K.3
2/27/03

URS

February 27, 2003

Mr. Jamie Dunn
Regional Hydrogeologist
WDNR – Northern Region
810 W. Maple Street
P.O. Box 309
Spooner, WI 54801

RE: URS Project No. 05644-098
Quality Assurance Project Plan Addendum
Task Specific –OU4 Winter Sediment Split Sample Collection
Ashland Lakefront Site, Ashland, Wisconsin

Dear Mr. Dunn:

As we discussed, URS has prepared this addendum for the Quality Assurance Project Plan (QAPP) recently submitted by SEH for the upcoming sediment sampling for the above referenced project. It is to be considered only as an addendum covering URS activities, and does not represent an independent QAPP. Laboratory services for fingerprinting will be provided by META Environmental Inc., (META) of Watertown Massachusetts.

This addendum includes the following: A separate URS Standard Operating Procedure (SOP) for the collection of split soil samples for finger print analysis (Attachment 1); two META Laboratory SOPs for fingerprinting analyses (Attachment 2), and the remainder of META's Laboratory QA Plan (Attachment 3). Please note that we are including Attachment 3 for completeness. Much of the laboratory procedures included in META's QA Plan will not apply because the analyses that META will perform will be limited to fingerprinting on the collected split samples.

We will submit this document in pdf format under a separate cover.

URS understand that the WNDR has tentatively scheduled the collection of sediment samples for the weeks of March 17 and March 24, 2003.

We look forward to initiating the work. Please call us with questions me at (608) 245-8085 with questions.

Sincerely,

URS

David P. Trainor, P.E., P.G.
Principal

cc: Jerry Winslow, Xcel Energy
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EPA Region 5 Records Ctr.
278365

URS
STANDARD OPERATING PROCEDURE 200
SPLIT SAMPLE COLLECTION

1.0 SCOPE

This procedure describes the collection of split samples for soil and/or sediment. This SOP is for the splitting samples collected by URS by others.

2.0 OBJECTIVES

- Insure that the representative soil/sediment and groundwater samples will be collected to properly characterize site conditions.
- Insure quality control and consistency in taking samples.
- Serve as a means to allow traceability of error(s) in sampling and data recording.

3.0 PROCEDURE

3.1 Split Soil Sample Collection

Representative split soil/sediment samples will be collected for laboratory analysis based on visual observations, field screening results, or predetermined locations. Each soil/sediment sample will be collected by placing soil in laboratory provided containers. Split samples collected for fingerprinting analysis will be placed in 40 mL unpreserved vials with zero head space. All samples will be held on ice in a cooler, and shipped to the laboratory with the completed chain-of-custody form.

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META STANDARD OPERATING PROCEDURES
MET4007 AND 4008 FOR
HYDROCARBON FINGER PRINTING ANALYSIS

EPA 8100mod

MET4007

Simultaneous Determination of Monocyclic Aromatic Hydrocarbons (MAHs) and Polycyclic Aromatic Hydrocarbons (PAHs) by Gas Chromatography with Flame Ionization Detection (GC/FID)

1.0 Scope and Application

1.1 This method is applicable to the analysis of the following compounds:

Compound	CAS Number
MONOCYCLIC AROMATIC HYDROCARBONS (MAHs)	
Benzene	71-43-2
Toluene	108-88-3
Ethylbenzene	100-41-4
Styrene	100-42-5
m-Xylene	108-38-3
p-Xylene	106-42-3
o-Xylene	95-47-6
Trimethylbenzene	95-63-6
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)	
Naphthalene	91-20-3
1-Methylnaphthalene	90-12-0
2-Methylnaphthalene	91-57-6
Acenaphthylene	208-96-8
Acenaphthene	83-32-9
Fluorene	86-73-7
Phenanthrene	85-01-8
Anthracene	120-12-7
Fluoranthene	206-44-0
Pyrene	129-00-0
Benz(a)anthracene	56-55-3
Chrysene	218-01-9
Benzo(b)fluoranthene	205-99-2
Benzo(k)fluoranthene	207-08-9
Benzo(a)pyrene	50-32-8

1.1Continued . . .

Compound	CAS Number
PAHs, Cont.	
Indeno(1,2,3-cd)pyrene	193-39-5
Dibenz(a,h)anthracene	53-70-3
Benzo(g,h,i)perylene	191-24-2

1.2This method can be applied to any combination of the compounds in this list, or to the complete list. Other hydrocarbon compounds may be added once their retention times and response factors have been established.

1.3This method is applicable to the determination of MAHs and PAHs for extracts prepared according to SOP No. MET2005 and MET2508.

1.4This method may also be used to determine MAHs only for extracts prepared according to SOP Nos. MET2001 and 2501, or to determine PAHs only for extracts prepared according to SOP Nos. MET2003, MET2503, and MET2504.

2.0Analysis of Extracts

2.1GC Operating Conditions

2.1.1Samples are analyzed by capillary column GC/FID operated in the splitless injection mode.

2.1.2The following GC conditions apply:

Column:30 m x 0.32 mm fused silica capillary with 0.5 μm film thickness chemically bonded 5% phenyl methyl polysiloxane (DB-5 or equivalent)

Injector:2 mm splitless liner with glass wool plug
Inlet purge valve open after 0.25 minutes

Oven: 2.0 minutes at 35°C
Ramp at 6°C/minute to 310°C
Hold for 20 minutes

Pressure program: (if available)	0.25 minutes at 30.0 psi Ramp at 99.0 psi/minute to 13.0 psi Hold at constant flow
Inlet:	295°C
Detector:	320°C

2.1.31 or 2 μL samples are injected by autosampler.

2.2 System Performance Evaluation

2.2.1Proper operation and performance of the GC system is critical for the generation of accurate, precise, and comparable results.

2.2.2Calibration standards which contain the target compounds, the surrogate compounds, and the internal standards must be run and evaluated prior to the analysis of samples.

2.2.2.aThe internal standard concentration should be the same in all standards.

2.2.3A 50 μg/mL M/PAH standard must give a chromatogram with the following characteristics.

2.2.3.aPeaks do not exhibit significant tailing or fronting.

2.2.3.bThere is minimal baseline rise.

2.2.3.cThe RRFs of the Calibration Check Compounds (CCC) acenaphthene and fluoranthene to the internal standard (*o*-terphenyl) must equal 1 $\pm$0.05, and the RRF of the CCC benzo(g,h,i)perylene must equal 1 $\pm$0.20.

2.2.3.dThe RRFs of the MAHs to the internal standard *o*-terphenyl must be greater than 0.9. (Note that this is not the internal standard from which the MAHs will be quantitated).

2.2.3.eThere should be greater than 50% separation between

benzo(b)fluoranthene and benzo(k)fluoranthene, and between indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene.

2.2.4A 50 μg/mL standard containing normal alkanes from C_9 to C_{40} plus the PAH compound naphthalene and the internal standard compound *o*-terphenyl must be run and give a chromatogram with the following characteristics.

2.2.4.aPeaks do not exhibit significant tailing or fronting.

2.2.4.bThe ratio of the area of C_{36} to C_{20} must be greater than 0.9.

2.2.4.cThere should be greater than 50% separation between naphthalene and C_{12}, and between *o*-terphenyl and C_{19}.

2.2.4.dThe RRFs of the alkanes to the internal standard (o-terphenyl) must be 1 $\pm$0.05

2.3Peak Integration

2.3.1All peak integrations (baseline placement and splitting) must be checked manually and corrected when necessary.

2.3.2Peak integration corrections must be performed prior to sample calculations.

2.4 Compound Identification

2.4.1Identify sample components by comparison of retention times (RTs) to RT data from the most recent, previous calibration standard. The width of the RT window should be based upon measurement of actual RT variations of standards over the course of a day. However, the experience of the analyst should weigh heavily in the interpretation of the chromatograms, particularly if pattern recognition is an important factor for peak identifications.

2.4.2If the peak area exceeds the linear range of the instrument as demonstrated during the initial calibration, the extract must be diluted and reanalyzed.

2.5Calculations

2.5.1 The internal standard compounds 2,4-difluorotoluene and *o*-terphenyl are added to give a final concentration in the extract of 50 μg/mL.

2.5.2 The concentration of each component is calculated using the Internal Standard Method (ISM) and based on the areas of the peaks of interest.

2.5.3 Refer to SOP No. MET1008 for more information on performing sample calculations.

3.0 Quality Control

3.1 Refer to the section 2.2 on "system performance evaluation".

3.2 An initial calibration consisting of five levels of concentration should be analyzed prior to sample analysis. The %RSD of the relative response factors (RRFs, for internal standard methods) or calibration factors (CFs, for external standard methods) should be $\leq$ 30%.

3.2.1 After the ICAL, a check standard should be analyzed. Check standard recoveries should be 90 to 110% of the true values.

3.2.2 For more information on evaluating initial calibration performance, see SOP No. MET1002.

3.3 On each day that samples are analyzed, a continuing calibration (CCAL) standard must be analyzed prior to sample analysis. The CCAL should be at a mid-level concentration. The %D between the CCAL RRFs or CFs and the ICAL average RRFs or CFs should be $\leq$ 15%.

3.3.1 In addition, a CCAL standard should be analyzed after every 15 samples and at the end of the sequence, to evaluate shifts in retention times and instrument sensitivity.

3.4 Surrogate standard and matrix spike compound %Recs in the samples.should be 40 to 120% of the true values.

3.4.1 For method and spike blanks, surrogate and matrix spike compound %Recs should be 50 to 120% of the true values.

3.5 Internal standard areas in the samples should be within $\pm$15% of the internal standard areas in the most recent, previous CCAL standard.

3.6 Duplicate sample results should agree within ±50% for solids or ±30% for waters.

3.7 Method blanks should be free of target compounds or contaminants that could interfere with the proper quantitation of target compounds.

3.8 Extracts must be analyzed within 14 days of extraction.

MET4008

Determination of Polycyclic Aromatic Hydrocarbons (PAHs), and Alkyl-PAHs by Gas Chromatography with Mass Spectrometric Detection Using the Selective Ion Monitoring Mode (GC/MS/SIM)

1.0 Scope and Application

1.1 This method is applicable to the analysis of the following compounds:

Compound	CAS Number
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)	
*Naphthalene	91-20-3
C_1-Naphthalenes	
C_2-Naphthalenes	
C_3-Naphthalenes	
C_4-Naphthalenes	
*1-Methylnaphthalene	90-12-0
*2-Methylnaphthalene	91-57-6
*Acenaphthylene	208-96-8
*Acenaphthene	83-32-9
*Fluorene	86-73-7
C_1-Fluorenes	
C_2-Fluorenes	
C_3-Fluorenes	
*Dibenzothiophene	132-65-0
C_1-Dibenzothiophenes	
C_2-Dibenzothiophenes	
C_3-Dibenzothiophenes	
*Phenanthrene	85-01-8
*Anthracene	120-12-7
C_1-Phenanthrene/anthracenes	
C_2-Phenanthrene/anthracenes	
C_3-Phenanthrene/anthracenes	
C_4-Phenanthrene/anthracenes	
*Fluoranthene	206-44-0
*Pyrene	129-00-0
C_1-Fluoranthene/pyrenes	
C_2-Fluoranthene/pyrenes	
C_3-Fluoranthene/pyrenes	

1.1Continued . . .

Compound	CAS Number
PAHs, Continued ...	
*Benz(a)anthracene	56-55-3
*Chrysene	218-01-9
C_1-Chrysenes	
C_2-Chrysenes	
C_3-Chrysenes	
C_4-Chrysenes	
*Benzo(b)fluoranthene	205-99-2
*Benzo(k)fluoranthene	207-08-9
*Benzo(a)pyrene	50-32-8
*Indeno(1,2,3-cd)pyrene	193-39-5
*Dibenz(a,h)anthracene	53-70-3
*Benzo(g,h,i)perylene	191-24-2

*Indicates an analyte quantified by comparison to a known reference standard. All other analytes are estimated using assumed response factors.

1.2This method can be applied to any combination of the compounds on this list, or to the complete list. Other hydrocarbon compounds may be added once their retention times and response factors have been established.

1.3This method is applicable to the determination of compounds for extracts prepared according to SOP No. MET2510.

2.0Analysis of Extracts

2.1GC/MS Operating Conditions

2.1.1Samples are analyzed by capillary column GC/MS with the GC operated in the splitless injection mode, and the MS operated in the selective ion monitoring (SIM) mode.

2.1.2The following GC conditions apply:

Column:30 m x 0.25 mm fused silica capillary with 0.25 μm film thickness chemically bonded 5% phenyl methyl polysiloxane (DB-5 or equivalent)

	Inlet purge valve open after 0.5 minutes
Oven:	2.0 minutes at 33°C Ramp at 6°C/minute to 300°C Hold for 15 minutes
Pressure program: (if available)	0.01 minutes at 6.0 psi Ramp at 99.0 psi/minute to 25.0 psi Hold for 0.10 minutes Ramp at 99.0 psi/minutes to 6.0 psi Then constant flow mode
Inlet:	295°C
Detector:	280°C

2.1.31 to 2 μL samples are injected by autosampler.

2.1.4The PAHs and alkyl-PAHs are analyzed for the selected m/z ions specified below. Because of the large number of m/z ions being scanned for, it is necessary to analyze each sample extract twice.

2.1.4.1Because the retention times of the compounds shift, it is recommended to run a known sample of petroleum and/or coal tar using full scan MS to determine the time intervals for the different groups of m/z ions, before the calibration standard is run. The analyst must be sure the time interval for each group is sufficiently large to include all compounds of interest.

2.1.4.2The groups listed in 2.1.4.c are suggestions, but may need to be changed if retention times shift. If other target compounds are added to the method, the m/z ion groupings may need to be changed to accomodate the new m/z ions.

2.1.4.3 <u>Run A</u>Scans for naphthalene, alkyl-naphthalenes, phenanthrene, anthracene, alkylated phenanthrenes/anthracenes, fluoranthene, pyrene, alkylated fluoranthenes/pyrenes, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene.

m/z ions:
Group 1:96, 126, 127

Group 2:127, 128, 129, 136, 141, 142, 155, 156, 170, 171, 172

Group 3:141, 155, 156, 165, 169, 170, 176, 178, 179, 184, 188, 191, 192

Group 4:101, 165, 178, 179, 188, 189, 191, 192, 202, 205, 206, 215, 216, 219, 220, 230, 234, 245, 260

Group 5:189, 205, 215, 216, 219, 220, 230, 234, 240, 244

Group 6: 189, 244, 252, 253, 260, 264

Run BScans for biphenyl, acenaphthylene, acenaphthene, fluorene, alkylated fluorenes, dibenzothiophene, alkylated dibenzothiophenes, benz(a)anthracene, chrysene, alkylated benz(a)anthracenes/chrysenes, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene.

m/z ions:
Group 1:96, 126, 127

Group 2:136, 152, 153, 154, 171, 172

Group 3:139, 152, 165, 166, 176, 179, 180, 184, 193, 194, 208

Group 4:139, 152, 165, 179, 180, 184, 188, 193, 194, 197, 198, 208, 211, 212, 226, 230, 245

Group 5:211, 226, 228, 230, 240, 241, 242, 256, 270, 284

Group 6:226, 241, 242, 256, 264, 270, 284

Group 7: 138, 139, 276, 278

2.2 Compound Identification

2.2.1 Identify sample components by comparison of retention times (RTs) to RT data from the most recent, previous calibration standard. The width of the RT window should be based upon measurement of actual RT variations of standards over the course of a day. However, the experience of the analyst should weigh heavily in the interpretation of the chromatograms, particularly if pattern recognition is an important factor for peak identifications.

2.2.2 Confirm the identity of all compounds by comparing their mass spectra to the standard mass spectra. Determine the peak area for the primary ion extracted ion current profile (EICP) for each compound, internal standard, and surrogate standard peak.

2.2.3 If any peak area exceeds the linear range of the instrument as demonstrated during the initial calibration, the extract must be diluted and reanalyzed.

2.3 Calculations

2.3.1 The internal standard compounds fluorene-d10 and chrysene-d12 are added to every extract to give a concentration of 40 μg/mL in the final extract.

2.3.2 The concentration of each component is calculated using the Internal Standard Method (ISM) and based on the areas of the peaks of interest and the RRFs for the individual unsubstituted PAHs relative to the appropriate internal standard.

2.3.2.1 The concentrations of the PAHs are determined directly using the RRFs obtained from the daily calibration standard.

2.3.2.2 The concentrations of the alkyl-PAHs are determined using the RRFs of the corresponding unsubstituted PAH compounds from the daily calibration standard.

2.3.3 Each group of alkyl-PAH homologs is treated as a single multicomponent constituent.

2.3.3.1 The appropriate m/z ion and RT windows is determined by full scan GC/MS analysis of appropriate standards (e.g., crude oil and coal tar).

2.3.3.2 Once the homolog group has been identified, the EICP area response is determined by straight baseline integration.

2.3.4 Refer to SOP No. MET1008 for more information on performing sample calculations.

3.0 Quality Control

3.1 The GC/MS system must be tuned every twelve hours to meet the criteria in Table 1 for a 50-ng injection of decafluorotriphenylphosphine (DFTPP).

3.1.1 The twelve-hour time period for a GC/MS analytical run begins at the moment of injection of the DFTPP verification standard.

3.1.2 The mass spectrum of DFTPP must be acquired in the following manner. Three scans (the peak scan, and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is required and must be accomplished using a single scan prior to the elution of DFTPP.

3.1.3 Analyses, including calibrations, should not begin until all of the criteria are met.

3.1.4 All subsequent standards, field samples, and QC samples must be analyzed under the DFTPP-verified mass spectrometer conditions.The GC/MS system must be tuned to meet the criteria in Table 1 for a 50-ng injection of decafluorotriphenylphosphine (DFTPP). Analyses, including calibrations, should not begin until all of the criteria are met. Background subtraction should be straightforward and designed only to eliminate column bleed or instrument background ions.

3.2 Prior to analyzing any standards or samples, run a crude oil and coal tar standard, using the same operating conditions, except the MS in full scan mode.

3.2.1 Use the crude oil and coal tar standards to determine the proper RT windows for the alkyl-PAHs.

3.3 An initial calibration consisting of five levels of concentration should be analyzed prior to sample analysis. The %RSD of the relative response factors (RRFs) should be $\leq 20\%$.

3.3.1 After the ICAL, a check standard should be analyzed. Check standard recoveries should be 90 to 110% of the true values.

3.3.2 For more information on evaluating initial calibration performance, see SOP No. MET1002.

3.4 On each day that samples are analyzed, a continuing calibration (CCAL) standard must be analyzed prior to sample analysis. The CCAL should be at a mid-level concentration. The %D between the CCAL RRFs and the ICAL average RRFs should be ≤ 15%.

3.4.1 In addition, a CCAL standard should be analyzed after every 15 samples and at the end of the sequence, to evaluate shifts in retention times and instrument sensitivity.

3.5 Surrogate standard and matrix spike compound %Recs in the samples.should be 50 to 120% of the true values.

3.5.1 For spike blanks, matrix spike compound %Recs should be 80 to 120% of the true values.

3.6 Internal standard areas in the samples should be within -50 to +200% of the internal standard areas in the most recent, previous CCAL standard.

3.7 Duplicate sample results should agree within ±50% for solids or ±30% for waters.

3.8 Method blanks should be free of target compounds or contaminants that could interfere with the proper quantitation of target compounds.

3.9 Independent check sample %Recs should be 80 to 120% of the true values.

3.10 Extracts must be analyzed within 40 days of extraction.

Table 1
DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	30 - 60% of mass 198
68	< 2% of mass 69
69	Present
70	< 2% of mass 69
127	40 - 60% of mass 198
197	< 1% of mass 198
198	Base peak, 100% relative abundance
199	5 - 9% of mass 198
275	10 - 30% of mass 198
365	> 1% of mass 198
441	Present, but less than mass 443
442	40 - 110% of mass 198
443	17 - 23% of mass 442

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META ENVIRONMENTAL, INC.

LABORATORY QUALITY ASSURANCE PLAN

Prepared by:

META Environmental, Inc.
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Watertown, MA 02472
617-923-4662

Written by: David M. Mauro, Quality Assurance Officer — Date: 1/31/03

Updated by: David R. Craig, Laboratory Director — Date: 1/31/03

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Source Materials Database 50

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APPENDIX A: PERSONNEL RESUMES
APPENDIX B: STANDARD OPERATING PROCEDURES

SOP No.	Title	(Add new SOPs and EPA Method #s where appropriate)

General Procedures

MET1001	Cleaning Laboratory Glassware
MET1002	Preparation, Storage, Documentation, and Use of Chemical Standards
MET1003	Maintenance of Gas Chromatographs (GCs)
MET1004	Percent Solids (%Sol) by Gravimetric Analysis
MET1005	Handling and Disposal of Laboratory Wastes
MET1006	Preparation of Sodium Sulfate
MET1007	Reduction of Extract Contamination
MET1008	Calculation of Organic Gas Chromatographic (GC) Data Results
MET1009	Ordering, Storage, Handling, and Monitoring of Laboratory Solvents and Acids
MET1010	*RENAMED MET5505*
MET1011	*RENAMED MET5506*
MET1012	*RENAMED MET5507*
MET1013	Procedures for Monitoring Refrigerator and Freezer Performance
MET1014	Procedure for Monitoring Analytical Balance Performance
MET1015	*RETRACTED*
MET1016	Preparation and Activation of Alumina
MET1017	Maintenance of the Mass Selective Detector (MS)
MET1018	RESERVED (Procedures for Good Laboratory Syringe Technique)
MET1019	Common Statistical Formulas for Evaluating Accuracy and Precision
MET1020	Preparation of Sodium Hydroxide Solutions
MET1021	Preparation of Sulfuric Acid Solutions
MET1022	Maintenance of Gas Chromatographic (GC) Detectors
MET1023	Maintenance of the Fourier Transform Infrared Spectrophotometer (FTIR)
MET1024	Procedures for Changing Compressed Gas Cylinders
MET1025	Preparing the Gas Chromatograph (GC) for an Idle Period
MET1026	Required Quality Control (QC) Samples
MET1027	Preparation, Use, and Analysis of Reference Spikes

Aqueous Extraction Methods

MET2001	Extraction of Monocyclic Aromatic Hydrocarbons (MAHs) from Water by Liquid-Liquid Microscale Solvent Extraction (MSE)
MET2002	Extraction of Acidic Organic Compounds (including CPs and SVOCs) from Water by Liquid-Liquid Microscale Solvent Extraction (MSE)
MET2003	Extraction of Neutral Organic Compounds (including PAHs, some MAHs, PCBs, MO, SVOCs, and TPH) from Water by Liquid-Liquid Microscale Solvent Extraction (MSE)
MET2004	Extraction of Total Petroleum Hydrocarbons (TPH) from Water by Liquid-Liquid Microscale Solvent Extraction (MSE)
MET2005	Extraction of Acidic, Neutral, and/or Basic Organic Compounds (including MAHs, PAHs, and Phenols) from Water by Hand Shake Microscale Solvent Extraction (MSE)

Solid Extraction Methods

MET2501	Extraction of Monocyclic Aromatic Hydrocarbons (MAHs) From Soil by Hand Shake Microscale Solvent Extraction (MSE)
MET2502	Extraction of Acidic Organic Compounds (including CPs) from Soil by Sonication Microscale Solvent Extraction (MSE)
MET2503	Extraction of Organic Compounds (including PAHs, some MAHs, PCBs, MO, SVOCs, N-PACs, S-PACs, and TPH) from Soil by Sonication Microscale Solvent Extraction (MSE)
MET2504	Extraction of Organic Compounds (including PAHs, some MAHs, PCBs, MO, SVOCs, N-PACs, S-PACs, and TPH) from Soil by Soxhlet Microscale Solvent Extraction (MSE)
MET2505	Extraction of Total Petroleum Hydrocarbons (TPH) from Soil by Sonication Microscale Solvent Extraction (MSE)
MET2506	Extraction of Monocyclic Aromatic Hydrocarbons (MAHs) from Tar by Hand Shake Microscale Solvent Extraction (MSE)
MET2507	Extraction of Organic Compounds (including PAHs, N-PACs, and S-PACs) from Tar by Hand Shake Microscale Solvent Extraction (MSE)
MET2508	Extraction of Monocyclic Aromatic Hydrocarbons (MAHs), Polycyclic Aromatic Hydrocarbons (PAHs), and Phenolic Compounds From Soil by Hand Shake Microscale Solvent Extraction (MSE)
MET2509	Extraction of Chlorinated Phenolic (CP) Compounds from Wood by Soxhlet Microscale Solvent Extraction (MSE)
MET2510	Extraction of Organic Compounds (including PAHs, Alkyl-PAHs, and Biomarker Compounds) from Soil by Macro-Soxhlet
MET2511	Extraction of HPAHs and PCP from Soil by Soxhlet
MET2512	Waste Dilution of NAPL Samples

Extract Cleanup Methods

MET3001	Acid/Base Partition Cleanup of Extracts
MET3002	Cleanup of Extracts with Silica Gel by Hand Shaking
MET3003	Florisil Column Cleanup of Extracts
MET3004	Acid Cleanup of Extracts
MET3005	Sulfur Cleanup of Extracts
MET3006	Alumina Column Class Fractionation of Extracts of Petroleum Wastes: Method One
MET3007	Alumina Column Class Fractionation of Extracts of Petroleum Wastes: Method Two
MET3008	Alumina Column Cleanup of Extracts
MET3009	Silica Gel Fractionation

Sample (Extract) Analysis Methods

MET4001	Determination of Monocyclic Aromatic Hydrocarbons (MAHs) by Gas Chromatography with Flame Ionization Detection (GC/FID)
MET4002	Determination of Organic Compounds (including CPs and PCBs) by Gas Chromatography with Electron Capture Detection (GC/ECD)
MET4003	Determination of Organic Compounds (including PAHs, some MAHs, Saturated Hydrocarbons, and TPH) by Gas Chromatography with Flame Ionization Detection (GC/FID)
MET4004	Determination of Organic Compounds (including PAHs, S-PACs, N-PACs, SVOCs, and TPH) by Gas Chromatography with Mass Spectrometric Detection (GC/MS)
MET4005	Determination of Total Petroleum Hydrocarbons (TPH) by Fourier Transform Infrared Spectroscopy (FTIR)
MET4006	Determination of Organic Compounds (including N-PACs) by Gas Chromatography with Mass Spectrometric Detection Using the Selective Ion Monitoring Mode (GC/MS/SIM)
MET4007	Simultaneous Determination of Monocyclic Aromatic Hydrocarbons (MAHs) and Polycylic Aromatic Hydrocarbons (PAHs) by Gas Chromatography with Flame Ionization Detection (GC/FID)

MET4008	Determination of Polycyclic Aromatic Hydrocarbons (PAHs) and Alkyl-PAHs by Gas Chromatography with Mass Spectrometric Detection Using the Selective Ion Monitoring Mode (GC/MS/SIM)
MET4009	Determination of Chlorinated Benzenes (CBs) by Gas Chromatography with Electron Capture Detection (GC/ECD)
MET4010	Determination of High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs) and Pentachlorophenol (PCP) by Gas Chromatography with Mass Spectrometric Detection Using the Selective Ion Monitoring Mode (GC/MS/SIM)
MET4011	Determination of Biomarker Compounds by Gas Chromatography with Mass Spectrometric Detection Using the Selective Ion Monitoring Mode (GC/MS/SIM)
MET4012	Determination of
MET4013	Determination of

Information and Document Management

MET5001	Writing and Management of Standard Operating Procedures (SOPs)
MET5002	General Procedures for Project and Information Management
MET5003	Procedures for Information Tracking and Management in the Laboratory
MET5004	Procedures for Sample Receipt, Login, and Documentation
MET5005	Procedures for the Use and Maintenance of the Sample Tracking Database
MET5006	RESERVED (Procedures for the Use and Maintenance of the Chemical Inventory Database)
MET5007	RESERVED (Procedures for the Use and Maintenance of the Source Materials Database)
MET5008	RESERVED (Organization and Long Term Storage of Electronic Data)
MET5009	RESERVED (Raw Data Migration)

Data Reporting

MET5501	Excel Macro Reporting: For GC Data Generated by Hewlett-Packard Chemstation Software
MET5502	Excel Macro Reporting: For GC Data Generated with a Hewlett-Packard 3396a Integrator
MET5503	Excel Custom Reports: For GC/MS Data Generated by Hewlett-Packard Chemstation Software
MET5504	RESERVED (Generating Fourier Transform Infrared (FTIR) Spectrophotometer Data Using Custom Macros)
MET5505	Initial Reduction and Review of Chemical Data (*formerly MET1010*)
MET5506	Secondary Review of Chemical Data (*formerly MET1011*)
MET5507	Quality Assurance (QA) Review of Chemical Data (*formerly MET1012*)
MET5508	RESERVED (Preparing and Generating Quality Control Charts)

Field Sampling Methods

MET6001	Decontamination of Equipment in the Field
MET6002	Procedures for Logging Subsurface Conditions in Test Pit Excavations
MET6003	Procedures for the Use of Soil Boring Logs
MET6004	RESERVED (Procedures for Subsurface Soil Sampling: Little Beaver)
MET6005	RESERVED (Procedures for Subsurface Soil Sampling: Geoprobe)
MET6006	Procedures for Subsurface Soil Sampling: Drilling
MET6007	RESERVED (Procedures for Soil Sample Compositing and Homogenization)
MET6008	Procedures for Sampling Surface and Seep Waters
MET6009	Procedures for the Packing and Shipping Environmental Samples
MET6010	Procedures for Surface Soil Sampling
MET6011	RESERVED (Collection of Groundwater Samples by Bailer)
MET6012	RESERVED (Collection of Groundwater Samples by Grundfos)
MET6013	Designation of Sample Priority
MET6014	Procedure for the Collection of PCB Wipe Samples

MET6015	RESERVED (Procedures for Subsurface Soil Samples: and Augers)
MET6016	Installation and Development of Screened Multilevel Samplers (SMLSs)
MET6017	Procedures for the Sampling of Screened Multilevel Samplers (SMLSs)
MET6018	RESERVED (Procedures for Evaluating and Sampling Test Pits)
MET6019	RESERVED (Procedures for the Preservation of Field Samples)
MET6020	Procedures for the Installation of Groundwater Monitoring Wells
MET6021	Procedure for the Collection of Groundwater Samples by Peristaltic Pump
MET6022	Procedure for the Preparation of Chain-of-Custody (COC) Forms
MET6023	Procedures for the Monitoring of Ambient Air Quality Using a Portable PID Meter
MET6024	Procedures for the Screening of Samples in the Field Using a Portable PID Meter
MET6025	RESERVED (Procedures for the Development of Groundwater Monitoring Wells)
MET6026	Procedures for Sampling Sediments

Client-Specific or Special Methods and Procedures

MET7001	Gravimetric Determination of Percent Oil and Grease (%O&G) and Total Extractable Hydrocarbons (TEH) in Soil by Macro-Soxhlet Solvent Extraction
MET7002	Gravimetric Determination of Percent Extractable Organics (%EO) in Soil or Water by Solvent Extraction
MET7003	*RETRACTED*
MET7004	Determination of Ethanol (EtOH) in Soil by Direct Aqueous Injection (DAI) onto a Gas Chromatograph with a Flame Ionization Detector (GC/FID)
MET7005	RESERVED (Determination of PTE and PXE by GC/FID)
MET7006	RESERVED (BCI Carbon Trap Extraction)

In-House SOPs for Standard, Published Methods

MET8270	In-House Procedures for the Preparation and Analysis of Samples by USEPA Standard Method 8270 Mod.
MET8508	In-House Procedures for the Preparation and Analysis of Aqueous Samples by USEPA Standard Method 508 Mod.
MET8525	In-House Procedures for the Preparation and Analysis of Aqueous Samples by USEPA Standard Method 525.2 Mod.
MET8608	In-House Procedures for the Preparation and Analysis of Samples by USEPA Standard Method 608 Mod.

APPENDIX C: ASSORTED DOCUMENTATION

- Analytical Request Form
- Chain of Custody Record
- Sample Receipt Logsheet
- Sample Storage Logsheet
- Sample Extraction Logsheet
- Instrument Maintenance Logsheet
- Standard Preparation Logsheet
- Laboratory QC Summary Form
- Refrigerator/Freezer Temperature Logsheet
- Balance Daily Check Record
- Laboratory Distilled Water Check Logsheet
- Chemical Inventory Logsheet
- Non Conformance Report Form
- Quality Assurance Report Form

APPENDIX D: METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS
APPENDIX E: IN-HOUSE LABORATORY AUDIT CHECKLIST
APPENDIX F: IN-HOUSE SAFETY INSPECTION CHECKLIST

LIST OF ABBREVIATIONS

AB..... .....Aqueous Method (Extraction) Blank
ABS.... .....Aqueous Blank Spike
CLP.... .....Contract Laboratory Program
CB..... .....Chlorinated Benzene compound
CP..... .....Chlorinated Phenolic compound
COC... .....Chain of Custody
DFTPP Decafluorotriphenylphosphine
EB..... .....Equipment Blank
EPA.... .....Environmental Protection Agency
ESM ... .External Standard Method of calculation
FB..... .....Field Blank
FTIR... .....Fourier Transform Infrared Spectroscopy
GC ....Gas Chromatography
GC/ECD.....GC with Electron Capture Detection
GC/FID GC with Flame Ionization Detection
GC/MS GC with Mass Spectrometric Detection
HASP.. .....Health and Safety Plan
HPAH. .....High Molecular Weight Polycyclic Aromatic Hydrocarbon compound
HSO.... .....Health and Safety Officer
IS..... .....Internal Standard
ISM ....Internal Standard Method of calculation
LB..... .....Laboratory Equipment Blank
LD..... .....Laboratory Director
LQAP . .....Laboratory Quality Assurance Plan
MAH .. ..Monocyclic Aromatic Hydrocarbon compound
MADEP.....Massachusetts Department of Environmental Protection
MDL... .....Method Detection Limit
MSDS.. .....Material Safety Data Sheet
MSE ... .Microscale Solvent Extraction
MS/MSD.....Matrix Spike/Matrix Spike Duplicate
N-PAC. .....Nitrogen containing Polycyclic Aromatic compound
PAC.... .....Polycyclic Aromatic Compound
PAH.... .....Polycyclic Aromatic Hydrocarbon compound
PCB.... .....Polychlorinated Biphenyl compound
PCP.... .....Pentachlorophenol
PE..... .....Performance Evaluation
PFTBA .....Perfluorotributylamine
PM ....Project Manager

PQL.... .....Practical Quantitation Limit
QA ....Quality Assurance
QAPP.. .....Quality Assurance Project Plan
QAO... .....Quality Assurance Officer
QC ....Quality Control
RB..... .....Reagent Blank
%Rec .. ..Percent Recovery
RPD.... .....Relative Percent Difference
RS..... .....Reagent Spike
%RSD . .....Percent Relative Standard Deviation
SAP ....Sampling and Analysis Plan
SB ....Soil Method (Extraction) Blank
SBS..... .....Soil Blank Spike
SOW... .....Statement of Work
S-PAC . .....Sulfur containing PAC
SS..... .....Surrogate Standard
SVOC.. .....Semivolatile Organic Compound
TAT.... .....Turnaround Time for analysis
TB..... .....Trip Blank
TCL.... .....Target Compound List
TPH.... .....Total Petroleum Hydrocarbon compounds
VOC ... .Volatile Organic Compound
WB..... .....(Field) Water Blank

Section 1

INTRODUCTION

As a result of the upsurge in environmental awareness and the regulations promulgated as a result of this increasing awareness, the growth in the environmental analysis field has been phenomenal. Along with this growth has come an increasing need to standardize laboratory operations so that data generated by different laboratories are comparable. Data quality, and the means by which that quality is documented, has become an important issue not only for the users of the data, but for the analytical laboratories generating it. The terms "quality assurance" and "quality control" are now in common use. Although there are many definitions of quality assurance and quality control, nearly everyone in the environmental field has some understanding of their meaning and their necessity.

This Laboratory Quality Assurance Plan (LQAP) attempts to define quality assurance and quality control as they are understood by this company, and also details the specific mechanisms by which those terms are embodied by the actions of this laboratory.

QUALITY ASSURANCE

Quality assurance (QA) is the system of methods used to ensure high quality data output. Generally speaking, QA occurs on the "management" level, and includes such measures as: the establishment of analytical Standard Operating Procedures (SOPs), documentation of sample history (Chain-of-Custody), use of quality glassware and solvents, routine preventive maintenance of analytical systems, and multistep data review and approval.

Quality control (QC) is the system of analytical tests and checks used to assure that the data being generated conform to the QA standards, and to document that fact for review. QC occurs on a "functional" level, and may include: establishment of sample extraction and analytical holding times, establishment of initial and continuing calibration criteria for the analytical system, the analysis of various QC samples (such as duplicates and matrix spike samples), and the use of internal and surrogate standards to ensure accuracy, precision, representativeness, completeness, and comparability of sample results.

This LQAP details the QA measures and QC tests used to produce data of known and documented quality.

GOALS

Simply stated, it is the goal of META Environmental, Inc. (META) to produce data of the highest quality possible. Whether samples are analyzed by standard methods, modifications of standard methods, or by a method developed specifically for use at a particular site or on a particular type of sample, the resultant data should be of known quality. The QC criteria used to evaluate performance should be well defined, and will be at least as stringent as criteria stated in similar published methods. The QC criteria will be appropriate and applicable both to the type of analysis being considered, and to the overall goals of the project for which the data are being used.

POLICIES

META's policies are constantly growing and expanding, as our company grows and expands. The relationship is dynamic, designed to reflect the important commitments that all of META's personnel support. In particular, META is committed to:

- generating data of high quality
- safety in the workplace
- preservation of the environment
- being responsive to client needs
- building a reputation based on excellence

OBJECTIVES

The overall analytical QA objective for any project is to provide physical and chemical data of known quality. To this end, data quality will be assessed for precision, accuracy, completeness, representativeness, and comparability, and appropriate QC measures will be employed.

Although every project is evaluated individually to design a system of QA/QC that will be most effective and applicable to that project's goals, some generalizations may be made. A system of careful monitoring and documentation, along with the use of quality equipment and established procedures, is used to ensure high quality results. For example, the use of frequent blank analyses helps monitor analytical method performance.

LEVEL OF QA EFFORTS

META employs an internal QA program, defined by this LQAP. The QA program is a system of overall management, which ensures that the specific QC measures for any project are functioning properly to generate data of high quality. As will be detailed in the following sections, the QA program includes:

- a mechanism for data review and evaluation
- a mechanism for the identification of QA problems
- expedition of corrective actions
- a system for preventive maintenance of analytical equipment
- documentation of training
- well-defined SOPs
- a system for internal laboratory and performance audits

Accuracy and Precision

Accuracy is a measure of the degree of agreement between an analyzed value and the true or accepted reference value where it is known. Accuracy is determined through the analysis of matrix spike (MS) samples, QC check standards,

and performance evaluation (PE) samples, and is usually expressed in terms of percent recovery (%Rec) of analytes. SOP No. MET1008 describes the calculation of %Rec.

Precision is a measure of the mutual agreement among individual measurements of the same parameter under similar conditions. Precision is determined through the analysis of duplicate samples, including laboratory, blind, and field duplicate samples. Matrix spike/matrix spike duplicate (MS/MSD) samples may also be used as a measure of precision. Precision is usually expressed in terms of relative percent difference (RPD) or percent relative standard deviation (%RSD). SOP No. MET1008 describes the calculation of RPD and %RSD.

Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system, expressed as a percentage of the number of valid measurements that should have been or were planned to be collected. META will make every attempt to generate valid data from all samples received. Sufficient sample material should be collected to assure that samples can be reanalyzed as necessary. In addition, precautions should be taken during the packing and shipping of samples to minimize the possibility of breakage. SOP No. MET6009 describes the optimum procedures for packing and shipping field samples in order to minimize in-transport breakage. However, realistically, some samples may be lost or results deemed questionable due to sample matrix effects or internal QC problems. META will make every attempt to generate data that is at least 95% complete.

Representativeness

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the sample. Sampling will be performed in strict accordance with the sampling procedures defined in the approved project sampling plan. These sampling procedures were developed to preserve the representativeness of the collected samples. In addition, measures will be taken to ensure that cross-contamination of field samples does not occur. In particular, field decontamination of all reusable sampling equipment is performed between every sample, and rinsate blanks are collected regularly. SOP No. MET6001 describes the proper procedure for decontamination of field sampling equipment.

Comparability

Comparability is a measure of how closely sample data generated by the primary laboratory and method compared to data generated by another laboratory or method. META will ensure data comparability by operating within the linear range of the analytical instruments and by strict adherence to the analytical and QA/QC protocols defined in this LQAP and/or the project-specific Quality Assurance Project Plan (QAPP).

Definition of QC Blank Sample Types

A field water blank (WB) is a blank prepared from each of the distilled water sources used on-site. One field water blank is required from each water source. If distilled water is purchased for use, then a single blank is required for each brand of water purchased. The field water blank is an indicator of problems with the distilled water used in equipment decontamination procedures.

A field equipment blank (FB or EB) is a composite rinsate of all of the sampling equipment that comes into contact with the sample during the sampling procedure. It is an indicator of problems with the equipment decontamination procedures.

A trip blank (TB) is a blank prepared at the analytical laboratory, then shipped out to the field. The trip blank is stored and shipped in the same cooler as the samples being collected. The trip blank is an indicator of contamination that may have occurred within the cooler during storage and shipment. The trip blank is generally analyzed for volatile organic compounds only.

A laboratory equipment blank (LB) is a composite rinsate of all the laboratory sample preparation equipment that comes into direct contact with the sample. This equipment includes: weighing pans, culture tubes, scintillation vials, K-D receivers, and extract vials. If any contamination is found, then individual rinsates must be performed. The laboratory equipment blank is an indicator of in-house contamination problems.

A reagent blank (RB) is an aliquot of each type and quality of reagent used in the analytical process that has been spiked with surrogate and internal standards. It is an indicator of problems with contaminated solvents.

A method (extraction) blank (SB for soil or AB for aqueous) is an aliquot of clean water or $NASO_4$ that has been extracted under the same conditions as the samples. It is an indicator of problems with contaminants introduced during the sample preparation procedure.

Definition of QC Duplicate Sample Types

A field duplicate is a sample that is collected in duplicate in the field at the time of sampling. Two sample containers are filled, and they are logged in separately upon arrival at the laboratory. Since an internal laboratory ID is assigned to each sample at the time of log in, and since these internal IDs are used to track the sample through the extraction and analysis process, a field duplicate sample is essentially the same as a blind duplicate (described below), although the laboratory does have the means of identifying field duplicates by examining the original sample IDs.

A blind duplicate, like a field duplicate, is a sample that is collected in duplicate in the field at the time of sampling. However, in addition, the sample IDs for a sample and its blind duplicate are not indicative of the relationship between the two samples. In this way, the laboratory has no means of identifying possible duplicate pair samples, and it can be assumed that the analytical results will be completely unaffected by subjective judgements in this regard.

A laboratory duplicate is a duplicate that is prepared at the time of extraction. A single sample jar has been received, but the laboratory prepares two separate aliquots of the sample for extraction and analysis.

Definition of QC Spike Sample Types

A blank spike (SBS for soil or ABS for aqueous) is an aliquot of clean water or $NaSO_4$ that has been spiked with a mixture of some or all of the target analytes at a known concentration prior to extraction. The BS is then extracted

under the same conditions as the samples. The BS is an indicator of extraction efficiency within a specific extraction batch or for a specific analyte.

A matrix spike (MS) sample is prepared by taking a second aliquot of a sample which is being extracted, and spiking it with a mixture of some or all of the target analytes at a known concentration prior to extraction. The MS sample is extracted at the same time and under the same conditions as the unspiked or "native" sample. By knowing the amount spiked and the unspiked sample result, a percent recovery (%Rec) may be calculated for each of the spiked analytes. The MS is an indicator of extraction efficiency and sample matrix effects.

A matrix spike duplicate (MSD) sample is prepared by taking a third aliquot of the same sample used for the MS, and spiking it with the same mixture of target analytes at known concentration. The MSD sample is also extracted at the same time and under the same conditions as the native sample and the MS sample. %Recs may be calculated for the MSD, as they were for the MS. Also, by comparing the %Recs of the MS and MSD, it is possible to calculate a percent relative difference (RPD) between the two results. The MSD, therefore, is an indicator of extraction efficiency and sample matrix effects, as well as an indicator of analytical precision.

A reagent spike (RS) sample is prepared by spiking an aliquot (equal to the nominal final volume of the sample extracts) of the final solvent with the QC mixtures. This is done to evaluate the concentration of QC in the calibration standards and to normalize recoveries.

STANDARD OPERATING PROCEDURES

META recognizes the need for Standard Operating Procedures (SOPs) in order to have effective laboratory operation. The EPA CLP SOW (OLM01) states, "In any operation that is performed on a repetitive basis, reproducibility is best accomplished through the use of SOPs. As defined by the EPA, an SOP is a written document which provides directions for the step-by-step execution of an operation, analysis, or action which is commonly accepted as the method for performing certain routine or repetitive tasks."

META has established written SOPs for all developed or modified extraction, cleanup, and analysis methods, as well as for information management, good laboratory practices, sampling techniques, special or client-specific methods, and standard, published methods. A complete listing of all SOPs relevant to laboratory functions is included as Appendix B of this LQAP. Also, a three-ring binder containing the latest revisions of all SOPs relevant to laboratory functions is available in the laboratory. Each SOP is concluded with a signature page that is signed by every employee who has read that SOP. Laboratory employees are not allowed to perform any laboratory function unless they have read and signed the applicable SOPs.

In addition, META has established a numbering system for SOPs that facilitates the location of appropriate SOPs. Since a company may have literally hundreds of SOPs, a method of organizing those SOPs, and easily identifying the category into which the SOP falls, is extremely helpful. META's SOP numbering scheme is as follows:

Series	Description

MET1000 through 1999	General Procedures
MET2000 through 2499	Aqueous Extraction Methods
MET2500 through 2999	Solid Extraction Methods (includes tar, oil, wood, wipes, etc.)
MET3000 through 3999	Extract Cleanup Methods
MET4000 through 4999	Sample (Extract) Analysis Methods
MET5000 through 5499	Information and Document Management
MET5500 through 5999	Data Reporting
MET6000 through 6999	Field Sampling Methods
MET7000 through 7999	Client-Specific or Special Methods and Procedures
MET8000 through 8999	In-House SOPs for Standard Published Methods

In addition to having in-house SOPs for standard methods, META maintains a three-ring binder which contains copies of all the standard methods routinely used. Behind each standard method listing is a signature page that is signed by every employee who has read that method. Employees are not allowed to perform any standard method unless they have read and signed the method, as well as the in-house SOP for the method.

Section 2

CAPABILITIES

DEVELOPED AND MODIFIED METHODS

META has a broad range of developed and/or modified methods for the detection and quantification of organic compounds in various matrices. META also has the equipment, experience, and expertise to develop specific methods for many other types of organic compounds in difficult matrices. META has developed and continues to develop methods for clients with special analytical needs. META also offers significantly lower costs and shorter turnaround times than traditional analytical techniques. Twenty-four hour turnaround time is available for many methods. The following is a list of the developed and/or modified methods which META is currently capable of performing.

Constituent Group	Matrices
Monocyclic aromatic hydrocarbons	Soil, sediment, water, tar, wood
Polycyclic aromatic hydrocarbons	Soil, sediment, water, tar, wood
Chlorinated phenols, including pentachlorophenol	Soil, sediment, water, wood
Phenols and methyl phenols	Soil, sediment, water, tar
Polychlorinated biphenyls (Aroclors and congeners)	Soil, sediment, water, oil, wipes
Organochlorine pesticides	Soil, sediment, water
Nitrogen containing polycylic aromatic hydrocarbons	Soil, sediment, water, tar
Sulfur containing polycylic aromatic hydrocarbons	Soil, sediment, water, tar
Total petroleum hydrocarbons (by IR, GC or GC/MS)	Soil, sediment, water, tar
Biodegradation products of PAHs	Soil, sediment, water, tar

STANDARD METHODS

In addition, META can perform many standard, published analytical methods. Table 1 is a list of standard methods that can be performed by META.

ANALYTICAL REQUEST FORM

Clients wishing to have samples analyzed by META's laboratory are assigned a Project Manager (PM). They inform the PM, either verbally or in writing, of the number and types of samples to be analyzed, arrival date(s), method(s) of analysis, and the type of data package and turnaround time required. The PM then fills out an Analytical Request Form and submits it to the Laboratory Director (LD). When properly completed, this form assures that META has all the information necessary to properly analyze the samples to the client's specifications, and to generate a data package that suits the client's needs. A copy of the Analytical Request Form is included in Appendix C of this LQAP.

The PM should consult with the laboratory director (LD) as to whether the laboratory has the resources to analyze the requested samples, before promising such analysis to the client, especially if rush turnaround times (TAT) are involved.

Table 1
Standard Published Methods Performed by META

Reference	Constituent(s)	Description
EXTRACTION METHODS		
3510C	Semivolatile or non-volatile organics	Neutral, or acid/base/neutral two phase separatory funnel solvent extraction of waters
3540C	Semivolatile or non-volatile organics	Soxhlet solvent extraction of solids
3550B	Semivolatile or non-volatile organics	Sonication solvent extraction of solids
3580A	Semivolatile or non-volatile organics	Solvent dilution of waste or pure product
ANALYSIS METHODS		
608	Organochlorine pesticides and PCBs	Gas chromatography with electron capture detection
625	Acid/base/neutral extractables	Gas chromatography with mass spectrometric detection
8270C	Semivolatile organics	Gas chromatography with mass spectrometric detection
8061A	Phthalate esters	Gas chromatography with electron capture detection
8100	Polycylic aromatic hydrocarbons	Gas chromatography with flame ionization detection
COMBINED METHODS		
504.2	Ethylene dibromide (EDB) and dibromochloropropane (DBCP)	Microextraction of drinking waters, gas chromatography with electron capture detection
505.2	Organohalide pesticides and Aroclors	Microextraction of drinking waters, gas chromatography with electron capture detection
508	Chlorinated Pesticides	Separatory funnel solvent extraction of drinking waters, gas chromatography with electron capture detection
525.2	Polycyclic aromatic hydrocarbons	Solid phase extraction of drinking waters, gas chromatography with mass spectrometric detection
418.1/418.1 mod.	Total petroleum hydrocarbons	Separatory funnel or sonication solvent extraction, fourier transform infrared spectroscopy (FTIR)

GRO/DRO, AK101/102, WTPH-G/-D	Gasoline/diesel range total petroleum hydrocarbons	Separatory funnel, sonication or Soxhlet solvent extraction, gas chromatography with flame ionization detection

Table 1, Continued . . .
Standard, Published Methods Performed by META

Reference	Constituent(s)	Description
COMBINED METHODS, Continued . . .		
8015B	Non-halogenated volatile organics (including GRO)	Direct aqueous injection, gas chromatography with flame ionization detection
8015B mod.	Semivolatile or non-volatile organics (including DRO)	Separatory funnel, Soxhlet or sonication solvent extraction, gas chromatography with flame ionization detection

Section 3

LABORATORY ORGANIZATION

PERSONNEL

All META personnel associated with laboratory functions have been thoroughly trained, following the procedures outlined in Section 4 of this manual. All full-time laboratory personnel hold at least a four year degree in a scientific field, and several hold advanced degrees. Resumes for key laboratory personnel may be found in Appendix A of this LQAP. The organization and responsibilities of META's laboratory personnel are described in the following paragraphs.

Quality Assurance Officer

The Quality Assurance Officer (QAO) is responsible for overseeing META's Quality Assurance program to ensure that it is functioning properly. The responsibilities of the QAO are to:

- advise the Laboratory Director on methodology and QA/QC practices;
- discuss methods and QA/QC objectives with the Project Managers for each project;
- ensure annual internal laboratory audits are performed, including written summaries of the results of the audit;
- review a portion of the analytical data generated by the laboratory in accordance with the specifications in SOP No. MET5507;
- advise corrective actions for nonconformances;
- oversee all projects with regards to the methods and QA/QC practices;
- monitor and review all laboratory procedures and activities to assure conformance with the LQAP;
- oversee the development, writing, review, and maintenance of SOPs; and
- suggest pathways, experiments, or procedural changes to resolve laboratory QA issues.

Quality Assurance Staff

Quality assurance staff are not full time laboratory personnel. However, they do have significant experience with instrumental analyses, and data review and validation practices, so that they may review data for the LD if a backlog occurs. The quality assurance staff are responsible for familiarizing themselves with the project specific QA/QC criteria to be used when reviewing data. The quality assurance staff are also responsible for performing any QA related tasks that may be assigned to them by the QAO.

Laboratory Director

The Laboratory Director (LD) has overall responsibility for the smooth functioning of the laboratory, as well as the day-to-day activities. Only the LD may approve new incoming work. The responsibilities of the LD are to:

- monitor laboratory personnel for conformance with the QA/QC procedures described in the LQAP;

- advise laboratory personnel of any special requirements pertaining to a project;
- schedule the extraction and analysis of all samples, so that required holding times and/or the project specific timelines are met;
- oversee the implementation of any SOPs and modifications to SOPs pertaining to laboratory activities;
- review all data packages in accordance with SOP No. MET5506;
- review databases, tables of results, and QC reports prepared by the analysts;
- review or initiate nonconformance reports as necessary, suggest corrective actions for nonconformances; and
- develop training programs designed to continually improve the capabilities of the laboratory personnel.

Laboratory Analysts

The laboratory analysts are responsible for each task assigned to them by the LD. They are responsible for knowing the analytical and QC requirements specific to each project on which they work, and for reading the QAPP for those projects. If they are not familiar with a project's requirements, they are responsible for actively seeking that information by asking the QAO, LD and/or the Project Manager. In addition, the responsibilities of the laboratory analysts are to:

- be familiar with all SOPs relating to the laboratory, including: samples, storage, extraction, analysis, data reporting and documentation, and waste disposal;
- be familiar with all published analytical methods used by the laboratory;
- extract and analyze samples and prepare analytical standards;
- calculate and reduce generated analytical data in accordance with SOP No. MET5505, prior to review by the LD;
- use diligence to ensure that the data they generate is of the highest quality; and
- maintain the equipment and instruments that are used in the laboratory.

Laboratory Technicians

The responsibilities of the laboratory technicians are to:

- perform sample extractions and percent solids determinations;
- clean laboratory glassware in accordance with SOP No. MET1001; and
- archive and dispose of samples and extracts as directed by the LD.

Sample Custodian

The responsibilities of the sample custodian are to:

- sign for incoming field samples and verify the data entered on the Chain-of-Custody forms;
- enter sample information into the Sample Receipt Login database;

- generate Sample Receipt Logsheets;
- enter information into the sample tracking database;
- generate sample tracking reports;
- remove and replace samples in locked refrigerators and maintain Sample Storage logbooks.

Project Managers

Project Managers (PMs) may or may not be laboratory personnel. However, they do have significant interactions with the laboratory personnel. They work with the QAO, the LD, and the laboratory personnel to see that their projects are being performed and completed in conformance with the specified guidelines.

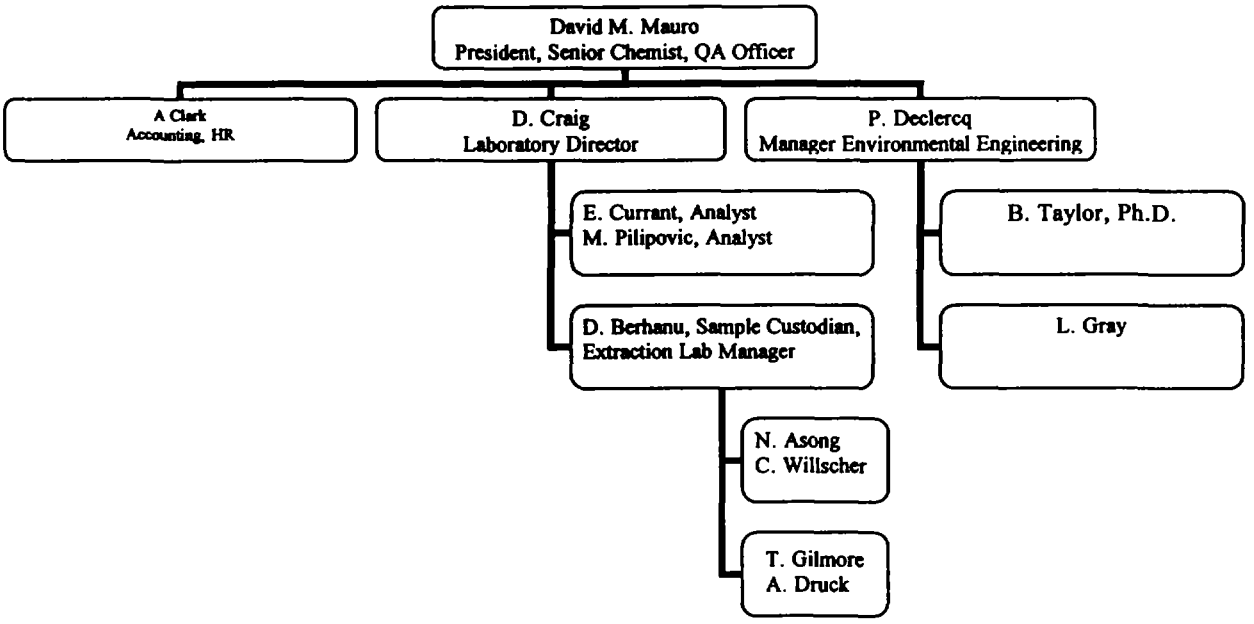
The responsibilities of the PM are to:

- confer with the QAO to determine the QA/QC objectives and methods to be used for each project;
- write a Sampling and Analysis Plan (SAP), a Health and Safety Plan (HASP), and a Quality Assurance Project Plan (QAPP) which detail those QA/QC objectives and methods;
- inform the LD of the QA/QC objectives, methods, and timeline for each project;
- coordinate sampling events with the LD to make certain that the laboratory is prepared to receive samples, and can handle the proposed sample load;
- organize all project data according to SOP Nos. MET5002 and MET5003 which describe the methods for project and information management, and sample tracking; and
- review the status of ongoing work in the laboratory and consult with the LD and QAO to see that the project objectives are being met.

The PM's responsibilities may be vary slightly from project to project, especially when META is not responsible for field sampling.

Figure 1 shows the organization of personnel at META.

Figure 1


David M. Mauro
President, Senior Chemist, QA Officer
A Clark
Accounting, HR
D. Craig
Laboratory Director
P. Declercq
Manager Environmental Engineering
E. Currant, Analyst
M. Pilipovic, Analyst
D. Berhanu, Sample Custodian,
Extraction Lab Manager
N. Asong
C. Willscher
T. Gilmore
A. Druck
B. Taylor, Ph.D.
L. Gray

Section 4

TRAINING

ANALYST TRAINING

All META laboratory analysts and technicians are thoroughly trained before they are allowed to perform unsupervised laboratory tasks. In addition, the QAO and the LD regularly check to make certain that no "bad habits" are being practiced. Corrective action is initiated at the first sign of any poor or questionable laboratory technique. Analysts are held accountable for sample data that they produce, and any questions regarding technique or documentation must be addressed by the analyst.

Iterative Training

META uses an iterative training technique, wherein the trainee is required to observe or perform a task several times under close supervision before they are approved for that task. The training series includes the following steps:

1. First, the trainee carefully reads the SOP for the procedure or the published standard method. Each analyst is given their own personal copy of the SOPs and/or method listings for all procedures for which they are trained. Any questions are answered by the person supervising the training before proceeding.
2. Second, the trainee observes the procedure being performed by a trained chemist. Again, any questions are answered before proceeding. The trainee is encouraged to take notes at this time.
3. Third, the trainee performs the procedure side-by-side with a trained analyst.
4. Fourth, the trainee performs the procedure alone, while being supervised by the LD.

The laboratory is equipped with two three-ring binder notebooks. One contains the most recent revision of each SOP related to laboratory operations. The other contains listings of every standard method routinely used by META. At the back of each SOP or method is a signature page, which is signed by each analyst qualified to do the described tasks. Employees are not allowed to perform any tasks unless they have read and signed the applicable SOP(s) and/or standard method(s).

Abbreviated Training

For an experienced analyst, the LD may feel it is adequate to use an abbreviated training series to introduce a new procedure. In this case, the training series includes, at a minimum, the following steps:

1. Reading the applicable SOP(s);

2. Clear verbal instructions from the LD or a trained analyst;

3. Performing the procedure alone, while being supervised by the LD or by a trained analyst with a final check by the LD.

DOCUMENTATION OF TRAINING

META keeps a current copy of each laboratory employee's resume. In addition, the signature pages located at the back of every SOP and standard method provide a means of tracking the training of each employee.

Each analyst is encouraged to keep a personal training file. The file could contain copies of SOPs, standard methods, personal notes, and the employee's current resume.

IDCs

Section 5

SAMPLE CUSTODY

CHAIN OF CUSTODY

The Chain-of-Custody (COC) form is designed to track the custody of environmental samples from the time they are collected in the field to the time they are received at the laboratory. It is signed and dated by all handlers. This information can be very important, especially if legal defensibility of the data is an issue.

All samples received into META's laboratory should be accompanied by a COC form. This form should filled out as completely as possible, including the following information: field ID, sample matrix, date of sampling, sampling team members, project name and number, signature of sample release with the time and date, and, most importantly, the analyses requested for the samples submitted. SOP No. MET6022 details the proper method of filling out the COC form. The COC should include field and trip blank samples. A copy of META's COC form is included in Appendix C of this LQAP. Because of the nature of the work that META performs in the laboratory, not all samples received by META (especially those sampled by someone other than META) are accompanied by the COC described above. If necessary, the client is called to obtain any missing information necessary for analysis. META does not reject samples based solely on the COC accompanying the samples.

SAMPLE RECEIPT

When a cooler containing samples arrives at META's laboratory, it is received by a laboratory worker who signs, dates, notes the time, and records the temperature of the samples contained in the cooler on the COC before proceeding. Next, the information entered on the COC form is checked against the contents of the cooler for accuracy. The samples are checked to make sure that all are present and properly labeled. The condition of the samples is inspected, and anything that might compromise sample integrity is noted. For example, broken or cracked sample jars or lids, or the internal temperature of the cooler upon arrival. In addition, the field preservation of the samples is checked for appropriateness to the requested method(s) of analysis. SOP No. MET6019 gives detailed information on the preservation of field samples, and also contains a summary table showing which preservatives are appropriate for each analysis. Any discrepancies are clearly noted and initialed on the COC. If the discrepancy is such that the sample IDs may be in doubt, the PM will be contacted and will work with the login staff and the sampling staff to resolve the discrepancy. In addition, if the samples were collected by someone other than META, then the client is contacted regarding any problems with the samples before analysis proceeds.

Each sample is assigned a laboratory ID, and the laboratory IDs are written on the COC. The laboratory IDs also are marked on the sample jars using either an indelible ink pen, or a printed label. The completed COC is filed in the Sample Receipt binder, behind the login sheets (described below). In addition, a copy of the COC is given to the PM. If the samples were shipped by common carrier (USP, FedEx, etc.) a copy of the shipping papers should also be filed in the Sample Receipt binder.

SAMPLE LOGIN

The assigned laboratory IDs consist of a two-letter prefix indicating the client, followed by the date of receipt, and a two-digit sequential number. For example, the sample ID XX020101-01 would indicate the first sample of the batch received from the XX Corporation on January 1, 2002. The two-letter prefix is decided upon by the PM and the LD prior to or upon the receipt of the samples, and recorded in the Sample Codes logbook. The Sample Codes logbook reduces the possibility of the same prefix being assigned to two different clients. If multiple jars of each sample are received, the laboratory ID is appended with an 'a' for the first, a 'b' for the second, etc. Field duplicate samples are assigned their own sample IDs (i.e., the suffix -DUP is not used).

The samples are then logged into the Sample Receipt Login database. This database contains the following information about every sample: lab ID, field ID, matrix, analyses requested, date sampled, date received, number and types of containers received, storage location, and any special comments pertinent to each sample or the project. For example, if the client has requested that a specific sample be used for the MS/MSD, that would be noted in the "comments" section of the login database. This procedure is detailed in SOP No. MET5004. After the samples are logged in, a copy of the Sample Receipt logsheet is printed out, checked for accuracy, signed and dated, and placed in the Sample Receipt binder in front of the COC. In addition, a copy is given to the PM. A copy of the Sample Receipt logsheet is included in Appendix C of this LQAP. SOP No. MET5004 details the sample login procedure.

In order to ensure the integrity of the sample information contained in the Sample Receipt Login database, the database is protected by a password. Only authorized staff know the password and have access to the database.

SAMPLE TRACKING DATABASE

In addition, the sample login information is entered into a Sample Tracking database. The Sample Tracking database contains all the information necessary to track the history of any sample analyzed by META's laboratory: field and laboratory sample IDs; all applicable dates (due, sampled, received, extracted, concentrated, analyzed); holding time; type of analysis; instrument of analysis; quality control batch ID and related QC samples; and reruns and dilutions.

The Sample Tracking database software is capable of sorting through the entered information in many ways, allowing the generation of customized status reports. For example, PMs can request project-specific status reports that list the samples that have been extracted, run, are awaiting dilution or rerun, or have been completed. And the LD can get a status report listing all samples that require percent solids, extraction, concentration, cleanup, analysis, dilution, reanalysis, etc.

The Sample Tracking database is maintained to aid in laboratory scheduling and document chain of custody for each sample, as well as provide a method of long term electronic storage. The Sample Tracking database is described in greater detail in SOP No. MET5005.

SAMPLE STORAGE

Following login, samples are placed into the walk-in refrigerator for storage. In the case of overflow, there are also additional refrigerators available for sample storage. There is also an upright freezer for samples which must be stored frozen. Each refrigerator or freezer containing samples has an associated Sample Storage logbook. These logs list which samples are currently stored in each refrigerator/freezer. Whenever samples are placed into a refrigerator/freezer, they are also added to the Sample Storage log listing. Also, every time samples are removed and replaced (i.e., when they are being extracted), the analyst must sign and date the log. Finally, when samples are removed for archiving or disposal, it is recorded on the Sample Storage log. A copy of the Sample Storage logsheet is included in Appendix C of this LQAP.

All sample storage locations at META are secure, to ensure the integrity of the samples while they are being stored. The walk-in refrigerator is supplied with a lock, and only the LD, sample custodian, and QAO have copies of the key. All other refrigerators and freezers used to store samples are located in a secure area.

SAMPLE DISPOSAL

Samples are stored at META for a standard period of at least 30 days after the final data have been reported, unless the client requests a longer storage period. After the storage period has expired, samples are returned to the client by standard ground shipping. Samples that cannot be returned are disposed of in accordance with SOP No. MET1005 (Disposal of Laboratory Wastes). As noted above, the date of disposal is recorded in the refrigerator or freezer logbook and sample tracking database.

SAMPLE EXTRACTION

SAMPLE EXTRACTION METHODS

All of the sample extraction and extract cleanup methods that were developed or modified by META are described in detail in SOPs. The SOP numbering system is described in Section 1 of this LQAP. The applicable SOP numbers are MET2000 through MET3999. The 8000 series is reserved for SOPs detailing META's procedures for standard published methods. The list of SOPs is continually growing as more procedures are added and methods developed

A summary of the current sample extraction methods, and their corresponding SOP numbers is listed in Table 2. A summary of SOPs for standard published methods, and their corresponding SOP numbers is listed in Table 3. A summary of the current extract cleanup techniques, and their corresponding SOP numbers is listed in Table 4. A complete listing of all SOPs is included as Appendix B of this LQAP.

Most of the extraction, cleanup, and analysis SOPs listed in this section and Section 5 are associated with specific methods developed by META. In this case, the sample extraction, cleanup, and analysis techniques are also fully described in a complete method listing, which is prepared in the standard EPA method format. The complete method listings also contain additional information not normally provided in the SOPs, including: scope and application, summary of method, interferences, safety, apparatus, equipment, consumable materials, reagents, sample collection, preservation, and storage, calibration, QC measures and frequency, and estimated method detection limits. The complete method listings for META-developed methods are documented elsewhere (Taylor, 1995).

Table 2
META Developed or Modified Sample Extraction Methods

Matrix	Analyte	Applicable SOP
Water	VOCs MAHs	MET2001
	Acidic SVOCs CPs	MET2002
	Neutral SVOCs MAHs/PAHs PCBs MO TPH (by GC)	MET2003
	TPH (by IR)	MET2004

	Acidic/Basic/Neutral OCs Phenols Simultaneous MAHs/PAHs	MET2005
Soil, Sediment	VOCs MAHs	MET2501
	CPs	MET2502
	SVOCs MAHs/PAHs S-PACs/N-PACs PCBs MO TPH (by GC)	MET2503, MET2504
	TPH (by IR)	MET2505
	Creosote constituents Simultaneous MAHs/PAHs	MET2508
	Biomarker compounds Alkyl PAHs	MET2510
Tar, Oil	MAHs	MET2506
	PAHs/S-PACs/N-PACs	MET2507
	(Waste Dilution)	MET2512
Wood	CPs	MET2509

Table 3

Standard Published Methods

Method Number	Method	Applicable SOP
508	Organochlorine Pesticides and Polychlorinated Biphenyls in Drinking Water	MET8508
525.2	PAHs in Drinking Water	MET8525
608	Organochlorine Pesticides and Polychlorinated Biphenyls in Aqueous and Solid Samples	MET8608
USEPA 9/82	"The Determination of PCBs in Transformer Fluid and Waste Oils"	MET8608
8270	Semivolatile Organic Compounds in Aqueous and Solid Samples	MET8270

Table 4

META Developed or Modified Extract Cleanup Techniques

Cleanup Technique	Applicable SOP
Acid/Base Partition Cleanup	MET3001
Silica Gel Cleanup	MET3002
Florisil Column Cleanup	MET3003
Acid Cleanup	MET3004
Sulfur Cleanup	MET3005
Alumina Column Fractionation of Petroleum Wastes: Method 1	MET3006
Alumina Column Fractionation of Petroleum Wastes: Method 2	MET3007
Alumina Column Cleanup	MET3008
Silica Gel Fractionation	MET3009

Documentation

When samples are extracted, they are divided into batches. A batch is defined as 20 or fewer samples extracted within a 24-hour period. All extraction information is documented in method-specific extraction notebooks. The information includes laboratory sample IDs, dates, amount of sample extracted, spiking information, date extracted, any aliquots taken or reference to cleanup methods performed, final extract volume and date brought to final volume, and the initials of all laboratory workers involved in the extraction procedure are recorded. Also, the sample extraction page may contain additional information about different steps of the procedure, and there is always a comments section to write any pertinent notes. An example of a sample extraction page is included in Appendix C of this LQAP.

When the extraction of a set of samples is completed, a copy of the sample extraction page is given to the LD, and is also put into all applicable files of analyzed data. All copies of the sample extraction page are stamped "COPY".

After samples have been extracted, they are signed over to the analyst responsible for running them. This information is also recorded on the sample extraction page. The extracts are stored in an Extract Storage Refrigerator until ready for analysis. After the analysis of a batch of sample extracts is complete, they are assigned a sequential "box" number and archived. Extracts are always archived in complete batches, along with all associated QC samples. The "box" number is permanently recorded on the Sample Extraction logsheet, and the box of archived extracts is stored in an Extract Storage Freezer, in order by "box" number. Archived extracts are kept for a period of approximately 12 to 18 months, after which they are removed for disposal. All extracts are disposed of in accordance with SOP No. MET1005.

QUALITY CONTROL

Holding Times

Holding times are calculated from the date of sampling. Samples must be extracted within the required holding time unless a project specific exemption is provided. Table 5 lists the holding times that apply to sample extractions, unless otherwise specifically stated in the published method, or when superseded by project-specific requirements. If a sample is being extracted for a combination of analytes (e.g., simultaneous M/PAHs), then the shorter holding time takes precedence.

Table 5
Extraction Holding Times

Category	Types	Matrix	Holding Time
Volatile Organic Compounds	VOCs, MAHs	Water	7 Days
		Soil	
Semivolatile and Non-Volatile Organic Compounds	TPH, PAHs, CPs, CBs, SVOCs, PCBs, etc.	Water	7 Days
		Soil	14 Days

Quality Control Samples

Several types of QC samples are required for every method performed at META, including method blanks, spike blanks, duplicates, and matrix spike samples. These are prepared at the same time that the samples are extracted, in the same extraction batch. An extraction batch is defined as a group of 20 or fewer samples of the same matrix, extracted at the same time, for the same analytes. The QC sample frequencies are summarized in Table 6, and apply unless more stringent requirements are specifically stated in the method SOP or are needed for a specific project. In addition, SOP No. MET1026 provides a detailed listing of the required QC samples and other QC measures such as the use of surrogate and internal standards.

Table 6
Required Quality Control Samples

Type	Requirement	Criteria
Method blanks	For each batch, a minimum of one method (extraction) blank must be prepared.	All TCL compounds < 5 X MDL. If not, then re-extract associated samples.

Blank spikes	For each batch, a minimum of one blank spike must be prepared.	Spike compound recovery criteria are specific to each method, but are approximately 60 to 120% of the true values. %Recs must be within the specified limits.
Duplicate samples	A minimum of one duplicate sample must be prepared for every twenty samples prepared by a particular extraction method. Projects of ten or more samples get project specific QC.	Duplicate precision requirements may be method specific, but generally, RPD between sample results must not exceed 30% for waters or 50% for soils.
Matrix spike samples	A minimum of one matrix spike sample must be prepared for every twenty samples prepared by a particular extraction method. If it is thought that there are no samples suitable for spiking at the levels required in the method (i.e., all samples seem to be highly contaminated), or the spiking mixture will be added at a higher level than described in the method. All exceptions will be carefully noted.	Spike compound recovery criteria are specific to each method, but are approximately 50 to 120% of the true values. %Recs must be within the specified limits.
Surrogate standards	Surrogate standard compounds are added to every sample, blank, and spike just prior to extraction. The surrogate standard compounds and the concentrations used are described in each SOP (for META modified or developed methods) or published method (for standard methods).	Surrogate standard recovery criteria are specific to each method, but are approximately 40 to 120% of the true values. %Recs must be within the specified limits.
Internal standards	Many methods require the addition of internal standard compounds to all sample, blank, and spike extracts prior to analysis. The internal standard compounds and the concentrations used are described in each SOP (for META modified or developed methods) or published method (for standard methods).	Internal standard recovery criteria are specific to each method, but generally for GC/MS analysis, the IS area must be 50 to 200% of the most recent, previous standard IS area; and for GC analysis, the IS area must be ±15% of the most recent previous standard IS area.

Section 7

SAMPLE ANALYSIS

SAMPLE (EXTRACT) ANALYSIS METHODS

All analytical methods developed or modified by META are described in detail in SOPs. Specifically, the 4000 series is reserved for analytical methods, and the 8000 series is reserved for SOPs detailing META's procedures for standard published methods. The list of SOPs is continually growing as more procedures are added and more methods are developed.

A summary of the current analysis methods, and their corresponding SOP numbers is listed in Table 7. A summary for standard, published methods was shown previously in Table 3. A complete listing of all SOPs is included as Appendix B of this LQAP. The complete method listings for META-developed methods contain significant additional information not normally provided in the SOPs, and are available in another document (Taylor, 1995).

Table 7
META Developed or Modified Analytical Methods

Instrument	Analyte	Applicable SOP
GC/FID	MAHs	MET4001
	MAHs PAHs TPH Saturated hydrocarbons Hydrocarbon fingerprint	MET4003
	Creosote constituents Simultaneous MAHs/PAHs	MET4007
GC/ECD	CPs PCBs	MET4002
	CBs	MET4009
GC/MS	SVOCs PAHs/S-PACs TPH	MET4004

	VOCs/SVOCs	MET4013
GC/MS/SIM	N-PACs	MET4006
	Biomarker compounds	MET4011
	Alkyl-PAHs	MET4008
	HPAHs PCP	MET4010
FTIR	TPH	MET4005

Documentation

Each instrument has two notebooks dedicated to that instrument only, the run logbook and the maintenance logbook. The notebooks are described in the following sections.

Each day samples are analyzed, they are entered into a Sample Sequence table. A copy of which is placed in the run logbook. The Sample Sequence table information is entered into the computer, and, at a minimum, the lab sample ID, sequence date, analyst's initials, analysis method, vial number, and dilution factor must be entered. Other information such as injection volume, final extract volume, reason for reanalysis (if applicable), and any other pertinent comments may be included.

The maintenance logbook is for recording Instrument Maintenance and Repair. Every time any maintenance or repair is performed, whether it is routine or non-routine, it is recorded in the Instrument logbook. At a minimum, the date, analyst's initials, and a brief description of the problem (if any) and maintenance or repair performed must be entered. In addition, work orders for repairs performed by non-META personnel are stored in this logbook. A copy of the Instrument Maintenance logsheet is included in Appendix C of this LQAP.

QUALITY CONTROL

Holding Times

All sample extracts must be analyzed within 14 days of extraction for volatile organic compounds, and within 40 days of extraction for semi-volatile and non-volatile organic compounds. All samples will be approved for disposal approximately thirty days from release of the final report, unless specifically requested otherwise by the client or project manager. All sample extracts will be disposed of 12 to 18 months after being generated, unless specifically requested otherwise by the client or project manager.

Instrument Calibration

Method-specific instrument calibration requirements are detailed in the SOP and/or in the published method. Table 8 contains a list of general requirements that apply unless otherwise stated.

Analytical Standards

Analytical reference standards are prepared from neat compounds and/or from concentrated stock solutions, both of which are of known purity and composition, and are obtained from an accredited vendor. Specific procedures for the preparation of stock and working analytical reference standard solutions are described in the SOP No. MET1002. This SOP also describes the proper documentation techniques, storage, and handling of standard materials, and methods for verification of standard solutions.

Table 8

Instrument Calibration Requirements

Instrument	Requirement(s)
GC	➢ An initial calibration curve of five or more points to demonstrate the linearity of the instrument response. Instrument response and linearity are evaluated in the following way: • The %RSD of the RRFs or CFs must meet the criteria stated in the SOP or method, but generally must be ≤ 25%. • There may be additional criteria regarding the minimum acceptable RRF or area response of specific compounds.
	➢ A QC check standard after every initial calibration. • A QC check standard is an analytical reference standard that is obtained from a different source than the standards used to perform the initial calibration. • The recovery of check standard components is method-specific, but generally should be 90 to 110%.
	➢ A continuing calibration standard after every 15 samples that are analyzed. • For some methods, continuing calibration standards are required more frequently. • CCAL %D criteria are method-specific, but generally must be ≤ 25%.
GC/MS	➢ In addition to the criteria for GC analyses, the GC/MS system must be tuned at least once every 12 hours that samples are analyzed with DFTPP tuning compound, followed by a continuing calibration standard. • Some methods require more frequent tuning of the GC/MS system. • The spectral ion abundances must meet all criteria as set forth in the EPA CLP SOW (OLM01).
FTIR	➢ Analysis of a thin film of polystyrene. • Peak wavenumbers and absorbances must match the standard spectra.
	➢ Background scan of solvent for subtracting from sample spectra. • On dual beam instruments, a cuvette containing the extraction solvent is placed in one of the beams during sample analysis.
	➢ Analysis of a solvent blank. • The scan should show a flat line, indicating that background subtraction of the solvent is effective.

	➢ A five point initial calibration curve to demonstrate the linearity of the instrument response. • An ICAL is analyzed every day that samples are analyzed. • The correlation coefficient of the absorbances must be ≥ 0.995.
	➢ A continuing calibration standard after every ten samples. • CCAL %Ds must be ≤ 10%.

All analytical standards are prepared in accordance with SOP No. MET1002. Furthermore, the standards preparation process is completely documented from start to finish. Each time an analytical standard is prepared, whether it is a working or stock standard, the appropriate standard preparation notebook is filled out by the preparer. There are two standard preparation notebooks. One is for working spiking solutions such as surrogate and matrix spikes. The other notebook is for all other solutions, including calibration standards, check standards, and all stock solutions. The standard preparation logsheet lists sufficient information regarding the amounts and types of analytes and solvent used, such that any other laboratory employee can duplicate the standard based on the logsheet only. Each standard preparation logsheet is reviewed and initialed by the LD. A copy of the Standard Preparation logsheet is included in Appendix C of this LQAP. In addition, once the Standard Preparation logsheet has been checked and approved by the LD, the information is entered into the Chemical Inventory database. For further discussion of the Chemical Inventory database, see Section 11 of this LQAP.

All analytical standards, whether they are neat, ampule, stock, or working standards are assigned an expiration date when they are prepared or received. No stock or working standards are used once their expiration date has passed. However, neat compounds or stocks shipped in ampules may be used beyond the manufacturer recommended expiration date if an assay is performed that indicates that purity has not been comprised. Table 9 lists the recommended holding times for all analytical standards prepared at META, and is posted on the front of the freezer used to store analytical standards. The holding times are assigned according to compound class. Also, the Standard Preparation logsheet has a space to record the date discarded.

When a new working standard is prepared, it must be verified. The new standard is analyzed and compared to the ICAL, and the %D values must meet the criteria set forth in the SOP and/or the published method. For spiking solutions, a spike test is performed. An aliquot of the standard is spiked into clean solvent at the same concentration as would be found in the samples, then analyzed. The area/concentration response must be within ±15% of the true value. If a standard does not meet the criteria, then appropriate corrective actions are initiated.

In some cases a new working standard is prepared. If degradation of the stock standard is suspected a new stock standard may be prepared. If the standard itself does not appear to be the source of the problem, instrument maintenance or repair may be performed.

Table 9

Holding Times for Analytical Standards

Compound Class(es)	Holding Times (in months)[5]			
	Neat[1] Solids or Liquids[6]	Ampules[2]	Stock[3]	Working[4]
Monocyclic aromatic hydrocarbons	24	24	6	1
Polycyclic aromatic hydrocarbons	60	36	6	2
Nitrogen and sulfur containing polycyclic aromatic compounds	36	12	6	2
Phthalates, esters	36	12	6	2
_ Chlorine and nitrogen containing semivolatile organic compounds _ Organochlorine pesticide compounds	36	12	6	2
_ Benzoic acid, benzyl alcohol _ Phenol, and methyl- and dimethyl- phenols _ Chloro-, nitro-, and bromo- phenols	36	12	6	2
Organic carboxylic acids	36	12	6	1
_ Benzidines _ Anilines	24	12	6	1
PCBs and Aroclors	60	36	6	2
Creosote, light tars	24	24	6	2
Gasoline range petroleum	24	24	6	1
Diesel, kerosene	24	24	6	2
Fuel oils, crude oil, heavy tars and pitches	36	24	6	2

1. Neat compounds are single compounds or mixtures of compounds, each of which is > 95% purity.
2. Ampules are purchased mixtures of compounds sealed into ampules for storage.
3. Stock standards are not used directly in the analysis and/or preparation of samples (i.e., they require further dilution prior to use). Stock standards are also not handled very often.
4. Working standards are used directly in the analysis and/or preparation of samples (i.e., they do not require further dilution prior to use). Working standards are handled frequently.
5. If multiple compound classes are present in a standard mixture, then the holding time is based on the shortest holding time listed for all the individual components.
6. Holding times as listed, or as specified by the manufacturer. Manufacturer recommended holding times may be extended if assay tests of the material determine that the purity has not been affected. Holding times may not exceed those listed.

In addition to the analytical reference standards obtained from the primary vendor, META also attempts to obtain an analytical standard appropriate for use as a QC check standard from a
second, independent vendor for every routine analytical method performed by our laboratory. A QC Check standard is analyzed after every ICAL.

For special projects, META may also obtain a Certified Reference Material (CRM) appropriate for analysis. CRMs are actual samples whose analyte concentrations have been certified through an exhaustive analytical program. They are available in a variety of natural matrices such as marine sediments, etc. Unlike analytical standards, they offer a special benefit to any good quality control program by helping to evaluate the accuracy of the analytical and extraction methods based on recovery of analytes from a natural (complex) matrix.

Section 8

DETECTION AND REPORTING LIMITS

METHOD DETECTION LIMITS

The Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. At META, MDLs are determined annually for every method performed, whether the method is a standard published method or a method developed or modified by META. MDLs are determined in accordance with 40 CFR, Part 136, Appendix B, Revision 1.11. In summary, a series of at least seven clean soil or water samples are spiked with the target analytes at levels that are similar to the suspected MDLs. They are then taken through the entire extraction and analysis procedure for that method, as if they were real samples. The standard deviations of the resulting concentrations are calculated for every compound. The MDL is equivalent to 3.14 times the standard deviation of the seven replicate analyses for each target compound. The factor of 3.14 is the Student's *t*-value for six degrees of freedom and 99% confidence. If more than seven samples are prepared, the appropriate Student's *t*-value is used. Method detection limit study results are kept in the LD's files.

The MDLs for all target compounds in each method used by META are listed in Appendix D of this LQAP. It should be understood that MDLs can vary dependant upon the amount of sample being extracted, the final extract volume, and the calibration range of the instrument. The desired MDLs for a specific project should be determined in advance of sampling, as it will influence the decision regarding which methods of extraction and analysis to use.

PRACTICAL QUANTITATION LIMITS (Reporting Limits)

The Practical Quantitation Limit (PQL) is the concentration down to which the laboratory can confidently report quantitative data and corresponds to the sample equivalent of the lowest linear calibration standard. PQLs are generally two to ten times greater than their corresponding MDLs. However, the judgement of the analyst and the needs of the client are considered when determining PQLs, and lower PQLs can usually be achieved if requested. The PQLs for all target compounds in each method used by META are listed in Appendix D of this LQAP.

APPLICATION OF LIMITS IN DATA REPORTING

In reporting data, the following rules pertaining to detection limits shall apply:

- Values detected below the PQL shall be reported as not detected at the PQL value.
- Values detected above the PQL shall be reported as the concentration found, without any qualifiers.
- In instances where the client's needs make it necessary to report values between the PQL and the MDL, the concentration found shall be reported as an estimated value, and will be flagged with a "J".
- Values less than the MDL are never reported.

Section 9

DATA REDUCTION, REVIEW, AND REPORTING

DATA REDUCTION

The way in which raw data is calculated and formatted into an acceptable report form varies with individual instruments and analyses. Specific details of data reduction and review procedures are described in the SOP numbers MET5000 through MET5999. In general, the analyst will check the chromatogram and quantitation report to make certain that all compound peaks have been properly identified, integrated, and quantitated. The analyst will then generate a sample data result worksheet, the format of which is dependent upon the instrument and method used for analysis. The worksheets are then checked by the analyst for the presence of blank contaminants, false positives, and results below the PQL or above the calibration range. Finally, the worksheet is initialed and dated by the analyst and passed on to the LD or a quality assurance staff member.

DATA REVIEW PROCESS

Data review is a multi-step process, with every data package going through two to three separate reviews, to minimize the number of errors. The data review process is described in detail in the SOP Nos. MET5505 through MET5507. A brief summary is presented in the following paragraphs.

First the data is reduced and reviewed by the analyst (described above), and submitted to the LD or a quality assurance staff member. At this time the analyst will note recommendations to re-extract, re-analyze, or dilute samples on the instrument status sheet.

Next, the LD a quality assurance staff member reviews the data and checks for correct transcription of sample IDs, amount extracted, final extract volume, percent solids, dilution factors, spike amounts, etc. Integration of the chromatograms, identification of peaks, and calculations are also checked. The reviewer confirms the recommendations for re-extraction, re-analysis, or dilution, and has the analyst update the instrument status sheet. The data package may then be submitted to the QAO.

Finally, the QAO reviews representative data packages. The QAO reviews the calculations and peak identifications, as well as looks for evidence of systematic errors. The QAO reviews all of the associated QC data, and may recommend that samples be re-analyzed if the data are not in conformance with the LQAP or the QAPP for the project. Additional work may be recommended to the LD to confirm or clarify any questions raised pertaining to the data. The QAO also fills out a QA Report form for each data package inspected. (The QA Report form is described in Section 16 of this LQAP).

DATA REPORTING

Reporting Data to the Project Manager

When the results of the sample analyses are fully reviewed, and any corrections made or corrective actions taken (discussed in Section 13), the sample results are ready to be reported. The results may be reported to the PM in the

form of tables of results, individual forms for each sample, or as a database of results for large projects. The PM receives a hard copy of the results, and may also receive a copy on diskette.

All soil data should be corrected for percent solids. Percent solids determination is automatically scheduled for every soil sample submitted to META's laboratory. Percent solids are determined in accordance with SOP No. MET1004.

Reporting Data to the Client

It is the responsibility of the PM to report sample data results to the client. Data is never reported directly from the laboratory to the client. The PM submits a hardcopy of the final data report to the client. In some cases, the faxed or sent to the client electronically. Electronic data is generally sent in Microsoft Office or Adobe Acrobat (.pdf) format, however other formats are available upon request. The PM may report sample results only, or may include a partial or full supporting QC package at the client's request.

Preliminary data may sometimes be reported if the client is particularly eager for the results. Any data that have not been through the entire data review process, as described above, or have not been corrected for percent solids, are considered to be preliminary. Any data that are reported to a client in preliminary form will be well marked as **Draft** so that they cannot be mistaken for final results.

When reporting results to MADEP, META uses the most updated forms available. The most updated version can be downloaded from the Internet.

DATA VALIDATION

If necessary for the project, META is also capable of performing a partial or full validation of data generated by the laboratory. Several staff members have extensive experience in data validation techniques. They can perform an in-depth review of sample and QC data, and write a detailed report describing any problems encountered with the QA/QC, including explanations of how the usability of the data may be affected.

STORAGE OF DATA

Raw Data

Raw data, including chromatograms, quantitation reports, and (for GC/MS and FTIR data) spectra are filed in individual file folders by analytical batch. Also included in the file folders are copies of the finalized sample result worksheets, copies of all associated QC data (standards, tunes, etc.), and the QC Summary form(s). Recent or active raw data files are stored in order by instrument and date of analysis in the laboratory file storage area. Once the laboratory data file storage area is full, the raw data files are transferred to labeled cardboard storage boxes and placed in archive storage in a locked warehouse. The raw data files are transferred to archive storage monthly or as needed.

Separate folders are prepared for ICALs, even if they are run with other samples. ICAL folders include instrument printouts for the standards, as well as summary tables for the ICAL %RSDs and the QC Check standard %Recs. ICALs are filed along with other data in order by instrument and date of analysis in the QA storage area.

Results of performance evaluation (PE) sample analyses and MDL studies also are stored in the QA storage area. Finally, any sample results generated during in-house quality control experiments also are stored in the QA storage area.

Electronic Data

In addition to keeping hard copies of the raw data on file, all data files are stored either on tapes or other electronic data archive devices. Data files are copied from the hard drive of the computer to the data archive area on the LDs PC in accordance with and at a frequency as specified in the SOP No. MET5008. For older data files, a Data File Storage Directory logbook is kept as a reference. That directory includes a hard copy of the file storage information (i.e., what files are stored on each disk or tape, and the ID of the tape or disk), and allows for easy retrieval of data files in the future. For more recent data files, the archiving software automatically records a library listing of the data files every time a system backup is performed. This library is easily accessible, and makes keeping a hardcopy printout unnecessary.

Project Manager Files

For each project, the laboratory gives the PM copies of the finalized sample result worksheets for all samples, as well as for all associated QC. In addition, the PM receives copies of the Extraction logsheets, Percent Solids Determination logsheets, and Sample Login forms. These items are placed in folders and filed in the PM's personal file storage area.

Section 10

INTERNAL QUALITY ASSURANCE

LABORATORY AUDITS

To monitor quality, META conducts internal quality assurance audits. The laboratory audits are performed by the QAO annually, and an In-House Laboratory Audit checklist is filled out. Any problems or nonconformances noted are written up in a brief report, and corrective actions initiated. The checklists and reports are stored in the QAO's files. A copy of the In-House Laboratory Audit checklist is included in Appendix E of this LQAP.

PERFORMANCE EVALUATION SAMPLES

META voluntarily analyzes performance evaluation (PE) samples twice annually. The samples are provided by an independent testing firm under the direction of the USEPA water pollution (WP) and water supply (WS) programs. META submits the results of the analyses, and receives a report evaluating their performance. Raw data results from PE samples are stored with all the other raw data in the laboratory file storage area. The PE evaluation reports are stored in the QAO's files.

CONTROL CHARTS

QC data generated by META's laboratory are used to compile Control Charts. Control charts are prepared for each standard, published method used to analyze samples at META, and are prepared for all surrogate and matrix spike standard compounds. Currently, control charts are prepared and updated manually. The preparation of Control Charts is described in SOP No. MET5508. Control charts may also be prepared for samples analyzed by one of META's developed or modified methods.

REFRIGERATOR MONITORING

To assure sample integrity during storage at META's facilities, all refrigerator and freezer temperatures are monitored on a daily basis. The results are recorded in the bound logbook associated with the specific refrigerator/freezer. A copy of a Refrigerator/Freezer Temperature logsheet is included in Appendix C of this LQAP.

Should any refrigerator display a temperature that is not 4±2°C, corrective actions are initiated immediately. Similarly, freezer temperatures must be less than -5°C. Refrigerator monitoring procedures and corrective actions are detailed in SOP No. MET1013.

ANALYTICAL BALANCE CHECK

To assure accuracy when weighing out compounds for standards preparation or small quantities of sample for waste dilution, the analytical balance is checked for accuracy on each day it is in use. ASTM Class 1 weights are used for this purpose. In addition, all balances used for weighing samples for extraction or percent solids are also checked at least weekly. The results are recorded in a bound notebook associated with the specific balance. A copy of the Balance Daily Check Record is included in Appendix C of this LQAP. The procedure for monitoring analytical balance precision and corrective actions are detailed in SOP No. MET1014.

THERMOMETER CALIBRATION

META has a certified thermometer from Ertco which measures from -20°C to 110°C in one-degree increments. All thermometers in the laboratory are calibrated at least annually (usually at the time of the laboratory audit) by comparing the reading of the thermometer with the calibrated thermometer. Thermometers are labeled with the adjustment necessary for a correct temperature reading. Any thermometer needing substantial correction (>4°C) should be repaired or replaced.

REDUCTION OF CONTAMINATION

Cleaning Glassware

The procedure for cleaning glassware in the laboratory is described in SOP No. MET1001. This SOP was developed to assure that sample or extract contamination would not occur due to poorly cleaned glassware. All laboratory glassware is cleaned in accordance with this SOP. In brief, laboratory glassware is washed with a warm detergent solution, followed by copious rinsing with tap water. Then the glassware are rinsed with deionized (DI) water and are given several solvent rinses. A Chem-Solv bath, consisting of NAOH and MeOH, can also be used for any glassware that is grossly contaminated.

Laboratory Water

META uses deionized (DI) water produced by a Barnstead E-Pure Ultrapure water filtration system, with a four cartridge organic-free kit. The water produced meets the specifications for ASTM Type I Ionically Pure Water, which must have a resistivity of ≥ 16.67 megohms/cm. DI water is used for all general laboratory applications, including rinsing of glassware and preparation of aqueous method blanks. The DI water is monitored on each day that water is produced, using an on-line resistance meter. The resistivity is recorded in the Laboratory Water Check logbook. The four cartridges of the water filtration system are changed at least once per year, or whenever the resistivity cannot reach 16.67 megohms/cm. A copy of the Laboratory Water Check logsheet is included in Appendix C of this LQAP.

The water filtration system is normally left off, and is only turned on when DI water is being generated. DI water is generated in batches of approximately 5 gallons at a time, and stored in a high-density polyethylene (HDPE) carboy until use. Water for applications requiring VOC free water should be generated on the day of use. Water stored in the carboy can absorb solvent vapors and other VOCs present in ambient laboratory air.

Laboratory Solvents

To assure high quality data output, META uses only analytical reagent grade or higher purity solvents for all laboratory operations including rinsing glassware. Solvent purity is monitored through the analysis of method blanks. Storage, handling, and monitoring of laboratory solvents is described in SOP No. MET1009.

Other Sources

In addition to the items described in the preceding paragraphs, SOP No. MET1007 discusses several other possible sources of laboratory contamination, and how to minimize them. Any contamination problems noted (in the DI water, solvents, or samples) are traced to their source, and corrective action initiated.

Section 11

MATERIAL PROCUREMENT AND CONTROL

SOLVENTS

All solvents used in META's laboratory are at least reagent grade or equivalent. In general, no more than 48 liters of any single solvent are stored on the premises at any time. Solvents are stored in the original packing material in which they were shipped until they are ready to be used. Opened solvent bottles are stored in a flammable liquid storage cabinet. Squeeze bottles full of solvent are stored underneath a hood when not in use. Waste solvents are disposed of according to SOP No. MET1005. Each lot of procured solvent is monitored by the laboratory for purity. Solvents are ordered, handled, stored, and monitored as described in SOP No. MET1009.

The solvents methylene chloride, acetone, methanol, pentane and hexane are used regularly at META, so expiration dates are generally not a concern. However, all solvent bottles are labeled with the date they are opened. If any solvent has been stored opened for more than three months, then a solvent blank must be prepared and analyzed prior to its use. The solvent blank must document that the solvent is free of interfering contaminants before any samples are prepared.

The commonly used solvents are entered into a Chemical Inventory logbook upon receipt, and upon opening of each bottle. Chemical Inventory logbook contains the following information: date of receipt, quantity received, date opened, and lot number. The Chemical Inventory logbook provides sufficient information to allow tracking of solvent lots in the event that a contaminated batch of solvent is discovered. A copy of the Chemical Inventory logsheet is included in Appendix C of this LQAP.

The solvents not commonly used are entered into the Chemical Inventory database, as described below.

ACIDS

All acids used in META's laboratory are of known, certifiable high purity. All opened acid bottles are stored in an acid storage cabinet. In general, no more than four liters of any single acid are stored on the premises at any time. Waste acids are disposed of according to SOP No. MET1005. Acids are ordered, handled, and stored as described in SOP No. MET1009. Acids are entered into the Chemical Inventory logbook at the time they are received.

REAGENTS, CHEMICALS, AND PREPARED SOLUTIONS

Assorted reagents, chemicals, and prepared solutions are stored at META for making standards, and performing derivitizations and experiments in support of our environmental consulting division and laboratory activities. Chemicals and reagents are always purchased from an accredited vendor, at known purity levels. Copies of the MSDS sheets for all purchased compounds are placed in the MSDS binder in the laboratory. Chemicals and reagents are purchased in the smallest quantities feasible to minimize the generation of laboratory waste. Chemical solutions are prepared according to SOP No. MET1002.

Chemical Inventory Database

When any purchased reagent, chemical or prepared solution is received at the laboratory, the container must be labeled with the date of receipt and the initials of the receiver. It must also be logged into the Chemical Inventory database. This database is maintained in Paradox 40, and contains, as appropriate, the following information: date of receipt, standard name, components, concentration, volume, number of vials, expiration date, storage location, and any necessary notes or comments. META SOP No. MET5006 provides a more detailed description of the use and maintenance of the Chemical Inventory database.

When a container is opened, this too is noted on the outside and in the Chemical Inventory database. All reagents, chemicals, and prepared solutions are disposed of according to SOP No. MET1005.

COMPRESSED GASES

Compressed gases routinely stored at META include the following: helium, nitrogen, air, carbon dioxide, hydrogen, and argon:methane (95%:5%). All gas cylinders are chained to a concrete wall. When they are open, potentially flammable gases (hydrogen, argon:methane) are stored separately from other gases. All cylinders that are not in use are kept covered with a metal cap. Compressed gas cylinders are received from a local welding supply distributor. When the cylinders are empty, they are returned for refill. In general, a complete set of backup gas cylinders is available for each instrument.

SOURCE MATERIALS

META has collected, over the years, a wide variety of organic source materials which may be used in the identification and characterization of unknown samples. Some of the source samples are standard reference materials available through entities such as the National Institute of Standards and Testing (NIST). Others are pure products collected at actual sites across the nation. Still others are soils which are contaminated with a variety of organic residues.

Source Materials Database

All of the source materials obtained by META are entered into the Source Materials database. First they are assigned a source number, using the following convention.

(P, T or M)###

where,

P	indicates a petroleum source,
T	indicates a tar source,
M	indicates a miscellaneous source, and
###	is a three-digit number assigned to each sample sequentially.

As much of the following information as is known about the material is entered into the database: source number, storage location or locations, quantity or quantities, type, manufacturer, description or identification of material, visual description of material, site where the material was collected, utility or client who submitted the material, META

laboratory ID assigned to the material, and any relevant background information. META SOP No. MET5007 provides a more detailed description of the use and maintenance of the Source Materials database.

Section 12

FACILITIES AND EQUIPMENT

META's laboratory is 1,300 square feet of floor space, equipped with the following:

- 100 linear feet of counter space
- 10 feet of hood space
- One sink with hot and cold running water
- One dishwasher
- 5 upright refrigerators, 1 upright freezer and one 350 cubic foot walk-in refrigerator
- 4 HP5890 Series II gas chromatographs equipped with a total of 3 flame ionization detectors, 2 electron capture detectors, and 2 mass spectrometric detectors.
- 6 HP7376B Autosamplers
- 4 HP ChemStations for reducing data
- 1 HNU Systems Model 321 field portable gas chromatograph with photoionization and electron capture detectors
- 2 Whatman Hydrogen generators
- 1 Whatman Zero Air generator and compressor
- 1 Perkin-Elmer Series 1620 Fourier Transform Infrared Spectrometer
- 1 N-EVAP hot water bath and nitrogen blowdown apparatus
- 1 Turbovap system
- 1 NESLAB CFT-33 refrigerated recirculator
- 1 Barnstead E-pure Ultrapure water filtration system
- Ohaus four-place analytical balance
- Assorted sonicators, micro- and full-size Soxhlet extraction and K-D concentration equipment, TCLP and solid phase extraction equipment, vacuum filtration equipment, balances, centrifuges, dry ice maker, vortex genie, micro- and macro-separatory funnels, rotator, etc.

Section 13

INSTRUMENT MAINTENANCE

META follows a routine laboratory equipment maintenance program for all major instrumentation. Routine maintenance is essential to preventing the failure of laboratory equipment during use. A routine maintenance program also helps to avoid delays due to instrument downtime. A substantial spare parts inventory is maintained to assure timely repair of instruments. The following is a partial inventory of spare parts routinely stored at META.

GC: columns, ferrules, o-rings, septa, injection port liners and baseplates, syringes, detector cleaning kits, FID jets, and PID lamps.

GC/MS: all of the above as well as filaments, source cleaning tools, pump oil, PFTBA calibration compound.

FTIR: desiccant.

Routine preventive maintenance procedures such as lubrication, source cleaning, detector cleaning, and the frequency of such maintenance are performed according to the procedures outlined in the manufacturer's instrument manual. Chromatographic carrier gas purification traps, injection port liners, and septa are cleaned or replaced regularly. The preventive maintenance performed on major laboratory instrumentation is summarized in Table 10.

When routine maintenance procedures do not correct a problem with instrumentation, outside repair services are generally available on a next day basis.

All maintenance and repair procedures are documented in the Instrument Maintenance logbook, described in Section 7 of this LQAP.

Chromatographic performance is evaluated based on peak resolution, presence of fronting, tailing or split peaks, spectral quality, retention time shifts, and changes in instrument sensitivity.

Table 10

Routine Maintenance for Major Instrumentation

Instrument	Maintenance Procedure	Schedule
GC	Change septa and injection port liner, clip column	As needed, when chromatographic performance shows signs of degradation
	Change gas line purifier trap (oxygen/molecular sieve)	Every 6 months or more frequently as needed

	"Bake off" column and/or detector	As needed, when chromatographic performance shows signs of degradation
	Clean detector and/or replace column	As needed, when chromatographic performance shows signs of degradation
GC/MS (all of the above, plus)	Replace pump oil	As specified by manufacturer
	Change filament	When lack of signal response indicates filament is broken or dirty
	Clean source	As needed, when chromatographic performance shows signs of degradation
	Replace electron multiplier	When increasing EM volts indicate multiplier is failing (>2800 emv)
FTIR	Change desiccant	As specified by manufacturer
	Change lamp	As needed, as indicated by consistency, repeatability, and stability of response

Section 14

SAFETY

META is very concerned about safety in the workplace. All employees are given a complete tour of the facilities by the Health and Safety Officer (HSO), while the locations of the safety features and any possible hazards are described and pointed out. Safety tours are conducted for all new employees before they are allowed to perform any work.

As another check of workplace safety, the QAO performs an internal safety inspection at the same time the internal quality assurance audit is being performed. Thus, the safety audits are performed annually, and an In-House Safety Inspection checklist is filled out. Any problems or non-conformances are noted and reported to the HSO for resolution. The safety inspection checklists are stored in the HSO's files. A copy of the In-House Safety Inspection checklist is included in Appendix F of this LQAP.

META's facilities include the following safety features:

- An easily accessible safety shower located near the laboratory;
- A fire blanket located in the extraction laboratory;
- Acid, caustic, and solvent spill clean up kits;
- Mercury absorbent containers for broken thermometers;
- A fire extinguisher and eye wash station located in every laboratory room;
- Sufficient quantities of safety glasses and lab coats for all lab employees and potential guests;
- Full and half face respirators with organic vapor cartridges available for use;
- Convenient exits;
- A posted copy of META's "Health and Safety Plan" and Material Safety Data Sheets (MSDSs).

In addition, all laboratory personnel are required to wear safety glasses, lab coats, and gloves when in the laboratory. Ear plugs are available to personnel working with the sonicators, special acid resistant gloves, face shield, and apron are available to personnel working with the chromic acid bath, and special insulated gloves are available to personnel working with the drying ovens. All laboratory personnel are required to wear appropriate clothing (i.e., long pants, sturdy shoes), and to keep long hair pulled back.

META's laboratory hoods are monitored quarterly for proper airflow. The HSO or designee performs the airflow test for each hood in the laboratory, using a purchased "Fume Hood Face Velocity Calibration" kit, and according to the instructions provided by the manufacturer of the kit. The kit also includes safety inspection stickers which are posted on each hood, and initialed and dated each time the hood is successfully tested. Any hood showing insufficient airflow is serviced immediately, and the safety inspection sticker is not dated until the hood is operating within the specified performance limits.

All laboratory standards are prepared under a hood. All solvent rinsing of laboratory glassware is performed under a hood. All solvents are stored in a Flammable Liquids Cabinet. All acids are stored in an Acid Cabinet. All other reagents are stored in a freezer or cabinet designated for storage. All gas cylinders are chained to a concrete wall.

META also has an internal Health and Safety Plan. All employees are required to read this manual, and any updates. Each employee must sign a sheet stating that he/she has read the safety manual, and a record of those signatures is kept by the HSO. In addition, a copy of the safety manual is posted in the laboratory for easy reference. META keeps a posted copy of the Material Safety Data Sheets (MSDSs) for all compounds, solutions, and standards in the laboratory for easy reference.

Section 15

ENVIRONMENTAL CONTROLS

META is an environmental company, and we demonstrate our concern about the environment through our company policies as well as our work. For example, META advocates and practices the use of microscale modifications of standard methods. Much of the work we currently perform utilizes methods that are microscale modifications of standard methods. This results in less solvent waste, and saves energy because less solvent is used (less solvent has to be produced). It also means that the amount of sample collected can be significantly smaller, reducing the amount of solid (soil and glass) waste generated, and increasing the available options for sampling techniques.

META is committed to the environment in other ways. All of our reports are printed on recycled paper, and we recycle all of our paper waste. We also recycle all of our glass, plastic, metal, newspaper, magazine, and cardboard waste. At this time META does not have the means to practice solvent reclamation, but it is our intent to achieve this goal. We also do not currently have scrubbers on our hood exhaust, but that is another goal we intend to achieve in the near future. META will convert to non-chlorofluorocarbon solvents as options to standard procedures become available.

META has researched the correct disposal procedures for the many types of wastes generated by the laboratory. Wastes include spent solvents and standards, extracted soils, leftover soils, gloves, paper towels, etc. META's disposal practices are detailed in SOP No. MET1005, "Disposal of Laboratory Wastes", and are summarized in Table 11.

Table 11

Summary of Disposal Practices

Waste/Drum Label	SOLID WASTE	SOIL WASTE	PCB WASTE	AQUEOUS WASTE	CHLORINATED WASTE	SOLVENT WASTE	FREON WASTE	Comments
Post-extraction: scintillation vials, culture tubes, centrifuge tubes. Also, used (empty) sample jars.	X							Crush glassware before disposal.
Post-extraction or filtration: plastic caps, soil, thimbles, sodium sulfate, boiling chips, silica gel, weighing tins, used (punctured) autosampler vials.	X							No closed containers.
Post-blowdown or cleanup: culture tubes and centrifuge tubes.	X							Dispose as specified or clean and reuse.
Solid neat compounds leftover from analytical standard preparation	X							
Excess soil samples.		X						Get HSO approval.
Post-percent solids soils.		X						
Soils contaminated with polychlorinated biphenyls			X					
Excess water samples.				X				Get HSO approval.
Field decontamination fluids.				X				
Post cleanup acidic water.				X				Neutralize before disposal.
Spent, rinsate, or reclaimed methylene chloride.					X			No mixed solvents! Must be > 98%.
Spent, rinsate, or reclaimed acetone, methanol, hexane, mixed solvents, etc.						X		
Standard solutions and neat liquid compounds						X		
Spent, rinsate, or reclaimed Freons.							X	Must be > 95%.
Excess TPH extracts.	X						X	Decant extracts into Freon waste drum, dispose of tubes and caps as above.
All other excess extracts.	X					X		Decant extracts into Solvent waste drum, dispose of vials and caps as above.
Kimwipes, lab gloves, paper towels, aluminum foil.								Place in dumpster.
Empty solvent bottles and clean broken glassware.								Remove labels and place in recycled glass box.
Broken thermometers.								Store in mercury absorbent containers until a mercury waste pickup is scheduled.

Section 16

STATISTICS

CONTROL CHARTS

Control charts are an important and useful part of any QA/QC program. They are also regarded as a significant tool in a total quality management (TQM) program. The visual aspect of a control chart allows method performance information to be easily understood. A control chart is able to display trends in the performance of a system and when deviations from acceptable performance are detected, corrective action can be quickly initiated.

Control Chart Program

Standard Published Methods

Control charts are currently kept for each standard, published method performed at META. Surrogate standard recoveries and matrix spike recoveries are plotted on the control charts. Acceptable QC limits, as stated in the methods are shown as well as the mean and upper and lower warning limits. The upper warning limit is the mean plus 2 standard deviations as calculated from a representative set of at least 20 data points. The lower warning limit is the mean minus 2 times the standard deviation from a representative set of at least 20 data points. Control charts are updated as needed, after the analysis of 20 or more samples by a particular method have been completed. Control charts are generally prepared separately for each analytical instrument, although data from multiple instruments can be combined as necessary to achieve at least 20 data points per chart. When multiple instruments are represented on a single control chart, different symbols will be used to represent each instrument.

META Developed or Modified Methods

There is currently no formal program for the generation of control charts for META methods. However, control charts can be (and have been) generated manually on an as-needed basis, by project.

Interpreting Control Charts

As a chart is updated, it is examined for out-of-control situations. Any out-of-control situations are to be reported immediately to the LD and the QAO, and a documented corrective action must follow (see Section 17). An out-of-control situation is indicated for any of the following:

- any one point is outside the acceptable QC limits;
- any seven consecutive points are on the same side of the mean;
- three consecutive points are beyond the warning limit of ± 2 standard deviations from the mean;
- any seven consecutive points are successively larger or smaller than their immediate predecessor; and

- any obviously cyclic pattern is observed.

Section 17

CORRECTIVE ACTION

Whenever a QC result shows that a sample analysis is out of control, appropriate corrective actions need to be initiated. This is true whether the problem is a minor one (slightly low surrogate recovery) or a major one (no surrogate standard added to sample). However, the types of corrective action initiated, the level of documentation necessary, and the involvement of the QA staff in the process will vary depending upon the specific situation.

MINOR OR COMMON QC PROBLEMS

Some types of QC problems are common, no matter how "in control" a laboratory may be. Examples of "common" QC problems include the following: low or high surrogate recoveries, matrix spike recoveries or internal standard areas, continuing calibration %Ds that exceed the criteria, or method blanks with low levels of contamination (< 5 X PQL).

During the initial reduction and review of chemical data, the analyst checks the sample results for compliance with the appropriate QC limits. Any deviations or exceptions should be noted in writing on the sample results worksheets, along with the suggested corrective action. For example, a sample result worksheet might contain the following comment "Low SS, reextract", indicating the surrogate standard recovery did not meet the QC criteria, and the sample should be reextracted. The sample results worksheets are then reviewed by the LD during the secondary review of the data who either approves the corrective action or suggests a different corrective action. The LD is also responsible for ensuring that the approved corrective action is implemented.

MAJOR OR UNCOMMON QC PROBLEMS

Nonconformance Reports

Occasionally, a more major infraction of the QC criteria may occur. Examples of major problems include the following: missed extraction or analytical holding times, incorrect spiking of surrogate, internal, or matrix spike compounds, or lost, broken or frozen samples. In those cases, a more complete documentation process is necessary.

META uses Nonconformance Reports to document those incidents that are unusual, require corrective action above and beyond normal, or simply need to be documented as exceptions. The nonconformance report contains three sections. The first lists several nonconformance occurrences. The user may check one or write a description of the problem in the comments section, which is provided. The second section lists several possible corrective actions. Again, the user may check one, or may use the comments section to suggest an alternative corrective action or describe why no corrective action is necessary. The third and final section is completed after corrective action has been taken. At this point the Nonconformance Report is considered complete and is given to the PM for filing in the project file. A copy of the Nonconformance Report is included in Appendix C of this LQAP.

A Nonconformance Report may be initiated by the analyst, the LD, or the QAO. Regardless of who initiates the report, it is then reviewed by the LD, who brings the issue to the attention of the PM and the QAO. After discussing the problem and possible resolutions, a corrective action is decided upon and recorded on the report. The LD is responsible for seeing that the corrective action is carried out by the analyst. Once the corrective action has been completed, the Nonconformance Report is given to the PM for inclusion in the project file. A copy is kept by the LD and placed in the Corrective Actions logbook, described below.

QUALITY ASSURANCE REPORTS

META also uses Quality Assurance Report forms for the data review process. A QA Report form is filled out by the QAO any time a data package is subjected to a QA review as described in SOP No. MET5507. A QA Report form is filled out for every package of data reviewed, regardless of whether that package requires actions or corrections. After the data has been reviewed by the QAO, it is returned along with the QA Report form to the LD. The LD initiates any corrective actions suggested, and/or returns the package to the analyst for the necessary corrections. Once corrective actions have been taken, or corrections made, the package is considered final, and does not need to be reviewed by the QAO again. A copy of the QA Report form is included in Appendix C of this LQAP.

CORRECTIVE ACTIONS LOGBOOK

META maintains a Corrective Actions logbook, which contains copies of all QA Report and Nonconformance Report forms. The logbook is divided into two sections for "active" and "resolved" reports. When the QA Report or Nonconformance Report form is initially filled out, it is filed in the "active" section of the logbook. As the analyst performs the necessary actions and/or corrections to the data, it is initialed and noted on the form by the analyst. Once all of the issues have been resolved, the form is initialed and dated by the LD and moved to the "resolved" section.

Section 18

REFERENCES

Taylor, J.K., "Quality Assurance of Chemical Measurements", Lewis Publishers, 1987.

Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, U.S. EPA Contract Laboratory Program, OLM01.2, March 1990, Revised January 1991.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846 Third Edition, Office of Solid Waste, U.S. EPA, Washington, D.C., 1986 Revised July 1992.

Code of Federal Regulations, Title 40 "Protection of Environment", Office of the Federal Register, National Archives and Records Administration, July 1991.

Taylor, B., Mauro, D., Staub, J., "Microscale Solvent Extraction (MSE) Methods for the Analysis of Solids and Liquids", EPRI Report No. TR-105317-V2, 1995.

Appendix A

Personnel Resumes

David M. Mauro

President/Senior Chemist
META Environmental, Inc.

EDUCATION

Ph.D. Candidate - Boston University - Chemistry
Dissertation Title: *"Resolution of Infrared Spectra of Mixtures by Self-Modeling Curve Resolution Using a Library of Reference Spectra with Simplex-Assisted Searching"*

M.S. - 1982 - Florida Institute of Technology - Environmental Science
Thesis Title: *"4-(4-Nitrobenzyl)pyridine Tests for Mutagens Following Chemical Oxidative Activation"*

B.S. - 1977 - Southampton College of Long Island University - Biology & Env. Science

BACKGROUND

Mr. Mauro is an environmental and analytical chemist with more than 15 years experience in the field. He is co-founder and president of META Environmental, Inc. (META), an environmental consulting and laboratory services company which specializes in electric and gas utility issues. At META, he is responsible for laboratory operations, selected project management, and environmental chemistry research. In addition, he is leader of the environmental forensics group.

Mr. Mauro has 13 years direct experience in electric utility work which has included serving as the project manager or senior technical consultant for dozens of projects involving design and implementation of site characterization studies, source identification and cost allocation studies, treatability studies, environmental fate and transport studies, statistical and quality control studies, and remedial designs. Mr. Mauro has extensive experience developing, evaluating, and implementing chemical analysis methods, as well as management of on-site and off-site laboratories. He is a principal investigator of several EPRI-sponsored research programs concerning MGP site management and coal tar chemistry, wood treating chemicals in the environment, dielectric fluid chemistry and fate, environmental forensic methods, and microscale analytical methods.

Selected Professional Experience

- Mr. Mauro is a Principal Investigator for a EPRI contract, "MGP Site and Materials Research: Source Characterization, Identification, and Fingerprinting." This contract includes a detailed literature, field, and laboratory study of the formation, sources, and chemical composition of wastes, such as tars and oils, found at former MGP sites. In addition, the project objectives include evaluating sampling and analysis methods for discriminating sources of contamination, applying mathematical and display methods for

quantifying dissimilarity, and developing bases for cost allocation.

- Mr. Mauro was a Principal Investigator and Project Manager for the multiyear EPRI contract, "Sampling and Analysis of Organic Substances - An Initial Evaluation and Case Studies." The goals of this project were to develop an understanding of the distribution, movement, and fate of organic substances at MGP sites, and to develop sampling and analysis techniques, and remediation methods for use at MGP sites. His responsibilities included conducting soil gas surveys, developing rapid on-site analytical techniques and operating on-site laboratories, managing contract laboratory work, evaluating data quality, evaluating chemical fate and transport, and conducting treatability studies.

- Mr. Mauro was a Project Manager or Senior Chemist for nine remedial investigations at former MGP sites. His duties included design and implementation of sampling and analysis plans, design of quality assurance plans, management of on-site and off-site laboratories, and data review and interpretation.

- Mr. Mauro has participated as the Project Manager or Senior Chemist for source identification projects at more than 25 former MGP sites for private clients. He was responsible for the review and interpretation of historical data, design of sampling and analysis plans, management of field and laboratory work, interpretation and presentation of the data, and expert testimony.

- Mr. Mauro was the Principal Investigator and Senior Chemist for three research projects on the chemistry, transport, and fate of dielectric fluids. Several dielectric fluids were examined, including mineral oil, alkylbenzenes, and polybutenes.

In addition to these projects, Mr. Mauro has extensive experience in the characterization, fate and transport properties, analytical methods, and quality assurance procedures at sites contaminated with refined petroleum products, wood preservatives (creosote and PCP), PCBs, non-PCB dielectric fluids, metals and solvents.

EXPERIENCE

META ENVIRONMENTAL, INC.
April 2000 – present
President

February 1990 - 2000
Vice President, co-founder and part owner

Responsible for the management of day to day operations.
Principal Investigator or Project Manager for numerous contracts concerning environmental problems at utility-owned sites.
Serves as company environmental forensics specialist and provides litigation support and expert

testimony.
Manages data validation projects.
Serves as company quality assurance officer.
Serves as company health and safety officer.
Serves as Senior Chemist.
Designed, built, and manages a certified research and testing laboratory.
Manages company-wide computer and IT systems.
Directs marketing and sales efforts.
Manages company facilities and equipment.

CAMBRIDGE ANALYTICAL ASSOCIATES, INC.
October 1988 - February 1990
Consulting Services Department, Assistant Director
[1989 - Outstanding Service Award]

March 1986 - October 1988
Consulting Services Department, Senior Chemist

April 1985 - March 1986
Environmental Services Division, Environmental Scientist

Senior chemist and manager of data validation group, completing numerous projects for EPA, NYSDEC, NJDEP, and private clients.
Played a lead role in the historical data review effort under a major EPA contract for the Love Canal hazardous waste site.
Served as consultant for U.S. EPA's CLP Program and other special analytical projects.
Senior chemist for a major contract concerning fate and transport of utility waste products.
Managed contract concerning investigation and remediation of major hazardous waste sites in New York State.
Developed sensitive analytical methods for the determination of metabolites from the biodegradation of chlorinated organic compounds.
Operated laboratory instrumentation.
Developed new business and wrote proposals.

MEDICAL RESEARCH INSTITUTE
September 1981 - August 1982
Research Associate

Managed a small organic and analytical chemistry research laboratory studying the formation and detection of chemical mutagens.
Designed, operated, and evaluated a bench-scale vapor scrubbing system for NASA, testing methods for more efficient removal of hypergolic rocket fuel vapors during fueling of the space shuttle.

HONORS AND AFFILIATIONS

Certificate of Recognition - National Aeronautics and Space Administration, 1982
President's Scholarship - Southampton College of Long Island U., 1973-1977
New York State Regents Scholarship - New York State, 1973-1977
Certificate of Award - Sigma XI, The Research Society, 1982
Member - American Chemical Society 1977 to present
Member - Board of Directors, Hamilton Children's Center, 1988 to 1990

SELECTED REPORTS *(D. Mauro was author, Principal Investigator, and/or Senior Chemist for these studies)*

"Congener-Specific Measurement and Leaching of PCBs," EPRI Report 1005309, November 2002.

"Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Soil," EPRI Technical Report 1005295, November 2002.

"Guidance for the Selection of Monitored Natural Attenuation as a Remedial Measure," EPRI Technical Report 1005306, July 2002.

"Characterization of Pipe-Type Cable Fluids and Development of Risk-Based Cleanup Goals," EPRI Technical Report 1001932, March 2002.

"Managing Odors at Manufactured Gas Plant Sites: Issues and Approaches," EPRI Technical Brief, February 2002.

"Material Consolidation, Rendering, and Disposal Studies of Gas Holders at Former Manufactured Gas Plant Sites," EPRI Report # , 2001.

"Chemical Source Attribution at Former MGP Sites," EPRI Final Report 1000728, December 2000.

"Coal Pile Liner Investigation Report," EPRI Report #1000583, October 2000.

"Laboratory Studies on Rendering Tarry Materials Nonhazardous," EPRI Final Report #1000589, September 2000.

"Mineral Insulating Oils Used in the Power Industry: Chemical Composition and Dissolution Characteristics," EPRI Final Report TR-1000141, August 2000.

"Accelerated GC/MS Analyses of Samples from Former MGP Sites," EPRI Report TR-114786, *March 2000.*

"Literature Review of Background Polycyclic Aromatic Hydrocarbons," EPRI Report TR-114755, March 2000.

"Characterization and Monitoring Before and After Source Removal at a Former Manufactured Gas Plant (MGP) Disposal Site, Part 2 of the Site 24 Report" EPRI Report TR-105921-V2, March 2000.

"Distribution of Tar and PAHs in the Subsurface at a Former MGP Site," EPRI Report TR-114174, December 1999.

"Survey of Physical and Chemical Properties of Soils Collected from Former Manufactured Gas Plant Sites," EPRI Report TR-114192, December 1999.

"Mineral Insulating Oils Used in the Power Industry: Chemical Composition and Dissolution Characteristics," EPRI Interim Report TR-114129, December 1999.

"Non-PCB Capacitor Fluids Used in the Power Industry: Chemical Composition and Dissolution Characteristics," EPRI Report TR-113974, December 1999.

"Microscale Solvent Extraction Methods for Organic Compound Analyses," EPRI technical brief, TB-114122, November 1999.

"The Use of High Resolution Areal and Vertical Sampling at a Wood Pole Storage Yard," EPRI technical brief, TB-113581, November 1999.

"The Leaching of PCBs From Soil," EPRI technical brief, TB-113511, October 1999.

"Characterization of PCBs in Groundwater Using a Drive Point Sampler," EPRI Report TR-113372, July 1999.

"Delineation of Coal Tar Dense Nonaqueous Phase Liquid and Groundwater Plumes at a Former Manufactured Gas Plant Site," EPRI Report TR-111537, November 1998.

"Source Identification Methods at Utility Sites," EPRI technical brief, TB-113668, September 1999.

"Options for Reducing Environmental-Related Utility Costs Associated with Dielectric Fluids Employed in Cables and Transformers," EPRI Report TR-111722, December 1998.

"Mineral Oil Transport and Fate Investigations at Franklin Substation," EPRI Report TR-111238, November 1998.

"Orimulsion Combustion By-Products Chemical Composition and Leaching Characteristics," EPRI Report TR-109020, August 1998.

"Chemical-Physical Characteristics of Mineral Insulating Oils and Environmental Risk Analyses," EPRI Technical Brief, TB-111083, August 1998.

"Site 24 Compact Disk Containing Environmental Data, Photographs, and Graphic Displays Users Guide," EPRI Report TR-110830, June 1998.

"PCDDs and PCDFs in Coal Combustion By-Products (CCBS)," EPRI Report TR-110399, March 1998.

"Literature Review: Asphalt Batching of MGP Tar-Containing Soil," EPRI Report TR-108597, December 1997.

"Insulating Oil Characteristics, Volume 1: Characterization Results," EPRI Report TR-106898-V1, December 1996.

"Insulating Oil Characteristics, Volume 2: Fate and Transport Evaluation," EPRI Report TR-106898-V2, December 1996.

"Characterization and Monitoring Before and After Source Removal at a Former Manufactured Gas Plant (MGP) Disposal Site," EPRI Report TR-105921, January 1996.

"Interim Report on the Fate of Wood Preservatives in Soils Adjacent to In-Service Utility Poles in the United States," EPRI Report, TR-104968, June 1995.

"Limited Field Investigation of the Former Manufactured Gas Plant Site in Mason City, Iowa Report of Results," prepared for Spencer, Fane, Britt & Browne, June 14, 1995.

"Microscale Solvent Extraction (MSE) Methods for Analysis of Soils and Waters, Volumes I & II", EPRI Report, TR-105317-V1 and -V2, March 1995.

"Pentachlorophenol (PCP) in Soils Adjacent to In-Service Utility Poles in New York State," EPRI Report, TR-104893, March 1995.

"Evaluation of Information, Reports, Data, and Samples Regarding the Waynesboro Site Arbitration: Report of Results," prepared for Blank, Rome, Comisky & McCauly, February 27, 1995.

"Field Pan Studies on Treatment of Manufactured-Gas Plant (MGP) Soils Using Commercially Grown Fungus," EPRI Report, TR-102185, July 1993.

"Chemical and Physical Characteristics of Tar Samples From Selected Manufactured Gas Plant (MGP) Sites," EPRI Report, TR-102184, May 1993.

"Treatability of PCB-Contaminated Soils With Quicklime (CaO)," EPRI Report TR-101778, December 1992.

"Improved Hypergolic Vapor Removal Systems", J. Thomas, R. Barile, D. Mauro, L. Osborne. National Aeronautics and Space Administration, Document NAS 10-10106, September, 1982.

"Alumina Packed Bed Removes Hypergol Vapors from Gas Stream", J. Thomas, R. Barile, D. Mauro, NASA Tech Briefs, 1984.

SELECTED JOURNAL ARTICLES AND BOOKS

"The Determination of Anaerobic Biodegradation Products of Aromatic Hydrocarbons in Groundwater Using LC/MS/MS", in "Mass Spectrometry, LC/MS/MS and TOF/MS: Analysis of Emerging Contaminants", Chapter 19, ACS volume 850, Ferrer and Thurman, Eds., (2003), Oxford University Press.

"Simultaneous Determination of Volatile and Semivolatile Organic Compounds in Soil," D.M. Mauro, Remediation, Vol. 10, Number 4, Autumn 2000.

"Studies on the Applicability of Biomarkers in Estimating the Systemic Bioavailability of Polynuclear Aromatic Hydrocarbons from Manufactured Gas Plant Tar-Contaminated Soils," A. Koganti, D.A. Spina, K. Rozett, B. Ma, E.H. Weyand, B.B. Taylor, and D.M. Mauro, Environmental Science and Technology, Vol. 32, No. 20, 1998.

"Studies Estimating the Dermal Bioavailability of Polynuclear Aromatic Hydrocarbons from Manufactured Gas Plant Tar-Contaminated Soils," T.A. Roy, A.J. Krueger, B.B. Taylor, D.M. Mauro, and L.S. Goldstein, Environmental Science and Technology, Vol. 32, No. 20, 1998.

"Organic Substances in the Subsurface: Delineation, Migration, and Remediation," I. Murarka, E. Neuhauser, M. Sherman, B.B. Taylor, D.M. Mauro, J. Ripp, and T. Taylor, Journal of Hazardous Materials, vol. 32, 1992, pp. 245-261.

"4-(4-Nitrobenzyl) Pyridine Tests for Alkylating Agents Following Chemical Oxidative Activation," J.J. Thomas, J.H. Kim, and D.M. Mauro, Archives of Environmental Contamination and Toxicology, Vol. 22, 1992.

"Biochemical Effects of Coal Tar Components in Mice Following Ingestion", Polycyclic Aromatic Compounds, E. Weyand, Y. Wu, S. Patel, B.B. Taylor, and D.M. Mauro, Spring 1992.

"Urinary Excretion and DNA Binding of Coal Tar Components in B6C3F1 Mice Following

Ingestion", E. Weyand, Y. Wu, S. Patel, B.B. Taylor, and D.M. Mauro, Chem. Res. Toxicology, vol. 4, 1991.

"Resolution of Infrared Spectra of Mixtures by Self-Modeling Curve Resolution Using a Library of Reference Spectra with Simplex Assisted Searching", D.M. Mauro and M.F. Delaney. Analytical Chemistry, Nov. 1987.

"Extension of Multi-Component Self-Modeling Curve Resolution Using a Library of Reference Spectra", D.M. Mauro and M.F. Delaney, Analytical Chimica Acta, Vol. 172, 1985.

SELECTED PRESENTATIONS AND SEMINARS

"Compound-specific Carbon Isotope Ratios and Extended PAH Profiles as Forensic Methods at Former MGP Sites," D.M. Mauro, D.R. Craig, R.P. Philp, and J. Allen, presented at the 14th International Conference on Site Remediation Technologies & Environmental Management in the Utility Industry, December 2001.

"Compound-specific Carbon Isotope Ratios used in Forensic Studies of Former Manufactured Gas Plant Sites," D.M. Mauro, D.R. Craig, R.P. Philp, and J. Allen, presented at the 17th Annual Conference on Contaminated Soils, Sediments and Water, October 2001.

"Polycyclic Aromatic Hydrocarbons in Surface Soil in the United States," A.J. Coleman and D.M. Mauro, presented at the International Conference on Remediation of Contaminated Sediments, Venice, Italy, October 2001.

"Background PNA Study," A. Coleman and D.M. Mauro, presented at the Illinois Manufactured Gas Plant (MGP) Forum, May 24, 2001.

"Identifying the Source of PAH Contamination," S. Emsbo-Mattingly and D.M. Mauro, presented at the 16th Annual International Conference on Contaminated Soils, Sediments and Water, October 2000.

"Forensics and Fingerprinting," D.M. Mauro, presented at the EPRI/GRI Conference on Management of Former MGP Sites, June 2000.

"Accelerated Extraction and GC/MS Analysis of Samples from Former MGP Sites," D.M. Mauro, presented at the EPRI/GRI Conference on Management of Former MGP Sites, June 2000.

"Simultaneous Measurement of Volatile and Semivolatile Compounds: Introducing Methods 3511 and 3570," D.M. Mauro, presented at the 15th Annual International Conference on Contaminated Soils & Water, October 1999.

"Source Identification for PAHs in Sediments," D.M. Mauro, presented at the EPRI Workshop

on Sediments at MGP Sites, September 1999.

"Simultaneous PAHs and MAHs by MSE," D.M. Mauro and I.P. Murarka, presented at the Management of Manufactured Gas Plant Sites Technology Transfer Seminar, September 1997.

"Source Identification at MGP Sites," D.M. Mauro and I.P. Murarka, presented at the Management of Manufactured Gas Plant Site Technology Transfer Seminar, September 1997.

"30 Years Later. Risk Assessment of a Site Contaminated During the Great Alaskan Earthquake," J.A. Pfeiffer, J. Ibarra, M.J. Meehan, I.P. Murarka, B.B. Taylor, D.M. Mauro, I. Silverstein, and L.F. von Oldenburg, presented at the 1996 Annual Meeting of the Pacific Northwest International Section of the Air & Waste Management Association, December 12, 1996.

"Identifying, Evaluating, and Implementing Strategies for Remediation of Contaminated Sites in the U.S.A.," I.P Murarka, B.B. Taylor, and D.M. Mauro, presented in Milan, Italy, May 1996.

"Applications of Microscale Solvent Extraction (MSE) Methods at Former Manufactured Gas Plant Site (MGP)," D.M. Mauro and I.P. Murarka, presented at the Internation Symposium and Trade Fair on the Clean-up of Manufactured Gas Plants, September 1995.

"On the Application of Total Petroleum Hydrocarbon (TPH) Methods at Former Manufactured Gas Plant (MGP) Sites," D.M. Mauro and I.P Murarka, presented at the International Symposium and Trade Fair on the Clean-up of Manufactured Gas Plants, September 1995.

"Source Characterization and Assignment at Former Manufactured Gas Plant (MGP) Sites," D.M. Mauro, presented at the International Symposium and Trade Fair on the Clean-up of Manufactured Gas Plants, September 1995.

"Microscale Solvent Extraction (MSE) Methods for the Simultaneous Determination of PCBs and Mineral Insulating Oil or PCBs Alone," D.M. Mauro, B.B. Taylor, and I.P. Murarka, EPRI, presented at the EPRI: 1995 PCB Seminar, Boston MA, August 1995.

"The Formation of Nitriles and Related Halogenated Disinfection By-Products in Chlorinated and Chloraminated Water; Applications of Microscale Analytical Procedures," M.S. Young, D.M. Mauro, P.C. Uden, and D.A. Reckhow, presented at the Meeting of the American Chemical Society, August 20-24, 1995.

"An Innovative Discrete Multilevel Sampler Design", B.K. Marvin, P.J. DeClercq, B.B. Taylor, and D.M. Mauro, presented at the 1995 ASCE-CSCE Environmental Engineering

Conference in Pittsburgh, PA, July 23-26, 1995.

"Microscale Solvent Extraction Methods for Organic Compound Analyses," D.M. Mauro, presented at the 18th Annual EPA Conference on Analysis of Pollutants in the Environment, May 1995.

"The Development of Direct Push Multilevel Sampling Technology as a Flexible Site Investigation Tool", P.J. DeClercq, B.K. Marvin, B.B. Taylor, and D.M. Mauro, presented at the National Groundwater Association Outdoor Action Conference in Las Vegas, NV, May 2-4, 1995.

"The Impact of Source Removal and Natural Processes on an MGP Contaminant Plume at Site 24", J.P. Foxwell, B.B. Taylor, D.M. Mauro, and I.P. Murarka, presented at the National Groundwater Association Outdoor Action Conference in Las Vegas, NV, May 2-4, 1995.

"Characterization and Remediation Alternatives Study at a Diesel Spill Site", I. Murarka, B.B. Taylor, D.M. Mauro, I. Silverstein, L. von Oldenburg, R. Kuczek, and J. Ibarra, Municipal Light & Power, presented at the Hazardous Waste and Environmental Management in the Gas Industry, and IGT Conference held in Albuquerque, New Mexico on January 26, 1995.

"Microscale Solvent Extraction Methods for Organic Compound Analyses" D.M. Mauro, B.B. Taylor, and I.P. Murarka, presented at the SUPERFUND XV Conference & Exhibition, a HMCRI Conference held in Washington, DC from November 29 - December 1, 1994.

"A Microscale Solvent Extraction (MSE) Procedure foı the Simultaneous Determination of Volatile and Semivolatile Petroleum Hydrocarbons in Soil or Aqueous Samples", M.S. Young, D.M. Mauro, and K.W. Craigie, presented at the Ninth Annual Conference on Contaminated Soils, held in Amherst, MA from October 17 - 20, 1994.

"The Use of Microscale Solvent Extraction (MSE) Methods at Former Manufactured Gas Plant (MGP) Sites", B.B. Taylor, D.M. Mauro, M.S. Young, J.A. Staub, presented at the IGT Conference, Hazardous Waste and Environmental Management in the Gas Industry, Albuquerque, NM, January 19-24, 1994.

"Microscale Solvent Extraction (MSE) Methods for Tarry Soils from Former Manufactured Gas Plant (MGP) Sites", D.M. Mauro, J.A. Schneider, M.S. Young, B.B. Taylor, I.P. Murarka, in Proceedings of the Ninth Annual Waste Testing and Quality Assurance Symposium, EPRI/EPA, July 1993.

"Analysis of Groundwater for Selected Organic Compounds at Trace Levels: A Case Study of Quality Assurance/Quality Control (QA/QC) at EBOS Site 24", B.B. Taylor and D.M. Mauro, in Proceedings of the 1990 International Conference on Measuring Waterborne Trace Substances, Baltimore, MD, August 28-30, 1990.

"Composition and Migration of Coal Tar-Derived Organic Compounds in Sandy Aquifer", in Proceedings: Environmental Research Conference on Groundwater Quality and Waste Disposal, B. Taylor, D. Mauro, M.B. Hayes, B. Holmen, and M. Young, EPRI/EPA, EPRI EN-6749, March 1990.

"Determination of Toxic Heterocyclic Components of Coal Tar by Gas Chromatographic Methods Suitable for Field or Laboratory Use", D.M. Mauro and M.S. Young, presented at The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, March 1991.

"Analytical Techniques for Characterization of MGP Site Soils, Wastes, and Waters", presented at the Manufactured Gas Plant Technology Transfer Seminar, April 1991.

"Improved Methods for Field GC Analysis for Priority Pollutants", M.S. Young and D.M. Mauro, presented at The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, March 1990.

"Multicomponent Self-Modeling Curve Resolution", presented at the Eastern Analytical Symposium, November 1985.

"Spectral Compound Identification - Qualitative Chemometrics", presented at the Federation of Analytical Chemistry and Spectroscopy Societies, September 1985.

"Separating Overlapped Spectro-Chromagrams Using Self-Modeling Curve Resolution with Library Searching", presented at The Pittsburgh Conference and Exposition, February 1985.

"Gas Chromatography with Infrared Spectrometric Detection", presented at the New England Regional Meeting of the American Chemical Society, June 1983.

EXPERT TESTIMONY

Curtiss-Wright Corporation vs. Aetna Casualty and Surety Company, et al.
Superior Court of New Jersey
Case No. BER-L-05305-92
Deposition taken October 29, 1997

Interstate Power Company vs. Kansas City Power & Light Company, et al.
United States District Court for the Northern District of Iowa
Case No. C8903033
Depostion taken July 13, 1995

Landis Tool Company Division of Western Atlas vs. South Penn Gas
Independent Arbitration

Deposition April 1995 (not transcribed)

U.S. Coast Guard vs Bel Air Leasing Limited Partnership
Sheepshead Bay: FPN B99007 and Civil Penalty 0190MV99000950
Coast Guard Investigation MSL Case No. 99-134
Testimony at Coast Guard hearing, May 25, 2000

Volunteers of America of Western New York, Inc. v. Heinrich, et al.
Case No.: 99-CV-6238TB
Testimony at hearing, April 9, 2001

Commonwealth of Massachusetts v. Boston Edison Company, SAK Recycling Company, Fiore Construction Co., Inc., and Walter Fiore
Suffolk Superior Court, Massachusetts
Civil Action No. 96-0673A
Deposition given October 24, 2002

Certificate of Achievement

This Is To Certify That

David M. Mauro

Has Successfully Completed

A Study in Mass Spectral Interpretation

An American Chemical Society Short Course
For
The Northeastern Section of the ACS
May 12 & 13, 1997

O. David Sparkman
Instructor

DAVID R. CRAIG

EDUCATION

B.S. - 1992 - Gordon College - Chemistry

EXPERIENCE

META ENVIRONMENTAL, INC.
April, 2000 - present
Laboratory Manager

Management of the day to day activites of the laboratory.
Supervision of laboratory staff.
Management of all laboratory projects and schedules.
Review of data, preparation of reports.
On-site field laboratory management.
Troubleshooting and maintenance of analytical instruments.
Methods development.

T.R. WILBURY LABORATORIES INC.
October, 1998 - April 2000
Analytical Chemist

Preparation and analysis of samples using HPLC & GC.
Coordination of studies in conjunction with biology department.
Troubleshooting and maintenance of instruments.
Method development and validation under GLP.

META ENVIRONMENTAL, INC.
July 1992 - September 1998
Environmental Chemist

Extraction of samples for organic contaminants using standard and microscale methods.
Analysis of extracts via GC/FID, GC/PID, GC/ECD, GC/MS, FTIR, and Gravimetry.
On-site field laboratory analysis.
Troubleshooting and maintenance of analytical instruments.
Sample custody and disposal management.
Review of data prior to QA review.
Methods development.

GORDON COLLEGE
September 1989 - May 1992
Laboratory Assistant

Taught Organic Chemistry laboratories skills and techniques.
Supervised laboratory safety and administered tutorial help.

SALEM STATE COLLEGE
May 1991 - August 1991
Laboratory Assistant

Instructed in laboratory techniques and supervised safety.
Administered private and class tutorial sessions.

SAMUEL CABOT INC.
May 1990 - August 1990
Laboratory Assistant Technician

Prepared samples for color matching.
Checked specifications for quality control.
Checked and sampled solvent wash for EPA reports.

HONORS AND AWARDS
A. J. Gordon Scholar, Gordon College; National Merit Scholar
President, Student Affiliate Chapter, ACS

EDWARD C. CURRANT

50 Moulton Rd. Arlington, MA (781) 643.9715 ecibis@earthlink.net

MAJOR SKILLS Supervising experience, quality assurance/quality control, data validation, GC,GC/MS analysis, troubleshooting and repair, project management,client relations, Turbochrom, LIMS systems, HP Chemstation, EPA methods and regulations

EXPERIENCE

GC, GC/MS Analyst
META Environmental, Inc.
May 2002 – present

Responsible for operation and maintenance of GC and GC/MS instruments
Reviews data and prepares laboratory reports

Laboratory Supervisor
North State Environmental, South San Francisco, CA
July 1996- February 2002
Responsible for QA/QC, and data validation for all data and analysis.
Developed a custom LIMS database system compatible with COELT and Geotracker software for EDF reporting and multi-level data validation.
Managed and directed laboratory staff to operate within set deadlines and GLP parameters. Supervised all organic, inorganic and wet chemistry extractions and analysis
Served as a customer point of contact during all aspects of sample analysis and reporting
Conducted internal audits to ensure data quality and proper waste management procedures. Worked with state agencies to ensure compliance
Developed current SOP's for all laboratory procedures and developed new methods
Maintained and repaired lab equipment including GC and GC/MS instruments, auto-samplers, and software

Gas Chromatography Analyst
Alpha Analytical Labs, Westborough, MA
November 1994- February 1996
Loaded, operated, maintained, and repaired GC,GC/MS,HPLC instruments, auto samplers, and purge and trap extractors
Analyzed data and presented reports for glycol, chlorinated, aromatic, PCB, Pesticide, Petroleum, and Herbicide analysis according to EPA guidelines
Programmed and operated Turbochrom Navigator 4.0 and 4.1 software programs, worked with spreadsheet programs, and recorded sample inventory on LIMS software
Performed and analyzed state certification evaluation tests

OTHER EXPERIENCE

Computer Experience: Java, C, HTML, WORD, Excel, Powerpoint, Wordperfect, Lotus, Turbochrom Navigator, HP Chemstation, Access, Fox Pro, COELT, MS Office, Windows 95, 98, NT, extensive working knowledge of internet applications, repairing and upgrading computer hardware and networked systems

Related Training:
Restek Environmental Training Course. Course emphasized EPA methods overview, Instrument configuration detection limits, PQL's, RL's, and calculations for PCB, PNA, GRO/DRO, and volatile analysis

EDUCATION

University of Massachusetts, *Amherst, MA*
Major: Environmental Sciences
Bachelor of Science degree received in May 1994

University of Berkeley Extension, *San Francisco, CA*

Java Basics	*Grade received: A*
Programming Logic and Design	*Grade received: A*

DINSRY BERHANU

EDUCATION

B.S. - 1999 - Gordon College - Biology
Minor in Chemistry

EXPERIENCE

META Environmental, Inc.
October 1999 - Present
Environmental Chemist

Extraction and cleanup of soil and water samples for organic contaminants using standard and in-house methods.
Analysis of samples by GC/FID.
Analysis of extracts via FTIR, and Gravimetry.
Sample leaching by EPA 1311 TCLP methods.
Treatability studies for rendering non-hazardous material non-hazardous.
Sample custody, disposal management, and daily equipment monitoring.

Northeastern University
Department of Chemistry
May 1999 - June 1999
Laboratory Technician

Set-up laboratories.
Assisted professor in the stock room.

ETHIOPIAN EVANGELICAL CHURCH, Boston
February 1999 - July 1999
Administrative Assistant

Performed administrative and clerical projects.
Interacted with members and different ministries within the church.
Handled public and members information requests.
Responsible for handling finances.

GORDON COLLEGE
Fall 1997
Teaching Assistant

Assisted professor with clerical duties.
Assisted students in laboratories.
Helped professor grade lab reports.

Green House Assistant
Fall 1997 - Spring 1998

Assisted professor in planting for various plant physiology course.
Provided general care.

Mirjana Pilipovic
353 Sea St., #24, Quincy, MA 02169
Cell: (617) 290-4925
470 - 5235

[redacted]

[redacted]

Education:
Belgrade University — Belgrade, Yugoslavia
B.S. in Chemistry, 1996

Laboratory Skills:
HPLC, GC/MS(HP 5890/6890 GCs/HP 5970/5971/5972/5973 MSDs) ,GC/ECD, AA, UV-VIS, IR, TLC, SDS-gel electrophoresis.

Computer Skills:
OS Windows, Microsoft Office, HP ChemStation (GC/LC), HP EnviroQuant.

Related Experience:
Lyne Laboratories, Inc. — Brockton, MA
Research Chemist (temp) — 9/2001-3/2002
Provided R&D, HPLC method development and validation (precision, accuracy, linearity, selectivity, robustness, ruggedness, LOD, LOQ) for Metformin HCl and Snac/Heparin drug products following GMP guidelines.

STL Technologies, Inc. — Quincy, MA
Mobile Lab Manager — 2001
Operated and managed a laboratory (3-4 people). Responsibilities included instrument maintenance, troubleshooting, result reporting, data reviewing, validating and approving. I also supervised analysis performance of PCBs(GC/ECD), PAHs(GC/MS), VOCs(GC/MS), TPHs(IR), metal analysis(AA).

STL Technologies, Inc — Quincy, MA
Senior Chemist-Analyst — 1999-2001
Analyzed solid and water samples for semi-volatiles, volatiles and PCBs, following EPA methods 8270, 8260 and 8082 with strict adherence to GLP guidelines.

Kasindo Hospital — Sarajevo, YU
Analytical Chemist — 1996-1997
Performed blood testing while utilizing chromatography and electrophoresis.

Belgrade University — Belgrade, YU
Chemical Technician — 1994-1996
Provided technical support and assistance in chemical and biochemical analysis. Worked with a team of professionals, including chemists and engineers, to oversee and participate in various laboratory measurement procedures performed by students. Also, operated and maintained laboratory equipment. Calculated and recorded results to apply quality control and quality assurance procedures during analysis.

References will be furnished upon request.

[redacted]

Todd C. Gilmore

On Assignment

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Education:

M.S. 2000. Marine Environmental Science
State University of New York at Stony Brook
GPA: 3.65

B.S. 1996. Biology
State University of New York at Geneseo
GPA: 3.45

Employment History:

2001-Present — Media Consultant. Creates large media-rich web sites, advertisement banners and production music. Develops site architecture and designs user interfaces. Efficiently works with other designers to meet client's needs. Continuously updates skill set to remain current.

2001-Present — CD Spins, Inc. Product Buyer/Shift Supervisor. Assesses condition, appraises value, and purchases incoming product. Supervises sales clerks.

Summary of Research:

1998-2000 — Fish Ecology Laboratory, SUNY Stony Brook, NY. Graduate Research Assistant. Lead intensive oceanographic research project. Developed new methods, collected specimens and processed samples. Documented information and constructed large database. Analyzed results employing statistical methods. Wrote progress reports and standard operating procedures. Presented work at seminars and scientific meetings.

Laboratory Skills:

- Microscopy and digital imaging
- Media preparation and cell culturing
- Dissection and tissue collection
- General lab activities (weighing, measuring, solutions, dilutions, etc.)

Computer Skills

- Access, Excel, Scion Image, Statistica, Word

On Assignment
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Aaron M. Druck

OBJECTIVE: A position within the biomedical research industry, utilizing my research based experiences in biochemistry and molecular biology

EDUCATION:

Colby College, Waterville ME
1997-1999

New Mexico State University, Las Cruces, NM BS.
May 2002

Double Major: Microbiology and Biology
Honors: Dean's List, four semesters
Activities: Emergency Medical Technician I, Environmental Biology Club

RELEVENT COURSEWORK:

Biochemistry	Genetics	Microbiology
Organic Chemistry	Microbial Genetics	Immunology
Analytic Chemistry	Microbial Physiology	Microbial Systematics
Environmental Ecology	Medical Microbiology	

LABORATORY SKILLS:

Molecular Biology Techniques: Experience in preparing recombinant DNA samples, Plasmid DNA extraction, Polymerase Chain Reaction procedures, ELISA, Gel Electrophoresis, DNA Transformation and Blotting.

Organic Chemistry: Frequent procedures in Gas Chromatography, Wet Chemistry, and Organic Synthesis

Microbiology Techniques: Culturing, Staining, Coliform testing

Computer Based Analysis of Sequence Data: Familiarity with Blast, PAUP, POY,

COMPUTER SKILLS: Word, Works, Access, Excel

PREVIOUS EMPLOYMENT:

Crackerbarrel, Las Cruces, NM
Server 2002

Napalitos Restaurant, Las Cruces, NM
Server 2000-2002

Hard Chargers Café , Playa Hermosa, Costa Rica

Bartender and Server 7/99-2/00
Pappadeaux Restaurant, Houston, TX
Server 1995-1997

VOLUNTEER EXPERIENCE:
Southwest Environmental Center, Las Cruces NM
Project Volunteer 2000-2002

AWARDS:
Popcorn's Poetry Slam Runner-up, Las Cruces NM February 2001

References available upon request

Kelly Scientific
RESOURCES
617-482-0859

Nkengafeh Asong

EDUCATION

Austin College, Sherman, Texas — September 2000 – May 2002
Bachelor of Arts in Chemistry
G.P.A: 3.85 (out of 4.0)

University of Maryland, Princess Anne, Maryland — January 1999 – May 2000

HONORS & SCHOLARSHIPS

National Collegiate Natural Science Award
National Deans List
Member of Alpha Chi
Certificate of Academic Achievement

EXPERIENCE

Instrumental Analysis — August – December 2001
One semester course designed specifically to increase skills in the operation of chemical instruments such as HPLC, GC, Spectrophotometer, and IR instruments.

- Course work consisted of a weekly four-hour laboratory session in which experiments were performed.
- Wrote laboratory reports paying special attention to ways in which the experiments could be improved or further applied

Fiangep Clinic, Cameroon, West Africa — June – August 2001
Individual Study Off Campus

- Reported on quality of patient care and lack of hospital services
- Proposed and implemented services in deficient areas
- Observed patient/healthcare personnel interactions
- Gave a presentation and wrote a report on findings

Wilson N Jones Hospital, Sherman, Texas — January 2001
January Term – Intern

- Observed and interacted with hospital personnel/ patients
- Kept a daily log of events

Leadership

EXPERIENCE

WISE (Women's Issues campus organization) — 2000-2001
Vice President

University of Maryland Campus Guide — September 1999

- One of several students charged with assisting in freshmen orientation

Austin College Communication Inquiry Course — August – December 2000
Class Leader under Dr Bernice Melvin

- One of five senior students in a course designed to aid freshmen adjust to college
- Assisted in the evaluation of course examinations and research papers

University of Maryland, *Access to Success Program* — September 1998–May 2000
Tutor

- Tutored college students in Chemistry, Mathematics and Physics

SKILLS

Skilled in *Word Perfect, Microsoft Word* and *Excel*
Ability to operate *Mathematica* and *Spartan*
Ability to operate *HPLC, GC, IR* and *Spectroscopy* instruments
Ability to perform *Western Blotting* and *Electrophoresis*

LAB SUPPORT
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Claire E. Willscher

Biotechnology and Pharmaceutical Research Qualifications

- Capacities to conduct research, identify key issues, and present findings in written and oral forms.
- Strong quantitative and qualitative analytical abilities developed through intensive project focused curriculum.
- Experience with grant writing, budget development, and expenditure tracking efforts.
- Strong written communication skills demonstrated through co-authoring a journal article.
- Windows, Microsoft Word, Excel, Power Point and Internet applications competencies.

Chemistry, Science, and Liberal Arts Education

UNIVERSITY OF ROCHESTER, Rochester, NY
Bachelor of Arts, Chemistry, May 2002, with major GPA of 3.81 / 4.0

- Dean's List 8 of 8 eligible semesters.
- Chemistry Departmental Award, presented to graduating chemistry majors with outstanding achievements during their undergraduate careers.
- Xerox Scholarship Award and Rush Rhees Scholarship Award, both awarded based on merit.
- Garnish Scholarship Award, awarded to 6 varsity athletes based on display of strong leadership and character in the University of Rochester's athletic program.
- Golden Key National Honor Society Recognition.
- University Athletic Association's All Academic Recognition for Swimming 1999-2002.
- Member of varsity swim team 1998-2002, member of varsity soccer team 1998.

Laboratory and Policy Research Experience

HOUSE OF COMMONS—BRITISH PARLIAMENT, London, England
Research Assistant to Ann Keen MP, Fall 2001

- Researched governmental policy, and assisted in informing constituents of various issues.
- Attended meetings between the Member of Parliament and her constituents.

MASSACHUSETTS GENERAL HOSPITAL — HARVARD MEDICAL SCHOOL, Boston, MA
Research Assistant to Dr. Tayyaba Hasan, specialist in Photodynamic Therapy, Summer 2001

- Identified how treatment of cancer cells with feretinide contributes to the uptake of fluorescence labeled markers.
- Determined specific protein concentrations in several strains of ovarian cancer cells.

DANA-FARBER CANCER INSTITUTE — HARVARD MEDICAL SCHOOL, Boston, MA
Research Assistant to Dr. Glenn Dranoff, specialist in Immunology and Gene Therapy, Summer 2000

- Researched capabilities of certain proteins (GM-CSF and related cytokines) stimulating anti-tumor immunity.
- Prepared cultures of cancerous cells intended for tumor growth and analysis.

DARTMOUTH-HITCHCOCK MEDICAL CENTER, Hanover, NH
Research Assistant to Dr. Brian Pogue, specialist in Biomedical Laser Applications, Summer 1999

- Researched Near-infrared (NIR) optical images of breast cancer.
- Co-authored journal article published December 2000 in *Medical Physics* entitled "Contrast-detail analysis for detection and characterization with near-infrared diffuse tomography."
- Constructed models used to calibrate NIR laser prior to patient exams.
- Assisted building of upgraded imaging system.

Teaching Experience

UNIVERSITY OF ROCHESTER, Rochester, NY
Organic Chemistry Teaching Assistant, Fall 2000

- Met weekly with students to address subject-specific issues, reinforce concepts presented in lectures, and support preparation for exams and lab exercises.

Outside Interests

- Traveled solo through Great Britain, France, Italy, Germany, Austria, and the Czech Republic.
- Triathlons, water skiing, sailing, backpacking, tennis, and squash.

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Patrick J. O'Connor

Objective: To obtain a challenging position in the Environmental industry, utilizing a strong background in science education, laboratory and hands on sampling techniques.

Employment:

2002-2003 *Organic Prep Chemist* **Alpha Analytical**

Worked as an Organic Prep Chemist/GCMS Operator. Supervision of night shift.

2001-2002 *Lab Pack Field Chemist* **Cyn Environmental**

Identifying, packing, sampling, labeling, categorizing and shipping hazardous waste from multiple customer sites to appropriate disposal centers.
Responsible for writing manifests and profiles to comply with DOT regulations.
Gained a full understanding of EPA and state regulated codes for disposal.
Daily interaction with clients to ensure customer satisfaction.

2000-2001 *Senior GC Chemist* **GeoLabs, Inc.**

TPH, EPH, CtEPH, PCB's/Pesticides, DRO & TCLP analysis.
Responsible for running/maintaining (2)HP6890; (5)HP5890 with HPChemStation software on Windows 98.
GC maintenance techniques, column conditioning.
Sample extraction and standard/curve preparation.
GC experience with ECD, FID, PID detectors

1997-2000 *Teacher* **Natick High School**

Permanent substitute teacher, general science teacher, track coach, fencing instructor, and special education teacher.

Education: 98-2000 *Framingham State College* **Framingham, MA**
Teaching Certification, M.Ed.

95-96 *University of New Hampshire* **Durham, NH**
Continuing Education, Horticultural Technology

89-93 *University of New Hampshire* **Durham, NH**
Bachelor of Science, Environmental Science

KATHLEEN A. PETERSON

EDUCATION
B.S. - 1989 - Salem State College - Environmental Geography

EXPERIENCE
META ENVIRONMENTAL, INC.
November 2002 - present
QA/QC Associate

Review of GC and GC/MS data review.
Management of QC data and control charts.

September 1996 - November 2002
GC/MS Analyst

Analysis and data processing of contaminated soil and water extracts using the HP 5890A Gas Chromatograph with FID, ECD, and MS detectors.
Performs EPA analysis methods for potable water, non-potable water, and soil samples.
Develops extraction, fractionation, and analysis methods for PCBs by GC/ECD and GC/MS.
Extraction of soil and water samples for organic contaminants using standard and microscale methods.
Analysis of extracts via GC/FID, GC/PID, GC/ECD, and GC/MS.
Responsible for maintaining instrumentation and development of procedures for data processing.
Troubleshooting and maintenance of analytical instruments.
Review of data prior to QA review.
Management of QC data and control charts.
Methods development.

TMA/SKINNER AND SHERMAN
July 1991 - August 1996
Chemist and Analyst

Daily management of the sample preparation and volatile laboratories.
Extraction of soil and water samples for organic contaminants using standard US EPA methods.
Analysis of samples via PT/GC/MS for volatile organics.
Troubleshooting and maintenance of analytical instruments.
Review of data prior to QA review.
Methods development.
Assembled data packages.

ANALYTICHEM
January 1991 - June 1991
Chemist

Extraction of soil and water samples for organic contaminants using standard US EPA methods.

RESUME

Michael S Young, Ph.D.

EDUCATION

University of Massachusetts at Amherst
Ph.D. in Chemistry, 1988

PROFESSIONAL SUMMARY

Experienced in all major applications of separation science with particular experience in gas and liquid chromatography and mass spectrometry. Is an expert in sample preparation and has made original contributions to the field of solid-phase extraction (SPE). Has considerable general knowledge of organic chemistry and environmental science. Has supervised laboratory operations in contract environmental and agrochemical laboratories.

EXPERIENCE

WATERS CORPORATION., Milford, MA
October 1994 to present
Senior Applications Chemist

META ENVIRONMENTAL, INC., Watertown, MA
1992 to 1994
Senior Chemist

Principle research chemist and special project manager.
Developed methods for determination of pollutant metabolites in soils and waters.
Developed microextraction methods for a wide range of organic analytes.

TOXIKON, INC., Woburn, MA
April to October 1992
Director of Special Chemistry Services

Directed analytical laboratory providing support of product validation studies and other projects under FDA and FIFRA guidelines.
Reviewed data, wrote reports, and certified release of data to clients.

NET ATLANTIC INC., CAMBRIDGE DIVISION, Bedford, MA
1989 to 1992
Senior Staff Scientist

Developed rapid turnaround on site methods and directed onsite laboratory projects.
Supervised CLP organics laboratory.

CAMBRIDGE ANALYTICAL ASSOCIATES, INC. Bioremediation Division,
Boston, MA, 1986 to 1989
Project Scientist

Was chief chemist in supervision of other technical staff. Developed analytical methods in support of field remediation projects and laboratory treatability studies.

UNIVERSITY OF MASSACHUSETTS AT AMHERST
1981 to 1985
Graduate Research and Teaching Assistant

KOCH ABCOR, Wilmington, MA
1977 to 1981
Industrial Hygiene Chemist

Developed the hydrogen fluoride passive air sampler and was principle investigator for site demonstration and validation of the device at Oak Ridge (TN) Gaseous Diffusion Plant. Supervised GC laboratory and served as QC chemist.

HONORS AND AFFILIATIONS

Massachusetts Board of Higher Education Honor Scholarship, 1971 to 1975.
Member, American Chemical Society, 1975 to present.
Member, Advisory Board, University of Massachusetts Center for Analytical Chemistry Development, 1990.

Author of numerous papers and reports in the environmental and chromatographic field.

Appendix B

Standard Operating Procedures
(see separate SOP book)

EPA Method 3570

MET2508

Extraction of Monocyclic Aromatic Hydrocarbons (MAHs), Polycyclic Aromatic Hydrocarbons (PAHs), and Phenolic Compounds From Soil and Sediment by Microscale Solvent Extraction (MSE)

1.0 Scope and Application

1.1 This method is applicable to the extraction of the following compound classes and analytes from solid samples:

Compound	CAS Number
MONOCYCLIC AROMATIC HYDROCARBONS (MAHs)	
Benzene	71-43-2
Toluene	108-88-3
Ethylbenzene	100-41-4
Styrene	100-42-5
m-Xylene	108-38-3
p-Xylene	106-42-3
o-Xylene	95-47-6
Trimethylbenzene	95-63-6
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)	
Naphthalene	91-20-3
1-Methylnaphthalene	90-12-0
2-Methylnaphthalene	91-57-6
Acenaphthylene	208-96-8
Acenaphthene	83-32-9
Fluorene	86-73-7
Phenanthrene	85-01-8
Anthracene	120-12-7
Fluoranthene	206-44-0
Pyrene	129-00-0
Benz(a)anthracene	56-55-3
Chrysene	218-01-9
Benzo(b)fluoranthene	205-99-2
Benzo(k)fluoranthene	207-08-9
Benzo(a)pyrene	50-32-8

1.1Continued . . .

Compound	CAS Number
PAHs, Continued	
Indeno(1,2,3-cd)pyrene	193-39-5
Dibenz(a,h)anthracene	53-70-3
Benzo(g,h,i)perylene	191-24-2
NITROGEN CONTAINING PA COMPOUNDS (N-PACs)	
Carbazole	86-74-8
Quinoline	91-22-5
PHENOLIC AND CHLORINATED PHENOLIC COMPOUNDS (CPs)	
Phenol	108-95-2
2-Methylphenol	95-48-7
3-Methylphenol	108-39-4
4-Methylphenol	106-44-5
2,4-Dimethylphenol	105-67-9
Pentachlorophenol	87-86-5

1.2This method can be applied to any combination of compounds on this list, or to the complete list. Other MAHs, PAHs, and phenolics may be added once their retention times and response factors have been established.

1.3This method also may be used to determine any volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) that have chromatographic retention characteristics that allow their separation from other target compounds, and are amenable to detection by FID.

1.4This method is applicable to the determination of MAHs and PAHs if the extracts are analyzed by GC/FID.

1.5By modifying the surrogate compounds, this method can also be used to determine VOCs and SVOCs by GC/MS

2.0 Introduction

2.1Since MAHs are volatile compounds, their extraction from solids requires special handling and particular attention to detail.

2.2All solid samples are kept cold during the extraction procedure by storing them in a small cooler with blue ice. Samples are removed from the cooler only for as long as necessary to remove the sample aliquot. As much as possible, the sample jar is kept tightly capped.

2.3Samples should be prepared one at a time to the point of solvent addition (i.e., do not pre-weigh a number of samples then add the solvent). Pay particular attention to minimizing the exposure of the sample and/or extract to air.

2.4Samples should be extracted as soon after collection as possible, but no longer than 7 days from the date of collection. Do not weigh out percent solids before the samples. Do not homogenize the samples unless they appear to be heterogeneous. If so, thoroughly chill the sample and spatula before proceeding. Homogenize quickly and gently, then re-cap and re-chill the sample before proceeding.

3.0 Sample Extraction

3.1Add approximately 2.5 grams of anhydrous sodium sulfate to a chilled, pre-cleaned Teflon extraction tube which has a Teflon screw cap. The sodium sulfate should be prepared in accordance with SOP No. MET1006. Also add 5 to 10 pre-cleaned glass beads.

3.2Weigh 2 to 3 grams of soil into the tared extraction tube. Wipe the lip and threads of the tube with a Kimwipe. Tightly cap, then record the exact weight of the soil on the Sample Extraction sheet.

3.3Add 50 μg of the surrogate standard compounds (fluorobenzene, 2-fluorobiphenyl, and 5-α-androstane) in methylene chloride (DCM) directly to the soil. If the sample is a matrix spike sample, add 50 μg of the appropriate matrix spike compounds.

3.3.1The surrogate and matrix spike compounds should be at a concentration of 100 μg/mL.

3.3.2The surrogate standard compound 5-α-androstane does not need to be added if the sample is not to be fractionated into aromatic and aliphatic portions.

3.4Add 12 mL of DCM to the tube, and cap tightly. Do not homogenize the soil/sodium sulfate mixture at this point!

3.5Shake the tubes vigorously until the slurry is free-flowing. If it is necessary to break

up large lumps, work quickly but gently. Do not strongly agitate the extract while the vial is open. Cap immediately when finished.

3.5.1 Add more sodium sulfate as necessary to produce a free-flowing slurry.

3.6 Extract the samples by rotating for at least 4 hours.

3.7 Allow the solids to settle. Decant or pipet the solvent layer into a small glass funnel containing a layer of anhydrous sodium sulfate over a plug of glass wool. The sodium sulfate should be thoroughly pre-wetted with DCM. Filter the extract into a Kuderna-Danish (K-D) concentrator tube. Rinse the sodium sulfate with 2 to 3 mL of DCM as soon as the surface is exposed. Do not allow the top of the sodium sulfate layer to go dry!

3.8 Extract the soil twice more by adding approximately 5 mL of DCM to the sample, capping the extraction tube tightly, and shaking vigorously by hand for 2 minutes. Be certain to wipe the lip and threads of the extraction tube with a Kimwipe before capping each time.

3.8.1 More sodium sulfate can be added at this point as necessary to dry the extract and break up any clumps that may have formed.

3.9 After each extraction step, follow step 3.7.

3.10 Add a boiling stick to the K-D concentrator tube, and attach one, two-ball micro-Snyder column and one, three-ball micro-Snyder column.

3.11 Pre-wet the Snyder columns by adding 0.5 mL of DCM to the top of the column.

3.12 Place the K-D apparatus in a constant temperature hot water bath so that the concentrator tube is partially, but not completely, immersed. Adjust the temperature of the bath and the position of the apparatus so that the solvent boils evenly, and the micro-Snyder column balls chatter but the chambers do not flood with solvent (approximately 60 to 65°C).

3.13 Reduce sample volume to approximately 1.0 mL. Remove and allow to cool and drain for several minutes.

3.14 Remove the Snyder columns and the boiling stick.

3.15 Record the exact final volume of the extract on the Sample Extraction sheet.

3.15.1If the volume of the extract does not fall exactly on one of the calibration lines of the concentrator tube, then add enough DCM so that it does, then record that volume on the Sample Extraction sheet.

3.16Add an appropriate amount of the internal standard compound (o-terphenyl) to give a concentration of 50 μg/mL in the extract. Add the internal standard directly to the K-D tube. Transfer the extract to a 1.5 mL vial with a Teflon lined screw cap. Cap the vial and store in the freezer or over ice until analysis.

3.16Analyze by SOP No. MET4007.

4.0Quality Control

4.1Refer to SOP No. MET1026.

4.2Samples must be extracted within seven days of collection.

EPA 8270mod.

MET4014

In-House Procedures for the Preparation and Analysis of Samples by Simultaneous Determination of Volatile and Semivolatile Compounds.

1.0 Scope and Application

1.1 This SOP is based on Method 8270C and EPA Method 8260 published in SW-846: "Semi-Volatile Organic Compounds by GC/MS" (January 1998) and "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (1996). It is applicable to the determination of the following compounds in samples:

VOCS:

Compound	CAS Number
cis-1,2-Dichloroethene	156-59-2
2,2-Dichloropropane	594-20-7
Chloroform	67-66-3
1,1,1-Trichloroethane	71-55-6
1,2-Dichloroethane	107-06-2
1,1-Dichloropropene	
Benzene	71-43-2
Carbon Tetrachloroide	56-23-5
1,2-Dicloropropane	78-87-5
Trichloroethene	79-01-6
Dibromomethane	74-95-3
Bromodichloromethane	75-27-4
cis-1,3-Dichloropropene	10061-01-5
n-Nitrosodimethylamine	62-75-9
Toluene	108-88-3
trans-1,3-Dichloropropene	
1,1,2-Trichloroethane	79-00-5
1,3-Dichloropropane	142-28-9
Dibromochloromethane	
1,2-Dibromomethane	74-95-3
Tetrachloroethene	127-18-4

n-Nitrosomethylethylamine	
Chlorobenzene	108-90-7
VOCS continued...	
1,1,1,2-Tetrachloroethane	630-20-6
Ethylbenzene	100-41-4
m/p-Xylene	108-38-3/106-42-3
Bromoform	75-25-2
Styrene	100-42-5
o-Xylene	95-47-6
N-Nitrosodiethylamine	
1,1,2,2-Tetrachloroethane	79-34-5
1,2,3-Trichloropropane	96-18-4
Isopropylbenzene	98-82-8
Bromobenzene	108-86-1
2-Chlorotoluene	95-49-8
Propylbenzene	103-65-1
4-Chlorotoluene	106-43-4
1,3,5-Trimethylbenzene	108-67-8
Pentachloroethane	76-01-7

SVOCS:

Acenaphthylene	208-96-8
Anthracene	120-12-7
Benz(a)anthracene	56-55-3
Benzo(b)fluoranthene	205-99-2
Benzo(k)fluoranthene	207-08-9
Benzo(a)pyrene	50-32-8
Benzo(ghi)perylene	191-24-2
Benzyl butyl phthalate	85-68-7
Bis(2-chloroethyl) ether	111-44-4
Bis(2-chloroethoxy)methane	111-91-1
Bis(2-ethylhexyl)phthalate	117-81-7
Bis(2-chloroisopropyl) ether	108-60-1
4-Bromophenyl phenyl ether	101-55-3
2-Chloronaphthalene	91-58-7
4-Chlorophenyl phenyl ether	7005-72-3
Chrysene	218-01-9
Dibenz(a,h)anthracene	53-70-3
Di-n-butylphthalate	84-74-2
1,3-Dichlorobenzene	541-73-1
1,2-Dichlorobenzene	95-50-1

1,4-Dichlorobenzene	106-46-7
3,3'-Dichlorobenzidine	91-94-1
Diethyl phthalate	84-66-2
Dimethyl phthalate	131-11-3
2,4-Dinitrotoluene	121-14-2
2,6-Dinitrotoluene	606-20-2
Di-n-octylphthalate	117-84-0
Fluoranthene	206-44-0
Fluorene	86-73-7
Hexachlorobenzene	118-74-1
Hexachlorobutadiene	87-68-3
Hexachloroethane	67-72-1
Indeno(1,2,3-cd)pyrene	193-39-5
Isophorone	78-59-1
Naphthalene	91-20-3
Nitrobenzene	98-95-3
n-Nitrosodi-n-propylamine	621-64-7
Phenanthrene	85-01-8
Pyrene	129-00-0
1,2,4-Trichlorobenzene	120-82-1
4-Chloro-3-methylphenol	59-50-7
2-Chlorophenol	95-57-8
2,4-Dichlorphenol	120-83-2
2,4-Dimethylphenol	105-67-9
2,4-Dinitrophenol	51-28-5
2-Methyl-4,6-dinitrophenol	534-52-1
2-Nitrophenol	88-75-5
4-Nitrophenol	100-02-7
Pentachlorophenol	87-86-5
Phenol	108-95-2
2,4,6-Trichlorophenol	88-06-2
Aniline	62-53-3
tert-Butylbenzene	98-06-6
1,2,4-Trimethylbenzene	95-63-6
sec-Butylbenzene	135-98-8
p-Isopropyltoluene	99-87-6
Benzyl Alcohol	100-51-6
2-Methylphenol (m-cresol)	108-39-4
4-Methylphenol (p-cresol)	106-44-5
n-Butylbenzene	104-51-8
3-Methylphenol (o-cresol)	95-48-7
n-Nitrosopyrrolidine	930-55-2
n-Nitrosomorpholine	

1,2-Dibromo-3-chloropropane	
n-Nitrosopiperidine	
SVOCS continued...	
2,6-Dichlorophenol	87-65-0
4-Chloroaniline	106-47-8
Hexachloropropene	1888-71-7
1,2,3-Trichlorobenzene	87-61-6
n-Nitrosodi-n-butylamine	
2-Methylnaphthalene	7297-45-2
1,2,4,5-Tetrachlorobenzene	95-94-3
Hexachlorocyclopentadiene	77-47-4
2,4,5-Trichlorophenol	95-95-4
2-Nitroaniline	88-74-4
3-Nitroanlilne	99-09-2
Acenaphthene	83-32-9
Dibenzofuran	132-64-9
Pentachlorobenzene	608-93-5
2,3,4,6-Tetrachlorophenol	
4-Nitroaniline	100-01-6
n-Nitrosodiphenylamine	156-10-5
Dinoseb (DNBP)	

1.2 This method is restricted to use by or under the supervision of analysts experienced in the use of gas chromatograph/mass spectrometers and skilled in the interpretation of mass spectra.

2.0 Standard Preparation

2.1 The following procedures for standard formulation are intended as guidelines. Substitute equipment and materials are allowed as long as the final extract concentration remains the same.

2.2 Surrogate Standard

2.2.1 Purchase two surrogate stocks from Ultra. Catalog #STM-330N and #ISM-331-1, at 2000 µg/mL and 4000 µg/mL, respectively.

2.2.2 Record the formulation of all stock solutions to be used in the surrogate standard in the QC spiking solutions logbook. Each entry should include the solution's unique laboratory ID (QCXXXXX), source

information (vendor, lot number, expiration date), and initial and final concentrations of the individual components.

2.2.3 Rinse a 2 mL class A volumetric flask, stopper, and 1000 µL syringe three times with DCM, and inspect for contamination.

2.2.4 Excluding all air bubbles from the syringe, and measuring from the bottom of the plunger, syringe 1000 µL of the STM-330N surrogate stock into the central body of the volumetric flask. Add 500 µL of ISM-331-1 surrogate stock to the volumetric flask. Bring the solution level up to the calibration line with DCM, using a syringe. The final concentration of each component should be 1000 µg/mL.

2.2.5 Stopper the volumetric, invert and swirl gently two times.

2.2.6 Dispense the surrogate solution into a 2 mL amber vial, seal with zero-headspace closures, and wrap with teflon tape to prevent evaporation. Label with the unique ID, solvent, and expiration date.

2.2.7 Spike 0.9 mL of DCM with 0.1 mL of the surrogate solution and submit for QC analysis. Percent recoveries of the surrogate compounds should be 90-110%.

2.3 Matrix Spike

2.3.1 Purchase the following stocks from Restek and Ultra:

Custom Aromatics	Restek	Cat #56506
VOC Mixture	Ultra	Cat #DWM-826A
Phenols	Ultra	Cat #US-107N
Phenols	Ultra	Cat #US-117N
Nitrosoamines	Ultra	Cat #US-113N
Chlorinated Hydrocarbons	Ultra	Cat #US-111
Ethers/Phthalates	Ultra	Cat #US-110
Toxic Substances #2	Ultra	Cat #US-104N

2.3.2 Record the formulation of all stock solutions to be used in the surrogate standard in the QC spiking solutions logbook. Each entry should include the solution's unique laboratory ID (QCXXXXX), source information (vendor, lot number, expiration date), and initial and final concentrations of the individual components.

2.3.3 Rinse a 5 mL class A volumetric flask, stopper, and 1000 µL syringe

three times with DCM, and inspect for contamination.

2.3.4 Excluding all air bubbles from the syringe, and measuring from the bottom of the plunger, syringe 1500 µL of the Custom Aromatics into the central body of the volumetric flask. Add 500 µL of all the rest of the above stocks to the volumetric flask. Bring the solution level up to the calibration line with DCM, using a syringe. The final concentration of each component will be between 120-200 µg/mL.

2.3.5 Stopper the volumetric, invert and swirl gently two times.

2.3.6 Dispense the surrogate solution into a 6 mL amber vial, seal with zero-headspace closures, and wrap with teflon tape to prevent evaporation. Label with the unique ID, solvent, and expiration date.

2.3.7 Spike 0.9 mL of DCM with 0.1 mL of the surrogate solution and submit for QC analysis. Percent recoveries of the surrogate compounds should be 90-110%.

2.4 Calibration Standards

2.4.1 Prepare calibration standards at a minimum of five concentration levels.

2.4.2 Make calibration standards by serially diluting a stock mixture of the compounds described in section 2.3.1. The stock mixture would also have the surrogate described in section 2.2.1. The final concentration of the stock mixture should be 200 µg/mL. If this method is used, record the formulations of all the stock and working standard solutions in the Standard Preparation logbook.

2.4.3 The internal standard that is used for this calibration method and for addition to samples is the MET4007 IS, which is made up of 2,4-Difluorotoluene and OTP at a concentration of 5000 µg/mL. 8270 IS, which may be purchased from Ultra at a concentration of 4000 µg/mL is also added. The final concentration of the IS for any analysis, should be 50 µg/mL for 2,4-Difluorotoluene and 40 µg/mL for the 8270 IS.

2.5 DFTPP Solution

2.5.1 Prepare a tuning solution of decafluorotriphenylphosphine (DFTPP) by

diluting 1250 µL of a 1000 µg/mL stock solution to 25 mL. The resulting working solution will be 50 µg/mL. The stock solution can be purchased from Ultra, catalog #GCM-150-1. This stock solution contains the DFTPP, 4,4-DDT, pentachlorophenol and benzidine.

3.0 Preparation for Extractions

3.1 No more than one day before samples are scheduled to arrive, prepare for the in-house quality control (QC) blank samples.

3.1.1 For each QC blank sample to be extracted and analyzed, prepare one vial as described below.

3.1.2 The vials must be prepared far enough in advance that the water has time to cool before extraction.

3.1.3 The vials should not be allowed to sit in the refrigerator for more than 24 hours, or their integrity may be suspect.

3.2 Each extraction batch of 20 or fewer samples, will require one method blank and one blank spike.

3.2.1 For each QC blank, add 35 mL of distilled (DI) water to a 40 mL glass VOA vial with Teflon lined septum screw top.

3.2.1.a The VOA vials may be purchased as pre-cleaned, QC-acceptable vessels.

4.0 Water Sample Extraction

4.1 Make sure all field and QC samples are chilled to at least 4°C before proceeding.

4.1.1 Prior to the extraction:

4.1.1.a Prepare enough weigh boats with approximately 12.0g NaCl for each sample and QC in the batch.

4.1.1.b Clean a 10 µL, 50 µL, 1.0 µL and a 2.5 µL syringe. Have methanol, acetone and DCM rinse containers ready.

4.1.2 Take 3-4 samples out of the refrigerator at a time.

4.2 Syringe exactly 2.0 mL of DCM into the 2.5 mL syringe and put aside.

4.3 Tare the balance.

4.4 Open one of the samples and place it on the balance with its cap off. Using a pastuer pipette remove enough of the sample until the balance reads between 60-61 g. This will leave approximately 35 mL of sample in the VOA vial. Record the weight in the logbook.

4.4.1 The removed sample is disposed according to the guidelines set forth in SOP No. MET1005 (Disposal of Laboratory Wastes).

4.5 Add 10.0 μL of the surrogate solution directly into the sample. If the sample is matrix spike sample, add 50 μL of the matrix spike mix directly into the sample. Be sure to rinse syringes between each sample.

4.6 Add exactly 2.00 mL of methylene chloride (DCM) and approximately 12 grams of anhydrous sodium chloride to the VOA vial.

4.7 Cap the vial and shake vigorously for 5 minutes. Make sure the sodium chloride has dissolved completely. Set the sample aside and prepare the other samples accordingly.

4.7.1 Remember to add DCM to the 2.5 mL Gastight syringe before removing the cap from the next sample.

4.7.1.a If there are more than 3-4 samples, return the samples or QC containing the surrogate/DCM/NaCl to the refrigerator and take out 3-4 samples and repeat section 5.3 through 5.6.

4.8 Briefly allow the phases to settle, then centrifuge at 500 times the force of gravity (500 G's) for a recommended 15 minutes, 5 minutes minimum.

4.9 Prepare enough 1.5 mL amber vials for all the samples and QC with a small layer of anhydrous sodium sulfate before transferring. Using a 1.00 mL gas-tight syringe, transfer exactly 1.00 mL of the lower (DCM) layer to a 1.5 mL vial with a Teflon lined screw cap.

5.8.1 Try not to transfer any water to the 1.5 mL vial that contains $NaSO_4$. Gently swirl the extract so that it mixes with the $NaSO_4$.

4.10 Prior to analysis, add 10.0 μL of the internal standards to the 1.0 mL of extract.

4.11 Discard the remaining contents of the VOA vial, according to SOP No. MET1005. Shake off the last few drops with short, brisk wrist movements. Reweigh the vial, with the cap off, and record the weight in the logbook to the nearest 0.1 grams.

4.11.1 The difference between this weight, and the weight determined in step 5.3 is equal to the volume of water extracted, in milliliters.

4.12 Analyze extracts by SOP No. MET4014.

4.13 Keep in mind that although there is only 1.00 mL of extract in the screw top vial, the final volume of the extract must take into account the solvent remaining in the VOA vial for the purposes of calculating the sample results.

4.13.1 For all extracts, the final extract volume is 2.00 mL.

5.0 **Soil Sample Extraction:**

5.1 Add approximately 2.5 grams of anhydrous sodium sulfate to a chilled, pre-cleaned Teflon extraction tube which has a Teflon screw cap. The sodium sulfate should be prepared in accordance with SOP No. MET1006. Also add 5 to 10 pre-cleaned glass beads.

5.2 Weigh 2 to 3 grams of soil into the tared extraction tube. Wipe the lip and threads of the tube with a Kimwipe. Tightly cap, then record the exact weight of the soil on the Sample Extraction sheet.

5.3 Add 50 μg of the surrogate standard directly to the soil. If the sample is a matrix spike sample, add 50 μg of the appropriate matrix spike compounds.

5.3.1 The surrogate and matrix spike compounds should be at a concentration of 100 μg/mL.

5.4 Add 12 mL of DCM to the tube, and cap tightly. Do not homogenize the soil/sodium sulfate mixture at this point!

5.5 Shake the tubes vigorously until the slurry is free-flowing. If it is necessary to break up large lumps, work quickly but gently. Do not strongly agitate the extract while the vial is open. Cap immediately when finished.

5.5.1 Add more sodium sulfate as necessary to produce a free-flowing slurry.

5.6 Extract the samples by rotating for at least 4 hours.

5.7 Allow the solids to settle. Decant or pipet the solvent layer into a small glass funnel containing a layer of anhydrous sodium sulfate over a plug of glass wool. The sodium sulfate should be thoroughly pre-wetted with DCM. Filter the extract into a Kuderna-Danish (K-D) concentrator tube. Rinse the sodium sulfate with 2 to 3 mL of DCM as soon as the surface is exposed. Do not allow the top of the sodium sulfate layer to go dry!

5.8 Extract the soil twice more by adding approximately 5 mL of DCM to the sample, capping the extraction tube tightly, and shaking vigorously by hand for 2 minutes. Be certain to wipe the lip and threads of the extraction tube with a Kimwipe before capping each time.

5.8.1 More sodium sulfate can be added at this point as necessary to dry the extract and break up any clumps that may have formed.

5.9 After each extraction step, follow step 5.7.

6.0 NAPL Samples

6.1 Follow SOP No. MET2512 for waste dilution. No surrogate is required. The sample will not require concentration.

7.0 Extract Concentration

7.1 Add a boiling stick to the K-D concentrator tube, and attach one, two-ball micro-Snyder column and one, three-ball micro-Snyder column.

7.2 Pre-wet the Snyder columns by adding 0.5 mL of DCM to the top of the column.

7.3 Place the K-D apparatus in a constant temperature hot water bath so that the concentrator tube is partially, but not completely, immersed. Adjust the temperature of the bath and the position of the apparatus so that the solvent boils evenly, and the micro-Snyder column balls chatter but the chambers do not flood with solvent (approximately 60 to 65°C).

7.4 Reduce sample volume to approximately 1.0 mL. Remove and allow to cool and drain for several minutes.

7.5 Remove the Snyder columns and the boiling stick.

7.6 Record the exact final volume of the extract on the Sample Extraction sheet.

7.6.1 If the volume of the extract does not fall exactly on one of the calibration lines of the concentrator tube, then add enough DCM so that it does, then record that volume on the Sample Extraction sheet.

7.7 Add an appropriate amount of the internal standard compounds. Add the internal standard directly to the K-D tube. Transfer the extract to a 1.5 mL vial with a Teflon lined screw cap. Cap the vial and store in the freezer or over ice until analysis.

8.0 Extract Cleanup

8.1 If necessary, extracts may be cleaned up by any of the following methods prior to GC/MS analysis:

Method	SOP No.
Acid/Base Partition Cleanup	MET3001
Florisil Cleanup	MET3003
Acid Cleanup	MET3004
Sulfur Cleanup	MET3005
Alumina Fractionation 1	MET3006
Alumina Fractionation 2	MET3007
Alumina Column Cleanup	MET3008
Silica Gel Fractionation	MET3009

9.0 GC/MS Analysis

9.1 Analyses are performed on a gas chromatograph equipped with a mass selective detector (GC/MS) and an autosampler, and capable of operating in the splitless mode.

9.2 Prior to performing any analyses, complete the initial demonstration of laboratory capability and MDL study.

9.3 GC/MS Operating Conditions

9.3.1 Samples are analyzed by capillary column GC/MS, with the GC operated in the splitless injection mode, and the MS operated in the full scanning mode.

9.3.2 The following GC conditions apply:

Column:	30 m x 0.25 mm fused silica capillary with 0.25 or 0.5 µm film thickness chemically bonded 5% phenyl methyl polysiloxane phase (DB-5 or equivalent)
	Inlet purge valve open after 1.0 minutes
Pressure:	8.0 psi initial Ramp at 99 psi/minute to 20.0 psi Hold for 0.95 minutes Ramp at 99 psi/minute to 15.0 psi
Oven:	8.0 minutes at 33°C Ramp at 10.0°C/minute to 220°C Ramp at 8.0°C/minute to 320°C Hold for 14 minutes
Inlet:	280 °C
Detector:	280 °C

9.3.3 1 µL samples are injected by autosampler.

9.3.4 Acquire data from m/z 35 to 450 with a total cycle time of one second or less.

9.3.5 Adjust the cycle time to 1.7 scans per second.

9.3.6 Phenanthrene and anthracene should be separated by baseline.

9.3.7 Benz(a)anthracene and chrysene should be separated by a valley whose height is less than 25% of the average peak height of the two compounds.

9.3.8 The MS should be capable of recognizing a GC peak for all of the compounds.

9.3.9 Prior to performing any analyses, inject a 1 µL aliquot of a 50 µg/mL solution of DFTPP tuning solution. Make certain that the mass spectrum meets all the requirements listed in Table 1.

9.4 Perform an initial system calibration.

9.4.1 Tune the GC/MS system as described in 9.4.

9.4.2 Use the GC/MS operating conditions established in 9.3.2.

9.4.3 Prepare calibration standards at the five concentration levels described in section 2.4. Calibration standards are prepared according to SOP No. MET1002.

9.4.4 Inject 1 µL of each standard, and calculate the relative response factor (RRF) of each analyte and surrogate compound.

9.4.4.1 Use the internal standard method of calculation.
9.4.4.2 Use the internal standard closest in retention time to each analyte to calculate the RRFs.

9.4.5 The initial calibration is considered valid when the %RSD of the RRFs is less than 30%.

9.4.6 Confirm that there are at least five usable calibration points for each compound.

9.4.7 Following initial calibration, analyze the calibration check solution. Check standard recoveries should be 90 and 110% of the true values.

9.5 Verify the initial calibration.

9.5.1 The GC/MS system must be retuned every twelve hours, following the procedure in 9.4.1, and prior to the analysis of the continuing calibration standard.

9.5.2 Every twelve hours that samples are analyzed, the initial calibration must also be verified by the analysis of a continuing calibration standard.

9.5.2.1 Inject 1 µL of a mid point calibration standard (50 µg/mL) containing each of the analytes as well as the surrogate standard compounds. Calculate the RRFs for each. Compare the continuing RRFs to the average RRF from the initial calibration sequence.

9.5.2.2 Confirm that the percent difference (%D) between the initial calibration average ratio of response and the continuing

calibration ratio of response does not exceed 25% for any analyte.

9.5.2.3 If the %D exceeds 25%, analyze a fresh continuing calibration standard. Alternatively, perform a new initial calibration of the system.

9.6 Analyze the sample extracts.

9.6.1 Prior to analysis, add 10 µL of internal standard to 1000 µL of each extract to be analyzed, such that the concentration of each internal standard is 40 µg/mL and 50µg/mL for the 2,4-diflurotoluene in the extract.

9.6.1 Make sure the extracts are at room temperature. Inject 1 µL of each sample extract. Identify the analytes in the sample by comparing the retention times and mass spectra of the peaks in the sample chromatograms with those of the peaks in standard chromatograms.

9.6.2 If the response for a peak exceeds the working range of the system, dilute extract, add an appropriate amount of internal standard, and reanalyze.

9.7 Compound Identification

9.7.1 Identify sample components by comparison of retention times (RTs) to RT data and mass spectra from the most recent, previous calibration standard. The width of the RT window should be based upon measurements of actual RT variations of standards over the course of a day. As a guideline, the RT of the sample peaks should fall within ±0.5 minutes of the calibration peak.

9.7.2 Confirm the identity of all compounds, by comparing their mass spectra to the standard mass spectra. As a guideline, the three characteristic masses in the extracted ion current profile (EICP) must fall within ±20% of the relative intensities of the same masses in the reference mass spectrum.

9.7.3 Determine the peak area for the primary ion EICP for each compound, IS, and SS peak. If any area exceeds the linear range of the instrument as demonstrated during the initial calibration, the extract must be diluted and reanalyzed.

9.8 Calculations

9.8.1 IS compounds are added to every sample extract.

9.8.2 Calculate the sample concentrations and surrogate recoveries using the internal standard method. Use the average RRFs from the initial calibration.

9.8.3 The concentration of each component is calculated using the Internal Standard Method (ISM) and based on the primary m/z ion areas of the peaks of interest.

9.8.4 Refer to SOP No. MET1008 for more information on performing sample calculations.

10.0 Quality Control

10.1 The GC/MS system must be tuned every twelve hours to meet the criteria in Table 1 for a 50-ng injection of decafluorotriphenylphosphine (DFTPP).

10.1.1 The twelve-hour time period for a GC/MS analytical run begins at the moment of injection of the DFTPP verification standard.

10.1.2 The mass spectrum of DFTPP must be acquired in the following manner. Three scans (the peak scan, and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is required and must be accomplished using a single scan prior to the elution of DFTPP.

10.1.3 Analyses, including calibrations, should not begin until all of the criteria are met.

10.1.4 All subsequent standards, field samples, and QC samples must be analyzed under the DFTPP-verified mass spectrometer conditions.

10.2 On each day that samples are analyzed, a continuing calibration (CCAL) standard must be analyzed prior to sample analysis. The CCAL should be at a mid-level concentration. The %D between the CCAL RRFs and the ICAL average RRFs should be $\leq 25\%$.

10.3 For each batch of samples extracted (up to 20 samples), a method blank, a blank spike, a matrix spike, and a duplicate sample must be extracted. For samples where detectable amounts of organics are present, duplicate samples may be

appropriate in place of matrix spiked ones. Be sure to refer to the project QAPP for deviations from these requirements.

10.4 Surrogate standard recovery limits must be established after 30 samples of the same matrix have been extracted and analyzed, as described in section 8.9 of USEPA method 8270. The internal laboratory limits must fall within the following limits:

	Water Samples	Soil Samples
Nitrobenzene-d_5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
p-Terphenyl-d_{14}	33-141	18-137
Phenol-d_6	10-94	24-113
2-Fluorophenol	21-100	25-121
2,4,6-Tribromophenol	10-123	19-122

The surrogate recovery limits must be confirmed annually.

10.5 If the surrogate recoveries in a sample are outside of the internal laboratory limits, the sample should be re-extracted. Only re-extract a sample once, if the poor surrogate recoveries are due to matrix interferences.

10.6 Matrix spike compound % Recovery should be between 50-120% of the true values.

10.7 Internal standard areas in the samples should be within -50 to +200% of the internal standard areas in the most recent, previous CCAL standard.

10.7.1 If the recoveries are outside these limits, the sample must be reanalyzed.

10.7.2 If the internal standard recoveries are still outside of the limits, it may be attributed to matrix effects, and sample results should be calculated externally.

10.8 Duplicate sample results should agree within ±50% for solids or ±30% for waters.

10.8.1 If sample results are not in agreement, check that all peaks were integrated correctly.

10.9 Method blanks should be free of target compounds or contaminants that could interfere with the proper quantitation of target compounds. If samples are affected by the contamination, they must be reextracted.

10.9.1 The source of the contamination must be identified and eliminated as soon as possible.

10.10 Extracts must be analyzed within 40 days of extraction.

10.11 The laboratory documents method performance (surrogates and matrix spikes) through the use of control charts, as described in SOP No. MET5010.

Table 1
DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	30 - 60% of mass 198
68	< 2% of mass 69
69	Present
70	< 2% of mass 69
127	40 - 60% of mass 198
197	< 1% of mass 198
198	Base peak, 100% relative abundance
199	5 - 9% of mass 198
275	10 - 30% of mass 198
365	> 1% of mass 198
441	Present, but less than mass 443
442	40 - 110% of mass 198
443	17 - 23% of mass 442

MET8270

In-House Procedures for the Preparation and Analysis of Samples by USEPA Standard Method 8270D, Rev. 4, 1/98 Mod.

1.0 Scope and Application

1.1 This SOP is based on Method 8270C, 3540C Soxhlet, 3510C Separatory Funnel, published in SW-846: "Test Methods for Evaluating Solid Wastes" (December 1996) and "Semi-Volatile Organic Compounds by GC/MS" (January 1998) and Method 625 Base/ Neutrals and Acids, Part 136, Appendix A as published in the July 1, 1991 Code of Federal Regulations. It is applicable to the determination of the following compounds in samples:

Compound	CAS Number
Base/Neutral Extractables	
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benz(a)anthracene	56-55-3
Benzo(b)fluoranthene	205-99-2
Benzo(k)fluoranthene	207-08-9
Benzo(a)pyrene	50-32-8
Benzo(ghi)perylene	191-24-2
Benzyl butyl phthalate	85-68-7
Bis(2-chloroethyl) ether	111-44-4
Bis(2-chloroethoxy)methane	111-91-1
Bis(2-ethylhexyl)phthalate	117-81-7
Bis(2-chloroisopropyl) ether	108-60-1
4-Bromophenyl phenyl ether	101-55-3
2-Chloronaphthalene	91-58-7
4-Chlorophenyl phenyl ether	7005-72-3
Chrysene	218-01-9
Dibenz(a,h)anthracene	53-70-3
Di-n-butylphthalate	84-74-2
1,3-Dichlorobenzene	541-73-1
1,2-Dichlorobenzene	95-50-1
1,4-Dichlorobenzene	106-46-7
3,3'-Dichlorobenzidine	91-94-1

Base/Neutral Extractables, Continued . . .

Diethyl phthalate	84-66-2
Dimethyl phthalate	131-11-3
2,4-Dinitrotoluene	121-14-2
2,6-Dinitrotoluene	606-20-2
Di-n-octylphthalate	117-84-0
Fluoranthene	206-44-0
Fluorene	86-73-7
Hexachlorobenzene	118-74-1
Hexachlorobutadiene	87-68-3
Hexachloroethane	67-72-1
Indeno(1,2,3-cd)pyrene	193-39-5
Isophorone	78-59-1
Naphthalene	91-20-3
Nitrobenzene	98-95-3
n-Nitrosodi-n-propylamine	621-64-7
Phenanthrene	85-01-8
Pyrene	129-00-0
1,2,4-Trichlorobenzene	120-82-1

Acid Extractables

4-Chloro-3-methylphenol	59-50-7
2-Chlorophenol	95-57-8
2,4-Dichlorphenol	120-83-2
2,4-Dimethylphenol	105-67-9
2,4-Dinitrophenol	51-28-5
2-Methyl-4,6-dinitrophenol	534-52-1
2-Nitrophenol	88-75-5
4-Nitrophenol	100-02-7
Pentachlorophenol	87-86-5
Phenol	108-95-2
2,4,6-Trichlorophenol	88-06-2

1.2 Other compounds may be added once their retention times and response factors have been established. These additional compounds may include aroclors:

PCB 1016	12674-11-2
PCB 1221	11104-28-2
PCB 1232	11141-16-5
PCB 1242	53469-21-9
PCB 1248	12672-29-6
PCB 1254	11097-69-1
PCB 1260	11096-82-5

1.3 Modifications to USEPA Method 8270 include the following:

- Abbreviated target list
- Temperature/Pressure Program (see section 6.3.2)
- Indeno (1,2,3-cd)pyrene is calculated off the internal standard Perylene-d_{12}
- The amine compounds are reactive. The QC criteria are advisory only.

1.4 Modifications to USEPA Method 625 include the following:

- Abbreviated target list
- Use of 2,4,6-Tribromophenol and p-Terphenyl-d_{14} as surrogates
- Use of Acenaphthene-d_{10}, Chrysene-d_{12}, 1,4-Dichlorobenzene-d_4, and Perylene-d_{12} as internal standards
- % RSDs for the initial calibration and %Ds for continuing calibration are those established for Method 8270 C
- The amine compounds are reactive. The QC criteria are advisory.

1.5 Method 8270C, Sections 3, 4, 5 and 6 and USEPA Method 625, Sections 3, 4, 5, 6, and 9 describe the method interferences, safety, apparatus and materials, reagents, and sample collection, preservation, and handling. Those topics are not described in this SOP.

1.6 This method is restricted to use by or under the supervision of analysts experienced in the use of gas chromatograph/mass spectrometers and skilled in the interpretation of mass spectra.

2.0 Standard Preparation

2.1 The following procedures for standard formulation are intended as guidelines. Substitute equipment and materials are allowed as long as the final extract concentration remains the same.

2.2 Surrogate Standard

2.2.1 Purchase surrogate stock containing all of the compounds at 4000 µg/mL. The solution can be purchased from Ultra, catalog #ISM-331-1.

2.2.2 Record the formulation of all stock solutions to be used in the surrogate standard in the QC spiking solutions logbook. Each entry should include the solution's unique laboratory ID (QCXXXXX), source information (vendor, lot number, expiration date), and initial and final concentrations of the individual components.

2.2.3 Rinse a 25 mL class A volumetric flask, stopper, and 1000 µL syringe three times with DCM and five times with Acetone, and inspect for contamination. Fill the volumetric flask 90% full with acetone. Rinse the syringe two times with the stock surrogate standard.

2.2.4 Excluding all air bubbles from the syringe, and measuring from the bottom of the plunger, syringe 625 µL of surrogate stock into the central body of the volumetric flask. Bring the solution level up to the calibration line with acetone, using a syringe. The final concentration of each component should be 100 µg/mL.

2.2.5 Stopper the volumetric, invert and swirl gently two times.

2.2.6 Dispense the surrogate solution into 6 mL amber vials, seal with zero-headspace closures, and wrap with teflon tape to prevent evaporation. Label with the unique ID, solvent, and expiration date.

2.2.7 Spike 0.9 mL of DCM with 0.1 mL of the surrogate solution and submit for QC analysis. Percent recoveries of the surrogate compounds should be 90-110%.

2.3 Matrix Spike

2.3.1 Prepare the matrix spike solution in the manner described in 2.2, diluting 500 µL of a 2000 µg/mL solution to 10 mL in acetone. The final working solution should contain the matrix spike compounds at 100 µg/mL. The stock solution can be purchased from Ultra, catalog #US-106N.

2.4 Calibration Standards

2.4.1 Prepare calibration standards at a minimum of five concentration levels.

2.4.2 Make calibration standards by serially diluting a commercial semivolatiles mixture in the manner described in section 2.2. If this method is used, record the formulations of all the stock and working standard solutions in the Standard Preparation logbook.

Alternatively, ready-to-use commercial solutions which do not require dilution may be purchased. For example, calibration solutions manufactured by NSI (catalog #K-714B) can be used. The standards contain internal standard compounds at 40 µg/mL and target analytes

and surrogates at the following concentrations:

Level 1	160 µg/mL
Level 2	120 µg/mL
Level 3	80 µg/mL
Level 4	50 µg/mL
Level 5	20 µg/mL

2.4.3 The compounds in the calibration solutions must be:

Target Analytes:

Acenaphthene	2,4-Dinitrophenol
Acenaphthylene	2,4-Dinitrotoluene
Anthracene	2,6-Dinitrotoluene
Aniline	Diethylphthalate
Azobenzene	Dimethylphthalate
Benzidine	Di-n-butyl-phthalate
Benzyl Alcohol	Di-n-octyl-phthalate
Benz(a)anthracene	Fluoranthene
bis(2Ethylhexyl)phthalate	Fluorene
Benzo(b)fluoranthene	Hexochlorobenzene
Benzo(k)fluoranthene	Hexachlorobutadiene
Benzo(g,h,i)perylene	Hexachlorocyclopentadiene
Benzo(a)pyrene	Hexachloroethane
Benzoic acid	Indeno(1,2,3-cd)pyrene
4-Bromophenyl phenyl ether	Isophorone
Butyl benzyl phthalate	2-Methylnaphthalene
Carbazole	Naphthalene
4-Chloroaniline	o-Nitroaniline
Chrysene	m-Nitroaniline
bis(2-Chloroethoxy)ether	p-Nitroaniline
bis(2-Chloroethyl)ether	p-Nitroaniline
bis(2-Chloroisopropyl)ether	Nitrobenzene
4-Chloro-3-methylphenol	2-Nitrophenol
2-Chloronaphthalene	4-Nitrophenol
2-Chlorophenol	N-Nitrosodimethylamine
4-Chlorophenyl phenyl ether	N-Nitrosodiphenylamine
o-Cresol	N-Nitrosodi-n-propylamine
p-Cresol	Pentachlorophenol
Dibenz(a,h)anthracene	Phenanthrene
Dibenzofuran	Phenol
1,2-Dichlorobenzene	Pyrene
1,3-Dichlorobenzene	Pyridine
1,4-Dichlorobenzene	1,2,4-Tichlorobenzene

3,3'-Dichlorobenzidine	2,4,5-Trichlorophenol
2,4-Dichlorophenol	2,4,6-Trichlorophenol
2,4-Dimethylphenol	
4,6-Dinitro-2-methyl phenol	

Surrogates:

2-Fluorobiphenyl	Phenol-d_5
2-Fluorophenol	p-Terphenyl-d_{14}
Nitrobenzene-d_5	2,4,6-Tribromophenol

Internal Standards:

Acenaphthene-d_{10}	Naphthalene-d_8
Chrysene-d_{12}	Perylene-d_{12}
1,4-Dichlorobenzene-d_4	Phenanthrene-d_{10}

2.5 Calibration Check Solution

2.5.1 Prepare the calibration check solution in the manner described in 2.2, diluting 25 µL of a 2000 µg/mL solution to 1.0 mL in DCM. The final working solution should contain the check compounds at 50 µg/mL. The stock solution can be purchased from Ultra, catalog #GCM-150-1. This stock solution contains the DFTPP, 4,4-DDT, pentachlorophenol and benzidine.

2.6 DFTPP Solution

2.6.1 Prepare a tuning solution of decafluorotriphenylphosphine (DFTPP) by diluting 1250 µL of a 1000 µg/mL stock solution to 25 mL. The resulting working solution will be 50 µg/mL. The stock solution can be purchased from Ultra, catalog #GCM-150-1. This stock solution contains the DFTPP, 4,4-DDT, pentachlorophenol and benzidine.

3.0 Sample Extraction

3.1 Water Samples

3.1.1 Mark the water meniscus on the side of the sample bottle for later determination of sample volume. Pour the entire sample into a 2 L, Teflon separatory funnel which has been cleaned according to SOP No. MET1001.

3.1.2 Add 1000 µL of the surrogate standard solution (100 µg of each compound) directly into the sample in the separatory funnel.

3.1.2.1 If the sample is a matrix spike sample, add 1000 µL of the matrix spike solution (100 µg of each analyte).

3.1.3 Check the pH of the sample with wide range pH paper, and adjust the pH to greater than 11 with 10 N sodium hydroxide solution (made following SOP MET1020).

3.1.4 Add 60 mL of methylene chloride (DCM) to the sample bottle, seal, and shake for 30 seconds to rinse the inner surface.

3.1.5 Transfer the solvent to the separatory funnel and extract the sample by shaking the funnel vigorously for two minutes, with periodic venting to release excess pressure.

3.1.6 Allow the organic layer to separate for a minimum of 10 minutes.

3.1.6.1 If the emulsion interface between the layers is more than one-third the volume of the solvent layer, take steps to break the emulsion.

3.1.6.1.a Add approximately five grams of sodium chloride (precleaned according to SOP No. MET1006 for sodium sulfate) to the separatory funnel, recap, and shake until the sodium chloride is completely dissolved.

3.1.6.1.b Continue adding sodium chloride and shaking until the emulsion is broken.

3.1.6.1.c If the emulsion cannot be broken, drain off the solvent very carefully, being careful not to include any of the emulsified layer. Continue with the extraction, but on the last cycle include the emulsified layer when draining.

3.1.6.1.d Stirring with a glass rod will sometimes break up the emulsion.

3.1.6.1.e The emulsified layer can also be removed and put into a centrifuge to break it up.

3.1.7 Collect the lower, DCM layer in a 500 mL round bottom flask.

3.1.8 Repeat steps 3.1.4 through 3.1.7 twice more, for a total of three extraction cycles.

3.1.9 Collect and combine the extracts in the 500 mL round bottom flask and label it as the base/neutral (BN) fraction.

3.1.10 Acidify the sample to pH less than 2 with 1:1 sulfuric acid. Seal the separatory funnel, and shake, venting if needed. Check the pH of the sample, and add more acid if necessary.

3.1.11 Serially extract the sample with three 60-mL portions of DCM, as described in steps 3.1.4 through 3.1.7, collecting and combining the extracts in a round bottom flask labeled as the acid (A) fraction.

3.1.12 Alternatively, the BN and acid fractions may be combined in the same round bottom flask.

3.1.13 Determine the sample volume by filling the sample bottle to the mark with water and transferring the liquid to a 1000 mL graduated cylinder. Record the sample volume to the nearest 5 mL. Record all information pertaining to the extraction in the semi-volatile separatory funnel logbook.

3.2 Soil Samples

3.2.1 Soil samples are extracted by Soxhlet, closely following EPA method 3540.

3.2.2 Weigh between 10-50 grams of soil, as directed by the project objectives, into a tared Soxhlet thimble which has been pre-cleaned by solvent rinsing and contains approximately 10 grams of pre-rinsed, anhydrous sodium sulfate (prepared according to SOP No. MET1006). Record the exact weight of the soil to the nearest 0.01 g in the soxhlet extraction logbook.

3.2.3 Add a mass, equivalent to that of the sample, of pre-rinsed, anhydrous sodium sulfate to the thimble and gently mix the solids with a clean stainless steel spatula until a free flowing powder develops. Add more anhydrous sodium sulfate if necessary. Place a small plug of pre-rinsed glass wool on the top of the thimble so that it completely covers the sample. Do not pack the glass wool.

3.2.3.1 Alternatively, the sample may be mixed with the anhydrous sodium sulfate in a clean beaker. Place a glass wool plug directly inside the soxhlet body. Transfer the sample from the beaker using a stainless steel spatula. Rinse the beaker and the spatula with DCM and add to the soxhlet extractor body. Place an additional glass wool plug on top of the sample.

3.2.4 Add 1000 µL of standard surrogate solution to the soil sample (100 µg of each compound).

3.2.4.1 If the sample is a matrix spike sample, add 1000 µL of the matrix spike solution (100 µg of each analyte).

3.2.5 Place the thimble into a Soxhlet extractor body, which has been attached to a 500 mL round bottom flask containing 300 mL of 1:1 DCM:acetone and several boiling chips. Attach the condensing tube to the top of the Soxhlet apparatus, and make sure cold water is flowing through the condenser coils.

3.2.6 Place the assembled apparatus into a heating mantle and adjust the temperature for a gentle boil and moderate drip. Usually the mantle setting is at 30. Extract the sample for 16 to 20 hours. Remove from the heating mantle and allow to cool and drain. As necessary, tilt the Soxhlet apparatus to make certain that any solvent remaining in the extractor body drains into the round bottom flask.

3.3 NAPL Samples

3.3.1 Follow SOP No. MET2512 for waste dilution. No surrogate is required. The sample will not require concentration.

4.0 Extract Concentration

4.1 Pour the extract (acid and base/neutral fractions for waters if still separate) through a solvent-rinsed funnel containing about 10 cm of anhydrous sodium sulfate, and collect the dried extract in an appropriate round bottom flask. Rinse the round bottom flask and drying column with 20 to 30 mL of DCM to complete the quantitative transfer.

4.2 Add one or two clean, Teflon boiling chips to the round bottom flask, and attach a three-ball Snyder column.

4.3 Prewet the Snyder column by adding about 1 mL of DCM to the top.

4.4 Place the concentrating apparatus in a heating mantle set on 30 (60 to 65°C), and attach the solvent condensing/collection apparatus to the top of the snyder column. When the mantle temperature is correct, the balls of the column will actively chatter, but the chambers will not flood with condensed solvent.

4.5 When the apparent volume of liquid in the flask reaches several milliliters, remove the apparatus and allow it to cool and drain for at least 10 minutes.

4.6 Remove the Snyder column. Use a pasteur pipet to rinse the flask and its lower joint into the concentrator tube with 1 to 2 mL of DCM.

4.7 Quantitatively transfer the extract to a concentrator tube. At this point, the acid and base/neutral fractions of water extracts may be combined, if they have not been thus far. Add one or two clean Teflon boiling chips to the concentrator tube, and attach a micro Snyder column.

4.8 Prewet the Snyder column by adding a small amount of DCM to the top.

4.9 Place the concentrating apparatus in a water bath set at 60 to 65°C. When the bath temperature is correct, the balls of the column will actively chatter, but the chambers will not flood with condensed solvent.

4.10 When the apparent volume of liquid in the flask reaches 0.5 mL, remove the apparatus and allow it to cool and drain for at least 10 minutes.

4.11 Adjust the final volume of the extract to exactly 1.0 mL with DCM. Transfer the extract to a 1 mL screw top sample vial with a Teflon-lined screw cap.

4.11.1 The extract may be stored in the refrigerator until it is ready for cleanup or analysis.

5.0 Extract Cleanup

5.1 If necessary, extracts may be cleaned up by any of the following methods prior to GC/MS analysis:

Method	SOP No.
Acid/Base Partition Cleanup	MET3001
Florisil Cleanup	MET3003
Acid Cleanup	MET3004

Sulfur Cleanup	MET3005
Alumina Fractionation 1	MET3006
Alumina Fractionation 2	MET3007
Alumina Column Cleanup	MET3008
Silica Gel Fractionation	MET3009

6.0 GC/MS Analysis

6.1 Analyses are performed on a gas chromatograph equipped with a mass selective detector (GC/MS) and an autosampler, and capable of operating in the splitless mode.

6.2 Prior to performing any analyses, complete the initial demonstration of laboratory capability and MDL study.

6.3 GC/MS Operating Conditions

6.3.1 Samples are analyzed by capillary column GC/MS, with the GC operated in the splitless injection mode, and the MS operated in the full scanning mode.

6.3.2 The following GC conditions apply:

Column: 30 m x 0.25 mm fused silica capillary with 0.25 or 0.5 µm film thickness chemically bonded 5% phenyl methyl polysiloxane phase (DB-5 or equivalent)

Inlet purge valve open after 1.0 minutes

Pressure: 8.0 psi initial
Ramp at 99 psi/minute to 20.0 psi
Hold for 0.95 minutes
Ramp at 99 psi/minute to 15.0 psi

Oven: 4.0 minutes at 40°C
Ramp at 10.0°C/minute to 300°C
Hold for 4 minutes
Ramp at 10.0°C/minute to 330°C
Hold for 10 minutes

Inlet: 280 °C

Detector: 280 °C

6.3.3 1 µL samples are injected by autosampler.

6.3.4 Acquire data from m/z 35 to 450 with a total cycle time of one second or less.

6.3.5 Adjust the cycle time to 1.7 scans per second.

6.3.6 Phenanthrene and anthracene should be separated by baseline.

6.3.7 Benz(a)anthracene and chrysene should be separated by a valley whose height is less than 25% of the average peak height of the two compounds.

6.3.8 The MS should be capable of recognizing a GC peak for all of the compounds.

6.4 Prior to performing any analyses, inject a 1 µL aliquot of a 50 µg/mL solution of DFTPP tuning solution. Make certain that the mass spectrum meets all the requirements listed in Table 1. Benzidine and pentachlorophenol should be present at their normal responses, and no peak tailing should be visible. Also, make certain that the degradation of 4,4-DDT to DDD and DDE does not exceed 20%.

6.4.1 Calculate percent breakdown as follows:

$$\% \text{ breakdown of DDT} = \frac{\text{Sum of degradation peak areas (DDD + DDE)}}{\text{sum of all peak areas (DDT + DDE + DDD)}} \times 100$$

6.5 Perform an initial system calibration.

6.5.1 Tune the GC/MS system as described in 6.4.

6.5.2 Use the GC/MS operating conditions established in 6.3.2.

6.5.3 Prepare calibration standards at the five concentration levels described in section 2.4. Calibration standards are prepared according to SOP No. MET1002.

6.5.4 Inject 1 µL of each standard, and calculate the relative response factor (RRF) of each analyte and surrogate compound.

6.5.4.1 Use the internal standard method of calculation.

6.5.4.2 Use the internal standard closest in retention time to each analyte to calculate the RRFs.

6.5.4.3 Use the extracted ion areas for each compound. Table 1 of method 8270D list the suggested quantitation ions for the compounds.

6.5.5 Confirm that the percent relative standard deviation (%RSD) of each component is ≤ 15%. The calibration check compounds (CCCs) which are listed in Table 2 may have a %RSD of ≤ 30%. The table is taken from Table 4 of Method 8270D, Rev. 4, 1/98.

6.5.5.1 If the %RSD is > 15%, or 30% in the instance of the CCCs, analyze additional aliquots of appropriate calibration solutions to obtain acceptable %RSD of RRFs over the entire concentration range, or take action to improve GC/MS performance.

6.5.5.2 A performance check must be done so that miimum average RFs are met before the calibration curve is used. The System Performance Check Compounds (SPCCs) are: N-nitro-di-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RF for these compounds is 0.050. These SPCCs typically have very low RFs (0.1-0.2) and tend to decrease in response as the chromatographic system begins to deteriorate or the standard material begins to deteriorate.

6.5.5.3 If the initial calibration RRFs exceed the criteria stated in section 6.5.5, linear and non-linear calibration curves may be used as described in Method 8000B, Rev. 2, 12/96.

6.5.5.4 The amine compounds are reactive. The QC criteria is advisory only.

6.5.6 Confirm that there are at least five usable calibration points for each compound.

6.5.7 Following initial calibration, analyze the calibration check solution (8270Check). Check standard recoveries should be 90 and 110% of the true values.

6.6 Verify the initial calibration.

6.6.1 The GC/MS system must be retuned every twelve hours, following the procedure in 6.4, and prior to the analysis of the continuing calibration standard.

6.6.2 Every twelve hours that samples are analyzed, the initial calibration must also be verified by the analysis of a continuing calibration standard.

6.6.2.1 Inject 1 µL of a mid point calibration standard (50 µg/mL) containing each of the analytes as well as the surrogate standard compounds. Calculate the RRFs for each. Compare the continuing RRFs to the average RRF from the initial calibration sequence.

6.6.2.2 Confirm that the percent difference (%D) between the initial calibration average ratio of response and the continuing calibration ratio of response does not exceed 20% for any analyte.

6.6.2.3 If the %D exceeds 20%, analyze a fresh continuing calibration standard. Alternatively, perform a new initial calibration of the system.

6.7 Analyze the sample extracts.

6.7.1 Prior to analysis, add 5 µL of internal standard to 500 µL of each extract to be analyzed, such that the concentration of each internal standard is 40 µg/mL in the extract. A commercial solution may be purchased from Ultra, catalog #ISM-108N. This solution is at the correct concentration for spiking as described above (4000 µg/mL).

6.7.1 Make sure the extracts are at room temperature. Inject 1 µL of each sample extract. Identify the analytes in the sample by comparing the retention times and mass spectra of the peaks in the sample chromatograms with those of the peaks in standard chromatograms.

6.7.2 If the response for a peak exceeds the working range of the system, dilute extract, add an appropriate amount of internal standard, and reanalyze.

6.8 Compound Identification

6.8.1 Identify sample components by comparison of retention times (RTs) to RT data and mass spectra from the most recent, previous calibration standard. The width of the RT window should be based upon measurements of actual RT variations of standards over the course of a day. As a guideline, the RT of the sample peaks should fall within ±0.5 minutes of the calibration peak.

6.8.2 Confirm the identity of all compounds, by comparing their mass spectra to the standard mass spectra. As a guideline, the three characteristic masses in the extracted ion current profile (EICP) must fall within ±20% of the relative intensities of the same masses in the reference mass spectrum.

6.8.3 Determine the peak area for the primary ion EICP for each compound, IS, and SS peak. If any area exceeds the linear range of the instrument as demonstrated during the initial calibration, the extract must be diluted and reanalyzed.

6.9 Calculations

6.9.1 IS compounds are added to every sample extract.

6.9.2 Calculate the sample concentrations and surrogate recoveries using the internal standard method described in the published methods. Use the average RRFs from the initial calibration.

6.9.3 The concentration of each component is calculated using the Internal Standard Method (ISM) and based on the primary m/z ion areas of the peaks of interest.

6.9.4 Refer to SOP No. MET1008 for more information on performing sample calculations.

7.0 Quality Control

7.1 The GC/MS system must be tuned every twelve hours to meet the criteria in Table 1 for a 50-ng injection of decafluorotriphenylphosphine (DFTPP).

7.1.1 The twelve-hour time period for a GC/MS analytical run begins at the moment of injection of the DFTPP verification standard.

7.1.2 The mass spectrum of DFTPP must be acquired in the following manner.

Three scans (the peak scan, and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is required and must be accomplished using a single scan prior to the elution of DFTPP.

7.1.3 Analyses, including calibrations, should not begin until all of the criteria are met.

7.1.4 All subsequent standards, field samples, and QC samples must be analyzed under the DFTPP-verified mass spectrometer conditions.

7.2 An initial calibration consisting of five levels of concentration should be analyzed prior to sample analysis. The %RSD of the relative response factors (RRFs, for internal standard methods) or calibration factors (CFs, for external standard methods) should be ≤ 15%, and 20% for the CCCs.

7.2.1 After the ICAL, a check standard should be analyzed. Check standard recoveries should be 90 to 110% of the true values.

7.2.2 For more information on evaluating initial calibration performance, see SOP No. MET1002.

7.3 On each day that samples are analyzed, a continuing calibration (CCAL) standard must be analyzed prior to sample analysis. The CCAL should be at a mid-level concentration. The %D between the CCAL RRFs or CFs and the ICAL average RRFs or CFs should be ≤ 20%.

7.3.1 In addition, a CCAL standard should be analyzed after every 15 samples and at the end of the sequence, to evaluate shifts in retention times and instrument sensitivity.

7.4 For each batch of samples extracted (up to 20 samples), a method blank, a blank spike, a matrix spike, and a duplicate sample must be extracted. For samples where detectable amounts of organics are present, duplicate samples may be appropriate in place of matrix spiked ones. Be sure to refer to the project QAPP for deviations from these requirements.

7.4 Surrogate standard recovery limits must be established after 30 samples of the same matrix have been extracted and analyzed, as described in section 8.9 of USEPA method 8270. The internal laboratory limits must fall within the following limits:

	Water Samples	Soil Samples
Nitrobenzene-d_5	35-114	23-120

2-Fluorobiphenyl	43-116	30-115
p-Terphenyl-d_{14}	33-141	18-137
Phenol-d_6	10-94	24-113
2-Fluorophenol	21-100	25-121
2,4,6-Tribromophenol	10-123	19-122

The surrogate recovery limits must be confirmed annually.

7.5 If the surrogate recoveries in a sample are outside of the internal laboratory limits, the sample should be re-extracted. Only re-extract a sample once, if the poor surrogate recoveries are due to matrix interferences.

7.6 Matrix spike compound %Recovery should be between 50-120% of the true values.

7.7 Internal standard areas in the samples should be within -50 to +200% of the internal standard areas in the most recent, previous CCAL standard.

7.7.1 If the recoveries are outside these limits, the sample must be reanalyzed.

7.7.2 If it suspected that the internal standard solution used has degraded, respike the remaining 500 µL of unspiked extract with a fresh internal standard solution, and reanalyze.

If the internal standard recoveries are still outside of the limits, it may be attributed to matrix effects, and sample results should be calculated externally.

7.8 Duplicate sample results should agree within ±50% for solids or ±30% for waters.

7.8.1 If sample results are not in agreement, check that all peaks were integrated correctly.

7.9 Method blanks should be free of target compounds or contaminants that could interfere with the proper quantitation of target compounds.

7.9.1 If contaminants are present in the method blank, evaluate the contaminants and check that samples associated with that blank were not also affected. If samples are affected by the contamination, they must be re-extracted.

7.9.2 The source of the contamination must be identified and eliminated as soon

as possible.

7.10 Extracts must be analyzed within 40 days of extraction.

7.11 The laboratory documents method performance (surrogates and matrix spikes) through the use of control charts, as described in SOP No. MET5010.

Table 1

DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	30 - 60% of mass 198
68	< 2% of mass 69
69	Present
70	< 2% of mass 69
127	40 - 60% of mass 198
197	< 1% of mass 198
198	Base peak, 100% relative abundance
199	5 - 9% of mass 198
275	10 - 30% of mass 198
365	> 1% of mass 198
441	Present, but less than mass 443
442	40 - 110% of mass 198
443	17 - 23% of mass 442

Table 2

Calibration Check Compounds (CCC)

Base/Neutral Fraction	Acid Fraction
Acenaphthene	4-Chloro-3-methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
Diphenylamine	Phenol
Di-n-octylphthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	

Appendix C

Assorted Documentation

META Environmental, Inc.

ANALYTICAL REQUEST FORM

Client Contact: _____

Client: _____

Address: _____

_____

_____

Phone Number: _____

Fax Number: _____

Date of Request: _____

Date(s) Samples Arrive: _____

Saturday Delivery?: ☐ yes ☐ no

META Project Manager: _____

META Project Number: _____

No. Samples Expected	Matrix	Parameter/Method	Comments

Type of Data Package: ☐ Results Only ☐ QC Summary ☐ Full

Type of Service: ☐ 24 Hour ☐ 48 Hour ☐ 1 Week ☐ 2 Week ☐ 4 Week

Special Instructions: _____

_____

_____

:HAIN OR JSTODY RECORD

ROJECT NAME _____

:OMPANY _____

.DDRESS _____

HONE ( )

AMPLED BY

(Print Name) _____ Signature _____

(Print Name) _____ Signature _____

(Print Name) _____ Signature _____

META Environmental, Inc.

49 Clarendon ...
Watertown, MA ... 72
TEL (617) 923-4662
FAX (617) 923-4610

SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	CONTAINER SIZE	CONTAINER G/P	GRAB	COMP	NO. OF CONTAINERS	SAMPLE MATRIX	PRESERVATIVE	ANALYSES										COMMENTS

Relinquished by	Date/Time	Received by	Relinquished by	Date/Time	Received by
Relinquished by	Date/Time	Received by	Relinquished by	Date/Time	Received for Laboratory by

Method of Shipment

Remarks:

Rev 7/92

PT 1 - ORIGINAL PT 2 META Project Manager - Yellow

META ENVIRONMENTAL SAMPLE RECEIPT

Lab ID	Field ID	Matrix	Analysis	Date Sampled	Date Received	Client/ Project	Container/ Storage	Comments/Logger

SAMPLE STO JE LOG

Storage Unit ID:

Lab Sample ID	IN Date/Init	OUT Date/Init	IN Date/Init	OUT Date/Init	IN Date/Init	OUT Date/Init	IN Date/Init	OUT Date/Init	Comments (Arch, Disp, Moved?)

INSTRUMENT MAINTENANCE LOGBOOK
META Environmental, Inc.

QA 001

Date: _____ Analyst: _____

Problem:

Corrective Action:

Resolution:

QA Review: _____ Date: _____ Page:

STANDARDS PREPARATION LOGBOOK

QA002

META Environmental, Inc.

Mix Identification: _____

Date Prepared: _____

Preparation Chemist's Initials: _____

Date Concentration Verified: _____

Certification Analyst's Initials: _____

Prepared In (Solvent): _____

Date Consumed/Discontinued: _____

Unique Laboratory Identification	Analyte	Vendor	Source			Volume Diluted (mL)	Final Volume (mL)	Final Concentration (ug/mL)
			Lot Number	Expiration Date	Stock Concentration (ug/mL)			

Reviewer: _____ Date: _____ QA Reviewer: _____ Date: _____

Page:

LABORATORY QUALITY C .TROL SUMMARY

Batch Identification

XX970119-SB

QC Type	Statistic	BLANK	BLANK SPK	%REC	SAMPLE	SAMPLE DUP	RPD	SAMPLE	SPIKE	%REC	SPIKE DUP	%REC	RPD
Frequency	(1)	1/Batch	1/Batch			1/Batch			1/Batch		1/Batch by Request		
META ID	Matrix	XX970119-SB	XX970119-SBS	Soil	XX970115-04	X970115-04DUP		XX970115-09	XX970115-09MS	Soil			
GC ID	Sample Size	III-FID	III-FID	2.000	III-FID	III-FID		III-FID	III-FID	1.918			
File ID	% Solid	31JANR54	31JANR55	1.000	31JANF13	31JANF14		31JANR59	31JANR60	68.2%			
Inject Date	Spike Amt	1/31/97	1/31/97	50.0	1/31/97	1/31/97		1/31/97	1/31/97	50.0			
Benzene													
Toluene													
Ethylbenzene													
m/p Xylene													
Styrene													
o-Xylene													
124-Trimethylbenzene													
Naphthalene													
2-Methylnaphthalene													
1-Methylnaphthalene													
Acenaphthylene													
Acenaphthene													
Dibenzofuran													
Fluorene													
Phenanthrene													
Anthracene													
Fluoranthene													
Pyrene													
Benz(a)anthracene													
Chrysene													
Benzo(b)fluoranthene													
Benzo(k)fluoranthene													
Benzo(a)pyrene													
Indeno(123cd)pyrene													
Dibenz(ah)anthracene													
Benzo(ghi)perylene													
Additional Compounds:													
Fluorobenzene (SS)													
2-Fluorobiphenyl													
5-alpha-Androstane													

(1) A batch is 20 or fewer samples extracted within the same 24 hour period of time.

C:\LQAP\[MPAHQC XLS]Template

ANALYST:_____ DATE:_____

REVIEWER:_____ DATE:_____

QA:_____ DATE:_____

SAMPLES EXTRACTED

METHOD NAME: MAHPAH
METHOD SOP#: MET2508
MATRIX: SOIL

Initial each step upon completion.
Concentration temperature:

	SAMPLE ID		WEIGHT EXTRACTED (g)	SURR. SPIKE	MATRIX SPIKE	DATE EXTD(init)	TIME STARTED	TIME STOPPED	DATE CONC.(init)	FINAL VOLUME (mL)	INTERNAL STANDARD	NOTES
SB		Soil Blank										
SBS		Blank Spike										
Dup		Duplicate										
Dup		Duplicate										
MS		Matrix Spike										

NOTES & COMMENTS:

Extract released (Date & Initials):

Extract received (Date & Initials):

___µL of MET2508 surrogate 0.1mg/mL in DCM Lot: Analyst:

___µL of MET2508 spike 0.1mg/mL in DCM Lot: Analyst:

MET4007 Internal Std. 5.0mg/mL in DCM Lot: Analyst:

META Environmental, Inc.

REFRIGERATOR/FREEZER TEMPERATURE

Date	Initials	Temperature (°C)	Corrective Action
11/1/97			
11/2/97			
11/3/97			
11/4/97			
11/5/97			
11/6/97			
11/7/97			
11/8/97			
11/9/97			
11/10/97			
11/11/97			
11/12/97			
11/13/97			
11/14/97			
11/15/97			
11/16/97			
11/17/97			
11/18/97			
11/19/97			
11/20/97			
11/21/97			
11/22/97			
11/23/97			
11/24/97			
11/25/97			
11/26/97			
11/27/97			
11/28/97			
11/29/97			
11/30/97			

Refrigerator temperature should be 2 to 4°C, freezer temperature should be < -5 C. If any readings do not meet these criteria, refer to SOP No. MET1013 for corrective actions.

BALANCE WEEKLY CHECK RECORD

Balance ID: Sartorious Basic
Month: October
Year: 1998

Date	Initials	Known Weight No. 1 (in g) (K1)	Balance Reading (R1)	%Error of 1 $\frac{(K1-R1)}{(K1)} \times 100$	Known Weight No. 2 (in mg) (K2)	Balance Reading (R2)	%Error of 2 $\frac{(K2-R2)}{(K2)} \times 100$
1st week							
2nd week							
3rd week							
4th week							
5th week							

Notes: _____

1. Two weights must be checked weekly.
2. If either %Error value is > 2.0%, repeat balance check.
3. If either %Error value is still > 2.0%, DO NOT USE BALANCE! Notify the QAM.

LABORATORY DISTILLED WATER CHECK

Date	Initials	Resistivity (megohms/cm)	Okay?	Date	Initials	Resistivity (megohms/cm)	Okay?

1. The resistivity must be > 16.67 megohms/cm.
2. If the resistivity is < 16.67 megohms/cm, change cartridges.

CHEMICAL INVENTORY of Solvents & Acids

Chemical	Vendor	Date Rec'd	Init.	Lot No.	Volume	Date Opened

1. The date received and initials should be written on every chemical bottle, in order to establish their order of use.
2. If the solvent lot number received is a new one, highlight the entry, indicating that solvent monitoring should be perfo

NONCONFORMANCE REPORT

Nonconformance reports are used to document incidents that require corrective action or simply to document changes in standard procedure. This report will be passed to the Lab Director, to Quality Assurance, to the Project Manager, and filed in the project file

Project(s): _____ Sample(s) Affected: _____

Initiator/Date _____
Lab Director/Date _____
Quality Assurance/Date _____
Project Manager/Date _____

Nonconformance(check one) Additional Comments

_____ sample received warm/cracked/broken _____

_____ COC does not match samples _____

_____ sample extracted out of holding time _____

_____ sample extract lost during extraction _____

_____ extraction method changed/modified _____

_____ sample extract analyzed out of holding time _____

_____ other: _____

Corrective Action Additional Comments

_____ project manager notified, client informed _____

_____ sample reextracted(within holding time/out of holding time) _____

_____ other: _____

Additional Comments/Conclusions _____

NONCONFORMANCE REPORT

Sign and date all comments.

QUALITY ASSURANCE (QA) REPORT

Results of QA Review of Data

Method: _____

Sequence Name: _____

Data Path: _____

Acquisition Date: _____

Project: _____

Item	Corrective Action

QA Review by: _____

Date: _____

Appendix D

Method Detection Limits and Practical Quantitation Limits

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in μg/L)

Description of Method:	PAHs and some MAHs by GC/FID			
Applicable SOPs:	MET2003, MET2503, MET2504, MET4003			
Compound	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
Toluene	0.032	1.6	0.05	10.0
Ethylbenzene	0.111	1.9	0.05	10.0
m,p-Xylene	0.012	3.8	0.05	10.0
o-Xylene	0.007	2.0	0.05	10.0
Styrene	0.008	2.1	0.05	10.0
1,2,4-Trimethylbenzene	0.015	2.0	0.05	10.0
Naphthalene	0.014	2.2	0.05	10.0
1-Methylnaphthalene	0.009	2.3	0.05	10.0
2-Methylnaphthalene	0.016	2.6	0.05	10.0
Acenaphthylene	0.015	2.7	0.05	10.0
Acenaphthene	0.023	2.5	0.05	10.0
Dibenzofuran	0.022	2.7	0.05	10.0
Fluorene	0.015	2.5	0.05	10.0
Phenanthrene	0.053	2.8	0.05	10.0
Anthracene	0.043	2.6	0.05	10.0
Fluoranthene	0.301	2.9	0.05	10.0
Pyrene	0.353	2.9	0.05	10.0
Benz(a)anthracene	0.137	5.0	0.05	10.0
Chrysene	0.626	2.2	0.05	10.0
Benzo(b)fluoranthene	0.163	ND	0.05	10.0
Benzo(k)fluoranthene	0.148	ND	0.05	10.0
Benzo(a)pyrene	0.183	3.8	0.05	10.0
Indeno(1,2,3-cd)pyrene	0.135	2.2	0.10	20.0
Dibenz(a,h)anthracene	0.097	2.1	0.10	20.0
Benzo(g,h,i)perylene	0.214	3.7	0.10	20.0

[1] Determined 09/03/93 on "GCIII". Preliminary results only, to be rerun.
[2] Determined 11/01/93 on "GCIII".

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in mg/L)

Description of Method:	MAHs by GC/FID			
Applicable SOPs:	MET2001, MET2501, MET4001			
	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
Benzene	0.078	0.005	0.25	0.013
Toluene	0.077	0.017	0.25	0.013
Ethylbenzene	0.071	0.010	0.25	0.013
m-/p-Xylene	0.093	0.022	0.25	0.013
o-Xylene/Styrene	0.177	0.021	0.25	0.013

[1] Determined 10/27/93 on "GCI". Preliminary results only, to be rerun.
[2] Determined 10/27/93 on "GCI". Preliminary results only, to be rerun.

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in μg/L)

Description of Method:	CPs by GC/ECD			
Applicable SOPs:	MET2002, MET2502, MET2509, MET3001, MET4002			
Compound	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
2,4-Dichlorophenol	0.026	0.18	0.025	5.0
2,3,5-Trichlorophenol	0.0015	0.18	0.025	5.0
2,4,5-Trichlorophenol	0.0017	0.13	0.025	5.0
2,4,6-Trichlorophenol	0.0013	0.14	0.025	5.0
2,3,4-Trichlorophenol	0.0017	0.14	0.025	5.0
2,3,6-Trichlorophenol	0.0020	0.14	0.025	5.0
2,3,5,6-Tetrachlorophenol	0.0022	0.22	0.025	5.0
2,3,4,6-Tetrachlorophenol	0.0024	0.24	0.025	5.0
Pentachlorophenol	0.016	1.7	0.025	5.0

[1] Determined 11/05/93 on "GCI".
[2] Determined 11/05/93 on "GCI".

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in mg/L)

Description of Method:	PCBs by GC/ECD			
Applicable SOPs:	MET2003, MET2503, MET2504, MET3003, MET3004, MET3005, MET4002			
Compound	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
Aroclor 1016			0.25	0.025
Aroclor 1221			0.25	0.025
Aroclor 1232			0.25	0.025
Aroclor 1242			0.25	0.025
Aroclor 1248			0.25	0.025
Aroclor 1254			0.25	0.025
Aroclor 1260			0.25	0.025
Aroclor 1262			0.25	0.025
Aroclor 1268			0.25	0.025
Mineral oil			50	5.0

1,2 To be determined.

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in mg/L)

Description of Method:	TPHs by FTIR			
Applicable SOPs:	MET2004, MET2505, MET3002, MET4005			
Compound	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
TPHs - aliphatic fraction, plus approximately 34% aromatic content	10	0.5	50	5.0

Description of Method:	TPHs by GC/FID			
Applicable SOPs:	MET2003, MET2503, MET2504, MET4003			
Compound	MDLs		PQLs	
	Soil[3]	Water[4]	Soil	Water
TPHs - total extractable hydrocarbons including the aliphatic and aromatic fractions			50	5.0

[1,2] Determined 10/26/93 on the FTIR.
[3,4] To be determined.

META

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs)
(Soils in mg/kg, Waters in μg/L)

Description of Method:	Simultaneous MAHs and PAHs (including Creosote Constituents) by GC/FID			
Applicable SOPs:	MET2005, MET2508, MET4007			
Compound	MDLs		PQLs	
	Soil[1]	Water[2]	Soil	Water
ACID/NEUTRAL FRACTION				
Benzene	0.039	12.7	0.125	14.0
Toluene	0.045	13.4	0.125	14.0
Ethylbenzene	0.041	14.2	0.125	14.0
m/p-Xylenes	0.086	28.2	0.125	14.0
o-Xylene	0.038	22.6	0.125	14.0
Styrene	0.044	15.8	0.125	14.0
Phenol	1.28	4.43	0.125	14.0
1,2,4-Trimethylbenzene	0.054	9.34	0.125	14.0
2-Methylphenol	0.071	9.30	0.125	14.0
3/4-Methylphenols	0.061	5.30	0.125	14.0
2,4-Dimethylphenol	0.057	5.14	0.125	14.0
Naphthalene	0.034	7.89	0.125	14.0
2-Methylnaphthalene	0.049	10.7	0.125	14.0
1-Methylnaphthalene	0.048	7.66	0.125	14.0
Acenaphthalene	0.064	6.66	0.125	14.0
Acenaphthene	0.043	7.91	0.125	14.0
Fluorene	0.048	7.11	0.125	14.0
Pentachlorophenol	0.038	6.37	0.500	56.0
Phenanthrene	0.043	6.08	0.125	14.0
Anthracene	0.039	7.38	0.125	14.0
Fluoranthene	0.073	16.3	0.125	14.0
Pyrene	0.099	25.5	0.125	14.0
Benz(a)anthracene	0.101	14.8	0.125	14.0
Chrysene	0.892	15.0	0.125	14.0
Benzo(b)fluoranthene	0.059	6.68	0.125	14.0
Benzo(k)fluoranthene	0.065	7.82	0.125	14.0
Benzo(a)pyrene	0.031	9.63	0.125	14.0
Indeno(1,2,3-cd)pyrene	0.044	7.36	0.125	14.0
Dibenz(a,h)anthracene	0.042	9.48	0.125	14.0
Benzo(g,h,i)perylene	0.038	8.72	0.125	14.0
BASE FRACTION				
Quinoline	0.073	7.22	0.125	14.0
Carbazole	0.051	6.96	0.125	14.0

[1] Determined 11/05/93 on "GCII". Preliminary results only, to be rerun.
[2] Determined 11/05/93 on "GCII". Preliminary results only, to be rerun.

META

INITIAL DEMONSTRATIC F CAPABILITY
META Environmental, Inc.

Method USEPA 525.2
Empore SPE Disk Extraction

Analyte	IDC	Sample 1 (ug/L)	Sample 2 (ug/L)	Sample 3 (ug/L)	Sample 4 (ug/L)	Average Conc (ug/L)	True Value (ug/L)	Percent Recovery	RSD
Naphthalene	0930	5.73	6.87	6.57	6.15	6.33	5.0	127%	0.08
Acenaphthylene	1017	6.55	6.01	7.22	4.65	6.11	5.0	122%	0.18
Acenaphthene	1017	5.68	5.41	5.71	3.10	4.98	5.0	100%	0.25
Fluorene	0930	4.72	4.45	4.65	4.69	4.63	5.0	93%	0.03
Phenanthrene	0930	5.33	6.18	4.80	4.86	5.29	5.0	106%	0.12
Anthracene	0930	4.50	4.18	5.21	4.93	4.70	5.0	94%	0.10
Fluoranthene	0930	5.24	5.52	5.26	5.39	5.35	5.0	107%	0.02
Pyrene	0930	5.21	5.31	5.27	5.31	5.27	5.0	105%	0.01
Benz[a]anthracene	0930	5.35	4.75	5.72	5.55	5.34	5.0	107%	0.08
Chrysene	0930	5.19	4.96	6.18	5.75	5.52	5.0	110%	0.10
Benzo[b]fluoranthene	0930	4.96	4.86	7.50	4.00	5.33	5.0	107%	0.28
Benzo[k]fluoranthene	0930	4.42	4.57	2.63	4.97	4.15	5.0	83%	0.25
Benzo[a]pyrene	0930	4.25	4.37	4.88	4.48	4.49	5.0	90%	0.06
Indeno[1,2,3-cd]pyrene	0930	4.48	4.89	5.04	4.87	4.82	5.0	96%	0.05
Dibenz[a,h]anthracene	0930	4.33	4.98	5.04	4.85	4.80	5.0	96%	0.07
Benzo[g,h,i]perylene	0930	4.35	4.90	5.14	4.95	4.84	5.0	97%	0.07

METHOD DETEC. 'MIT
META Environmer. .nc.

Method USEPA 525.2
Empore SPE Disk Extraction

Analyte	Sample 1 (ug/L)	Sample 2 (ug/L)	Sample 3 (ug/L)	Sample 4 (ug/L)	Sample 5 (ug/L)	Sample 6 (ug/L)	Sample 7 (ug/L)	Sample 8 (ug/L)	Average Conc (ug/L)	True Value (ug/L)	Sigma	MDL (ug/L)
Naphthalene	0.258	0.236	0.173	0.200	0.165	0.339	0.181	0.270	0.228	0.500	0.060	0.180
Acenaphthylene	0.530	0.598	0.525	0.652	0.554	0.626	0.602	0.678	0.596	0.500	0.056	0.168
Acenaphthene	0.483	0.472	0.419	0.554	0.443	0.571	0.489	0.576	0.501	0.500	0.059	0.178
Fluorene	0.241	0.255	0.230	0.247	0.253	0.260	0.247	0.265	0.250	0.500	0.011	0.033
Phenanthrene	0.220	0.365	0.301	0.274	0.370	0.268	0.299	0.289	0.298	0.500	0.050	0.150
Anthracene	0.251	0.322	0.296	0.324	0.339	0.341	0.351	0.344	0.321	0.500	0.033	0.099
Fluoranthene	0.196	0.241	0.216	0.236	0.282	0.240	0.246	0.225	0.233	0.500	0.020	0.060
Pyrene	0.228	0.250	0.237	0.265	0.277	0.253	0.269	0.242	0.253	0.500	0.017	0.051
Benz[a]anthracene	0.299	0.384	0.350	0.372	0.370	0.381	0.382	0.373	0.364	0.500	0.028	0.085
Chrysene	0.302	0.425	0.388	0.376	0.454	0.384	0.390	0.386	0.388	0.500	0.044	0.131
Benzo[b]fluoranthene	0.216	0.294	0.419	0.255	0.442	0.267	0.265	0.278	0.304	0.500	0.081	0.244
Benzo[k]fluoranthene	0.287	0.443	0.178	0.353	0.182	0.358	0.364	0.377	0.317	0.500	0.095	0.284
Benzo[a]pyrene	0.216	0.344	0.295	0.274	0.323	0.288	0.290	0.301	0.291	0.500	0.038	0.113
Indeno[1,2,3-cd]pyrene	0.184	0.313	0.276	0.247	0.300	0.273	0.284	0.270	0.266	0.500	0.039	0.116
Dibenz[a,h]anthracene	0.179	0.281	0.268	0.217	0.266	0.256	0.252	0.246	0.244	0.500	0.032	0.095
Benzo[g,h,i]perylene	0.181	0.287	0.273	0.236	0.284	0.257	0.259	0.272	0.256	0.500	0.035	0.104

METHOD DETECTION ...IT STUDY
META Environmental, Inc.

Method: 8525 Column: Rtx-5MS
Project:

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4				
Sequence ID	980522	980522	980522	980522	980522	980522	980522	980522	980522	980522				
File ID	22MAY012.D	22MAY013.D	22MAY014.D	22MAY015.D	22MAY016.D	22MAY017.D	22MAY018.D	22MAY021.D	22MAY022.D	22MAY023.D				
Lab ID	0416-01	0416-02	0416-03	0416-04	0416-05	0416-06	0416-07	0416-08	0416-09	0416-10	Standard	Replicates	t-value	MDL
Field ID	PAH-01	PAH-02	PAH-03	PAH-04	PAH-05	PAH-06	PAH-07	PAH-08	PAH-09	PAH-10	Deviation			
Sample Size (g or mL)	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0				
Final Volume (ml)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
%Solids (decimal format)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
1,3-Dimethyl-2-nitrobenze	5.9344	5.7560	6.0506	5.7815	6.0140	5.9885	5.7642	5.9171	5.8390	5.7430	0.115	10.000	2.821	0.323
Pyrene-d10	3.6783	3.7577	4.0654	3.6558	3.7226	3.7703	4.0368	3.9277	3.7785	3.8158	0.143	10.000	2.821	0.404
Triphenylphosphate	5.1947	4.2248	4.3844	5.4640	4.5821	4.2981	5.4937	4.9382	4.9603	5.5144	0.508	10.000	2.821	1.434
Perylene-d12	4.3838	4.4484	4.0733	4.6936	4.6326	4.5587	4.4631	4.5352	4.5582	4.3092	0.179	10.000	2.821	0.504
Acenapthylene	2.9975	2.8817	3.0268	3.0006	3.0001	2.9861	3.0033	3.0063	3.0147	2.8686	0.056	10.000	2.821	0.158
Fluorene	2.5888	2.6188	2.5932	2.6348	2.5918	2.6638	2.6622	2.6380	2.6991	2.5975	0.040	10.000	2.821	0.114
Phenanthrene	2.2930	2.3283	2.3634	2.2802	2.2580	2.3245	2.3300	2.3315	2.2919	2.3581	0.034	10.000	2.821	0.095
Anthracene	1.8681	1.8112	1.5380	2.0724	1.7580	1.7775	1.9555	1.9797	2.0009	1.9090	0.155	10.000	2.821	0.436
Pyrene	2.5034	2.5898	2.7685	2.4319	2.4984	2.4874	2.6888	2.6578	2.4844	2.4957	0.111	10.000	2.821	0.313
Benz[a]anthracene	2.8168	2.5280	2.4440	3.0047	2.8459	2.3911	2.8720	2.7419	2.7213	3.0162	0.224	10.000	2.821	0.632
Chrysene	2.4208	2.3024	2.3877	2.5505	2.4153	2.3300	2.4632	2.4589	2.4451	2.6490	0.101	10.000	2.821	0.284
Benzo[b]fluoranthene	3.2979	2.8562	2.9944	3.4127	2.9731	2.7676	3.0962	3.1714	2.9999	3.4414	0.228	10.000	2.821	0.642
Benzo[k]fluoranthene	2.2598	2.2612	2.1758	2.3003	2.3207	2.3151	2.3608	2.2472	2.4111	2.4764	0.087	10.000	2.821	0.244
Benzo[a]pyrene	2.1547	1.9309	1.7277	2.4014	2.1161	1.9366	2.2504	2.1428	2.1743	2.0325	0.189	10.000	2.821	0.533
Indeno(1,2,3-cd)pyrene	2.8378	3.0515	3.1542	3.2485	3.3304	3.2663	3.2858	3.0954	3.1324	3.2434	0.146	10.000	2.821	0.411
Dibenz[a,h]anthracene	2.4785	2.7637	2.8817	2.9015	2.9758	2.9422	2.9095	2.6521	2.7685	2.8299	0.151	10.000	2.821	0.426
Benzo[g,h,i]perylene	2.5318	2.8400	2.9236	3.0272	3.1041	3.0868	3.0127	2.7907	2.8484	2.9618	0.171	10.000	2.821	0.481
Areas:														
Naphthalene	1180523	1122598	1047899	1211830	1198602	1215264	1217828	1063432	1248832	1305796				
Acenaphthene	1857603	1751537	1692850	2003278	1952140	2025471	1971085	1861355	2011284	1995207				
Fluoranthene	1793966	1737556	1821355	1875830	1915593	1904835	1961320	1714933	2001157	1932686				
Concentrations:														
Naphthalene	4.0707	3.9377	3.6756	4.2507	4.2043	4.2627	4.2717	3.7301	4.3804	4.5803	0.285	10.000	2.821	0.803
Acenaphthene	4.3874	4.1180	3.9801	4.7099	4.5897	4.7621	4.6342	3.9060	4.7287	4.6909	0.331	10.000	2.821	0.935
Fluoranthene	4.6803	4.5332	4.7518	4.8939	4.9976	4.9696	5.1169	4.4741	5.2209	5.0422	0.250	10.000	2.821	0.704

KD 6/9/98

METHOD DETECTI... LIMIT STUDY
Analyte Recoveries
META Environmental, Inc.

Method: 8525
Project:

Column: Rtx-5MS

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4
Sequence ID	980522	980522	980522	980522	980522	980522	980522	980522	980522	980522	980522
File ID	22MAY024.D	22MAY012.D	22MAY013.D	22MAY014.D	22MAY015.D	22MAY016.D	22MAY017.D	22MAY018.D	22MAY021.D	22MAY022.D	22MAY023.D
Lab ID	Reference	0416-01	0416-02	0416-03	0416-04	0416-05	0416-06	0416-07	0416-08	0416-09	0416-10
Field ID	Standard 1	PAH-01	PAH-02	PAH-03	PAH-04	PAH-05	PAH-06	PAH-07	PAH-08	PAH-09	PAH-10
Sample Size (g or mL)	1.000	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0
Final Volume (ml)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
%Solids (decimal format)	1.000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

1,3-Dimethyl-2-nitrobenzene	5	119%	115%	121%	116%	120%	119%	115%	118%	117%	115%
Pyrene-d10	5	74%	75%	81%	73%	74%	75%	81%	79%	76%	76%
Triphenylphosphate	5	104%	84%	88%	109%	92%	86%	110%	99%	99%	110%
Perylene-d12	5	88%	89%	81%	94%	93%	91%	89%	91%	91%	86%
Acenapthylene	5	60%	58%	61%	60%	60%	60%	60%	60%	60%	57%
Fluorene	5	51%	52%	52%	53%	52%	53%	53%	53%	54%	52%
Phenanthrene	5	46%	47%	47%	46%	45%	46%	47%	47%	46%	47%
Anthracene	5	37%	36%	31%	41%	35%	36%	39%	40%	40%	38%
Pyrene	5	50%	51%	55%	49%	50%	49%	54%	53%	50%	50%
Benz[a]anthracene	5	56%	51%	49%	60%	51%	48%	57%	55%	54%	60%
Chrysene	5	48%	46%	48%	51%	48%	47%	49%	49%	49%	53%
Benzo[b]fluoranthene	5	66%	57%	60%	68%	59%	55%	62%	63%	60%	69%
Benzo[k]fluoranthene	5	45%	45%	44%	46%	46%	46%	47%	45%	48%	50%
Benzo[a]pyrene	5	43%	39%	35%	48%	42%	39%	45%	43%	43%	41%
Indeno[1,2,3-cd]pyrene	5	57%	61%	63%	65%	67%	65%	66%	62%	63%	65%
Dibenz[a,h]anthracene	5	50%	55%	57%	58%	60%	59%	58%	53%	55%	57%
Benzo[g,h,i]perylene	5	51%	57%	58%	61%	62%	62%	60%	56%	57%	59%

Areas:

Naphthalene	1425463
Acenaphthene	2126660
Fluoranthene	1916494

Calibration Factors :

Naphthalene	285093
Acenaphthene	425332
Fluoranthene	383299

Naphthalene	5	81%	79%	74%	85%	84%	85%	85%	75%	88%	92%
Acenaphthene	5	87%	82%	80%	94%	92%	95%	93%	78%	95%	94%
Fluoranthene	5	94%	91%	95%	98%	100%	99%	102%	89%	104%	101%

6/9/98

Method Detec _limit Study
META Environmental, Inc.

Method: MET8525
Project: MC980630

Column: Rtx-5MS

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4				
Sequence ID	980706	980706	980706	980706	980706	980706	980706	980706	980706	980706				
File ID	06JUL010.D	06JUL011.D	06JUL012.D	06JUL013.D	06JUL014.D	06JUL015.D	06JUL016.D	06JUL016.D	06JUL018.D	06JUL019.D				
Lab ID	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-1	Standard	Replicates	t-value	MDL
Field ID	525REP-1	525REP-2	525REP-3	525REP-4	525REP-5	525REP-6	525REP-7	525REP-8	525REP-9	525REP-10	Deviation			
Sample Size (g or mL)	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0				
Final Volume (ml)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
Matrix	W	W	W	W	W	W	W	W	W	W				
%Solids (decimal format)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
			Blown to Dryness											
Naphthalene	0.9294	1.0197		1.0045	1.0347	1.0339	1.0040	1.0040	1.0557	1.0818	0.043	9.000	2.896	0.123
Acenapthylene	1.1437	1.1931		1.1508	1.1989	1.1099	1.1603	1.1603	1.1927	1.1984	0.031	9.000	2.896	0.089
Acenapthene	1.1992	1.2252		1.1728	1.2100	1.1938	1.1691	1.1691	1.2380	1.2523	0.031	9.000	2.896	0.089
Fluorene	1.1249	1.1360		1.1007	1.1782	1.0632	1.1521	1.1521	1.0995	1.1012	0.035	9.000	2.896	0.102
Phenanthrene	1.1435	1.1407		1.1278	1.1545	1.0884	1.1386	1.1386	1.1082	1.0990	0.023	9.000	2.896	0.066
Anthracene	0.8803	0.8960		0.8925	0.8897	0.8238	0.8683	0.8683	0.9355	0.9669	0.041	9.000	2.896	0.119
Fluoranthene	1.2058	1.2285		1.1385	1.2043	1.1955	1.1471	1.1471	1.2125	1.1894	0.032	9.000	2.896	0.094
Pyrene	1.1973	1.2130		1.1314	1.1708	1.2056	1.0741	1.0741	1.1828	1.1795	0.053	9.000	2.896	0.155
Benz(a)anthracene	1.0852	1.0454		1.1113	1.0620	1.0151	1.0438	1.0438	1.1303	1.1236	0.041	9.000	2.896	0.118
Chrysene	1.0843	1.0592		1.0975	1.0834	1.0406	1.0911	1.0911	1.1008	1.1122	0.022	9.000	2.896	0.064
Benzo(b)fluoranthene	0.9579	0.9195		0.9695	0.8997	0.9230	0.9415	0.9415	0.9648	0.9646	0.024	9.000	2.896	0.070
Benzo(k)fluoranthene	1.3515	1.2812		1.3688	1.3039	1.2905	1.2749	1.2749	1.3708	1.3221	0.039	9.000	2.896	0.113
Benzo(a)pyrene	0.9768	0.9105		1.0557	0.9536	0.9788	1.0042	1.0042	1.0692	1.0520	0.052	9.000	2.896	0.151
Indeno(1,2,3-cd)pyrene	1.1334	1.0981		1.1631	1.0732	1.1168	0.9824	0.9824	1.0913	1.0851	0.060	9.000	2.896	0.175
Dibenz(a,h)anthracene	1.0595	1.0339		1.0771	1.0093	1.0386	1.0326	1.0326	1.0070	0.9822	0.028	9.000	2.896	0.082
Benzo(g,h,i)perylene	1.0993	1.0741		1.1089	1.0534	1.0936	1.0514	1.0514	1.0550	1.0168	0.029	9.000	2.896	0.085
1,3-Dimethyl-2-nitrobenzene	96%	86%		100%	100%	97%	97%	97%	118%	115%				
Pyrene-d10	110%	112%		103%	109%	115%	102%	102%	111%	108%				
Triphenylphosphate	111%	106%		110%	110%	101%	109%	109%	115%	115%				
Perylene-d12	94%	88%		97%	90%	92%	90%	90%	91%	87%				

Method Detection Limit Study
META Environmental, Inc.
Percent Recoveries

Method: MET8525
Project: MC980630

Column: Rtx-5MS

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4		
Sequence ID	980706	980706	980706	980706	980706	980706	980706	980706	980706	980706	980706		
File ID	06JUL010.D	06JUL010.D	06JUL011.D	06JUL012.D	06JUL013.D	06JUL014.D	06JUL015.D	06JUL016.D	06JUL016.D	06JUL018.D	06JUL019.D		
Lab ID	MC980630-R	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-0	MC980630-1	Average	Percent
Field ID	MC980630-R	525REP-1	525REP-2	525REP-3	525REP-4	525REP-5	525REP-6	525REP-7	525REP-8	525REP-9	525REP-10		RSD
Sample Size (g or mL)	1000.000	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0		
Final Volume (ml)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Matrix	W	W	W	W	W	W	W	W	W	W	W		
%Solids (decimal format)	1.000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
Naphthalene	1.0373	90%	98%		97%	100%	100%	97%	97%	102%	104%	98%	4%
Acenaphthylene	1.1542	99%	103%		100%	104%	98%	101%	101%	103%	104%	101%	3%
Acenapthene	1.2385	97%	99%		95%	98%	98%	94%	94%	100%	101%	97%	3%
Fluorene	1.0189	110%	111%		108%	116%	104%	113%	113%	108%	108%	110%	3%
Phenanthrene	1.0261	111%	111%		110%	113%	108%	111%	111%	108%	107%	110%	2%
Anthracene	0.9012	98%	99%		99%	99%	91%	98%	98%	104%	107%	99%	5%
Fluoranthene	0.9368	129%	131%		122%	129%	128%	122%	122%	129%	127%	127%	3%
Pyrene	0.9824	122%	123%		115%	119%	123%	109%	109%	120%	120%	118%	5%
Benz(a)anthracene	0.8736	124%	120%		127%	122%	118%	119%	119%	129%	129%	123%	4%
Chrysene	0.9934	109%	107%		110%	109%	105%	110%	110%	111%	112%	109%	2%
Benzo(b)fluoranthene	0.7209	133%	128%		134%	125%	128%	131%	131%	134%	134%	131%	3%
Benzo(k)fluoranthene	1.0469	129%	122%		130%	124%	123%	122%	122%	131%	128%	125%	3%
Benzo(a)pyrene	0.7587	129%	120%		139%	128%	129%	132%	132%	141%	139%	132%	5%
Indeno(1,2,3-cd)pyrene	0.6616	171%	168%		174%	162%	169%	148%	148%	165%	164%	163%	6%
Dibenz(a,h)anthracene	0.5786	183%	179%		186%	174%	180%	178%	178%	174%	170%	178%	3%
Benzo(g,h,i)perylene	0.7384	149%	145%		150%	143%	148%	142%	142%	143%	138%	145%	3%
1,3-Dimethyl-2-nitrobenzene	120%	80%	72%		84%	84%	81%	81%	81%	97%	96%	84%	10%
Pyrene-d10	99%	110%	113%		104%	109%	115%	102%	102%	112%	109%	109%	4%
Triphenylphosphate	94%	118%	112%		117%	117%	107%	115%	115%	122%	122%	116%	4%
Perylene-d12	91%	103%	97%		106%	99%	102%	99%	99%	100%	96%	100%	3%

INITIAL DEMONSTRATION CAPABILITY
META Environmental, Inc.

Method USEPA 608
Empore SPE Disk Extraction

Analyte	Sample 1 (ug/L)	Sample 2 (ug/L)	Sample 3 (ug/L)	Sample 4 (ug/L)	Average Conc (ug/L)	True Value (ug/L)	Average % Rec
TCMX	0.063	0.063	0.065	0.065	0.0640	0.075	85%
a-BHC	0.060	0.057	0.066	0.064	0.0619	0.075	83%
g-BHC	0.061	0.060	0.067	0.065	0.0630	0.075	84%
b-BHC	0.061	0.060	0.067	0.064	0.0628	0.075	84%
Heptachlor	0.063	0.061	0.066	0.065	0.0639	0.075	85%
d-BHC	0.060	0.057	0.065	0.063	0.0613	0.075	82%
Aldrin	0.057	0.056	0.060	0.058	0.0577	0.075	77%
Heptachlor Epoxide	0.062	0.061	0.067	0.065	0.0638	0.075	85%
g-Chlordane	0.064	0.061	0.069	0.066	0.0651	0.075	87%
a-Chlordane	0.061	0.059	0.065	0.062	0.0630	0.075	84%
Endosulfan I	0.065	0.063	0.068	0.065	0.0659	0.075	88%
4,4'-DDE	0.122	0.118	0.131	0.126	0.1242	0.15	83%
Dieldrin	0.127	0.121	0.135	0.129	0.1278	0.15	85%
Endrin	0.125	0.122	0.136	0.131	0.1285	0.15	86%
4,4-DDD	0.125	0.120	0.134	0.128	0.1267	0.15	84%
Endosulfan II	0.127	0.123	0.136	0.130	0.1289	0.15	86%
4,4'-DDT	0.115	0.113	0.123	0.116	0.1169	0.15	78%
Endrin Aldehyde	0.118	0.110	0.096	0.092	0.1040	0.15	69%
Endosulfan Sulfate	0.133	0.127	0.140	0.135	0.1338	0.15	89%
Methoxychlor	0.666	0.620	0.662	0.638	0.6465	0.75	86%
Endrin Ketone	0.134	0.123	0.134	0.127	0.1297	0.15	86%
DCB	0.133	0.127	0.135	0.131	0.1316	0.15	88%

All values from DB-608 except a-Chlordane and Endosulfan I which were from RTX-1701 column

METHOD DETECTION . " RESULTS

META Environmental, Inc.

Method USEPA 608

Empore SPE Disk Extraction

Compound	Sample 1 (ug/L)	Sample 2 (ug/L)	Sample 3 (ug/L)	Sample 4 (ug/L)	Sample 5 (ug/L)	Sample 6 (ug/L)	Sample 7 (ug/L)	Sample 8 (ug/L)	Average Conc (ug/L)	True Value (ug/L)	Sigma	MDL (ug/L)
TCMX	0.0070	0.0076	0.0105	0.0091	0.0098	0.0095	0.0081	0.0061	0.0084	0.0100	0.00151	0.0045
a-BHC	0.0031	0.0031	0.0033	0.0038	0.0037	0.0029	0.0026	0.0033	0.0032	0.0050	0.00039	0.0012
g-BHC	0.0036	0.0039	0.0086	0.0037	0.0102	0.0033	0.0030	0.0035	0.0050	0.0050	0.00276	0.0082
Aldrin	0.0051	0.0058	0.0057	0.0048	0.0054	0.0041	0.0041	0.0043	0.0049	0.0050	0.00069	0.0021
Heptachlor	0.0054	0.0060	0.0061	0.0050	0.0053	0.0042	0.0040	0.0044	0.0050	0.0050	0.00079	0.0024
b-BHC	0.0048	0.0053	0.0113	0.0055	0.0105	0.0048	0.0047	0.0050	0.0065	0.0050	0.00274	0.0082
d-BHC	0.0043	0.0049	0.0043	0.0038	0.0038	0.0032	0.0033	0.0034	0.0039	0.0050	0.00059	0.0018
Heptachlor Epoxide	0.0043	0.0051	0.0044	0.0040	0.0043	0.0036	0.0041	0.0036	0.0042	0.0050	0.00050	0.0015
g-Chlordane	0.0039	0.0042	0.0034	0.0035	0.0038	0.0031	0.0036	0.0035	0.0036	0.0050	0.00034	0.0010
a-Chlordane	0.0035	0.0036	0.0030	0.0031	0.0031	0.0029	0.0030	0.0032	0.0032	0.0050	0.00024	0.0007
Endosulfan I	0.0037	0.0037	0.0039	0.0035	0.0040	0.0034	0.0030	0.0034	0.0036	0.0050	0.00031	0.0009
4,4'-DDE	0.0073	0.0088	0.0066	0.0071	0.0071	0.0063	0.0072	0.0067	0.0072	0.0100	0.00074	0.0022
Dieldrin	0.0087	0.0090	0.0086	0.0103	0.0087	0.0066	0.0071	0.0075	0.0083	0.0100	0.00119	0.0036
Endrin	0.0073	0.0074	0.0064	0.0071	0.0071	0.0068	0.0073	0.0072	0.0071	0.0100	0.00032	0.0010
4,4-DDD	0.0071	0.0071	0.0059	0.0068	0.0066	0.0060	0.0066	0.0070	0.0066	0.0100	0.00047	0.0014
Endosulfan II	0.0070	0.0073	0.0063	0.0070	0.0071	0.0064	0.0071	0.0073	0.0069	0.0100	0.00040	0.0012
4,4'-DDT	0.0077	0.0079	0.0066	0.0076	0.0073	0.0075	0.0073	0.0085	0.0076	0.0100	0.00054	0.0016
Endrin Aldehyde	0.0075	0.0081	0.0070	0.0078	0.0077	0.0080	0.0080	0.0086	0.0078	0.0100	0.00048	0.0014
Endosulfan Sulfate	0.0119	0.0111	0.0138	0.0113	0.0135	0.0129	0.0090	0.0095	0.0116	0.0100	0.00175	0.0053
Methoxychlor	0.0226	0.0225	0.0215	0.0235	0.0244	0.0223	0.0210	0.0223	0.0225	0.0250	0.00105	0.0032
Endrin Ketone	0.0078	0.0107	0.0078	0.0076	0.0083	0.0077	0.0068	0.0067	0.0079	0.0100	0.00125	0.0037
DCB	0.0162	0.0139	0.0132	0.0152	0.0159	0.0148	0.0148	0.0155	0.0150	0.0200	0.00100	0.0030

All values from DB-608 except a-Chlordane and Endosulfan I which were from RTX-1701

METHOD DETECTION LIMIT STUDY
META Environmental, Inc

Method:	EPA608						
Project	MC970604	Average	True	Average			
Column:	DB 608	Conc	Conc	Percent		Percent	MDL
Analyte		(ug/L)	(ug/L)	Recovery	Sigma	RSD	(ug/L)
TCMX		0.1502	0.2500	60%	0.0255	16.9%	0.0718
a-BHC		0.0034	0.0050	67%	0.0005	15.3%	0.0014
g-BHC		0.0035	0.0050	69%	0.0004	11.4%	0.0011
b-BHC		0.0054	0.0050	108%	0.0005	9.8%	0.0015
Heptachlor		0.0044	0.0050	87%	0.0006	13.2%	0.0016
d-BHC		0.0053	0.0050	105%	0.0007	12.7%	0.0019
Aldrin		0.0051	0.0050	102%	0.0005	9.9%	0.0015
Heptachlor Epoxide		0.0058	0.0050	117%	0.0010	16.6%	0.0027
g-Chlordane		0.0061	0.0050	121%	0.0011	18.9%	0.0032
a-Chlordane		0.0056	0.0050	113%	0.0005	8.4%	0.0013
Endosulfan I		0.0046	0.0050	92%	0.0005	10.0%	0.0013
4,4'-DDE		0.0105	0.0100	105%	0.0009	8.5%	0.0025
Dieldrin		0.0089	0.0100	89%	0.0008	9.2%	0.0023
Endrin		0.0103	0.0100	103%	0.0011	10.9%	0.0031
4,4-DDD		0.0085	0.0100	85%	0.0007	7.7%	0.0019
Endosulfan II		0.0114	0.0100	114%	0.0009	8.0%	0.0026
4,4'-DDT		0.0090	0.0100	90%	0.0018	20.1%	0.0051
Endrin Aldehyde		0.0124	0.0100	124%	0.0014	11.7%	0.0041
Endosulfan Sulfate		0.0190	0.0100	190%	0.0016	8.2%	0.0044
Methoxychlor		0.0494	0.0500	99%	0.0057	11.6%	0.0161
Endrin Ketone		0.0112	0.0100	112%	0.0015	13.0%	0.0041
DCB		0.1974	0.3000	66%	0.0134	6.8%	0.0379

Method:	EPA608						
Project:	MC970604	Average	True	Average			
Column:	Rtx-1701	Conc	Conc	Percent		Percent	MDL
Analyte		(ug/L)	(ug/L)	Recovery	Sigma	RSD	(ug/L)
TCMX		0.1412	0.2500	56%	0.0231	16.4%	0.0653
a-BHC		0.0033	0.0050	66%	0.0006	18.1%	0.0017
g-BHC		0.0035	0.0050	69%	0.0004	12.6%	0.0012
Heptachlor		0.0040	0.0050	81%	0.0006	14.3%	0.0016
Aldrin		0.0044	0.0050	88%	0.0007	15.6%	0.0019
b-BHC		0.0072	0.0050	145%	0.0013	17.6%	0.0036
d-BHC		0.0052	0.0050	104%	0.0010	18.7%	0.0027
Heptachlor Epoxide		0.0061	0.0050	122%	0.0010	16.8%	0.0029
Endosulfan I		0.0045	0.0050	91%	0.0006	13.3%	0.0017
g-Chlordane		0.0056	0.0050	112%	0.0006	10.1%	0.0016
a-Chlordane		0.0056	0.0050	112%	0.0007	12.1%	0.0019
4,4'-DDE		0.0101	0.0100	101%	0.0013	12.9%	0.0037
Dieldrin		0.0083	0.0100	83%	0.0008	9.3%	0.0022
Endrin		0.0103	0.0100	103%	0.0021	20.8%	0.0060
Endosulfan II				Coelution with 4,4-DDD			
4,4-DDD							
4,4'-DDT		0.0088	0.0100	88%	0.0024	26.8%	0.0066
Endrin Aldehyde		0.0109	0.0100	109%	0.0030	27.6%	0.0085
Endosulfan Sulfate		0.0115	0.0100	115%	0.0018	15.2%	0.0049
Methoxychlor		0.0629	0.0500	126%	0.0092	14.7%	0.0261
Endrin Ketone		0.0114	0.0100	114%	0.0011	9.3%	0.0030
DCB		0.1840	0.3000	61%	0.0124	6.7%	0.0350

Method Detectk . Study
META Environmental, Inc.

Method:	EPA608												
Project:	MC970604	0604-RS1	0604-AB	0604-01	0604-02	0604-03	0604-04	0604-05	0604-06	0604-07	0604-08	0604-09	0604-10
Column:	DB 608	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
TCMX	8.130	0.3922	0.1035	0.1337	0.1089	0.1486	0.1891	0.1337	0.1443	0.1821	0.1512	0.1771	0.1333
a-BHC	9.734	0.0075	0.0000	0.0032	0.0024	0.0032	0.0038	0.0031	0.0029	0.0038	0.0033	0.0039	0.0041
g-BHC	10.582	0.0078	0.0000	0.0034	0.0027	0.0034	0.0039	0.0035	0.0030	0.0040	0.0035	0.0039	0.0033
b-BHC	10.723	0.0109	0.0019	0.0053	0.0044	0.0054	0.0056	0.0056	0.0046	0.0062	0.0054	0.0057	0.0056
Heptachlor	11.262	0.0092	0.0002	0.0042	0.0033	0.0039	0.0048	0.0043	0.0040	0.0053	0.0044	0.0050	0.0044
d-BHC	11.484	0.0089	0.0000	0.0053	0.0040	0.0051	0.0050	0.0053	0.0046	0.0059	0.0052	0.0061	0.0061
Aldrin	11.938	0.0115	0.0027	0.0049	0.0044	0.0047	0.0058	0.0052	0.0046	0.0058	0.0052	0.0054	Int
Heptachlor Epoxide	13.127	0.0118	0.0000	0.0055	0.0047	0.0054	0.0061	0.0057	0.0048	0.0064	0.0058	0.0059	0.0082
g-Chlordane	13.509	0.0118	0.0002	0.0057	0.0049	0.0057	0.0061	0.0060	0.0049	0.0064	0.0061	0.0058	0.0090
a-Chlordane	13.914	0.0119	0.0000	0.0055	0.0049	0.0056	0.0059	0.0058	0.0048	0.0062	0.0059	0.0057	0.0061
Endosulfan I	14.000	0.0095	0.0000	0.0045	0.0039	0.0044	0.0048	0.0047	0.0039	0.0050	0.0047	0.0047	0.0053
4,4'-DDE	14.580	0.0223	0.0000	0.0104	0.0091	0.0105	0.0109	0.0109	0.0089	0.0115	0.0110	0.0105	0.0115
Dieldrin	14.652	0.0180	0.0000	0.0090	0.0078	0.0087	0.0094	0.0092	0.0074	0.0099	0.0094	0.0092	0.0095
Endrin	16.038	0.0199	0.0000	0.0106	0.0083	0.0100	0.0112	0.0104	0.0085	0.0118	0.0107	0.0109	0.0101
4,4-DDD	16.437	0.0179	0.0000	0.0085	0.0077	0.0087	0.0089	0.0090	0.0073	0.0094	0.0090	0.0086	0.0081
Endosulfan II	16.712	0.0237	0.0000	0.0114	0.0101	0.0117	0.0120	0.0121	0.0098	0.0128	0.0121	0.0115	0.0108
4,4'-DDT	17.684	0.0178	0.0000	0.0083	0.0071	0.0085	0.0086	0.0087	0.0077	0.0107	0.0087	0.0083	0.0134
Endrin Aldehyde	18.075	0.0215	0.0000	0.0116	0.0107	0.0123	0.0126	0.0132	0.0102	0.0138	0.0126	0.0116	0.0150
Endosulfan Sulfate	18.593	0.0243	0.0060	0.0205	0.0187	0.0186	0.0197	0.0190	0.0170	0.0203	0.0200	0.0201	0.0189
Methoxychlor	21.507	0.0968	0.0003	0.0488	0.0398	0.0488	0.0550	0.0499	0.0395	0.0557	0.0515	0.0504	0.0546
Endrin Ketone	21.808	0.0219	0.0000	0.0106	0.0095	0.0112	0.0117	0.0115	0.0091	0.0120	0.0114	0.0108	0.0144
DCB	28.082	0.3923	0.1598	0.2013	0.1774	0.2063	0.2022	0.2055	0.1720	0.2126	0.2088	0.1967	0.1913

Method:	EPA608												
Project:	MC970604	0604-RS1	0604-AB	0604-01	0604-02	0604-03	0604-04	0604-05	0604-06	0604-07	0604-08	0604-09	0604-10
Column:	Rtx-1701	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
TCMX	5.778	0.3462	0.1013	0.1260	0.1057	0.1392	0.1780	0.1278	0.1384	0.1703	0.1407	0.1652	0.1227
a-BHC	7.674	0.0074	0.0000	0.0030	0.0024	0.0031	0.0036	0.0031	0.0028	0.0037	0.0032	0.0036	0.0046
g-BHC	8.459	0.0060	0.0000	0.0033	0.0027	0.0035	0.0040	0.0035	0.0028	0.0039	0.0035	0.0039	0.0036
Heptachlor	8.779	0.0092	0.0006	0.0036	0.0032	0.0037	0.0044	0.0039	0.0035	0.0045	0.0040	0.0042	0.0052
Aldrin	9.248	0.0107	0.0004	0.0039	0.0036	0.0039	0.0048	0.0044	0.0038	0.0049	0.0043	0.0045	0.0059
b-BHC	10.006	0.0121	0.0050	0.0070	0.0067	0.0065	0.0075	0.0071	0.0058	0.0069	0.0069	0.0075	0.0106
d-BHC	10.355	0.0092	0.0002	0.0050	0.0043	0.0047	0.0053	0.0049	0.0041	0.0056	0.0049	0.0054	0.0076
Heptachlor Epoxide	10.548	0.0119	0.0001	0.0058	0.0050	0.0058	0.0060	0.0059	0.0051	0.0065	0.0059	0.0065	0.0086
Endosulfan I	10.999	0.0095	0.0000	0.0042	0.0039	0.0042	0.0046	0.0044	0.0037	0.0055	0.0045	0.0055	0.0047
g-Chlordane	11.144	0.0118	0.0000	0.0053	0.0048	0.0054	0.0057	0.0057	0.0047	0.0063	0.0057	0.0060	0.0064
a-Chlordane	11.254	0.0118	0.0000	0.0053	0.0047	0.0054	0.0056	0.0056	0.0047	0.0065	0.0056	0.0060	0.0068
4,4'-DDE	11.447	0.0216	0.0001	0.0097	0.0083	0.0098	0.0101	0.0100	0.0084	0.0116	0.0102	0.0108	0.0126
Dieldrin	11.633	0.0188	0.0000	0.0080	0.0069	0.0084	0.0083	0.0084	0.0074	0.0097	0.0086	0.0089	0.0088
Endrin	11.985	0.0196	0.0000	0.0095	0.0078	0.0093	0.0103	0.0098	0.0082	0.0119	0.0099	0.0111	0.0152
Endosulfan II	12.913						Coelution with 4,4-DDD						
4,4-DDD	12.917												
4,4'-DDT	13.179	0.0168	0.0000	0.0083	0.0066	0.0081	0.0082	0.0085	0.0067	0.0093	0.0085	0.0086	0.0151
Endrin Aldehyde	13.846	0.0208	0.0008	0.0112	0.0104	0.0130	0.0112	0.0119	0.0104	0.0126	0.0131	0.0121	0.0028
Endosulfan Sulfate	14.666	0.0239	0.0006	0.0124	0.0106	0.0124	0.0123	0.0128	0.0104	0.0127	0.0124	0.0121	0.0071
Methoxychlor	14.737	0.1025	0.0092	0.0658	0.0493	0.0629	0.0613	0.0626	0.0530	0.0636	0.0617	0.0641	0.0846
Endrin Ketone	15.687	0.0249	0.0020	0.0108	0.0104	0.0119	0.0127	0.0118	0.0094	0.0130	0.0117	0.0117	0.0111
DCB	19.040	0.3526	0.1511	0.1881	0.1669	0.1924	0.1893	0.1920	0.1626	0.1976	0.1950	0.1836	0.1719

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Method:	EPA608																
Project:	MC980623	0623-RS1	0623-RS2	0623-01	0623-02	0623-03	0623-04	0623-05	0623-06	0623-07	0623-08	0623-09	0623-10	Average	Sigma	t-Value	MDL
Column:	RTX-5	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Conc
Analyte	RT	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)		(ng/L)
cridiazole	10.410	9.7000	8.9600	13.8000	15.0400	15.2700	13.9700	13.5700	15.1500	23.1300	12.8000	15.4800	13.9700	15.218	2.913	2.821	8.219
chlorneb	11.140	6.4100	6.3000	6.6200	9.4400	13.7900	7.9800	11.4100	6.9000	17.3200	16.5900	18.5000	9.0800	11.983	4.250	2.821	11.988
propachlor	12.760	11.4300	12.3000	20.6300	17.0400	26.0600	53.3700	21.3000	22.6600	13.3900	15.9300	15.6300	69.1400	27.535	18.544	2.821	52.312
TCMX	12.990	17.7000	17.2000	15.9000	17.5000	18.5000	15.9000	19.7000	17.8000	22.7000	20.9000	19.7000	17.8000	18.640	2.150	2.821	6.054
trifluralin	13.620	9.6200	8.7700	12.6800	14.6500	13.2900	12.3400	16.6700	13.4000	15.6500	13.6500	19.5500	13.4300	14.531	2.213	2.821	6.242
a-BHC	14.300	7.9700	7.5000	8.6800	6.7200	7.3500	8.3200	7.9200	9.1800	8.2600	8.8600	9.2500	8.9800	8.350	0.822	2.821	2.319
hexachlorobenzene	14.560	10.9700	10.2100	9.7500	11.5300	10.1800	8.9100	8.7900	9.6200	11.1100	10.4100	9.6800	9.5000	9.948	0.879	2.821	2.480
b-BHC	15.200	9.9600	10.3600	7.0000	11.2000	13.6900	11.4100	14.4000	12.3800	13.8000	12.5700	12.3500	10.3100	11.909	2.139	2.821	6.035
g-BHC	15.390	6.5700	7.7900	8.6500	8.9500	7.2800	6.4700	7.7000	7.5200	10.7800	9.2000	7.5700	7.1900	8.131	1.262	2.821	3.561
d-BHC	16.200	7.8100	8.3300	8.6100	10.8200	9.8100	10.8300	9.8600	8.6300	12.6400	11.1500	11.0200	10.7900	10.416	1.223	2.821	3.449
chlorothalonil	16.370	8.2100	9.4200	6.9900	7.1900	8.1400	9.8000	6.9900	6.5200	7.7900	7.5300	7.0200	6.7200	7.469	0.954	2.821	2.691
Heptachlor	17.760	9.2900	10.2900	6.8700	8.2100	6.4700	12.5200	10.3700	8.7300	8.7900	7.4100	7.0000	7.1200	8.349	1.879	2.821	5.300
Aldrin	18.960	7.9900	8.9600	10.3500	10.2600	9.6900	8.5600	11.3600	8.2700	9.6300	9.4800	8.7100	8.2500	9.456	1.021	2.821	2.879
Chloropyrifos	19.150	10.0500	11.9900	11.1200	10.6700	11.2500	11.2600	13.2400	11.8800	14.6600	11.6200	13.8100	14.6200	12.413	1.522	2.821	4.295
DCPA	19.340	7.5900	8.1400	8.5600	7.0100	9.0900	7.1200	8.0500	8.2800	9.3100	8.5100	8.0100	8.5200	8.246	0.744	2.821	2.098
Heptachlor Epoxide	20.360	8.7100	10.0800	7.8800	8.4800	8.4900	7.4800	7.2600	7.2700	8.9100	8.6800	7.9100	10.4300	8.279	0.958	2.821	2.703
g-Chlordane	21.180	9.1200	10.2800	8.2200	8.7900	9.4600	8.6300	9.8300	8.7300	10.5600	10.0400	10.6100	10.2600	9.493	0.885	2.821	2.440
Endosulfan I	21.620	9.6500	9.4600	7.0500	10.7000	10.7300	11.6500	5.4600	5.8600	5.6300	6.2000	5.2800	5.2800	7.384	2.579	2.821	7.275
a-Chlordane	21.710	8.3500	8.9100	7.5600	7.3400	7.3400	7.9800	7.5000	7.9900	8.6100	8.2000	8.3300	8.3700	7.922	0.461	2.821	1.300
p,p-DDE	22.430	9.2100	9.1600	10.2600	9.6800	10.3200	8.9300	8.7700	11.4400	10.7700	11.8000	12.3100	11.3100	10.559	1.191	2.821	3.360
Dieldrin	22.530	7.3600	8.1500	7.5500	8.8800	7.6400	7.0400	6.7500	7.5800	8.4000	8.6800	7.4200	7.0200	7.496	0.635	2.821	1.791
Endrin	23.300	10.7700	10.8900	16.7900	13.6800	13.3400	12.2500	11.8700	12.9400	13.9000	12.1600	11.8000	12.0500	12.978	1.250	2.821	3.526
Endosulfan II	23.640	9.2600	9.0200	5.0600	3.7900	6.0500	5.0100	3.3700	2.8600	4.5500	2.8900	4.2300	1.9500	3.976	1.241	2.821	3.502
chlorobenzilate	23.550	12.2100	11.9900	10.2200	12.1600	9.9800	13.2000	11.7800	11.1600	13.4500	16.5900	17.1000	18.5800	13.422	3.013	2.821	8.501
p,p-DDD	23.900	7.3400	8.5900	7.4300	6.8200	8.0600	6.9600	6.9300	7.4200	7.7900	7.8000	7.2900	9.5100	7.601	0.786	2.821	2.217
Endrin Aldehyde	24.290	8.1400	0.7550	7.1600	6.8400	6.6200	6.8400	5.8600	7.1500	8.4200	7.2200	6.0900	6.8000	6.900	0.697	2.821	1.967
Endosulfan Sulphate	25.110	9.9100	11.0700	12.5700	13.3100	13.4900	13.4400	11.7500	11.0400	14.4800	11.7300	12.4600	12.5600	12.683	1.022	2.821	2.883
p,p-DDT	25.170	7.4100	6.9900	8.6300	7.6500	8.7100	7.8200	8.8400	8.4200	9.8800	8.1500	8.7700	8.4400	8.531	0.620	2.821	1.750
Methoxychlor	27.170	11.0200	9.8300	14.7400	24.6000	16.6000	20.6900	14.9000	17.0600	20.8800	18.6300	17.6700	18.6300	18.460	2.990	2.821	8.434
cis-permethrin	30.220	11.9300	12.2900	7.6600	8.0100	8.2500	10.2800	8.2200	10.6500	11.3200	10.2100	13.0200	8.1900	9.581	1.782	2.821	5.028
trans-permethrin	30.460	5.4900	4.6600	8.5100	8.0400	7.4900	8.6500	6.9500	18.8000	12.6500	12.9700	8.5000	8.3300	10.089	3.678	2.821	10.375
DCB	33.300	23.9000	25.8000	24.8000	24.8000	26.5000	22.9000	21.1000	27.3000	26.2000	23.6000	23.7000	24.4000	24.530	1.840	2.821	5.192

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Method:	EPA608														
Project:	MC980623	0623-RS1	0623-RS2	0623-01	0623-02	0623-03	0623-04	0623-05	0623-06	0623-07	0623-08	0623-09	0623-10	Average	Sigma
Column:	RTX-5	Conc		Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ng/L)		(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)
etridiazole	10.410	100%		154%	168%	170%	156%	151%	169%	258%	143%	173%	156%	170%	33%
chlorneb	11.140	100%		140%	150%	219%	127%	181%	110%	275%	263%	294%	144%	190%	67%
propachlor	12.760	100%		169%	139%	212%	434%	173%	184%	109%	130%	127%	562%	224%	151%
TCMX	12.990	100%		92%	102%	108%	92%	115%	103%	132%	122%	115%	103%	108%	12%
trifluralin	13.620	100%		145%	167%	152%	141%	190%	153%	178%	156%	223%	153%	166%	25%
a-BHC	14.300	100%		116%	90%	98%	111%	106%	122%	110%	118%	123%	120%	111%	11%
hexachlorobenzene	14.560	100%		95%	113%	100%	87%	86%	94%	109%	102%	95%	93%	97%	9%
b-BHC	15.200	100%		68%	108%	132%	110%	139%	119%	133%	121%	119%	100%	115%	21%
g-BHC	15.390	100%		111%	115%	93%	83%	99%	97%	138%	118%	97%	92%	104%	16%
d-BHC	16.200	100%		103%	130%	118%	130%	118%	104%	152%	134%	132%	130%	125%	15%
chlorothalonil	16.370	100%		74%	76%	86%	104%	74%	69%	83%	80%	75%	71%	79%	10%
Heptachlor	17.760	100%		67%	80%	63%	122%	101%	85%	85%	72%	68%	69%	81%	18%
Aldrin	18.960	100%		116%	115%	108%	96%	127%	92%	107%	106%	97%	92%	106%	11%
Chloropyrifos	19.150	100%		93%	89%	94%	94%	110%	99%	122%	97%	115%	122%	104%	13%
DCPA	19.340	100%		105%	86%	112%	87%	99%	102%	114%	105%	98%	105%	101%	9%
Heptachlor Epoxide	20.360	100%		78%	84%	84%	74%	72%	72%	89%	86%	79%	104%	82%	10%
g-Chlordane	21.180	100%		80%	86%	92%	84%	94%	85%	103%	98%	103%	100%	93%	8%
Endosulfan I	21.620	100%		75%	113%	113%	123%	58%	62%	60%	66%	56%	56%	78%	27%
a-Chlordane	21.710	100%		85%	82%	82%	90%	84%	90%	97%	92%	93%	94%	89%	5%
p,p-DDE	22.430	100%		112%	106%	113%	97%	96%	125%	118%	129%	134%	123%	115%	13%
Dieldrin	22.530	100%		93%	84%	94%	86%	83%	93%	103%	107%	91%	86%	92%	8%
Endrin	23.300	100%		145%	126%	122%	112%	109%	119%	128%	112%	108%	111%	119%	11%
Endosulfan II	23.640	100%		56%	42%	67%	56%	37%	32%	50%	32%	47%	22%	44%	14%
chlorobenzilate	23.550	100%		85%	101%	83%	110%	98%	93%	112%	138%	143%	155%	112%	25%
p,p-DDD	23.900	100%		86%	79%	94%	81%	81%	86%	91%	91%	85%	111%	88%	9%
Endrin Aldehyde	24.290	100%		948%	906%	877%	906%	776%	947%	1115%	956%	807%	901%	914%	92%
Endosulfan Sulphate	25.110	100%		114%	120%	122%	121%	106%	100%	131%	106%	113%	113%	115%	9%
p,p-DDT	25.170	100%		123%	109%	125%	112%	126%	120%	141%	117%	125%	121%	122%	9%
Methoxychlor	27.170	100%		150%	250%	171%	210%	152%	174%	212%	190%	180%	190%	188%	30%
cis-permethrin	30.220	100%		62%	65%	67%	84%	67%	87%	92%	83%	106%	67%	78%	15%
trans-permethrin	30.460	100%		183%	173%	161%	186%	149%	403%	271%	278%	182%	179%	217%	79%
DCB	33.300	100%		96%	96%	103%	89%	82%	106%	102%	91%	92%	95%	95%	7%

METHOD DETECTION LIMIT STUDY
META Environmental, Inc

Method:	EPA508						
Project:	MC970604	Average	True	Average			
Column	DB 608	Conc	Conc	Percent		Percent	MDL
Analyte		(ug/L)	(ug/L)	Recovery	Sigma	RSD	(ug/L)
TCMX		0.1686	0.2500	67%	0.0232	13.7%	0.0653
a-BHC		0.0035	0.0050	71%	0.0005	13.7%	0.0014
g-BHC		0.0035	0.0050	70%	0.0004	12.0%	0.0012
b-BHC		0.0048	0.0050	97%	0.0005	10.5%	0.0014
Heptachlor		0.0046	0.0050	92%	0.0005	11.7%	0.0015
d-BHC		0.0055	0.0050	109%	0.0009	17.0%	0.0026
Aldrin		0.0057	0.0050	114%	0.0013	23.0%	0.0037
Heptachlor Epoxide		0.0059	0.0050	117%	0.0007	11.9%	0.0020
g-Chlordane		0.0059	0.0050	118%	0.0008	14.0%	0.0023
a-Chlordane		0.0056	0.0050	113%	0.0007	11.9%	0.0019
Endosulfan I		0.0044	0.0050	88%	0.0005	10.8%	0.0013
4,4'-DDE		0.0101	0.0100	101%	0.0010	10.4%	0.0030
Dieldrin		0.0086	0.0100	86%	0.0008	9.9%	0.0024
Endrin		0.0105	0.0100	105%	0.0011	10.6%	0.0031
4,4-DDD		0.0085	0.0100	85%	0.0009	10.7%	0.0026
Endosulfan II		0.0111	0.0100	111%	0.0012	10.5%	0.0033
4,4'-DDT		0.0075	0.0100	75%	0.0010	13.2%	0.0028
Endrin Aldehyde		0.0104	0.0100	104%	0.0011	10.2%	0.0030
Endosulfan Sulfate		0.0187	0.0100	187%	0.0018	9.7%	0.0051
Methoxychlor		0.0493	0.0500	99%	0.0055	11.1%	0.0155
Endrin Ketone		0.0115	0.0100	115%	0.0012	10.9%	0.0035
DCB		0.1940	0.3000	65%	0.0196	10.1%	0.0554

Method:	EPA508						
Project:	MC970604	Average	True	Average			
Column:	Rtx-1701	Conc	Conc	Percent		Percent	MDL
Analyte		(ug/L)	(ug/L)	Recovery	Sigma	RSD	(ug/L)
TCMX		0.1571	0.2500	63%	0.0196	12.5%	0.0553
a-BHC		0.0034	0.0050	67%	0.0004	11.6%	0.0011
g-BHC		0.0035	0.0050	70%	0.0005	12.9%	0.0013
Heptachlor		0.0038	0.0050	77%	0.0004	9.8%	0.0011
Aldrin		0.0042	0.0050	84%	0.0005	10.9%	0.0013
b-BHC		0.0074	0.0050	148%	0.0022	29.8%	0.0062
d-BHC		0.0054	0.0050	107%	0.0009	17.6%	0.0027
Heptachlor Epoxide		0.0062	0.0050	125%	0.0008	13.0%	0.0023
Endosulfan I		0.0052	0.0050	105%	0.0011	20.5%	0.0030
g-Chlordane		0.0057	0.0050	113%	0.0006	9.8%	0.0016
a-Chlordane		0.0058	0.0050	116%	0.0006	10.5%	0.0017
4,4'-DDE		0.0102	0.0100	102%	0.0011	10.7%	0.0031
Dieldrin		0.0082	0.0100	82%	0.0008	9.7%	0.0022
Endrin		0.0106	0.0100	106%	0.0013	12.6%	0.0038
Endosulfan II				Coelution with 4,4-DDD			
4,4-DDD							
4,4'-DDT		0.0085	0.0100	85%	0.0017	19.4%	0.0047
Endrin Aldehyde		0.0097	0.0100	97%	0.0011	11.6%	0.0032
Endosulfan Sulfate		0.0119	0.0100	119%	0.0010	8.3%	0.0028
Methoxychlor		0.0600	0.0500	120%	0.0054	8.9%	0.0151
Endrin Ketone		0.0107	0.0100	107%	0.0011	10.6%	0.0032
DCB		0.1822	0.3000	61%	0.0169	9.3%	0.0476

Method Detect. 1 Study
META Environ. l, Inc.

Method:	EPA608												
Project:	MC970604	0604-RS1	0604-AB	0604-01	0604-02	0604-03	0604-04	0604-05	0604-06	0604-07	0604-08	0604-09	0604-10
Column:	DB 608	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
TCMX	8.129	0.3274	0.2397	0.2027	0.1881	0.1769	0.1476	0.2031	0.1677	0.1615	0.1444	0.1462	0.1475
a-BHC	9.732	0.0081	0.0005	0.0044	0.0039	0.0038	0.0031	0.0041	0.0032	0.0033	0.0031	0.0030	0.0035
g-BHC	10.580	0.0067	0.0005	0.0042	0.0040	0.0038	0.0031	0.0037	0.0032	0.0033	0.0030	0.0031	0.0035
b-BHC	10.722	0.0101	0.0030	0.0052	0.0057	0.0055	0.0047	0.0049	0.0044	0.0049	0.0041	0.0045	0.0045
Heptachlor	11.261	0.0080	0.0048	0.0053	0.0051	0.0053	0.0043	0.0050	0.0040	0.0043	0.0040	0.0041	0.0044
d-BHC	11.483	0.0080	0.0012	0.0059	0.0066	0.0056	0.0048	0.0060	0.0042	0.0046	0.0050	0.0049	0.0071
Aldrin	11.935	0.0107	0.0287	0.0057	0.0082	0.0079	0.0052	0.0058	0.0047	0.0051	0.0045	0.0046	0.0053
Heptachlor Epoxide	13.126	0.0114	0.0000	0.0064	0.0068	0.0068	0.0057	0.0061	0.0049	0.0056	0.0049	0.0053	0.0060
g-Chlordane	13.509	0.0113	0.0004	0.0077	0.0065	0.0065	0.0054	0.0053	0.0050	0.0059	0.0053	0.0053	0.0061
a-Chlordane	13.913	0.0114	0.0000	0.0065	0.0064	0.0061	0.0054	0.0064	0.0048	0.0055	0.0047	0.0052	0.0054
Endosulfan I	14.000	0.0090	0.0000	0.0051	0.0051	0.0049	0.0043	0.0044	0.0039	0.0044	0.0038	0.0041	0.0041
4,4'-DDE	14.585	0.0215	0.0000	0.0106	0.0120	0.0113	0.0101	0.0100	0.0088	0.0101	0.0086	0.0096	0.0095
Dieldrin	14.852	0.0175	0.0000	0.0093	0.0099	0.0097	0.0085	0.0086	0.0074	0.0084	0.0075	0.0082	0.0081
Endrin	16.040	0.0196	0.0000	0.0118	0.0120	0.0117	0.0104	0.0099	0.0088	0.0104	0.0090	0.0101	0.0104
4,4-DDD	16.439	0.0182	0.0000	0.0083	0.0102	0.0098	0.0087	0.0084	0.0074	0.0085	0.0074	0.0082	0.0080
Endosulfan II	16.715	0.0233	0.0058	0.0111	0.0133	0.0128	0.0112	0.0110	0.0097	0.0111	0.0095	0.0106	0.0105
4,4'-DDT	17.687	0.0147	0.0017	0.0081	0.0089	0.0087	0.0074	0.0076	0.0061	0.0084	0.0062	0.0071	0.0068
Endrin Aldehyde	18.077	0.0247	0.0000	0.0100	0.0123	0.0114	0.0106	0.0111	0.0094	0.0109	0.0089	0.0097	0.0095
Endosulfan Sulfate	18.597	0.0250	0.0107	0.0209	0.0205	0.0195	0.0196	0.0178	0.0166	0.0183	0.0160	0.0208	0.0169
Methoxychlor	21.512	0.0867	0.0090	0.0530	0.0575	0.0535	0.0525	0.0508	0.0382	0.0465	0.0441	0.0477	0.0493
Endrin Ketone	21.812	0.0230	0.0038	0.0114	0.0135	0.0122	0.0121	0.0113	0.0094	0.0111	0.0100	0.0109	0.0129
DCB	28.088	0.3837	0.3018	0.1947	0.2317	0.2187	0.1959	0.1983	0.1702	0.1912	0.1879	0.1885	0.1826

Method:	EPA608												
Project:	MC970604	0604-RS1	0604-AB	0604-01	0604-02	0604-03	0604-04	0604-05	0604-06	0604-07	0604-08	0604-09	0604-10
Column:	Rtx-1701	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
TCMX	5.774	0.2928	0.2192	0.1860	0.1748	0.1621	0.1393	0.1854	0.1589	0.1512	0.1351	0.1386	0.1396
a-BHC	7.673	0.0061	0.0014	0.0038	0.0038	0.0037	0.0030	0.0038	0.0032	0.0033	0.0028	0.0029	0.0034
g-BHC	8.458	0.0070	0.0001	0.0042	0.0041	0.0041	0.0033	0.0038	0.0031	0.0032	0.0030	0.0032	0.0034
Heptachlor	8.779	0.0077	0.0016	0.0042	0.0045	0.0041	0.0036	0.0041	0.0036	0.0039	0.0033	0.0035	0.0036
Aldrin	9.247	0.0094	0.0002	0.0043	0.0051	0.0046	0.0041	0.0045	0.0041	0.0044	0.0037	0.0038	0.0036
b-BHC	10.008	0.0120	0.0004	0.0065	0.0130	0.0092	0.0064	0.0062	0.0056	0.0062	0.0063	0.0070	0.0077
d-BHC	10.354	0.0085	0.0021	0.0053	0.0071	0.0062	0.0048	0.0056	0.0041	0.0048	0.0048	0.0045	0.0062
Heptachlor Epoxide	10.547	0.0013	0.0038	0.0060	0.0078	0.0063	0.0060	0.0069	0.0051	0.0059	0.0055	0.0058	0.0071
Endosulfan I	10.998	0.0091	0.0007	0.0046	0.0068	0.0049	0.0047	0.0073	0.0037	0.0049	0.0049	0.0056	0.0049
g-Chlordane	11.143	0.0113	0.0007	0.0055	0.0067	0.0059	0.0058	0.0061	0.0047	0.0057	0.0050	0.0056	0.0056
a-Chlordane	11.253	0.0116	0.0004	0.0058	0.0069	0.0061	0.0061	0.0061	0.0047	0.0060	0.0051	0.0060	0.0056
4,4'-DDE	11.446	0.0207	0.0015	0.0097	0.0117	0.0108	0.0113	0.0107	0.0080	0.0103	0.0093	0.0108	0.0095
Dieldrin	11.633	0.0181	0.0003	0.0078	0.0094	0.0088	0.0089	0.0082	0.0069	0.0087	0.0075	0.0086	0.0074
Endrin	11.984	0.0191	0.0022	0.0106	0.0122	0.0113	0.0113	0.0125	0.0081	0.0102	0.0090	0.0109	0.0103
Endosulfan II	12.917						Coelution with 4,4-DDD						
4,4-DDD	12.917												
4,4'-DDT	13.178	0.0140	0.0018	0.0098	0.0108	0.0109	0.0097	0.0078	0.0065	0.0072	0.0068	0.0073	0.0084
Endrin Aldehyde	13.845	0.0226	0.0024	0.0109	0.0113	0.0095	0.0089	0.0078	0.0098	0.0109	0.0099	0.0090	0.0087
Endosulfan Sulfate	14.667	0.0239	0.0036	0.0127	0.0138	0.0129	0.0119	0.0116	0.0110	0.0120	0.0105	0.0116	0.0111
Methoxychlor	14.738	0.0906	0.0225	0.0684	0.0651	0.0619	0.0618	0.0611	0.0524	0.0587	0.0518	0.0627	0.0559
Endrin Ketone	15.689	0.0245	0.0025	0.0104	0.0130	0.0121	0.0107	0.0106	0.0096	0.0108	0.0092	0.0104	0.0099
DCB	19.043	0.3451	0.2714	0.1822	0.2145	0.2036	0.1844	0.1881	0.1625	0.1808	0.1600	0.1773	0.1706

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Method:	EPA508																
Project:	MC980623	0623-RS1	0623-RS2	0623-01	0623-02	0623-03	0623-04	0623-05	0623-06	0623-07	0623-08	0623-09	0623-10	Average	Sigma	t-Value	MDL
Column:	RTX-5	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Conc
Analyte	RT	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)		(ng/L)
etridiazole	10.410	8.0500	8.6100	12.7500	11.1500	12.0000	14.9000		10.4000	16.4400	15.6800	15.0500	14.3600	13.637	2.129	2.896	6.167
chlornb	11.150	6.6600	9.3000	16.6700	19.1200	13.8300	6.9200		7.6900	12.0000	12.0400	14.2600	12.7500	12.809	3.873	2.896	11.217
propachlor	12.700	12.6600	9.4900	26.9900	4.8500	59.4900	61.2500		64.1300	74.2000	17.2700	21.0700	11.2800	37.837	26.566	2.896	76.934
TCMX	13.000	16.4000	18.4000	19.3000	15.0000	17.2000	17.2000		20.3000	20.8000	19.4000	20.8000	15.0000	18.333	2.316	2.896	6.706
trifluralin	13.620	7.5200	8.2900	13.9800	14.0000	13.9500	14.5000		14.9900	16.4600	15.2100	19.9700	13.6700	15.192	1.991	2.896	5.765
a-BHC	14.300	7.1700	6.4500	8.2200	6.5200	8.2700	8.6800		8.3700	8.6900	8.5200	9.3100	8.6300	8.357	0.760	2.896	2.202
hexachlorobenzene	14.560	9.0400	9.1100	10.2500	10.1800	9.5000	8.3800		10.4500	9.7200	9.8100	9.6400	9.1600	9.677	0.631	2.896	1.826
b-BHC	15.200	9.5800	8.4100	12.1100	11.4100	13.5900	15.3400		13.5600	14.4700	13.0100	15.4100	11.8000	13.411	1.472	2.896	4.264
g-BHC	15.390	6.6500	6.9300	7.5100	6.6600	8.8900	6.9200		7.4400	9.6700	7.4600	8.0800	6.7100	7.704	1.017	2.896	2.945
d-BHC	16.200	6.5900	6.7300	10.3200	8.4100	11.3300	10.6200		10.8500	11.7500	10.5400	11.4000	10.9600	10.687	0.968	2.896	2.804
chlorothalonil	16.370	7.6100	6.9300	7.7900	7.7100	8.9300	6.3000		6.3000	7.3000	7.5300	7.0700	6.6400	7.286	0.837	2.896	2.424
Heptachlor	17.760	7.8900	8.4700	13.9400	5.5800	6.5100	6.9400		6.2400	6.4700	7.3800	7.2900	5.5800	7.326	2.564	2.896	7.424
Aldrin	18.960	7.6600	8.2000	11.2900	8.7000	8.4900	9.6300		8.0500	7.9000	8.6600	8.7900	7.3000	8.757	1.152	2.896	3.337
Chlorpyrifos	19.150	9.1100	10.1100	12.3000	10.4600	10.7300	12.4500		11.9200	12.2700	12.4500	15.9800	11.2000	12.196	1.608	2.896	4.658
DCPA	19.340	8.1200	9.5200	7.3500	6.8200	9.2300	8.5600		7.4500	9.4900	8.9100	8.7600	9.2200	8.421	0.966	2.896	2.797
Heptachlor Epoxide	20.360	8.1500	9.4100	8.4700	7.5200	10.5500	10.4400		9.5000	9.4200	9.5200	9.3000	7.8100	9.170	1.054	2.896	3.053
g-Chlordane	21.180	8.5600	9.4900	10.3500	8.1500	9.2600	12.4400		11.7300	10.1500	11.3200	11.3000	9.6300	10.483	1.346	2.896	3.899
Endosulfan I	21.630	8.3700	9.2300	6.7500	6.6300	7.4800	7.6500		5.3500	5.6600	4.7800	5.3500	4.6600	6.034	1.124	2.896	3.255
a-Chlordane	21.710	7.5800	9.3900	7.6000	6.7100	7.2500	7.0300		6.7500	6.9800	6.6900	6.8900	6.6900	6.954	0.307	2.896	0.890
p,p-DDE	22.430	8.1600	8.2500	10.3900	8.4800	11.9200	11.5600		11.4800	11.9200	10.1400	11.8800	11.3200	11.010	1.150	2.896	3.330
Dieldrin	22.530	8.0600	8.6800	7.9400	8.8800	9.4400	7.5800		8.8700	8.1600	7.8100	8.4600	7.8400	8.109	0.746	2.896	2.182
Endrin	23.300	9.7900	10.3100	17.3900	10.7200	12.3100	13.0900		13.4200	12.3900	13.5600	12.3300	13.3600	13.174	1.807	2.896	5.233
Endosulfan II	23.640	8.6500	9.4000	5.8700	5.8000	6.6700	6.7100		4.1500	4.1000	3.3300	4.1600	2.0400	4.759	1.596	2.896	4.622
chlorobenzilate	23.550	10.3600	9.8600	12.4500	12.7700	6.7600	8.6800		10.0600	10.8800	4.0000	15.1900	13.8400	10.492	3.569	2.896	10.335
p,p-DDD	23.900	7.3000	7.1900	7.5000	7.0200	7.7100	8.1900		7.4100	7.6800	7.2400	9.2500	7.5800	7.731	0.656	2.896	1.901
Endrin Aldehyde	24.300	7.1500	7.8100	7.5900	7.7100	7.4400	7.8000		7.8100	7.7900	6.8800	8.2700	7.8500	7.682	0.375	2.896	1.087
Endosulfan Sulphate	25.110	8.8100	10.6800	13.0800	12.5500	13.0800	12.6800		11.8500	12.8700	11.9700	10.5900	14.4200	12.566	1.051	2.896	3.045
p,p-DDT	25.170	8.1300	7.3500	8.5600	7.7100	8.7600	8.9200		8.5700	9.8200	8.1400	7.6900	8.1200	8.477	0.665	2.896	1.928
Methoxychlor	27.170	10.6700	9.0400	15.5500	15.5200	15.8000	17.5100		19.4300	18.1400	18.5200	20.8900	19.1400	17.833	1.903	2.896	5.511
cis-permethrin	30.230	12.2500	11.8900	11.1800	8.0000	7.8900	11.9400		49.2700	9.8200	9.1000	8.8100	8.9100	13.878	13.341	2.896	38.635
trans-permethrin	30.470	6.1400	8.4300	9.1000	8.4700	9.9800	8.7800		12.9500	13.9000	13.3800	12.6300	11.1100	11.142	2.134	2.896	6.180
DCB	33.310	23.8000	25.6000	26.7000	24.7000	26.5000	25.3000		28.8000	23.8000	26.1000	25.7000	27.6000	26.133	1.504	2.896	4.356

METHOD DETEC[illegible] LIMIT STUDY
META Environmental, Inc.

Method:	EPA508															
Project:	MC980623	0623-RS1	0623-RS2	0623-01	0623-02	0623-03	0623-04	0623-05	0623-06	0623-07	0623-08	0623-09	0623-10	Average	Sigma
Column:	RTX-5	Conc		Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc
Analyte	RT	(ng/L)		(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)	(ng/L)
etridiazole	10.410	100%		148%	130%	139%	173%	0%	121%	191%	182%	175%	167%	158%	25%
chlorneb	11.150	100%		179%	206%	149%	74%	0%	83%	129%	129%	153%	137%	138%	59%
propachlor	12.700	100%		284%	51%	627%	645%	0%	676%	782%	182%	222%	119%	399%	292%
TCMX	13.000	100%		105%	82%	93%	93%	0%	110%	113%	105%	113%	82%	100%	34%
trifluralin	13.620	100%		169%	169%	168%	175%	0%	181%	199%	183%	241%	165%	183%	62%
a-BHC	14.300	100%		127%	101%	128%	135%	0%	130%	135%	132%	144%	134%	130%	42%
hexachlorobenzene	14.560	100%		113%	112%	104%	92%	0%	115%	107%	108%	106%	101%	106%	34%
b-BHC	15.200	100%		144%	136%	162%	182%	0%	161%	172%	155%	183%	140%	159%	53%
g-BHC	15.390	100%		108%	96%	128%	100%	0%	107%	140%	108%	117%	97%	111%	38%
d-BHC	16.200	100%		153%	125%	168%	158%	0%	161%	175%	157%	189%	163%	159%	52%
chlorothalonil	16.370	100%		112%	111%	129%	91%	0%	91%	105%	109%	102%	96%	105%	35%
Heptachlor	17.760	100%		165%	86%	77%	82%	0%	74%	76%	87%	86%	66%	86%	40%
Aldrin	18.960	100%		138%	106%	104%	117%	0%	98%	96%	106%	107%	89%	107%	36%
Chloropyrifos	19.150	100%		122%	103%	106%	123%	0%	118%	121%	123%	158%	111%	121%	41%
DCPA	19.340	100%		77%	72%	97%	90%	0%	78%	100%	94%	92%	97%	88%	30%
Heptachlor Epoxide	20.360	100%		90%	80%	112%	111%	0%	101%	100%	101%	99%	83%	97%	33%
g-Chlordane	21.160	100%		109%	86%	98%	131%	0%	124%	107%	119%	119%	101%	110%	37%
Endosulfan I	21.630	100%		73%	72%	81%	83%	0%	58%	61%	52%	58%	50%	65%	24%
a-Chlordane	21.710	100%		81%	71%	77%	75%	0%	72%	74%	71%	73%	71%	74%	24%
p,p-DDE	22.430	100%		126%	103%	144%	140%	0%	139%	144%	123%	144%	137%	133%	44%
Dieldrin	22.530	100%		89%	77%	106%	85%	0%	100%	92%	88%	95%	88%	91%	30%
Endrin	23.300	100%		169%	104%	119%	127%	0%	130%	120%	132%	120%	130%	128%	44%
Endosulfan II	23.640	100%		62%	62%	71%	71%	0%	44%	44%	35%	44%	22%	51%	23%
chlorobenzilate	23.550	100%		126%	129%	88%	88%	0%	102%	108%	40%	154%	140%	106%	48%
p,p-DDD	23.900	100%		104%	98%	107%	114%	0%	103%	107%	101%	129%	105%	108%	35%
Endrin Aldehyde	24.300	100%		97%	99%	95%	100%	0%	100%	100%	88%	106%	101%	98%	31%
Endosulfan Sulphate	25.110	100%		122%	118%	122%	119%	0%	111%	121%	112%	99%	135%	118%	38%
p,p-DDT	25.170	100%		116%	105%	119%	121%	0%	117%	134%	111%	105%	110%	115%	37%
Methoxychlor	27.170	100%		172%	172%	175%	194%	0%	215%	201%	205%	231%	212%	197%	65%
cis-permethrin	30.230	100%		94%	67%	66%	100%	0%	414%	83%	77%	74%	75%	117%	112%
trans-permethrin	30.470	100%		142%	132%	155%	136%	0%	201%	218%	208%	196%	173%	173%	63%
DCB	33.310	100%		104%	98%	104%	99%	0%	113%	93%	102%	100%	108%	102%	33%

METHOD DETEC. .N LIMIT STUDY
META Environmental, Inc.

Arochlor1016/1260 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:			
Conc. of PCB in Waste Oil (ng/mL):	100	Weight Transformer Oil (g)	0.1112
Conc. of Surr in Waste Oil (ng/mL):	20	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	1

Date: 2/16/99
Analyst: TML
Method: EPA608

Rear Project: Column: Analyte	MC990216 RTX-CLP2 RT	STD Conc (ug/Kg)	1 Conc (ug/Kg)	2 Conc (ug/Kg)	3 Conc (ug/Kg)	4 Conc (ug/Kg)	5 Conc (ug/Kg)	6 Conc (ug/Kg)	7 Conc (ug/Kg)	8 Conc (ug/Kg)	9 Conc (ug/Kg)	Avg Rec	Avg Conc (ug/kg)	STDEV (ug/kg)	t-Value	MDL Conc (ug/Kg)
TCMX	11.490	1799	1958.8	1813.9	1720.3	1947.0	1859.5	1839.9	1772.5	1808.2	1759.0	101.8%	1831.00	80.90	2.896	234.30
AR1016	15.600	8993	13027.0	11694.2	12282.6	13009.0	12288.6	12066.5	11856.3	11154.0	11772.5	134.9%	12127.85	609.79	2.896	1765.95
AR1016 (2)	15.710	8993	8767.9	9014.1	7989.9	8558.2	8090.2	8409.2	7923.0	8017.2	8345.3	92.8%	8346.12	379.57	2.896	1099.24
AR1016 (3)	16.990	8993	7494.7	7338.9	7158.6	7416.8	6884.0	7402.9	7111.4	7021.3	7592.6	80.8%	7269.02	236.37	2.896	684.53
AR1016 (4)	20.240	8993	8478.6	7901.5	7796.6	8378.9	8756.7	8054.0	7681.1	7434.5	7828.2	89.3%	8034.47	424.19	2.896	1228.46
AR1016 (5)	20.940	8993	8926.5	8104.1	8376.0	9079.0	8017.9	8554.9	8482.2	8031.2	8946.0	94.5%	8501.98	409.83	2.896	1186.86
AR1016 Average		8993	9338.94	8810.58	8720.73	9288.39	8807.47	8897.48	8610.82	8331.64	8896.94	98.5%	8855.89	312.52	2.896	905.07
AR1260	22.730	8993	8077.1	7375.2	7265.5	7808.4	7561.6	7534.2	7084.6	6953.0	7495.5	83.0%	7461.67	346.82	2.896	1004.379
AR1260 (2)	23.300	8993	8364.7	7910.8	7724.9	8449.4	7946.0	8045.0	7499.1	7426.2	7953.2	88.1%	7924.37	345.41	2.896	1000.311
AR1260 (3)	24.070	8993	8318.9	7684.5	7551.2	8217.7	7835.1	7909.2	7331.5	7151.3	7903.8	86.4%	7767.01	382.98	2.896	1109.122
AR1260 (4)	25.690	8993	8464.0	7980.3	7751.5	8557.8	8227.8	8277.0	7650.3	7770.3	8163.7	90.0%	8093.62	324.08	2.896	938.524
AR1260 (5)	27.660	8993	9392.4	7812.1	6478.2	8509.8	7527.8	8088.1	7927.3	7835.9	8498.2	89.0%	8007.76	795.31	2.896	2303.232
AR1260 Average		8993	8523.42	7752.55	7354.28	8308.61	7819.66	7970.68	7498.56	7427.32	8002.88	87.3%	7850.89	396.87	2.896	1149.349
DCB	33.590	1799	1666.9	1522.8	1406.6	1609.0	1554.5	1610.6	1389.4	1338.7	1583.6	84.5%	1520.25	114.98	2.896	332.970

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Arochlor1221 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:			
Conc. of PCB in Waste Oil (ng/mL):	50	Weight Transformer Oil (g)	0.1079
Conc. of Surr in Waste Oil (ng/mL):	10	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	0.5

Date: 2/18/99
Analyst: TML
Method: EPA608
Project: MC990218

Front		STD	1	2	3	4	5	6	7	8	9					
Column Type	RTX-CLP	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	10.600	927	1129.4	980.6	908.7	1012.5	1011.5	1150.8	1183.1	1052.5	1470.8	118.7%	1099.98	164.47	2.896	476.30
AR1221 (1)	11.250	4634	3652.4	3321.6	3390.8	3543.0	3264.3	3794.3	3667.0	3710.6	4516.8	78.8%	3651.18	372.73	2.896	1079.43
AR1221 (2)	11.740	4634	6502.7	7359.7	6264.3	6603.1	6635.6	5737.2	8569.4	6917.4	9432.4	154.0%	7135.75	1167.50	2.896	3381.08
AR1221 (3)	11.870	4634	5414.7	5051.1	4981.4	4885.8	4783.1	5247.6	5427.9	4741.1	6694.9	113.2%	5247.51	598.71	2.896	1733.85
DCB	29.200	927	844.1	866.6	844.1	758.5	807.6	931.8	879.8	855.1	931.3	92.5%	857.66	55.01	2.896	159.30
AR1221 Average		4634	5189.94	5244.12	4878.82	5077.31	4894.34	4926.38	5888.07	5123.02	6881.33	115.3%	5344.82	652.50	2.896	1889.64

Rear																
Column type	RTX-CLP2	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	11.47	927	833.8	755.6	760.1	833.4	778.6	751.2	691.2	928.4	830.5	85.9%	795.87	68.69	2.896	198.92
AR1221 (1)	13.43	4634	3328.1	3369.0	2984.2	3367.0	3152.0	3035.4	2793.9	3637.1	3313.7	69.5%	3220.05	253.52	2.896	734.18
AR1221 (2)	15.69	4634	3425.7	2427.4	3156.3	3162.9	3242.4	3045.8	2772.0	3445.6	3266.7	67.0%	3104.99	324.71	2.896	940.35
AR1221 (3)	16.97	4634	3383.6	3144.3	3237.3	3864.5	3285.0	3427.3	3005.1	3801.9	3785.5	74.2%	3437.17	311.34	2.896	901.65
DCB	33.57	927	891.8	787.1	843.9	868.8	1038.1	962.2	796.8	1198.7	890.2	99.2%	919.74	130.55	2.896	378.07
AR1221 Average		4634	3379.12	2980.23	3125.94	3464.78	3226.50	3169.52	2856.97	3628.22	3455.32	70.2%	3254.07	249.38	2.896	722.21

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Arochlor1232 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:			
Conc. of PCB in Waste Dil (ng/mL):	50	Weight Transformer Oil (g)	0.1068
Conc. of Surr in Waste Dil (ng/mL):	10	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	0.5

Date: 2/17/99
Analyst: TML
Method: EPA608

Rear Project:	MC990217	STD	1	2	3	4	5	6	7	8	9					
Column:	RTX-CLP2	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	11.470	936	779.0	806.6	787.0	714.9	827.7	831.5	752.8	891.9	758.4	84.8%	794.4	52.16	2.896	151.065
AR1232 (1)	13.430	4682	1463.5	1707.4	1637.6	1580.5	1684.0	1852.5	1845.1	1918.1	1669.5	36.0%	1684.2	135.53	2.896	392.490
AR1232 (2)	15.690	4682	4179.8	4676.0	4596.9	5251.4	4882.4	5369.9	5166.7	5025.7	5031.4	104.8%	4906.7	372.52	2.896	1078.828
AR1232 (3)	16.970	4682	3431.2	3789.3	3610.5	3545.4	3919.0	3972.4	3812.3	4235.5	3683.9	80.6%	3775.5	245.89	2.896	712.084
AR1232 (4)	18.680	4682	2809.0	2754.7	2892.8	2687.7	2959.3	3001.4	2834.3	3306.6	2737.8	61.7%	2887.1	188.01	2.896	544.478
AR1232 (5)	20.230	4682	2683.1	2608.1	2629.2	2666.7	2912.5	2853.9	2763.1	3099.7	2923.2	59.7%	2793.3	165.44	2.896	479.105
DCB	33.570	936	647.9	581.0	674.2	538.9	750.5	836.6	570.7	967.7	715.4	74.6%	698.1	138.43	2.896	400.892
AR1232 Average		4682	2913.3	3107.1	3073.4	3146.3	3267.4	3410.0	3244.3	3517.1	3205.1	68.6%	3209.4	180.33	2.896	522.243

METHOD DETEC... LIMIT STUDY
META Environmental, Inc.

Arochlor1242 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:			
Conc. of PCB in Waste Oil (ng/mL):	50	Weight Transformer Oil (g)	0.1126
Conc. of Surr in Waste Oil (ng/mL):	10	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	0.5

Date: 2/18/99
Analyst: TML
Method: EPA608
Project: MC990218

Front Column Type Analyte	RTX-CLP RT	STD Conc (ug/Kg)	1 Conc (ug/Kg)	2 Conc (ug/Kg)	3 Conc (ug/Kg)	4 Conc (ug/Kg)	5 Conc (ug/Kg)	6 Conc (ug/Kg)	7 Conc (ug/Kg)	8 Conc (ug/Kg)	9 Conc (ug/Kg)	Avg Rec	Avg Conc (ug/kg)	STDEV (ug/kg)	t-Value	MDL Conc (ug/Kg)
TCMX	10.600	888	1001.3	628.3	687.8	762.0	644.6	922.3	552.0	827.3	892.1	86.6%	768.65	152.07	2.896	440.38
AR1242 (1)	11.880	4440	*	3894.3	4745.1	3785.5	3302.8	3635.9	2487.1	3780.2	4066.2	83.6%	3712.14	644.71	2.998	1932.85
AR1242 (2)	15.300	4440	*	3917.0	3961.8	4360.8	4058.6	4657.6	3190.1	4450.3	4831.3	94.1%	4179.17	517.10	2.998	1550.26
AR1242 (3)	16.470	4440	*	3666.5	3927.8	4053.7	3805.1	4258.9	3253.1	4362.8	4725.6	90.2%	4006.68	453.55	2.998	1359.73
AR1242 (4)	18.630	4440	*	3798.0	3528.4	4041.7	3671.8	3897.9	3307.7	4227.4	4246.4	86.5%	3839.92	331.60	2.998	994.15
AR1242 (5)	19.930	4440	*	3487.1	3219.4	3609.7	3650.1	3630.6	3105.2	3844.6	3937.8	80.2%	3560.56	284.72	2.998	853.59
DCB	29.200	888	606.4	626.6	664.7	679.0	644.3	662.5	604.8	713.6	752.7	77.0%	683.84	63.81	2.896	184.80
AR1242 Average		4440		3752.58	3876.47	3971.49	3697.69	4016.16	3068.65	4133.04	4361.46	88.9%	3859.69	383.07	2.896	1109.38

Rear Column type Analyte	RTX-CLP2 RT	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Conc (ug/Kg)	Avg Rec	Avg Conc (ug/kg)	STDEV (ug/kg)	t-Value	MDL Conc (ug/Kg)
TCMX	11.47	888	702.9	596.8	633.2	649.2	660.3	628.3	609.2	627.0	625.2	71.7%	636.92	31.13	2.896	90.16
AR1242 (1)	13.34	4440	1771.3	2313.9	2797.1	2786.0	2647.9	2785.1	2585.3	2817.1	2597.7	57.8%	2564.58	336.82	2.896	975.42
AR1242 (2)	15.70	4440	5051.5	2923.6	3099.9	3126.6	2978.7	2898.8	2897.0	2931.6	2944.0	72.2%	3205.74	697.20	2.896	2019.08
AR1242 (3)	17.75	4440	5573.7	4280.2	3664.7	3581.3	3569.7	3523.1	3444.0	4147.9	4122.1	89.8%	3989.64	670.85	2.896	1942.78
AR1242 (4)	18.70	4440	4636.3	3238.5	3007.5	3175.4	3338.1	3016.9	3031.1	2900.5	3175.4	73.9%	3279.75	526.28	2.896	1524.12
AR1242 (5)	20.24	4440	2206.9	2064.8	2464.9	2371.2	2527.1	2400.1	2444.9	2389.0	2591.5	53.7%	2386.72	156.14	2.896	452.17
DCB	33.57	888	661.6	435.6	575.5	617.7	628.6	582.1	655.4	607.0	625.7	67.4%	598.83	67.68	2.896	196.01
AR1242 Average		4440	3847.96	2968.21	3006.84	3008.08	3011.90	2920.78	2880.46	3037.21	3086.15	69.5%	3085.29	292.45	2.896	846.93

* Chromatographic interference

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Arochlor1248 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:

Conc. of PCB in Waste Oil (ng/mL):	50	Weight Transformer Oil (g)	0.1174
Conc. of Surr in Waste Oil (ng/mL):	10	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	0.5

Date: 2/19/99
Analyst: TML
Method: EPA608
Project: MC990218

Front Column Type	RTX-CLP	STD Conc	1 Conc	2 Conc	3 Conc	4 Conc	5 Conc	6 Conc	7 Conc	8 Conc	9 Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	10.600	852	624.57	623.14	612.88	695.16	574.61	551.49	622.44	602.32	878.32	75.5%	642.77	96.74	2.896	280.16
AR1248 (1)	13.000	4259	3077.50	3039.85	3057.65	3946.81	3308.18	3032.32	3123.38	3255.47	3548.44	76.7%	3265.51	306.23	2.896	886.83
AR1248 (2)	16.390	4259	3400.11	3432.67	3354.52	3920.70	3531.50	3206.27	3407.00	3547.97	3865.15	82.6%	3518.43	234.83	2.896	680.06
AR1248 (3)	19.870	4259	3163.05	3226.33	3197.56	3621.35	3327.00	3024.02	3164.01	3270.43	3571.49	77.1%	3285.03	195.54	2.896	566.29
AR1248 (4)	20.800	4259	2982.98	2780.93	3302.58	3645.45	3407.89	2965.83	3286.86	3387.07	3600.14	76.6%	3262.17	295.29	2.896	855.15
AR1248 (5)	21.710	4259	3005.45	3076.92	2930.31	3487.42	3054.93	2855.18	2952.31	2992.62	3247.35	72.0%	3066.94	192.21	2.896	556.64
DCB	29.200	852	629.88	603.00	614.12	691.32	650.84	610.20	642.76	645.64	760.03	76.3%	649.76	49.21	2.896	142.50
AR1248 Average		4259	3125.82	3111.34	3168.53	3724.35	3325.90	3016.73	3186.67	3290.71	3566.51	77.0%	3237.05	230.33	2.896	667.04

Rear Column type	RTX-CLP2	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	11.47	852	670.28	695.65	693.13	684.39	670.08	625.63	693.92	745.13	693.66	80.5%	685.76	31.44	2.896	91.06
AR1248 (1)	18.66	4259	3183.18	2869.52	2586.49	2720.04	2568.11	2384.32	2460.29	2547.28	3259.15	64.1%	2730.93	311.72	2.896	902.74
AR1248 (2)	20.05	4259	2419.42	2401.37	2503.63	2431.45	2404.98	2284.67	2366.48	2522.88	2398.96	56.7%	2414.87	70.42	2.896	203.93
AR1248 (3)	20.21	4259	2575.49	2426.82	2566.35	2494.30	2476.00	2366.21	2442.83	2598.37	2485.15	58.5%	2492.39	76.33	2.896	221.05
AR1248 (4)	22.57	4259	2724.16	2660.06	2859.47	2720.60	2720.60	2553.23	2706.35	2891.52	2920.01	64.6%	2750.67	118.33	2.896	342.70
AR1248 (5)	23.40	4259	3086.28	2695.39	2899.58	2707.05	2654.55	2724.56	2438.68	3144.62	2730.39	65.4%	2786.79	221.04	2.896	640.15
DCB	33.57	852	627.89	579.99	664.84	691.67	675.25	560.83	586.02	720.95	566.86	74.0%	630.48	59.73	2.896	172.99
AR1248 Average		4259	2797.70	2610.63	2683.10	2614.69	2564.85	2462.60	2482.93	2740.93	2758.73	61.9%	2635.13	119.42	2.896	345.85

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Arochlor1254 in Transformer Oil, Waste Diluted and Cleaned-up

Prep Information:			
Conc. of PCB in Waste Dil (ng/mL):	50	Weight Transformer Oil (g)	0.1045
Conc. of Surr in Waste Dil (ng/mL):	10	Final Volume of waste Dilution (mL)	10
		Initial Cleanup Volume (mL)	1
		Final Cleanup Volume (mL)	0.5

Date: 2/19/99
Analyst: TML
Method: EPA608
Project: MC990219

Front Column Type	RTX-CLP	STD Conc	1 Conc	2 Conc	3 Conc	4 Conc	5 Conc	6 Conc	7 Conc	8 Conc	9 Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	10.60	957	704.31	689.47	811.00	664.59	766.99	898.56	782.78	772.73	658.85	78.4%	749.92	78.28	2.896	226.71
AR1254 (1)	15.74	4785	3323.92	3504.78	3412.92	3189.47	3516.75	3733.97	3804.31	3918.18	3272.25	73.6%	3519.62	251.48	2.896	728.29
AR1254 (2)	17.74	4785	3859.33	3650.72	4182.30	3586.60	4251.20	4389.00	4392.34	3886.60	3580.38	83.1%	3975.39	334.99	2.896	970.13
AR1254 (3)	19.93	4785	3889.00	3789.00	4470.81	3722.49	4441.15	4596.85	4243.54	4160.77	3908.13	86.4%	4135.73	322.86	2.896	935.02
AR1254 (4)	20.86	4785	3695.69	3579.43	3919.14	3461.24	3966.99	3991.87	3854.07	3687.56	3485.17	78.1%	3737.91	204.07	2.896	590.99
AR1254 (5)	21.47	4785	3734.93	3577.03	3971.29	3522.97	3911.96	3966.51	3790.91	3807.18	3509.57	78.5%	3754.70	182.45	2.896	528.39
DCB	29.20	957	653.59	601.91	655.50	604.78	711.48	706.70	643.54	664.11	613.40	68.0%	650.56	40.27	2.896	116.62
AR1254 Average		4785	3700.57	3620.19	3991.29	3496.56	4017.61	4135.60	4017.03	3892.06	3551.10	79.9%	3824.67	235.30	2.821	663.77

Rear Column type	RTX-CLP2	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc	Conc		Avg Conc	STDEV		MDL Conc
Analyte	RT	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	(ug/Kg)	Avg Rec	(ug/kg)	(ug/kg)	t-Value	(ug/Kg)
TCMX	11.47	957	800.00	807.18	829.19	789.95	858.37	856.94	836.36	850.24	860.77	87.0%	832.11	27.19	2.896	78.73
AR1254 (1)	17.74	4785	3809.09	4289.95	3817.70	4024.88	4083.25	4523.92	6839.71	4488.04	3977.51	92.6%	4428.23	941.28	2.896	2725.94
AR1254 (2)	20.23	4785	2879.90	2919.62	2872.25	2972.25	3029.67	3169.38	3028.71	3144.02	3013.88	62.8%	3003.30	105.60	2.896	305.81
AR1254 (3)	20.94	4785	2885.65	2928.23	2939.23	3018.66	3099.52	3321.53	3355.50	3325.36	3156.94	65.1%	3114.51	185.20	2.896	536.35
AR1254 (4)	22.58	4785	2919.14	1450.72	2838.76	2888.04	3010.05	3220.57	2969.86	3196.65	3055.02	59.3%	2838.76	536.51	2.896	1553.72
AR1254 (5)	22.58	4785	2580.38	2960.77	2894.74	3074.16	3104.31	3364.11	3155.02	3358.37	3128.23	64.1%	3068.90	240.79	2.896	697.33
DCB	33.57	957	788.04	811.48	789.00	899.52	889.47	1020.57	875.60	993.30	855.98	92.0%	880.33	82.99	2.896	240.34
AR1254 Average		4785	3014.83	2909.86	3072.54	3195.60	3265.36	3519.90	3869.76	3502.49	3266.32	68.8%	3290.74	298.27	2.896	863.79

Con...d

MRPA14 Water

GC ID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID						
File ID	27MARR55.D	27MARR56.D	27MARR57.D	27MARR58.D	27MARR59.D	27MARR60.D	27MARR61.D	27MARR62.D	27MARR63.D						
Lab ID	MC970326-01	MC970326-02	MC970326-03	MC970326-04	MC970326-05	MC970326-06	MC970326-07	MC970326-08	MC970326-09						
Field ID	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Average (ug/L)	Spike Conc (ug/L)	Average %Rec	Sigma (ug/L)	%RSD	MDL (ug/L)
Sample Size (g or mL)	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000						
Final Volume (ml)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000						
%Solids (decimal format)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000						
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000						
Benzene	4.88478	5.43355	5.19173	4.69995	5.03711	4.86528	4.10753	4.75432	4.84960	4.87	5.0	97%	0.366	8%	1.061
Toluene	3.55162	5.74952	4.17080	4.74315	5.18938	4.63715	5.31063	4.81691	4.30753	4.72	5.0	94%	0.660	14%	1.911
Ethylbenzene	4.98907	5.44966	5.14735	4.82587	4.91156	4.53651	4.39660	5.06416	4.53259	4.84	5.0	97%	0.358	7%	1.037
m/p-Xylene	9.98398	10.91200	10.29505	9.05702	9.83460	9.08410	8.79174	8.09066	9.08471	9.23	10.0	92%	1.370	15%	3.969
Styrene	6.66725	5.60038	6.76560	5.60378	5.80711	4.64958	5.27054	7.10119	5.56286	5.89	5.0	118%	0.794	13%	2.299
o-Xylene	6.66725	5.60038	6.77726	5.61526	5.80711	4.66144	5.27054	7.11275	5.57470	5.90	5.0	118%	0.794	13%	2.300
1,2,4-Trimethylbenzene**	4.45730	5.68846	4.84236	5.80588	6.60061	6.35369	7.71814	8.30513	7.55420	6.09	5.0	122%	1.152	19%	3.336
Naphthalene	7.29509	4.79906	5.73836	7.99262	6.39722	5.74041	5.65373	7.80222	6.99750	6.71	5.0	134%	1.293	19%	3.658
2-Methylnaphthalene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	5.0	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1-Methylnaphthalene	5.85856	4.57345	9.47058	4.92311	6.71472	8.16132	5.53325	6.20669	4.62287	6.23	5.0	125%	1.663	27%	4.816
Acenaphthylene	4.09663	6.96356	6.76752	6.75440	4.92521	7.32592	5.28795	5.33037	4.53414	5.77	5.0	115%	1.188	21%	3.440
Acenaphthene	5.54346	6.22581	5.29460	5.70205	4.76070	5.88714	4.89253	4.07796	4.52892	5.21	5.0	104%	0.698	13%	2.022
Dibenzofuran**	#VALUE!	#VALUE!	16.07567	#VALUE!	#VALUE!	9.66393	#VALUE!	4.50428	4.74336	#VALUE!	5.0	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Fluorene	7.83263	6.98649	8.94744	8.48064	8.05649	6.99633	8.36417	6.28972	7.80834	7.75	5.0	155%	0.788	10%	2.282
Phenanthrene	5.80562	5.57073	9.54758	7.01257	6.96225	6.58109	7.25144	5.89968	6.52556	6.80	5.0	136%	1.186	17%	3.435
Anthracene	4.84073	4.85346	6.27452	5.16526	4.85457	5.37445	4.92175	5.22977	5.09051	5.16	5.0	103%	0.476	9%	1.378
Fluoranthene	5.21958	5.02116	6.70218	5.82036	5.51809	6.20006	5.26594	5.78159	5.20459	5.63	5.0	113%	0.547	10%	1.584
Pyrene	4.99209	4.86020	5.28334	5.23439	5.28448	4.90857	5.25256	4.98369	5.03195	5.09	5.0	102%	0.170	3%	0.494
Benz(a)anthracene	5.80932	5.80100	6.47881	5.60352	6.04987	6.07853	5.43071	6.21058	5.28244	5.84	5.0	117%	0.393	7%	1.137
Chrysene	5.80932	5.80100	6.48357	5.60352	6.04987	6.08537	5.43748	6.21718	5.28244	5.84	5.0	117%	0.394	7%	1.142
Benzo(b)fluoranthene	4.58895	5.44341	5.93081	5.01068	5.71577	5.11736	5.42678	4.32001	6.05779	5.29	5.0	106%	0.588	11%	1.702
Benzo(k)fluoranthene	4.58372	5.44257	5.92956	5.00518	5.70926	5.11153	5.42090	4.31509	6.05089	5.29	5.0	106%	0.588	11%	1.703
Benzo(a)pyrene	4.27286	5.34830	5.73797	5.11582	5.60135	5.64442	4.75928	4.75321	6.36427	5.29	5.0	106%	0.634	12%	1.836
Indeno(1,2,3-cd)pyrene	4.94004	5.17875	7.23301	6.70090	6.11090	6.59064	7.20660	6.06871	5.97230	6.22	5.0	124%	0.805	13%	2.331
Dibenz(a,h)anthracene	4.23563	3.74700	4.23735	4.10546	4.53231	4.98937	3.68482	3.69250	3.78922	4.11	5.0	82%	0.443	11%	1.284
Benzo(g,h,i)perylene	4.33688	4.46135	6.39155	5.75105	5.17648	4.67153	3.88865	6.85355	4.44875	5.11	5.0	102%	1.015	20%	2.939
Fluorobenzene (SS1)	78%	104%	86%	83%	97%	81%	111%	91%	90%	91%					
2-Fluorobiphenyl (SS2)	81%	84%	80%	81%	78%	84%	79%	74%	80%	80%					
5a-Androstane (SS3)	90%	92%	91%	95%	93%	95%	94%	90%	97%	93%					
m/p-Xylene	222	298	245	238	278	231	316	260	257	260.57	285.7	91%	31.382	12%	90.882
1-Methylnaphthalene	230	239	230	232	223	241	225	212	229	228.96	285.7	80%	8.576	4%	24.835
Acenaphthylene	257	262	259	271	267	273	268	256	277	265.51	285.7	93%	7.400	3%	21.429

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Method: MET2508 Column: RTX-5MS
Project: MC980527 Spike Amount: 0.20 ug/mL or 0.10 ug/g

GC ID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID				
Sequence ID	980602	980602	980602	980602	980602	980602	980602	980602	980602	980602				
File ID	02JUNR22.	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR3	02JUNR31.D				
Lab ID	C980527-0	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	Standard	Replicates	t-value	MDL
Field ID	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	2508 MDL	Deviation			
Sample Size (g or mL)	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000				
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
%Solids (decimal format)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
Benzene	0.0913	0.0906	0.0911	0.0946	0.0940	0.1026	0.0824	0.0938	0.1033	0.086	0.0063	9.000	2.896	0.0184
Toluene	0.1006	0.1025	0.1021	0.1010	0.1051	0.1164	0.0912	0.1097	0.1194	0.097	0.0086	9.000	2.896	0.0250
Ethylbenzene	0.0910	0.0978	0.0929	0.0932	0.1003	0.1084	0.0846	0.1049	0.1146	0.090	0.0094	9.000	2.896	0.0273
m/p-Xylene	0.2174	0.2317	0.2236	0.2204	0.2363	0.2657	0.2066	0.2472	0.2767	0.212	0.0231	9.000	2.896	0.0670
Styrene	0.0840	0.0884	0.0841	0.0876	0.0911	0.1016	0.0782	0.0978	0.1071	0.083	0.0093	9.000	2.896	0.0270
o-Xylene	0.0868	0.0930	0.0878	0.0902	0.0944	0.1052	0.0808	0.1007	0.1114	0.086	0.0097	9.000	2.896	0.0281
1,2,4-Trimethylbenzene	0.0920	0.1261	0.0898	0.0971	0.1245	0.1091	0.0851	0.1325	0.1541	0.103	0.0234	9.000	2.896	0.0678
Naphthalene	0.09333043	0.111601	0.08417	0.083877	0.085601	0.069443	0.092566	0.093147	0.092638	0.095317	0.0113	9.000	2.896	0.0326
2-Methylnaphthalene	0.105	0.125108	0.099912	0.100351	0.103706	0.097007	0.093907	0.105959	0.104199	0.104252	0.0089	9.000	2.896	0.0257
1-Methylnaphthalene	0.104	0.114815	0.102634	0.102514	0.10572	0.100789	0.092825	0.108266	0.103464	0.109395	0.0059	9.000	2.896	0.0171
Acenaphthylene	0.104	0.112593	0.097733	0.09748	0.102554	0.096695	0.086767	0.099557	0.096635	0.105788	0.0069	9.000	2.896	0.0200
Acenaphthene	0.131	0.144971	0.133305	0.126562	0.131514	0.13227	0.119346	0.133677	0.133947	0.146972	0.0068	9.000	2.896	0.0196
Dibenzofuran	0.090	0.096978	0.090509	0.087017	0.093734	0.087802	0.07923	0.092615	0.090405	0.097102	0.0050	9.000	2.896	0.0145
Fluorene	0.104	0.117299	0.109424	0.104124	0.104477	0.107515	0.096127	0.108544	0.105903	0.108938	0.0056	9.000	2.896	0.0163
Phenanthrene	0.102	0.108204	0.095395	0.091303	0.099855	0.09542	0.090199	0.099211	0.093793	0.100727	0.0057	9.000	2.896	0.0166
Anthracene	0.088	0.093106	0.092918	0.084648	0.088073	0.089661	0.074646	0.086978	0.08476	0.085067	0.0055	9.000	2.896	0.0160
Fluoranthene	0.115	0.117816	0.106421	0.10518	0.116955	0.111263	0.096524	0.109544	0.108448	0.111464	0.0067	9.000	2.896	0.0193
Pyrene	0.103	0.097842	0.0923	0.093169	0.094982	0.093002	0.082763	0.091576	0.089884	0.091661	0.0055	9.000	2.896	0.0158
Benz(a)anthracene	0.080	0.083587	0.076934	0.078024	0.081906	0.075396	0.067536	0.077689	0.076559	0.078401	0.0046	9.000	2.896	0.0133
Chrysene	0.088	0.093202	0.08316	0.089871	0.094059	0.082093	0.080506	0.089711	0.091128	0.093324	0.0049	9.000	2.896	0.0143
Benzo(b)fluoranthene	0.082	0.08736	0.079212	0.077801	0.080807	0.075056	0.065606	0.069512	0.070736	0.073055	0.0069	9.000	2.896	0.0200
Benzo(k)fluoranthene	0.083	0.088934	0.080129	0.08082	0.082512	0.078274	0.087684	0.076793	0.073656	0.074934	0.0060	9.000	2.896	0.0175
Benzo(a)pyrene	0.073	0.075915	0.068875	0.06862	0.070591	0.065291	0.055342	0.065482	0.061012	0.056501	0.0062	9.000	2.896	0.0180
Indeno(123-cd)pyrene	0.061	0.073465	0.062793	0.05885	0.057127	0.05292	0.047877	0.054757	0.050071	0.049142	0.0077	9.000	2.896	0.0223
Dibenz(a,h)anthracene	0.056	0.066434	0.060417	0.056343	0.050286	0.051361	0.042612	0.053962	0.047014	0.044052	0.0071	9.000	2.896	0.0206
Benzo(g,h,i)perylene	0.062	0.067368	0.056062	0.064592	0.060304	0.054287	0.042854	0.056726	0.042633	0.038924	0.0088	9.000	2.896	0.0254

METHOD DETEC I LIMIT STUDY
Analyte Recoveries
META Environmental, Inc.

Method: MET2508 Column: RTX-5MS
Project: MC980527 Spike Amount: 0.20 ug/mL or 0.10 ug/g

GC ID	GC III-FID	GC-1	GC III-FID	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FID		
Sequence ID	980602	980528	980602	980602	980602	980602	980602	980602	980602	980602	980602	980602		
File ID	02JUNR20.	980521.D	02JUNR22.	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR2	02JUNR3	02JUNR31.D		
Lab ID	MC980527-	Reference	C980527-0	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	Average	Standard
Field ID	Reference S	Standard 2	2508 MDL	2508 MD	2508 MD	2508 MD	2508 MD	2508 MD	2508 MD	2508 MD	2508 MD	2508 MDL		Deviation
Sample Size (g or mL)	2.000	1.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000		
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
%Solids (decimal format)	100%	200%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Dilution Factor	1.000	2.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
Fluorobenzene (SS1)	1.13984892		59%	54%	55%	57%	56%	60%	49%	55%	61%	52%	56%	4%
Benzene	0.11645789		77%	76%	77%	80%	79%	87%	70%	79%	87%	73%	79%	5%
Toluene	0.13358921		75%	77%	76%	76%	79%	87%	68%	82%	89%	73%	79%	6%
Ethylbenzene	0.12102788		75%	81%	77%	77%	83%	90%	70%	87%	95%	74%	81%	8%
m/p-Xylene	0.23950906		91%	97%	93%	92%	99%	111%	86%	103%	116%	89%	99%	10%
Styrene	0.1170754		72%	75%	72%	75%	78%	87%	67%	84%	92%	71%	78%	8%
o-Xylene	0.12192218		71%	76%	72%	74%	77%	86%	66%	83%	91%	71%	77%	8%
1,2,4-Trimethylbenzene	0.13335581		69%	95%	67%	73%	93%	82%	64%	99%	116%	77%	84%	18%
Naphthalene	0.11127413		84%	100%	76%	75%	77%	62%	83%	84%	83%	86%	81%	10%
2-Methylnaphthalene	0.11424256		92%	110%	87%	88%	91%	85%	82%	93%	91%	91%	91%	8%
1-Methylnaphthalene	0.12001567		87%	96%	86%	85%	88%	84%	77%	90%	86%	91%	87%	5%
Acenaphthylene	0.12542257		83%	90%	78%	78%	82%	77%	69%	79%	77%	84%	79%	6%
Acenaphthene	0.13747548		95%	105%	97%	92%	96%	96%	87%	97%	97%	107%	96%	5%
Dibenzofuran	0.10221945		88%	95%	89%	85%	92%	86%	78%	91%	88%	95%	88%	5%
Fluorene	0.10030604		104%	117%	109%	104%	104%	107%	96%	108%	106%	109%	106%	6%
Phenanthrene	0.10294478		100%	105%	93%	89%	97%	93%	88%	96%	91%	98%	95%	6%
Anthracene	0.09864378		89%	94%	94%	86%	89%	91%	76%	88%	86%	86%	88%	6%
Fluoranthene	0.10720156		107%	110%	99%	98%	109%	104%	90%	102%	101%	104%	102%	6%
Pyrene	0.09911678		104%	99%	93%	94%	96%	94%	84%	92%	91%	92%	94%	5%
Benz(a)anthracene	0.09339515		86%	89%	82%	84%	88%	81%	72%	83%	82%	84%	83%	5%
Chrysene	0.09586347		92%	97%	87%	94%	98%	86%	84%	94%	95%	97%	92%	5%
Benzo(b)fluoranthene	0.08668466		95%	101%	91%	90%	93%	87%	76%	80%	82%	84%	88%	8%
Benzo(k)fluoranthene	0.09647925		86%	92%	83%	84%	86%	81%	70%	80%	76%	78%	82%	6%
Benzo(a)pyrene	0.08757966		83%	87%	79%	78%	81%	75%	63%	75%	70%	65%	77%	7%
Indeno(123-cd)pyrene	0.08141211		75%	90%	77%	72%	70%	65%	59%	67%	62%	60%	71%	9%
Dibenz(a,h)anthracene	0.08205334		68%	81%	74%	69%	61%	63%	52%	66%	57%	54%	66%	9%
Benzo(g,h,i)perylene	0.09316491		67%	72%	60%	69%	65%	58%	46%	61%	46%	42%	60%	9%

METHOD DETECTION LIMIT STUDY
META Environmental, Inc.

Method: AHFSIM Column: Rtx-5MS
Project:

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4				
Sequence ID	980605	980605	980605	980605	980605	980605	980605	980605	980605	980605				
File ID	05JUN007.D	05JUN008.D	05JUN011.D	05JUN012.D	05JUN013.D	05JUN014.D	05JUN015.D	05JUN016.D	05JUN019.D	05JUN020.D				
Lab ID	0527-11	0527-12	0527-13	0527-14	0527-15	0527-16	0527-17	0527-18	0527-19	0527-20	Standard	Replicates	t-value	MDL
Field ID	PAH-01	PAH-02	PAH-03	PAH-04	PAH-05	PAH-06	PAH-07	PAH-08	PAH-09	PAH-10	Deviation			
Sample Size (g or mL)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0				
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
%Solids (decimal format)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
2-Fluorobiphenyl	46.7416	45.1331	43.9576	45.7386	44.8237	46.5084	45.3895	44.9889	48.6485	49.5262	1.759	10.000	2.821	4.9620
5-alpha-Androstane	52.3198	53.1592	53.0415	54.8444	54.4702	58.7777	58.6176	55.8433	51.8888	52.5249	1.818	10.000	2.821	5.1298
Toluene	0.0279	0.0220	0.0260	0.0279	0.0244	0.0251	0.0277	0.0247	0.0288	0.0289	0.002	10.000	2.821	0.0064
Ethylbenzene	0.0292	0.0259	0.0283	0.0287	0.0260	0.0275	0.0275	0.0246	0.0281	0.0282	0.001	10.000	2.821	0.0041
m/p-Xylenes	0.0616	0.0533	0.0578	0.0588	0.0557	0.0574	0.0558	0.0505	0.0589	0.0603	0.003	10.000	2.821	0.0093
Styrene	0.0284	0.0247	0.0250	0.0250	0.0229	0.0231	0.0228	0.0203	0.0233	0.0225	0.002	10.000	2.821	0.0061
o-Xylene	0.0302	0.0270	0.0279	0.0287	0.0267	0.0270	0.0276	0.0249	0.0287	0.0282	0.001	10.000	2.821	0.0040
1,2,4-Trimethylbenzene	0.0292	0.0262	0.0253	0.0244	0.0222	0.0226	0.0218	0.0202	0.0231	0.0213	0.003	10.000	2.821	0.0076
Naphthalene	0.0288	0.0265	0.0246	0.0237	0.0220	0.0221	0.0209	0.0199	0.0225	0.0210	0.003	10.000	2.821	0.0078
2-Methylnaphthalene	0.0270	0.0249	0.0215	0.0213	0.0186	0.0190	0.0168	0.0165	0.0189	0.0179	0.003	10.000	2.821	0.0098
1-Methylnaphthalene	0.0260	0.0264	0.0232	0.0234	0.0211	0.0219	0.0197	0.0195	0.0208	0.0208	0.003	10.000	2.821	0.0079
Acenaphthylene	0.0256	0.0238	0.0211	0.0213	0.0192	0.0198	0.0185	0.0186	0.0178	0.0195	0.002	10.000	2.821	0.0070
Acenaphthene	0.0260	0.0267	0.0229	0.0232	0.0212	0.0215	0.0198	0.0201	0.0194	0.0201	0.003	10.000	2.821	0.0083
Dibenzofuran	0.0301	0.0294	0.0262	0.0272	0.0257	0.0264	0.0249	0.0253	0.0253	0.0259	0.002	10.000	2.821	0.0050
Fluorene	0.0373	0.0376	0.0348	0.0363	0.0356	0.0365	0.0360	0.0363	0.0368	0.0374	0.001	10.000	2.821	0.0025
Phenanthrene	0.0293	0.0297	0.0269	0.0281	0.0270	0.0279	0.0255	0.0265	0.0256	0.0261	0.001	10.000	2.821	0.0042
Anthracene	0.0242	0.0244	0.0212	0.0218	0.0211	0.0218	0.0185	0.0203	0.0195	0.0194	0.002	10.000	2.821	0.0055
Fluoranthene	0.0295	0.0309	0.0284	0.0293	0.0282	0.0285	0.0267	0.0273	0.0260	0.0263	0.002	10.000	2.821	0.0044
Pyrene	0.0279	0.0298	0.0257	0.0267	0.0255	0.0258	0.0245	0.0249	0.0242	0.0250	0.002	10.000	2.821	0.0049
Benz[a]anthracene	0.0289	0.0295	0.0284	0.0293	0.0297	0.0290	0.0272	0.0283	0.0266	0.0285	0.001	10.000	2.821	0.0028
Chrysene	0.0341	0.0349	0.0335	0.0336	0.0323	0.0324	0.0334	0.0336	0.0352	0.0348	0.001	10.000	2.821	0.0028
Benzo[b]fluoranthene	0.0115	0.0106	0.0083	0.0088	0.0085	0.0085	0.0088	0.0093	0.0094	0.0116	0.001	10.000	2.821	0.0035
Benzo[k]fluoranthene	0.0211	0.0194	0.0158	0.0147	0.0157	0.0150	0.0138	0.0152	0.0158	0.0163	0.002	10.000	2.821	0.0063
Benzo[a]pyrene	0.0097	0.0084	0.0064	0.0065	0.0065	0.0063	0.0056	0.0064	0.0066	0.0074	0.001	10.000	2.821	0.0034
Indeno[1,2,3-cd]pyrene	0.0056	0.0049	0.0054	0.0048	0.0041	0.0053	0.0054	0.0051	0.0051	0.0060	0.000	10.000	2.821	0.0014
Dibenz[a,h]anthracene	0.0066	0.0053	0.0044	0.0041	0.0042	0.0042	0.0039	0.0043	0.0051	0.0046	0.001	10.000	2.821	0.0023
Benzo[g,h,i]perylene	0.0114	0.0104	0.0086	0.0087	0.0085	0.0087	0.0088	0.0101	0.0090	0.0096	0.001	10.000	2.821	0.0027

METHOD DETECTION LIMIT STUDY
Analyte Recoveries
META Environmental, Inc.

Method: AHFSIM
Project:

Column: Rtx-5MS

GC ID	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	GC-4	
Sequence ID	980605	980605	980605	980605	980605	980605	980605	980605	980605	980605	980605	
File ID	05JUN006.D	05JUN007.D	05JUN008.D	05JUN011.D	05JUN012.D	05JUN013.D	05JUN014.D	05JUN015.D	05JUN016.D	05JUN019.D	05JUN020.D	
Lab ID	0527-RS	0527-11	0527-12	0527-13	0527-14	0527-15	0527-16	0527-17	0527-18	0527-19	0527-20	Average
Field ID	Ref Std	PAH-01	PAH-02	PAH-03	PAH-04	PAH-05	PAH-06	PAH-07	PAH-08	PAH-09	PAH-10	%Rec
Sample Size (g or mL)	30.000	30.000	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
%Solids (decimal format)	1.000	1.000	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
2-Fluorobiphenyl	50	93%	90%	88%	91%	90%	93%	91%	90%	97%	99%	92%
5-alpha-Androstane	50	105%	106%	106%	110%	109%	114%	113%	112%	104%	105%	108%
Toluene	0.025	112%	88%	104%	112%	97%	101%	111%	99%	115%	116%	105%
Ethylbenzene	0.025	117%	104%	113%	115%	104%	110%	110%	98%	112%	113%	110%
m/p-Xylenes	0.050	123%	107%	116%	118%	111%	115%	112%	101%	118%	121%	114%
Styrene	0.025	114%	99%	100%	100%	92%	92%	91%	81%	93%	90%	95%
o-Xylene	0.025	121%	108%	112%	115%	107%	108%	110%	100%	115%	113%	111%
1,2,4-Trimethylbenzene	0.025	117%	105%	101%	98%	89%	90%	86%	81%	92%	85%	94%
Naphthalene	0.025	115%	106%	98%	95%	88%	88%	84%	80%	90%	84%	93%
2-Methylnaphthalene	0.025	108%	100%	86%	85%	75%	76%	67%	66%	75%	72%	81%
1-Methylnaphthalene	0.025	112%	105%	93%	94%	84%	88%	79%	78%	83%	83%	90%
Acenaphthylene	0.025	102%	95%	84%	85%	77%	79%	74%	74%	71%	78%	82%
Acenaphthene	0.025	112%	107%	92%	93%	85%	86%	79%	80%	78%	80%	89%
Dibenzofuran	0.025	120%	118%	105%	109%	103%	106%	100%	101%	101%	103%	107%
Fluorene	0.025	149%	150%	139%	145%	143%	146%	144%	145%	147%	150%	146%
Phenanthrene	0.025	117%	119%	108%	112%	108%	112%	102%	106%	102%	104%	109%
Anthracene	0.025	97%	98%	85%	87%	84%	87%	74%	81%	78%	78%	85%
Fluoranthene	0.025	118%	123%	113%	117%	113%	114%	107%	109%	104%	105%	112%
Pyrene	0.025	112%	119%	103%	107%	102%	103%	98%	100%	97%	100%	104%
Benz[a]anthracene	0.025	115%	118%	113%	117%	119%	116%	109%	113%	107%	114%	114%
Chrysene	0.025	137%	140%	134%	134%	129%	130%	134%	134%	141%	139%	135%
Benzo[b]fluoranthene	0.025	46%	42%	33%	35%	34%	34%	35%	37%	38%	46%	38%
Benzo[k]fluoranthene	0.025	85%	78%	63%	59%	63%	60%	55%	61%	63%	65%	65%
Benzo[a]pyrene	0.025	39%	34%	26%	26%	26%	25%	22%	26%	26%	30%	28%
Indeno[1,2,3-cd]pyrene	0.025	22%	19%	22%	19%	16%	21%	22%	20%	20%	24%	21%
Dibenz[a,h]anthracene	0.025	26%	21%	18%	16%	17%	17%	16%	17%	20%	18%	19%
Benzo[g,h,i]perylene	0.025	46%	42%	34%	35%	34%	35%	35%	40%	36%	39%	38%

METHOD DETEC N LIMIT STUDY
META Environmental, Inc.

Method: Soxhlet MPAH GC/FID Column: RTX-5MS
Project: MC980527 Spike Amount: 1.0 ug/mL or 0.033 ug/g

GC ID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID	GC III-FID				
Sequence ID	980619	980619	980619	980619	980619	980619	980619	980619	980619	980619				
File ID	19JUNF05.D	19JUNF0	19JUNF0	19JUNF0	19JUNF0	19JUNF1	19JUNF1	19JUNF1	19JUNF1	19JUNF14.D				
Lab ID	C980527-1	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	Standard	Replicates	t-value	MDL
Field ID	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	8270 MDL	Deviation			
Sample Size (g or mL)	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000				
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
%Solids (decimal format)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
Benzene	0.023	0.017	0.016	0.019	0.017	0.016	0.023	0.019	0.018	0.017	0.0027	10.000	2.821	0.0075
Toluene	0.029	0.026	0.024	0.026	0.026	0.025	0.032	0.028	0.029	0.027	0.0023	10.000	2.821	0.0065
Ethylbenzene	0.034	0.033	0.062	0.031	0.032	0.030	0.039	0.034	0.035	0.032	0.0095	10.000	2.821	0.0268
m/p-Xylene	0.123	0.117	0.102	0.113	0.119	0.106	0.101	0.086	0.091	0.107	0.0121	10.000	2.821	0.0343
Styrene	0.031	0.031	0.027	0.028	0.030	0.028	0.033	0.030	0.032	0.030	0.0019	10.000	2.821	0.0054
o-Xylene	0.031	0.032	0.028	0.029	0.030	0.029	0.034	0.031	0.033	0.030	0.0019	10.000	2.821	0.0055
1,2,4-Trimethylbenzene	0.032	0.033	0.028	0.029	0.031	0.029	0.034	0.031	0.033	0.031	0.0020	10.000	2.821	0.0056
Naphthalene	0.032	0.034	0.031	0.034	0.032	0.034	0.034	0.033	0.035	0.034	0.0012	10.000	2.821	0.0033
2-Methylnaphthalene	0.033	0.036	0.031	0.034	0.033	0.034	0.035	0.034	0.036	0.036	0.0016	10.000	2.821	0.0044
1-Methylnaphthalene	0.032	0.035	0.031	0.034	0.033	0.034	0.034	0.034	0.034	0.035	0.0013	10.000	2.821	0.0035
Acenaphthylene	0.033	0.036	0.032	0.036	0.034	0.036	0.035	0.035	0.035	0.037	0.0015	10.000	2.821	0.0043
Acenaphthene	0.037	0.039	0.035	0.038	0.037	0.039	0.039	0.039	0.038	0.040	0.0014	10.000	2.821	0.0039
Dibenzofuran	0.034	0.036	0.033	0.036	0.036	0.036	0.036	0.036	0.036	0.038	0.0013	10.000	2.821	0.0035
Fluorene	0.034	0.037	0.034	0.037	0.036	0.037	0.037	0.037	0.036	0.038	0.0013	10.000	2.821	0.0037
Phenanthrene	0.034	0.037	0.035	0.037	0.037	0.037	0.038	0.037	0.037	0.039	0.0014	10.000	2.821	0.0039
Anthracene	0.032	0.035	0.034	0.037	0.035	0.035	0.036	0.035	0.035	0.038	0.0014	10.000	2.821	0.0041
Fluoranthene	0.034	0.039	0.036	0.038	0.038	0.039	0.038	0.038	0.038	0.039	0.0014	10.000	2.821	0.0039
Pyrene	0.035	0.034	0.037	0.038	0.037	0.035	0.037	0.038	0.037	0.040	0.0018	10.000	2.821	0.0051
Benz(a)anthracene														
Chrysene	0.030	0.032	0.031	0.033	0.032	0.033	0.032	0.033	0.032	0.033	0.0009	10.000	2.821	0.0024
Benzo(b)fluoranthene	0.034	0.037	0.036	0.037	0.037	0.038	0.037	0.038	0.037	0.038	0.0012	10.000	2.821	0.0034
Benzo(k)fluoranthene	0.036	0.039	0.039	0.040	0.040	0.040	0.040	0.040	0.040	0.041	0.0012	10.000	2.821	0.0035
Benzo(a)pyrene	0.032	0.034	0.033	0.034	0.036	0.036	0.032	0.037	0.034	0.037	0.0019	10.000	2.821	0.0052
Indeno(123-cd)pyrene	0.031	0.034	0.032	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.0009	10.000	2.821	0.0026
Dibenz(a,h)anthracene	0.032	0.035	0.034	0.035	0.035	0.035	0.035	0.035	0.035	0.036	0.0010	10.000	2.821	0.0028
Benzo(g,h,i)perylene	0.034	0.036	0.035	0.037	0.036	0.037	0.036	0.037	0.036	0.038	0.0010	10.000	2.821	0.0029

METHOD DETEC ON LIMIT STUDY
Analyte Recoveries
META Environmental, Inc.

Method: Soxhlet MPAH GC/FID Column: RTX-5MS
Project: MC980527 Spike Amount: 1.0 ug/mL or 0.033 ug/g

GC ID	GC III-FID	GC-1	GC III-FID	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FI	GC III-FID		
Sequence ID	980619	980528	980619	980619	980619	980619	980619	980619	980619	980619	980619	980619		
File ID	19JUNF04.	980521.D	19JUNF05.	19JUNF0	19JUNF0	19JUNF0	19JUNF0	19JUNF1	19JUNF1	19JUNF1	19JUNF1	19JUNF14.D		
Lab ID	MC980527-	Reference	C980527-1	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	C980527-	Average	Standard
Field ID	Reference S	Standard 2	8270 MDL	8270 MD	8270 MD	8270 MD	8270 MD	8270 MD	8270 MD	8270 MD	8270 MD	8270 MDL		Deviation
Sample Size (g or mL)	30.000	1.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000		
Final Volume (ml)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
%Solids (decimal format)	100%	200%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Dilution Factor	1.000	2.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
Fluorobenzene (SS1)	0.91084365		60%	41%	38%	45%	40%	38%	57%	49%	44%	40%	46%	8%
Benzene	0.03028343		76%	55%	52%	61%	56%	52%	75%	63%	59%	56%	61%	9%
Toluene	0.03091817		93%	85%	78%	84%	85%	81%	104%	89%	93%	87%	88%	8%
Ethylbenzene	0.02966408		116%	111%	210%	104%	109%	102%	132%	113%	117%	109%	124%	34%
m/p-Xylene	0.06106436		202%	191%	187%	186%	196%	173%	165%	141%	149%	176%	174%	21%
Styrene	0.02934412		104%	106%	92%	97%	102%	95%	114%	103%	109%	102%	103%	7%
o-Xylene	0.03087079		101%	103%	90%	95%	99%	93%	111%	101%	106%	98%	100%	7%
1,2,4-Trimethylbenzene	0.0297533		107%	109%	93%	98%	104%	97%	114%	105%	111%	104%	104%	7%
Naphthalene	0.03446721		93%	99%	91%	99%	94%	98%	99%	97%	101%	100%	97%	3%
2-Methylnaphthalene	0.03481691		95%	102%	89%	99%	95%	99%	99%	99%	102%	105%	98%	4%
1-Methylnaphthalene	0.03529164		92%	98%	88%	97%	93%	97%	96%	95%	97%	100%	95%	3%
Acenaphthylene	0.03519116		92%	102%	91%	101%	96%	102%	100%	100%	99%	105%	98%	4%
Acenaphthene	0.04041052		90%	97%	88%	95%	90%	96%	95%	96%	95%	99%	94%	3%
Dibenzofuran	0.03681583		91%	98%	90%	98%	98%	97%	97%	97%	97%	102%	96%	3%
Fluorene	0.03597363		95%	102%	94%	102%	99%	103%	102%	102%	101%	105%	100%	3%
Phenanthrene	0.03593768		95%	104%	97%	103%	102%	104%	104%	103%	103%	108%	102%	3%
Anthracene	0.03461047		94%	102%	98%	106%	101%	101%	103%	101%	100%	109%	101%	3%
Fluoranthene	0.03551457		97%	110%	102%	107%	107%	108%	106%	108%	107%	109%	106%	4%
Pyrene	0.03598709		97%	95%	102%	105%	104%	97%	103%	106%	102%	112%	101%	4%
Benz(a)anthracene														
Chrysene	0.03167776		95%	101%	99%	103%	101%	104%	99%	103%	100%	103%	101%	3%
Benzo(b)fluoranthene	0.03396342		100%	108%	105%	109%	110%	112%	109%	111%	110%	111%	108%	4%
Benzo(k)fluoranthene	0.03897959		98%	106%	104%	107%	108%	109%	108%	109%	107%	110%	106%	3%
Benzo(a)pyrene	0.03457818		92%	99%	96%	98%	104%	103%	91%	106%	99%	106%	99%	5%
Indeno(123-cd)pyrene	0.03295193		95%	103%	99%	103%	102%	103%	102%	103%	102%	104%	101%	3%
Dibenz(a,h)anthracene	0.03414697		95%	103%	100%	104%	102%	104%	103%	104%	103%	105%	102%	3%
Benzo(g,h,i)perylene	0.03479871		98%	105%	102%	106%	102%	107%	105%	108%	105%	108%	104%	3%

Method C Limit Study
Combined Massach. ,PH and EPH Methods

QC ID:		GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	Water Statistics					
Sequence ID:		980805	980730	980730	980730	980730	980730	980730	980730	980730	980730	980730						
File ID		05AUGF04	30JULF46/47	30JULF48/49	30JULF50/51	30JULF52/53	30JULF55/56	30JULF57/58	30JULF59/60	30JULF61/62	30JULF63/64	30JULF65/66						
Laboratory ID:		MC980729-RS	MC980729-01	MC980729-02	MC980729-03	MC980729-04	MC980729-05	MC980729-06	MC980729-07	MC980729-08	MC980729-09	MC980729-10	Average	Average	Sigma	Reps	t-value	MDL
Field ID:		Reference Stand	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Water VEPH MD	Conc	Recovery				
Method ID:		D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A MTH	D4007A MTH	D4007A MTH		µg/L				
Sample Size (L):			1	1	1	1	1	1	1	1	1	1						
Percent Solids:			1	1	1	1	1	1	1	1	1	1						
Final Volume (mL)			1	1	1	1	1	1	1	1	1	1						
Dilution Factor			1	1	1	1	1	1	1	1	1	1						
											-Lost-							
RT	Compound		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)					(ug/L)
2.807	Heptane	1547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0%	0.000	9.000	2.896	0.000
5.032	Octane	4070	0.351	0.181	0.254	0.184	0.202	0.289	0.295	0.251		0.265	0.253	25%	0.055	9.000	2.896	0.159
7.892	Nonane	4225	0.561	0.362	0.514	0.318	0.393	0.507	0.507	0.431		0.496	0.454	45%	0.082	9.000	2.896	0.238
10.396	Decane	4415	0.693	0.494	0.672	0.422	0.525	0.659	0.675	0.547		0.637	0.592	59%	0.097	9.000	2.896	0.281
12.990	Undecane	4256	0.716	0.511	0.713	0.439	0.554	0.700	0.721	0.563		0.666	0.521	52%	0.105	9.000	2.896	0.305
15.434	Dodecane	4325	0.707	0.522	0.712	0.456	0.557	0.712	0.723	0.546		0.672	0.623	62%	0.102	9.000	2.896	0.296
17.732	Tridecane	8946	0.699	0.540	0.729	0.488	0.580	0.749	0.732	0.548		0.712	0.642	64%	0.101	9.000	2.896	0.293
19.898	Tetradecane	4365	0.841	0.681	0.864	0.603	0.714	0.878	0.881	0.689		0.872	0.780	78%	0.108	9.000	2.896	0.312
21.940	Pentadecane	4672	0.937	0.799	0.942	0.703	0.826	0.978	0.993	0.819		0.982	0.887	89%	0.102	9.000	2.896	0.297
23.875	Hexadecane	4600	1.100	0.924	1.048	0.790	0.950	1.071	1.120	0.966		1.096	1.007	101%	0.108	9.000	2.896	0.314
25.715	Heptadecane	4334	1.071	0.978	1.085	0.817	0.985	1.104	1.144	1.011		1.130	1.036	104%	0.102	9.000	2.896	0.296
27.483	Octadecane	9229	1.161	1.298	1.219	1.186	1.573	1.266	1.329	1.410		1.301	1.305	130%	0.129	9.000	2.896	0.365
29.134	Nonadecane	707893	0.634	0.631	0.694	0.549	0.888	0.892	0.710	0.660		0.764	0.669	67%	0.061	9.000	2.896	0.176
30.721	Eicosane	4432	1.182	1.149	1.229	0.971	1.215	1.227	1.297	1.148		1.252	1.185	119%	0.094	9.000	2.896	0.272
32.243	Heneicosane	4451	1.185	1.138	1.239	0.975	1.210	1.233	1.284	1.134		1.294	1.188	119%	0.098	9.000	2.896	0.283
33.703	Docosane	4440	1.153	1.119	1.217	0.951	1.189	1.205	1.251	1.105		1.227	1.157	116%	0.092	9.000	2.896	0.265
35.105	Tricosane	4447	1.155	1.117	1.225	0.957	1.187	1.203	1.251	1.110		1.246	1.161	116%	0.092	9.000	2.896	0.267
36.450	Tetracosane	4481	1.092	1.063	1.169	0.907	1.143	1.138	1.188	1.055		1.191	1.105	111%	0.090	9.000	2.896	0.260
37.748	Pentacosane	4368	1.109	1.068	1.181	0.922	1.163	1.156	1.211	1.085		1.225	1.128	113%	0.093	9.000	2.896	0.269
38.997	Hexacosane	4373	1.111	1.068	1.190	0.930	1.163	1.163	1.219	1.080		1.220	1.129	113%	0.091	9.000	2.896	0.264
40.198	Heptacosane	4394	1.106	1.092	1.181	0.927	1.174	1.153	1.212	1.079		1.205	1.125	113%	0.089	9.000	2.896	0.257
41.383	Octacosane	4888	0.996	0.974	1.069	0.832	1.064	1.050	1.100	0.982		1.098	1.018	102%	0.085	9.000	2.896	0.245
42.487	Nonacosane														Coeluted with OTP			
43.878	Triacontane	4474	1.074	1.051	1.152	0.899	1.135	1.128	1.184	1.048		1.185	1.095	110%	0.090	9.000	2.896	0.261
45.650	Dotriacontane	4082	1.096	1.054	1.176	0.898	1.143	1.160	1.206	1.057		1.178	1.107	111%	0.096	9.000	2.896	0.278
47.604	Tetratriacontane	3309	1.110	1.050	1.268	0.909	1.244	1.256	1.341	1.116		1.229	1.169	117%	0.134	9.000	2.896	0.389
49.690	Hexatriacontane	3593	0.965	0.764	0.976	0.679	0.969	1.073	1.047	0.929		0.926	0.925	93%	0.127	9.000	2.896	0.368
56.452	Tetracontane	3132	0.595	0.500	0.780	0.463	0.770	0.888	0.901	0.638		0.554	0.556	56%	0.159	9.000	2.896	0.456
2.290	Benzene	3034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0%	0.000	9.000	2.896	0.000
4.272	Toluene	4837	0.819	0.421	0.437	0.345	0.394	0.511	0.495	0.502		0.532	0.462	46%	0.065	9.000	2.896	0.188
6.870	Ethylbenzene	4976	2.290	2.323	3.187	1.555	2.926	2.688	2.828	2.879		3.716			Interference			
6.889	m,p-Xylene	4529	0.612	0.461	0.542	0.423	0.500	0.570	0.596	0.566		0.611	0.542	54%	0.067	9.000	2.896	0.195
7.470	Styrene	4691	0.559	0.439	0.499	0.386	0.431	0.507	0.527	0.494		0.524	0.485	49%	0.055	9.000	2.896	0.159
7.518	o-Xylene	4225	0.650	0.495	0.589	0.466	0.496	0.602	0.632	0.586		0.637	0.573	57%	0.069	9.000	2.896	0.200
10.244	1,2,4-Trimethylbenzene	4381	0.679	0.612	0.628	0.475	0.530	0.605	0.643	0.591		0.652	0.591	59%	0.070	9.000	2.896	0.203
15.134	Naphthalene	4716	0.787	0.705	0.774	0.607	0.720	0.778	0.834	0.765		0.801	0.752	75%	0.067	9.000	2.896	0.194
17.718	2-Methylnaphthalene	8946	0.747	0.678	0.750	0.597	0.695	0.754	0.809	0.724		0.782	0.726	73%	0.063	9.000	2.896	0.182
18.103	1-Methylnaphthalene	4709	0.741	0.675	0.757	0.600	0.708	0.754	0.818	0.725		0.784	0.729	73%	0.064	9.000	2.896	0.184
21.070	Acenaphthylene	4738	0.744	0.751	0.750	0.630	0.773	0.786	0.801	0.754		0.840	0.759	76%	0.057	9.000	2.896	0.166
21.795	Acenaphthene	4895	0.767	0.742	0.766	0.639	0.783	0.802	0.819	0.768		0.830	0.765	77%	0.056	9.000	2.896	0.162
22.416	Dibenzofuran	4084	0.797	0.818	0.804	0.678	0.815	0.860	0.880	0.836		0.908	0.822	82%	0.065	9.000	2.896	0.189
23.722	Fluorene	4772	0.818	0.814	0.793	0.685	0.832	0.859	0.909	0.816		0.883	0.823	82%	0.064	9.000	2.896	0.185
27.319	Phenanthrene	4866	0.931	0.962	0.938	0.817	0.973	1.012	1.005	0.974		1.029	0.960	96%	0.063	9.000	2.896	0.182
27.487	Anthracene	9229	0.762	0.820	0.769	0.677	0.833	0.848	0.837	0.760		0.850	0.795	80%	0.058	9.000	2.896	0.167
31.887	Fluoranthene	4843	0.942	0.991	0.950	0.874	0.982	1.021	1.013	0.992		1.044	0.979	98%	0.051	9.000	2.896	0.147
32.892	Pyrene	4836	0.956	0.982	0.945	0.859	0.974	1.015	1.006	0.989		1.039	0.974	97%	0.052	9.000	2.896	0.151
37.394	Benz(a)anthracene	4915	0.849	0.897	0.843	0.756	0.890	0.919	0.911	0.890		0.948	0.878	88%	0.057	9.000	2.896	0.164
37.544	Chrysene	3831	0.911	0.972	0.907	0.822	0.972	0.999	0.988	0.981		1.026	0.953	95%	0.063	9.000	2.896	0.182
41.321	Benzo(b)fluoranthene	4888	0.890	0.933	0.893	0.806	0.931	0.970	0.966	0.951		1.000	0.927	93%	0.057	9.000	2.896	0.165
41.409	Benzo(k)fluoranthene	9046	0.960	1.008	0.975	0.866	1.020	1.054	1.062	1.031		1.085	1.007	101%	0.066	9.000	2.896	0.192
42.353	Benzo(a)pyrene	4386	0.759	0.828	0.780	0.668	0.841	0.828	0.819	0.744		0.884	0.794	79%	0.064	9.000	2.896	0.185
45.780	Indeno(123-cd)pyrene	4515	0.833	0.884	0.837	0.756	0.887	0.930	0.933	0.903		0.960	0.880	88%	0.063	9.000	2.896	0.182
45.894	Dibenzo(ah)anthracene	2976	0.829	0.872	0.830	0.750	0.901	0.916	0.906	0.887		0.940	0.870	87%	0.058	9.000	2.896	0.169
48.472	Benzo(ghi)perylene	4834	0.860	0.899	0.861	0.766	0.940	0.937	0.915	0.950		1.010	0.904	90%	0.070	9.000	2.895	0.202

C:\A_SM1998\PROJECTS\A_DATA\GC3\980730\980730.XLS\Water MDLs 8/25/1998 10:30

Method D
Combined Massachs.

Jmt Study
PH and EPH Methods

GC ID:	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP	GC-III HP									
Sequence ID:	980806	980730	980730	980730	980730	980730	980730	980730	980730	980730	980730									
File ID:	05AUGF04	30JULF16/17	30JULF18/19	30JULF20/21	30JULF22/23	30JULF24/25	30JULF26/27	30JULF28/29	30JULF31/32	30JULF33/34	30JULF35/36									
Laboratory ID:	MC980729-R3	MC980727-01	MC980727-02	MC980727-03	MC980727-04	MC980727-05	MC980727-06	MC980727-07	MC980727-08	MC980727-09	MC980727-10									
Field ID:	Reference Stand	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL	Soil VEPH MDL									
Method ID:	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH	D4007A.MTH									
Sample Size (g):		10	10	10	10	10	10	10	10	10	10									
Percent Solids:		1	1	1	1	1	1	1	1	1	1									
Final Volume (mL):		1	1	1	1	1	1	1	1	1	1									
Dilution Factor		1	1	1	1	1	1	1	1	1	1									
															Soil Statistics					
													Average Conc	Average Recovery	Sigma	Reps	t-Value	MDL		
														0.13 mg/kg						
RT	Compound	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	-Lost- (mg/kg)	(mg/kg)	(mg/kg)		(mg/kg)					(mg/kg)
2.807	Heptane	1547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.037		0.000	0.054	4%	0.012	9.000	2.896			0.036
5.032	Octane	4070	0.036	0.038	0.049	0.044	0.046	0.037	0.040	0.052		0.061	0.045	45%	0.008	9.000	2.896			0.024
7.692	Nonane	4225	0.062	0.063	0.082	0.077	0.082	0.068	0.066	0.100		0.112	0.079	79%	0.017	9.000	2.896			0.049
10.398	Decane	4415	0.075	0.074	0.091	0.091	0.097	0.081	0.083	0.119		0.125	0.093	93%	0.018	9.000	2.896			0.053
12.990	Undecane	4256	0.079	0.078	0.097	0.095	0.104	0.087	0.089	0.127		0.132	0.095	95%	0.020	9.000	2.896			0.057
15.434	Dodecane	4325	0.082	0.080	0.100	0.097	0.106	0.091	0.089	0.132		0.137	0.102	102%	0.020	9.000	2.896			0.059
17.732	Tridecane	8946	0.088	0.086	0.103	0.100	0.114	0.095	0.091	0.136		0.151	0.107	107%	0.023	9.000	2.896			0.066
19.896	Tetradecane	4365	0.094	0.090	0.103	0.099	0.131	0.096	0.101	0.136		0.147	0.112	112%	0.020	9.000	2.896			0.059
21.940	Pentadecane	4672	0.101	0.096	0.200	0.106	0.129	0.136	0.099	0.151		0.165	0.132	132%	0.035	9.000	2.896			0.102
23.875	Hexadecane	4600	0.110	0.108	0.120	0.114	0.138	0.114	0.105	0.165		0.175	0.127	127%	0.026	9.000	2.896			0.076
25.715	Heptadecane	4334	0.111	0.108	0.121	0.116	0.138	0.116	0.107	0.166		0.181	0.129	129%	0.027	9.000	2.896			0.078
27.463	Octadecane	9229	0.139	0.137	0.162	0.155	0.182	0.154	0.141	0.221		0.241	0.175	175%	0.037	9.000	2.896			0.108
29.134	Nonadecane	707893	0.051	0.050	0.054	0.053	0.063	0.051	0.049	0.077		0.082	0.059	59%	0.012	9.000	2.896			0.036
30.721	Eicosane	4432	0.117	0.112	0.125	0.121	0.143	0.121	0.110	0.175		0.189	0.135	135%	0.029	9.000	2.896			0.083
32.243	Heneicosane	4451	0.116	0.113	0.126	0.121	0.143	0.123	0.112	0.173		0.186	0.135	135%	0.027	9.000	2.896			0.079
33.703	Docosane	4440	0.114	0.112	0.124	0.120	0.141	0.120	0.111	0.170		0.184	0.132	132%	0.027	9.000	2.896			0.077
35.105	Tricosane	4447	0.115	0.114	0.125	0.120	0.142	0.121	0.112	0.173		0.186	0.134	134%	0.027	9.000	2.896			0.079
36.450	Tetracosane	4481	0.112	0.109	0.130	0.122	0.133	0.118	0.107	0.170		0.177	0.127	127%	0.026	9.000	2.896			0.075
37.748	Pentacosane	4368	0.113	0.110	0.122	0.118	0.138	0.119	0.109	0.169		0.182	0.131	131%	0.027	9.000	2.896			0.077
38.997	Hexacosane	4373	0.113	0.111	0.121	0.118	0.138	0.117	0.110	0.168		0.182	0.131	131%	0.027	9.000	2.896			0.077
40.198	Heptacosane	4394	0.112	0.109	0.121	0.117	0.138	0.117	0.108	0.166		0.179	0.130	130%	0.026	9.000	2.896			0.076
41.363	Octacosane	4888	0.100	0.098	0.109	0.105	0.123	0.105	0.098	0.151		0.162	0.117	117%	0.024	9.000	2.896			0.069
42.487	Nonacosane														Coeluted with OTP					
43.575	Triacontane	4474	0.108	0.106	0.119	0.115	0.134	0.114	0.106	0.162		0.176	0.127	127%	0.025	9.000	2.896			0.074
45.650	Dotriacontane	4062	0.111	0.107	0.123	0.122	0.143	0.113	0.112	0.163		0.177	0.130	130%	0.025	9.000	2.896			0.073
47.604	Tetratriacontane	3309	0.113	0.110	0.137	0.143	0.165	0.110	0.133	0.164		0.178	0.139	139%	0.025	9.000	2.896			0.074
49.890	Hexatriacontane	3593	0.086	0.082	0.112	0.136	0.149	0.080	0.121	0.119		0.123	0.112	112%	0.024	9.000	2.896			0.070
56.452	Tetracontane	3132	0.066	0.061	0.102	0.144	0.153	0.052	0.125	0.080		0.080	0.095	95%	0.037	9.000	2.896			0.108
2.260	Benzene	3034	0.000	0.000	0.000	0.037	0.035	0.025	0.033	0.123		0.025	0.031	31%	0.038	9.000	2.896			0.110
4.272	Toluene	4637	0.052	0.041	0.051	0.056	0.050	0.042	0.020	0.056		0.020	0.043	43%	0.014	9.000	2.896			0.040
6.670	Ethylbenzene	4975	1.121	0.731	0.993	1.075	0.680	1.113	1.804	0.118		1.106			Interference					
6.889	m,p-Xylene	4529	0.065	0.049	0.066	0.073	0.066	0.062	0.026	0.076		0.038	0.059	59%	0.017	9.000	2.896			0.048
7.470	Styrene	4691	0.062	0.047	0.061	0.069	0.059	0.060	0.026	0.073		0.030	0.054	54%	0.016	9.000	2.896			0.048
7.518	o-Xylene	4225	0.078	0.063	0.083	0.091	0.072	0.086	0.056	0.222		0.049	[illegible]	[illegible]	[illegible]	9.000	2.896			0.150
10.244	1,2,4-Trimethylbenzene	4381	0.078	0.067	0.082	0.093	0.081	0.083	0.075	0.326		0.055	[illegible]	55%	[illegible]	9.000	2.896			0.243
15.134	Naphthalene	4716	0.091	0.063	0.084	0.101	0.086	0.089	0.092	0.544		0.092	0.138	138%	0.053	9.000	2.896			0.442
17.716	2-Methylnaphthalene	8946	0.083	0.071	0.089	0.097	0.087	0.089	0.091	0.497		0.099	[illegible]	[illegible]	[illegible]	9.000	2.896			0.396
18.103	1-Methylnaphthalene	4709	0.085	0.070	0.089	0.093	0.087	0.089	0.092	0.483		0.096	[illegible]	[illegible]	[illegible]	9.000	2.896			0.382
21.070	Acenaphthylene	4738	0.094	0.072	0.096	0.103	0.097	0.097	0.093	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.896			0.417
21.795	Acenaphthene	4895	0.089	0.078	0.089	0.094	0.090	0.091	0.095	0.510		0.106	[illegible]	[illegible]	[illegible]	9.000	2.896			0.404
22.416	Dibenzofuran	4064	0.094	0.078	0.095	0.098	0.095	0.096	0.100	0.529		0.115	0.145	45%	0.044	9.000	2.896			0.418
23.722	Fluorene	4772	0.098	0.080	0.095	0.101	0.096	0.099	0.102	0.538		0.119	0.147	47%	0.045	9.000	2.896			0.433
27.319	Phenanthrene	4666	0.106	0.088	0.103	0.105	0.103	0.105	0.108	0.571		0.126	0.157	157%	0.048	9.000	2.896			0.450
27.487	Anthracene	9229	0.092	0.071	0.092	0.092	0.091	0.093	0.088	0.521		0.112	0.139	139%	0.043	9.000	2.896			0.415
31.887	Fluoranthene	4843	0.108	0.090	0.105	0.109	0.105	0.108	0.110	0.580		0.130	0.161	161%	0.049	9.000	2.896			0.456
32.892	Pyrene	4836	0.105	0.089	0.105	0.109	0.105	0.108	0.109	0.052		0.128	0.157	157%	0.048	9.000	2.896			0.450
37.394	Benz(a)anthracene	4915	0.084	0.082	0.097	0.100	0.098	0.084	0.101	0.554		0.120	0.145	145%	0.043	9.000	2.896			0.443
37.544	Chrysene	3831	0.288	0.091	0.104	0.108	0.107	0.107	0.111	0.595		0.131	0.183	183%	0.056	9.000	2.896			0.481
41.321	Benzo(b)fluoranthene	4888	0.108	0.089	0.102	0.113	0.105	0.106	0.108	0.607		0.127	0.162	162%	0.057	9.000	2.896			0.484
41.409	Benzo(k)fluoranthene	9046	0.110	0.093	0.107	0.114	0.109	0.111	0.112	0.611		0.131	0.166	166%	0.057	9.000	2.896			0.484
42.353	Benzo(a)pyrene	4386	0.090	0.059	0.091	0.086	0.088	0.091	0.078	0.541		0.111	0.137	137%	0.052	9.000	2.896			0.440
45.780	Indeno(123-cd)pyrene	4515	0.099	0.083	0.094	0.100	0.096	0.099	0.100	0.564		0.120	0.151	151%	0.055	9.000	2.896			0.450
45.894	Dibenzo(ah)anthracene	2978	0.101	0.085	0.096	0.102	0.098	0.099	0.101	0.570		0.120	0.152	152%	0.057	9.000	2.896			0.454
46.472	Benzo(ghi)perylene	4634	0.103	0.084	0.098	0.103	0.099	0.101	0.102	0.579		0.121	0.154	154%	0.059	9.000	2.896			0.462

Appendix E

In-House Laboratory Audit Checklist

Laboratory Audit

Date of audit: _____

Evaluator: _____

Location of audit: _____

_____

1.0 General

1.1 Have corrective actions identified in the last QA audit been implemented? _____ ☐ Yes ☐ No

_____

_____

_____

1.2 Was the laboratory found to be neat and orderly? _____ ☐ Yes ☐ No

_____

1.3 Is a current copy of the Laboratory Quality Assurance Plan (LQAP) available in the laboratory? ☐ Yes ☐ No

1.4 Is a current copy of the Health and Safety Plan available in the laboratory? ☐ Yes ☐ No

1.5 Are current copies of Material Safety Data Sheets (MSDSs) available in the laboratory? ☐ Yes ☐ No

2.0 Sample Log-in

2.1 Is a sample log-in SOP available to the log-in staff? ☐ Yes ☐ No

2.2 If custody seals were used, is condition noted on the chain of custody (COC)? _____ ☐ Yes ☐ No

_____

2.3 Does the log-in staff record the physical condition, temperature, or any ambiguities (such as samples not listed on the COC) on the COC? ☐ Yes ☐ No

_____

_____

2.4 At what point are the COCs signed? _____

_____

2.5 Who is notified (and when) of any problems with the samples or sample log-in? _____

_____

2.6 Are the COC forms stored in a designated, secure, and orderly place? ☐ Yes ☐ No

_____

_____

2.7 Are all COC forms dated for receipt? _____ ☐ Yes ☐ No

_____

2.8 Are Lab IDs written on the COCs? _____ ☐ Yes ☐ No

_____

2.9 Is a copy of the lab log-in sheet included with the COC in the notebook? _____ ☐ Yes ☐ No

_____

3.0 Sample Storage

3.1 Are all samples kept in sample refrigerators when not being logged-in or extracted? _____ ☐ Yes ☐ No

_____

3.2 Is the temperature of all refrigerators recorded daily in logbooks? ☐ Yes ☐ No

3.3 What corrective actions are initiated if the refrigerator temperature is out of control? _____

_____

_____

3.4 Are the refrigerators containing custody-sealed samples kept locked when not in use? _____ ☐ Yes ☐ No

_____

3.5 Are other refrigerators located in a secure area of the facility with restriced access? _____ ☐ Yes ☐ No

_____

3.6 Does the Sample Storage Log listing match the contents of the storage unit? _____ ☐ Yes ☐ No

_____

3.7 Is the storage unit ID listed on the sample log-in sheet? _____ ☐ Yes ☐ No

_____

3.8 Are samples signed out and back in by the laboratory staff? _____ ☐ Yes ☐ No

_____

_____

3.9 Are samples kept separate from standards and extracts? _____ ☐ Yes ☐ No

_____

3.10 Is there adequate storage for the number of samples received and stored? _____ ☐ Yes ☐ No

_____

3.11 How long are samples kept before being disposed of or returned to the client? _____

_____

4.0 Sample Preparation

4.1 Are there laboratory specific SOPs for all developed or modified sample preparation methods? _____ ☐ Yes ☐ No

_____

4.2 Are copies of standard methods available for all standard sample preparation methods? _____ ☐ Yes ☐ No

_____

4.3 Are SOPs current? _____ ☐ Yes ☐ No

_____

4.4 Are SOPs readily available to laboratory staff? _____ ☐ Yes ☐ No

_____

4.5 Is trace-free water available for preparation of standards and blanks? ☐ Yes ☐ No

_____

_____

4.6 Is the lab water monitored for contaminants regularly? ☐ Yes ☐ No
How is this done? _____

_____

4.7 Is sufficient dedicated glassware and equipment available to meet project needs? _____ ☐ Yes ☐ No

_____

4.8 Are sufficient solvents available for preparation of samples? _____ ☐ Yes ☐ No

_____

4.9 Are solvents stored properly (in flammable or acid storage cabinets or original packaging)? _____ ☐ Yes ☐ No

_____

4.10 Are solvents monitored for contaminants regularly? (Check logbook) ☐ Yes ☐ No

_____

_____

4.11 Are all solvent bottles labelled with the date of receipt and date of opening? _____ ☐ Yes ☐ No

_____

4.12 Are all sample extraction sheets completed? ☐ Yes ☐ No

Dates	☐ Yes	☐ No
Initials	☐ Yes	☐ No
Sample amounts	☐ Yes	☐ No
Spike solution IDs	☐ Yes	☐ No
Final volumes	☐ Yes	☐ No
Single-line crossouts, initialed and dated	☐ Yes	☐ No

_____

_____

4.13 Are all sample extraction sheets filed in the correct notebook? ☐ Yes ☐ No

_____

4.14 Are copies of the sample extraction sheets submitted to the correct project manager? _____ ☐ Yes ☐ No

_____

4.15 Are all samples routinely prepared within proper holding times? ☐ Yes ☐ No

_____

4.16 If holding times are exceeded, are proper procedures followed to notify the QA manager, project manager, and client? _____ ☐ Yes ☐ No

_____

4.17 Is there sufficient hood space? _____ ☐ Yes ☐ No

_____

4.18 Is a method blank, matrix spike blank, duplicate, and matrix spike prepared with every extraction batch, unless specified otherwise by the project manager, QAM or QAO? _____ ☐ Yes ☐ No

_____

_____

5.0 Sample Analysis

5.1 Are method detection limit (MDL) study results available for each method and matrix analyzed? _____ ☐ Yes ☐ No

_____

5.2 Are MDL studies updated annually? _____ ☐ Yes ☐ No

_____

5.3 Are the MDL results filed appropriately? _____ ☐ Yes ☐ No

_____

5.4 Does the laboratory maintain an instrument logbook for each instrument? _____ ☐ Yes ☐ No

_____

5.5 Are all three sections of each instrument logbook up-to-date?

Run log/Sequence table	☐ Yes	☐ No
Instrument Maintenance/Repair	☐ Yes	☐ No
ICal summary	☐ Yes	☐ No

_____

_____

5.6 Can verification be made that initial calibrations are run after major instrument maintenance (i.e. column changes)? _____ ☐ Yes ☐ No

_____

5.7 Is a QC check standard(s) run after every initial calibration? _____ ☐ Yes ☐ No

_____

5.8 Have logbook corrections been made by a single-line cross-out, initialed and dated? _____ ☐ Yes ☐ No

_____

5.9 Are there laboratory specific SOPs for all developed or modified sample analysis methods? _____ ☐ Yes ☐ No

_____

5.10 Are copies of standard methods available for all standard sample analysis methods? ☐ Yes ☐ No

5.11 Are corrective actions, if needed, taken in a timely manner to assure analysis will be completed within the required holding times? ☐ Yes ☐ No

_____

5.12 Does the laboratory reextract samples when surrogates are not within recovery limits? _____ ☐ Yes ☐ No

_____

5.13 Does the laboratory reextract samples associated with a method blank with contamination greater than five times the PQL? _____ ☐ Yes ☐ No

_____

5.14 Are samples routinely analyzed within analytical holding times? ☐ Yes ☐ No

_____

5.15 Is the GC/MS properly tuned before running any standards or samples? _____ ☐ Yes ☐ No

_____

5.16 Is the run logbook filled out daily or are the sequence tables printed out daily? _____ ☐ Yes ☐ No

_____

5.17 Does the sample header information include dilution factors, final volumes (if not a standard), complete lab ID, etc.? _____ ☐ Yes ☐ No

_____

5.18 Are the standard IDs unique and traceable? _____ ☐ Yes ☐ No

_____

5.19 Are the method blank IDs unique and traceable? _____ ☐ Yes ☐ No

_____

5.20 If the system does not meet calibration criteria for the method, is the system recalibrated and associated samples reanalyzed? _____ ☐ Yes ☐ No

_____

5.21 Are out-of-range samples diluted and reanalyzed? _____ ☐ Yes ☐ No

_____

5.22 Does the laboratory have an updated inhouse NBS library? _____ ☐ Yes ☐ No

_____

5.23 Are sufficient compressed gases available? _____ ☐ Yes ☐ No

_____

6.0 Instrument Maintenance and Repair

6.1 Are sufficient spare parts available (i.e. septa, syringes, ferrules, filaments)? _____ ☐ Yes ☐ No

_____

6.2 Does the laboratory have a service contract for each instrument? ☐ Yes ☐ No

_____

6.3 Does the laboratory maintain an instrument maintenance logbook for each instrument? _____ ☐ Yes ☐ No

_____

6.4 Is the maintenance logbook up-to-date? _____ ☐ Yes ☐ No

_____

6.5 Are all entries initialed and dated? _____ ☐ Yes ☐ No

_____

7.0 Data Reduction and Review

Select an analytical batch from the instrument run logbook and examine the data for the following:

7.1 Are copies of the chromatogram, scaled chromatogram (if necessary), quant report, and area report printed out for each sample, blank, and standard? _____ ☐ Yes ☐ No

_____

7.2 If the samples were analyzed by GC/MS, are copies of EICs for all detected unspiked compounds included for all samples? _____ ☐ Yes ☐ No

_____

_____

7.3 Are copies of the sample results worksheets present for every sample, blank, and standard? _____ ☐ Yes ☐ No

_____

7.4 Are the sample results worksheets properly reviewed by the analyst before being given to the lab director (i.e. have results <PQL or misidentified peaks been crossed off, results over calibration range flagged "E", and acceptable results boxed)? _____ ☐ Yes ☐ No

_____

_____

7.5 Is the correct header information listed on the sample results worksheet (particularly instrument ID)? _____ ☐ Yes ☐ No

_____

7.6 Are worksheets initialed and dated by the analyst? _____ ☐ Yes ☐ No

_____

7.7 Have the worksheets been reviewed and signed by the lab director? ☐ Yes ☐ No

_____

7.8 Have blank contaminants been flagged? _____ ☐ Yes ☐ No

_____

7.9 Is the correct associated method blank used for review? _____ ☐ Yes ☐ No

_____

7.10 Have the internal standard areas and surrogate spike recoveries been reviewed? _____ ☐ Yes ☐ No

_____

7.11 Have reanalyses, reextractions, and dilutions been noted on the worksheet? _____ ☐ Yes ☐ No

_____

7.12 Have the raw data and worksheets been QA reviewed by the QAM or QAO prior to release to the project manager? _____ ☐ Yes ☐ No

_____

7.13 Have copies of the completed worksheets been submitted to the project manager? _____ ☐ Yes ☐ No

_____

8.0 Data Acquisition and Storage

8.1 Are there laboratory specific SOPs for data reporting, reduction review, and storage? ☐ Yes ☐ No

8.2 Are all raw data stored on magnetic media? _____ ☐ Yes ☐ No

_____

8.3 At what frequency is a system backup performed? _____

_____

8.4 Is there a file storage directory? _____ ☐ Yes ☐ No

_____

8.5 Is it a simple matter to locate and retrieve from tape or disk an archived data file? _____ ☐ Yes ☐ No

_____

8.6 How long does the laboratory routinely retain these tapes? _____

_____

9.0 Standard Preparation and Storage

9.1 Does the laboratory maintain a logbook for standards preparation? ☐ Yes ☐ No

_____

_____

9.2 Can all standards be traced from chromatogram header information back to a specific source and lot number? _____ ☐ Yes ☐ No

_____

9.3 Are all entries signed, dated, and reviewed by the lab director? ☐ Yes ☐ No

_____

9.4 Are there laboratory SOPs for standard preparations? _____ ☐ Yes ☐ No

_____

9.5 Have all laboratory staff whose names appear in the standard preparation notebook also signed the SOP for standards preparation? ☐ Yes ☐ No

_____

_____

9.6 Are fresh standards prepared consistent with the LQAP? _____ ☐ Yes ☐ No

_____

9.7 Are all standards labelled correctly and fully? _____ ☐ Yes ☐ No

_____

9.8 Are all standards labelled with an expiration date consistent with the LQAP? _____ ☐ Yes ☐ No

_____

9.9 Are any standards beyond their expiration dates? _____ ☐ Yes ☐ No

_____

9.10 Are all standards stored in a freezer separate from samples and extracts? _____ ☐ Yes ☐ No

_____

9.11 Is the temperature of the standards freezer recorded daily? _____ ☐ Yes ☐ No

_____

9.12 What corrective actions are initiated if the freezer temperature is out of control? _____

_____

9.13 Are all standards verified by the analysis of a QC check standard prior to use? _____ ☐ Yes ☐ No

_____

9.14 Are old standards purged as new ones are made? _____ ☐ Yes ☐ No

_____

9.15 Is the standards rolodex file up-to-date? _____ ☐ Yes ☐ No

_____

9.16 Is the chemical inventory logbook up-to-date? _____ ☐ Yes ☐ No

_____

10.0 Sample and Laboratory Waste Disposal

10.1 Does an SOP exist for waste disposal? _____ ☐ Yes ☐ No

_____

10.2 Is there a posted summary of lab waste disposal? _____ ☐ Yes ☐ No

_____

10.3 Are all laboratory staff well-versed in proper disposal practice? ☐ Yes ☐ No

_____

10.4 Are there sufficient waste containers for each type of waste? _____ ☐ Yes ☐ No

_____

10.5 Are laboratory solvent waste containers emptied into the waste storage drums on a regular basis (i.e. when they are full)? _____ ☐ Yes ☐ No

_____

10.6 Are samples purged from the refrigerators and disposed of on a regular basis? _____ ☐ Yes ☐ No

_____

11.0 Training Records

11.1 Does the laboratory have an active training program for all employees? _____ ☐ Yes ☐ No

_____

11.2 Can evidence be provided that all employees have received training and can demonstrate proficiency prior to analyzing samples? ☐ Yes ☐ No

_____

_____

11.3 Are training records current? _____ ☐ Yes ☐ No

_____

11.4 Do SOPs exist for the training program? _____ ☐ Yes ☐ No

_____

11.5 Do all employees sign that they have read and understand the laboratory SOPs? _____ ☐ Yes ☐ No

_____

12.0 Observations and Conclusions:

13.0 Corrective Actions: