25.6
1,1,2,2-TETRACHLOROETHANE	17.6	21.3	16.4	18.4	11.4	73.7
1,2,3-TRICHLOROPROPANE	21.1	21.2	17.0	19.8	9.9	79.1
n-PROPYL BENZENE	8.9	12.7	8.7	10 1	18.3	40.4
2-CHLOROTOLUENE	13.4	16.8	12.3	14.2	13.6	56.6
4-CHLOROTOLUENE	15.0	18.8	13.7	15.8	13.5	63.3
tert-BUTYLBENZENE	12.3	12.0	12.5	12.3	1.6	49.1
1,3,5-TRIMETHYLBENZENE	12.2	13.5	11.5	12.4	6.8	49.6
sec-BUTYL BENZENE	12.8	13.6	9.9	12.1	13.1	48.5
1,2-DIBROMO-3-CHLOROPROPANE	17.2	17.8	11.7	15.6	17.5	62.3
1,2,4-TRIMETHYLBENZENE	14.1	16.3	7.0	12.4	31.8	49 8
1,3-DICHLOROBENZENE	4.2	5.2	2.9	4.1	22.7	16.3
p-ISOPROPYL TOLUENE	9.9	12.7	8 7	10.4	16.4	41.7
1,4-DICHLOROBENZENE	4.1	5.1	3.8	4.3	12.5	17.3
1,2-DICHLOROBENZENE-d4	1.9	1.8	1.2	1.6	17.3	6.6
1,2-DICHLOROBENZENE	4.5	4.7	3.9	4.3	7.7	17.4
n-BUTYL BENZENE	8.3	11.0	6.1	8.5	23.7	33.8
1,2,4-TRICHLOROBENZENE	4.9	6.4	3.5	4.9	23.6	19.8
HEXACHLOROBUTADIENE	1.6	3.3	1.9	2.3	33.0	9.1
NAPHTHALENE	10.2	12.4	9.6	10.7	11.3	43.0
1,2,3-TRICHLOROBENZENE	1.1	4.0	1.9	2.3	52.3	9 2

NF=not found
NI=not included

TABLE 22
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD TOLUENE-d8

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	9.7	10.8	7.9	9.5	12.8	37.9
CHLOROMETHANE	12.5	14.7	11.6	12.9	10.1	51.8
VINYL CHLORIDE	10.8	8.3	10.0	9.7	10.6	38.8
BROMOMETHANE	15.7	NF	6.1	10.9	59.2	43.6
CHLOROETHANE	11.7	15.1	10.0	12.3	17.3	49.0
TRICHLOROFLUOROMETHANE	10.5	14.8	10.5	11.9	17.2	47.7
1,1-DICHLOROETHENE	11.4	11.4	10.4	11.1	4.1	44.3
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	15.7	15.9	14.7	15.4	3.5	61.7
1,1-DICHLOROETHANE	16.6	16.7	16.3	16.5	1.1	66.1
2,2-DICHLOROPROPANE	23.5	24.2	25.9	24.5	4.1	98.2
cis-1,2-DICHLOROETHENE	18.0	18.8	18.6	18.4	1.9	73.8
BROMOCHLOROMETHANE	16.5	16.8	16.4	16.6	1.2	66.2
CHLOROFORM	19.6	20.7	19.3	19.8	3.1	79.4
1,1,1-TRICHLOROETHANE	19.7	20.2	19.9	20.0	1.1	79.8
1,1-DICHLOROPROPENE	19.9	20.6	19.1	19.9	3.0	79.5
CARBON TETRACHLORIDE	21.4	21.1	20.4	21.0	2.0	83.9
BENZENE	25.6	26.7	25.5	25.9	2.1	103.7
1,2-DICHLOROETHANE	24.1	26.0	25.2	25.1	3.2	100.3
TRICHLOROETHYLENE	21.9	22.8	21.6	22.1	2.3	88.3
1,2-DICHLOROPROPANE	21.2	23.1	22.1	22.1	3.6	88.5
DIBROMOMETHANE	19.5	22.3	20.4	20.7	5.6	82.9
BROMODICHLOROMETHANE	23.0	25.6	24.3	24.3	4.2	97.2
TOLUENE	27.1	29.5	27.2	27.9	4.0	111.6
1,1,2-TRICHLOROETHANE	23.1	24.5	24.2	24.0	2.5	95.8
TETRACHLOROETHYLENE	25.2	26.7	26.0	26.0	2.4	103.9
1,3-DICHLOROPROPANE	24.0	27.1	26.5	25.9	5.2	103.6
DIBROMOCHLOROMETHANE	22.2	24.0	23.6	23.3	3.3	93.1
1,2-DIBROMOETHANE	21.3	23.1	21.8	22.1	3.6	88.3
CHLOROBENZENE	24.8	27.1	25.9	25.9	3.5	103.7
1,1,1,2-TETRACHLOROETHANE	27.5	31.6	29.6	29.6	5.6	118.2
ETHYL BENZENE	31.6	34.4	32.4	32.8	3.6	131.2
p-XYLENE	29.7	31.4	29.1	30.1	3.2	120.3
o-XYLENE	29.3	31.7	31.0	30.7	3.4	122.6
STYRENE	21.9	22.0	19.5	21.2	5.4	84.7
BROMOFORM	23.9	25.5	26.7	25.4	4.6	101.5
ISOPROPYLBENZENE	29.8	32 8	31.3	31.3	4.0	125.2
p-BROMOFLUOROBENZENE	28.0	29.4	28.0	28.5	2.3	113.9
BROMOBENZENE	20.5	22.7	29.5	24.2	15.7	96.9
1,1,2,2-TETRACHLOROETHANE	20.8	22.3	27.7	23.6	12.6	94.5
1,2,3-TRICHLOROPROPANE	31.1	33.5	31.6	32.0	3.2	128.2
n-PROPYL BENZENE	22.0	23.7	23.3	23.0	3.1	92.0
2-CHLOROTOLUENE	21.5	23.3	22.5	22.4	3.3	89.7
4-CHLOROTOLUENE	24.0	26.0	25.1	25.1	3.4	100.2
tert-BUTYLBENZENE	21.9	23.6	22.7	22.7	3.1	90.9
1,3,5-TRIMETHYLBENZENE	20.6	22.8	22.2	21.9	4.3	87.6
sec-BUTYL BENZENE	21.7	23.5	22.8	22.6	3.3	90.5
1,2-DIBROMO-3-CHLOROPROPANE	17.1	18.2	18.0	17.8	2.6	71.0
1,2,4-TRIMETHYLBENZENE	21.1	22.8	22.2	22.0	3.3	88.1
1,3-DICHLOROBENZENE	21.0	23.4	22.6	22.4	4.4	89.4
p-ISOPROPYL TOLUENE	21.4	23.2	22.6	22.4	3.4	89.7
1,4-DICHLOROBENZENE	20.5	23.1	22.3	22.0	4.8	87.8
1,2-DICHLOROBENZENE-d4	14.1	16.3	13.9	14.7	7.3	58.9
1,2-DICHLOROBENZENE	21.0	22.6	22.5	22.0	3.3	88.2
n-BUTYL BENZENE	20.7	22.2	21.4	21.4	3.0	85.7
1,2,4-TRICHLOROBENZENE	20.7	21.9	21.0	21.2	2.6	84.7
HEXACHLOROBUTADIENE	19.6	21.7	19.7	20.4	4.7	81.4
NAPHTHALENE	21.1	22.8	22.3	22.1	3.2	88.2
1,2,3-TRICHLOROBENZENE	18.9	20.7	19.2	19.6	4.2	78.3

NF=not found
NI=not included

TABLE 23
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD TOLUENE-d8

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	19.0	14.5	17.8	17.1	11.2	68.5
CHLOROMETHANE	32.5	22.5	35.7	30.3	18.6	121.0
VINYL CHLORIDE	24.2	18.7	22.0	21.7	10.6	86.6
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	25.4	20.9	22.8	23.0	7.9	92.1
TRICHLOROFLUOROMETHANE	27.4	20.3	21.4	23.0	13.5	92.1
1,1-DICHLOROETHENE	20.1	13.2	9.6	14.3	30.3	57.2
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	24.7	16.1	20.2	20.3	17.3	81.3
1,1-DICHLOROETHANE	28.2	18.1	24.2	23.5	17.7	94.1
2,2-DICHLOROPROPANE	25.6	22.4	26.9	25.0	7.7	99.9
cis-1,2-DICHLOROETHENE	28.4	19.4	24.2	24.0	15.4	96.0
BROMOCHLOROMETHANE	33.7	20.7	28.6	27.7	19.4	110.7
CHLOROFORM	36.2	23.0	29.8	29.7	18.2	118.6
1,1,1-TRICHLOROETHANE	29.1	19.0	25.5	24.6	17.0	98.3
1,1-DICHLOROPROPENE	24.9	17.3	21.4	21.2	14.6	84.7
CARBON TETRACHLORIDE	24.2	17.6	19.7	20.5	13.6	81.9
BENZENE	36.3	24.3	31.1	30.6	16.2	122.2
1,2-DICHLOROETHANE	46.6	31.5	39.1	39.1	15.7	156.2
TRICHLOROETHYLENE	26.4	20.0	22.2	22.9	11.6	91.5
1,2-DICHLOROPROPANE	38.1	25.2	32.4	31.9	16.5	127.6
DIBROMOMETHANE	41.4	27.0	35.9	34.7	17.1	139.0
BROMODICHLOROMETHANE	38.5	28.0	35.7	34.1	13.0	136.3
TOLUENE	29.7	24.3	26.9	27.0	8.2	107.8
1,1,2-TRICHLOROETHANE	42.7	29.9	42.5	38.4	15.5	153.5
TETRACHLOROETHYLENE	19.3	17.4	19.5	18.7	5.2	75.0
1,3-DICHLOROPROPANE	41.0	31.2	38.9	37.0	11 4	148.0
DIBROMOCHLOROMETHANE	33.0	26.0	32.0	30.4	10.1	121.4
1,2-DIBROMOETHANE	35.2	26.1	31.7	31.0	12.0	124.0
CHLOROBENZENE	21.6	20.5	22.6	21.6	3.8	86.2
1,1,1,2-TETRACHLOROETHANE	28.5	25.1	28.3	27.3	5.8	109.3
ETHYL BENZENE	21.9	21.5	23.7	22.4	4.3	89.5
p-XYLENE	21.6	22.0	22.8	22.1	2.2	88.5
o-XYLENE	21.6	20.5	22.6	21.6	4.0	86.4
STYRENE	2.8	3.3	3.0	3.0	6.4	12.1
BROMOFORM	32.3	27.9	32.2	30.8	6.6	123.2
ISOPROPYLBENZENE	14.8	16.1	16.5	15.8	4.4	63.1
p-BROMOFLUOROBENZENE	19.3	18.0	21.1	19.5	6.6	78.0
BROMOBENZENE	22.1	21.7	25.5	23.1	7 3	92.4
1,1,2,2-TETRACHLOROETHANE	36.0	28.7	36.6	33.7	10.6	134.9
1,2,3-TRICHLOROPROPANE	49.7	19.5	52.5	40.6	36.8	162.3
n-PROPYL BENZENE	11.6	13.9	14.3	13.3	9.0	53.0
2-CHLOROTOLUENE	14.1	16.7	16.7	15.8	7.8	63.3
4-CHLOROTOLUENE	15.7	18.6	15.1	16.5	9 3	65 9
tert-BUTYLBENZENE	10.4	11.9	13.4	11.9	10.5	47.6
1,3,5-TRIMETHYLBENZENE	11.9	13.1	13.4	12.8	5.2	51.1
sec-BUTYL BENZENE	9.1	10.2	10.4	9.9	5.7	39.6
1,2-DIBROMO-3-CHLOROPROPANE	28.4	23.6	36.4	29.5	17.9	117.8
1,2,4-TRIMETHYLBENZENE	15.5	15.9	17.5	16.3	5.3	65.1
1,3-DICHLOROBENZENE	9.8	13.2	12 1	11.7	12.2	46.8
p-ISOPROPYL TOLUENE	8.6	9.0	10.6	9.4	9.4	37.6
1,4-DICHLOROBENZENE	9.6	13.0	11.9	11.5	12.2	46.0
1,2-DICHLOROBENZENE-d4	5.7	6 6	6.0	6.1	6.4	24.5
1,2-DICHLOROBENZENE	11.4	11.8	14.1	12.4	9.8	49.7
n-BUTYL BENZENE	6.9	7.0	8.1	7.3	7.3	29.3
1,2,4-TRICHLOROBENZENE	3.6	6.0	5.1	4.9	20.1	19.7
HEXACHLOROBUTADIENE	2.0	3.3	4.5	3.2	32.1	12.9
NAPHTHALENE	9.9	10.6	13.3	11.3	13.0	45.1
1,2,3-TRICHLOROBENZENE	3.4	5.8	5.4	4.9	21 0	19.5

NF=not found
NI=not included

TABLE 24
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD TOLUENE-d8

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	28.7	37.9	35.7	34.1	11.4	136.4
CHLOROMETHANE	30.9	39.9	41.1	37.3	12.3	149.2
VINYL CHLORIDE	26.6	40.1	38.8	35.2	17.3	140.7
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	3.3	17.8	24.1	15.1	57.8	60.3
TRICHLOROFLUOROMETHANE	32.9	46.5	44.8	41.4	14.6	165.6
1,1-DICHLOROETHENE	26.0	35.1	34.5	31.9	13.1	127.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	14.3	22.3	20.8	19.1	18.3	76.5
1,1-DICHLOROETHANE	30.1	43.3	38.7	37.3	14.7	149.4
2,2-DICHLOROPROPANE	41.7	50.4	47.1	46.4	7.8	185.6
cis-1,2-DICHLOROETHENE	22.9	33.5	29.2	28.5	15.3	114.2
BROMOCHLOROMETHANE	19.1	31.6	22.8	24.5	21.4	98.0
CHLOROFORM	32.9	63.8	44.4	47.0	27.1	188.2
1,1,1-TRICHLOROETHANE	45.0	63.1	51.6	53.2	14.1	213.0
1,1-DICHLOROPROPENE	24.9	40.2	33.1	32.7	19.1	130.9
CARBON TETRACHLORIDE	33.1	51.2	40.8	41.7	17.8	166.8
BENZENE	29.7	49.9	36.0	38.6	21.9	154.3
1,2-DICHLOROETHANE	26.3	44.1	31.8	34.1	21.9	136.3
TRICHLOROETHYLENE	20.2	30.0	25.3	25.2	15.8	100.7
1,2-DICHLOROPROPANE	31.2	53.9	37.0	40.7	23.7	162.8
DIBROMOMETHANE	18.4	31.5	22.4	24.1	22.8	96.4
BROMODICHLOROMETHANE	23.5	35.4	28.0	29.0	17.0	115.9
TOLUENE	31.1	58.7	32.5	40.8	31.1	163.0
1,1,2-TRICHLOROETHANE	23.4	38.8	30.9	31.0	20.2	124.1
TETRACHLOROETHYLENE	22.4	32.7	28.0	27.7	15.2	110.8
1,3-DICHLOROPROPANE	17.1	27.9	21.2	22.1	20.2	88.2
DIBROMOCHLOROMETHANE	15.0	22.5	17.0	18.2	17.4	72.7
1,2-DIBROMOETHANE	9.0	13.0	8.8	10.3	18.7	41.0
CHLOROBENZENE	11.0	15.7	11.3	12.7	16.8	50.7
1,1,1,2-TETRACHLOROETHANE	31.7	37.5	33.7	34.3	7.0	137.1
ETHYL BENZENE	22.3	32.7	22.0	25.7	19.3	102.7
p-XYLENE	22.1	33.4	19.6	25.0	24.0	100.1
o-XYLENE	17.6	26.4	15.4	19.8	24.1	79.2
STYRENE	6.7	5.4	4.1	5.4	19.9	21.5
BROMOFORM	13.4	19.9	14.8	16.0	17.4	64.2
ISOPROPYLBENZENE	18.9	25.3	18.1	20.8	15.5	83.1
p-BROMOFLUOROBENZENE	6.6	11.1	8.7	8.8	21.1	35.3
BROMOBENZENE	7.9	10.6	9.2	9.2	11.9	36.9
1,1,2,2-TETRACHLOROETHANE	23.5	32.0	24.0	26.5	14.7	106.0
1,2,3-TRICHLOROPROPANE	28.2	31.8	24.8	28.3	10.1	113.2
n-PROPYL BENZENE	11.9	19.2	12.8	14.6	22.2	58.6
2-CHLOROTOLUENE	17.9	25.2	17.9	20.4	16.8	81.4
4-CHLOROTOLUENE	20.0	28.1	20.0	22.7	16.8	90.9
tert-BUTYLBENZENE	16.6	18.1	18.3	17.7	4.5	70.7
1,3,5-TRIMETHYLBENZENE	16.3	20.4	16.9	17.9	10.2	71.5
sec-BUTYL BENZENE	17.2	20.5	14.5	17.4	14.0	69.6
1,2-DIBROMO-3-CHLOROPROPANE	23.3	27.2	17.4	22.6	17 9	90.6
1,2,4-TRIMETHYLBENZENE	12.6	16.4	6.8	11.9	32.9	47.8
1,3-DICHLOROBENZENE	5.6	7.8	4.3	5.9	24.7	23.6
p-ISOPROPYL TOLUENE	13.3	19.3	12.8	15.1	19.7	60.5
1,4-DICHLOROBENZENE	5.5	7.7	5.6	6.3	15.9	25.0
1,2-DICHLOROBENZENE-d4	2.7	3.0	1.9	2.5	17.4	10.0
1,2-DICHLOROBENZENE	6.0	7.0	5.7	6.2	9.3	24.9
n-BUTYL BENZENE	11.2	16.6	8.9	12.2	26.3	48.9
1,2,4-TRICHLOROBENZENE	6.6	9.6	5.2	7.1	26.0	28.5
HEXACHLOROBUTADIENE	2.1	5.0	2.8	3.3	36.9	13.3
NAPHTHALENE	13.6	18.6	14.0	15.4	14.6	61.5
1,2,3-TRICHLOROBENZENE	1.4	5.9	2.8	3.4	55.4	13.5

NF=not found
NI=included

TABLE 25
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD CHLOROFORM-d

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	10.7	11.4	8.7	10.2	11.0	40.9
CHLOROMETHANE	10.9	13.1	10.9	11.7	8.8	46.6
VINYL CHLORIDE	11.2	14.1	11.2	12.2	11.3	48.7
BROMOMETHANE	17.2	NF	8.0	12 6	55.9	50.4
CHLOROETHANE	12.3	15.1	10.5	12.7	15.0	50.6
TRICHLOROFLUOROMETHANE	13.1	16.9	12.9	14.3	12.9	57.1
1,1-DICHLOROETHENE	12.5	11.9	11.5	12.0	3.6	47.9
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	17.3	16.7	16.3	16.8	2.6	67.1
1,1-DICHLOROETHANE	18.0	17.4	17.8	17.7	1.4	71.0
2,2-DICHLOROPROPANE	24.6	24.6	27.0	25.4	4.6	101.6
cis-1,2-DICHLOROETHENE	19.5	19.5	20.2	19.7	1.7	78.9
BROMOCHLOROMETHANE	18.2	17.7	18.1	18.0	1.3	72.0
CHLOROFORM	22.2	22.0	21.8	22.0	0.6	88.0
1,1,1-TRICHLOROETHANE	21.5	21.1	21.8	21.5	1.3	85.9
1,1-DICHLOROPROPENE	21.9	21.5	21.1	21.5	1.5	86.0
CARBON TETRACHLORIDE	21.8	20.5	21.0	21.1	2.5	84.5
BENZENE	28.0	27.8	27.9	27.9	0.2	111.4
1,2-DICHLOROETHANE	26.3	27.1	27.6	27.0	2.0	108.0
TRICHLOROETHYLENE	23.9	23.7	23.6	23.7	0.6	94.9
1,2-DICHLOROPROPANE	23.3	24.2	24.4	23.9	2.0	95.7
DIBROMOMETHANE	21.4	23.2	22.5	22.4	3.4	89.4
BROMODICHLOROMETHANE	25.2	26.6	26.6	26.1	2.6	104.6
TOLUENE	29.5	30.7	29.8	30.0	1.7	120.0
1,1,2-TRICHLOROETHANE	25.3	25.6	26.6	25.9	2.1	103.4
TETRACHLOROETHYLENE	27.5	27.8	28.6	28.0	1.6	111.9
1,3-DICHLOROPROPANE	26.3	28 2	29.1	27.9	4.2	111.4
DIBROMOCHLOROMETHANE	24.1	25.0	25.7	24.9	2.6	99.7
1,2-DIBROMOETHANE	23.2	24.1	23.8	23.7	1.6	94.7
CHLOROBENZENE	27.3	28.3	28.5	28.0	2.0	112.1
1,1,1,2-TETRACHLOROETHANE	30.4	33.1	32.9	32.1	3.8	128.5
ETHYL BENZENE	34.5	35.8	35.3	35.2	1.5	140.7
p-XYLENE	33.6	35.3	36.3	35.0	3.2	140.1
o-XYLENE	31.7	32.9	33.7	32.8	2.4	131.1
STYRENE	23.9	23.0	21.4	22.8	4.6	91.1
BROMOFORM	25.8	26.4	28.9	27.1	5.0	108.2
ISOPROPYLBENZENE	32.5	34.1	34.2	33.6	2.4	134.4
p-BROMOFLUOROBENZENE	30.5	30.5	30.5	30.5	0.0	121.9
BROMOBENZENE	22.4	23.7	32.1	26.1	16.6	104.3
1,1,2,2-TETRACHLOROETHANE	22.8	23.2	30.3	25.5	13.6	101.8
1,2,3-TRICHLOROPROPANE	33.9	34 8	34.5	34.4	1.1	137.6
n-PROPYL BENZENE	24.0	24.6	25.4	24.7	2.3	98.6
2-CHLOROTOLUENE	23.4	24.3	24.6	24.1	2.1	96.5
4-CHLOROTOLUENE	26.1	27 0	27.3	26.8	2 0	107.2
tert-BUTYLBENZENE	23.9	24.6	24.9	24.5	1.6	97.9
1,3,5-TRIMETHYLBENZENE	22.5	23.8	24.4	23.6	3.2	94.2
sec-BUTYL BENZENE	23.6	24.4	24.9	24.3	2.2	97.3
1,2-DIBROMO-3-CHLOROPROPANE	18.7	19.0	19.7	19.1	2.3	76.6
1,2,4-TRIMETHYLBENZENE	23.0	23.7	24.3	23.7	2.3	94.7
1,3-DICHLOROBENZENE	23.0	24.4	24.7	24.0	3.2	96.1
p-ISOPROPYL TOLUENE	23.4	24.2	24.8	24.1	2.4	96.6
1,4-DICHLOROBENZENE	22.4	24.0	24.3	23.6	3.5	94.3
1,2-DICHLOROBENZENE-d4	17.0	18.0	16.8	17.2	3.0	69.0
1,2-DICHLOROBENZENE	22.9	23.5	24.6	23.6	3.0	94.5
n-BUTYL BENZENE	22.6	23.2	23.5	23.1	1.6	92.4
1,2,4-TRICHLOROBENZENE	22.5	22.8	22.9	22.7	0.8	90.9
HEXACHLOROBUTADIENE	21.4	22.6	21.6	21.9	2.4	87.4
NAPHTHALENE	23.0	23.7	24.3	23.7	2.4	94.6
1,2,3-TRICHLOROBENZENE	20.4	21.5	20.8	20.9	2 1	83.5

NF=not found
NI=not included

TABLE 26
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD CHLOROFORM-d

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	14.1	13.0	12.7	13.2	4.4	53.0
CHLOROMETHANE	25.3	20.4	27.1	24.3	11.7	97.1
VINYL CHLORIDE	18.2	16.8	17.4	17.5	3.4	69.9
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	18.3	18.0	16.0	17.4	5.8	69.8
TRICHLOROFLUOROMETHANE	21.3	18.4	16.0	18.5	11.7	74.2
1,1-DICHLOROETHENE	14.9	11.8	7.0	11.2	29.2	44.9
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	17.9	14.3	14.2	15.5	11.0	61.8
1,1-DICHLOROETHANE	21.6	16.3	17.9	18.6	11.9	74.5
2,2-DICHLOROPROPANE	21.8	20.5	21.7	21.4	2.7	85.4
cis-1,2-DICHLOROETHENE	22.0	17.5	18.0	19.2	10.3	76.7
BROMOCHLOROMETHANE	24.6	18.5	20.2	21.1	12.2	84.4
CHLOROFORM	24.2	20.1	19.4	21.2	10.0	85.0
1,1,1-TRICHLOROETHANE	22.0	17.1	18.7	19.3	10.6	77.1
1,1-DICHLOROPROPENE	18.4	15.5	15.4	16.4	8.6	65.7
CARBON TETRACHLORIDE	16.7	15.2	13.6	15.1	8.5	60.6
BENZENE	27.5	21.8	22.7	24.0	10.3	96.0
1,2-DICHLOROETHANE	34.8	28.2	28.3	30.4	10.1	121.7
TRICHLOROETHYLENE	20.1	18.0	16.3	18.2	8.5	72.7
1,2-DICHLOROPROPANE	28.3	22.6	23.3	24.7	10.2	98.9
DIBROMOMETHANE	30.7	24.1	25.8	26.9	10.3	107.5
BROMODICHLOROMETHANE	28.8	25.1	25.9	26.6	6.0	106.5
TOLUENE	22.2	21.8	19.5	21.2	5.6	84.7
1,1,2-TRICHLOROETHANE	31.7	26.8	30.6	29.7	7.1	118.9
TETRACHLOROETHYLENE	14.5	15.6	14.2	14.8	4.1	59.0
1,3-DICHLOROPROPANE	30.6	27.9	28.1	28.9	4.2	115.4
DIBROMOCHLOROMETHANE	25.4	23.6	23.9	24.3	3.3	97.1
1,2-DIBROMOETHANE	26.7	23.5	23.4	24.5	6.4	98.1
CHLOROBENZENE	16.2	18.4	16.3	17.0	6.1	67.9
1,1,1,2-TETRACHLOROETHANE	20.8	22.3	19.9	21.0	4.6	84.1
ETHYL BENZENE	16.5	19.4	17.3	17.7	6.9	70.8
p-XYLENE	16.1	19.7	16.4	17.4	9.4	69.7
o-XYLENE	16.4	18.5	16.6	17.2	5.5	68.7
STYRENE	2.1	2.9	2.2	2.4	15.9	9.6
BROMOFORM	25.0	25.3	24.3	24.9	1.8	99.5
ISOPROPYLBENZENE	11.1	14.4	12.0	12.5	11.3	50.0
p-BROMOFLUOROBENZENE	14.6	16.2	15.5	15.4	4.3	61.7
BROMOBENZENE	16.6	19.5	18.6	18.2	6.7	73.0
1,1,2,2-TETRACHLOROETHANE	27.1	25.8	26.7	26.5	2.1	106.1
1,2,3-TRICHLOROPROPANE	37.2	17.5	38.0	30.9	30.7	123.6
n-PROPYL BENZENE	8.8	12.5	10.5	10.6	14.5	42.3
2-CHLOROTOLUENE	10.6	15.0	12.2	12.6	14.4	50.4
4-CHLOROTOLUENE	11.9	16.8	11.1	13.3	18.9	53.1
tert-BUTYLBENZENE	7.8	10.7	9.7	9.4	13.0	37.7
1,3,5-TRIMETHYLBENZENE	8.9	11.8	9.7	10.2	11.9	40.7
sec-BUTYL BENZENE	6.9	9.2	7.6	7.9	12.0	31.6
1,2-DIBROMO-3-CHLOROPROPANE	21.1	21.1	26.0	22.7	10.2	91.0
1,2,4-TRIMETHYLBENZENE	11.6	14.3	12.7	12.9	8.4	51.4
1,3-DICHLOROBENZENE	7.4	11.9	8.8	9.4	20.0	37.4
p-ISOPROPYL TOLUENE	6.5	8.1	7.7	7.4	9.6	29.7
1,4-DICHLOROBENZENE	7.3	11.7	8.7	9.2	20.0	36.9
1,2-DICHLOROBENZENE-d4	3.9	5.7	3.9	4.5	18.5	18.0
1,2-DICHLOROBENZENE	8.6	10.7	10.4	9.9	9.1	39.5
n-BUTYL BENZENE	5.2	6.3	5.9	5.8	8.0	23.2
1,2,4-TRICHLOROBENZENE	2.8	5.5	3.7	4.0	28.0	15.9
HEXACHLOROBUTADIENE	1.5	2.9	3.3	2.6	30.7	10.3
NAPHTHALENE	7.5	9.5	9.8	8.9	11.3	35.7
1,2,3-TRICHLOROBENZENE	2.6	5.2	4.0	3.9	27.0	15.7

NF=not found
NI=not included

TABLE 27
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD CHLOROFORM-d

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	16.6	19.2	20.8	18.9	9.3	75.5
CHLOROMETHANE	19.4	22.5	25.8	22.6	11.7	90 4
VINYL CHLORIDE	15.9	21.0	22.6	19.8	14.5	79.2
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	1.9	8.8	13.5	8.1	59.0	32.3
TRICHLOROFLUOROMETHANE	21.0	27.1	28.8	25.6	13.1	102.5
1,1-DICHLOROETHENE	15.1	17.6	19.5	17.4	10.3	69.6
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	8.2	10.8	11.5	10.2	14.0	40.7
1,1-DICHLOROETHANE	18.5	23.8	23.6	22.0	11.2	87.9
2,2-DICHLOROPROPANE	32.8	40.5	38.4	37.2	8.8	148.8
cis-1,2-DICHLOROETHENE	14.2	18.6	17.9	16.9	11.5	67.6
BROMOCHLOROMETHANE	11.0	15.4	12.8	13.1	13.9	52.3
CHLOROFORM	16.5	23.1	20.5	20.0	13.5	80.1
1,1,1-TRICHLOROETHANE	26.1	31.9	29.3	29.1	8.1	116.4
1,1-DICHLOROPROPENE	14.5	20.0	18.7	17.7	13.1	71.0
CARBON TETRACHLORIDE	17.1	20.8	19.7	19.2	7.9	76.8
BENZENE	17.7	25.8	20.9	21.5	15.6	85.9
1,2-DICHLOROETHANE	15.6	22.8	18.5	18.9	15.5	75.8
TRICHLOROETHYLENE	12.3	16.0	15.1	14.4	11.1	57.8
1,2-DICHLOROPROPANE	18.3	27.1	21.1	22.1	16.5	88.6
DIBROMOMETHANE	10.9	16.1	12.9	13.3	16.1	53.1
BROMODICHLOROMETHANE	14.0	18.3	16.3	16.2	11.0	64.8
TOLUENE	18.5	30.3	18.9	22.6	24.3	90.2
1,1,2-TRICHLOROETHANE	13.8	19.8	17.8	17.1	14.4	68.5
TETRACHLOROETHYLENE	13.3	16.9	16.3	15.5	10.2	61.9
1,3-DICHLOROPROPANE	10.2	14.4	12.3	12.3	14.1	49.2
DIBROMOCHLOROMETHANE	9.1	12.0	10.1	10.4	11.7	41.6
1,2-DIBROMOETHANE	7.5	9.8	7.9	8.4	12.3	33.6
CHLOROBENZENE	5.4	6.7	5.1	5.7	12.3	22.9
1,1,1,2-TETRACHLOROETHANE	17.9	18.1	18.5	18.2	1.4	72.7
ETHYL BENZENE	13.2	16.9	12.8	14.3	12.8	57.2
p-XYLENE	13.1	17.2	11.3	13.9	17.7	55.6
o-XYLENE	10.5	13.6	8.9	11.0	17.9	44.0
STYRENE	4.0	2.8	2.4	3.0	22.4	12.1
BROMOFORM	8.2	10.7	8.8	9.2	11.8	37.0
ISOPROPYLBENZENE	11.2	13.1	10.5	11.6	9.3	46.4
p-BROMOFLUOROBENZENE	4.0	5.8	5.1	5 0	15.6	19.9
BROMOBENZENE	4.7	5.5	5.4	5.2	6.7	20.8
1,1,2,2-TETRACHLOROETHANE	14.1	16.7	14.0	14.9	8.4	59.8
1,2,3-TRICHLOROPROPANE	16.9	16.6	14.5	16.0	6.6	64.1
n-PROPYL BENZENE	7.1	9.9	7.4	8.1	15.6	32.5
2-CHLOROTOLUENE	10.8	13.2	10.5	11.5	10.5	45.9
4-CHLOROTOLUENE	12.1	14.8	11.8	12.9	10.4	51.6
tert-BUTYLBENZENE	9.8	9.4	10.6	9.9	5.3	39.7
1,3,5-TRIMETHYLBENZENE	9.7	10.6	9.8	10.0	3.9	40.1
sec-BUTYL BENZENE	10.3	10.7	8.5	9.8	9.7	39.4
1,2-DIBROMO-3-CHLOROPROPANE	13.7	13.8	10.0	12.5	14.1	50.1
1,2,4-TRIMETHYLBENZENE	11.2	12.7	6.0	9.9	29.1	39 8
1,3-DICHLOROBENZENE	3 4	4.1	2.5	3.3	19.4	13.2
p-ISOPROPYL TOLUENE	7.9	10.0	7.4	8.4	13.1	33.8
1,4-DICHLOROBENZENE	3.3	4.0	3.3	3.5	9.5	14.1
1,2-DICHLOROBENZENE-d4	1.5	1.4	1.1	1.3	13.8	5.2
1,2-DICHLOROBENZENE	3.6	3.7	3.3	3.5	4.1	14.2
n-BUTYL BENZENE	6.6	8.6	5.2	6.8	20.4	27.2
1,2,4-TRICHLOROBENZENE	4.0	5.0	3.9	4.3	12.0	17.2
HEXACHLOROBUTADIENE	1.3	2.6	1.7	1.9	30.5	7.4
NAPHTHALENE	8.2	9.8	8.3	8.8	8.5	35.0
1,2,3-TRICHLOROBENZENE	0 9	3.1	1.6	1.9	49.9	7.5

NF=not found
NI=not included

TABLE 28
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD BROMOCHLOROMETHANE-d2

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	16.3	18.6	14.0	16.3	11.4	65.1
CHLOROMETHANE	13 2	16.9	13.9	14.7	11.1	58.7
VINYL CHLORIDE	16.5	22.2	17.3	18 7	13.5	74.7
BROMOMETHANE	17.7	26.7	14.1	19.5	27.1	78.0
CHLOROETHANE	17.6	23.1	15.9	18.9	16.5	75.5
TRICHLOROFLUOROMETHANE	13.9	20.1	14.7	16.2	17.0	64.9
1,1-DICHLOROETHENE	15.1	15.4	14.6	15.0	2.1	60.1
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	28.0	29.0	27.9	28.3	1.8	113.2
1,1-DICHLOROETHANE	21.0	21.7	21.8	21.5	1.8	86.1
2,2-DICHLOROPROPANE	19.6	21.0	24.2	21.6	9.0	86.3
cis-1,2-DICHLOROETHENE	22.6	24.3	24.8	23.9	3.9	95.7
BROMOCHLOROMETHANE	28.9	30.2	30.5	29.9	2.2	119.4
CHLOROFORM	37.4	39.9	39.1	38.8	2.6	155.3
1,1,1-TRICHLOROETHANE	25.5	26.7	27.2	26.5	2.8	105.9
1,1-DICHLOROPROPENE	25.9	27.3	26.4	26.5	2.2	106.1
CARBON TETRACHLORIDE	26.1	26.3	26.5	26.3	0.6	105.2
BENZENE	33.3	35.4	35.0	34.6	2.7	138.3
1,2-DICHLOROETHANE	31.2	34.4	34.5	33.4	4.7	133.5
TRICHLOROETHYLENE	28.3	30.1	29.4	29.3	2.6	117.0
1,2-DICHLOROPROPANE	27.4	30.5	30.2	29.4	4.8	117.5
DIBROMOMETHANE	25.3	29.5	28.1	27.6	6.3	110.4
BROMODICHLOROMETHANE	29.8	33.8	33.3	32.3	5.5	129.4
TOLUENE	35.0	39.1	37.3	37.1	4.5	148.6
1,1,2-TRICHLOROETHANE	29.9	32.4	33.1	31.8	4.3	127.2
TETRACHLOROETHYLENE	32.6	35.3	35.7	34.5	4.0	138.0
1,3-DICHLOROPROPANE	31.1	35.8	36.4	34.4	6.9	137.8
DIBROMOCHLOROMETHANE	28.6	31.8	32.4	31.0	5.4	123.8
1,2-DIBROMOETHANE	27.5	30.7	29.8	29.3	4.6	117.3
CHLOROBENZENE	32.1	35.7	35.4	34.4	4.8	137.5
1,1,1,2-TETRACHLOROETHANE	34.7	40.2	39.4	38.1	6.3	152.3
ETHYL BENZENE	41.2	45.9	44.7	43.9	4.5	175.7
p-XYLENE	39.9	44.9	45.6	43.5	5.8	173.9
o-XYLENE	38.4	42.7	43.2	41.4	5.3	165.7
STYRENE	28.4	29.2	26.8	28.1	3.6	112.4
BROMOFORM	30.9	34.0	37.2	34.0	7.5	136.1
ISOPROPYLBENZENE	38.4	43.2	42.7	41.4	5.2	165.7
p-BROMOFLUOROBENZENE	36.6	39.2	38.6	38.1	3.0	152.6
BROMOBENZENE	26.5	30.1	40.6	32.4	18.4	129.6
1,1,2,2-TETRACHLOROETHANE	27.0	29.5	38.2	31.5	15.2	126.2
1,2,3-TRICHLOROPROPANE	40.5	44.6	43.6	42.9	4.1	171.5
n-PROPYL BENZENE	28.5	31.4	31.9	30.6	5.0	122.5
2-CHLOROTOLUENE	27.8	30.9	30.9	29.8	4.9	119.4
4-CHLOROTOLUENE	31.1	34.6	34.6	33.4	4.9	133.7
tert-BUTYLBENZENE	28.3	31.2	31.1	30.2	4.4	120.9
1,3,5-TRIMETHYLBENZENE	26.8	30.4	30.6	29.3	5.9	117.1
sec-BUTYL BENZENE	28.0	31.1	31.3	30.1	4.9	120.5
1,2-DIBROMO-3-CHLOROPROPANE	22.0	23.9	24.5	23.5	4.5	93.8
1,2,4-TRIMETHYLBENZENE	27.2	30.1	30.4	29.2	5.0	116.9
1,3-DICHLOROBENZENE	27.2	31.0	31.0	29.7	6.0	119.0
p-ISOPROPYL TOLUENE	27.7	30.7	31.0	29.8	5.0	119.3
1,4-DICHLOROBENZENE	26.6	30.6	30.5	29.2	6.4	116.9
1,2-DICHLOROBENZENE-d4	38.6	42.4	40.5	40.5	3.9	162.0
1,2-DICHLOROBENZENE	27.1	29.9	30.9	29.3	5.5	117.2
n-BUTYL BENZENE	26.8	29.4	29.4	28.5	4.3	114.1
1,2,4-TRICHLOROBENZENE	26.6	29.0	28.7	28.1	3.7	112.4
HEXACHLOROBUTADIENE	25.3	28.7	27.0	27.0	5.1	108.0
NAPHTHALENE	27.2	30.1	30.6	29.3	5.1	117.2
1,2,3-TRICHLOROBENZENE	23.7	26.9	25.5	25.4	5.2	101.5

NI=not included

TABLE 29
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD BROMOCHLOROMETHANE-d2

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	20.4	22.4	19.6	20.8	5.8	83.2
CHLOROMETHANE	24.9	23.4	28.4	25.6	8.2	102.2
VINYL CHLORIDE	22.2	24.3	20.5	22.3	6.9	89.3
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	21.6	25.4	19.8	22.3	10.4	89.1
TRICHLOROFLUOROMETHANE	20.5	20.8	15.8	19.0	12.1	76.0
1,1-DICHLOROETHENE	14.8	14.0	7.4	12.1	27.6	48.2
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	23.8	23.1	20.3	22.4	6.6	89.7
1,1-DICHLOROETHANE	21.1	18.6	18.2	19.3	6.6	77.2
2,2-DICHLOROPROPANE	12.7	14.6	14.1	13.8	5.8	55.3
cis-1,2-DICHLOROETHENE	21.4	19.8	18.2	19.8	6.7	79.2
BROMOCHLOROMETHANE	31.6	28.9	27.8	29.4	5.4	117.7
CHLOROFORM	33.1	34.2	29.6	32.3	6.1	129.2
1,1,1-TRICHLOROETHANE	21.6	19.8	19.2	20.2	4.9	80.8
1,1-DICHLOROPROPENE	18.2	18.3	16.1	17.5	5.8	70.0
CARBON TETRACHLORIDE	16.5	17.7	14.0	16.1	9.6	64.2
BENZENE	27.0	25.4	23.5	25.3	5.7	101.3
1,2-DICHLOROETHANE	34.2	32.9	29.3	32.1	6.4	128.5
TRICHLOROETHYLENE	19.6	20.7	16.6	19.0	9.2	75 9
1,2-DICHLOROPROPANE	27.4	26.2	23.9	25.9	5.5	103.4
DIBROMOMETHANE	29.8	28.1	26.5	28.2	4.8	112.6
BROMODICHLOROMETHANE	28.3	29.4	26.8	28.2	3.8	112.6
TOLUENE	21.9	25.4	20.2	22.5	9.7	90.0
1,1,2-TRICHLOROETHANE	30.9	31.1	31.4	31.1	0.7	124.5
TETRACHLOROETHYLENE	14.2	18.2	14.7	15.7	11.4	62.8
1,3-DICHLOROPROPANE	30.0	32.5	29.0	30.5	4.9	122.0
DIBROMOCHLOROMETHANE	25.1	27.5	24.7	25.7	4.8	103.0
1,2-DIBROMOETHANE	26.5	27.5	24.2	26.0	5.3	104.1
CHLOROBENZENE	15.9	21.5	16.9	18.1	13.5	72.3
1,1,1,2-TETRACHLOROETHANE	20.4	25.8	20.7	22.3	11.2	89.2
ETHYL BENZENE	16.1	22.5	17.8	18.8	14.5	75.2
p-XYLENE	15.9	23.1	17.1	18.7	16.8	74.7
o-XYLENE	15.9	21.4	17.0	18.1	13.2	72.3
STYRENE	2.1	3.4	2.2	2.6	23.6	10.3
BROMOFORM	24.7	29.8	25.1	26.6	8.7	106.2
ISOPROPYLBENZENE	11.0	16.9	12.4	13.4	18.8	53.6
p-BROMOFLUOROBENZENE	14.2	18.8	15.8	16.2	11.7	65.0
BROMOBENZENE	16.2	22.8	19.1	19.4	13.8	77.5
1,1,2,2-TETRACHLOROETHANE	26.7	30.1	27.7	28.1	5.1	112.6
1,2,3-TRICHLOROPROPANE	36.7	20.5	39.4	32.2	26.0	128 7
n-PROPYL BENZENE	8.3	14.2	10.5	11.0	22.1	44.1
2-CHLOROTOLUENE	10.3	17.3	12.5	13.4	22.1	53.5
4-CHLOROTOLUENE	11.5	19.4	11.3	14.1	27.0	56.2
tert-BUTYLBENZENE	7.7	12.6	10.1	10.1	19.8	40.5
1,3,5-TRIMETHYLBENZENE	8.6	13.6	9.9	10.7	19.7	42 9
sec-BUTYL BENZENE	6.6	10.5	7.8	8.3	19.7	33.2
1,2-DIBROMO-3-CHLOROPROPANE	20.7	24.6	26.7	24.0	10.4	96.0
1,2,4-TRIMETHYLBENZENE	11.5	16.7	13.2	13.8	15.8	55.1
1,3-DICHLOROBENZENE	7.1	13.6	9.0	9.9	27.9	39.6
p-ISOPROPYL TOLUENE	6.4	9.5	8.0	8.0	16.1	31.8
1,4-DICHLOROBENZENE	7.0	13.4	8.8	9.8	27.9	39.0
1,2-DICHLOROBENZENE-d4	12.3	19.5	13.1	15.0	21.7	59.9
1,2-DICHLOROBENZENE	8.2	12.1	10.4	10.2	15.6	40.9
n-BUTYL BENZENE	5 1	7.4	6.1	6.2	15.1	25.0
1,2,4-TRICHLOROBENZENE	2.6	6.1	3.7	4.2	35.7	16.6
HEXACHLOROBUTADIENE	1 4	3.3	3.3	2.7	33.8	10.7
NAPHTHALENE	7.1	10.8	9.8	9.2	16 8	36.8
1,2,3-TRICHLOROBENZENE	2.3	5.4	3 7	3.8	34.3	15 1

NF=not found
NI=not included

TABLE 30
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD BROMOCHLOROMETHANE-d2

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	35.7	38.9	42.6	39.1	7.3	156.2
CHLOROMETHANE	24.9	32.4	39.0	32.1	18.0	128.4
VINYL CHLORIDE	31.8	39.6	44.5	38.6	13.5	154.4
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	3.7	16.4	25.8	15.3	59.3	61.2
TRICHLOROFLUOROMETHANE	33.3	42.3	47.0	40.8	13.9	163.4
1,1-DICHLOROETHENE	24.7	27.1	31.0	27.6	9.5	110.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	19.0	23.5	25.7	22.8	12.2	91.0
1,1-DICHLOROETHANE	29.5	36.6	37.5	34.5	10.4	138.1
2,2-DICHLOROPROPANE	44.6	68.6	62.1	58.4	17.4	233.7
cis-1,2-DICHLOROETHENE	21.9	27.9	27.7	25.8	10.8	103.3
BROMOCHLOROMETHANE	24.6	32.2	27.9	28.2	10.9	113.0
CHLOROFORM	40.6	50.0	47.4	46.0	8.6	184.0
1,1,1-TRICHLOROETHANE	43.4	50.3	47.9	47.2	6.1	188.8
1,1-DICHLOROPROPENE	23.8	30.7	29.9	28.1	11.0	112.5
CARBON TETRACHLORIDE	27.8	32.1	31.6	30.5	6.3	122.0
BENZENE	28.7	39.8	33.4	34.0	13.4	135.8
1,2-DICHLOROETHANE	25.2	34.9	29.3	29.8	13.3	119.4
TRICHLOROETHYLENE	19.3	24.2	23.5	22.3	9.7	89.2
1,2-DICHLOROPROPANE	29.6	41.1	33.4	34.7	13.8	138.8
DIBROMOMETHANE	17.7	24.8	20.7	21.1	13.8	84.2
BROMODICHLOROMETHANE	22.6	28.1	25.8	25.5	9.0	102.1
TOLUENE	30.0	46.6	30.0	35.6	22.0	142.2
1,1,2-TRICHLOROETHANE	22.5	30.4	28.3	27.0	12.4	108.2
TETRACHLOROETHYLENE	21.4	25.9	25.8	24.4	8.5	97.4
1,3-DICHLOROPROPANE	16.4	22.1	19.5	19.4	12.0	77.5
DIBROMOCHLOROMETHANE	14.0	17.8	15.4	15.7	9.9	62.9
1,2-DIBROMOETHANE	11.6	14.7	12.2	12.8	10.6	51.4
CHLOROBENZENE	8.6	10.2	8.1	9.0	10.3	35.9
1,1,1,2-TETRACHLOROETHANE	29.3	28.0	29.7	29.0	2.5	115.9
ETHYL BENZENE	21.5	26.0	20.4	22.6	10.7	90.5
p-XYLENE	21.1	26.4	18.0	21.8	15.9	87.3
o-XYLENE	17.1	21.2	14.3	17.5	16.1	70.1
STYRENE	6.4	4.2	3.8	4.8	24.2	19.2
BROMOFORM	12.3	15.5	13.1	13.6	10.1	54.5
ISOPROPYLBENZENE	18.1	20.0	16.7	18.3	7.6	73.1
p-BROMOFLUOROBENZENE	6.2	8.7	7.9	7.6	13.8	30.5
BROMOBENZENE	7.5	8.3	8.5	8.1	5.2	32.5
1,1,2,2-TETRACHLOROETHANE	22.6	25.6	22.2	23.4	6.4	93.8
1,2,3-TRICHLOROPROPANE	27.2	25.4	23.0	25.2	6.9	100.8
n-PROPYL BENZENE	11.5	15.4	11.9	13.0	13.4	51.8
2-CHLOROTOLUENE	17.2	20.0	16.5	17.9	8.6	71.6
4-CHLOROTOLUENE	19.2	22.4	18.5	20.0	8.6	80.2
tert-BUTYLBENZENE	15.9	14.4	16.9	15.7	6.6	62.8
1,3,5-TRIMETHYLBENZENE	15.7	16.3	15.7	15.9	1.8	63.6
sec-BUTYL BENZENE	16.5	16.2	13.3	15.3	9.3	61.4
1,2-DIBROMO-3-CHLOROPROPANE	22.3	21.4	16.2	20.0	13.6	79.9
1,2,4-TRIMETHYLBENZENE	18.1	19.5	9.4	15.7	28.3	62.7
1,3-DICHLOROBENZENE	5.3	6.1	3.9	5.1	18.2	20.3
p-ISOPROPYL TOLUENE	12.8	15.4	11.9	13.4	11.1	53.5
1,4-DICHLOROBENZENE	5.2	6.0	5.1	5.4	7.5	21.7
1,2-DICHLOROBENZENE-d4	8.7	7.9	6.3	7.6	13.1	30.6
1,2-DICHLOROBENZENE	5.5	5.4	5.1	5.3	3.7	21.4
n-BUTYL BENZENE	10.7	13.1	8.2	10.7	18.8	42.7
1,2,4-TRICHLOROBENZENE	6.1	7.5	4.6	6.1	19.0	24.3
HEXACHLOROBUTADIENE	2.0	3.9	2.5	2.8	28.3	11.3
NAPHTHALENE	12.8	14.6	12.7	13.3	6.5	53.4
1,2,3-TRICHLOROBENZENE	1.2	4.2	2.3	2.6	48.4	10.4

NF= not found
NI=not included

TABLE 31
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD BROMOBENZENE-d5

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	9.3	9.4	5.4	8.0	23.3	32.1
CHLOROMETHANE	9.7	10.9	6 9	9.2	18.6	36.6
VINYL CHLORIDE	9.9	11.7	6 9	9.5	20.5	38.0
BROMOMETHANE	15.3	20.2	8.2	14.6	34.0	58.3
CHLOROETHANE	11.6	13.4	7.0	10.7	25.2	42.7
TRICHLOROFLUOROMETHANE	10.2	12.9	7.2	10.1	23.1	40.4
1,1-DICHLOROETHENE	11.3	10.1	7.4	9.6	17.3	38.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	15.9	14.5	10.7	13.7	16.3	54.8
1,1-DICHLOROETHANE	15.5	14.1	10.8	13.5	14.6	53.8
2,2-DICHLOROPROPANE	12.7	12.0	10.6	11.8	7.7	47.0
cis-1,2-DICHLOROETHENE	16.6	15.6	12.2	14.8	12.7	59.3
BROMOCHLOROMETHANE	16.4	15.0	11.5	14.3	14.2	57.1
CHLOROFORM	24.9	23.3	17.4	21.9	14.7	87.6
1,1,1-TRICHLOROETHANE	18.9	17.4	13.6	16.6	13.6	66.6
1,1-DICHLOROPROPENE	19.4	18.0	13.3	16.9	15.6	67.6
CARBON TETRACHLORIDE	19.5	17.2	13.2	16.6	15.5	66.6
BENZENE	24.7	23.1	17.4	21.8	14.4	87.1
1,2-DICHLOROETHANE	23.3	22.5	17.3	21.0	12.7	84.1
TRICHLOROETHYLENE	20.9	19.5	14.6	18.4	14.8	73.4
1,2-DICHLOROPROPANE	20.5	20.1	15.2	18.6	13.0	74.4
DIBROMOMETHANE	18.9	19.4	14.1	17.5	13.8	69.8
BROMODICHLOROMETHANE	22.3	22.2	16.7	20.4	12.9	81.5
TOLUENE	26.1	25.6	18.6	23.4	14.5	93.7
1,1,2-TRICHLOROETHANE	22.4	21.3	16.6	20.1	12.5	80.4
TETRACHLOROETHYLENE	24.3	23.1	17.9	21.8	12.9	87.1
1,3-DICHLOROPROPANE	23.2	23.5	18.2	21.6	11.3	86.6
DIBROMOCHLOROMETHANE	21.1	20.6	16.0	19.2	12.0	77.0
1,2-DIBROMOETHANE	20.4	20.0	14.8	18.4	13.7	73.5
CHLOROBENZENE	24.0	23.4	17.7	21.7	13.0	86.9
1,1,1,2-TETRACHLOROETHANE	26.3	26.6	19.9	24.3	12.7	97.1
ETHYL BENZENE	30.7	30.0	22.3	27.7	13.8	110.6
p-XYLENE	29.7	29 3	22.7	27.3	11.8	109.0
o-XYLENE	28.4	27.8	21.4	25.9	12.2	103.6
STYRENE	21.2	19.1	13.4	17.9	18.5	71.4
BROMOFORM	22.7	21.9	18.3	21.0	9.2	83.8
ISOPROPYLBENZENE	28.7	28.4	21.4	26.1	12.9	104.6
p-BROMOFLUOROBENZENE	27.2	25.6	19.2	24.0	14.3	96.0
BROMOBENZENE	20 1	20.2	22.3	20.9	4.9	83.5
1,1,2,2-TETRACHLOROETHANE	20.1	19.3	19 0	19.5	2.3	77.9
1,2,3-TRICHLOROPROPANE	30.1	29.1	21.7	27.0	13.9	108.0
n-PROPYL BENZENE	21.1	20.4	15 8	19.1	12.2	76.5
2-CHLOROTOLUENE	20.7	20.2	15 4	18.7	12.7	74.9
4-CHLOROTOLUENE	23.2	22.6	17.2	21.0	12.7	84.0
tert-BUTYLBENZENE	21.2	20.5	15.6	19.1	13.1	76.4
1,3,5-TRIMETHYLBENZENE	20.0	19.8	15.3	18.3	11 9	73.4
sec-BUTYL BENZENE	20.9	20.3	15.6	18.9	12 5	75.7
1,2-DIBROMO-3-CHLOROPROPANE	16 5	15.7	12.3	14.9	12.3	59.4
1,2,4-TRIMETHYLBENZENE	20.3	19.8	15.2	18 4	12.4	73.8
1,3-DICHLOROBENZENE	20.2	20.2	15.4	18.6	12.1	74.5
p-ISOPROPYL TOLUENE	20.7	20.2	15.5	18.8	12.4	75.3
1,4-DICHLOROBENZENE	19.8	19.9	15.2	18.3	12.0	73.2
1,2-DICHLOROBENZENE-d4	26.1	25 2	18.4	23.3	14.9	93.0
1,2-DICHLOROBENZENE	20.1	19.4	15.3	18.3	11.5	73.2
n-BUTYL BENZENE	20.1	19.3	14.7	18.0	13.1	72 1
1,2,4-TRICHLOROBENZENE	19.8	18.9	14.2	17.6	13 7	70.5
HEXACHLOROBUTADIENE	18.8	18.7	13.4	17.0	14.9	67.9
NAPHTHALENE	20.1	19.6	15.2	18.3	12.2	73.2
1,2,3-TRICHLOROBENZENE	17.3	17.3	12.5	15.7	14.4	62.8

NI=not included

TABLE 32
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD BROMOBENZENE-d5

ANALYTE	NG RECOVERED Sample 1	Sample 1	Sample 1	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	18.3	11.5	17.7	15.8	19.3	63.3
CHLOROMETHANE	29.8	16.0	34.2	26.7	29.2	106.7
VINYL CHLORIDE	21.6	13.6	20.2	18.5	19.0	73.9
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	23.2	15.6	21.5	20.1	16.3	80.4
TRICHLOROFLUOROMETHANE	24.4	14.2	18.9	19.2	21.9	76.7
1,1-DICHLOROETHENE	18.1	9.8	9.1	12.3	33.0	49.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	22.1	12.3	19.1	17.8	22.9	71.3
1,1-DICHLOROETHANE	25.4	12.8	22.1	20.1	26.4	80.3
2,2-DICHLOROPROPANE	13.5	8.9	15.1	12.5	21.0	50.0
cis-1,2-DICHLOROETHENE	25.6	13.6	21.9	20.4	24.6	81.4
BROMOCHLOROMETHANE	29.1	15.2	25.8	23.4	25.3	93.6
CHLOROFORM	35.9	21.2	32.4	29.8	21.0	119.4
1,1,1-TRICHLOROETHANE	26.1	13.8	23.5	21.1	25.2	84.5
1,1-DICHLOROPROPENE	22.2	12.8	19.8	18.3	21.9	73.2
CARBON TETRACHLORIDE	20.0	12.3	17.2	16.5	19.2	66.0
BENZENE	32.8	17.6	28.7	26.4	24.3	105.5
1,2-DICHLOROETHANE	41.5	22.9	36.0	33.5	23.3	133.9
TRICHLOROETHYLENE	23.6	14.3	20.2	19.4	19.8	77.5
1,2-DICHLOROPROPANE	33.5	18.3	29.5	27.1	23.6	108.5
DIBROMOMETHANE	36.4	19.6	32.7	29.6	24.4	118.3
BROMODICHLOROMETHANE	34 4	20.4	32.9	29.2	21.4	117.0
TOLUENE	26.5	16.6	24.7	22.6	19.1	90.5
1,1,2-TRICHLOROETHANE	37.6	21.7	38.6	32.7	23.7	130.7
TETRACHLOROETHYLENE	17.3	12.7	18.0	16.0	14.8	64.0
1,3-DICHLOROPROPANE	36.5	22.7	35.6	31.6	20.0	126.4
DIBROMOCHLOROMETHANE	30.1	18.9	30.0	26.3	19.9	105.3
1,2-DIBROMOETHANE	32.0	19.0	29.5	26.8	20.9	107.2
CHLOROBENZENE	19.3	15.0	20.8	18.4	13.4	73.4
1,1,1,2-TETRACHLOROETHANE	25.1	18.2	25.7	23.0	14.7	92.0
ETHYL BENZENE	19.5	15.6	21.8	19.0	13.4	75.9
p-XYLENE	19.4	16.1	21.0	18.9	10.9	75.5
o-XYLENE	19.1	14.8	20.7	18.2	13.7	72.8
STYRENE	2.5	2.4	2.7	2.6	5.6	10.2
BROMOFORM	29.5	20.4	30.3	26.8	16.9	107.0
ISOPROPYLBENZENE	13.3	11.8	15.2	13.5	10.5	53.8
p-BROMOFLUOROBENZENE	17.1	13.0	19.3	16.5	15.9	66.0
BROMOBENZENE	25.5	18.4	26.5	23.5	15.4	93.9
1,1,2,2-TETRACHLOROETHANE	32.4	20.9	33.9	29.0	19.9	116.2
1,2,3-TRICHLOROPROPANE	44.5	14.2	48.3	35.7	42.8	142.7
n-PROPYL BENZENE	10.0	9.8	12.8	10.9	12.5	43.6
2-CHLOROTOLUENE	12.4	12.0	15.3	13.2	10.9	53.0
4-CHLOROTOLUENE	13.9	13.5	13.8	13.7	1.4	55.0
tert-BUTYLBENZENE	9.4	8.8	12 4	10.2	15.8	40.8
1,3,5-TRIMETHYLBENZENE	10.5	9.4	12.1	10.7	10.4	42.7
sec-BUTYL BENZENE	8.1	7.3	9.5	8.3	11.0	33.1
1,2-DIBROMO-3-CHLOROPROPANE	25.3	17.2	32.9	25.1	25.5	100.6
1,2,4-TRIMETHYLBENZENE	14.0	11.6	16.2	13.9	13.4	55.8
1,3-DICHLOROBENZENE	8.6	9.5	11.0	9.7	10.2	38.7
p-ISOPROPYL TOLUENE	7.7	6.6	9.9	8.1	16.6	32.3
1,4-DICHLOROBENZENE	8.5	9.3	10.8	9.5	10.2	38.1
1,2-DICHLOROBENZENE-d4	13.6	12.4	14.6	13.5	6.8	54.0
1,2-DICHLOROBENZENE	9.9	8.3	12.7	10.3	17.5	41.2
n-BUTYL BENZENE	6.3	5.2	7.6	6.3	15.2	25.4
1,2,4-TRICHLOROBENZENE	3.1	4.2	4.5	4.0	15.3	15.9
HEXACHLOROBUTADIENE	1.7	2.3	4.0	2.7	36.9	10.7
NAPHTHALENE	8.6	7.4	11.9	9.3	20.4	37.2
1,2,3-TRICHLOROBENZENE	2.7	3 7	4.4	3.6	19.7	14.4

NF=not found
NI=not included

TABLE 33
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD BROMOBENZENE-d5

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	43.9	66.1	61.8	57.2	16.8	229.0
CHLOROMETHANE	48.1	74.6	76.6	66.4	19.5	265.8
VINYL CHLORIDE	40.8	70.3	67.3	59.4	22.3	237.8
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	5.2	32.0	43.0	26.7	59.4	106.8
TRICHLOROFLUOROMETHANE	52.1	91.6	86.6	76.8	22.9	307.1
1,1-DICHLOROETHENE	39.7	60.3	58.9	53.0	17.7	211.9
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	23.2	39.7	37.0	33.3	21.6	133.3
1,1-DICHLOROETHANE	46.6	80.1	69.9	65.5	21.4	262.0
2,2-DICHLOROPROPANE	62.1	132.4	102.0	98.8	29.1	395.3
cis-1,2-DICHLOROETHENE	34.4	60.6	51.3	48.8	22.2	195.0
BROMOCHLOROMETHANE	29.8	53.9	39.8	41.2	24.0	164.7
CHLOROFORM	57.8	98.6	79.6	78.7	21.2	314.7
1,1,1-TRICHLOROETHANE	69.1	110.9	89.8	89.9	19.0	359.7
1,1-DICHLOROPROPENE	38.3	68.4	56.6	54.4	22.8	217.8
CARBON TETRACHLORIDE	44.4	71.1	59.4	58.3	18.7	233.3
BENZENE	45.7	87.7	62.7	65.4	26.4	261.4
1,2-DICHLOROETHANE	40.4	77.3	55.2	57.6	26.3	230.5
TRICHLOROETHYLENE	30.6	53.0	43.8	42.5	21.7	169.8
1,2-DICHLOROPROPANE	47.5	91.3	63.3	67.4	26.9	269.5
DIBROMOMETHANE	28.4	55.0	39.1	40.8	26.8	163 3
BROMODICHLOROMETHANE	36.0	62.2	48.7	49.0	21.8	195.9
TOLUENE	45.9	103.0	56.5	68.4	36 2	273.7
1,1,2-TRICHLOROETHANE	36.0	67.3	53.5	52.3	24.5	209.0
TETRACHLOROETHYLENE	34.3	57.3	48.7	46.8	20.3	187.2
1,3-DICHLOROPROPANE	26.3	49.0	36.8	37.4	24.8	149.5
DIBROMOCHLOROMETHANE	22.2	38.9	28.6	29.9	23.0	119.5
1,2-DIBROMOETHANE	18 4	32.4	22.8	24 5	23.7	98.1
CHLOROBENZENE	13.8	22.7	15.2	17.3	22.6	69 0
1,1,1,2-TETRACHLOROETHANE	47.3	62.7	56.6	55.5	11.3	222.1
ETHYL BENZENE	34.3	57.3	38.3	43.3	23.3	173 2
p-XYLENE	33.9	58.6	34.0	42.2	27.5	168.7
o-XYLENE	27.1	46.5	26.8	33.4	27.5	133.8
STYRENE	10.2	9.4	7.1	8.9	15.2	35.7
BROMOFORM	19.3	33.7	24.3	25.8	23.2	103.1
ISOPROPYLBENZENE	29.0	44.4	31.4	35.0	19.3	139.8
p-BROMOFLUOROBENZENE	9 9	19.2	14.9	14.7	26.0	58.7
BROMOBENZENE	16.9	19.8	21.3	19.3	9.4	77.4
1,1,2,2-TETRACHLOROETHANE	36.1	56.4	41.6	44.7	19.2	178.7
1,2,3-TRICHLOROPROPANE	43.4	56.1	43.1	47.5	12.7	190.1
n-PROPYL BENZENE	18.3	33.8	22.3	24.8	26 5	99.2
2-CHLOROTOLUENE	27.3	44.2	30.9	34.1	21.2	136.6
4-CHLOROTOLUENE	30.6	49.5	34 7	38.3	21.2	153.1
tert-BUTYLBENZENE	25.4	31.8	31.8	29.7	10.2	118.8
1,3,5-TRIMETHYLBENZENE	25.1	35.9	29.4	30 1	14.8	120.5
sec-BUTYL BENZENE	26.3	35.8	25.0	29.0	16.6	116.1
1,2-DIBROMO-3-CHLOROPROPANE	35.9	47.7	30.6	38.0	18 8	152.1
1,2,4-TRIMETHYLBENZENE	29.0	43.1	17.8	30.0	34 5	119.9
1,3-DICHLOROBENZENE	8.4	13.4	7.2	9.7	27.6	38.8
p-ISOPROPYL TOLUENE	20.6	34.1	22.4	25.7	23.3	102.7
1,4-DICHLOROBENZENE	8.3	13.2	9.5	10.4	20.2	41.4
1,2-DICHLOROBENZENE-d4	12.7	15.9	10.8	13.1	16.0	52.4
1,2-DICHLOROBENZENE	8.8	11.9	9.5	10.1	13.1	40.2
n-BUTYL BENZENE	17 1	29.1	15.5	20.6	29.5	82.3
1,2,4-TRICHLOROBENZENE	9.8	16.4	8.7	11.6	29.4	46.4
HEXACHLOROBUTADIENE	3.2	8.6	4.8	5.5	41.1	22.1
NAPHTHALENE	20.2	32.0	23.7	25.3	19.5	101 3
1,2,3-TRICHLOROBENZENE	1.9	9.2	4.2	5 1	59.4	20 5

NF=not found
NI=not included

TABLE 34
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/SAND
INTERNAL STANDARD 2-BROMO-1-CHLOROPROPANE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	9.4	9.8	7.2	8.8	13.0	35.2
CHLOROMETHANE	9.6	11.4	9.1	10.0	9.8	40.0
VINYL CHLORIDE	9.9	12.2	9.3	10.5	12.3	41.8
BROMOMETHANE	16.0	22.3	11.5	16.6	26.8	66.4
CHLOROETHANE	11.0	13.4	8.9	11.1	16.5	44.3
TRICHLOROFLUOROMETHANE	10.1	13.4	9.5	11.0	15.7	44.0
1,1-DICHLOROETHENE	11.3	10.6	9.8	10.6	5.8	42.4
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	16.0	15.3	14.3	15.2	4.6	60.8
1,1-DICHLOROETHANE	15.4	14.7	14.3	14.8	2.9	59.2
2,2-DICHLOROPROPANE	12.1	12.0	13.4	12.5	5.2	50.0
cis-1,2-DICHLOROETHENE	16.4	16.2	16.1	16.3	0.7	65.1
BROMOCHLOROMETHANE	18.1	17.4	17.1	17.5	2.5	70.1
CHLOROFORM	23.7	23.3	22.2	23.1	2.8	92.2
1,1,1-TRICHLOROETHANE	18.8	18.2	18.0	18.4	1.9	73.4
1,1-DICHLOROPROPENE	19.4	18.9	17.7	18.7	3.8	74.6
CARBON TETRACHLORIDE	19.4	18.0	17.6	18.3	4.1	73.4
BENZENE	24.6	24.2	23.2	24.0	2.5	96.0
1,2-DICHLOROETHANE	23.2	23.6	23.0	23.2	1.1	92.9
TRICHLOROETHYLENE	20.8	20.4	19.4	20.2	3.0	80.8
1,2-DICHLOROPROPANE	20.5	21.0	20.3	20.6	1.6	82.4
DIBROMOMETHANE	18.9	20.3	18.7	19.3	3.6	77.2
BROMODICHLOROMETHANE	22.2	23.2	22.2	22.5	2.1	90 0
TOLUENE	26.0	26.7	24.8	25.8	3.1	103.3
1,1,2-TRICHLOROETHANE	22.3	22.3	22.1	22.2	0.4	89.0
TETRACHLOROETHYLENE	24.2	24.2	23.8	24.1	0.9	96.2
1,3-DICHLOROPROPANE	23.1	24.6	24.2	24.0	2.5	95.9
DIBROMOCHLOROMETHANE	21.0	21.5	21.2	21.2	1.0	84.9
1,2-DIBROMOETHANE	20.2	20.8	19.7	20.2	2.3	81.0
CHLOROBENZENE	23.9	24.5	23.7	24.0	1.5	96.2
1,1,1,2-TETRACHLOROETHANE	26.2	28.0	26.6	27.0	2.8	107.8
ETHYL BENZENE	30.5	31.3	29.6	30.5	2.3	122.0
p-XYLENE	29.5	30.7	30.2	30.1	1.6	120.5
o-XYLENE	28.2	29.0	28.5	28.6	1.1	114.2
STYRENE	20.2	18.6	18.3	19.0	4.3	76.1
BROMOFORM	22.5	22.8	24.2	23.1	3.2	92.6
ISOPROPYLBENZENE	28.6	29.7	28.4	28.9	1.9	115.6
p-BROMOFLUOROBENZENE	27.0	26.7	25.5	26.4	2.4	105.6
BROMOBENZENE	19.6	20.6	26.9	22.4	14.4	89.5
1,1,2,2-TETRACHLOROETHANE	20.0	20.2	25.3	21.8	11.4	87.3
1,2,3-TRICHLOROPROPANE	30.0	30.5	28.9	29.8	2.2	119.1
n-PROPYL BENZENE	20.9	21.3	21.0	21.1	0.8	84.4
2-CHLOROTOLUENE	20.6	21.1	20.4	20.7	1.3	82.7
4-CHLOROTOLUENE	23.0	23.6	22.9	23.1	1.3	92.5
tert-BUTYLBENZENE	21.1	21.4	20.7	21.1	1.3	84.3
1,3,5-TRIMETHYLBENZENE	19.8	20.7	20.3	20.3	1.8	81.1
sec-BUTYL BENZENE	20.7	21.2	20.7	20.9	1.1	83.5
1,2-DIBROMO-3-CHLOROPROPANE	16.4	16.5	16.4	16.4	0.2	65.7
1,2,4-TRIMETHYLBENZENE	20.2	20.7	20.3	20.4	0.9	81.6
1,3-DICHLOROBENZENE	20.1	21.1	20.5	20.6	2.1	82.3
p-ISOPROPYL TOLUENE	20.7	21.1	20.7	20.8	0.9	83.2
1,4-DICHLOROBENZENE	19.6	20.8	20.2	20.2	2.4	80.9
1,2-DICHLOROBENZENE-d4	24.9	25.2	23.4	24.5	3.2	98.0
1,2-DICHLOROBENZENE	19.9	20.3	20.3	20.2	0.9	80.7
n-BUTYL BENZENE	20.0	20.2	19.6	19.9	1.3	79.7
1,2,4-TRICHLOROBENZENE	19.6	19.7	18.9	19.4	1.9	77.6
HEXACHLOROBUTADIENE	18.7	19.5	17.8	18.7	3.8	74.7
NAPHTHALENE	20.0	20.4	20.1	20.2	0.9	80.7
1,2,3-TRICHLOROBENZENE	17.1	17.9	16.5	17.2	3.3	68.7

NI=not included

TABLE 35
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/CLAY
INTERNAL STANDARD 2-BROMO-1-CHLOROPROPANE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	14.3	12.0	12.7	13.0	7.6	52.0
CHLOROMETHANE	23.1	16.4	24.3	21.3	16.3	85.0
VINYL CHLORIDE	16.8	14.0	14.7	15.2	7.9	60.7
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	17.2	15.3	14.6	15.7	7.1	62.8
TRICHLOROFLUOROMETHANE	18.9	14.5	13.4	15.6	15.2	62.4
1,1-DICHLOROETHENE	14.1	10.2	6.5	10.3	30.2	41.0
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	17.3	12.8	13.7	14.6	13.4	58.3
1,1-DICHLOROETHANE	19.7	13.2	15.7	16.2	16.5	64.7
2,2-DICHLOROPROPANE	10.0	8.7	10.3	9.7	6.9	38.7
cis-1,2-DICHLOROETHENE	19.7	13.9	15.5	16.4	15.1	65.5
BROMOCHLOROMETHANE	25.1	17.4	20.4	21.0	15.0	84.0
CHLOROFORM	26.7	20.9	22.0	23.2	10.8	92.7
1,1,1-TRICHLOROETHANE	20.3	14.2	16.7	17.0	14.7	68.1
1,1-DICHLOROPROPENE	17.3	13.2	14.1	14.9	11.8	59.5
CARBON TETRACHLORIDE	15.5	12.7	12.2	13.5	10.9	53.9
BENZENE	25.4	18.1	20.4	21.3	14.3	85.3
1,2-DICHLOROETHANE	32.3	23.6	25.6	27.1	13.7	108.6
TRICHLOROETHYLENE	18.3	14.7	14.4	15.8	11.3	63.2
1,2-DICHLOROPROPANE	26.1	18.9	21.1	22.0	13.6	88.1
DIBROMOMETHANE	28.3	20.2	23.3	23.9	14.0	95.7
BROMODICHLOROMETHANE	26.8	21.0	23.4	23.7	9.9	94.8
TOLUENE	20.6	18.2	17.6	18.8	6.9	75.2
1,1,2-TRICHLOROETHANE	29.3	22.4	27.5	26.4	11.1	105.6
TETRACHLOROETHYLENE	13.4	13.1	12.8	13.1	1.9	52.4
1,3-DICHLOROPROPANE	28.4	23.3	25.3	25.7	8.0	102.7
DIBROMOCHLOROMETHANE	23.3	19.4	21.2	21.3	7.5	85.3
1,2-DIBROMOETHANE	24.8	19.5	20.9	21.7	10.2	86.9
CHLOROBENZENE	15.1	15.5	14.8	15.1	1.8	60.4
1,1,1,2-TETRACHLOROETHANE	19.6	18.8	18.3	18.9	2.8	75.7
ETHYL BENZENE	15.1	16.1	15.5	15.6	2.5	62.3
p-XYLENE	15.1	16.6	15.0	15.6	4.8	62.2
o-XYLENE	14.8	15.2	14.7	14.9	1.4	59.5
STYRENE	2.0	2.5	1.9	2.1	11.3	8.5
BROMOFORM	22.8	20.9	21.5	21.7	3.7	86.9
ISOPROPYLBENZENE	10.4	12.1	10.8	11.1	6.7	44.4
p-BROMOFLUOROBENZENE	13.3	13.4	13.7	13.5	1.4	53.8
BROMOBENZENE	15.3	16.3	16.7	16.1	3.6	64.2
1,1,2,2-TETRACHLOROETHANE	25.1	21.5	24.1	23.6	6.4	94.3
1,2,3-TRICHLOROPROPANE	34.5	14.6	34.3	27.8	33.6	111.2
n-PROPYL BENZENE	7.8	10.1	9.1	9.0	10.6	36.0
2-CHLOROTOLUENE	9.7	12.4	10.8	11.0	10.1	43.8
4-CHLOROTOLUENE	10.8	13.8	9.8	11.5	15.0	45.9
tert-BUTYLBENZENE	7.3	9.0	8.8	8.4	9.4	33.5
1,3,5-TRIMETHYLBENZENE	8.1	9.7	8.6	8.8	7.5	35.3
sec-BUTYL BENZENE	6.2	7.5	6.7	6.8	7.6	27.3
1,2-DIBROMO-3-CHLOROPROPANE	19.7	17.8	23.5	20.3	11.7	81.2
1,2,4-TRIMETHYLBENZENE	10.9	12.0	11.5	11.5	4.0	45.8
1,3-DICHLOROBENZENE	6.7	9.7	7.8	8.1	15.7	32.2
p-ISOPROPYL TOLUENE	6.0	6.8	7.0	6.6	6.5	26.5
1,4-DICHLOROBENZENE	6.6	9.6	7.7	7.9	15.7	31.8
1,2-DICHLOROBENZENE-d4	10.1	12.2	9.9	10.7	9.5	42.9
1,2-DICHLOROBENZENE	7.6	8.6	9.0	8.4	6.7	33.6
n-BUTYL BENZENE	4.9	5.4	5.4	5.2	4.4	20.8
1,2,4-TRICHLOROBENZENE	2.4	4.4	3.2	3.3	23.8	13.3
HEXACHLOROBUTADIENE	1.3	2.4	2.9	2.2	29.6	8.7
NAPHTHALENE	6.6	7.6	8.4	7.6	9.8	30.3
1,2,3-TRICHLOROBENZENE	2.1	3.8	3.1	3.0	23.6	12.0

NF=not found
NI=not included

TABLE 36
DETERMINATION OF % RECOVERY
25 ng FORTIFIED MMS/GARDEN SOIL
INTERNAL STANDARD 2-BROMO-1-CHLOROPROPANE-d6

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)
DICHLORODIFLUOROMETHANE	16.0	21.6	19.2	19.0	12.1	75.8
CHLOROMETHANE	17.4	24.2	23.6	21.7	14.1	87.0
VINYL CHLORIDE	14.8	23.0	20.8	19.5	17.6	78.2
BROMOMETHANE	NF	NF	NF	-	-	-
CHLOROETHANE	1.8	9.9	2.7	4.8	76.0	19.2
TRICHLOROFLUOROMETHANE	18.8	29.7	26.6	25.0	18.2	100.2
1,1-DICHLOROETHENE	14.5	19.7	18.2	17.5	12.5	69.9
METHYLENE CHLORIDE	NI	NI	NI	-	-	-
trans-1,2-DICHLOROETHENE	8.5	13.0	11.5	11.0	17.0	44.1
1,1-DICHLOROETHANE	16.9	26.0	21.5	21.5	17.3	85.9
2,2-DICHLOROPROPANE	21.6	41.2	30.1	30.9	25.9	123.8
cis-1,2-DICHLOROETHENE	12.4	19.6	15.7	15.9	18.4	63.7
BROMOCHLOROMETHANE	12.0	19.5	13.7	15.1	21.2	60.3
CHLOROFORM	20.1	30.7	23.5	24.7	17.8	99.0
1,1,1-TRICHLOROETHANE	25.1	36.0	27.7	29.6	15.8	118.5
1,1-DICHLOROPROPENE	13.9	22.3	17.5	17.9	19.2	71.7
CARBON TETRACHLORIDE	16.2	23.1	18.4	19.2	15.1	76.9
BENZENE	16.6	28.5	19.4	21.5	23.7	86.0
1,2-DICHLOROETHANE	14.7	25.2	17.1	19.0	23.7	75.8
TRICHLOROETHYLENE	11.1	17.2	13.5	14.0	18.1	55.8
1,2-DICHLOROPROPANE	17.3	29.8	19.6	22.2	24.4	89.0
DIBROMOMETHANE	10.3	17.9	12.1	13.4	24.1	53.8
BROMODICHLOROMETHANE	13.1	20.2	15.0	16.1	18.7	64.5
TOLUENE	17.4	33.5	17.4	22.8	33.3	91.1
1,1,2-TRICHLOROETHANE	13.1	21.9	16.5	17.2	21.2	68.8
TETRACHLOROETHYLENE	12.5	18.6	15.0	15.4	16.5	61.5
1,3-DICHLOROPROPANE	9.6	15.9	11.4	12.3	21.8	49.2
DIBROMOCHLOROMETHANE	8.0	12.6	8.8	9.8	20.4	39.3
1,2-DIBROMOETHANE	6.7	10.5	7.0	8.1	21.4	32.3
CHLOROBENZENE	5.0	7.4	4.7	5.7	21.0	22.9
1,1,1,2-TETRACHLOROETHANE	17.3	20.5	17.6	18.4	7.8	73.8
ETHYL BENZENE	12.4	18.6	11.8	14.3	21.6	57.2
p-XYLENE	12.3	19.1	10.5	14.0	26.4	55.9
o-XYLENE	9.8	15.1	8.2	11.1	26.5	44.2
STYRENE	3.7	3.1	2.2	3.0	21.2	12.0
BROMOFORM	7.0	10.9	7.5	8.4	20.8	33.8
ISOPROPYLBENZENE	10.5	14.4	9.7	11.6	17.8	46.3
p-BROMOFLUOROBENZENE	3.6	6.2	4.6	4.8	22.8	19.2
BROMOBENZENE	4.4	6.0	4.9	5.1	13.3	20.3
1,1,2,2-TETRACHLOROETHANE	13.1	18.3	12.8	14.8	17.1	59.0
1,2,3-TRICHLOROPROPANE	15.8	18.2	13.3	15.8	12.7	63.1
n-PROPYL BENZENE	6.6	11.0	6.9	8.2	24.4	32.6
2-CHLOROTOLUENE	9.9	14.4	9.6	11.3	19.4	45.1
4-CHLOROTOLUENE	11.1	16.1	10.7	12.6	19.4	50.4
tert-BUTYLBENZENE	9.2	10.4	9.8	9.8	4.7	39.2
1,3,5-TRIMETHYLBENZENE	9.1	11.7	9.1	9.9	12.3	39.8
sec-BUTYL BENZENE	9.5	11.6	7.7	9.6	16.6	38.5
1,2-DIBROMO-3-CHLOROPROPANE	13.1	15.5	9.5	12.7	19.7	50.8
1,2,4-TRIMETHYLBENZENE	10.5	14.0	5.5	10.0	34.9	40.1
1,3-DICHLOROBENZENE	3.1	4.4	2.2	3.2	27.2	12.9
p-ISOPROPYL TOLUENE	7.5	11.1	6.9	8.5	21.8	34.0
1,4-DICHLOROBENZENE	3.0	4.3	2.9	3.4	18.3	13.7
1,2-DICHLOROBENZENE-d4	4.4	4.9	3.2	4.2	17.5	16.7
1,2-DICHLOROBENZENE	3.2	3.9	2.9	3.3	11.8	13.3
n-BUTYL BENZENE	6.2	9.5	4.8	6.8	28.7	27.3
1,2,4-TRICHLOROBENZENE	3.5	5.3	2.7	3.8	28.7	15.4
HEXACHLOROBUTADIENE	1.2	2.8	1.5	1.8	39.2	7.2
NAPHTHALENE	7.3	10.4	7.3	8.3	17.3	33.4
1,2,3-TRICHLOROBENZENE	0.7	3.0	1.3	1.7	58.4	6.6

NF=not found
NI=not included

TABLE 37
EVALUATION OF ANALYTE RECOVERIES IN GARDEN SOIL
USING MULTIPLE INTERNAL STANDARD

ANALYTE	IS SELECTED	PERCENT RECOVERY
DICHLORODIFLUOROMETHANE	BENZENE-d6	95
CHLOROMETHANE	BENZENE-d6	109
VINYL CHLORIDE	BENZENE-d6	97
BROMOMETHANE	BENZENE-d6	NF
CHLOROETHANE	BENZENE-d6 *	40
TRICHLOROFLUOROMETHANE	BENZENE-d6	123
1,1-DICHLOROETHENE	BENZENE-d6	86
METHYLENE CHLORIDE	BENZENE-d6	NF
trans-1,2-DICHLOROETHENE	BENZENE-d6	51
1,1-DICHLOROETHANE	BENZENE-d6	107
2,2-DICHLOROPROPANE	BENZENE-d6	163
cis-1,2-DICHLOROETHENE	BENZENE-d6	82
BROMOCHLOROMETHANE	TOLUENE-d8	98
CHLOROFORM	BENZENE-d6	106
1,1,1-TRICHLOROETHANE	BENZENE-d6	147
1,1-DICHLOROPROPENE	BENZENE-d6	88
CARBON TETRACHLORIDE	BENZENE-d6	99
BENZENE	BENZENE-d6	107
1,2-DICHLOROETHANE	BENZENE-d6	94
TRICHLOROETHYLENE	TOLUENE-d8	101
1,2-DICHLOROPROPANE	BENZENE-d6	111
DIBROMOMETHANE	TOLUENE-d8	96
BROMODICHLOROMETHANE	BENZENE-d6	80
TOLUENE	TOLUENE-d8 ***	163
1,1,2-TRICHLOROETHANE	TOLUENE-d8	124
TETRACHLOROETHYLENE	TOLUENE-d8	111
1,3-DICHLOROPROPANE	TOLUENE-d8	88
DIBROMOCHLOROMETHANE	TOLUENE-d8	73
1,2-DIBROMOETHANE	BROMOBENZENE-d5	98
CHLOROBENZENE	BROMOBENZENE-d5	69
1,1,1,2-TETRACHLOROETHANE	BENZENE-d6	91
ETHYL BENZENE	TOLUENE-d8 ***	103
p-XYLENE	TOLUENE-d8 ***	101
o-XYLENE	TOLUENE-d8 ***	79
STYRENE	TOLUENE-d8	22
BROMOFORM	BROMOBENZENE-d5	103
ISOPROPYLBENZENE	TOLUENE-d8 ***	83
p-BROMOFLUOROBENZENE	BROMOBENZENE-d5	59
BROMOBENZENE	BROMOBENZENE-d5	77
1,1,2,2-TETRACHLOROETHANE	TOLUENE-d8	106
1,2,3-TRICHLOROPROPANE	TOLUENE-d8	113
n-PROPYL BENZENE	BROMOBENZENE-d5 ***	99
2-CHLOROTOLUENE	TOLUENE-d8	81
4-CHLOROTOLUENE	TOLUENE-d8	91
tert-BUTYLBENZENE	TOLUENE-d8	71
1,3,5-TRIMETHYLBENZENE	TOLUENE-d8 ***	72
sec-BUTYL BENZENE	TOLUENE-d8	70
1,2-DIBROMO-3-CHLOROPROPANE	TOLUENE-d8	91
1,2,4-TRIMETHYLBENZENE	BROMOBENZENE-d5 ***	120
1,3-DICHLOROBENZENE	BROMOBENZENE-d5 **	39
p-ISOPROPYL TOLUENE	BROMOBENZENE-d5 ***	103
1,4-DICHLOROBENZENE	BROMOBENZENE-d5 **	41
1,2-DICHLOROBENZENE-d4	BROMOBENZENE-d5	52
1,2-DICHLOROBENZENE	BROMOBENZENE-d5 **	40
n-BUTYL BENZENE	BROMOBENZENE-d5 ***	82
1,2,4-TRICHLOROBENZENE	BROMOBENZENE-d5 **	46
HEXACHLOROBUTADIENE	BROMOBENZENE-d5 **	22
NAPHTHALENE	BROMOBENZENE-d5	101
1,2,3-TRICHLOROBENZENE	BROMOBENZENE-d5 **	21

NI=NOT INCLUDED IN THIS STUDY
* BROMOMETHANE WAS ONLY FOUND IN THE SAND MATRIX
** 1,2-DICHLOROBENZENE-d4 IS RECOMMENDED AS AN ALTERNATE INTERNAL STANDARD
*** THESE ANALYTES WERE DETECTED IN THE UNFORTIFIED GARDEN SOIL SAMPLE

TABLE 38
DIFFERENT HEADSPACE VOLUME RECOVERIES
25 ng ANALYTE RESPONSE USING 10 mL OF MMS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	6611	5864	5622	6032	7
CHLOROMETHANE	2864	2833	2660	2786	3
VINYL CHLORIDE	7614	7900	8613	8042	5
BROMOMETHANE	2502	2994	2927	2808	8
CHLOROETHANE	1812	2112	2451	2125	12
TRICHLOROFLUOROMETHANE	15422	16457	17839	16573	6
1,1-DICHLOROETHENE	12277	12189	11855	12107	2
METHYLENE CHLORIDE	12993	13006	12055	12685	4
trans-1,2-DICHLOROETHENE	12540	13376	12801	12906	3
1,1-DICHLOROETHANE	13694	13134	13316	13381	2
2,2-DICHLOROPROPANE	8440	8459	6590	7830	11
cis-1,2-DICHLOROETHENE	13047	12735	11454	12412	6
BROMOCHLOROMETHANE	9151	8788	8336	8758	4
CHLOROFORM	12462	11873	12339	12225	2
1,1,1-TRICHLOROETHANE	12761	12030	11940	12244	3
1,1-DICHLOROPROPENE	9410	9095	8662	9056	3
CARBON TETRACHLORIDE	13991	14700	14378	14356	2
BENZENE	19026	19068	18341	18812	2
1,2-DICHLOROETHANE	12216	12158	10854	11743	5
TRICHLOROETHYLENE	8327	7856	7025	7736	7
1,2-DICHLOROPROPANE	7378	7764	7101	7414	4
DIBROMOMETHANE	5732	5324	5303	5453	4
BROMODICHLOROMETHANE	10337	10511	10665	10504	1
TOLUENE	25530	24195	23053	24259	4
1,1,2-TRICHLOROETHANE	6170	6050	5247	5822	7
TETRACHLOROETHYLENE	6785	7525	7065	7125	4
1,3-DICHLOROPROPANE	8097	7666	6841	7535	7
DIBROMOCHLOROMETHANE	10353	10620	10008	10327	2
1,2-DIBROMOETHANE	9379	9852	8922	9384	4
CHLOROBENZENE	12604	12069	12194	12289	2
1,1,1,2-TETRACHLOROETHANE	9551	10186	9296	9678	4
ETHYL BENZENE	24522	24702	22973	24066	3
p-XYLENE	26569	24137	27763	26156	6
o-XYLENE	24917	23808	21790	23505	6
STYRENE	20638	22441	21304	21461	3
BROMOFORM	6511	6377	6262	6383	2
ISOPROPYLBENZENE	39143	37637	38710	38497	2
p-BROMOFLUOROBENZENE	11665	10497	10313	10825	6
BROMOBENZENE	17357	20120	19285	18921	6
1,1,2,2-TETRACHLOROETHANE	12130	11281	10966	11459	4
1,2,3-TRICHLOROPROPANE	12796	12441	13991	13076	5
n-PROPYL BENZENE	34929	31429	29584	31981	7
2-CHLOROTOLUENE	24730	25175	21045	23650	8
4-CHLOROTOLUENE	21736	22540	20940	21739	3
tert-BUTYLBENZENE	27715	31621	30342	29893	5
1,3,5-TRIMETHYLBENZENE	37027	38753	39782	38521	3
sec-BUTYL BENZENE	42213	41967	39755	41312	3
1,2-DIBROMO-3-CHLOROPROPANE	6575	6478	6606	6553	1
1,2,4-TRIMETHYLBENZENE	38645	40168	38812	39208	2
1,3-DICHLOROBENZENE	16432	17884	16329	16882	4
p-ISOPROPYL TOLUENE	31083	32475	30033	31197	3
1,4-DICHLOROBENZENE	16049	17299	16165	16505	3
1,2-DICHLOROBENZENE-d4	16400	16768	16838	16669	1
1,2-DICHLOROBENZENE	15968	16348	16283	16200	1
n-BUTYL BENZENE	27498	24966	21889	24784	9
1,2,4-TRICHLOROBENZENE	11732	13097	11106	11978	7
HEXACHLOROBUTADIENE	8382	8220	7420	8007	5
NAPHTHALENE	32462	33868	33832	33387	2
1,2,3-TRICHLOROBENZENE	10149	10637	10368	10385	2

TABLE 39
DIFFERENT HEADSPACE VOLUME RECOVERIES
25 ng ANALYTE RESPONSE USING 10 mL MMS AND 5 mL GLASS BEADS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	8125	8014	6488	7542	10
CHLOROMETHANE	3842	4125	3798	3922	4
VINYL CHLORIDE	10355	11104	9218	10226	8
BROMOMETHANE	3956	4934	2514	3801	26
CHLOROETHANE	2728	2610	2445	2594	4
TRICHLOROFLUOROMETHANE	22674	23310	20385	22123	6
1,1-DICHLOROETHENE	15598	16008	14659	15422	4
METHYLENE CHLORIDE	16007	16872	15266	16048	4
trans-1,2-DICHLOROETHENE	15720	16893	15613	16075	4
1,1-DICHLOROETHANE	16923	18508	16093	17175	6
2,2-DICHLOROPROPANE	10284	12145	8999	10476	12
cis-1,2-DICHLOROETHENE	16282	17206	16068	16519	3
BROMOCHLOROMETHANE	10484	10796	9739	10340	4
CHLOROFORM	16501	14713	16420	15878	5
1,1,1-TRICHLOROETHANE	15456	17020	14563	15680	6
1,1-DICHLOROPROPENE	11809	12388	11360	11852	4
CARBON TETRACHLORIDE	20288	20996	19087	20124	4
BENZENE	24548	25647	23186	24460	4
1,2-DICHLOROETHANE	14855	15557	13128	14513	7
TRICHLOROETHYLENE	9832	10872	9393	10032	6
1,2-DICHLOROPROPANE	9237	9177	8844	9086	2
DIBROMOMETHANE	6635	6373	6285	6431	2
BROMODICHLOROMETHANE	13406	13090	12117	12871	4
TOLUENE	30883	33401	29156	31147	6
1,1,2-TRICHLOROETHANE	6500	7148	5962	6537	7
TETRACHLOROETHYLENE	9965	10909	10866	10580	4
1,3-DICHLOROPROPANE	9578	10250	9405	9744	4
DIBROMOCHLOROMETHANE	14526	13987	12654	13722	6
1,2-DIBROMOETHANE	11893	11634	11359	11629	2
CHLOROBENZENE	17149	17508	16661	17106	2
1,1,1,2-TETRACHLOROETHANE	14102	13947	12643	13564	5
ETHYL BENZENE	32862	39245	34849	35652	7
p-XYLENE	40467	17155	37039	31554	33
o-XYLENE	31830	35088	29839	32252	7
STYRENE	30567	32296	27161	30008	7
BROMOFORM	8598	8907	7584	8363	7
ISOPROPYLBENZENE	56044	58074	54961	56360	2
p-BROMOFLUOROBENZENE	14199	14520	13587	14102	3
BROMOBENZENE	21852	28681	24177	24903	11
1,1,2,2-TETRACHLOROETHANE	13437	13744	12845	13342	3
1,2,3-TRICHLOROPROPANE	10432	14309	10089	11610	16
n-PROPYL BENZENE	43713	48370	40174	44086	8
2-CHLOROTOLUENE	32816	35686	30970	33157	6
4-CHLOROTOLUENE	28420	32262	29459	30047	5
tert-BUTYLBENZENE	44517	48902	42801	45407	6
1,3,5-TRIMETHYLBENZENE	57887	65734	58713	60778	6
sec-BUTYL BENZENE	56397	64541	53599	58179	8
1,2-DIBROMO-3-CHLOROPROPANE	7566	6130	6123	6606	10
1,2,4-TRIMETHYLBENZENE	57398	67028	54111	59512	9
1,3-DICHLOROBENZENE	25751	25987	24080	25273	3
p-ISOPROPYL TOLUENE	45674	51946	42947	46856	8
1,4-DICHLOROBENZENE	25657	24718	22499	24291	5
1,2-DICHLOROBENZENE-d4	23135	26715	22323	24058	8
1,2-DICHLOROBENZENE	21562	26992	21981	23512	10
n-BUTYL BENZENE	32988	36873	31202	33688	7
1,2,4-TRICHLOROBENZENE	17003	18432	16842	17426	4
HEXACHLOROBUTADIENE	9981	12071	9701	10584	10
NAPHTHALENE	49234	47039	44236	46836	4
1,2,3-TRICHLOROBENZENE	15506	15857	15253	15539	2

TABLE 40
DIFFERENT HEADSPACE VOLUME RECOVERIES
25 ng ANALYTE RESPONSE USING 10 mL OF MMS AND 10 mL OF GLASS BEADS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	8318	7718	7085	7707	7
CHLOROMETHANE	3685	4115	3770	3857	5
VINYL CHLORIDE	11873	11294	10696	11288	4
BROMOMETHANE	3280	3999	3223	3501	10
CHLOROETHANE	3281	2907	2898	3029	6
TRICHLOROFLUOROMETHANE	27284	25819	24355	25819	5
1,1-DICHLOROETHENE	19108	17475	16826	17803	5
METHYLENE CHLORIDE	17357	16549	15586	16497	4
TRANS-1,2-DICHLOROETHENE	18268	17963	17447	17893	2
1,1-DICHLOROETHANE	20970	19258	18679	19636	5
2,2-DICHLOROPROPANE	12032	12492	10151	11558	9
CIS-1,2-DICHLOROETHENE	19660	18534	16457	18217	7
BROMOCHLOROMETHANE	11813	9660	9565	10346	10
CHLOROFORM	19543	18657	16967	18389	6
1,1,1-TRICHLOROETHANE	18976	18014	15909	17633	7
1,1-DICHLOROPROPENE	14562	13202	13664	13809	4
CARBON TETRACHLORIDE	25406	22362	21917	23228	7
BENZENE	31201	28669	28300	29390	4
1,2-DICHLOROETHANE	15646	14791	13179	14539	7
TRICHLOROETHYLENE	12302	12009	11179	11830	4
1,2-DICHLOROPROPANE	11052	10591	9604	10416	6
DIBROMOMETHANE	7064	5820	5658	6181	10
BROMODICHLOROMETHANE	13895	14468	12061	13475	8
TOLUENE	38485	38210	34809	37168	4
1,1,2-TRICHLOROETHANE	7663	7101	6444	7069	7
TETRACHLOROETHYLENE	14616	12535	12068	13073	8
1,3-DICHLOROPROPANE	10506	10536	9342	10128	5
DIBROMOCHLOROMETHANE	16073	14411	12416	14300	10
1,2-DIBROMOETHANE	13037	11509	10968	11838	7
CHLOROBENZENE	21443	19956	19184	20194	5
1,1,1,2-TETRACHLOROETHANE	17293	15184	14483	15653	8
ETHYL BENZENE	48232	42488	40310	43677	8
P-XYLENE	49392	48485	44836	47571	4
O-XYLENE	21740	24051	23070	22954	4
STYRENE	33724	35260	35084	34689	2
BROMOFORM	9231	8439	7909	8526	6
ISOPROPYLBENZENE	73506	72482	68917	71635	3
P-BROMOFLUOROBENZENE	18391	16425	15050	16622	8
BROMOBENZENE	26846	28662	26995	27501	3
1,1,2,2-TETRACHLOROETHANE	14636	13802	12354	13597	7
1,2,3-TRICHLOROPROPANE	13008	12225	11336	12190	6
N-PROPYL BENZENE	57912	54999	49581	54164	6
2-CHLOROTOLUENE	42142	41437	39107	40895	3
4-CHLOROTOLUENE	38823	36210	33817	36283	6
TER-BUTYLBENZENE	65410	59357	53252	59340	8
1,3,5-TRIMETHYLBENZENE	81294	68508	64784	71529	10
SEC-BUTYL BENZENE	81131	80833	69876	77280	7
1,2-DIBROMO-3-CHLOROPROPANE	6928	6478	6305	6570	4
1,2,4-TRIMETHYLBENZENE	81267	68736	68058	72687	8
1,3-DICHLOROBENZENE	34192	31423	26789	30801	10
P-ISOPROPYL TOLUENE	61698	59901	56488	59362	4
1,4-DICHLOROBENZENE	27929	27314	27388	27544	1
D4 1,2-DICHLOROBENZENE	33456	27869	28032	29786	9
1,2-DICHLOROBENZENE	30944	27016	27243	28401	6
N-BUTYLBENZENE	44471	41361	37183	41005	7
1,2,4-TRICHLOROBENZENE	22155	19725	18537	20139	7
HEXACHLOROBUTADIENE	13841	13783	12575	13400	4
NAPHTHALENE	54983	52167	47855	51668	6
1,2,3-TRICHLOROBENZENE	19623	17914	17199	18245	6

TABLE 41
DIFFERENT HEADSPACE VOLUME RECOVERIES
25 ng ANALYTE RESPONSE USING 10 mL OF MMS AND 15 mL GLASS BEADS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	9794	9871	8544	9403	6
CHLOROMETHANE	5038	5095	4422	4852	6
VINYL CHLORIDE	7635	13306	7776	9572	28
BROMOMETHANE	3555	3158	2926	3213	8
CHLOROETHANE	4102	4041	3854	3999	3
TRICHLOROFLUOROMETHANE	35146	36912	36629	36229	2
1,1-DICHLOROETHENE	25070	24111	23869	24350	2
METHYLENE CHLORIDE	20230	21403	20165	20599	3
trans-1,2-DICHLOROETHENE	23115	24732	23319	23722	3
1,1-DICHLOROETHANE	26960	27634	26621	27072	2
2,2-DICHLOROPROPANE	14513	15960	14575	15016	4
cis-1,2-DICHLOROETHENE	23319	24509	23848	23892	2
BROMOCHLOROMETHANE	13240	12461	11745	12482	5
CHLOROFORM	23609	23001	23188	23266	1
1,1,1-TRICHLOROETHANE	23385	25620	23928	24311	4
1,1-DICHLOROPROPENE	19460	19801	20856	20039	3
CARBON TETRACHLORIDE	32930	34820	36939	34896	5
BENZENE	38122	40322	40034	39493	2
1,2-DICHLOROETHANE	18482	18184	17215	17960	3
TRICHLOROETHYLENE	15994	16553	15595	16047	2
1,2-DICHLOROPROPANE	13522	14544	13750	13939	3
DIBROMOMETHANE	6442	7681	7821	7315	8
BROMODICHLOROMETHANE	16855	17803	16039	16899	4
TOLUENE	51831	54405	53153	53130	2
1,1,2-TRICHLOROETHANE	8746	9289	9398	9144	3
TETRACHLOROETHYLENE	20553	20571	22642	21255	5
1,3-DICHLOROPROPANE	13300	13287	12299	12962	4
DIBROMOCHLOROMETHANE	18674	18825	18986	18828	1
1,2-DIBROMOETHANE	14168	15548	14305	14674	4
CHLOROBENZENE	26195	29966	30228	28796	6
1,1,1,2-TETRACHLOROETHANE	24041	24311	23427	23926	2
ETHYL BENZENE	61526	65634	66498	64553	3
p-XYLENE	66020	69074	78679	71258	8
o-XYLENE	38983	33355	30764	34367	10
STYRENE	57152	51797	46628	51859	8
BROMOFORM	10611	11369	10107	10696	5
ISOPROPYLBENZENE	103999	119132	109681	110937	6
p-BROMOFLUOROBENZENE	22033	23382	22861	22759	2
BROMOBENZENE	42145	41191	39988	41108	2
1,1,2,2-TETRACHLOROETHANE	17068	17675	17485	17409	1
1,2,3-TRICHLOROPROPANE	15433	15923	16375	15910	2
n-PROPYL BENZENE	81130	82380	83046	82185	1
2-CHLOROTOLUENE	59234	60006	58781	59340	1
4-CHLOROTOLUENE	51148	53144	52324	52205	2
tert-BUTYLBENZENE	86219	99233	91977	92476	6
1,3,5-TRIMETHYLBENZENE	108576	109704	114631	110970	2
sec-BUTYL BENZENE	118000	117052	118862	117971	1
1,2-DIBROMO-3-CHLOROPROPANE	7555	7816	7050	7474	4
1,2,4-TRIMETHYLBENZENE	104627	115845	110816	110429	4
1,3-DICHLOROBENZENE	41114	46494	41868	43159	6
p-ISOPROPYL TOLUENE	87497	96265	91767	91843	4
1,4-DICHLOROBENZENE	41114	46498	40388	42667	6
1,2-DICHLOROBENZENE-d4	42301	42397	42037	42245	0
1,2-DICHLOROBENZENE	41414	43148	40419	41660	3
n-BUTYL BENZENE	59364	61787	59277	60143	2
1,2,4-TRICHLOROBENZENE	29074	32342	29469	30295	5
HEXACHLOROBUTADIENE	19205	20823	19736	19921	3
NAPHTHALENE	69496	72652	68996	70381	2
1,2,3-TRICHLOROBENZENE	26038	26821	26214	26358	1

TABLE 42
COMPARISON OF HEADSPACE VOLUME RECOVERIES
THREE REPLICATES OF EACH EXPERIMENT
VIAL PRESSURE 7.5 PSI

ANALYTE	MMS AVG AREA	MMS RSD (%)	MMS/5mL BEADS AVG AREA	MMS/5mL BEADS RSD (%)	MMS/10mL BEADS AVG AREA	MMS/10mL BEADS RSD (%)	MMS/15mL BEADS AVG AREA	MMS/15mL BEADS RSD (%)		% DIF 5 mL	% DIF 15 mL
DICHLORODIFLUOROMETHANE	6032	7	7542	10	7707	7	9403	6		98	122
CHLOROMETHANE	2786	3	3922	4	3857	5	4852	6		102	126
VINYL CHLORIDE	8042	5	10226	8	11288	4	9572	28		91	85
BROMOMETHANE	2808	8	3801	26	3501	10	3213	8		109	92
CHLOROETHANE	2125	12	2594	4	3029	6	3999	3		86	132
TRICHLOROFLUOROMETHANE	16573	6	22123	6	25819	5	36229	2		86	140
1,1-DICHLOROETHENE	12107	2	15422	4	17803	5	24350	2		87	137
METHYLENE CHLORIDE	12685	4	16048	4	16497	4	20599	3		97	125
TRANS-1,2-DICHLOROETHENE	12906	3	16075	4	17893	2	23722	3		90	133
1,1-DICHLOROETHANE	13381	2	17175	6	19636	5	27072	2		87	138
2,2-DICHLOROPROPANE	7830	11	10476	12	11558	9	15016	4		91	130
CIS-1,2-DICHLOROETHENE	12412	6	16519	3	18217	7	23892	2		91	131
BROMOCHLOROMETHANE	8758	4	10340	4	10346	10	12482	5		100	121
CHLOROFORM	12225	2	15878	5	18389	6	23266	1		86	127
1,1,1-TRICHLOROETHANE	12244	3	15680	6	17633	7	24311	4		89	138
1,1-DICHLOROPROPENE	9056	3	11852	4	13809	4	20039	3		86	145
CARBON TETRACHLORIDE	14356	2	20124	4	23228	7	34896	5		87	150
BENZENE	18812	2	24460	4	29390	4	39493	2		83	134
1,2-DICHLOROETHANE	11743	5	14513	7	14539	7	17960	3		100	124
TRICHLOROETHYLENE	7736	7	10032	6	11830	4	16047	2		85	136
1,2-DICHLOROPROPANE	7414	4	9086	2	10416	6	13939	3		87	134
DIBROMOMETHANE	5453	4	6431	2	6181	10	7315	8		104	118
BROMODICHLOROMETHANE	10504	1	12871	4	13475	8	16899	4		96	125
TOLUENE	24259	4	31147	6	37168	4	53130	2		84	143
1,1,2-TRICHLOROETHANE	5822	7	6537	7	7069	7	9144	3		92	129
TETRACHLOROETHYLENE	7125	4	10580	4	13073	8	21255	5		81	163
1,3-DICHLOROPROPANE	7535	7	9744	4	10128	5	12962	4		96	128
DIBROMOCHLOROMETHANE	10327	2	13722	6	14300	10	18828	1		96	132
1,2-DIBROMOETHANE	9384	4	11629	2	11838	7	14674	4		98	124
CHLOROBENZENE	12289	2	17106	2	20194	5	28796	6		85	143
1,1,1,2-TETRACHLOROETHANE	9678	4	13564	5	15653	8	23926	2		87	153
ETHYL BENZENE	24066	3	35652	7	43677	8	64553	3		82	148
p-XYLENE	26156	6	31554	33	47571	4	71258	8		66	150
o-XYLENE	23505	6	32252	7	22954	4	34367	10		141	150
STYRENE	21461	3	30008	7	34689	2	51859	8		87	149
BROMOFORM	6383	2	8363	7	8526	6	10696	5		98	125
ISOPROPYLBENZENE	38497	2	56360	2	71635	3	110937	6		79	155
p-BROMOFLUOROBENZENE	10825	6	14102	3	16622	8	22759	2		85	137
BROMOBENZENE	18921	6	24903	11	27501	3	41108	2		91	149
1,1,2,2-TETRACHLOROETHANE	11459	4	13342	3	13597	7	17409	1		98	128
1,2,3-TRICHLOROPROPANE	13076	5	11610	16	12190	6	15910	2		95	131
n-PROPYL BENZENE	31981	7	44086	8	54164	6	82185	1		81	152
2-CHLOROTOLUENE	23650	8	33157	6	40895	3	59340	1		81	145
4-CHLOROTOLUENE	21739	3	30047	5	36283	6	52205	2		83	144
t-BUTYLBENZENE	29893	5	45407	6	59340	8	92476	6		77	156
1,3,5-TRIMETHYLBENZENE	38521	3	60778	6	71529	10	110970	2		85	155
sec-BUTYL BENZENE	41312	3	58179	8	77280	7	117971	1		75	153
1,2-DIBROMO-3-CHLOROPROPANE	6553	1	6606	10	6570	4	7474	4		101	114
1,2,4-TRIMETHYLBENZENE	39208	2	59512	9	72687	8	110429	4		82	152
1,3-DICHLOROBENZENE	16882	4	25273	3	30801	10	43159	6		82	140
p-ISOPROPYL TOLUENE	31197	3	46856	8	59362	4	91843	4		79	155
1,4-DICHLOROBENZENE	16505	3	24291	5	27544	1	42667	6		88	155
d4 1,2-DICHLOROBENZENE	16669	1	24058	8	29786	9	42245	0		81	142
1,2-DICHLOROBENZENE	16200	1	23512	10	28401	6	41660	3		83	147
n-BUTYL BENZENE	24784	9	33688	7	41005	7	60143	2		82	147
1,2,4-TRICHLOROBENZENE	11978	7	17426	4	20139	7	30295	5		87	150
HEXACHLOROBUTADIENE	8007	5	10584	10	13400	4	19921	3		79	149
NAPHTHALENE	33387	2	46836	4	51668	6	70381	2		91	136
1,2,3-TRICHLOROBENZENE	10385	2	15539	2	18245	6	26358	1		85	144
									AVG	89	137
APPROXIMATE HEADSPACE VOLUME	12 mL		9.4 mL		6.8 mL		4.2 mL				

TABLE 43
DIFFERENT MMS AMOUNTS AT CONSTANT HEADSPACE VOLUME
25 ng ANALYTE RESPONSE USING 10 mL OF MMS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	Sample 3 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	775	825	1060	887	14
CHLOROMETHANE	842	977	1070	963	10
VINYL CHLORIDE	4774	4343	4235	4451	5
BROMOMETHANE	1690	1743	1582	1672	4
CHLOROETHANE	1546	1534	1529	1536	0
TRICHLOROFLUOROMETHANE	11729	11095	12912	11912	6
1,1-DICHLOROETHENE	9999	9392	10182	9858	3
METHYLENE CHLORIDE	11008	11118	11305	11144	1
trans-1,2-DICHLOROETHENE	11417	11224	11691	11444	2
1,1-DICHLOROETHANE	12137	12357	12203	12232	1
2,2-DICHLOROPROPANE	7697	8116	8443	8085	4
cis-1,2-DICHLOROETHENE	12730	13154	12711	12865	2
BROMOCHLOROMETHANE	7892	7592	7621	7702	2
CHLOROFORM	12048	12184	12869	12367	3
1,1,1-TRICHLOROETHANE	11280	11890	11910	11693	3
1,1-DICHLOROPROPENE	8509	8144	8702	8452	3
CARBON TETRACHLORIDE	13243	13426	14426	13698	4
BENZENE	17680	17822	18359	17954	2
1,2-DICHLOROETHANE	10394	10040	10781	10405	3
TRICHLOROETHYLENE	7095	7125	7223	7148	1
1,2-DICHLOROPROPANE	7050	6972	7463	7162	3
DIBROMOMETHANE	4562	4629	5019	4737	4
BROMODICHLOROMETHANE	9522	10329	10270	10040	4
TOLUENE	24326	24399	25441	24722	2
1,1,2-TRICHLOROETHANE	5350	5608	4926	5295	5
TETRACHLOROETHYLENE	7293	7403	7929	7542	4
1,3-DICHLOROPROPANE	7598	7490	7448	7512	1
DIBROMOCHLOROMETHANE	9798	9484	9455	9579	2
1,2-DIBROMOETHANE	8078	7965	7830	7958	1
CHLOROBENZENE	13526	14187	13640	13784	2
1,1,1,2-TETRACHLOROETHANE	9337	10545	11784	10555	9
ETHYL BENZENE	25807	25074	27869	26250	5
p-XYLENE	28624	28390	30810	29275	4
o-XYLENE	22488	24972	28442	25301	10
STYRENE	21395	22781	24036	22737	5
BROMOFORM	5964	5773	5782	5840	2
ISOPROPYLBENZENE	41420	43072	46134	43542	4
p-BROMOFLUOROBENZENE	11134	11171	10948	11084	1
BROMOBENZENE	18519	20073	20627	19740	5
1,1,2,2-TETRACHLOROETHANE	11389	10984	10323	10899	4
1,2,3-TRICHLOROPROPANE	8062	7619	8563	8081	5
n-PROPYL BENZENE	34062	36553	38223	36279	5
2-CHLOROTOLUENE	24519	25648	27527	25898	5
4-CHLOROTOLUENE	22637	25515	24774	24309	5
tert-BUTYLBENZENE	34178	35724	36403	35435	3
1,3,5-TRIMETHYLBENZENE	43199	44975	46886	45020	3
sec-BUTYL BENZENE	45214	44987	53873	48025	9
1,2-DIBROMO-3-CHLOROPROPANE	5426	4929	4656	5004	6
1,2,4-TRIMETHYLBENZENE	46431	42709	48617	45919	5
1,3-DICHLOROBENZENE	17486	19132	20422	19013	6
p-ISOPROPYL TOLUENE	36161	37118	38983	37421	3
1,4-DICHLOROBENZENE	17646	18420	19123	18396	3
1,2-DICHLOROBENZENE-d4	17602	19073	19312	18662	4
1,2-DICHLOROBENZENE	17865	18577	18669	18370	2
n-BUTYL BENZENE	26883	27737	29712	28111	4
1,2,4-TRICHLOROBENZENE	13794	13945	14244	13994	1
HEXACHLOROBUTADIENE	8853	8590	9489	8977	4
NAPHTHALENE	35739	36000	36964	36234	1
1,2,3-TRICHLOROBENZENE	11630	11949	12433	12004	3

TABLE 44
DIFFERENT MMS AMOUNTS AT CONSTANT HEADSPACE VOLUME
25 ng ANALYTE RESPONSE USING 7.2 mL OF MMS AND 5 Ml OF THE BEADS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	1206	811	1009	20
CHLOROMETHANE	1034	925	980	6
VINYL CHLORIDE	4365	4596	4481	3
BROMOMETHANE	1478	1367	1423	4
CHLOROETHANE	1780	1723	1752	2
TRICHLOROFLUOROMETHANE	13739	12977	13358	3
1,1-DICHLOROETHENE	10786	11031	10909	1
METHYLENE CHLORIDE	12537	12381	12459	1
trans-1,2-DICHLOROETHENE	12853	13508	13181	2
1,1-DICHLOROETHANE	13810	13592	13701	1
2,2-DICHLOROPROPANE	9173	9292	9233	1
cis-1,2-DICHLOROETHENE	13591	14525	14058	3
BROMOCHLOROMETHANE	8821	8640	8731	1
CHLOROFORM	13398	13955	13677	2
1,1,1-TRICHLOROETHANE	13600	13949	13775	1
1,1-DICHLOROPROPENE	9963	9960	9962	0
CARBON TETRACHLORIDE	15446	15624	15535	1
BENZENE	21227	20749	20988	1
1,2-DICHLOROETHANE	11750	11165	11458	3
TRICHLOROETHYLENE	8472	8651	8562	1
1,2-DICHLOROPROPANE	8145	8387	8266	1
DIBROMOMETHANE	5244	4906	5075	3
BROMODICHLOROMETHANE	10912	11209	11061	1
TOLUENE	29408	29785	29597	1
1,1,2-TRICHLOROETHANE	5592	5747	5670	1
TETRACHLOROETHYLENE	8632	9175	8904	3
1,3-DICHLOROPROPANE	8135	8497	8316	2
DIBROMOCHLOROMETHANE	11168	11122	11145	0
1,2-DIBROMOETHANE	8784	9124	8954	2
CHLOROBENZENE	15708	15326	15517	1
1,1,1,2-TETRACHLOROETHANE	12134	11460	11797	3
ETHYL BENZENE	32377	33818	33098	2
p-XYLENE	37960	38953	38457	1
o-XYLENE	32293	31310	31802	2
STYRENE	28080	29977	29029	3
BROMOFORM	6747	7044	6896	2
ISOPROPYLBENZENE	52798	51877	52338	1
p-BROMOFLUOROBENZENE	12649	13349	12999	3
BROMOBENZENE	20559	22967	21763	6
1,1,2,2-TETRACHLOROETHANE	12090	11807	11949	1
1,2,3-TRICHLOROPROPANE	9188	9590	9389	2
n-PROPYL BENZENE	42872	44610	43741	2
2-CHLOROTOLUENE	31451	31158	31305	0
4-CHLOROTOLUENE	29023	29927	29475	2
tert-BUTYLBENZENE	43874	44250	44062	0
1,3,5-TRIMETHYLBENZENE	56006	58388	57197	2
sec-BUTYL BENZENE	57026	60602	58814	3
1,2-DIBROMO-3-CHLOROPROPANE	5789	5633	5711	1
1,2,4-TRIMETHYLBENZENE	56175	55410	55793	1
1,3-DICHLOROBENZENE	21672	22567	22120	2
p-ISOPROPYL TOLUENE	42884	44041	43463	1
1,4-DICHLOROBENZENE	23353	23094	23224	1
1,2-DICHLOROBENZENE-d4	22842	21605	22224	3
1,2-DICHLOROBENZENE	21722	20765	21244	2
n-BUTYL BENZENE	32925	34170	33548	2
1,2,4-TRICHLOROBENZENE	16888	16338	16613	2
HEXACHLOROBUTADIENE	10759	11412	11086	3
NAPHTHALENE	41621	39900	40761	2
1,2,3-TRICHLOROBENZENE	13879	14396	14138	2

NF=not found

TABLE 45
DIFFERENT MMS AMOUNTS AT CONSTANT HEADSPACE VOLUME
25 ng ANALYTE RESPONSE USING 4.5 mL OF MMS AND 10 mL OF THE BEADS
VIAL PRESSURE 7.5 PSI

ANALYTE	Sample 1 Area	Sample 2 Area	AVG Area	RSD (%)
DICHLORODIFLUOROMETHANE	907	984	946	4
CHLOROMETHANE	974	884	929	5
VINYL CHLORIDE	3285	3215	3250	1
BROMOMETHANE	1236	1369	1303	5
CHLOROETHANE	1214	1327	1271	4
TRICHLOROFLUOROMETHANE	9638	9428	9533	1
1,1-DICHLOROETHENE	5349	4996	5173	3
METHYLENE CHLORIDE	10235	9742	9989	2
trans-1,2-DICHLOROETHENE	10316	9080	9698	6
1,1-DICHLOROETHANE	11000	10316	10658	3
2,2-DICHLOROPROPANE	7868	8193	8031	2
cis-1,2-DICHLOROETHENE	11786	11518	11652	1
BROMOCHLOROMETHANE	7502	6934	7218	4
CHLOROFORM	11673	10799	11236	4
1,1,1-TRICHLOROETHANE	10942	10759	10851	1
1,1-DICHLOROPROPENE	7384	7533	7459	1
CARBON TETRACHLORIDE	11861	11534	11698	1
BENZENE	17213	16791	17002	1
1,2-DICHLOROETHANE	10244	9441	9843	4
TRICHLOROETHYLENE	6786	6926	6856	1
1,2-DICHLOROPROPANE	6777	6349	6563	3
DIBROMOMETHANE	4864	4124	4494	8
BROMODICHLOROMETHANE	9483	9131	9307	2
TOLUENE	24163	22777	23470	3
1,1,2-TRICHLOROETHANE	5418	4860	5139	5
TETRACHLOROETHYLENE	6988	6613	6801	3
1,3-DICHLOROPROPANE	7781	6919	7350	6
DIBROMOCHLOROMETHANE	9770	8850	9310	5
1,2-DIBROMOETHANE	8299	7619	7959	4
CHLOROBENZENE	12907	11982	12445	4
1,1,1,2-TETRACHLOROETHANE	9804	9195	9500	3
ETHYL BENZENE	26068	25374	25721	1
p-XYLENE	29839	26669	28254	6
o-XYLENE	26021	23948	24985	4
STYRENE	21716	21139	21428	1
BROMOFORM	6429	5422	5926	8
ISOPROPYLBENZENE	40922	39100	40011	2
p-BROMOFLUOROBENZENE	10778	10636	10707	1
BROMOBENZENE	19604	17754	18679	5
1,1,2,2-TETRACHLOROETHANE	11505	10153	10829	6
1,2,3-TRICHLOROPROPANE	8139	7644	7892	3
n-PROPYL BENZENE	34969	34278	34624	1
2-CHLOROTOLUENE	25390	23492	24441	4
4-CHLOROTOLUENE	22681	22381	22531	1
tert-BUTYLBENZENE	34921	32522	33722	4
1,3,5-TRIMETHYLBENZENE	43411	40034	41723	4
sec-BUTYL BENZENE	48129	45396	46763	3
1,2-DIBROMO-3-CHLOROPROPANE	5987	5559	5773	4
1,2,4-TRIMETHYLBENZENE	43111	39730	41421	4
1,3-DICHLOROBENZENE	17328	17391	17360	0
p-ISOPROPYL TOLUENE	35433	33510	34472	3
1,4-DICHLOROBENZENE	16307	16285	16296	0
1,2-DICHLOROBENZENE-d4	16749	17278	17014	2
1,2-DICHLOROBENZENE	17094	16548	16821	2
n-BUTYL BENZENE	26772	27096	26934	1
1,2,4-TRICHLOROBENZENE	13473	12590	13032	3
HEXACHLOROBUTADIENE	9378	8759	9069	3
NAPHTHALENE	37329	32729	35029	7
1,2,3-TRICHLOROBENZENE	11781	11232	11507	2

NF=not found

TABLE 46
COMPARISON OF 25 ng ANALYTE RECOVERIES FOR
DIFFERENT MMS AMOUNTS AT CONSTANT HEADSPACE VOLUME
VIAL PRESSURE 7.5 PSI

ANALYTE	10 mL MMS AVG AREA	RSD (%)	7mL MMS/5mL BEADS AVG AREA	RSD (%)	4.5mL MMS/10mL BEADS AVG AREA	RSD (%)
DICHLORODIFLUOROMETHANE	887	14	1009	20	946	4
CHLOROMETHANE	963	10	980	6	929	5
VINYL CHLORIDE	4451	5	4481	3	3250	1
BROMOMETHANE	1672	4	1423	4	1303	5
CHLOROETHANE	1536	0	1752	2	1271	4
TRICHLOROFLUOROMETHANE	11912	6	13358	3	9533	1
1,1-DICHLOROETHENE	9858	3	10909	1	5173	3
METHYLENE CHLORIDE	11144	1	12459	1	9989	2
trans-1,2-DICHLOROETHENE	11444	2	13181	2	9698	6
1,1-DICHLOROETHANE	12232	1	13701	1	10658	3
2,2-DICHLOROPROPANE	8085	4	9233	1	8031	2
cis-1,2-DICHLOROETHENE	12865	2	14058	3	11652	1
BROMOCHLOROMETHANE	7702	2	8731	1	7218	4
CHLOROFORM	12367	3	13677	2	11236	4
1,1,1-TRICHLOROETHANE	11693	3	13775	1	10851	1
1,1-DICHLOROPROPENE	8452	3	9962	0	7459	1
CARBON TETRACHLORIDE	13698	4	15535	1	11698	1
BENZENE	17954	2	20988	1	17002	1
1,2-DICHLOROETHANE	10405	3	11458	3	9843	4
TRICHLOROETHYLENE	7148	1	8562	1	6856	1
1,2-DICHLOROPROPANE	7162	3	8266	1	6563	3
DIBROMOMETHANE	4737	4	5075	3	4494	8
BROMODICHLOROMETHANE	10040	4	11061	1	9307	2
TOLUENE	24722	2	29597	1	23470	3
1,1,2-TRICHLOROETHANE	5295	5	5670	1	5139	5
TETRACHLOROETHYLENE	7542	4	8904	3	6801	3
1,3-DICHLOROPROPANE	7512	1	8316	2	7350	6
DIBROMOCHLOROMETHANE	9579	2	11145	0	9310	5
1,2-DIBROMOETHANE	7958	1	8954	2	7959	4
CHLOROBENZENE	13784	2	15517	1	12445	4
1,1,1,2-TETRACHLOROETHANE	10555	9	11797	3	9500	3
ETHYL BENZENE	26250	5	33098	2	25721	1
p-XYLENE	19275	6	38457	1	28254	6
o-XYLENE	25301	10	31802	2	24985	4
STYRENE	22737	5	29029	3	21428	1
BROMOFORM	5840	2	6896	2	5926	8
ISOPROPYLBENZENE	43542	4	52338	1	40011	2
p-BROMOFLUOROBENZENE	11084	1	12999	3	10707	1
BROMOBENZENE	19740	5	21763	6	18679	5
1,1,2,2-TETRACHLOROETHANE	10899	4	11949	1	10829	6
1,2,3-TRICHLOROPROPANE	8081	5	9389	2	7892	3
n-PROPYL BENZENE	36279	5	43741	2	34624	1
2-CHLOROTOLUENE	25898	5	31305	0	24441	4
4-CHLOROTOLUENE	24309	5	29475	2	22531	1
tert-BUTYLBENZENE	35435	3	44062	0	33722	4
1,3,5-TRIMETHYLBENZENE	45020	3	57197	2	41723	4
sec-BUTYL BENZENE	48025	9	58814	3	46763	3
1,2-DIBROMO-3-CHLOROPROPANE	5004	6	5711	1	5773	4
1,2,4-TRIMETHYLBENZENE	45919	5	55793	1	41421	4
1,3-DICHLOROBENZENE	19013	6	22120	2	17360	0
p-ISOPROPYL TOLUENE	37421	3	43463	1	34472	3
1,4-DICHLOROBENZENE	18396	3	23224	1	16296	0
1,2-DICHLOROBENZENE-d4	18662	4	22224	3	17014	2
1,2-DICHLOROBENZENE	18370	2	21244	2	16821	2
n-BUTYL BENZENE	28111	4	33548	2	26934	1
1,2,4-TRICHLOROBENZENE	13994	1	16613	2	13032	3
HEXACHLOROBUTADIENE	8977	4	11086	3	9069	3
NAPHTHALENE	36234	1	40761	2	35029	7
1,2,3-TRICHLOROBENZENE	12004	3	14138	2	11507	2

DECREASING MMS VOLUME---------->

TABLE 47
DETERMINATION OF MDLs
25 ng FORTIFIED MMS/SAND

ANALYTE	NG RECOVERED Sample 1	Sample 2	Sample 3	AVG	RSD (%)	RECOVERY (%)	MDL (ug/Kg)
DICHLORODIFLUOROMETHANE	10.3	11.5	8.7	10.2	11.0	40.6	1.6
CHLOROMETHANE	13.1	15.5	12.7	13.8	8.8	55.0	1.7
VINYL CHLORIDE	11.3	8.8	11.0	10.4	11.1	41.5	1.6
BROMOMETHANE	17.7	26.7	14.1	19.5	27.1	78.0	7.4
CHLOROETHANE	17.6	23.1	15.9	18.9	16.5	75.5	4.3
TRICHLOROFLUOROMETHANE	12.6	17.1	12.9	14.2	14.2	56.8	2.8
1,1-DICHLOROETHENE	15.1	15.4	14.6	15.0	2.2	60.1	0.5
trans-1,2-DICHLOROETHENE	28.0	29.0	27.9	28.3	1.8	113.2	0.7
1,1-DICHLOROETHANE	17.4	17.6	17.9	17.6	1.1	70.5	0.3
2,2-DICHLOROPROPANE	24.2	24.9	27.3	25.5	5.3	101.9	1.9
cis-1,2-DICHLOROETHENE	22.6	24.3	24.8	23.9	3.9	95.6	1.3
BROMOCHLOROMETHANE	28.9	30.2	30.5	29.9	2.3	119.5	1.0
CHLOROFORM	21.1	22.3	21.9	21.8	2.3	87.0	0.7
1,1,1-TRICHLOROETHANE	20.8	21.3	21.9	21.3	2.2	85.3	0.7
1,1-DICHLOROPROPENE	25.9	27.3	26.4	26.5	2.2	106.1	0.8
CARBON TETRACHLORIDE	21.9	21.6	22.0	21.8	0.8	87.2	0.2
BENZENE	27.0	28.1	28.0	27.7	1.9	110.9	0.7
1,2-DICHLOROETHANE	25.4	27.5	27.8	26.9	4.0	107.5	1.5
TRICHLOROETHYLENE	21.9	22.8	21.6	22.1	2.3	88.4	0.7
1,2-DICHLOROPROPANE	22.4	24.4	24.5	23.8	4.2	95.1	1.4
DIBROMOMETHANE	25.3	29.5	28.1	27.6	6.3	110.5	2.4
BROMODICHLOROMETHANE	24.3	27.0	26.8	26.0	4.7	104.1	1.7
TOLUENE	27.1	29.5	27.2	27.9	4.0	111.7	1.5
1,1,2-TRICHLOROETHANE	24.4	25.9	26.8	25.7	3.8	102.9	1.4
TETRACHLOROETHYLENE	25.2	26.7	26.0	26.0	2.4	103.9	0.9
1,3-DICHLOROPROPANE	24.0	27.1	26.5	25.9	5.2	103.5	1.9
DIBROMOCHLOROMETHANE	23.3	25.2	25.9	24.8	4.4	99.2	1.5
1,2-DIBROMOETHANE	20.4	20.0	14.8	18.4	13.9	73.6	3.6
CHLOROBENZENE	24.8	27.1	25.9	25.9	3.6	103.7	1.3
1,1,1,2-TETRACHLOROETHANE	29.2	33.6	33.2	32.0	6.2	128.1	2.8
ETHYL BENZENE	31.6	34.4	32.4	32.8	3.6	131.2	1.6
p-XYLENE	29.7	31.4	29.1	30.1	3.2	120.3	1.4
o-XYLENE	29.3	31.7	31.0	30.7	3.3	122.7	1.4
STYRENE	21.9	22.0	19.5	21.1	5.5	84.5	1.6
BROMOFORM	22.7	21.9	18.3	21.0	9.1	83.9	2.7
ISOPROPYLBENZENE	29.8	32.8	31.3	31.3	3.9	125.2	1.7
p-BROMOFLUOROBENZENE	27.2	25.6	19.2	24.0	14.4	96.0	4.8
BROMOBENZENE	20.1	20.2	22.3	20.9	4.9	83.5	1.4
1,1,2,2-TETRACHLOROETHANE	22.0	23.5	30.6	25.4	14.8	101.4	5.2
1,2,3-TRICHLOROPROPANE	32.8	35.3	34.9	34.3	3.2	137.3	1.5
n-PROPYL BENZENE	21.1	20.4	15.8	19.1	12.3	76.4	3.3
2-CHLOROTOLUENE	21.5	23.3	22.5	22.4	3.3	89.7	1.0
4-CHLOROTOLUENE	24.0	26.0	25.1	25.0	3.3	100.1	1.1
tert-BUTYLBENZENE	21.9	23.6	22.7	22.7	3.1	90.9	1.0
1,3,5-TRIMETHYLBENZENE	20.6	22.8	22.2	21.9	4.2	87.5	1.3
sec-BUTYL BENZENE	21.7	23.5	22.8	22.7	3.3	90.7	1.0
1,2-DIBROMO-3-CHLOROPROPANE	22.0	23.9	24.5	23.5	4.5	93.9	1.5
1,2,4-TRIMETHYLBENZENE	20.3	19.8	15.2	18.4	12.5	73.7	3.2
1,3-DICHLOROBENZENE	20.2	20.2	15.4	18.6	12.2	74.4	3.2
p-ISOPROPYL TOLUENE	20.7	20.2	15.5	18.8	12.5	75.2	3.3
1,4-DICHLOROBENZENE	19.8	19.9	15.2	18.3	12.0	73.2	3.1
1,2-DICHLOROBENZENE-d4	26.1	25.2	18.4	23.2	14.8	92.9	4.8
1,2-DICHLOROBENZENE	20.1	19.4	15.3	18.3	11.6	73.1	2.9
n-BUTYL BENZENE	20.1	19.3	14.7	18.0	13.2	72.1	3.3
1,2,4-TRICHLOROBENZENE	19.8	18.9	14.2	17.6	13.9	70.5	3.4
HEXACHLOROBUTADIENE	19.6	21.7	19.7	20.3	4.8	81.3	1.3
NAPHTHALENE	20.1	19.6	15.2	18.3	12.0	73.2	3.1
1,2,3-TRICHLOROBENZENE	17.3	17.3	12.5	15.7	14.4	62.8	3.2

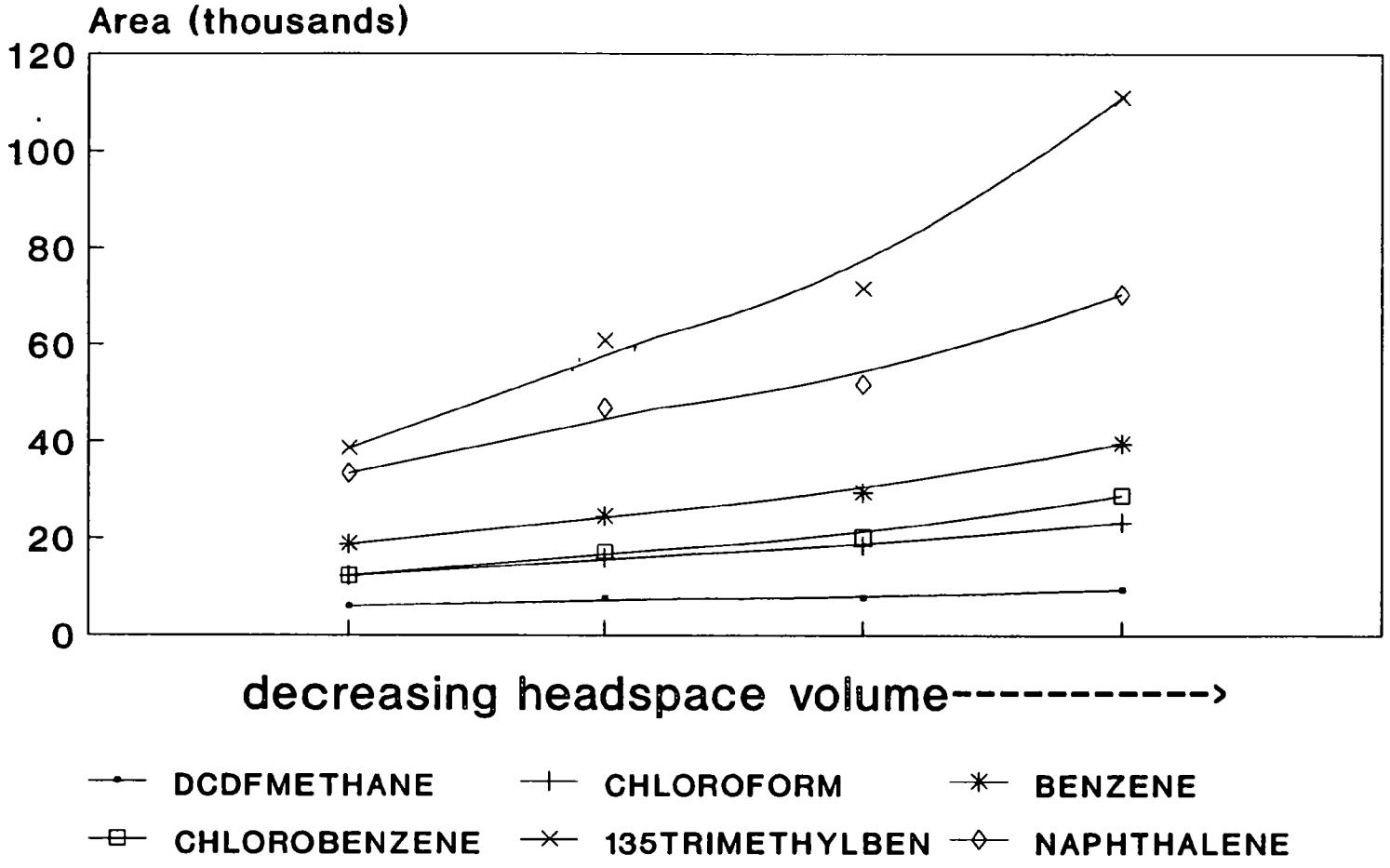

Figure 1. Effect of Different Headspace Volumes
On Analyte Recovery

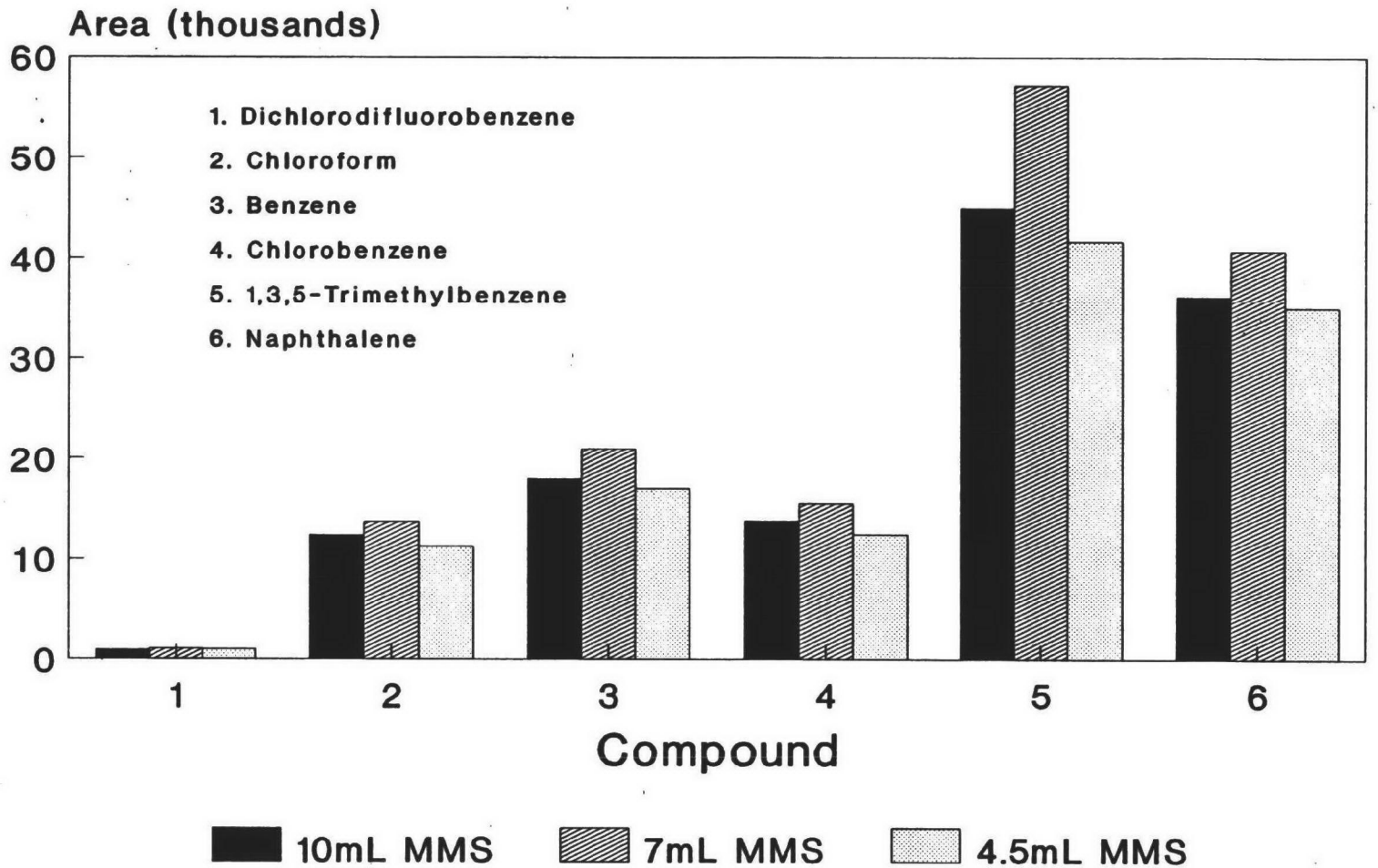

Figure 2. Effect of Different MMS Volumes On Analyte Recovery of Six Compounds