KERR-McGEE CHEMICAL CORPORATION

Test Plan - Phase I Treatability Study of Soil Washing Treatment Technology

Moss-American Site
Milwaukee, Wisconsin

BERGMANN USA

7 August 1992

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22 January 1993

Ms. Bonnie L. Eleder (HSRW-6J)
Remedial Project Manager
U.S. Environmental Protection Agency
77 W. Jackson Blvd.
Chicago, Illinois 60604-3590

Re: Final Test Plan - Phase I Treatability
Study of Soil Washing Treatment Technology
Moss-American Site - Milwaukee, WI

Dear Ms. Eleder:

Roy F. Weston, Inc. (WESTON®), on behalf of the settling defendant for the Moss-American Site, is hereby transmitting the final version of the above-referenced test plan.

This final version incorporates the revised pages that were approved in U.S. EPA's letter of 21 December 1992 and received by WESTON on 31 December 1992.

Please note that Section 6 of the test plan provides additional information related to anticipated goals of laboratory accuracy for the testing. This additional information addresses the remaining unresolved comment noted in your 21 December 1992 approval letter. By this transmittal, we are also providing our subcontractor, Bergmann USA, with authorization to begin the treatability study work. The work will then proceed per the schedule presented in Section 12 of the test plan.

Very truly yours,

ROY F. WESTON, INC.

Gary J. Deigan
Senior Project Manager

Kurt S. Stimpson
Project Director

GJD/KSS/slr
Enclosure (2 copies)

CH01\PUBLIC:\WO\MOSSAMER\9438.LTR

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TEST PLAN
PHASE I TREATABILITY STUDY OF SOIL WASHING TREATMENT TECHNOLOGY

Moss-American Site
Milwaukee, Wisconsin

Prepared by

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August 1992

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SECTION 1
PROJECT DESCRIPTION

Background

The United States Environmental Protection Agency (U.S. EPA), pursuant to Section 105 of 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), placed the Moss-American site in Milwaukee, Wisconsin (the Facility) on the National Priorities List (NPL). The U.S. EPA conducted a remedial investigation/feasibility study (RI/FS) for the Facility and issued the corresponding RI and FS reports on January 9, and May 24, 1990, respectively.

On May 29, 1990, U.S. EPA published a notice of completion of the RI/FS and issued the proposed remedial action plan for the Facility. A public comment period began with issuance of the proposed plan and extended until August 6, 1990. On September 27, 1990, the U.S. EPA Regional Administrator signed the Record of Decision (ROD), which describes the remedial action plan for the Facility. Public comments that were received, and the U.S. EPA response to the comments were included in the ROD with which the state of Wisconsin has expressed concurrence.

A Consent Decree (CD) incorporating the Statement of Work (SOW) was signed by Kerr-McGee Chemical Corporation, Inc. (KMCC) on July 17, 1991. The CD was lodged by the U.S. Department of Justice on December 28, 1991. Under this CD, the Settling Defendant, KMCC, will lead in developing and implementing the remedial design and remedial action plan for the Facility.

Facility Location

The Facility is located in the northwestern section of the city of Milwaukee, county of Milwaukee, state of Wisconsin, at the southeast corner of the intersection of Brown Deer and Granville Roads, at 8716 Granville Road. The Facility, as defined by the CD, includes the former Moss-American wood preserving plant property and approximately 5 miles of the Little Menomonee River. The Little Menomonee River, portions of which are defined as part of the Facility, flows through the eastern portion of the former wood preserving plant, continuing on through the Milwaukee County Parkway, to its confluence with the Menomonee River about 5 miles south. Portions of the Little Menomonee River's floodplain are included in the Facility boundary. Fifty-one acres of the former wood preserving plant are undeveloped Milwaukee County park land. Twenty-three acres are owned by the Chicago and North Western Transportation Company and used as a loading and storage area for automobile transport. The Facility is located in a moderately-populated suburban area of mixed industrial, commercial, residential, and recreational use. Population in the nearby area is estimated at 2,036 persons per square mile.

Purpose and Content of Test Plan

Excavated soils/sediments from the Moss American site which exceed the cleanup criterion will be treated by the bioslurry process. Soil washing may be used (at KMCC's option) as a adjunct to the bioslurry process. This option would be exercised if the use of soil washing will reduce subsequent treatment requirements.

Treatability testing to be conducted under this Test Plan will be used to evaluate the feasibility and implementability of soil washing as an adjunct to the bioslurry process.

Roy F. Weston, Inc. (WESTON®) is the prime contractor to the Settling Defendant, KMCC, responsible for the CD implementation. WESTON has contracted Bergmann USA of Stafford Springs, CT (Bergmann) to conduct laboratory-scale treatability studies to evaluate

the effectiveness of the soil washing technology in treating creosote-impacted soils at the Moss-American site. The treatability studies will be conducted as part of Predesign Task 16 of the Statement of Work (SOW).

Bergmann will provide all services necessary to plan, implement, analyze and report the results of treatability testing of the soil washing treatment process. The intent of testing is to determine the ability of such processes to treat creosote-contaminated soils from the Moss-American site. The polycyclic aromatic hydrocarbon (PAH) components of creosote and carcinogenic polycyclic aromatic hydrocarbons (CPAH) are the site contaminants of concern. According to the RI, the maximum PAH concentration is 32,000 milligrams per kilogram (mg/kg); BTX concentrations range up to 17 mg/kg. The CPAH concentrations are 300 to 400 mg/kg. Maximum CPAH concentrations are approximately 1,900 mg/kg. The SOW requires treatment of contaminated site soils and sediments to 6.1 mg/kg of total CPAHs.

SECTION 2

OVERVIEW OF THE BERGMANN SOIL/SEDIMENT WASHING PROCESS

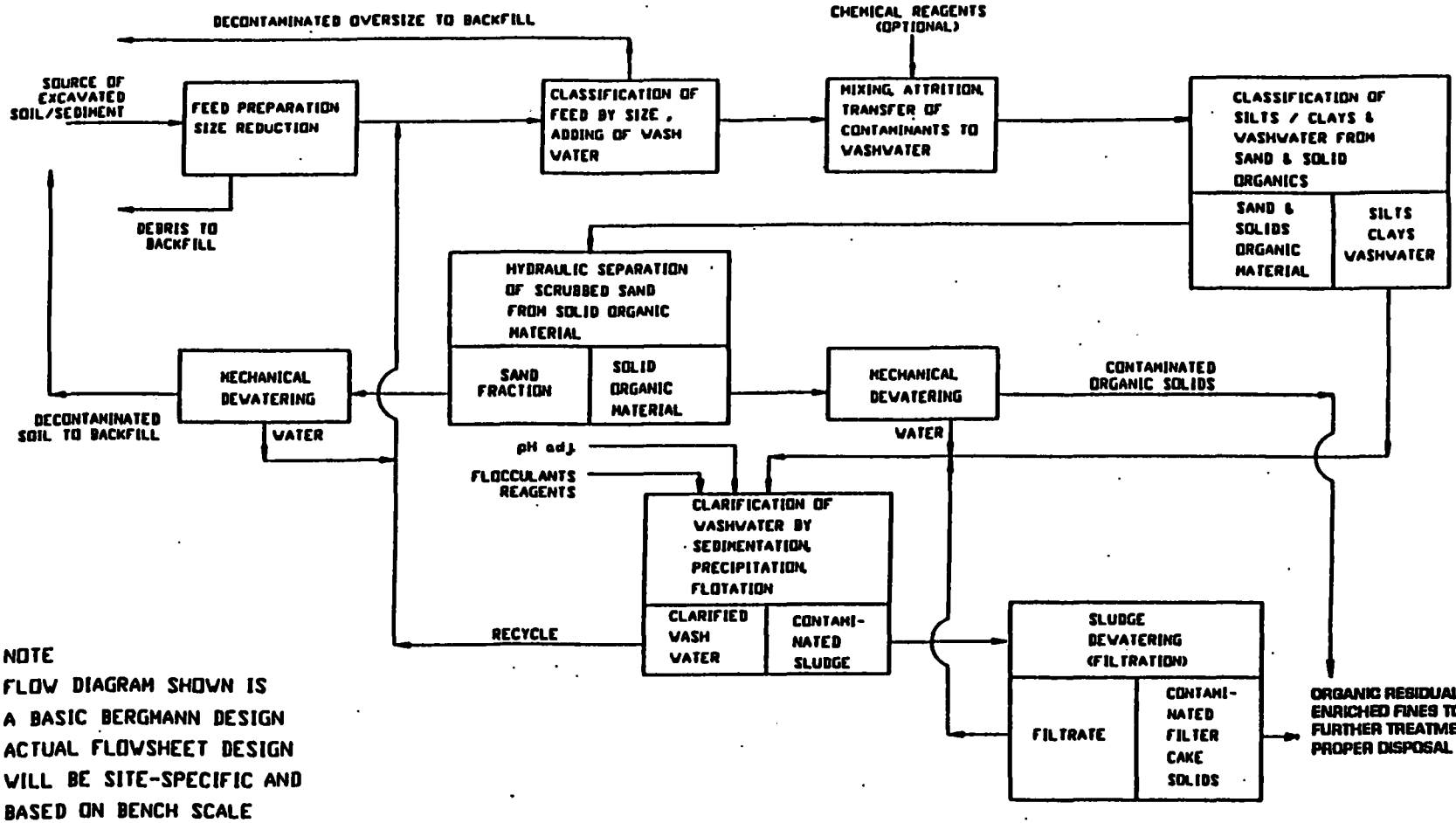
Soil and sediment washing is an aqueous (water based) volume reduction process whereby hazardous contaminants are extracted and concentrated into a smaller residual portion of the original volume using primarily physical separation methods. The process concept involves transfer of the contaminants from the soil or sediments to the wash water and their subsequent removal from the water via further treatment. Cleaned coarse sand and gravel portions of the treated soil/sediment may then be redeposited on site or otherwise beneficially used as construction fill material, concrete and asphalt aggregate, or daily landfill cover. The now smaller volume of contaminated residual concentrate is subsequently treated by other technologies.

The physical techniques that have been employed by the Bergmann technology have included crushing, screening, wet classification, attrition scrubbing, dense media separation, elutriation, dissolved air flotation, gravity separation and mechanical dewatering. Associated chemical additives may include detergents, surfactants, chelating agents, solvents, coagulants, flocculants and pH adjustment, as necessary. Figure 2-1 presents a typical process flow schematic of the soil washing technology.

Applications

The Bergmann soil washing technology may be an effective treatment involving volumetric reduction and feedstock preparation of land based soils, as well as river and harbor sediments.

The process can be an effective and economical remedial technology when the contaminated soil or sediment contains no more than 40 percent silt and clay material smaller than 63 micron (200 mesh). Solid organic material (leaves, roots, wood, etc.) should not exceed 20 percent by volume.



NOTE
FLOW DIAGRAM SHOWN IS A BASIC BERGMANN DESIGN ACTUAL FLOWSHEET DESIGN WILL BE SITE-SPECIFIC AND BASED ON BENCH SCALE TREATABILITY DATA.

NO.	DATE	REVISIONS	BY

BERGMANN USA

FIGURE 2-1
Conceptual Process Flow Diagram for Soils Washing Plant Design

MACHINED DIMENSIONS ± 1/64 EXCEPT WHERE NOTED FINISH 125 √ EXCEPT AS NOTED		MATERIAL	
DRAWN PTS	DATE:	DRAWING NUMBER BGB-1002	REV. 0
CHECKED	SCALE:		

Typical hazardous contaminant groups which have been removed from coarse soil and sediment fractions may include:

- Petroleum and heavy fuel residuals.
- PCP.
- Radioactive contaminants.
- Pesticides.
- Heavy metals.
- Cyanides.
- PCBs.

Effectiveness

Contaminant extraction efficiencies of up to 99 percent or better have been achieved by employing Bergmann commercial soil washing systems on specific contaminants and site soils. Cleanup performance is, in all cases, site-specific, and dependent upon the particular physical and chemical properties of the contaminated soil and sediment. Although Bergmann European designed soils washing plants have been successfully applied to creosote contaminated sites, the effectiveness of full-scale soil washing on creosote-impacted soils in the United States has not yet been widely demonstrated. A laboratory treatability study is an essential first step. On occasion, on site tests are also conducted using mobile or transportable 250 kg/day Bergmann pilot plant equipment.

Waste Minimization

Soils and sediment washing can make an important contribution to waste minimization when used as a **pretreatment** in conjunction with other treatment processes. Normally this process results in the concentration of hazardous contaminants into a residual (<63 microns) product representing 10 to 30 percent of the original volume. The residual contaminant concentrates produced from the soil/sediment washing operations can provide an efficient feedstock for downstream treatment technologies.

The washed (decontaminated) coarse fractions (>63 microns) which may represent 70 percent to 90 percent of the original volume, can either be redeposited on site or otherwise beneficially used.

SECTION 3
TEST OBJECTIVES

The test objective of the Phase I laboratory-scale treatability test program is to demonstrate the ability of the aqueous soil washing process to produce a clean sand product that will pass the currently established "clean-up criterion" for the excavated site materials of 6.1 mg/kg of the carcinogenic polycyclic aromatic hydrocarbon (CPAHs) fraction. Feasibility will be determined on the basis of both achievement of the cleanup criterion and an evaluation of overall treatment efficacy.

This testing will emphasize the aqueous, size classification soil washing process (without added chemical reagents/surfactants). Initial screening evaluation of selected reagents will be included. The need for chemical reagents/surfactants to achieve contaminant separation may negatively affect feasibility and implementability of the soil washing option. Phase 1 testing will provide an assessment of whether purely aqueous soil washing will provide adequate separation.

Specific findings/data that are anticipated to be determined during this treatability study include:

- Particle Size Distribution of Site Soils.
- Identification of Process for Contaminant Removal.
- Contaminant Removal Efficiency.
- Pilot/Full Scale Plant Process Flow Diagrams.
- Identification of Unit Process Modules & Operational Sequences.
- Full-Scale Operational System Mass Balance Calculations.

There findings/data will be presented in a Technical Memorandum (TM). This TM will be transmitted to U.S. EPA and WDNR for review and comment. Section 12 shows the anticipated schedule for the TM transmittal.

SECTION 4
EXPERIMENTAL DESIGN AND PROCEDURES

4.1 SAMPLE PROCUREMENT AND INITIAL CHARACTERIZATION (BY WESTON)

The test material employed in the soil washing studies will be collected from the Moss-American site. Two representative, composite samples will be collected, with one composite soil sample containing carcinogenic polycyclic aromatic hydrocarbons (CPAH) in the range of 300 to 600 milligrams per kilogram (mg/kg) and one sample containing CPAH in the range of 1,000 to 1,500 mg/kg. Initial characterization of the samples will be conducted immediately following sample collection. Test parameters will include bulk density, particle size distribution, porosity, moisture, liquid/plastic limits, pH, total organic carbon (TOC), and total and specific polycyclic aromatic hydrocarbons (PAH)-degrading microbial populations. A detailed description of WESTON's Protocol for Collection and Characterization of Treatability Study Test Matrix can be found in Appendix A. WESTON will conduct a single combined sampling and analysis for the bioslurry and soil washing test matrix.

The two composite soil samples, collected and characterized by WESTON, will be shipped to Bergmann's testing laboratory via a licensed commercial carrier. Approximately 110 pounds of each sample composite will be shipped to the laboratory to conduct the soil washing treatability testing. Appropriate shipping documentation will accompany the sample shipment from the Moss-American site to the testing laboratory in Stafford Springs, Connecticut.

4.2 CHARACTERIZATION AND SOIL WASHING TESTS

The following protocol will be followed by Bergmann for each of the two soil sample composites.

Table 4-1 presents the anticipated chemical analysis of the soil. The soils will be characterized to determine the size range of the soil components and the distribution of PAH contamination.

Figure 4-1 provides a schematic diagram showing the characterization process. Each sample will be homogenized by blending, and a sample will be split out for feed soil assay. The remaining material will be screened at 1/4 inch; the undersize material will be sampled for screen analysis, and the remaining minus 1/4 inch material will be advanced to the treatment program.

Figure 4-2 illustrates the test procedure to be used on the minus 1/4 inch soils. Tests will be run on soil samples from two locations, resulting in a total of 20 tests. The soils will be screened at 200 mesh to produce a coarse and fine fraction. This "break" or size split at 200 mesh (74 micron) represents the typical minimum performance level of Bergmann's full-scale (±15 TPH) commercial soils washing plants. Tests will be run on the coarse fraction using chemical formulations supplied by Bergmann USA. Each chemical formulation will be designed to remove the PAH compounds from the coarse sand fraction of the soil so that the clean product sand will pass the clean-up criterion concentration of 6.1 mg/kg of the CPAH fraction.

The fines fraction will be filtered to produce a filter cake. This cake will be returned to WESTON for storage pending potential future treatment tests which may be undertaken if the washing tests are successful.

Step 1.0 Characterization

The soil characterization process is shown schematically in Figure 4-1. Sampling and analytical requirements are detailed in Table 4-2.

Step 1.1: Blend and split ("cone & quarter") a sample of feed soil for analysis.

Table 4-1

Physical/Chemical Analyses Plan

Test Parameter	Analytical Method
Soil Grain Size Analyses	ASTM D4749-87 Standard Method for Performing Wet Sieve Analyses
pH analyses of both residual and filtrate fractions	EPA Method 9040
Polycyclic aromatic hydrocarbons (PAHs) analyses of both residual and filtrate fractions	EPA Method 8310
Benzene-toluene-xylene (BTX) analyses of both residual and filtrate fractions	EPA Method 8020
Oil and grease analyses of both residual and filtrate fractions	EPA Method 9071
Moisture analyses of residual fractions	ASTM D2216

FIGURE 4-1 -- SOIL CHARACTERIZATION PROCEDURE

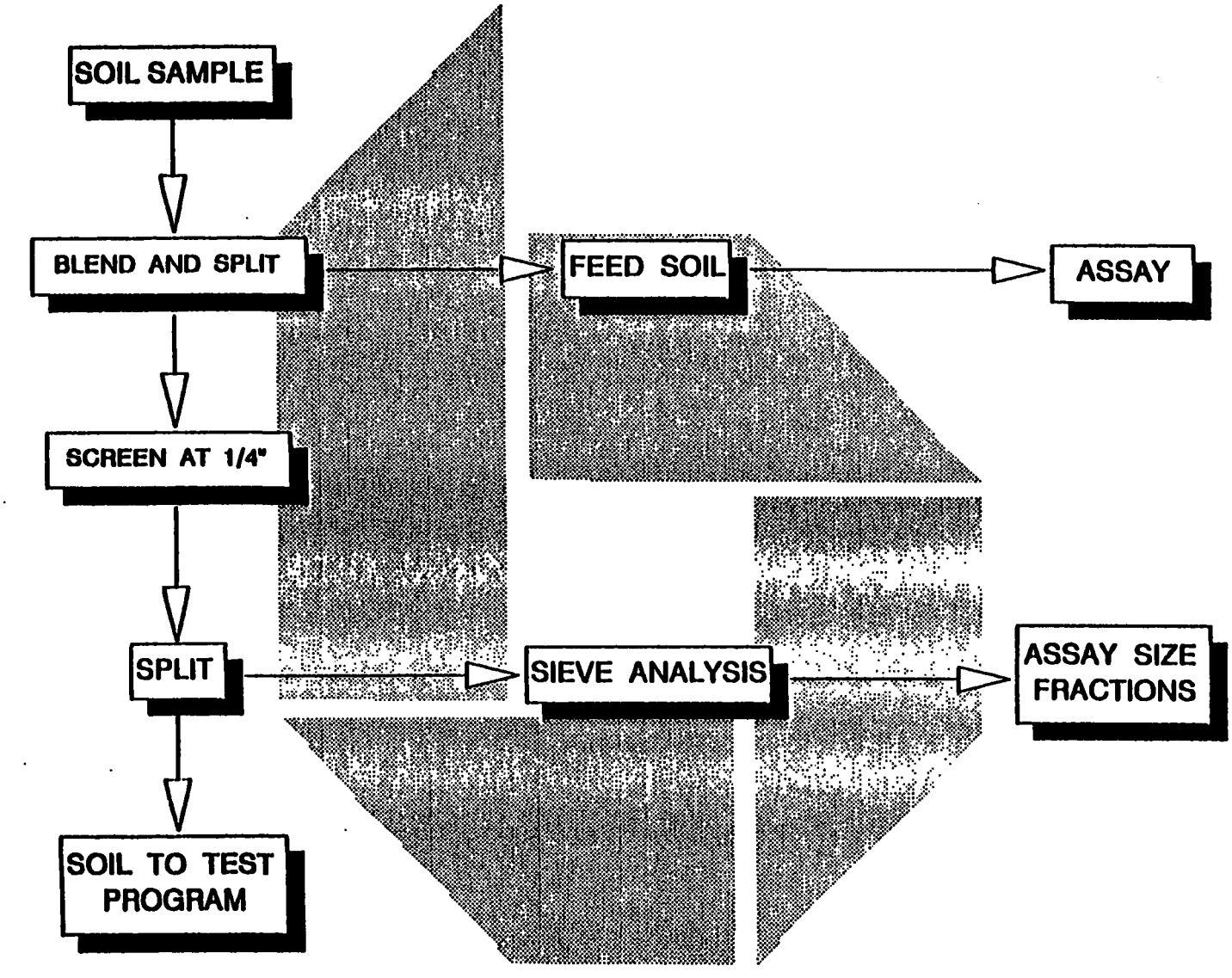


FIGURE 4-2 -- TEST PROTOCOL FOR CONTAMINATED SOIL WASHING

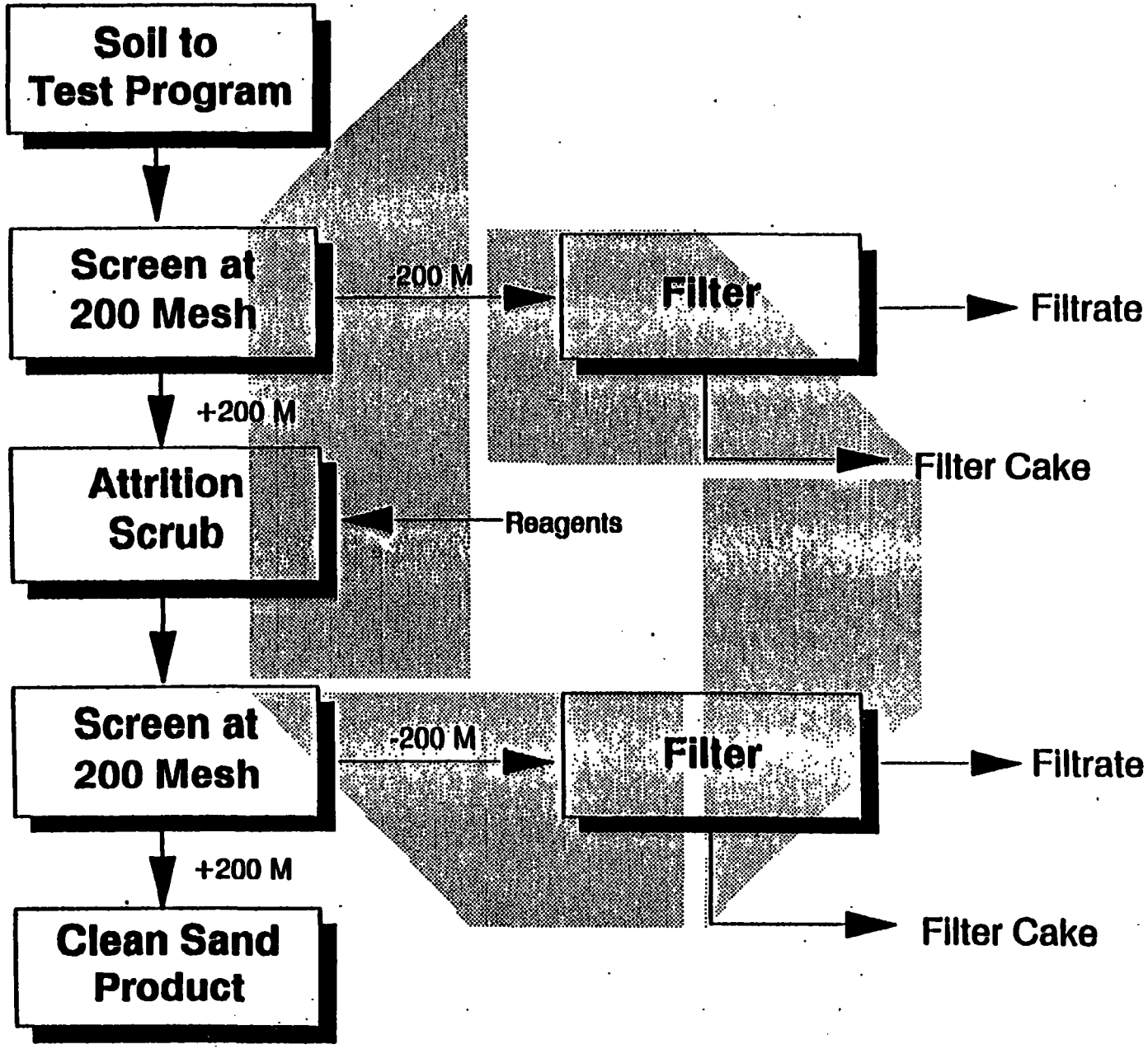


Table 4-2

Soil Characterization Analytical Requirements

Material	Weight/Volume	Sample A	Sample B	Duplicates
Feed Soil	Dry Weight			
Dry Screening				
-1/4 Inch	Dry Weight	1	1	0
+1/4 Inch	Dry Weight	1	1	0
Wet Screen Analysis (-1/4 Inch Soils)				
Size Fraction:				
+10 Mesh	Dry Weight	1	1	0
+50 Mesh	Dry Weight	1	1	0
+100 Mesh	Dry Weight	1	1	0
+200 Mesh	Dry Weight	1	1	0
+325 Mesh	Dry Weight	1	1	0
-325 Mesh	Dry Weight	1	1	0
TOTALS		8	8	0

* ASTM D4749-87 - Standard Method for Performing Wet Sieve Analysis.

Step 1.2: Dry screen the remaining material to remove 1/4-inch top size material. Weigh the +1/4 inch oversize, and the -1/4 inch undersize.

Step 1.3: Cone and quarter the minus 1/4-inch undersize material. Blend two opposing quarters, and cone and quarter again. Repeat this procedure to generate sufficient sample for wet screening and chemical analysis.

Step 1.4: If clay lumps form during dry screening, subject fractions to ultrasonic bath until lumps are broken up.

Step 2.0 Soil Washing Tests

The soil washing process is shown schematically in Figure 4-2. Sampling and analytical requirements are detailed in Table 4-3.

Step 2.1: Sample the feed soil and analyze as shown in Table 4-3.

Step 2.2: Wet screen the 1/4-inch material at 200 mesh to remove the fine fraction. Filter the -200 mesh slurry for sampling and analyses according to Table 4-3.

Step 2.3: Blend and split the +200 mesh fraction into 10 samples of approximately equal weight. The samples will be tested according to the test program presented in Table 4-3.

Step 2.3.1: Mix the samples with water and/or reagents to a pulp density of 75 percent solids.

Step 2.3.2: Attrition scrub for 15 minutes.

Step 2.3.3: Wet screen the pulp at 200 mesh. Measure the weight (wet and dry) of the +200 mesh clean sand product. Blend the wash water with -200 mesh fines fraction.

Step 2.3.4: Filter the -200 mesh fines to form a filter cake for analyses. Record weights and volumes.

Table 4-3

Soil Washing Analytical Requirements

Test	Weight/Volume	Moisture	Analyses			Duplicates		
			PAH	O&G	BTEX	PAH	O&G	BTEX
Feed[a]								
Soil to Test Program Solids	Dry Weight	2	2	2	2	--	--	--
Reject[a]								
-200 Mesh Screened Solids	Dry Weight	2	2	2	2	--	--	--
Filtrate	Volume	2	2	2	2	--	--	--
Test Program Products[b]								
Sands	Dry Weight	30	30	30	30	3	3	3
Fines	Dry Weight	30	30	30	30	3	3	3
Filtrate	Volume		30	30	30	3	3	3
TOTALS		66	96	96	96	9	9	9

[a] - Tests and analyses run on two samples, A and B.

[b] - Test Program:
Test #1 - Water only, two attrition scrubs. Assay sand fraction of second scrub.
Test #2 - Citrikleen type surfactant, high concentration.
Test #3 - Citrikleen type surfactant, low concentration.
Test #4 - Dodacyl sulfate surfactant, high concentration.
Test #5 - Dodacyl sulfate surfactant, low concentration.

Step 2.4: Submit samples for assay according to Table 4-3. Samples are scheduled to be sent to:

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, Pennsylvania 17601-5994
(717) 656-2301
ATTN: Pat Downing

Step 2.5: Clean the equipment between runs using reagent grade tri-sodium phosphate.

Step 3.0 Sample Disposal

Step 3.1: Package the solid and liquid products separately for return to the Moss-American site for storage.

Dr. William Lowe, at (215) 344-3762, or Gary Deigan at (708) 918-4000, WESTON, will be notified when submission of samples to laboratory for analyses has been done.

SECTION 5

PHASE I BENCH-SCALE SCREENING EQUIPMENT

Each contaminated site offers specific and unique characteristics for that location. The quantification and qualification of contaminants of interest, and their inter-relationship with the specific mineralogy of the soil require each new site to be evaluated individually for the optimum combination of washwater additives necessary to solubilize, mobilize, precipitate, or complex the organic and/or inorganic chemical constituents in site soils.

The Phase I Treatability Study for the Moss-American Site will utilized the following bench/pilot scale equipment which simulates the principal unit process operations of full-scale modular systems of Bergmann's commercial-scale (+15 TPH) transportable plants:

1. Precision Sample Splitter for mixing and accurately dividing granular material.
2. Vibratory Scalping Screen for removal of +1/4" material fraction.
3. Frietsh Wet Sieve Stack and Vibratory Table for wet sieving of sample material.
4. Elutriation Separation Column for specific gravity separation of contaminated organic materials (i.e., decayed leaves, twigs, wood, roots, etc.).
5. Sedimentation / flocculation cells for separation and concentration of suspended clay, silt and colloidal material.
6. Fines Dewatering Pressure Filter for concentration of clay, silt and colloidal materials for subsequent treatment technologies.

SECTION 6

SAMPLING AND ANALYSIS

Sampling and analysis during the soil washing treatability testing will be conducted by Lancaster Laboratories, Inc. of Lancaster, Pennsylvania. Lancaster Laboratories, Inc. will work as a lower tier subcontractor to Bergmann. The laboratory quality assurance plan and analytical method Standard Operating Procedures (SOPs) are presented in Appendix B of this test plan. Tables 4-1, 4-2, and 4-3 in Section 4 define the analytical methods of the test program.

SECTION 7
DATA MANAGEMENT

All data regarding these bench scale studies will be recorded on a standard laboratory data sheet, and placed in the appropriate file. A chain-of-custody document will accompany all samples being released to Lancaster Laboratories. Appendix B presents Lancaster Laboratories quality assurance plan which also addresses data management/data reporting procedures.

SECTION 8
DATA ANALYSIS AND INTERPRETATION

The results of this test program will be used to assess the feasibility and applicability of soil washing as an adjunct to the bioslurry treatment process for the Moss American Site. The need for extreme operating conditions with respect to equipment and materials (such as chemicals) in order to achieve satisfactory performance will indicate that the soil washing process is not feasible or implementable for this application.

If a positive determination with respect to feasibility is made, the data obtained from these bench scale treatability studies can be used to proceed with the preliminary design of a pilot test and/or of a full scale (±15 TPH) plant. The primary use of these data will be to identify the necessary unit process operations and their optimization required to meet the clean-up criterion and match these operations to both the mass flow rates and desired particle size separations.

Determination of the soil particle size distribution as a first order of business will allow for evaluation as to whether soils washing as a volumetric reduction/waste minimization step is economically practical. For example, should the contaminated soil contain a large amount of material finer than 74 microns (ie. 40% or more) then soils washing may not provide significant volume reduction to support associated costs. If however the size distribution appears appropriate, then the treatability tests can proceed with washing and attrition test work.

The washing and attrition studies will allow identification of the following:

- Required unit operations (for soils washing and washwater treatment).
- Sequence of unit operations.
- Residence times.
- Reagents.
- Materials of construction.

Utilizing this information along with the particle size distribution will allow the preliminary design of a process flowsheet along with the mass balances. Computer programs, which have been developed by Bergmann and their sister company, Linatex, are used to simulate the performance of the various equipment employed in a full-scale plant operation. These design programs generate mass balances throughout the equipment configuration as well as track attributes of the size fractions (i.e., concentration of contaminant by size fractions). Simulation or modeling programs involving separations are based on classification or **partition** curves which can generally be represented by a logistic function. The shape and position of these curves are modified by the programs to simulate performance for both process conditions encountered and various equipment configurations.

SECTION 9
HEALTH AND SAFETY

9.1 HAZARD ANALYSIS

The creosote-impacted soils used in this study contain polycyclic aromatic hydrocarbons (PAH). Appendix C contains the Material Safety Data Sheets (MSDS) for the compounds of concern.

Creosote is a yellow to black liquid with a tarry odor. It is a combustible liquid with a flashpoint of approximately 160°F. Exposure to creosote vapors may cause moderate irritation of the nose and throat. Liquid contact may cause severe eye burns, and reddening and itching of skin. Prolonged contact with skin may cause second-degree burns.

The major potential routes of exposure to PAH are respiratory via inhalation of vapors and skin absorption via skin contact with the waste or waste-contaminated equipment.

The benzene soluble fraction of creosote is carcinogenic, and repeated exposure has been associated with an increased risk of developing cancer of the lungs, skin, bladder, and kidneys.

Pregnant women may be susceptible to exposure effects associated with creosote volatiles. The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for creosote, benzene-soluble fraction, is 0.2 milligrams per cubic meter (mg/m^3) of air based on an 8-hour exposure.

The task involving the greatest potential exposure to PAH is handling and transferring the waste during the soil washing testing. Other tasks involving potential exposure to PAH are sample collection/handling and decontamination of equipment. Engineering controls will

be utilized to reduce or eliminate the potential for exposure to vapors. The engineering controls include use of laboratory exhaust hoods for all sample preparation.

Copies of the MSDS will be distributed to all personnel working on this project for review. Additionally, the MSDS will be posted near the soil washing test area where personnel have access to the hazard information before entering the project area.

9.2 PERSONAL PROTECTIVE EQUIPMENT

The level of personal protective equipment (PPE) used during the testing will be determined following an assessment of screening activities. If the exposure monitoring indicates that contaminants are present at one-half the PEL, then Level C PPE will be used. If the contaminant concentration is less than one-half the PEL or not detected, Level D PPE will be employed.

If Level C PPE is determined to be appropriate for handling and transferring waste, then it will be employed. Level C PPE will consist of:

- Full-face air-purifying respirator with organic vapor high-efficiency particulate air (HEPA) cartridges.
- Viton gloves - outer; latex gloves - inner.
- Rubber apron or polyethylene-coated Tyvek coveralls.
- Work uniforms.
- Steel-toed shoes.

Level D protection will be used for activities conducted within the laboratory exhaust hood. If Level D protection is shown to be appropriate for the treatability tasks, it will be employed. Level D PPE will include:

- Safety glasses with side shields (goggles when collecting liquid samples).
- Viton gloves - outer; latex gloves - inner (when collecting samples).
- Steel-toed shoes.
- Laboratory coat or polyethylene-coated Tyvek coveralls.

9.3 RESPIRATORY PROTECTION PROGRAM

A comprehensive respiratory protection program has been established by Bergmann. This program is mandated in all locations where use of such equipment is intended to lessen the potential for adverse health affects to an employee.

As part of the respiratory training program, each employee is instructed in the following elements:

- Nature of the respiratory hazard on the work site and the appraisal of potential consequences if the respiratory protection is not utilized.
- Use and proper fit of the respirator.
- Cleaning, disinfecting, inspecting, maintenance, and storing of the respirator.
- Proper selection, capabilities, and limitations of PPE.

Routinely used respiratory equipment will be inspected, cleaned, and disinfected daily to help ensure proper hygiene practices. An inspection of these breathing devices will include the following:

- Examination of the head straps for breaks, loss of elasticity, broken or malfunctioning buckles, and other attachments.
- Examination of the facepiece for excessive dirt, cracks, tears, distortion, holes, or inflexibility.
- Examination of the exhalation and inhalation valves for any foreign material, cracks, tears, or distortion in the valve. Additional checks will be made to inspect for proper insertion, defective valve covers, or improper installation.

- Examination of air-purifying elements for incorrect cartridge, expired shelf-life of the cartridge, or cracks or dents in the cartridge or cartridge holder.

- Examination of proper insertion of the cartridges into the facepiece and a check of the gaskets inside the cartridge holder.

When respiratory protection is required, respiratory cartridges will be changed daily. All respirators will be inspected prior to each day's use. If broken or malfunctioning parts are found during the cleaning process, these parts will be replaced or new respiratory equipment will be issued to the user.

The respiratory protective equipment will be stored in an area protected from any mechanical damage. The protection area will guard against dust, heat, excessive moisture, or damage by chemical contact. The storage area for the respirators will be in a readily accessible location.

The following guidelines apply to the use and storage of respirators.

- Only employees who have been trained to wear and maintain respirators properly will be allowed to use respiratory protection.

- Selection of respirators, as well as any decisions regarding upgrading or downgrading of respiratory protection, will be made by the health and safety officer or his designee.

- Positive and negative pressure tests will be performed each time the respirator is donned.

- Only employees who have been fit tested within the last 12 months will be allowed to work in atmospheres where respirators are required. Subcontractors will provide certificates of respirator fit tests completed within the last 12 months for each employee on site.

- Respirator users will be instructed in the proper use and limitations of respirators.

- If an employee has difficulty in breathing during the fit test or during use, he will be evaluated medically to determine if he can wear a respirator safely while performing assigned tasks.

- No employee will be assigned to tasks requiring the use of respirators if, based upon the most recent examination, a physician determines that the health or safety of the employee will be impaired by respirator use.

- Contact lenses will not be worn while using any type of respiratory protection.

- Respirators will be cleaned and sanitized daily after use.

- Respirators will be stored in a convenient, clean, and sanitary location on site.

- Respirators will be inspected during cleaning. Worn or deteriorated parts will be replaced.

- Facial hair that might interfere with a good facepiece seal or proper operation of the respirator is prohibited.

- The Bergmann USA project manager will review the respiratory protection program to ensure that employees are properly wearing and maintaining their respirators and that the respiratory protection is adequately protecting the employees.

- The health and safety officer and the project manager will evaluate the respiratory protection program routinely to ensure the continuing effectiveness.

- Respirators used for emergency response will be inspected weekly by the health and safety coordinator.

9.4 GENERAL WORK PRACTICES

The following work practices will be adhered to during the course of project activities. At least one copy of these procedures will be available at the treatability study work site.

- Contaminated protective equipment, such as respirators, hoses, boots, etc., will not be removed from the regulated work area until it has been cleaned or properly packaged and labeled.

- Legible and understandable precautionary labels that display identity and appropriate hazard warning will be prominently affixed to containers of contaminated scrap, waste, debris, and clothing.

- Removal of PAH-contaminated material from protective clothing or equipment by flowing, shaking, or any other means that disperse contaminated material into the air is prohibited.

- No food or beverages will be present or consumed in the treatability study work area.

- No tobacco products will be present or used, and cosmetics will not be applied in the treatability study work area.

- Employees will wash their hands and face before eating, drinking, smoking or applying cosmetics.

- PAH-contaminated materials will be stored in tightly-closed containers in well-ventilated areas.

- Containers will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.

- Emergency equipment will be located outside storage areas in readily accessible locations that will remain minimally contaminated with PAH.

- All areas that have been determined as uncontaminated inside the regulated area will be clearly marked as such. No personnel, equipment, etc. will be in these areas until they have been decontaminated.

9.5 PERSONNEL TRAINING

All personnel designated for treatability testing at the facility receive at least 40 hours of OSHA health and safety training. OSHA training includes a minimum of 24 hours of initial off-site training and a minimum of 8 hours annual refresher training. This includes instruction on exits, fire extinguishers, handwashing, safety showers, and eye wash stations. Supervisors receive an additional 8 hours of health and safety training. All personnel also receive 8 hours annual health and safety training, which meets the requirements of OSHA regulations included in 29 CFR 1910.120. Only personnel who have had qualitative fit tests

and annual fit tests thereafter will be allowed to work in areas where respirators are required.

Upon receipt of the creosote-impacted soils, a hazards communications meeting will be held to inform employees of project-specific contaminants and the project technical scope of work.

9.6 MEDICAL SURVEILLANCE

A pre-assigned health assessment will be required for all personnel working with toxic substances. This examination will include a previous work medical history. It will be followed by annual medical examinations, which will update and document any accidental exposures. All Bergmann employees participate in an annual medical surveillance program. This medical surveillance program meets the requirement of the OSHA regulations included in 29 CFR 1910.120.

9.7 SPILL PREVENTION AND CONTAINMENT

The primary spill prevention method that will be enforced throughout this project will minimize the quantity of toxic materials used for experimentation. Any visible quantity of spilled liquid (slurry) waste from the reactor operations must be cleaned up immediately with spill-absorbing pads located in the work area. These pads will be collected in sealable cans and stored for disposal. After the visible quantity is absorbed, the contaminated work surface will be wiped repeatedly with water-soaked rags and dried. Spills on concrete will be absorbed with a sweeping compound.

Major spills, fire, or explosions will necessitate response in accordance with laboratory emergency response. If an emergency situation arises, the first duty of project personnel is to alert all affected personnel and then contact the facility emergency coordinator.

At the end of the soil washing testing, any remaining liquids or solids will be poured into the waste container supplied by project personnel. The waste container will be properly identified as a satellite waste collection container and labeled for the type of waste it contains with an appropriate hazard warning. Questions on the proper disposal method should be directed to the appropriate project personnel.

SECTION 10
RESIDUALS MANAGEMENT

Following completion of treatability testing, all test residuals will be properly packaged and labeled and returned to the Moss-American site for storage with other predesign activity residuals pending final disposal.

The shipment of all wastes and treatment residuals will be done in compliance with applicable Department of Transportation (DOT) regulations.

SECTION 11
REPORTS

A Technical Memorandum (TM) will be prepared by Bergmann describing the Phase I soil washing treatability studies. Table 11-1 illustrates the tentative organization of the TM. The preparation of the TM will adhere to the standards described in United States Environmental Protection Agency (U.S. EPA), "Guide for Conducting Treatability Studies Under Comprehensive Environmental Response, Comprehensive and Liability Act (CERCLA)," EPA/540/2-89/058. The draft TM will be submitted to WESTON for review and comment. Following incorporation of and response to comments, Bergmann will prepare a draft TM suitable for submission (through WESTON) to the U.S. EPA and WDNR. All data generated in this study is subject to the confidentiality agreement between WESTON and Bergmann USA.

Table 11-1

Technical Memorandum Outline

1.0 Introduction
- 1.1 Site Description
  - 1.1.1 Site Name and Location
  - 1.1.2 History of Operations
  - 1.1.3 Prior Removal and Remediation Activities
- 1.2 Waste Description
  - 1.2.1 Waste Matrices
  - 1.2.2 Pollutants/Chemicals
- 1.3 Remedial Technology Description
  - 1.3.1 Treatment Process and Scale
  - 1.3.2 Operating Features

2.0 Conclusions and Recommendations
- 2.1 Conclusions
- 2.2 Recommendations

3.0 Treatability Study Approach
- 3.1 Test Objectives and Rationale
- 3.2 Experimental Design and Procedures
- 3.3 Equipment and Materials
- 3.4 Sampling and Analysis
  - 3.4.1 Waste
  - 3.4.2 Treatment Process
- 3.5 Data Management
- 3.6 Deviations from the Test Plan

4.0 Results and Discussion
- 4.1 Data Analysis and Interpretation
  - 4.1.1 Analysis of Waste Characteristics
  - 4.1.2 Analysis of Treatability Study Data
  - 4.1.3 Comparison to Test Objectives
- 4.1 Quality Assurance/Quality Control
- 4.2 Costs/Schedule for Performing the Treatability Study
- 4.4 Key Contacts

References

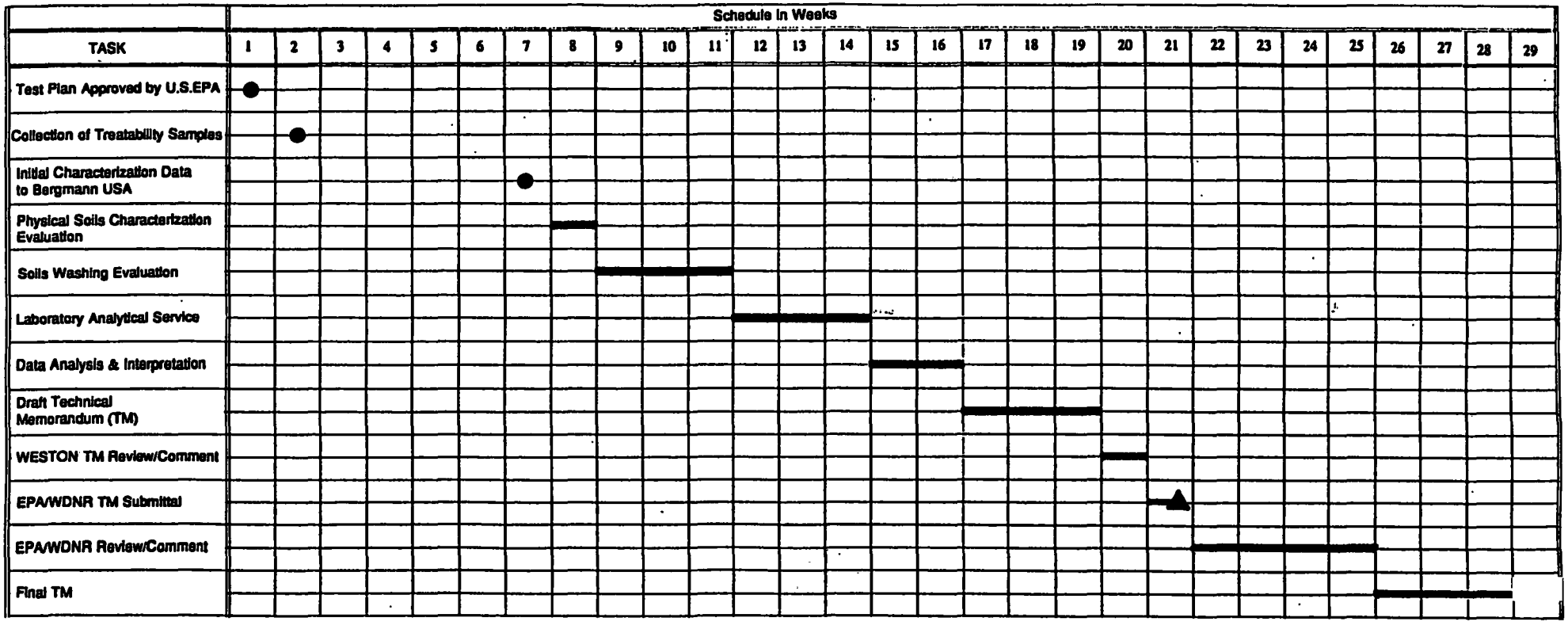
Appendices
- A Data Summaries
- B Standard Operating Procedures

SECTION 12
SCHEDULE

The project schedule for the Phase I soil washing treatability testing is presented in Figure 12-1.

FIGURE 12-1

Project Schedule for
Phase I Soils Washing Treatability Studies
Moss-American Site
Milwaukee, WI



▲ Deliverable to U.S.EPA

APPENDIX A

PROTOCOL FOR COLLECTION AND CHARACTERIZATION OF TREATABILITY STUDY TEST MATRIX

PROTOCOL FOR COLLECTION AND CHARACTERIZATION OF TREATABILITY STUDY TEST MATRIX

Soil samples for the Phase I laboratory-scale treatability study will be collected from the Moss-American site. One sampling event will be conducted. Sufficient quantities of soils for all planned Phase I bioslurry and soil washing treatability tests will be obtained during this sampling event and placed into drums for transport, and/or intermediate storage at the site awaiting transport to the testing laboratories.

SAMPLING OBJECTIVE

The objective of this sampling event is to collect sufficient quantities of CPAH-contaminated soils from the site to conduct the planned Phase I treatability studies on the bioslurry and soil washing technologies. These soil portions will be characterized prior to treatability testing, for parameters which are important in the treatability study program. Analytical data from this characterization will be used to support analyses and interpretation of treatability study results.

SOIL SAMPLE (TEST MATRIX) REQUIREMENTS

Two soil composites will be collected from the site. One composite is intended to provide soils exhibiting "average" CPAH concentrations in the range of 300-600 mg/kg. The second composite is intended to provide "high" CPAH concentrations in the range of 1,000-1,500 mg/kg. The selection of soil sampling locations to meet these criteria will be based upon existing RI/FS site characterization data and other predesign activities as these data may become available. The areas from which these samples will be taken include the former processing area and the former treated storage areas of the Moss-American site.

Due to possible RCRA restrictions on storage of soil quantities at the treatability test facility, soil quantities in excess of the permitted amount will be stored in tarp-covered

drums and staged on the Moss-American site pending transport to the designated testing facilities.

SOIL SAMPLING PROCEDURE

The area selected for site sampling will be marked with pin flags by the field sampling team. Within this area, the required volume of soil will be excavated using hand tools. The excavated soils will be placed temporarily on plastic sheeting located adjacent to the excavated area. Large debris, rocks, and turf will be manually separated from the soils. The excavated soils will be manually mixed using hand tools to provide a relatively homogeneous mixture. Following mixing, the soils will be placed into drums and sample containers as appropriate, sealed, labeled, and moved to the temporary staging area while awaiting shipment. Large debris, rocks, and turf will be returned to the excavation. Additional borrow soil will be used as necessary to fill the excavated area. The "average" concentration soil composite will be collected first and the "high" concentration composite collected second in a similar manner.

Equipment and personnel decontamination procedures presented in the Interim Health and Safety Plan and the Predesign Phase Quality Assurance Project Plan will be followed.

SOIL SAMPLE (TEST MATRIX) CHARACTERIZATION

Soil composites collected from the site will be characterized in order to evaluate properties or conditions that may affect or determine the results of the treatability test. Properties or conditions that will be considered include the following:

- CPAH concentration, which could affect treatability performance and the statistical interpretation of treatability test results.
- Physical/chemical properties, such as particle size distribution, organic carbon content and the presence of other contaminants, that may interfere with the treatment processes.

- Variables that may affect biological activity, such as macro- and micro-nutrient levels and pH.

Indigenous microbial activity levels in the soil samples/composites will be characterized to determine the potential need for microbial acclimation or stimulation. This effort will include an estimation of microbial population/viability and determination of PAH degradation capabilities, which will be accomplished by using aerobic plate counts or most probable number (MPN) methods.

At the time of the site sampling event, one portion (approximately 5 kg) of each composite will be shipped to WESTON's Environmental Technology Laboratory (ETL) in West Chester, PA for initial physical/chemical characterization. An additional portion will be aseptically transferred to sterile containers and transmitted to ETL for microbial enumeration. The initial characterization program is summarized in Table 2, while analytical methods and holding times are summarized in Table 3.

Soil composites and analytical samples will be shipped to the ETL and treatability testing laboratories by certified commercial carrier.

HEALTH AND SAFETY

The soil collection and compositing sampling event will be conducted in accordance with the Interim Predesign Health and Safety Plan, as amended by HASP Amendment No. 1.[1]

[1]Roy F. Weston, Inc., Draft Predesign Work Plan, Moss-American Site, Milwaukee, Wisconsin, 28 April 1992.

Table 1

Soil Composite Quantities

	Bioslurry Treatability Test (lb.)	Soil Washing Test (lb.)	Total
Average Soil Composite	100	110	210
High Soil Composite	100	110	210

Table 2

Initial Characterization Test Matrix

Parameter	Laboratory[1]	Average Soils	"High" Soils	Total
Microbial Enumeration	FE	1	1	2
Particle Size Distribution	ETL	1	1	2
Porosity (Bulk Density/Specific Gravity)	ETL	1	2	2
Moisture Content	ETL	1	1	2
Liquid/Plastic Limits	ETL	1	1	2
Percent Solids	ETL	1	1	2
pH	WA	1	1	2
Total Organic Carbon (TOC)	WA	1	1	2
CPAH	WA	1	1	2
BTX	WA	1	1	2

[1] FE - WESTON Fate and Effects Laboratory
ETL - WESTON Environmental Technology Laboratory
WA - WESTON Analytics (Lionville) Laboratory

Table 3

Analytical Methods

Parameter	Method	Sample Requirements	Preservation
Microbial Enumeration	Plate Count	100 g./ Sterile glass	Cool, 4°C
Particle Size Distribution	ASTM D422	1 l.	---
Porosity (Bulk Density/ Specific Gravity)	---	1 l.	None
Moisture Content	ASTM D2216	1 l.	None
Atterberg Limits	ASTM D423/D424	1 l.	None
Percent Solids	CLP SOW	250 ML/amber glass	Cool, 4°C
pH	9040	250 ML/amber glass	Cool, 4°C
Total Organic Carbon (TOC)	Method 415.1	250 ML/amber glass	Cool, 4°C
CPAH	EPA Method 8310	250 ML/amber glass	Cool, 4°C
BTX	EPA Method 8020	2-125 ML/amber glass	Cool, 4°C

APPENDIX B

LANCASTER LABORATORIES, INC.
QUALITY ASSURANCE PLAN

Laboratory SOPs

Analyses #180, 516, 1211, 1213,
1399, 1400, 1463,
1829, 1837, 4262,
4264, 4271, 539, 913,
939, 940, 941, 1163,
1174, 1226, 1379,
1380, 1464, 3341,
4266, 418, 420
Initiated Date: 12/4/90
Effective Date: NOV 2 2 1991

Purgeable Aromatics in Water and Solid Samples

References:

1. 40 CFR Part 136, Method 602, Purgeable Aromatics

2. SW-846 (Third Edition) Test Methods for Evaluating Solid Waste, Methods 5030, 8000, and 8020 (Purge and Trap/Aromatic Volatile Organics)

Scope:

This method is suitable for analyzing water and solid samples for the purgeable aromatic compounds listed in the table in Appendix A. The various LLI Scan numbers which are analyzed under this method are summarized in Appendix B for water samples and in Appendix C for solid samples. The corresponding limits of quantitation are also listed here. In addition to the aromatic compounds listed in Appendix A, two halogenated compounds, trichloroethene and tetrachloroethene, can also be determined by this method. The limit of quantitation for these compounds is 1. ug/l for water samples. The methods as written in the two references above are very similar with only minor differences. Generally, all statements in this method will apply to both references unless otherwise explicitly noted. If benzene, toluene, and ethylbenzene are the only aromatics being

analyzed for, they may be simultaneously analyzed with the volatile halocarbons using a Hall electrolytic conductivity detector and photoionization detector in series. This analysis is described in detail in LLI Method Analysis of Purgeable Halocarbons in Water and Solid Samples.

Summary:

The method is based on the purge and trap/gas chromatography method where an inert gas is bubbled through 5 ml of the sample solution. The volatile aromatics are purged from the sample and trapped on a sorbent trap. After purging is complete, the sorbent trap is heated and backflushed with inert gas to desorb the trapped aromatics onto a suitable gas chromatographic column. The gas chromatograph is then temperature programmed to separate the aromatics which are then detected and quantified with a photoionization detector. Typical chromatograms and printouts are shown in Figures I and II.

Apparatus:

Purge and Trap Concentrator - A Tekmar LSC-2, Model 4000 LSC-2000, ALS or equivalent device equipped with a Tenax trap as specified in the above references can be used. Alternatively, a trap packed with Carbopack B and Carbosieve S-III may be used, but different desorption and bake temperatures, as stated in the purge and trap conditions in Table II, must be used.

Gas Chromatograph - Any commercially available gas chromatograph capable of temperature programming and equipped with a photoionization detector that provides the proper sensitivity and linearity may be used. Although not necessary, a Hall electrolytic conductivity detector may be used in series with the photoionization detector to aid in the identification and confirmation of the halogenated compounds included in this method.

GC Columns -

1. 8 ft or 10 ft x 2 mm ID glass or metal column packed with 5% SP1200/1.75% Bentone 34 on 100/200 mesh Supelcoport.

2. 30 M x 0.53 mm ID fused silica capillary with bonded phase specifically designed for purgeables (e.g., Supelco VOCOL or equivalent).

3. 60 M x 0.75 mm ID glass capillary column with bonded phase specifically designed for purgeables (e.g., Supelco VOCOL or equivalent).

4. Stabilwax, 30 M x 0.53 mm ID, 1.5 um film thickness, fused silica capillary column.

Normal operations will use Column 1 or 4, however, Columns 2 and 3 may be used as either the primary analytical column or as a confirmation column. Other suitable columns as stated in the references may also be used as confirmation columns.

Materials:

Reagent grade (or equivalent) methanol is used to prepare all calibration standards.

All standards are prepared as stated in the references from neat compounds obtained from suppliers which indicate the purity of the compound. No correction for purity is made if the purity if listed as >95%. Premade solutions can be used as standards if the concentrations of the solutions are documented by the supplier.

Safety Precautions:

The toxicity of all the compounds used in this method have not been established. However, several of the compounds are considered carcinogens. Each compound should be treated as a potential health hazard. The major route of exposure is inhalation during handling of the neat materials while preparing stock standards. These stocks must therefore be prepared in a hood to eliminate the risk of inhaling the vapors of the neat materials. After the neat materials are diluted with methanol or other solvents, the potential for exposure is reduced significantly. Nevertheless, care must be taken in the handling of any and all standards. Information concerning the known toxicity, properties, or special handling precautions for any compound can be found with the material safety data sheets available from the safety officer.

Standards:

1. Surrogate/Internal Standard - Trifluorotoluene and n-propylbenzene are used as surrogate or internal standards. Stock surrogate standards are prepared in methanol from neat compounds at concentrations of approximately 6000 mg/l by adding about 60 mg of each compound to methanol in a 10 ml volumetric flask. These standards are stored in 16 ml vials with screw cap lids and teflon lined silicone septa at -10°C for up to six months. Secondary dilution standards in methanol at concentrations of approximately 120 mg/l are prepared monthly by diluting 0.5 ml of the stock standard with methanol in a 25 ml volumetric flask.

   Secondary dilution standards are stored in 2 ml autoinjector vials with screw cap lids and teflon lined silicone septa at -10°C for one month. Secondary Dilution standards are held for no more than one day on the bench before being discarded. Other compounds may be substituted as surrogates or internal standards if they do not coelute with or interfere with the quantitation of analytes of interest.

2. Calibration Standards - Stock calibration standards are prepared in methanol from neat compounds at concentrations of approximately 5000 mg/l by adding about 50 mg of each compound to methanol in a 10 ml volumetric flask. These standards are stored in 16 ml

vials with screw cap lids and teflon lined silicone septa at -10°C for up to six months. Secondary dilution standards, prepared by diluting 1.0 ml of stock standard with methanol in a 25 ml volumetric flask to give a final concentration of about 200 mg/l, are prepared monthly. Secondary dilution standards are stored in 2 ml autoinjector vials with screw cap lids and teflon lined septa at -10°C for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

3. Quality Control Check Standards - Stock check standards, containing all compounds which have been calibrated for, are prepared in methanol from neat compounds at concentrations of approximately 5000 mg/l by adding approximately 50 mg of each compounds to methanol in a 10 ml volumetric flask. The quality control check standard is prepared independently from the calibration standard. These standards are stored in 16 ml vials with screw cap lids and teflon lined silicone septa at -10°C for up to six months. Secondary dilution standards, prepared by diluting the 1.0 ml of the stock standard with methanol in a 25 ml volumetric flask to give a final concentration of about 200 mg/l, are prepared monthly. Secondary dilution standards are stored in 2 ml autoinjector vials with screw cap lids and teflon lined septa at -10°C for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

4. Spiking Standards - Stock spiking standards, which contain all of the compounds which have been calibrated for, are prepared in methanol from neat compounds at concentrations of approximately 2000 mg/l by adding approximately 50 mg of each compound to methanol in a 25 ml volumetric flask. These standards are stored in 16 ml vials with screw cap lids and teflon lined silicone septa at -10°C for up to six months. Secondary dilution standards, prepared by diluting the appropriate volume of stock standard with methanol in a 50 ml volumetric flask to give a concentration of approximately 20 mg/l, are prepared monthly. Secondary dilution standards are stored in 2 ml autoinjector vials with screw cap lids and teflon lined septa at -10°C for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

See Table I at the end of this method for a summary of concentrations, storage conditions, and shelf life for standards used with this method.

Calibration:

Five levels of calibration are required when calibrating according to SW-846, Method 5030/8020, Reference 2, and at least three levels are required when using EPA Method 602, Reference 1. For each method, the calibration range should be from approximately 5 to 200 ug/l. Working calibration

standards are prepared by diluting the appropriate volume (3 to 25 ul) of the secondary dilution standard with reagent water into 50, 100, 200, or 500 ml volumetric flasks. The secondary dilution standards are allowed to come to room temperature before an aliquot is withdrawn. The working standards are mixed by inverting the volumetric exactly three times. Five ml of each working standard is analyzed according to the procedure described below.

Calibration can be performed using either the external or internal standard calibration. In either case, a point to point calibration curve is used. For the external calibration, the two surrogate standards described above are used. For the internal standard calibration, trifluorotoluene is used as the internal standard and n-propylbenzene is used as a surrogate. The response factor (RF) defined in Department 25 IOP #D-4, Calculating Response Factors, is calculated for each calibration level for each analyte. If the relative standard deviation (RSD) of the RF for any analyte is greater than 20%, the calibration for that analyte must be repeated. If the RSD of the RF is less than 20% (Reference 2) or 10% (Reference 1), the average RF may be used for quantitation. Alternatively, a linear least squares fit of the calibration data may be used.

Once the system is calibrated, the working calibration curve is verified by analyzing a quality control check standard. This standard is prepared by diluting 10 ul of the secondary dilution check standard with reagent water in a 100 ml volumetric flask to give a final concentration of approximately

20 ug/l. If the recovery of any analyte is outside the 85 to 115% range, follow the Check Standard Protocol Flowchart found at the end of this method. The calibration curve is verified in this manner every 8 to 10 hours.

Sample Collection, Preservation, and Preparation:

The samples must be iced or refrigerated from the time of collection until analysis. All samples are to be preserved to pH <2 with 1+1 HCl. Samples should be collected in duplicate in 40 ml vials with Teflon lined silicone septa. All samples must be analyzed within 14 days of collection.

For water samples, no sample preparation is required except for dilutions which are described below in the procedure section. For soil samples, a low level (aqueous purge) method is described in LLI Analysis #377. Two methanolic extraction procedures are described in LLI Analysis #1401 (as per SW-846 exactly) and LLI Analysis #379 (a modification of SW-846).

Procedure:

Set the purge and trap and the GC conditions as described in Tables II and III for the particular trap and column being used. Calibrate the system as described above and perform the necessary QC analyses as described below. When sample analysis is to begin, allow the sample to come to room temperature. Remove the plunger from a 5 ml syringe and rinse both the syringe and the plunger with deionized water. Open the sample

bottle (or standard) and carefully pour the sample into the 5 ml syringe to overflowing. Replace the plunger, vent any residual air, and adjust the volume to 5 ml. Add 5 ul of the secondary dilution surrogate/internal standard solution to the syringe. Attach the syringe to the sampling valve on the purge and trap concentrator and inject the sample into the purging vessel and begin the purging cycle.

1. Identification of Analytes - Retention time windows of ± three times the standard deviation of the mean retention time for standards run over a three-day period are used to tentatively identify compounds. However, in many cases, the experience of the analyst should weigh heavily in the interpretation of the chromatogram. If the identification of a compound is in doubt due to the possibility of coelutors, the sample must be reanalyzed on a second confirmation column.

2. Dilutions - Samples which contain levels of analytes above the dynamic range of the method (the highest level calibration standard) must be reanalyzed. Before continuing with the analysis of the diluted sample, the analyst must be assured that the high level of analyte present in the sample will not carry over into the next injection. This can be accomplished by analyzing a lab blank. If the analytes are all below the reporting limit, then the analysis of the diluted sample can begin. If not, the cleanup blank is repeated.

To dilute a water sample, the sample is pulled into a 25, 100, 250, 500, or 1000 ul gas tight syringe. The exact volume is then added to 5 ml of reagent water in a glass syringe or to larger volumes of reagent water in volumetric flasks. If the sample is diluted in a volumetric flask, the contents of the flask are mixed by inverting the flask three times and then poured into the 5 ml glass syringe. Any residual air is vented, the volume is adjusted to 5 ml, and 5 ul of the surrogate/internal standard solution is added. The sample is loaded onto the purge and trap concentrator and the purge cycle is initiated.

Care should be taken to avoid carryover of high levels. The syringes used in diluting samples and the sparge vessel should be cleaned by rinsing with methanol and reagent water before analyzing further samples.

The dilution factor is calculated as follows:

When the sample is diluted directly into the 5 ml glass syringe:

DF = 5 / (ml of sample added to syringe)

When an intermediate dilution into a volumetric flask is used:

DF = (TV / Vs) x (5 / VDS)

Where Vs = The volume, in ml, of sample which is diluted in the intermediate dilution

TV = The total volume, in ml, of the intermediate dilution (i.e., volume of the volumetric flask)

VDS = The volume, in ml, of the diluted sample which is added to the 5 ml syringe

NOTE: If more than one intermediate dilution is performed, the factor (TV / Vs) is calculated for each intermediate dilution.

Calculations:

Procedures and the necessary equations for manual and automatic (computer data reduction) calculations are found in SOP #D2, Manual Calculations for Volatiles by GC. Methods for calculating concentrations using average response factors and point to point calibration curves are presented there for both external and internal standard calibrations.

Quality Control:

In order to monitor both the performance or the analytical system and the effectiveness of the method in dealing with each sample matrix, each blank, standard, sample, and spiked sample are spiked with 5 ul of surrogate/internal working standard. Surrogate recoveries should be between 75 and 125%. If the internal standard method is used, the height of the internal standard for each injection is recorded. The acceptable window for the height is the average ± three standard deviations from those obtained during calibration. If the recoveries fall outside this range, the injection should be repeated.

As stated above in the calibration section, the calibration curve is verified every 8 to 10 hours by analyzing a quality control check standard which contains every analyte of interest. If the recovery for any analyte falls outside the 85 to 115% range, follow the check standard protocol flow chart found at the end of this method.

A matrix spike (MS) and matrix spike duplicate (MSD) is performed on one sample in every batch of 20 samples. Five ul of the secondary dilution spiking standard, representing a concentration of approximately 20 ug/l in the sample, is added to 5 ml of the sample in a 5 ml glass syringe. The recovery for each analyte of interest should be between 75 to 125% for water samples, and 70 to 130% for soils. The maximum relative percent deviation (RPD) should be 15% for water samples, and 20% for soils. The RPD is calculated as follows:

$$RPD = [(2)\ (R1 - R2) / (R1 + R2)] \times 100$$

If the recovery for any analyte falls outside the above ranges, follow the Batch QC Protocol Flowchart found at the end of this method.

The results from the unspiked (BKG), MS, and MSD samples are recorded in the LLI sample management/QA database referencing each appropriate batch of 20 samples in which it was

performed. Surrogate standard recoveries, blank results, and sample replicate results for each batch are also entered into the data base.

180516
OR METHODS #2
102991

Prepared by: _____ Date: 11.14.91

Approved by: _____ Date: 11/14/91

Approved by: _____ Date: 11/21/91

Table I

Standards Used in the Purgeable Aromatics in Water Method

Standard	Approximate Concentration	Storage	Shelf Life
Surrogate/ Internal (Stock)	6000 mg/l in Methanol	-10°C, Vial Ambient, Vial	6 Months 12 Hours
Surrogate/ Internal (Secondary Dilution)	120 mg/l in Methanol	-10°C, Vials Ambient, Vial	30 Days 12 Hours
Calibration (Stock)	5000 mg/l in Methanol	-10°C, Vials	6 Months
Calibration (Secondary Dilution)	200 mg/l in Methanol	-10°C, Vials Ambient, Vial	30 Days 12 Hours
Calibration (Working)	5 to 100 ug/l in Water	Ambient, Flask	5 Minutes
QC Check (Stock)	5000 mg/l in Methanol	-10°C, Vials	6 Months
QC Check (Secondary Dilution)	200 mg/l in Methanol	-10°C, Vials Ambient, Vials	30 Days 12 Hours
QC Check (Working)	20 ug/l in Water	Ambient, Flask	5 Minutes
Spiking (Stock)	2000 mg/l in Methanol	-10°C, Vials	6 Months
Spiking (Secondary Dilution)	20 mg/l in Methanol	-10°C, Vials Ambient, Vial	30 Days 12 Hours

Table II

Purge and Trap Conditions

Trap*	T	CPB/CSS
Purge Flow (ml/min)	40	40
Purge Time (min)	8	11
Dry Purge (min)	4	13
Desorb Preheat (°C)	170	245
Desorb Temp (°C)	180	250
Desorb Time (min)	4	4
Bake Temp (°C)	220	260
Bake Time (min)	10	20
Heated Valve and Line Temps (°C)	100 to 130	100 to 130

* T = Tenax, CBP = Carbopack B, CSS = Carbosieve S-III

Higher bake temperatures and times may be used to remove analytes which may carry over after the analysis of samples containing high levels of volatiles.

Table III

GC Conditions

	Column 1	Column 2 or 3	Column 4
Detector Temp (°C)	250	250	250
Injector Temp (°C)	200	200	200
Carrier Flow (ml/min)	35	7 to 10	7 - 10
Detector Makeup Flow (ml/min)	--	20 to 25	20 - 25
Temperature Program			
Initial Temp (°C)	45	40	50
Initial Hold (min)	3	5	6
1st Ramp (°C/min)	8	5	4
Second Temp (°C)	---	---	70
Second Hold (min)	---	---	0.1
Second Ramp (°C/min)	---	---	25
Final Temp (°C)	155	190	155
Final Hold (min)	10	5	8

The PID detector sensitivity should be set so that 1. ug/l of benzene gives a S/N ratio of at least 10:1. If the sensitivity of the PID is not sufficient to reach this level, the lamp should be replaced or cleaned. Alternatively, the purge and trap concentrator should be checked for leaks and/or poor trap performance.

Appendix A

Individual Compounds Analyzed as Part of the Purgeable Aromatic Scan

Compound	LLI Analysis #
Benzene	539
p-Dichlorobenzene	913
o-Xylene	939
m-Xylene	940
p-Xylene	941
Toluene	1163
Cumene	1174
Ethylbenzene	1226
m-Dichlorobenzene	1379
p-Dichlorobenzene	1380
Methyl tertiary-butyl ether	1464
Styrene	3341
Trichloroethene	418
Tetrachloroethene	420
Naphthalene	4266

Appendix B

Various Scans Which Can Be Analyzed as Purgeable Aromatics in Water

Reference	1[a]	1[a]	2[b]	2[b]	2[b]	1[a]	1[a]
LLI Scan #	180	516	1399	1463	1829	4264	4271
	LOQ	LOQ	LOQ	LOQ	LOQ	LOQ	LOQ
Compound							
Benzene	1.	1.	0.5	1.	1.	1.	1.
m-Dichlorobenzene	1.						
o-Dichlorobenzene	1.						
p-Dichlorobenzene	1.					1.	1.
Ethylbenzene	1.	1.	0.5	1.	1.	1.	1.
Toluene	1.	1.	0.5	1.	1.	1.	1.
m-Xylene		1.	0.5	1.	1.	1.	1.
o-Xylene		1.	0.5	1.	1.	1.	1.
p-Xylene		1.	0.5	1.	1.	1.	1.
Methyl t-butylether					1.		1.
Naphthalene						5.	5.

a - 40 CFR Part 136, Method 602, Purgeable Aromatics

b - SW-846, Third Edition, Test Methods for Evaluating Solid Waste, Methods 5030, 8000, and 8020 (Purge and Trap/Aromatic Volatile Organics)

The limit of quantitation is 1 ug/l for all compounds. For analysis #1399, limits of quantitation of 0.5 ug/l are provided for the BTEX compounds.

Appendix C

Various Scans Which Can Be Analyzed as Purgeable Aromatics in Solids

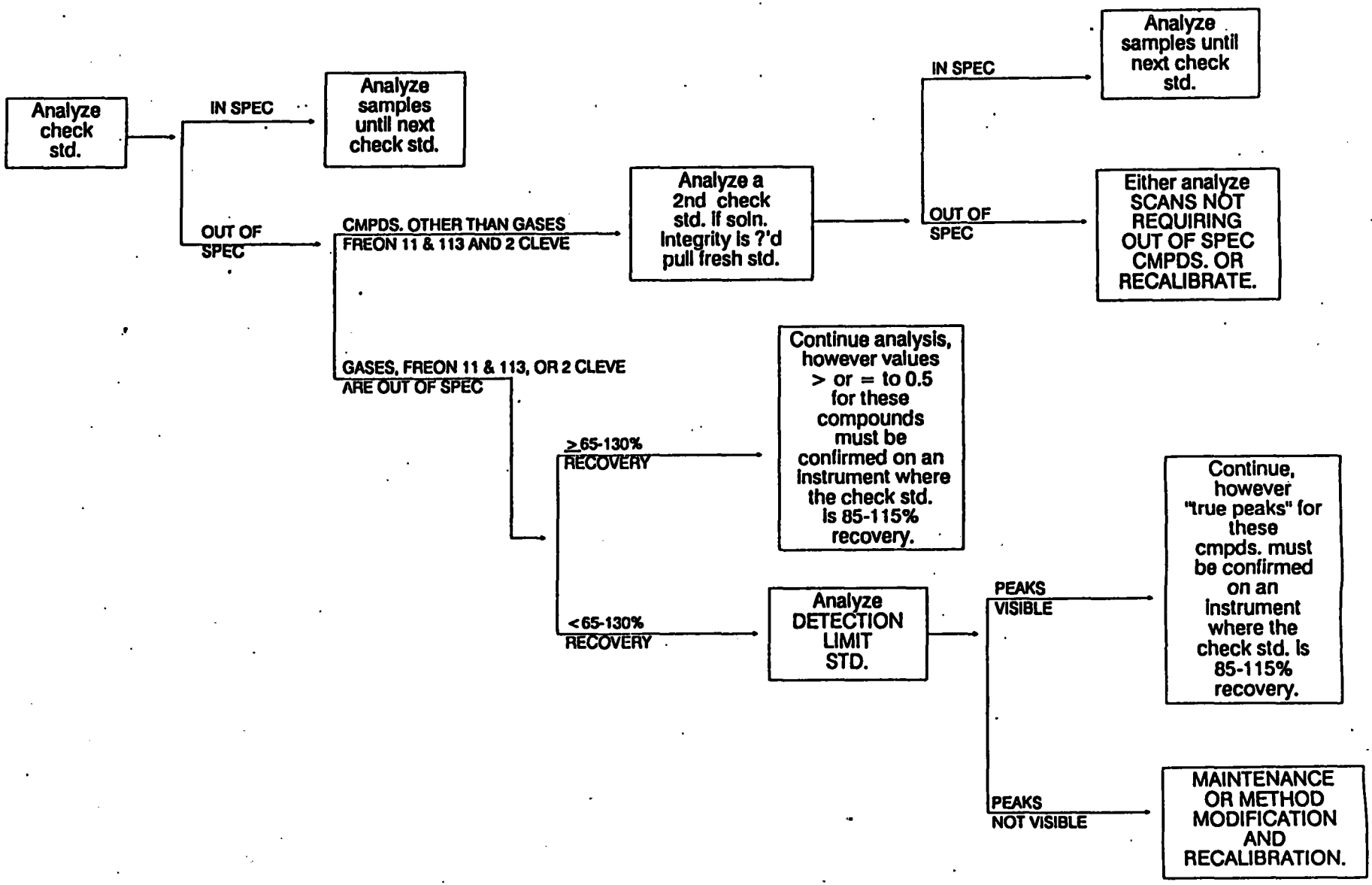
Reference	2[a]	2[a]	2[a]	2[a]	2[a]
LLI Scan #	1211[b] LOQ	1213[b] LOQ	1400[c] LOQ	1837[b] LOQ	4262[b] LOQ
Compound					
Benzene	20.	20.	1.	20.	20.
m-Dichlorobenzene					
o-Dichlorobenzene					
p-Dichlorobenzene					
Ethylbenzene	20.	20.	1.	20.	20.
Toluene	20.	20.	1.	20.	20.
m-Xylene		20.	1.	20.	20.
o-Xylene		20.	1.	20.	20.
p-Xylene		20.	1.	20.	20.
Methyl t-butylether				20.	
Naphthalene					100.

a - SW-846, Third Edition, Test Methods for Evaluating Solid Waste, Methods 5030, 8000, and 8020 (Purge and Trap/ Aromatic Volatile Organics)

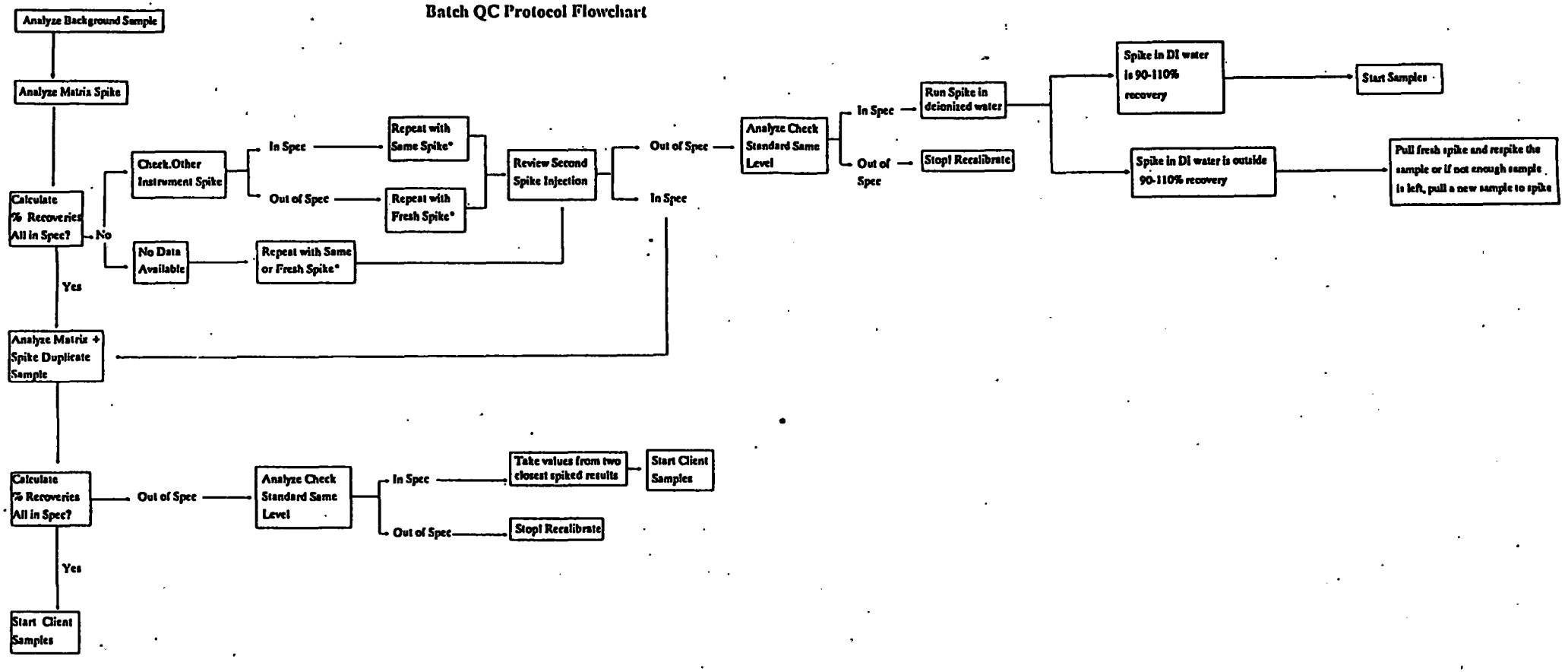
b - This analysis is performed using a modification of SW-846, methanolic extraction, described in LLI Analysis #379.

c - This analysis follows the SW-846 methanolic extraction procedures exactly. Low or midlevel analysis can apply. For the LOQ, the low level quantitation limit is referenced.

Check Std. Analysis Protocol Flowchart



Batch QC Protocol Flowchart



For data package groups with the background, spike, and spike dup. as independent LLI numbers, the 2nd injection of the spiked sample (*) should be from the matrix spike dup. vial. If the results of the 2 spikes match but are both out of spec. (values), run a check std. and a spike in deionized water. If the check std. is in spec., samples can be started. If the check std. is out of spec., STOP! and recalibrate. The spike in deionized water purpose is to help us evaluate the bkg./sp./sp. dup. results. Being in spec is not required to continue with samples. The critical determinate is the check std., this must be in spec. for all compounds being reported before continuing with samples. When one spike result is in spec. and the other out of spec., run a 3rd injection of a spiked sample using either the spike or spike dup. vial. This will be decided through analyst experience. Then follow protocol (+) from the point of the spike dup. injection.

Figure I: Packed Column

BTX Volatiles Analysis by Purge & Trap GC

SAMPLE NAME: **CHKSTD 10/100**
Batch Number: 91275/A04
Instrument: TRACOR540#4PID

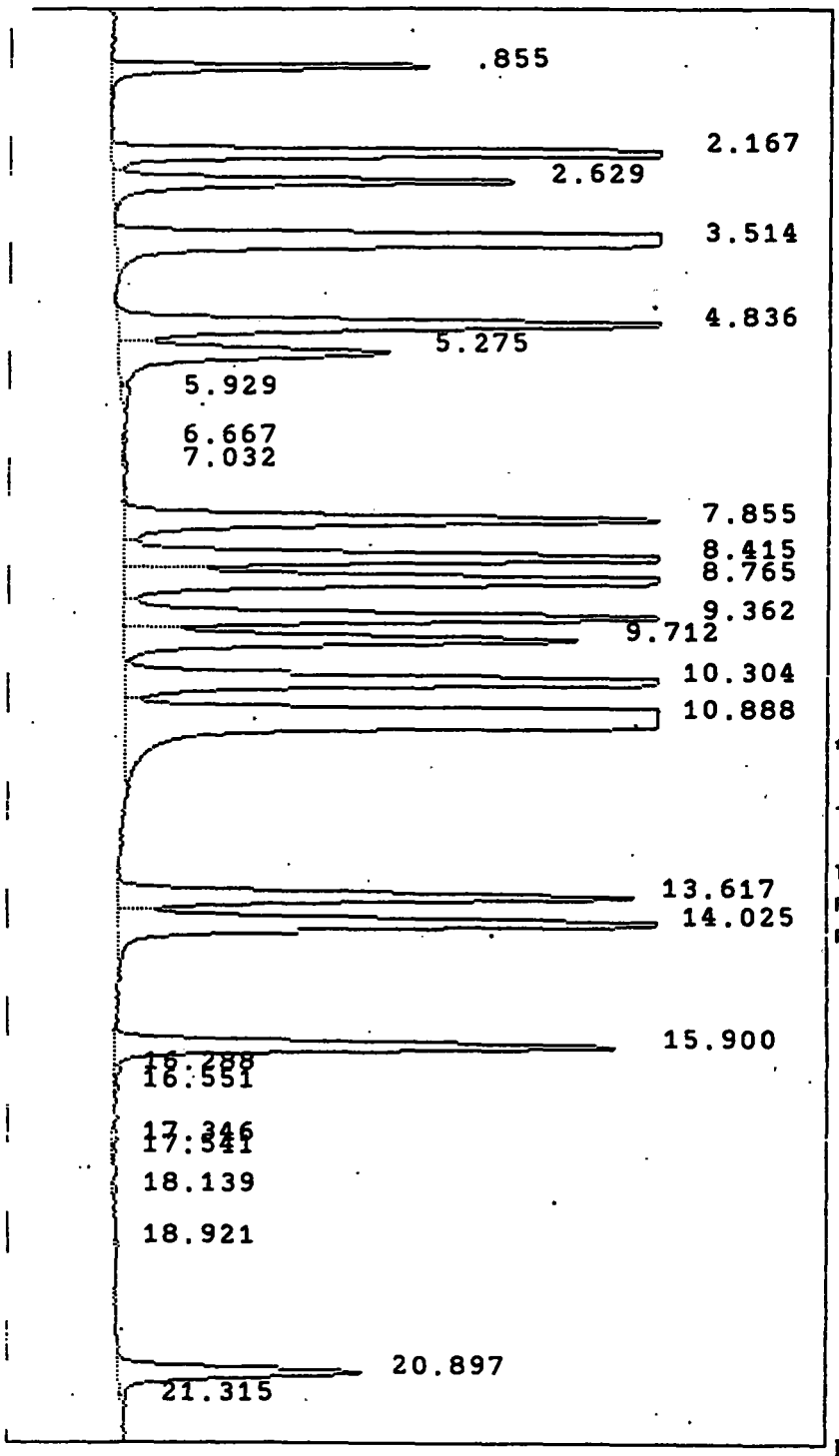
RESULT FILE: **/V2/RESULT/P04_275_048.RES**
Injected on Thu Oct 3, 1991 1:57:30 am

5% SP-1200/1.75% Bentone 34 on 100/120 Supelcoport
Trap - Tenax and OV-1
GC Conditions - 45C for 3 min, ramp 6C/min to 155C, hold 15 min

---

METHOD: **/V2/METHOD/P04_275N.MTH**
Quantitation: HeightUnits
Plot Fields: 1600 - 2600

Employee #634
Calculation: InternalSTD
Dilution Factor: 1.00E+00



RT	IDTime	Height	Code	*ug/L	Name
.85	.86	1080	PV	19.42	METHYL T-BUTYL ETHER
2.17	2.16	3014	PV	18.65	BENZENE
2.63	2.63	1314	VV	18.67	TRICHLOROETHENE
3.51	#3.52	6022	VB		ISTD - TFT
4.84	4.84	1836	BV	19.82	TOLUENE
5.28	5.29	843	VV	17.37	TETRACHLOROETHENE
7.86	7.86	1759	VV	18.20	ETHYLBENZENE
8.42	8.42	1998	VV	18.52	P-XYLENE
8.77	8.77	2128	VV	18.81	M-XYLENE
9.36	9.37	1722	VV	18.82	O-XYLENE
9.71	9.72	1417	VV	18.16	CUMENE
10.30	10.31	2374	VV	19.82	STYRENE
10.89	#10.89	13973	VV	100.43	- SURROGATE - NPRBENZENE
13.62	13.63	1607	VV	20.48	P-DICHLOROBENZENE
14.02	14.04	1938	VV	21.55	M-DICHLOROBENZENE
15.90	15.91	1582	VV	22.33	O-DICHLOROBENZENE
20.90	20.91	755	VV	20.55	NAPHTHALENE

Internal Standard Range: 4219 - 6328 (Midpoint - 5273)

Using check standard file.
/V2/RESULT/P04_275_025.RES

*Results are reported in ug/L for water samples and ug/kg for soil samples.

Integration Parameters: Run Time - 22.02
Threshold - 1.0 Minimum Area - 1.000E+02
Format File: /DATA/FORMAT/BTXONE.FMT
Reported on Thu Oct 3, 1991 2:26:36 am

Corrected Values From Above:

	Amount	DF	Surrogate
Benzene -			
Toluene -			
Ethylbenzene -			
p-Xylene -			
m-Xylene -			
o-Xylene -			
Methyl t-butyl ether -			
p-Dichlorobenzene -			
m-Dichlorobenzene -			
o-Dichlorobenzene -			
_____ -			
_____ -			

Report No. _____
Read by _____ on _____

Figure II: Capillary Column

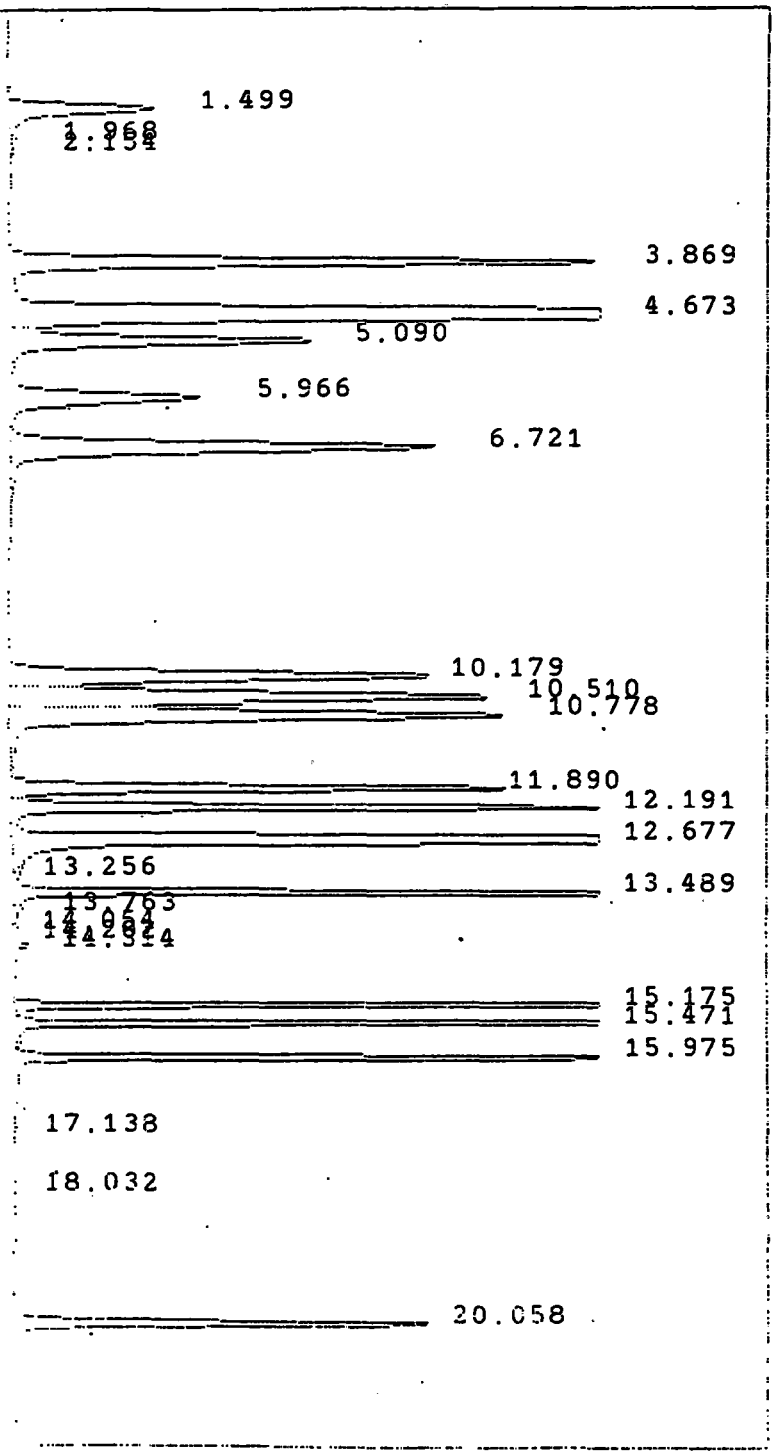
BTX Volatiles Analysis by Purge & Trap GC

SAMPLE NAME: **CHKSTD 10/100**
Batch Number: 91269/A07 RESULT FILE: **/V2/RESULT/P07_269_100.RES**
Instrument: TRACOR540#7PID Injected on Fri Sep 27, 1991 9:52:20 am

0.53 mm ID, 1.0 um STABILWAX COLUMN
Trap - Tenax and OV-1
GC Conditions - 50C for 6 min, ramp 4C/min to 70C, hold 0.1 min

METHOD: **/V2/METHOD/P07_269N.MTH**
Quantitation: HeightUnits
Plot Fields: 2800 - 5000

Employee #161
Calculation: InternalSTD
Dilution Factor: 1.00E+00



RT	IDTime	Height	Code	*ug/L	Name
1.50	1.48	962	BV	16.85	METHYL T-BUTYL ETHER
3.87	3.85	4014	BB	16.82	BENZENE
4.67	#4.65	9711	BV		ISTD - TFT
5.09	5.06	2046	VV	16.92	TRICHLOROETHENE
5.97	5.94	1264	PV	16.24	TETRACHLOROETHENE
6.72	6.69	2874	VV	16.75	TOLUENE
10.18	10.16	2869	BV	16.56	ETHYLBENZENE
10.51	10.48	3302	VV	17.17	P-XYLENE
10.78	10.75	3382	VV	17.47	M-XYLENE
11.89	11.87	3538	VV	17.17	CUMENE
12.19	12.19	5229	VV	17.66	O-XYLENE
12.68	#12.67	50859	VV	101.00	SURROGATE - NPRBENZE
13.49	13.48	13683	VV	17.85	STYRENE
15.18	15.20	13850	BV	19.35	M-DICHLOROBENZENE
15.47	15.48	11722	VV	17.89	P-DICHLOROBENZENE
15.98	15.97	9048	VV	19.25	O-DICHLOROBENZENE
20.06	20.09	3034	PV	18.35	NAPHTHALENE

Internal Standard Range: 8113 - 12169 (Midpoint - 10141)

Using check standard file.
/V2/RESULT/P07_267_081.RES

*Results are reported in ug/L for water samples and ug/kg for soil samples.

Integration Parameters: Run Time - 22.00
Threshold - 1.0 Minimum Area - 1.000E+02
Format File: /DATA/FORMAT/BTXONE.FMT
Reported on Fri Sep 27, 1991 10:15:30 am

Corrected Values From Above:

	Amount	DF	Surrogate
Benzene -			
Toluene -			
Ethylbenzene -			
p-Xylene -			
m-Xylene -			
o-Xylene -			
Methyl t-butyl ether -			
p-Dichlorobenzene -			
m-Dichlorobenzene -			
o-Dichlorobenzene -			
_____ -			
_____ -			

Report No. _____
Read by _____ on _____

Lancaster Laboratories
Where quality is a science.

Analysis #379
Initiated Date: 12/18/87
Effective Date: JUL 24 1992

Methanolic Extraction of Soils and Solid Waste

Reference:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Method 5030, Purge and Trap.

Scope:

This method is used to extract solid samples for the determination of purgeable halocarbons and aromatics. This includes Lancaster Laboratories, Inc. analysis scan numbers 1211, 1214, 1213, 4262, 1837, and single analytes that are part of these scans.

Summary:

This method is based on the midlevel method from EPA method SW-846 5030. A solid sample is shaken with methanol, the methanol decanted, diluted as needed and the diluent analyzed by purge and trap gas chromatography. See individual methods for specific analysis instructions.

Definitions:

1. Reagent grade methanol - Methanol which is free of volatile organics for which the sample is being analyzed.

2. Reagent water - Deionized water which is free of volatile organics for which the sample is being analyzed.

3. DF - Dilution factor.

Apparatus:

1. 40 ml vials

2. Spatula

3. Top loading balance capable of weighing to 0.01 g with 100 g capacity.

Procedure:

1. Mixing and weighing should be done in the hood. Mix soil samples in their original container. If this is not possible, sample from various places in the container.

2. After mixing the sample, weigh 20 g (± 0.1 g) into a tared 40 ml vial and record the sample weight on the vial in permanent marker. Also record date, sample number, sample weight and analyst's initials and employee number in the solid waste weigh out notebook. If there is sufficient sample, repeat the process. When not able to weigh out 20 g, smaller amounts may be used, however, a minimum of 5 g must be used.

3. Add 20 ml of reagent grade methanol to the vial containing the sample and seal with an open ended teflon septa lined cap. If 10 g of sample have been added to the vial, then add only 10 ml of reagent water. The ratio of methanol to soil is to be 1:1 unless not possible because of sample matrix. If the sample is not dense enough so that 20 ml will cover the whole sample,

or if the sample absorbs the full 20 ml, then add more methanol. Record the volume of methanol added on the container and both grams of sample and the volume of methanol on the run log sheet at the instrument of analysis if these parameters deviate from the 1:1 ratio.

4. Shake the sample vigorously for two minutes. Let the sample settle for one hour. Centrifuging may be necessary to remove suspended particles after the hour extraction. See manufacturer instructions for speed and length of centrifuging. After the hour extraction, decant off methanol extract and seal this in a 10 to 18 ml screw capped vial (dependent on availability). Record the sample number on the side of the vial in permanent marker.

5. The lowest dilution used for analysis 1211 and 1214 (for analysis 1213, 4262, 1837 see step #6) is a DF 20. Using a 0.5 or 1.0 ml gas tight syringe pull more than 0.25 ml of the methanol extract into the barrel. Expel all air and level the plunger to the 0.25 ml mark. Fill a 5 ml analysis syringe with a 4.75 ml of reagent water. Inject the 0.25 ml of extract into the 4.75 ml reagent water allowing the plunger of the 5 ml syringe to move to the 5 ml mark. If leaking occurs at the connection of the two syringes, empty the syringes and start again. A tight seal must be formed between the two syringes to insure a leak-free transfer of extract to reagent water. There also must not be air bubbles in the 5 ml syringe after the extract transfer. If this occurs, empty the syringes and start again. If further dilutions are made, care should be taken to wash all syringes used in the analysis before attempting analysis at a greater dilution.

6. The lowest dilution used for analysis 1213, 4262, 1837, is a DF 25. Using a 1.0 ml gas tight syringe pull more than 1.0 ml of methanol extract into the barrel. Expel all air and level the plunger to the 1.0 ml mark. Fill a 25 ml analysis syringe with 24 ml of reagent water. Inject the 1.0 ml of extract into the 24 ml reagent water allowing the plunger of the 25 ml syringe to move to the 25 ml mark. If leaking occurs at the connection of the two syringes, empty the syringes and start again. A tight seal must be formed between the two syringes to insure a leak-free transfer of extract to reagent water. There also must not be air bubbles in the 25 ml syringe after the extract transfer. If this occurs, empty the syringes and start again. If further dilutions are made, care should be taken to wash all syringes used in the analysis before attempting analysis at a greater dilution.

7. Add 5 ul surrogate/internal standard to the 5 ml or 25 ml of sample in the analysis syringe.

8. Calculate the dilution factor as follows using 5 ml total sample:

$$DF = \frac{\text{(ml methanol extract)}}{\text{(g of sample extracted)}} \times \frac{\text{(5 ml)}}{\text{(volume of extract injected in ml)}}$$

9. Calculate the dilution factor as follows using 25 ml total sample:

$$DF = \frac{\text{(ml methanol extract)}}{\text{(g of sample extracted)}} \times \frac{\text{(25 ml)}}{\text{(volume of extract injected in ml)}}$$

10. The dilution factor is entered into the integrator/data system and is used to set the detection limit. Record the dilution factor on the run log sheet of the instrument used for analysis.

NO379.W51
OR METHODS #1
072292

Prepared by: Judy A. Colello Date: 7/22/92

Approved by: Dennis J. Wilson Date: 7-23-92

Approved by: Kathy L. DeMunzio Date: 7/23/92

Analysis #182, 296, 297, 418, 419, 420, 463, 515, 537, 538, 539, 912, 1163, 1165, 1170, 1211, 1214, 1226, 1227, 1228, 1462, 1564, 4146, 4267, 4268, 4269, 4717
Initiated Date: 12/18/87
Effective Date: JUL 9 1992

Purgeable Halocarbons/Aromatics in Water and Solid Samples

References:

1. 40 CFR Part 136: Methods 601 (Purgeable Halocarbons) and 602 (Purgeable Aromatics).

2. SW-846 (Third Edition) Test Methods for Evaluating Solid Waste, Methods 5030 (Purge-and-Trap), 8000 (Gas Chromatography), 8010 (Purgeable Halocarbons), and 8020 (Purgeable Aromatics).

Scope:

This method is suitable for analyzing water and solid samples for the purgeable halocarbon and aromatic compounds listed in Appendix A. The various LLI scan numbers which are analyzed under this method are summarized in Appendix B. The corresponding limits of quantitation are also listed in these Appendices. In addition to the halocarbon compounds listed in Appendix A, three aromatic compounds, benzene, toluene, and ethylbenzene, can also be determined by this method when analyzed in conjunction with halocarbon analyses. If trichloroethene and tetrachloroethene are the only halocarbons being analyzed for, they may be simultaneously analyzed with the volatile aromatics using a photoionization detector and a Hall electrolytic conductivity detector in series.

The methods as written in the references above are very similar with only minor differences. Generally, all statements in this method will apply to the references unless otherwise explicitly noted.

Summary:

The method is based on the purge-and-trap gas chromatography method where an inert gas is bubbled through 5 ml of the sample solution. The volatile halocarbons and aromatics are purged from the sample and trapped on a sorbent trap. After purging is complete, the sorbent trap is heated and backflushed with inert gas to desorb the trapped compounds onto a suitable gas chromatographic column. The gas chromatograph is then temperature-programmed to separate the compounds which are then detected and quantified with a photoionization detector and an electrolytic conductivity detector in series. Typical chromatograms and printouts are shown in Figures 1 and 2.

Apparatus:

Purge-and-Trap Concentrator - Tekmar LSC-2, LSC-2000, Model 4000, ALS or equivalent device equipped with the Tenax/silica gel/charcoal trap as specified in the references. If none of the CFC's (dichlorodifluoromethane, trichlorofluoromethane, or trichlorotrifluoroethane) are being analyzed for, the charcoal can be eliminated and replaced with more Tenax. If none of the gaseous compounds (chloromethane, bromomethane, vinyl chloride, or chloroethane) are being analyzed for, an all-Tenax trap can be

used. A trap packed with Carbopack B and Carbosieve S-III may be used, but different desorption and bake temperatures must be used. The purge-and-trap conditions are summarized in Table I.

Gas Chromatograph - Any commercially-available gas chromatograph capable of temperature-programming and equipped with a Hall electrolytic conductivity detector and a photoionization detector that provide the proper sensitivity and linearity may be used. Although not necessary if not analyzing for benzene, toluene, or ethylbenzene, the photoionization detector may be used to aid in the identification and confirmation of the multiply-bonded compounds included in this method.

GC Columns:

1. 8 ft. or 10 ft. by 2 mm ID glass or metal column packed with 1% SP-1000 on Carbopack B 60/80 mesh or equivalent.

2. 30 m x 0.53 mm ID fused silica capillary column with bonded phase specifically designed for purgeables (e.g., Supelco VOCOL or equivalent).

3. 60 m x 0.75 mm ID glass capillary column with bonded phase specifically designed for purgeables (e.g., Supelco VOCOL or equivalent).

4. 105 m x 0.53 mm ID glass capillary column with bonded phase specifically designed for purgeables (e.g. Supelco VOCOL or equivalent).

Normal operations will use column 1, however, column 2, 3, or 4 may be used as either the primary analytical column or as a confirmation column. Other suitable columns as stated in the references may also be used as confirmation columns. The GC conditions are summarized in Table II.

Materials:

Laboratory deionized water is used to prepare all sample dilutions and working standards. Reagent grade (or equivalent) methanol is used to prepare all other calibration and QC standards. Standards not containing gaseous compounds are prepared as stated in the references from neat compounds obtained from suppliers which indicate the purity of the compound. No correction for purity is made if the purity is listed as >96%. Premade solutions are used for the gaseous compounds and can be used for other compounds if the concentrations of the solutions are documented by the supplier.

Safety Precautions:

The toxicities of all compounds used in this method have not been established. However, several of the compounds are considered carcinogens. Each compound should be treated as a potential health hazard. The major route of exposure is inhalation during handling of the neat materials while preparing stock standards. These stocks must therefore be prepared in a hood to eliminate the risk of inhaling the vapors of the neat materials. After the neat materials are diluted with methanol or other solvents, the potential for exposure is reduced significantly. Nevertheless,

care must be taken in the handling of any and all standards. Information concerning the known toxicity, properties, or special handling precautions for any compound can be found with the material safety data sheets available from the safety officer.

Standards:

1. Surrogate/Internal Standard - Bromochloromethane and 1-chloro-3-fluorobenzene are used as surrogates and trifluorotoluene is used as an internal standard. Stock surrogate/internal standards are prepared in methanol from neat compounds at concentrations of approximately 5000 mg/l by adding about 50 mg of each compound to methanol in a 10 ml volumetric flask. These standards are stored in 16 ml vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for up to six months.

   Secondary dilution standards in methanol at concentrations of approximately 60 mg/l are prepared monthly by diluting 0.3 ml of the stock standard with methanol in a 25 ml volumetric flask. Secondary dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for no longer than one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

Other compounds may be substituted as surrogates or internal standards if they do not coelute with or interfere with the quantitation of analytes of interest.

2. Calibration Standards - Three different standards are used as calibration standards:

a. Gaseous Compounds - Premade solutions of chloromethane, bromomethane, vinyl chloride, and chloroethane each at concentrations of 2000 mg/l are purchased from a supplier and used as stock standards. These ampulized standards are stored indefinitely at -10°C to -20°C (14°F to -4°F).

Secondary dilution standards are prepared by diluting 0.5 ml of the stock standard with methanol in a 5 ml volumetric flask at -10°C to -20°C (14°F to -4°F) to give a final concentration of 200 mg/l. Secondary dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F). Secondary dilution standards are kept at -10°C to -20°C (14°F to -4°F) at all times and are held for no more than one week before being discarded.

Care must be taken with the gaseous compound secondary dilution standards to ensure that they are kept at -10°C to -20°C (14°F to -4°F) at all times, due to the high volatility of the compounds.

b. 2-Chloroethyl Vinyl Ether (2-cleve) - No stock standards of 2-chloroethyl vinyl ether are prepared. The dilution standards of this compound are prepared weekly in methanol from the neat compound at concentrations of approximately 800 mg/l by adding about 20 mg of the compound to methanol in a 25 ml volumetric flask. The dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for one week. Dilution standards are held for no more than one day on the bench before being discarded.

2-Chloroethyl vinyl ether dilution standards must be prepared weekly due to the instability of the compound over longer periods of time.

c. Primary Compounds - Stock calibration standards are prepared in methanol from neat compounds at concentrations of approximately 10,000 mg/l by adding about 100 mg of each compound to methanol in a 10 ml volumetric flask. These standards are stored in 16 ml vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for up to six months.

Secondary dilution standards, prepared by diluting 1.0 ml of stock standard with methanol in a 25 ml volumetric flask to give a final concentration of

approximately 400 mg/l, are prepared monthly. Secondary dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

The primary compound standards contain all compounds listed in Appendix B, except for the gaseous compounds, 2-chloroethyl vinyl ether, and the six coelutor compounds listed in Appendix C.

3. Quality Control Check Standards - Three different standards are used as QC check standards:

   a. Gaseous Compounds - The same standard used as the gaseous compounds calibration standard is also used as the gaseous compounds QC check standard.

   b. 2-Chloroethyl Vinyl Ether - The same standard used as the 2-chloroethyl vinyl ether calibration standard is also used as the 2-chloroethyl vinyl ether QC check standard.

   c. Primary Compounds - Stock QC check standards, containing all compounds in the primary compound calibration standards, are prepared independently from the calibration standards. Stock QC check standards are prepared in methanol from neat

compounds at concentrations of approximately 10,000 mg/l by adding about 100 mg of each compound to methanol in a 10 ml volumetric flask. These standards are stored in 16 ml vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for up to six months.

Secondary dilution standards, prepared by diluting 1.0 ml of stock standard with methanol in a 25 ml volumetric flask to give a final concentration of approximately 400 mg/l, are prepared monthly. Secondary dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

The primary compound standards contain all compounds listed in Appendix B, except for the gaseous compounds, 2-chloroethyl vinyl ether, and the six coelutor compounds listed in Appendix C.

4. Spiking Standards - Two different standards are used as spiking standards:

   a. Gaseous Compounds - Gaseous compounds spiking standards are prepared by diluting 0.5 ml of the gaseous compounds secondary dilution calibration/QC check standard with methanol in a 5 ml volumetric

flask at -10°C to -20°C (14°F to -4°F) to give a final concentration of 20 mg/l. Spiking standards are stored in 0.3 ml conically-shaped autoinjector vials with screw-cap lids and teflon-lined septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F). Spiking standards are kept at -10°C to -20°C (14°F to -4°F) at all times and are held for no more than one week before being discarded.

Care must be taken with the gaseous compounds spiking standards to ensure that they are kept at -10°C to -20°C (14°F to -4°F) at all times, due to the high volatility of the compounds.

b. Primary Compounds - Stock primary compound spiking standards, containing all compounds in the primary compound calibration and QC check standards, are prepared independently from the calibration and QC check standards. Stock spiking standards are prepared in methanol from neat compounds at concentrations of approximately 2,000 mg/l by adding about 50 mg of each compound to methanol in a 25 ml volumetric flask. These standards are stored in 16 ml vials with screw-cap lids and teflon-lined silicone septa (may vary based on availability) at -10°C to -20°C (14°F to -4°F) for up to six months.

Secondary dilution standards, prepared by diluting 0.5 ml of stock standard with methanol in a 50 ml volumetric flask to give a final concentration of approximately 20 mg/l, are prepared monthly. Secondary dilution standards are stored in 1.5 ml autoinjector vials with screw-cap lids and teflon-lined septa (may vary based on availability) at 10°C to -20°C (14°F to -4°F) for one month. Secondary dilution standards are held for no more than one day on the bench before being discarded.

The primary compound standards contain all compounds listed in Appendix B, except for the gaseous compounds, 2-chloroethyl vinyl ether, and the six coelutor compounds listed in Appendix C.

NOTE: 2-Chloroethyl vinyl ether is not routinely used as a spike compound. No spiking standards for this compound are regularly prepared.

See Table III at the end of this method for a summary of concentrations, storage conditions, and shelf life for standards used with this method.

Calibration:

Five levels of calibration are required when calibrating according to SW-846, Methods 5030/8010 and 5030/8020 (Reference 2), and at least three levels are required when using EPA Methods 601 and 602 (Reference 1). For each method, the

calibration range should be from approximately 5 to 200 ug/l. Working calibration standards are prepared by diluting the appropriate volumes (3 to 25 ul) of the gaseous compounds secondary dilution standard, the 2-chloroethyl vinyl ether dilution standard, and the primary compounds secondary dilution standard with reagent water into 50, 100, 200, or 500 ml volumetric flasks. The 2-chloroethyl vinyl ether and primary compounds standards are allowed to come to room temperature before an aliquot is withdrawn. The working standards are mixed by inverting the volumetric once after the primary standards compounds have been added, once after the 2-chloroethyl vinyl ether has been added, and a final time after the gaseous compounds standard has been added. (Due to the high volatility of the gaseous compounds, standards should be added to the deionized water in this order.) Five ml of each working standard is analyzed as described below in the "Procedure" section.

Calibration can be performed using either the external or internal standard calibration. In either case, a point-to-point calibration curve is used. For the external calibration, two of the three surrogate standards described above are used (normally bromochloromethane and 1-chloro-3-fluorobenzene). For the internal standard calibration, one of the three surrogate standards described above is used as the internal standard (normally trifluorotoluene), and another is used as a surrogate (normally 1-chloro-3-fluorobenzene). The response factor (RF; as defined in Department 25 SOP-OR-020, Manual Calculation of the Analyte Response Factors and the Relative Standard Deviation for Analyte Response Factors, is calculated for each analyte in each calibration level. If the relative standard deviation (RSD)

of the RF's for any analyte is less than 20% (Reference 2) or 10% (Reference 1), the average RF may be used for the quantitation. Alternately, a linear least squares fit to the calibration data may be used.

Once the system is calibrated, the working calibration curve is verified by analyzing a QC check standard. This standard is prepared by diluting 10 ul of the primary compounds secondary dilution standard, 7 ul of the 2-chloroethyl vinyl ether dilution standard, and 20 ul of the gaseous compounds secondary dilution standard with reagent water in a 200 ml volumetric flask to give a final concentration of approximately 20 ug/l (30 ug/l of 2-chloroethyl vinyl ether). If the recovery of any analyte is outside the 85 to 115% range, the Check Standard Protocol Flowchart in Figure 3 at the end of this method is followed. The calibration curve is verified in this manner approximately every 8 to 10 hours.

Sample Collection, Preservation, and Preparation:

Samples should be adjusted to pH <2 with approximately 0.2 ml of 1:1 hydrochloric acid (HCL). If residual chlorine is present, the sample should also be preserved with sodium thiosulfate, (approximately 10 mg to 40 ml of sample) or ascorbic acid, (approximately 25 mg to 40 ml of sample). If 2-chloroethyl vinyl ether is to be analyzed for, the sample should not be acidified. All samples must be cooled to 2°C to 6°C (36°F to 43°F) at the time of collection until analysis. Samples should be collected in duplicate in 40 ml vials with teflon-lined silicone septa. All samples must be analyzed within 14 days of collection.

For water samples, no sample preparation is required except possibly for dilutions which are described below in the Procedure section. For solid samples, a low-level (aqueous purge) method is described in LLI Analysis #377. Two methanolic extraction procedures are described in LLI Analysis #1401 (as per SW-846 exactly) and LLI Analysis #379 (a modification of SW-846).

Procedure:

Set the purge-and-trap and GC conditions as described in Tables I and II for the particular trap and column being used. Calibrate the system as described above and perform the necessary QC analyses as described below. When sample analysis is to begin, allow the sample to come to room temperature. Remove the plunger from a 5 ml syringe and rinse both the syringe and the plunger with deionized water. Open the sample bottle (or standard) and carefully pour the sample into the 5 ml syringe to overflowing. Replace the plunger, vent any residual air, and adjust the volume to 5 ml. Add 5 ul of the secondary dilution surrogate/internal standard solution to the syringe. Attach the syringe to the sampling valve on the purge-and-trap concentrator, inject the sample into the purging vessel, and begin the purging cycle.

1. Identification of Analytes - Comparison of sample peak retention times to standard peak retention times is used to tentatively identify compounds. Further considerations include normal vs. abnormal peak shape and comparison of the chromatograms obtained from each detector (when a PID is being used). In many cases, the

experience and discretion of the analyst should weigh heavily in the interpretation of the chromatogram. If the identification of a compound is in doubt due to the possible presence of one of the coelutor compounds listed in Appendix C, the sample is reanalyzed on a second confirmation column.

2. Dilutions - Samples which contain levels of analytes above the dynamic range of the method (the highest-level calibration standard) must be reanalyzed. Before continuing with the analysis of the diluted sample, the analyst must be assured that the high level of the analyte present will not carry over into the next injection. This can be accomplished by analyzing a reagent water blank (cleanup blank). If the analytes are all below the limit of quantitation, then the analysis of the diluted sample can begin. If not, the cleanup blank is repeated until analyte levels are below the quantitation limit.

   To dilute a water sample or solid extract sample, the sample is pulled into a 25, 100, 250, 500, or 1000 ul gas-tight syringe. The exact volume is then added to 5 ml of reagent water in a glass syringe or to larger volumes of reagent water in volumetric flasks. If the sample is diluted in a volumetric flask, the contents of the flask are mixed by inverting the flask three times and then poured into the 5-ml glass syringe. Any residual air is vented, the volume is adjusted to 5 ml, and 5 ul of the surrogate/internal standard solution is

added. The sample is loaded into the purge-and-trap concentrator and the purge cycle is initiated.

Care should be taken to avoid carryover of high levels. The syringes and flasks used in diluting samples and the sparge vessel should be cleaned by rinsing with methanol and reagent water before analyzing further samples.

The dilution factor is calculated as follows:

When the sample is diluted directly into the 5 ml syringe:

$$DF = 5 / (\text{ml of sample added to syringe})$$

When an intermediate dilution into a volumetric flask is used:

$$DF = (TV / VS) \times (5 / VDS)$$

where VS = the volume, in ml, of sample which is diluted in the intermediate dilution

TV = the total volume, in ml, of the intermediate dilution (i.e., the volume of the volumetric flask)

VDS = the volume, in ml, of the diluted sample which is added to the 5-ml syringe

NOTE: If more than one intermediate dilution is performed, the factor (TV / VS) is calculated for each intermediate dilution.

Calculations:

Procedures and the necessary equations for manual and automatic (computer data reduction) calculations are found in Department 25 SOP-OR-004, Manual Calculations of Analyte Concentrations for Volatiles by GC. Methods for calculating concentrations using average response factors and point-to-point calibration curves are presented there for both external and internal standard calibrations.

Quality Control:

In order to monitor both the performance of the analytical system and the effectiveness of the method in dealing with each sample matrix, each blank, standard, sample, and spiked sample is spiked with 5 ul of secondary dilution surrogate/internal standard solution. Surrogate recoveries should be within the 75 to 125% range. If the internal standard method is used, the height of the internal standard for each injection is recorded. The acceptable range for the height is 80 to 120% of the average of those obtained during calibration, or 80 to 120% of the height obtained in a recently-analyzed acceptable QC check standard. If the recoveries fall outside of these ranges, the injection should be repeated.

As stated above in the calibration section, the calibration curve is verified approximately every 8 to 10 hours by analyzing a QC check standard which contains every analyte of interest. If the recovery of any analyte is outside of the 85 to 115% range, the Check Standard Analysis Protocol Flowchart in Figure 3 at the end of this method is followed.

A matrix spike (MS) and matrix spike duplicate (MSD) are performed on one sample in each batch of up to 20 samples. 5 ul of the primary compounds secondary dilution spiking standard and 5 ul of the gaseous compounds spiking standard, representing concentrations of approximately 20 ug/l in the sample, are added to 5 ml of the sample (prepared as described above in the Procedure section) in a 5 ml glass syringe. The acceptable recoveries for each compound in water and solid matrices are listed in Appendix D at the end of this method. This appendix also lists the maximum allowable relative percent deviation (RPD) of the spike recoveries for each compound. The RPD is calculated as follows:

$$RPD = [\ 2 \times (R1 - R2) / (R1 + R2)\ ] \times 100$$

If the recovery for any analyte falls outside the ranges listed in Appendix D, the Batch QC Protocol Flowchart in Figure 4 at the end of this method is followed.

The results from the unspiked (BKGD), MS, and MSD samples are recorded in the LLI sample management/QA database referencing each appropriate batch of up to 20 samples in which it was performed. Surrogate standard recoveries, blank results, and

sample replicate results for each batch are also entered into the database.

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OR METHODS #3
070192

Prepared by: Jeffrey N Schofield Date: 7-7-92

Approved by: Judy A. Colello Date: 7/7/92

Approved by: Kathy L. DeMunzio Date: 7/8/92

Table I

Purge-and-Trap Conditions

Trap Type *	T/SG/C	CPB/CSS
Purge Ready Temp (°C)	30	30
Purge Flow (ml/min)	40**	40**
Purge Time (min)	11	11
Dry Purge Time (min)	0	13
Desorb Preheat Temp (°C)	175	245
Desorb Temp (°C)	180	250
Desorb Time (min)	1	4
Bake Temp (°C)	220	260
Bake Time (min)	10	20
Heated Valve and Line Temps (°C)	100 to 130	100 to 130

* T/SG/C = Tenax/Silica Gel/Charcoal
CPB/CSS = Carbopack B/Carbosieve S-III

** can be set lower for optimum gases response (25-30 ml/min)

Higher bake temperatures and times may be used to remove analytes which may carry over after the analysis of samples containing high levels of volatiles.

The Purge and Trap conditions may be modified to achieve optimum instrument performance based on the manufacturer's specifications without adversely effecting the method performance.

Table II

GC Conditions

Column Number	1	2 or 3 or 4
Detector Temp - Hall (°C)	250	250
Detector Temp - PID (°C)	200	200
Injector Temp (°C)	150	200
Carrier Flow (ml/min)	30 to 40	7 to 10
Detector Makeup Flow (ml/min)	---	20 to 25
Initial Temp (°C)	45	40
Initial Hold Time (min)	3	5
Ramp Rate (°C/min)	8	5
Final Temp (°C)	220	190
Final Hold Time (min)	15	5

Hall Electrolytic Conductivity Detector

Mode	Halogen
Reactor Tube	Nickel 1/16 inch OD
Reactor Temp (°C)	800 to 900
Electrolyte	1-Propanol
Electrolyte Flow (ml/min)	0.4 to 0.8
Reaction Gas	Hydrogen, 25-30 ml/min

O-I Electrolytic Conductivity Detector

Mode	Halogen
Reactor Tube	Nickel 1/16 inch OD
Reactor Temp (°C)	800 to 900
Electrolyte	1-Propanol
Electrolyte Flow (ml/min)	0.03 to 0.05
Reaction Gas	Hydrogen, 90-110 ml/min

The HECD sensitivity should be set so that 0.5 ug/l of chloroform gives a S/N ratio of at least 10:1. If the sensitivity of the HECD is not sufficient to reach this level, the electrolyte, the conductivity cell, the reactor tube, and other components should be cleaned or replaced.

Table II

GC Conditions
(Continued)

The PID sensitivity should be set so that 1 ug/l of benzene gives a S/N ratio of at least 10:1. If the sensitivity of the PID is not sufficient to reach this level, the lamp should be cleaned or replaced.

Alternatively, the purge-and-trap concentrator should be checked for leaks and/or poor trap performance.

The GC conditions may be modified to achieve optimum instrument performance based on the manufacturer's specifications without adversely effecting the method performance.

Table III

Standards Used in the Purgeable Halocarbons/Aromatics Method

Standard	Approximate Concentration	Storage	Shelf Life
Surrogate/ Internal (stock)	5,000 mg/l in methanol	-10°C to -20°C, vial	6 months
Surrogate/ Internal (sec. dil.)	60 mg/l in methanol	-10°C to -20°C, ambient, vial	30 days 1 day
Gas. Cmpds. Cal./QC Check (stock)	2,000 mg/l in methanol	-10°C to -20°C, ampule	indefinite
Gas. Cmpds. Cal./QC Check (sec. dil.)	200 mg/l in methanol	-10°C to -20°C, vial	1 week
Gas. Cmpds. Cal. (working)	5 to 80 ug/l in water	ambient, flask	5 minutes
Gas. Cmpds. QC Check (working)	20 ug/l in water	ambient, flask	5 minutes
2-Cleve Cal./QC Check (dilution)	800 mg/l in methanol	-10°C to -20°C, ambient, vial	1 week 1 day
2-Cleve Cal. (working)	10 to 400 ug/l in water	ambient, flask	5 minutes
2-Cleve QC Check (working)	30 ug/l in water	ambient, flask	5 minutes
Primary Cmpds. Cal. (stock)	10,000 mg/l in methanol	-10°C to -20°C, vial	6 months
Primary Cmpds. Cal. (sec. dil.)	400 mg/l in methanol	-10°C to -20°C, ambient, vial	30 days 1 day

Table III
(Continued)

Standards Used in the Purgeable Halocarbons/Aromatics Method

Standard	Approximate Concentration	Storage	Shelf Life
Primary Cmpds. Cal. (working)	5 to 200 ug/l in water	ambient, flask	5 minutes
Primary Cmpds. QC Check (stock)	10,000 mg/l in methanol	-10°C to -20°C, vial	6 months
Primary Cmpds. QC Check (sec. dil.)	400 mg/l in methanol	-10°C to -20°C, ambient, vial	30 days 1 day
Primary Cmpds. QC Check (working)	20 ug/l in water	ambient, flask	5 minutes
Gas. Cmpds. Spiking	20 mg/l in methanol	-10°C to -20°C, vial	1 week
Primary Cmpds. Spiking (stock)	2,000 mg/l in methanol	-10°C to -20°C, vial	6 months
Primary Cmpds. Spiking (sec. dil.)	20 mg/l in methanol	-10°C to -20°C, ambient, vial	30 days 1 day

Appendix A

Individual Compounds Analyzed as Part of the Purgeable Halocarbons/Aromatics Scan

Compound	LLI Analysis #	LOQ
Chloroform	296	0.5
Carbon Tetrachloride	297	0.5
Trichloroethene (TCE)	418	0.5
1,1,1-Trichloroethane	419	0.5
Tetrachloroethene (PCE)	420	0.5
Methylene Chloride	463	1.
1,2-Dichloroethane	537	1.
1,1-Dichloroethene	538	1.
Benzene	539	1.
Vinyl Chloride	912	1.
Toluene	1163	1.
1,1-Dichloroethane	1170	1.
Ethylbenzene	1226	1.
Chloromethane	1564	5.
Trichlorofluoromethane (Freon 11)	4267	1.
Dichlorodifluoromethane (Freon 12)	4268	2.
Trichlorotrifluoroethane (Freon 113)	4269	1.
1,2-Dichloroethene (cis- and trans-) *	4717	1.

* The results of both isomers are reported as a total.

All LOQ values are in ug/l for water samples and ug/kg for solid samples.

Appendix B

Various Scans which can be Analyzed as Purgeable Halocarbons/Aromatics

Part 1 - Water Scans

LLI Scan #	182	515	1462	4146
EPA Method Reference	1	2	3	3
Compound	LOQ	LOQ	LOQ	LOQ
Chloromethane	5.	5.	5.	5.
Bromomethane	5.	5.	5.	
Vinyl Chloride	1.	1.	1.	1.
Dichlorodifluoromethane	2.			
Chloroethane	1.	1.	1.	
Methylene Chloride	1.	1.	1.	1.
Trichlorofluoromethane	1.		1.	1.
1,1-Dichloroethene	1.	1.	1.	1.
1,1-Dichloroethane	1.	1.	1.	1.
1,2-Dichloroethene (cis + trans)	1.	1.	1.	1.
Chloroform	1.	1.	1.	0.5
Trichlorotrifluoroethane				
1,2-Dichloroethane	1.	1.	1.	1.
1,1,1-Trichloroethane	1.	1.	1.	0.5
Carbon Tetrachloride	1.	1.	1.	
Bromodichloromethane	1.	1.	1.	
1,2-Dichloropropane	1.	1.	1.	
cis-1,3-Dichloropropene	1.	1.	1.	
Trichloroethene	1.	1.	1.	0.5
Dibromochloromethane	1.	1.	1.	
1,1,2-Trichloroethane	1.	1.	1.	
trans-1,3-Dichloropropene	1.	1.	1.	
2-Chloroethyl Vinyl Ether	10.			
Bromoform	2.	2.	2.	
Tetrachloroethene	1.	1.	1.	0.5
1,1,2,2-Tetrachloroethane	2.	2.	2.	
Chlorobenzene	1.	1.	1.	
Benzene		1.		
Toluene		1.		
Ethylbenzene		1.		

All LOQ values are in ug/l.

Appendix B

Various Scans which can be Analyzed as Purgeable Halocarbons/Aromatics

Part 2 - Solid Scans

LLI Scan #	1211	1214	1227	1228
EPA Method Reference	4a	3a	4b	3b
Compound	LOQ	LOQ	LOQ	LOQ
Chloromethane		100.		5.
Bromomethane		100.		5.
Vinyl Chloride		20.		1.
Dichlorodifluoromethane				
Chloroethane		20.		1.
Methylene Chloride		20.		1.
Trichlorofluoromethane				1.
1,1-Dichloroethene		20.		1.
1,1-Dichloroethane		20.		1.
1,2-Dichloroethene (cis + trans)		20.		1.
Chloroform		20.		1.
Trichlorotrifluoroethane				
1,2-Dichloroethane		20.		1.
1,1,1-Trichloroethane		20.		1.
Carbon Tetrachloride		20.		1.
Bromodichloromethane		20.		1.
1,2-Dichloropropane		20.		1.
cis-1,3-Dichloropropene		20.		1.
Trichloroethene		20.		1.
Dibromochloromethane		20.		1.
1,1,2-Trichloroethane		20.		1.
trans-1,3-Dichloropropene		20.		1.
2-Chloroethyl Vinyl Ether		200.		10.
Bromoform		40.		2.
Tetrachloroethene		20.		1.
1,1,2,2-Tetrachloroethane		40.		2.
Chlorobenzene		20.		1.
Benzene	20.		1.	
Toluene	20.		1.	
Ethylbenzene	20.		1.	

All LOQ values are in ug/kg.

Appendix B

Various Scans which can be Analyzed as Purgeable Halocarbons/Aromatics

Part 3 - References

1. 40 CFR Part 136: Method 601 (Purgeable Halocarbons).

2. SW-846 (Third Edition) Test Methods for Evaluating Solid Waste, Methods 5030 (Purge-and-Trap), 8000 (Gas Chromatography), 8010 (Purgeable Halocarbons), and 8020 (Purgeable Aromatics).

3. SW-846 (Third Edition) Test Methods for Evaluating Solid Waste, Methods 5030 (Purge-and-Trap), 8000 (Gas Chromatography), and 8010 (Purgeable Halocarbons).

   a. This analysis is performed using a modification of SW-846, methanolic extraction, described in LLI Analysis #379.

   b. This analysis follows the SW-846 methanolic extraction procedures exactly. Low- or mid-level analysis can apply. For the LOQ, the low-level quantitation limit is referenced.

4. SW-846 (Third Edition) Test Methods for Evaluating Solid Waste, Methods 5030 (Purge-and-Trap), 8000 (Gas Chromatography), and 8020 (Purgeable Aromatics).

   a. This analysis is performed using a modification of SW-846, methanolic extraction, described in LLI Analysis #379.

   b. This analysis follows the SW-846 methanolic extraction procedures exactly. Low- or mid-level analysis can apply. For the LOQ, the low-level quantitation limit is referenced.

Appendix C

Coelutor Compounds in the Purgeable Halocarbons/Aromatics Method

The following six compounds are coelutor compounds under the conditions described in this method and using column 1 listed in the Apparatus section of this method. These compounds are not contained in any of the standard solutions described in Table III, and therefore, are not routinely calibrated for:

Coelutor Compound not Contained in Standards	Compound Contained in Standards
Dichlorodifluoromethane	Vinyl Chloride
trans-1,2-Dichloroethene	cis-1,2-Dichloroethene
cis-1,3-Dichloropropene	1,2-Dichloropropane
trans-1,3-Dichloropropene	Dibromochloromethane
1,1,2-Trichloroethane	Dibromochloromethane
1,1,2,2-Tetrachloroethane	Tetrachloroethene

Analytes in the second column which have amounts above the LOQ are examined closely for the possible presence of a coelutor compound. If a coelutor is suspected, the sample is reanalyzed on one of either columns 2, 3, or 4 listed in the Apparatus section of this method as a confirmation.

Criteria used to determine the possible presence of a coelutor include analysis of the peak shape, comparison of Hall electrolytic conductivity detector and PID chromatograms, the retention time of the peak, and the pattern of other compounds present in the sample.

Appendix D

Maximum Allowable Spike Recovery and RPD Ranges in the Halocarbons/Aromatics Method

Matrix Type	Compound Type(s)	Maximum Spike Recovery Range	Maximum RPD Range
water	gases + freons **	65-130 %	20 %
water	all other compounds	75-125 %	15 %
solid	gases + freons **	65-135 %	25 %
solid	all other compounds	70-130 %	20 %

** includes dichlorodifluoromethane (freon 12),
trichlorofluoromethane (freon 11),
trichlorotrifluoroethane (freon 113)

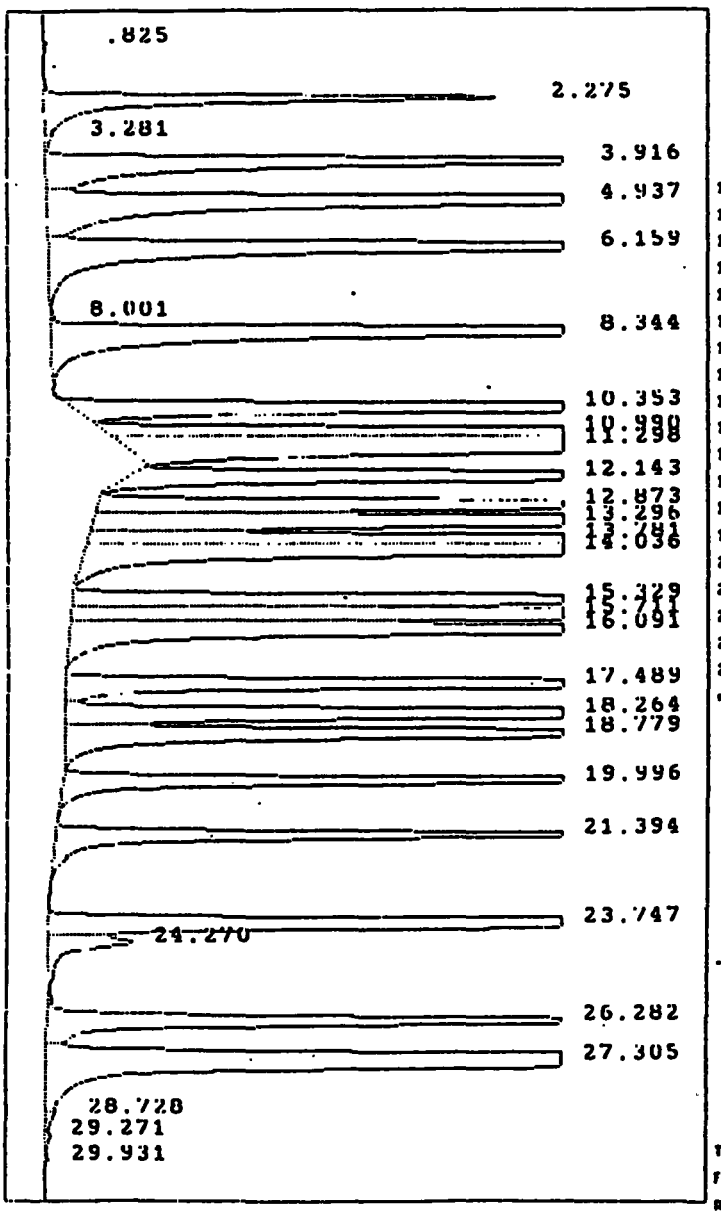
FIGURE 1 - Hall Detector

VOA Analysis by Purge & Trap GC

SAMPLE NAME: *CHKSTD 10-200 + 20 GASES*
Batch Number: 92113/A12 RESULTFILE: /V1/RESULT/H12_113_405.RES
Instrument: TRAC9000H12HALL Injected on Fri Apr 24, 1992 8:15:23 pm

EPA METHOD 5030/8010 CONDITIONS TRAP #1 (EPA 601)
1% SP-1000 on Carbopack B column - Hall Detector
HP 3350A LAS v. D.00.01 INSTRUMENT ID# 05819

METHOD: /V1/METHOD/H12_113NT.MTH Employee #330
Quantitation: HeightUnits Calculation: ExternalSTD
Plot Fields: 2900 - 6900 Dilution Factor: 1.00E+00



RT	IDTime	Height	Code	ug/L	Name
2.27	2.27	13529	VV	18.63	CHLOROMETHANE
3.92	3.95	23504	VV	24.17	BROMOMETHANE
4.94	4.94	42984	VV	25.94	VINYL CHLORIDE
6.16	6.16	43131	VV	22.39	CHLOROETHANE
8.34	#8.34	51404	VV	17.81	METHYLENE CHLORIDE
10.35	#10.35	47955	PV	17.57	TRICHLOROFLUOROMETHANE
10.99	#10.99	46936	VV	16.81	1,1-DICHLOROETHENE
11.30	#11.30	140520	VB	106.90	SURR-BRCLMETHANE
12.14	#12.14	46575	BV	15.89	1,1-DICHLOROETHANE
12.87	#12.87	48393	PV	17.76	CIS-1,2-DICHLOROETHENE
13.30	#13.30	67754	VV	17.91	CHLOROFORM
13.78	#13.78	38346	VV	16.92	TRICHLOROTRIFLUOROETHANE
14.04	#14.04	53295	VB	19.03	1,2-DICHLOROETHANE
15.33	#15.33	52922	BV	16.96	1,1,1-TRICHLOROETHANE
15.71	#15.71	58777	VV	17.89	CARBON TETRACHLORIDE
16.09	#16.09	46271	VB	18.64	BROMODICHLOROMETHANE
17.49	#17.49	40810	BV	17.46	1,2-DICHLOROPROPANE
18.26	#18.26	53152	VV	16.45	TRICHLOROETHENE
18.78	#18.78	31262	VB	18.59	DIBROMOCHLOROMETHANE
20.00	19.99	24872	BV	28.15	2-CHLOROETHYL VINYL ETHER
21.39	#21.39	17604	PV	20.28	BROMOFORM
23.75	#23.75	59262	PV	18.49	TETRACHLOROETHENE
26.28	#26.28	19327	VV	21.59	CHLOROBENZENE
27.31	#27.31	62610	VV	117.48	SURR-1CL3FBENZENE - HALL

*Results are reported in ug/L for water samples and ug/kg for soil samples.

Carlyles

VINYL CHLORIDE (dichlorodifluoromethane)
CIS-1,2-DICHLOROETHENE (trans-1,2-dichloroethene)
1,2-DICHLOROPROPANE (cis-1,3-dichloropropene)
DIBROMOCHLOROMETHANE (1,1,2-trichloroethane)
DIBROMOCHLOROMETHANE (trans-1,3-dichloropropene)
2-CHLOROETHYL VINYL ETHER (ethylene dibromide)
TETRACHLOROETHENE (1,1,2,2-tetrachloroethene)

Timed Events	Time	Event
1	11.35	ResetBLAtValley
2	14.90	ResetBLAtValley
3	17.14	ResetBLAtValley
4	19.70	ResetBLAtValley

Integration Parameters: Run Time - 31.00
Threshold - 2.0 Minimum Area - 1.000E+03
Formatfile: /DATA/FORMAT/VOADNE.FMT
Reported on Sat Apr 25, 1992 1:53:33 pm

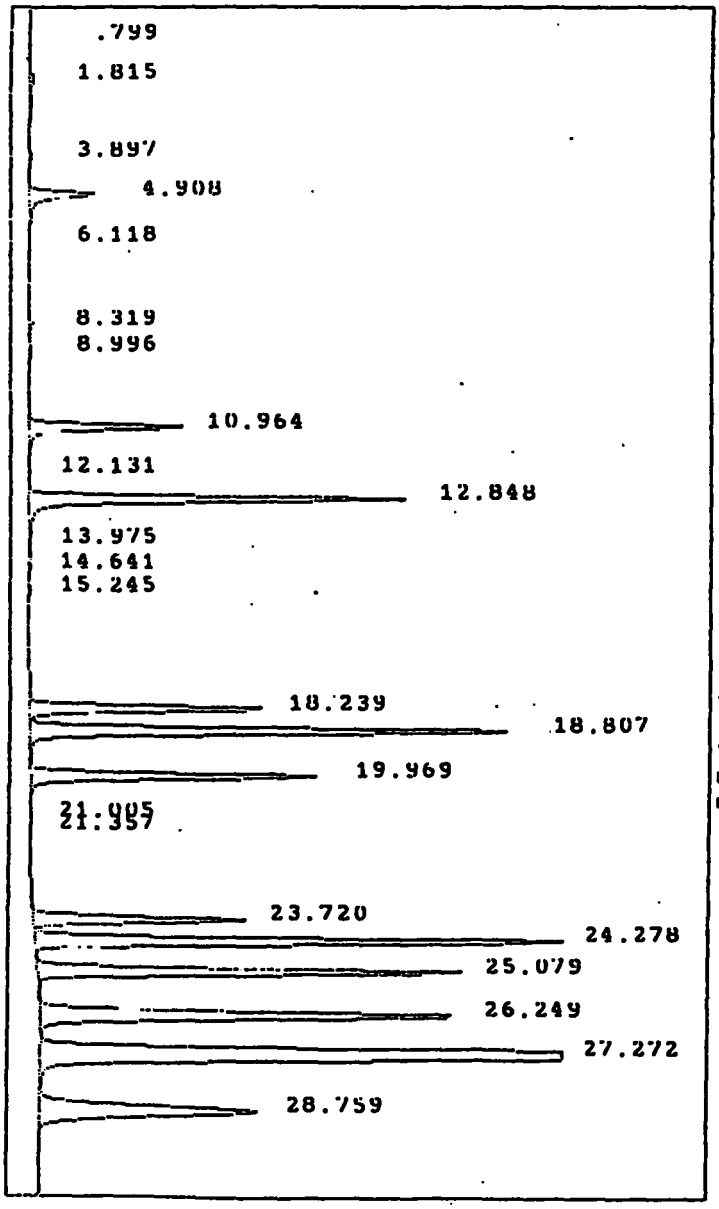
FIGURE 2 - PID Detector

VOA Analysis by Purge & Trap GC

SAMPLE NAME: *CHKSTD 10-200 + 20 GASES*
Batch Number: 92113/A12 RESULTFILE: /V1/RESULT/P12_113_405.RES
Instrument: TRAC9000#12PID Injected on Fri Apr 24, 1992 8:15:23 pm

EPA METHOD 5030/8010 CONDITIONS TRAP #1 (EPA 601)
1% SP-1000 on Carbopack B column - PID Detector
HP 3350A LAS v. D.00.01 INSTRUMENT ID# 03819

METHOD: /V1/METHOD/P12_113N111.MTH Employee #330
Quantitation: HeightUnits Calculation: InternalSTD
Plot Fields: 3000 - 6000 Dilution Factor: 1.00E+00



RT	IDTime	Height	Code	ug/L	Name
4.91	4.91	1479	VV	21.90	VINYL CHLORIDE
10.96	#10.96	3445	PV	15.94	1,1-DICHLORDETHENE
12.85	#12.85	8252	VV	17.05	CIS-1,2-DICHLORDETHENE
18.24	#18.24	5278	PV	16.77	TRICHLORDETHENE
18.81	#18.81	10719	VV	17.51	BENZENE
19.97	19.96	6414	VV	27.46	2-CHLORDETHYL VINYL ETHER
23.72	#23.72	4688	BV	18.17	TETRACHLORDETHENE
24.28	#24.28	12554	VB		ISTD - TFT
25.08	#25.08	9383	BV	16.73	TOLUENE
26.25	#26.25	9220	VB	19.36	CHLORDBENZENE
27.27	#27.27	19683	BV	102.98	SURR-1CL3FBENZENE - PID
28.76	#28.76	4773	VB	16.73	ETHYLBENZENE

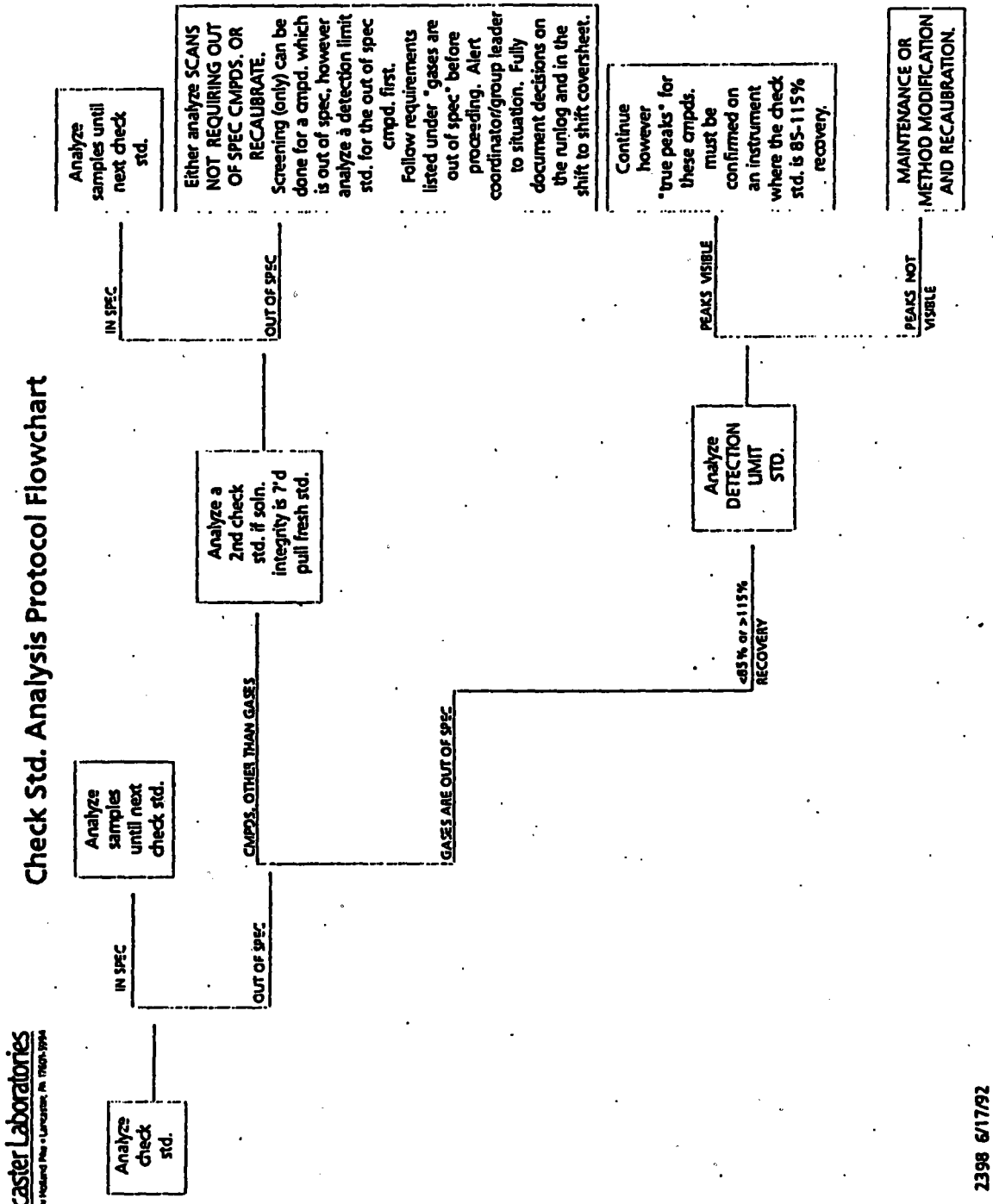
CIS-1,2-DICHLORDETHENE and TRANS-1,2-DICHLORDETHENE coelute.
Internal Standard Range: 10405 - 15607 (Midpoint - 13006)

Using check standard file.
/V1/RESULT/P12_113_395.RES
*Results are reported in ug/L for water samples and ug/kg for soil samples.

Timed Events	Time	Event
1	23.00	ResetBL
2	24.30	ResetBLAtValley
3	26.30	ResetBLAtValley

Integration Parameters: Run Time - 31.00
Threshold - 0.0 Minimum Area - 1.000E+02
Formatfile: /DATA/FORMAT/PVOAONE.FMT
Reported on Sat Apr 25, 1992 1:54:30 pm

FIGURE 3


Check Std. Analysis Protocol Flowchart
Lancaster Laboratories
Analyze check std.
IN SPEC
OUT OF SPEC
Analyze samples until next check std.
CMPDS. OTHER THAN GASES
GASES ARE OUT OF SPEC
Analyze a 2nd check std. if soln. integrity is ?'d pull fresh std.
IN SPEC
OUT OF SPEC
Analyze samples until next check std.
Either analyze SCANS NOT REQUIRING OUT OF SPEC CMPDS. OR RECALIBRATE.
Screening (only) can be done for a cmpd. which is out of spec, however analyze a detection limit std. for the out of spec cmpd. first.
Follow requirements listed under "gases are out of spec" before proceeding. Alert coordinator/group leader to situation. Fully document decisions on the runlog and in the shift to shift coversheet.
<85% or >115% RECOVERY
Analyze DETECTION LIMIT STD.
PEAKS VISIBLE
PEAKS NOT VISIBLE
Continue however "true peaks" for these cmpds. must be confirmed on an instrument where the check std. is 85-115% recovery.
MAINTENANCE OR METHOD MODIFICATION AND RECALIBRATION.
2398 6/17/92

Lancaster Laboratories

Batch QC Protocol Flowchart

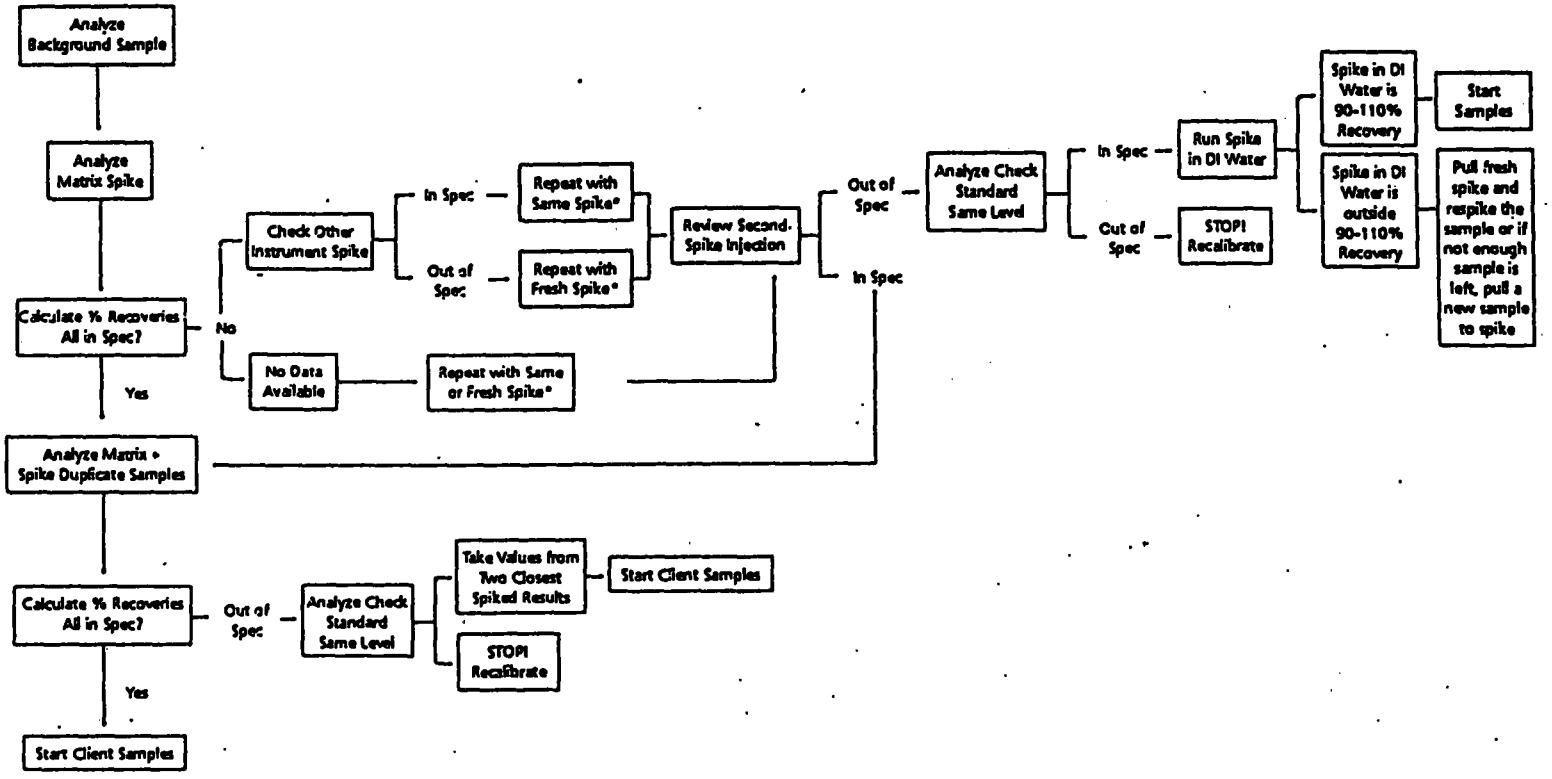


FIGURE 4

For data package groups with the background, spike, and spike dup. as independent LIJ numbers, the 2nd injection of the spiked sample (*) should be from the matrix spike dup. vial. If the result of the 2 spikes match but are both out of spec. (values), run a check std. and a spike in deionized water. If the check std. is in spec., samples can be started. If the check std. is out of spec., STOP! and recalibrate. The spike in deionized water purpose is to help us evaluate the bkg./sp./sp. dup. results. Being in spec. is not required to continue with samples. The critical determinate is the check std., this must be in spec. for all compounds being reported before continuing with samples. When one spike result is in spec. and the other out of spec., run a 3rd injection of a spiked sample using either the spike or spike dup. vial. This will be decided through analyst experience. Then follow protocol (+) from the point of the spike dup. injection.

2397 6/17/92

Analysis #182, 296, 297, 418,
419, 420, 463, 515,
537, 538, 539, 912,
1163, 1165, 1170, 1211,
1214, 1226, 1227, 1228,
1462, 1564, 4146, 4267,
4268, 4269, 4717
Initiated Date: 12/18/87
Effective Date: JUL 9 1992
Page 34 of 34

Lancaster Laboratories
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Analysis #1861, 3337
Initiated Date: 10/29/90
Effective Date: NOV 21 1991

Polynuclear Aromatic Hydrocarbons in Water and Wastewater

Reference:

Test Methods for Evaluating Solid Waste, EPA SW-846, Method 3510/3630/8310, September 1986.

Scope:

This method is applicable to the measurement of the following polynuclear aromatic hydrocarbons (PAH's) in water and wastewater.

Analyte	Quantitation Limit (ug/l)
Naphthalene	10.
Acenaphthylene	20.
Acenaphthene	20.
Fluorene	2.
Phenanthrene	2.
Anthracene	1.
Fluoranthene	0.5
Pyrene	2.
Benzo(a)anthracene	0.1
Chrysene	1.
Benzo(b)fluoranthene	0.2
Benzo(k)fluoranthene	0.1
Benzo(a)pyrene	0.2
Dibenzo(a,h)anthracene	0.2
Benzo(g,h,i)perylene	0.5
Indeno(1,2,3-cd)pyrene	0.5

The extraction phase of this method requires approximately one hour per sample with 12 to 15 samples prepared in an eight-hour day by one technician. Each extract requires 25 minutes to chromatograph and may require further dilution.

This method is used for analyzing water and wastewater samples scheduled for LLI analysis #1861.

Basic Principles:

A one liter sample of water or wastewater is extracted with 100% methylene chloride. The volume of the sample must not be altered unless it has a strong fuel odor and/or has a dark, oily appearance. The extract is dried, concentrated by evaporation and diluted into ACN. Silica gel clean-up may be used if unresolvable chromatographic interferences are present.

The acetonitrile extract is analyzed by reverse phase HPLC using both UV and fluorescence detectors for optimum sensitivity.

Apparatus and Materials:

1. Graduated cylinders - 1 liter capacity.

2. Separatory funnels - 1 liter capacity with teflon stopcocks.

3. Kuderna-Danish concentrator flasks - 500 ml with 10 ml graduated concentrator tubes.

4. Beakers - 1 liter capacity (glass or stainless steel).

5. Three ball Snyder columns.

6. Na_2SO_4 drying columns - 29 mm x 200 mm.

7. Glass wool.

8. Steam bath.

9. Glass beads.

10. N-evap.

11. 8 ml glass screw cap vials with teflon lined lids.

12. 1.0 ml gas tight injection syringe (Hamilton P/N or equivalent).

13. 20 ul injection loop.

14. Rheodyne 7125 injection valve or equivalent.

15. HPLC System:

    a. Shimadzu LC-6A Gradient pumping system or equivalent.

    b. Shimadzu SCL-6A system controller or equivalent.

    c. HPLC Column: Supelco LC-PAH, 15 mm x 4.6 mm 5 um column or equivalent.

16. Detectors:

    a. Kratos spectroflow 980 fluorescence detector or equivalent.

    b. Shimadzu SPD-6A UV detector or equivalent.

17. Dual channel integrating system.

18. Volumetric glassware.

Reagents and Standards:

1. HPLC grade water or filtered, degassed, deionized tap water. (if no contaminant peaks are present upon use.)

2. Acetonitrile, HPLC grade.

3. Methylene chloride, HPLC grade.

4. Sodium sulfate - baked for four hours in a muffle furnace at 400°C.

5. Neat standards.

6. Stock standards and intermediate standard solutions as outlined in Table 1. Store in amber glass in the freezer. Stable for one year.

7. A spiking solution containing each analyte prepared as follows: 1 ml of each stock (or intermediate where applicable--See Table 1) is diluted to volume with acetonitrile in a 25 ml volumetric flask. The solution must be transferred to an amber glass screw cap vial with a teflon lined lid and stored in the freezer for no more than one year.

8. Working standard mixes at five concentrations prepared as follows:

Level 1 - 1 ml of each stock (or intermediate where applicable-See Table 1) diluted in acetonitrile to a final volume of 100 mls.

Level 2 - 20 mls of Level 1 to 50 mls ACN.

Level 3 - 15 mls of Level 1 to 50 mls ACN.

Level 4 - 10 mls of Level 1 to 50 mls ACN.

Level 5 - 5 mls of Level 1 to 50 mls ACN.

Store all working mixes in glass screw cap vials in the freezer. The mixes are stable for one year when stored in the freezer.

9. A spiking solution of nitrobenzene is prepared in ACN at a concentration of 400 ug/ml (± 50 ug/ml). This surrogate spiking solution must be stored in the freezer and is stable for one year.

Safety Precautions:

Avoid inhaling the solvents and getting them on the skin. Wear gloves when handling methylene chloride. To avoid a buildup of pressure in the separatory funnels during extraction, vent the funnel into a hood by inverting and opening the stopcock.

Avoid contact with the standards. While handling the neat materials, wear gloves, a laboratory coat, and safety glasses.

Sample Collection, Preservation, and Handling:

Samples must be collected in amber glass with teflon lined lids (LLI bottle code #030). Sodium thiosulfate preservation may be used for chlorinated samples, but is not mandatory for nonchlorinated samples. The samples must be maintained cool, 4°C. Samples must not be collected in plastic due to the possibility of sample contamination from hydrocarbons within the plastic. Samples should not be collected in the presence of exhaust fumes. Samples must be extracted within seven days of collection and analyzed within 40 days of extraction.

A. Extraction Procedure:

1. Shake the sample well. If the sample has no strong odor, dark color, or any other indication of high organic content, then pour the entire sample aliquot into a graduated cylinder. Record the volume and then bring the total volume in the graduated cylinder up to 1 liter as needed. Transfer the sample to a 2 liter separatory funnel. (If the sample has a strong odor or color, then less sample volume may be used accordingly. The sample volume must be brought to 1 liter by adding deionized water. The bottle rinsing listed in Step 4 is not necessary in this case.)

2. Add one ml of spiking solution to the spike, spike duplicate, and laboratory control spike.

3. Add one half ml of surrogate standard spiking solution to each sample as well as the blank and QC samples.

4. Pour 60 ml of methylene chloride into the sample bottle, shake well, and then pour it into the separatory funnel and insert stopper. Invert funnel and vent to relieve pressure, then shake vigorously for two minutes, venting frequently. Allow phases to separate for at least ten minutes.

5. Assemble the Kuderna-Danish (K-D) apparatus by securing the concentrator tube to the 500 ml flask with teflon tape and a plastic clip. Place a boiling bead in the apparatus.

6. Place a small piece of glass wool at the bottom of a 29 mm x 200 mm chromatography column and fill with three inches of sodium sulfate. Place the column on top of the K-D.

7. Drain the methylene chloride phase (lower) into a 150 ml beaker and transfer through the sodium sulfate column into the K-D. If an emulsion has formed in the separatory funnel, add a small amount of saturated NaCl solution or centrifuge the methylene chloride layer with a small portion of the aqueous phase. Document the formation of any emulsions in the data notebook. Also document whether or not they were broken.

8. Repeat the extraction two more times, rinsing the empty beaker with 60 ml of methylene chloride before putting the solvent into the separatory funnel. Drain the methylene chloride through the sodium sulfate column into the K-D after each extraction. Discard the water phase after the final extraction. Rinse the beaker after extraction with methylene chloride and pour through a sodium sulfate column.

9. Rinse the sodium sulfate column with 20 ml of methylene chloride and let drain well.

10. Remove the sodium sulfate column, attach a three-ball Snyder column to the K-D flask, and prewet the column with about 5 ml of methylene chloride to keep pressure from building up in the K-D while concentrating.

11. Place the K-D on a steam bath which is at 90°C to 100°C. Position the flask so that the concentrator tube is partially immersed in the hot water and the bottom of the flask is bathed with hot vapor. The chambers of the Snyder column should not flood with solvent, but the balls should actively chatter. Concentrate to apparent dryness.

12. Remove from the steam bath. Allow the apparatus to cool and drain for ten minutes.

13. Adjust the final volume to 3.0 ml with methylene chloride.

14. Prepare a five-fold dilution of the extract in ACN.

15. Transfer the extract to a glass screw cap vial and store in the freezer.

B. Chromatographic Procedure:

1. HPLC Set-up:

Column - Supelco LC-PAH, 5 um 15 mm x 4.6 mm or equivalent

Mobile Phase - A = H_2O

B = Acetonitrile

Gradient - 35% B hold 2 minutes from 2 to 16 minutes
increase %B to 100%.

Flow - 1.5 ml/minute

Temperature - ambient

Injection loop size - 20 ul

UV - 254 nm
Fluorescence - 280 nm excitation
370 nm emmision
0.01 uA PMT signal

2. Both mobile phases must be degassed prior to use. A second degassing before seven days is usually not necessary.

3. If deionized tap water is being used it must be filtered prior to degassing.

4. The system should be set up and checked as described below:

   a. Set all HPLC parameters to those listed in Sections B1-3 of the method.

   b. Pump mobile phase at the initial gradient conditions for ten minutes. After ten minutes, check the entire system for leaks (i.e. all connections, injection loop, Shimadzu pump heads, detector inlets and outlets, etc.).

c. Inject an acetonitrile blank to confirm the absence of system contamination. If no peaks are seen (there is a 2 cm "peak" around 22 minutes which represents the sudden mobile phase change from 100% B back to the initial gradient conditions--disregard this), then the calibration may proceed.

d. If contamination peaks are seen, then plot a gradient only run without making an injection. If the peak remains, one or both of the mobile phases are suspect. Try new lots of acetonitrile and/or water if necessary.

e. Once the system is free of contamination, proceed to Section B5 (calibration).

5. External calibration is performed by injecting working mixes at five concentration levels. In order for each working mix to contain 16 peaks showing similar peak heights, the mixes must be prepared as described in the Reagent section of this method. Sample chromatograms are presented in Figures 1 and 2.

6. Calculate response factors (RF) for the first six compounds listed in this method from the UV data (RF = concentration [ug/ml] divided by peak height [or area]). Calculate RFs for the last ten compounds from the fluorescence data in the same fashion. RFs for the last ten compounds on UV and first six compounds on fluorescence need not be calculated unless 2nd

detector confirmation is required. If the RF value over the five working levels is constant (<20% RSD), then the average RF can be used in all subsequent calculations. If the RFs are to be used for confirmation only and sensitivity of the lower levels is a problem, then a minimum of three working levels may be used. If the %RSD for any or all of the compounds exceeds 20% then a least squares calibration curve (include zero) must be generated for the affected compounds.

7. The working calibration curve or RF must be verified at least once per day (after every ten injections is recommended) by injecting one of the calibration mixes. The peak height (or area) response for each analyte must show $\leq$15.0% RPD as compared to the initial injection of the calibration standard. RFs to be used for confirmation only must show $\leq$20% RPD.

8. If any or all of the RPDs are >15.0%, then the system is out of control. Every effort must be made to correct the problem. If any or all of the RFs used for confirmation only show >20% RPD then the analyst may choose to perform single point confirmation calculation or start a new calibration curve.

9. If the problem is corrected, it must be verified by showing all RPDs $\leq$15.0% (this applies to RFs to be used for primary quantitation only) and sample analysis may proceed. If the problem can not be corrected, then the system must be recalibrated. If no samples were injected after the system was deemed out of control then no sample reanalysis is necessary.

10. Retention time windows (for a given column) are generated by making three mid-level standard injections over a 72-hour period. Calculate the average retention time for each analyte. Each subsequent window is calculated as the average ± three times the standard deviation. Retention time windows may by updated as needed by modifying the midpoint retention times.

11. For any analyte to be reported, the following must occur:

    a. The retention times must be within the specified windows on both the fluorescence and the UV runs.

    b. The peak must be clearly resolved on both runs.

    c. The primary and confirmation values must agree within a factor of two.

12. UV detection is the primary mode of detection for the first six analytes listed in Table 1. Fluorescence detection is the primary mode of detection for the last ten analytes listed in Table 1.

13. Any analyte concentration above the working range of the standards must be diluted to within the range.

14. Silica gel cleanup (as per Method 3630 SW-846) may be used for messy samples.

15. Any time the injection sequence is discontinued for more than eight hours, the midlevel calibration mix must be injected just before and right after the break in the injection sequence. Before sample analysis proceeds, the requirements listed in Steps 8 to 9 must be met.

16. All standards and samples must be warmed to room temperature prior to being injected.

Calculations:

$$\frac{PK\ HT \times RF \times FV \times DF \times AF}{IV} = \text{Concentration (ug/l)}$$

Where: Pk Ht = Peak height found in sample.
RF = Response factor (ppm/peak height) of analyte in standard.
FV = Final volume of sample extract* (ml).
DF = Dilution factor (where applicable).
IV = Initial volume of sample extracted (liters).
**AF = Additional factor.

*Please note that the final volume of the extract is 3 ml.

**Additional factor is 5 to compensate for the dilution into ACN.

Quality Assurance:

1. A reagent blank (using deionized water) is extracted with every batch of 20 samples or less.

2. A laboratory control sample (a spiked reagent blank) and a laboratory control duplicate are extracted for every 20 samples or every 14 days whichever comes first.

3. Recovery and RPD data from ≥30 LCS/LCSD pairs is used to calculate 95% CIs for recoveries and RPDs. The data is deemed acceptable if all recoveries are within the 95% CIs (the 95% CIs are monitored on a monthly basis and updated when the upper and/or lower limit have changed by more than 15%. If the LCS and/or the LCSD recoveries fall outside the 95% CIs, then the data must be reviewed for errors in calculations etc. and the extract must be reanalyzed. If no correctable errors or problems can be found, then the entire batch must be re-extracted (even if the holding time has been exceeded). If the repeat LCS/LCSD data is prepped within the holding time, then the repeat data must be reported. If the repeat LCS/LCSD data is prepped beyond the holding time, then the original data must be reported and a comment must appear on the report. When all recovery data is in spec but the RPD values fall outside the 95% CIs, then the data is acceptable pending follow-up on potential system problems.

4. Surrogate standard recovery data from ≥30 data points is used to calculate a 99% CI. All sample data is deemed acceptable if it falls within these limits. The action steps taken for surrogates outside the 99% CI are as listed above with one exception. If the repeat extraction confirms the low recovery, then the recovery problem is attributed to the sample matrix.

NO1816
PP Methods #2
111391

Prepared by: James J. Schumacher Date: 11/14/91

Approved by: [signature] Date: 11/14/91

Approved by: [signature] Date: 11/18/91

Table 1

Stock/Intermediate Standard Solution Preparation

Analyte	Stock ug/ml (± 10%)	Solvent for Stock Solutions	Intermediate ug/ml	Solvent for Immediate
Naphthalene	4000.	ACN	--	--
Acenaphthylene	4000.	ACN	--	--
Acenaphthene	6000.	ACN	--	--
Fluorene	600.	ACN	--	--
Phenanthrene	200.	ACN	--	--
Anthracene	1000.	ACN	100.	ACN
Fluoranthene	8000.	ACN	80.	ACN
Pyrene	400.	ACN	--	--
Benzo(a)anthracene	400.	ACN	40.	ACN
Chrysene	200.	ACN	--	--
Benzo(b)fluoranthene	400.	ACN	40.	ACN
Benzo(k)fluoranthene	1500.	$MeCl_2$	15.	ACN
Benzo(a)pyrene	400.	ACN	40.	ACN
Dibenza(a,h)anthracene	800.	ACN	80.	ACN
Benzo(g,h,i)perylene	3000.	ACN	30.	ACN
Indeno(1,2,3-cd)pyrene	150.	ACN	--	--

Data File = S:A357-1.PTS Printed on 09-15-1998 at 14:23:22
Start time: 0.00 min. Stop time: 24.05 min. Offset: 0 mv.
Full Range: 7 millivolts

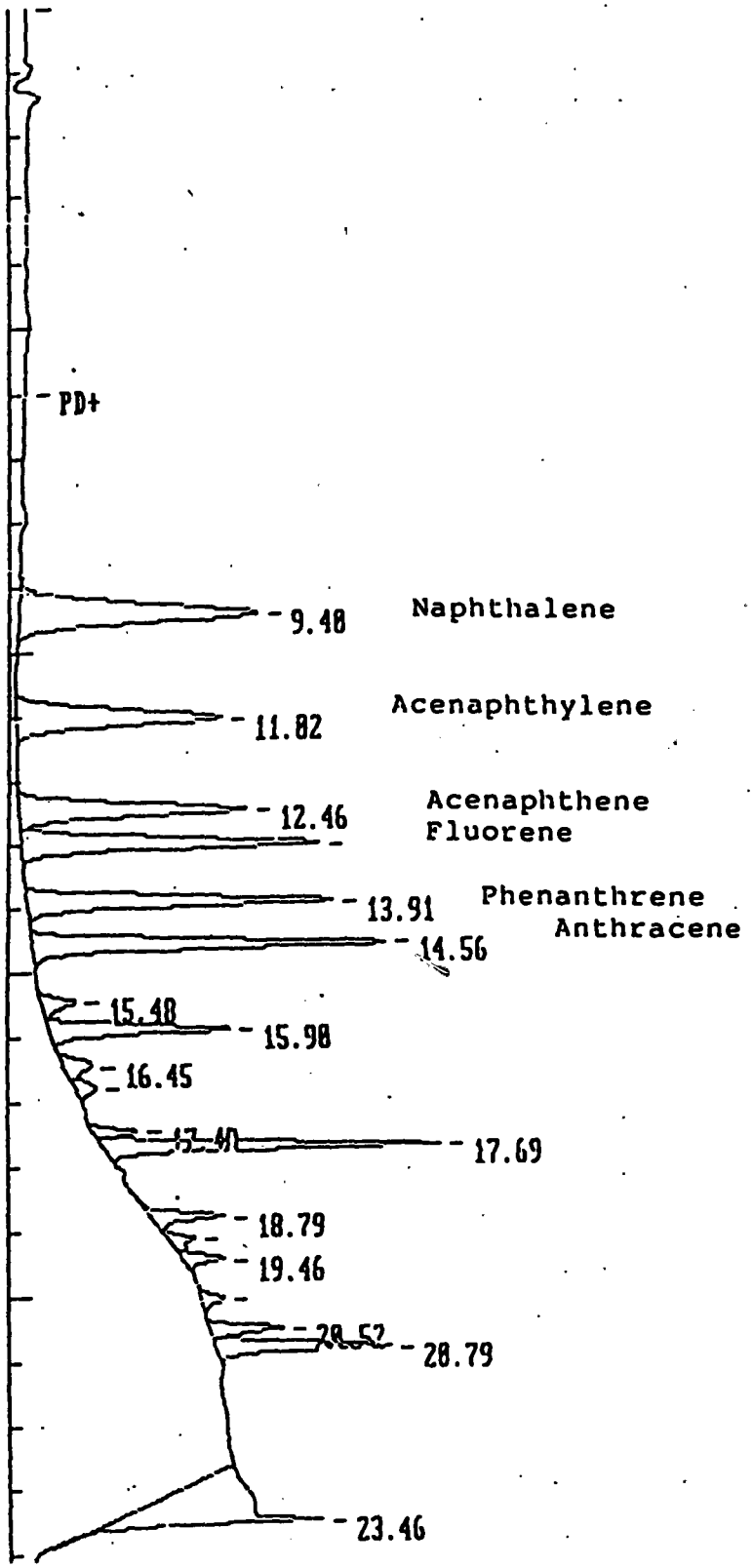

FIGURE 1: PAH's which are determined using UV detection as the primary mode of detection.

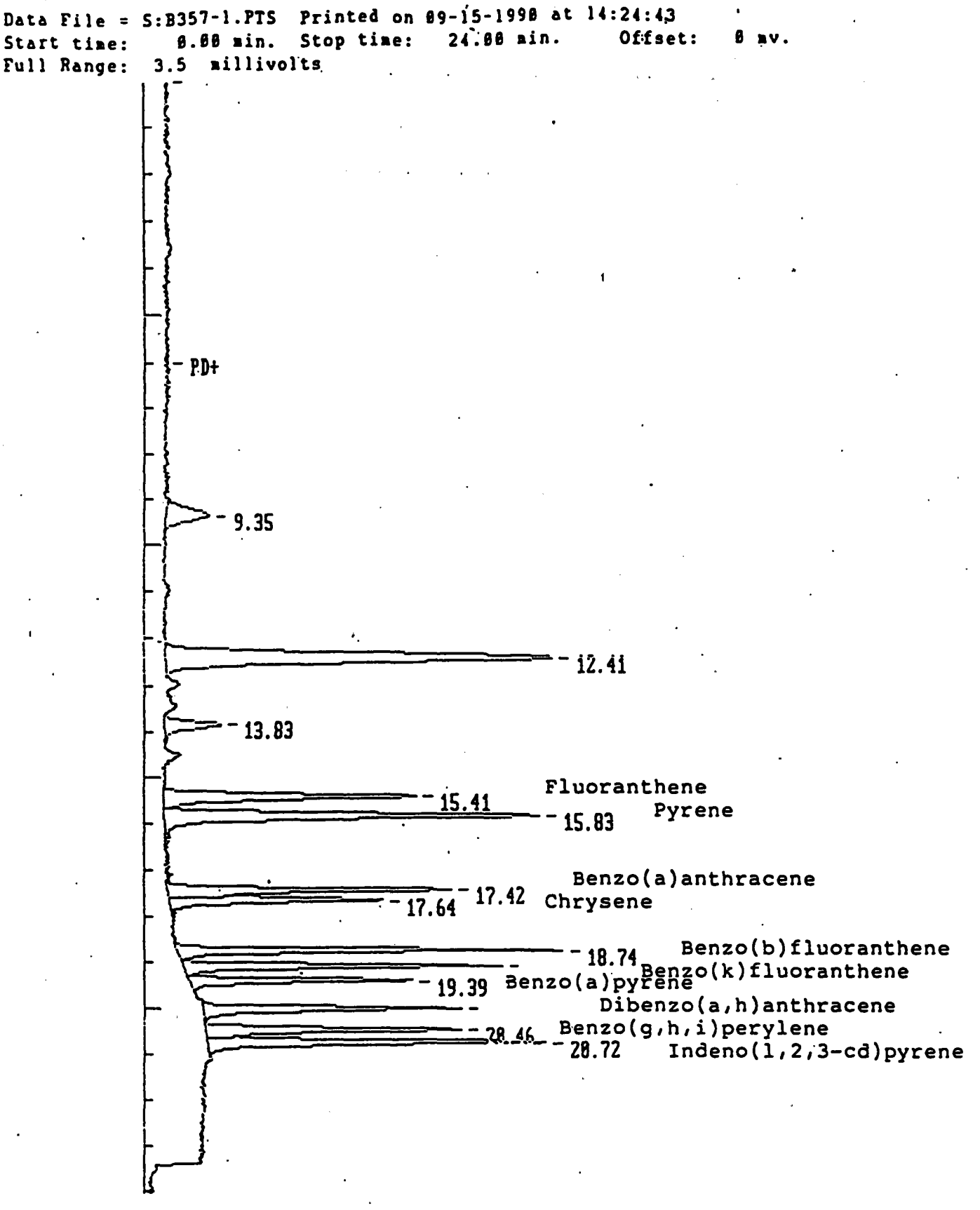

FIGURE 2: PAH's which are determined using Fluorescence detection as the primary mode of detection.

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Analysis #1862, 3338
Initiated Date: 10/26/90
Effective Date: NOV 21 1991

Polynuclear Aromatic Hydrocarbons in Soils and Sludges

Reference:

Test Methods for Evaluating Solid Waste, EPA SW-846, Method 3510/3630/8310, September 1986.

Scope:

This method is applicable to the measurement of the following polynuclear aromatic hydrocarbons (PAHs) in soils and sludges.

Analyte	Quantitation Limit (mg/kg)
Naphthalene	2.
Acenaphthylene	2.
Acenaphthene	2.
Fluorene	2.
Phenanthrene	0.5
Anthracene	0.5
Fluoranthene	0.2
Pyrene	0.2
Benzo(a)anthracene	0.01
Chrysene	0.1
Benzo(b)fluoranthene	0.02
Benzo(k)fluoranthene	0.02
Benzo(a)pyrene	0.02
Dibenzo(a,h)anthracene	0.02
Benzo(g,h,i)perylene	0.05
Indeno(1,2,3-cd)pyrene	0.05

The extraction procedure requires 1-2 hours per sample. One technician can prepare eight samples in an 8-hour day. Silica gel cleanup is optional (see Appendix V of Dept. 24 Methods Manual) and can be used when on resoluable matrix interference occurs. One technician can perform silica gel cleanup on 20 extracts in an 8-hour day.

This method is used for analyzing soil and sludge samples scheduled for analysis #1862.

This method is not useful for analyzing nonsoil solid samples.

Basic Principles:

A 30 g portion of homogenized sample is dried with sodium sulfate and extracted with 50% methylene chloride in acetone. The extract is filtered, dried, concentrated by evaporation, diluted into ACN and put through silica gel, if necessary. The PAHs are identified and quantitated using reverse phase HPLC with both UV and Fluorescence detection.

Apparatus:

1. Beakers - 250 ml (glass or stainless steel).

2. Glass stirring rods.

3. Buchner funnel.

4. Erlenmeyer filter flask - 500 ml.

5. Kuderna-Danish concentrator flasks - 500 ml with 10 ml graduated concentrator tubes.

6. Three-ball Snyder columns.

7. Na_2SO_4 drying columns - 29 mm x 200 mm.

8. Glass wool.

9. Steam bath.

10. Glass beads.

11. Amber glass screw cap vial - 12 ml capacity.

12. Ultrasonic cell disruptor, Heat Systems - Ultrasonics, Inc. Model #W-385, or equivalent.

13. HPLC Gradient pumping system.

14. Rheodyne 7125 injection valve or equivalent.

15. 20 ul injection loop.

16. UV spectrophotometric detector.

17. Fluorescence detector.

18. Dual channel integration system.

19. Supelco LC-PAH, 15 mm x 4.6 mm, 5 um or equivalent.

Reagents and Standards:

1. Hexane, HPLC grade.

2. Methylene chloride, HPLC grade.

3. Acetone, HPLC grade.

4. Acetonitrile, HPLC grade.

5. Sodium sulfate, baked in a muffle furnace for 4 hours at 400°C.

6. Standards (prepared as listed in LLI Analysis #1861) are stored in glass at 4°C and are stable for one year.

7. A spiking solution (prepared as listed in LLI Analysis #1861) is stored in glass at 4°C and is stable for one year.

Safety Precautions:

Avoid inhaling the solvents or getting them on the skin. Wear gloves when handling methylene chloride as well as the samples. Avoid contact with the standards. Wear gloves, a laboratory coat, and safety glasses while handling neat materials.

Sample Collection, Preservation, and Handling:

Samples must be collected in glass with teflon lined lids. The samples must be maintained cool, 4°C. Samples must not be collected in plastic due to the possibility of sample contamination from hydrocarbons within the plastic. Samples should not be collected in the presence of exhaust fumes. Samples must be extracted within 14 days of collection and analyzed within 40 days of extraction.

A. Sonic Probe Extraction:

1. Weigh out 30 g of sample into a 250 ml beaker.

2. Add 60 g of anhydrous powdered sodium sulfate and mix well.

3. Add 100 ml of methylene chloride in acetone (50% solution) to the sample.

4. Add 2 ml of matrix spiking solution where applicable.

5. Place the beaker with the sample under the disruptor horn of the sonicator so that the tip of the horn is 1/2 inch below the surface of the solvent, but above the sediment layer.

6. Sonicate for 3 minutes with the percent duty cycle at 50% and the cycle at 1 second pulse.

7. Decant and filter extract into a Buchner funnel through Whatman #3 filter paper using vacuum filtration by thoroughly wetting the filter paper with a portion of the 50% solution, then decanting the extract onto the center of the paper to keep small particulates from going under the edge of the paper. Then rinse the filter paper with a small amount of 50% solution.

8. Repeat extraction 2 more times with 2 additional 100 ml portions of 50% solution. Before each sonication, make sure sodium sulfate is free flowing. If not, break up any lumps with a glass stirring rod. Decant and filter the solvent after each sonication. After the final sonication, pour off all the liquid portion, including any suspended particulate matter.

9. Add 50-100 ml of 50% solution to the beaker and rinse the soil and beaker. Add this to the funnel. Rinse the Buchner funnel one more time.

10. If at this point the filtrate still contains particulate matter, refilter through a clean piece of #3 paper. Be sure to rinse the Erlenmeyer after transferring the filtrate.

11. Transfer the final filtrate through a Na_2SO_4 drying column into a K-D flask with a 10 ml concentrator tube. Rinse Erlenmeyer and put rinse into the K-D.

12. Add a boiling bead. Prewet Snyder with methylene chloride and concentrate to approximately 1 ml.

13. Bring the extract to a final volume of 10 ml with methylene chloride.

14. Prepare a five-fold dilution in ACN to run on the HPLC.

15. Transfer the extract to a glass screw cap vial and store in the freezer if the analysis cannot be performed immediately.

16. Proceed with the silica gel cleanup (if necessary), as listed in Appendix V of the departmental methods manual.

B. **Chromatographic Procedure:**

1. HPLC Setup:

Column - Supelco LC-PAH, 5 um 15 mm x 4.6 mm or equivalent

Mobile Phase - A = H_2O
B = Acetonitrile

Gradient - 35% B hold 2 minutes from 2 to 16 minutes increase %B to 100%.

Flow - 1.5 ml/minute

Temperature - ambient

Injection loop size - 20 ul

UV - 254 nm

Fluorescence - 280 nm excitation
370 nm emission
0.01 uA PMT signal

2. Both mobile phases must be degassed prior to use. A second redegassing before seven days is usually not necessary.

3. If deionized tap water is being used it must be filtered prior to degassing.

4. The system should be set up and checked as described below:

   a. Set all HPLC parameters to those listed in Sections B1-3 of the method.

   b. Pump mobile phase at the initial gradient conditions for ten minutes. After ten minutes, check the entire system for leaks (i.e. all connections, injection loop, Shimadzu pump heads, detector inlets and outlets, etc.).

c. Inject an acetonitrile blank to confirm the absence of system contamination. If no peaks are seen (there is a 2 cm "peak" around 22 minutes which represents the sudden mobile phase change from 100% B back to the initial gradient conditions--disregard this), then the calibration may proceed.

d. If contamination peaks are seen, then plot a gradient only run without making an injection. If the peak remains, one or both of the mobile phases are suspect. Try new lots of acetonitrile and/or water if necessary.

e. Once the system is free of contamination, proceed to Section B5 (calibration).

5. External calibration is performed by injecting working mixes at five concentration levels. In order for each working mix to contain 16 peaks showing similar peak heights, the mixes must be prepared as described in the Reagent section of this method. Sample chromatograms are presented in Figures 1 and 2.

6. Calculate response factors (RF) for the first six compounds listed in this method from the UV data (RF = concentration [ug/ml] divided by peak height [or area]). Calculate RFs for the last ten compounds from the fluorescence data in the same fashion. RFs for the last ten compounds on UV and first six compounds on fluorescence need not be calculated unless 2nd detector confirmation is required. If the RF value over the five working levels is constant (<20% RSD), then the average RF can be used in all subsequent

calculations. If the RFs are to be used for confirmation only and sensitivity of the lower levels is a problem, then a minimum of three working levels may be used. If the %RSD for any or all of the compounds exceeds 20% then a least squares calibration curve (include zero) must be generated for the affected compounds.

7. The working calibration curve or RF must be verified at least once per day (after every ten injections is recommended) by injecting one of the calibration mixes. The peak height (or area) response for each analyte must show $\leq$15.0% RPD as compared to the initial injection of the calibration standard. RFs to be used for confirmation only must show $\leq$20% RPD.

8. If any or all of the RPDs are >15.0%, then the system is out of control. Every effort must be made to correct the problem. If any or all of the RFs used for confirmation only show >20% RPD then the analyst may choose to perform single point confirmation calculation or start a new calibration curve.

9. If the problem is corrected, it must be verified by showing all RPDs $\leq$15.0% (this applies to RFs to be used for primary quantitation only) and sample analysis may proceed. If the problem can not be corrected, then the system must be recalibrated. If no samples were injected after the system was deemed out of control then no sample reanalysis is necessary.

10. Retention time windows (for a given column) are generated by making three midlevel standard injections over a 72-hour period. Calculate the average retention

time for each analyte. Each subsequent window is calculated as the average ± three times the standard deviation. Retention time windows may by updated as needed by modifying the midpoint retention times.

11. For any analyte to be reported, the following must occur:

    a. The retention times must be within the specified windows on both the fluorescence and the UV runs.

    b. The peak must be clearly resolved on both runs.

    c. The primary and confirmation values must agree within a factor of two.

12. UV detection is the primary mode of detection for the first six analytes listed in Table 1. Fluorescence detection is the primary mode of detection for the last ten analytes listed in Table 1.

13. Any analyte concentration above the working range of the standards must be diluted to within the range.

14. Silica gel cleanup (as per Method 3630 SW-846) may be used for messy samples.

15. Any time the injection sequence is discontinued for more than eight hours, the midlevel calibration mix must be injected just before and right after the break in the injection sequence. Before sample analysis proceeds, the requirements listed in Steps 8 to 9 must be met.

16. All standards and samples must be warmed to room temperature prior to being injected.

Calculations:

$$\frac{\text{PK HT} \times \text{RF} \times \text{FV} \times \text{DF} \times \text{AF}}{\text{IW}} = \text{Concentration (mg/kg)}$$

Where: Pk Ht = Peak height found in the sample

RF = Response factor (ppm/peak height) of the analyte in the standard

FV = Final volume of the sample extract (ml)*

AF = Additional factor**

DF = Dilution factor (where applicable)

IW = Initial weight of the sample extracted (gm)

*This value refers to the 10 ml of methylene chloride extract.

**This value is recorded as 5 to account for the dilution of the methylene chloride extract into ACN.

Quality Assurance:

1. A reagent blank (using sodium sulfate) is extracted with every batch of 20 samples or less.

2. A laboratory control sample (a spiked reagent blank) is extracted with every batch of 20 samples or less.

3. A matrix spike (MS) and a matrix spike duplicate (MSD) is extracted for every 20 samples or every 14 days, whichever comes first.

4. 95% CIs for LCS recoveries and 99% CIs for MS/MSD and RPD are generated using ≥30 data points. These limits are monitored and updated when the upper and/or lower limit has changed by more than 15%.

5. Sample data is deemed acceptable if the MS/MSD data and/or the LCS data is within the CI specified above. If the MS and/or MSD recoveries fall outside the 99% CIs and the LCS falls within the 95% CI, then the MS/MSD problems are assumed to be matrix related and the only action required is to review all MS/MSD data for errors and reanalyze the extracts if necessary. If the MS and/or MSD and the LCS are out of specification, then all data must be reviewed for errors and the extracts must be reanalyzed (at least the LCS). If no correctable errors are found, then the batch must be re-extracted (even if the holding time is exceeded). If the repeat MS/MSD and/or LCS data is within the specified CI and prepped within the holding time, then the repeat data must be reported. If the repeat MS/MSD and/or LCS is in specification but prepped beyond the holding time, then the original data is reported and a comment explaining that the original data was reported (and why) must appear on the sample report.

6. 99% CIs for surrogate standard recoveries are generated using ≥30 data points. These limits are monitored and updated quarterly. Samples outside the 99% CI must be re-extracted. If the re-extraction is within the holding time and within the 99% CI, then the repeat data is reported. If both extractions are

outside the 99% CI, then the problem is matrix related and a comment is included on the report. If the re-extraction is in spec but outside holding time, then the original data is reported and a comment is included on the report.

NO1862
PP METHODS #2
111391

Prepared by: Laura L. Schumacher Date: 11/14/91

Approved by: [signature] Date: 11/15/91

Approved by: [signature] Date: 11/18/91

Table 1

Stock/Intermediate Standard Solution Preparation

Analyte	Stock ug/ml (± 10%)	Solvent for Stock Solutions	Intermediate ug/ml	Solvent for Immediate
Naphthalene	4000.	ACN	--	--
Acenaphthylene	4000.	ACN	--	--
Acenaphthene	6000.	ACN	--	--
Fluorene	600.	ACN	--	--
Phenanthrene	200.	ACN	--	--
Anthracene	1000.	ACN	100.	ACN
Fluoranthene	8000.	ACN	80.	ACN
Pyrene	400.	ACN	--	--
Benzo(a)anthracene	400.	ACN	40.	ACN
Chrysene	200.	ACN	--	--
Benzo(b)fluoranthene	400.	ACN	40.	ACN
Benzo(k)fluoranthene	1500.	$MeCl_2$	15.	ACN
Benzo(a)pyrene	400.	ACN	40.	ACN
Dibenza(a,h)anthracene	800.	ACN	80.	ACN
Benzo(g,h,i)perylene	3000.	ACN	30.	ACN
Indeno(1,2,3-cd)pyrene	150.	ACN	--	--

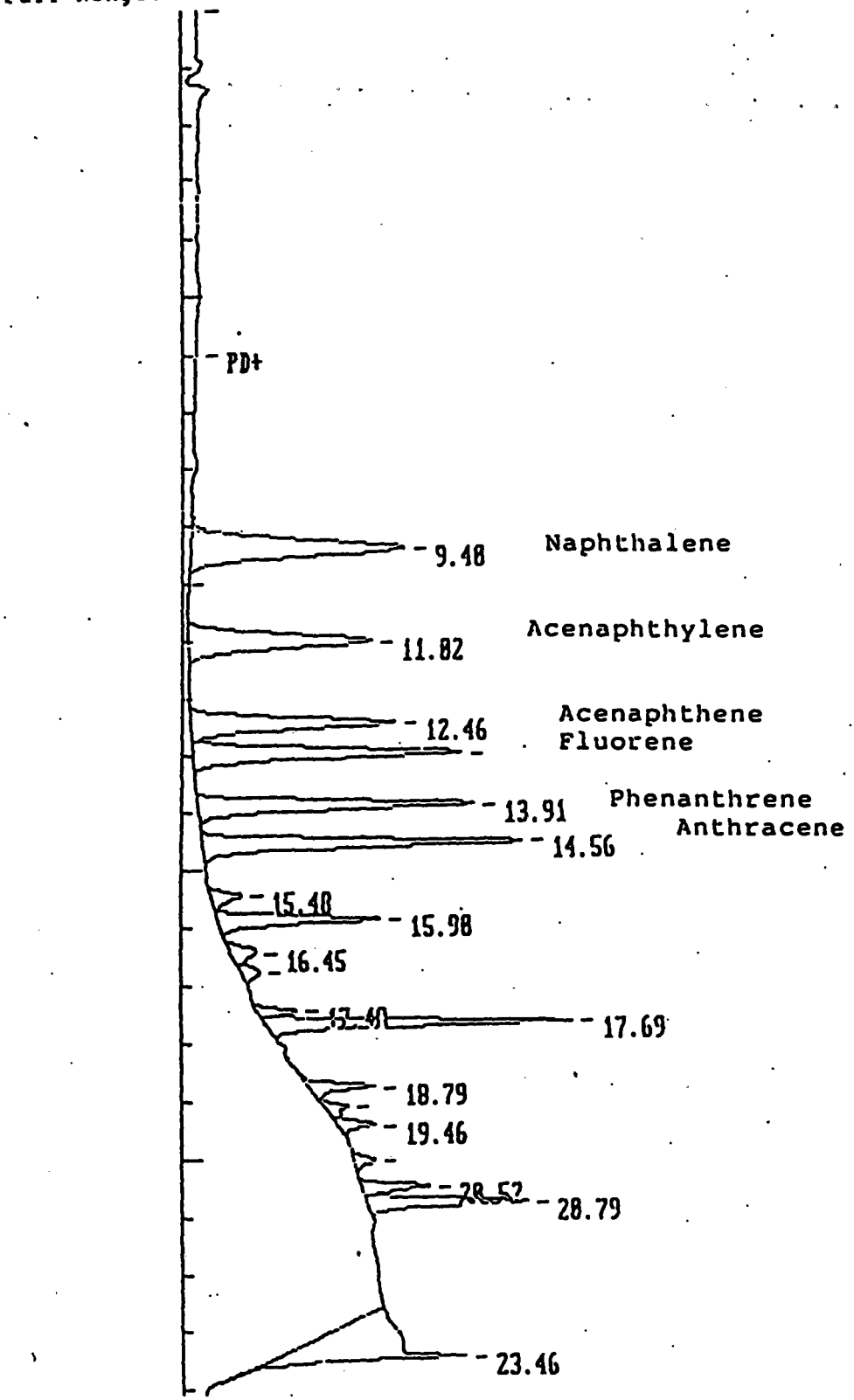

FIGURE 1: PAH's which are determined using UV detection as the primary mode of detection.

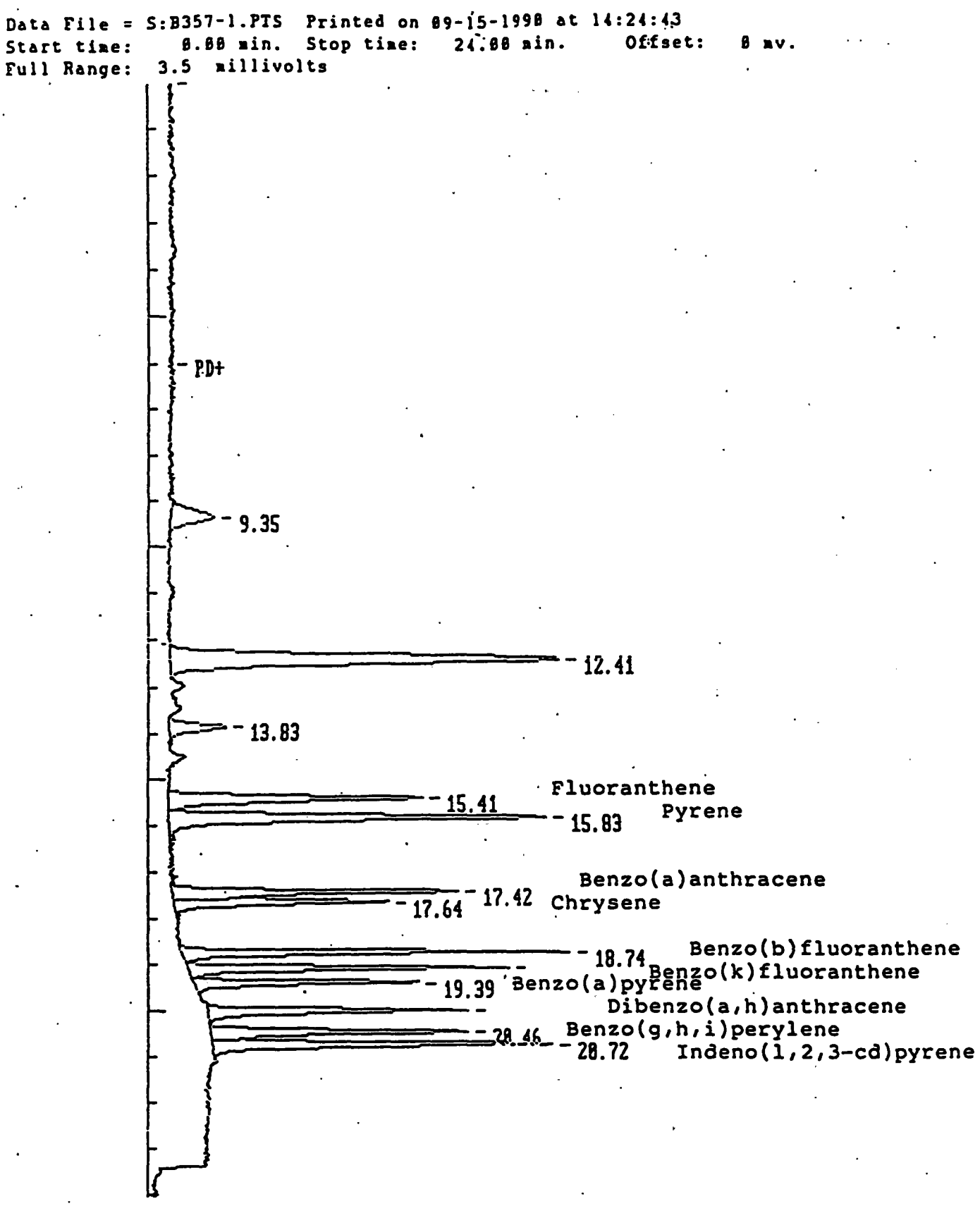

FIGURE 2: PAH's which are determined using Fluorescence detection — as the primary mode of detection.

Analysis #111
Initiated Date: 11/11/88
Effective Date: JAN 24 1992

Moisture

References:

1. EPA Methods for Chemical Analysis of Water and Wastes, EPA-600.4 - 79 - 020, p. 160.3.

2. Standard Methods for the Examination of Water and Wastewater, 17th edition, 1989, Method 2540G, p. 2-78 - 2-79.

3. LLENS SOP-WQ-014.

Scope:

This method is applicable to all routine samples for moisture analysis. The determination of moisture in solid and semisolid materials is subject to error due to loss of ammonium carbonate and volatile organic matter during drying.

Basic Principles:

A well mixed sample in a tared container is dried to constant weight in an oven at 103°C to 105°C. The decrease in weight after drying is calculated as the moisture content.

Apparatus and Reagents:

1. Crucibles or disposable aluminum pans.

2. Oven maintained at 103°C to 105°C.

3. Balance.

4. Standard solution of 10.5% NaCl: Thoroughly mix 105 g NaCl and 895 g deionized water. Store at 4°C. (This solution is used as prepared.) stable six months.

Safety Precautions:

There are no special safety precautions for this procedure. Follow routine laboratory safety steps.

Procedure:

1. Download a batch of samples to be performed using the LLENS system (consult SOP-WQ-014).

   a. "Downloading a Sample List" for analysis 111

      (1) When downloading samples for analysis 111, you must download the sample list for analysis 8200. All incomplete samples for analyses 111 and 1353 will appear in the sample table. Choose the appropriate samples using the "insert" key and press PF10 to save.

      (2) A table will appear labeled Sample Table Editing.

      (3) If the batch chosen above contains data package samples with client submitted Q.C. (the matrix spike sample will have moisture analysis 118, and the matrix spike duplicate samples will be entered for moisture analyses 118 and 121), type the following exactly as it appears next to the Q.C. samples:

BK1 Next to the background sample number

MS1 Next to the matrix spike sample number

MD1 Next to the duplicate sample number

Press PF10 to save

If the batch chosen above does not contain client submitted Q.C. refer to the LLENS SOP section A.2.

b. "Hand Entering a Sample Table" for analysis 111.

(1) Using the master P.C., hand enter a sample table for incomplete 111 moisture samples using analysis 8200 (See LLENS SOP-WQ-014 section A.1.). If the batch does not contain client submitted Q.C., choose the duplicate at this time.

(2) Move to the moisture P.C. and from the main menu execute "Balance Data Collection".

(3) Type in analysis "8200" and press "enter".

(4) Pick the batch which has the incomplete samples hand entered (using the "insert" key and pressing "enter).

(5) Execute "Analysis Scheduled".

(6) A table will appear with the incomplete sample on the left and the analyses (111, 118, 121, and 1353) on the right. Choose the appropriate analysis in the table by typing a "1" in the corresponding column. Note: If the batch contains client submitted Q.C., choose analysis 118 for the matrix spike sample and analyses 118 and 121 for the matrix spike duplicate sample.

(7) Press PF10 to save.

2. Check to see that the balance has been calibrated for the day and record this in the data book or on the LLENS cover sheet.

3. Number aluminum drying pans. Place aluminum pan on the tared balance and record its weight.

4. If using pre-tared crucibles:

   Record the permanent ID assigned to the crucible and its tared weight from the tare weight notebook.

5. Zero the balance. Weigh 5 to 10 grams of sample into the container, and record the weight.

6. Record the oven temperature in the lab notebook or LLENS cover sheet, then place the samples in the oven. Dry the samples overnight at 103° to 105°C.

7. Record the oven temperature and remove samples from the oven.

8. Cool the samples in a desiccator for one hour. (Check desiccant to be sure indicator crystals are still blue, not pink.)

9. Check to see that the balance has been calibrated for the day. Record this in the data book.

10. Weigh the dried samples and record this oven dried weight in the databook or using the LLENS system.

11. The percent moisture is calculated as follows:

$$\% \text{ moisture} = \frac{A - B}{C} \times 100$$

A = wt of sample and container before drying
B = wt of sample and container after drying
C - wt of sample before drying

Quality Assurance:
A duplicate and standard should be run with every batch of 20 samples.

NO111
WQ METHODS #3
012092

Prepared by: Tracy Schmidt Date: 1/22/92

Approved by: Beth Eby Date: 1/23/92

Approved by: Lee C. Stuart Date: 1/24/92

Analysis #236
Initiated Date: 3/486
Effective Date: AUG 29 1991

Oil and Grease

References:

1. USEPA SW846 Test Methods for Evaluating Solid Wastes, 1986, Method 9071.

2. Standard Methods for the Examination of Water and Wastewater, 17th Edition, 1989, 5520, D&E.

Scope:

This method is applicable to sludges and solids. The limit of quanitation is 0.01%.

Basic Principles:

Oil and grease is any material recovered as a substance soluble in trichlorotrifluoroethane. Drying acidified sludge or solids by heating leads to low oil and grease results. Magnesium sulfate is capable of combining with water to form $MgSO_4 \cdot 7H_2O$ and is used to dry sludge and solids. After drying, the oil and grease can be extracted with trichlorotrifluoroethane using a soxhlet apparatus.

Apparatus and Reagents:

Reagents must be ordered when there is only enough to last two weeks. Check ahead on glassware. Be sure what is needed for the next day is in the baths the night before.

1. Soxhlet extraction apparatus

2. Extraction thimble (cellulose)

3. Glass-wool

4. Filter paper

5. Concentrated hydrochloric acid, HCl

6. Vacuum pump

7. Magnesium sulfate, $MgSO_4$, anhydrous

8. Water bath

9. 1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon)
   (Each bottle FTIR checked at <0.01 absorbance)

10. 250 ml beakers (heavy duty)

11. Spoons and spatulas

12. 8 in. glass stir-rods

13. Electric Heating Mantle

14. Analytical Balance

15. Funnels, 7 cm, long stemmed

Safety Precautions:

Trichlorotrifluoroethane, or freon, is heavier than air and reduces the oxygen available for breathing. It should be used only in a well ventilated area.

Procedures:

1. Tare a 250 ml flask containing three boiling chips to be used as the extraction flask.

2. Weigh 20 ± .5 g of sample, into a 250 ml beaker.

3. Acidify the sample to a pH <2.0 with concentrated HCl, 0.5 ml is usually sufficient.

4. Add 25 g $MgSO_4$ and stir until a free-flowing, homogeneous mixture is achieved. Be sure to crush and mix all earthen lumps. Allow hot samples to cool.

5. Add the powder to the extraction thimble. Be careful to scrape the 250 ml beaker for dried sample adhering to the sides and bottom. Use small thimbles/ extractors as much as possible.

6. Cover the sample in the thimble with glass wool.

7. Extract in a soxhlet apparatus at 20 cycles per hour for 4 hours. (Time from first cycle.) 250 ml florence flasks should be filled with freon to the neck if a large extractor is used or to the 250 ml mark on the flask (160-170 mls) if a small extractor is used.

8. If the extract is turbid, filter the extract through pleated filter paper into another tared flask. Rinse flask and filter paper with trichlorotrifluoroethane.

9. Place flask in water bath set at 60°C. When the solvent level in the flask has reduced by approximately two thirds, turn bath up to 70°C. Draw air through it using an applied vacuum to remove any solvent vapor from the flask. Reheat on top of the water bath for at least 30 minutes, aspirate as before, then wipe outside of flask clean of water and fingerprints. Cool in a desiccator for 60 minutes and weigh.

10. Return to desiccator for 15 minutes, reweigh. If flask loses more than 1 mg in weight, redesiccate and reweigh. Continue in this way until constant weight is achieved.

Spiking Solution Preparation:

Weigh 2.5 ± .0010 g 10W-30 motor oil into a 25 ml volumetric flask. Dilute to volume with freon. This will yield a 100,000 mg/l standard. Store at 4°C. Hold time is one month.

Calculations:

$$\frac{\text{Gain in wt. of flask}}{\text{wt. of sample}} \times 100 = \% \text{ Oil and Grease in sample (as received)}$$

Statistical Information:

The examination of 6 replicate samples of sludge yielded a standard deviation of 4.6%.

Quality Assurance:

A background soil (10 g) spiked with a 2 ml of 100,000 mg/l standard should be analyzed every 20 samples. Duplicate, blank and spike (2 ml of 100,000 mg/l standard added to a 20 g sample) should be run every 20 samples. One batch of 20 samples is not to extend for a period of more than five working days. Be sure the sample selected for the QC duplicate contains some of the analyte to be determined. This increases client confidence in the reproducibility of the method.

NO236
WQ Methods #2
082291

Prepared by: Shelley L Gittleman Date: 8/28/91

Approved by: Beth Eby Date: 8/28/91

Approved by: Lee A Smith Date: 8/29/91

Laboratory QAPP

1. Laboratory Quality Assurance Plan

This document provides the laboratory portion of the response to EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" QAMS-005/80, Sections 5.1 - 5.16 as revised December 29, 1980.

As much as possible, the procedures in this document have been standardized to make them applicable to all types of environmental monitoring and measurement projects. However, under certain site specific conditions, all of the procedures discussed in this document may not be appropriate. In such cases it will be necessary to adapt the procedures to the specific conditions of the investigation.

Director of Quality Assurance _____

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3. Project Description

Tests will be performed according to the analytical methodology set forth in the USEPA SW846 3rd Edition, 1986*. SW846 provides specific analytical procedures to be used and defines the specific application of these procedures. Proven instruments and techniques will be used to identify and measure the concentrations of volatiles, semivolatiles and pesticide compounds and/or the inorganic elements. The laboratory will employ state-of-the-art GC/MS and/or GC procedures to perform all organic analyses, including all necessary preparation for analysis. Inorganic analyses will be performed using graphite furnace atomic absorption spectrophotometry (AA), inductively coupled plasma spectroscopy, cold vapor AA, flame AA, or hydride generation AA. Wet Chemical analyses will use appropriate instrumentation. The client is responsible for providing specifics on the project site.

* Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. SW846 (3rd Edition, 1986), or most recent revision unless otherwise requested by the client.

4. Project Organization

The objectives of the laboratory Quality Assurance Program are to establish procedures which will ensure that data generated in the laboratory are within acceptable limits of accuracy and precision, to ensure that quality control measures are being carried out, and to ensure accountability of the data through sample and data management procedures. To this end, a Quality Assurance Department has been established. The Director of Quality Assurance reports directly to the President of the Laboratory and has no direct responsibilities for data production, thus avoiding any conflict of interest.

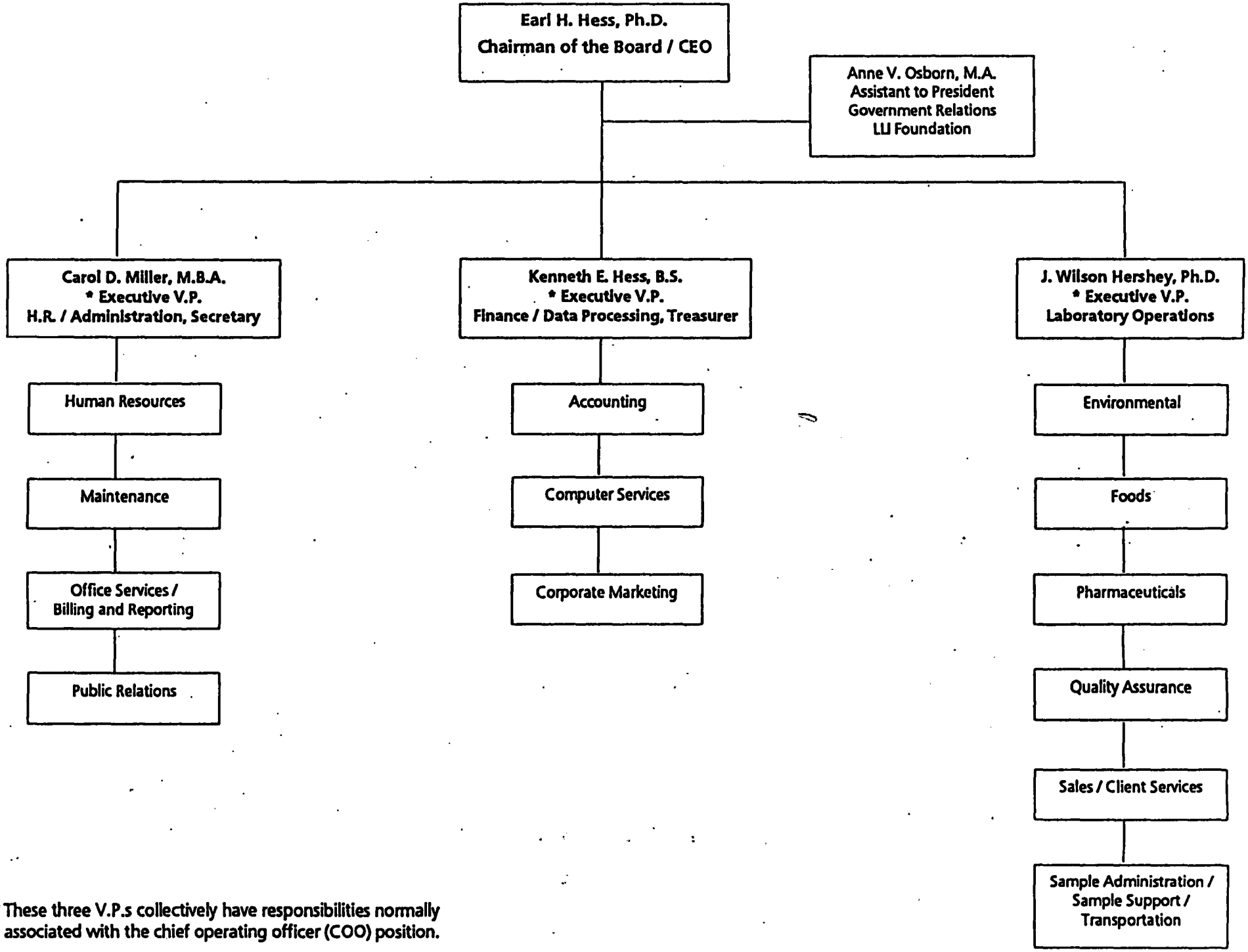
The attached organizational charts show the key personnel in both Corporate Services and the Environmental Sciences Division. Resumes of key individuals may be found in the enclosed Qualification Manual.

The Sample Administration Group will be responsible for receiving samples, signing the external chain-of-custody, checking sample condition, assigning unique laboratory sample identification numbers, assigning storage locations, checking and adjusting preservation, and homogenizing the sample as needed.

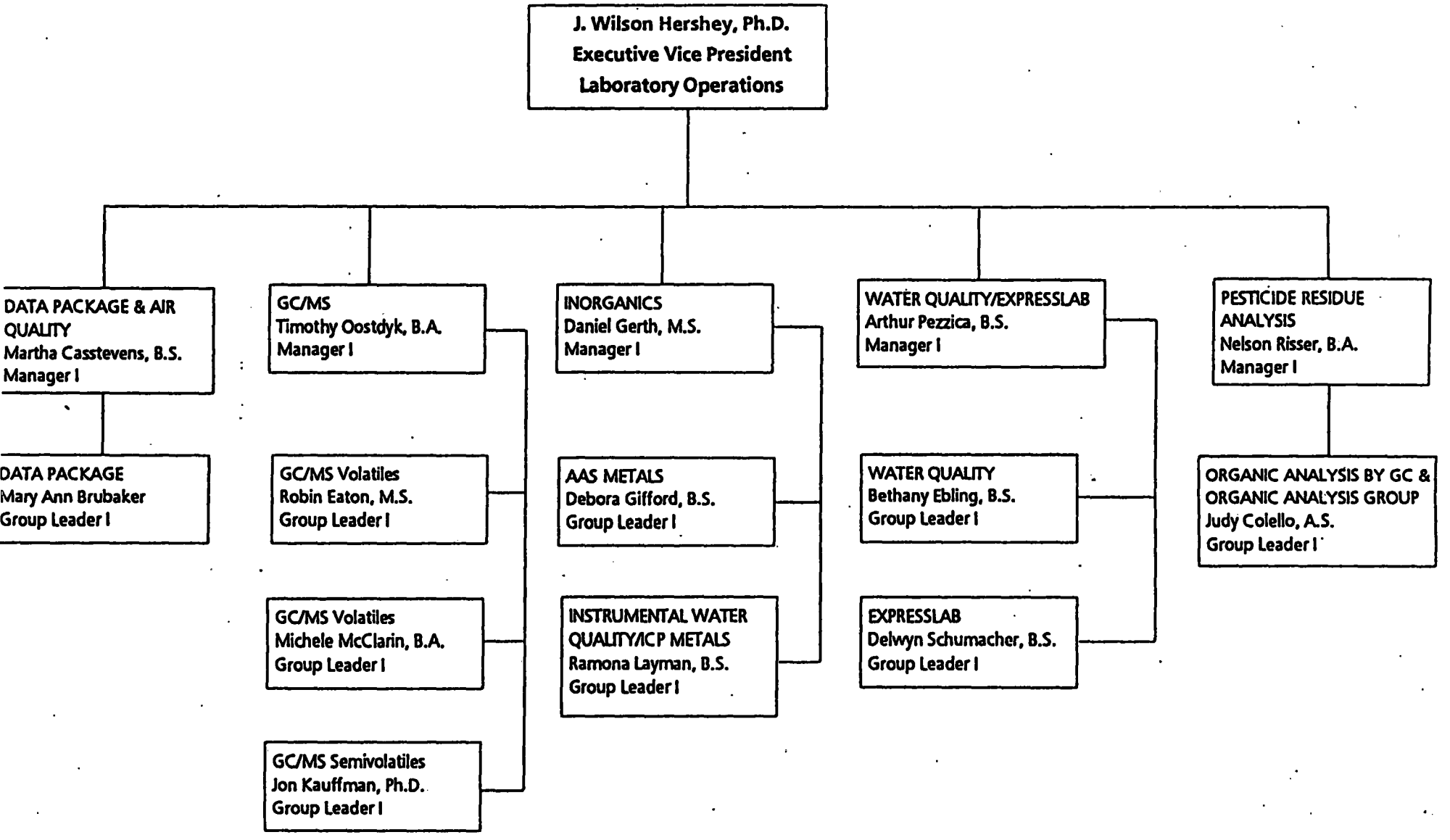
Group Leaders listed in each technical area are responsible for performing laboratory analyses, quality control as specified in the methods, instrument calibration, and technical data review. Data is reported using a computerized sample management system, which tracks sample progress through the laboratory and generates client reports when all analyses are complete. Quality control data is entered onto the same system for purposes of charting and monitoring data quality.

The Quality Assurance Department is responsible for reviewing quality control data, conducting audits in the laboratory and reporting findings to management, maintaining current copies of all analytical methods, maintaining copies of computer code used to calculate and report results, submitting blind samples to the laboratory and ensuring that appropriate corrective action is taken when quality problems are observed.

Data package deliverables are available upon request. The Quality Assurance Department reviews the contents of the deliverables for completeness and to be sure that all quality control checks were performed and met specifications. This step includes review of holding times, calibrations, instrument tuning, blank results, duplicate results, matrix spike results, and surrogate results. Every attempt to meet specifications will be made and any item outside of the specifications will be noted in the narrative. The laboratory will not validate data with regard to useability since this generally requires specific knowledge about the site.



* These three V.P.s collectively have responsibilities normally associated with the chief operating officer (COO) position.


J. Wilson Hershey, Ph.D.
Executive Vice President
Laboratory Operations
DATA PACKAGE & AIR QUALITY
Martha Casstevens, B.S.
Manager I
DATA PACKAGE
Mary Ann Brubaker
Group Leader I
GC/MS
Timothy Oostdyk, B.A.
Manager I
GC/MS Volatiles
Robin Eaton, M.S.
Group Leader I
GC/MS Volatiles
Michele McClarin, B.A.
Group Leader I
GC/MS Semivolatiles
Jon Kauffman, Ph.D.
Group Leader I
INORGANICS
Daniel Gerth, M.S.
Manager I
AAS METALS
Debora Gifford, B.S.
Group Leader I
INSTRUMENTAL WATER QUALITY/ICP METALS
Ramona Layman, B.S.
Group Leader I
WATER QUALITY/EXPRESSLAB
Arthur Pezzica, B.S.
Manager I
WATER QUALITY
Bethany Ebling, B.S.
Group Leader I
EXPRESSLAB
Delwyn Schumacher, B.S.
Group Leader I
PESTICIDE RESIDUE ANALYSIS
Nelson Risser, B.A.
Manager I
ORGANIC ANALYSIS BY GC & ORGANIC ANALYSIS GROUP
Judy Colello, A.S.
Group Leader I

5. QA Objectives For Measurement Data

Quality Assurance is the overall program for assuring reliability of monitoring and measurement data. Quality control is the routine application of procedures for obtaining set standards of performance in the monitoring and measurement process. Data quality requirements are based on the intended use of the data, the measurement process, and the availability of resources. The quality of all data generated and processed during this investigation will be assessed for Precision, Accuracy, Representativeness, Comparability, and Completeness.

Precision - Precision is determined by measuring the agreement among individual measurements of the same property, under similar conditions. The laboratory objective is to equal or exceed the precision demonstrated for the applied analytical method on comparable samples. The degree of agreement is expressed as the relative percent difference (RPD%). Evaluation of the RPD% is based on statistical evaluation of past lab data for organic and inorganic analyses. External evaluation of precision is accomplished by analysis of Standard Reference Material and interlaboratory performance data.

Accuracy - Accuracy is a measure of the closeness of an individual measurement to the true or expected value. Analyzing a reference material of known concentration or reanalyzing a sample which has been spiked with a known concentration/amount is a way to determine accuracy. Accuracy is expressed as a percent recovery (%R). Evaluation of the %R is based on statistical evaluation of past lab data or guidelines within the methods for organic and inorganic analyses.

Representativeness - Representativeness expresses the degree to which data accurately represents the media and conditions being measured. The representativeness of the data from the sampling site will depend on the sampling procedure. Sample collection is the responsibility of the client. Samples will be homogenized, if required, as part of the laboratory sample preparation. By comparing the quality control data for the samples against other data for similar samples analyzed at the same time, representativeness can be determined for this objective.

Comparability - Comparability conveys the confidence with which one set of data can be compared to another. The analytical results can be compared to other laboratories by using traceable standards and standard methodology and consistent reporting units. The Laboratory Quality Assurance Program documents internal performance, and the interlaboratory studies document performance compared to other laboratories.

Completeness - Completeness is a measure of the quantity of valid data acquired from a measurement process compared to the amount that was expected to be acquired under the measurement conditions. The completeness of an analysis can be documented by including in the data deliverables sufficient information to allow the data user to assess the quality of the results. Additional information will be stored in the laboratories archives, both hard copy and magnetic tape. Quality Assurance Standard Operating Procedures (SOP's) are in place to provide traceabilty of all reported results.

6. Sampling Procedures

In order for meaningful analytical data to be produced, the sample analyzed must be representative of the system from which they are drawn. It is the responsibility of the client to ensure that the samples are collected according to accepted or standard sampling methods.

If requested, the laboratory will provide sample containers and preservative. The majority of sample containers are precleaned by the supplier. Any reused bottles are cleaned in-house following Laboratory Standard Operating Procedures. Special containers with traceability documentation are available upon request. Because the laboratory does not stock this type of container, one month prior notice is required.

A list of containers, preservatives and holding times follows:

A List of Sample Containers, Preservatives and Holding Times for Aqueous Samples

	Vol. Req. (ml)	Container Plastic/ Glass	Preservation	Holding Time From Date of Collection Waters	Soils
Volatiles	3 x 40	G	Cool, 4C* pH < 2 w/HCl	14 days	14 days
Pesticides	2 x 1000	G	Cool, 4C*	7 days	14 days
Acid/Base Neutrals	2 x 1000	G	Cool, 4C*	7 days	14 days
Metals	500	P,G	HNO_3 to pH < 2	6 months (except mercury = 28 days)	6 months
Cyanide	1000	P,G	Cool, 4C NaOH to pH > 12	14 days	14 days
Sulfide	500	G	Cool, 4C NaOH, ZnAC	7 days	7 days
Phenol	500	G	Cool, 4C H_2SO_4 to pH <2	28 days	28 days
TOX	3 x 250	G	Cool, 4C HNO_3 to pH <2	14 days	14 days
TOC	125 ml	G	Cool, 4C H_2SO_4 to pH <2	28 days	28 days

* Thiosulfate needed for chlorinated samples.

NOTE: Solid Samples for any or all of the above analyses require a 500 ml glass container with a Teflon-lined cap. For volatiles analysis, the container should be filled completely, with no headspace. All sample containers, preservatives, and mailers will be supplied at no additional charge upon request, except for the special containers with traceability documentation. There is an additional charge for this type of container.

7. Sample Custody

A member of our Sample Administration Group will act as sample custodian for the project. To ensure accountability of our results, a unique identification number is assigned to each sample as soon as possible after receipt at the laboratory. When samples requiring preservation by either acid or base are received at the laboratory, the pH will be measured and documented. Samples requiring refrigeration will be stored in our walk-in cooler which is maintained at 4°C. The use of our computer system in tracking samples (by the LLI sample # assignment) will control custody of the sample from receipt until the time of its disposal. The security system on our laboratory building allows us to designate the entire facility as a secure area since all exterior doors are either locked or attended. Therefore, hand-to-hand chain of custody is not part of our routine procedure but, is available upon request. The procedures for sample log-in and chain-of-custody documentation are detailed in the QA Standard Operating Procedures included in Section No. 7 (QA102 and QA104).

Lancaster Laboratories INCORPORATED
Where quality is a science

Initiated Date: 3/87
Revised Date: 5/16/90

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-102

Title: Sample Log-in

Purpose:

In order to provide accountability of our results and to prevent sample loss or mix-up, a unique identification number is assigned to each sample.

Scope:

This SOP will cover the procedure used to log-in samples received for analysis.

Procedures:

1. All samples received by laboratory personnel shall be delivered to the Sample Administration Group immediately upon arrival at the laboratory.

2. All client correspondence relating to samples shall also be transferred to the Sample Administration Group. This includes purchase orders, quotes, letters and completed entry request forms.

3. Personnel of the Sample Administration Group shall log the samples into the computer as soon as practical after receipt. The computer will assign a unique identification number to each sample. Samples shall be logged in on the same day they are received with the following exceptions:

   a. Samples received during a holiday or between 6 p.m. on Friday and 6 p.m. on Sunday. These samples shall be logged-in on the next normal work day.

   b. Samples submitted by clients without any indication of the tests to be performed or with unclear or incomplete information. Every effort shall be made to contact the client on the same day as sample receipt.

   If same day entry is not possible, any special storage requirements (e.g., refrigeration) should be observed.

4. Upon assignment of a sample number, the computer will generate a label which shall be attached to the sample container. The information on the label will include the LLI sample number, the client name, the storage location, a list of analyses requested (by analytical method number), a bottle code indicating container and preservative type, and a unique bar code.

5. Addition of preservatives to unpreserved samples will be the responsiblity of the Sample Administration Group. Preservation should be performed immediately after log-in. A list of preservatives required for routine analyses may be found in the Fee Schedule.

6. All entries in preservation notebooks and on client paperwork shall be made in ink. The error correction procedure given in SOP-QA-109 shall be followed for any changes made in this documentation.

7. After samples are logged-in (or preserved, if required) they shall be stored in the computer-assigned location. If the computer-assigned location is inappropriate for the samples, the location code may be changed by manually overriding the computer.

QA102
SOP QA #1

Prepared by: M Louise Hess Date: 5/21/90

Approved by: Glenn M. Ackley Date: 4 June 90

Read and understood by: _____ Date: _____

Lancaster Laboratories
Where quality is a science.

Initiated Date: 3/87
Revised Date: 9/28/90

QUALITY ASSURANCE OPERATIONS MANUAL
STANDARD OPERATING PROCEDURE
QA-104

Title: Chain-of-Custody Documentation

Purpose:

In order to demonstrate reliability of data which may be used as evidence in a legal case or required by a regulatory agency, an accurate written record tracing the possession of the sample from its receipt at the laboratory to the time of its disposal must be maintained.

Scope:

Procedures for initiating and maintaining chain-of-custody documentation are described in this document.

Definition:

A sample is in custody if it is in any one of the following states:

1. In actual physical possession.
2. In view after being in physical possession.
3. In physical possession and locked up so that no one can tamper with it.
4. In a secured area, restricted to authorized personnel.

Procedures:

1. Chain-of-custody documentation shall be kept upon request of the client or for any samples which are known to be involved in a legal dispute. As with all analytical data, it is extremely important that documentation be filled out completely and accurately with every transfer. If changes to the form need to be made, the error correction procedure given in SOP-QA-109 shall be followed.

2. If requested by the client, the chain-of-custody documentation will begin with the preparation of bottles. A form (see Attachment 1) will be initiated by the person packing the sample bottles for shipment to the client. If the delivery of bottles is via our Transportation Department, the driver shall sign the form when relinquishing the bottles. Drivers must also sign chain-of-custody forms when picking up samples which require such documentation.

3. When samples arrive at the laboratory, a member of the Sample Administration Group will receive them and sign the chain-of-custody form, if one is provided with samples. If the sample was picked up by our Transportation Department, the driver must sign to indicate relinquishing the sample.

4. Samples will be logged into the computer as described in QA-102. Sample Administration personnel shall indicate locked storage, enter a lab note to inform analysts of the need for chain-of-custody documentation, and enter the analysis number for "laboratory chain-of-custody".

5. Sample Administration personnel shall initiate a "Laboratory Chain-of-Custody" form (Attachment 2) for each type of container in the sample, and relinquish the samples to a sample custodian or designated key holder, who will store the sample in the assigned locked location. At this point, external chain-of-custody forms will be filed with the Accounts Receivable Department to be returned with the invoice, and the internal forms will accompany the samples.

6. Sample handling should be kept to a minimum. Analysts requiring use of a sample will requisition it through the computer requisition program. During the hours where sample support is manned by sample custodians, the custodian will receive the computerized requisition, remove the sample from storage and sign the "released by" column to indicate the sample has been relinquished. The analyst shall sign the "received by" column and note the reason for change of custody before taking the samples to their work area. It will be a shared responsibility of technicians and sample custodians to ensure that forms are signed with each transfer.

All changes of custody must be documented on the form. The following changes of custody shall be handled as follows:

a. Signatures involving transfers from one shift to another shall be the responsibility of the technician who originally acquired the sample from sample support. When samples are then returned to storage, the person returning the samples shall be responsible to sign the "released by" column, and to ensure that samples were properly received by the custodian with his/her signature in the "received by" column.

b. Occasionally a sample will be needed for analysis by a technician in a department while it has been signed out to a technician in another department. It will be the responsibility of the first technician who received the sample to see that the second technician needing the sample signs for receipt and return of the sample to them.

c. Weekend work hours do not always have a sample custodian available. During these times the Lancaster Labs security personnel function as key holders to the storage areas. Technicians requiring use of samples over these times must obtain signatures from security personnel, in place of regular sample custodians. It may be necessary to page the security staff on weekends to acquire their signatures and assistance.

d. Some samples are released by sample support and stored temporarily in other areas of the laboratory e.g. GC/MS Volatiles. During this time they may be worked on by several people in that department. Each of these people must sign for change of custody. These samples when completed are then returned to sample support. It will be the responsibility of the department who held temporary storage to see that all necessary signatures are on the chain of custody form before returning samples and forms, at the same time, to sample support. It is also important to return these sample groups as soon as possible after verification of data, because the chains may be required for data packages.

7. Analysts in possession of samples shall remove the aliquot required for analysis and return the sample to storage as described in #8 below with a minimum of delay. During the time of possession, samples must remain in the analyst's view or be locked-up. If additional containers of the sample are created (e.g., an extract container from preparation for organic analysis), an additional form marked with the container type shall be created to accompany the new container.

8. After analysis, samples shall be relinquished to a key holder or sample custodian who will return the samples to locked storage. The forms which remain with the samples shall be signed again to indicate storage, and the sample custodian shall review the forms to ensure that all transfers are completely documented. Sample custodians shall not return a sample to its storage location without signing an accompanying chain.

9. After completion of analysis, these forms are given to the Data Package Group for inclusion in extended reports.

QA104
SOP QA #1

Prepared by: M Louise Dees Date: 10/2/90

Approved by: Ellen Crilly Date: 2 Oct 90

Read and understood by: _____ Date: _____

Lancaster Laboratories INCORPORATED
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Locked Storage Internal Chain of Custody

ORIGINAL SAMPLE

Client/Project: _____

Preservative: _____ Matrix: _____
Analyses:

Sample # Range: _____

Storage Location: _____

Sample Number(s)	Released by	Received by	Date	Time	Reason for Change of Custody

This form has been designed to accompany the sample from the moment it is originally entered into the computer until the last test is verified.

2016 Rev. 12/19/89

Lancaster Laboratories
INCORPORATED
2425 New Holland Pike, Lancaster, PA 17601 • 717/656-2301

Chain of Custody

Lancaster Laboratories Sample Number

Client: P.O. No.:

Work Order No.: Project Name:

Submit Report to: FSC:

Sampler: Project Location: Analyses

Sample Type:	
HZ	Hazardous
SO	Soil
PW	Potable Water
GW	Ground Water
SW	Surface Water
WW	Waste Water
SL	Sludge

Field sample number / sample identification	Date	Time	COMP	GRAB	Number of Containers (Total)	Sample Type (use reference)							Remarks:

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer

Section No. 7
Page 9 of 9

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Copies: White and Yellow copies accompany samples to Lab. Pink copy retained by Sampler.

8. Calibration Procedures

Procedures for initial calibration and continuing calibration verification are in place for all instruments within the laboratory. The calibrations generally involve checking instrument response to standards for each target compound to be analyzed. The source and accuracy of standards used for this purpose are integral to obtaining the best quality data. Standards used at Lancaster Laboratories, Inc. (LLI) are from two general sources. Many of the standards are purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy of these purchased standards is checked by comparing to solutions obtained from USEPA, when available. The other source of neat materials used in standard preparation is the USEPA Repository. Most solutions and all neat materials require subsequent dilution to an appropriate working range. All dilutions performed are documented and the resulting solution is checked by obtaining the instrument response of the new solution and comparing with the response to the solution currently in use. Any discrepancies between the responses are investigated and resolved before the new solution is used. Each standard is assigned a code which allows traceability to the original components. The standard container is marked with the code, date prepared and the initials of the preparer. Shelf-life for standards are included in the calibration procedures and new standards are prepared before the expiration date.

Each instrument is calibrated with a given frequency using one or more concentrations of the standard solution. As analysis proceeds, the calibration is checked for any change in instrument response. If the calibration check verifies the initial response, the analysis proceeds. If the calibration check indicates that a significant change in instrument response has occurred, then a new calibration is initiated. If necessary, maintenance may be performed prior to the recalibration.

Calibration records are usually kept in the form of raw data with the other instrument print-outs. In cases where no data system is used, calibration data is manually recorded in notebooks. Any maintenance or repair is also recorded in a notebook. The information recorded either in the notebooks or on the instrument print-out includes the date, employee name and/or identification number, and concentration or code number of standard.

The frequency of calibration and calibration verification, number of concentrations used, and acceptance criteria for each of the instruments to be used are listed on Table 8-1. In addition, to checking the instrument response to target compounds, the GC/MS units are checked to ensure that standard mass spectral abundance criteria are met. Prior to each calibration, instruments being used for volatile compound analysis are tuned using bromofluorobenzene (BFB) and instruments being used for semivolatile analysis are tuned using decafluorotriphenylphosphine (DFTPP). The key ions and their abundance criteria are listed in Table 8-2.

Table 8-1

	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# of Standard Concentrations	Acceptance Criteria	Frequency	# of Standard Concentrations	Acceptance Criteria
GC/MS Volatiles	After continuing calibration fails	5	RF for SPCC's ≥ 0.300 except for bromoform ≥ 0.25. Max %RSD for CCC's ≤ 30%	Every 12 hours	1	RF for SPCC's ≥ 0.300 except for bromoform ≥ 0.25. Max %D for CCC's ≤ 25%
GC/MS Semivolatiles	After continuing calibration fails	5	RF for SPCC's ≥ 0.050. Max %RSD for CCC's ≤ 30%	Every 12 hours	1	RF for SPCC's ≥ 0.050. Max %D for CCC's ≤ 25%
Gas Chromatograph (Volatiles)	After continuing calibration fails	5	% RSD for RF's ≤20% Except Brominated compounds, ≤40%	Every 8-10 hours	1	%D ≤15%
Gas Chromatograph (pesticides)	Each new run After continuing calibration fails	5	<20% RSD of calibration factors of initial calibration Degradation for DDT, endrin ≤ 20% initially (for Organochlorines).	Every 10 samples	1	≤15% difference from initial response
Flame Atomic Absorption Spectrophotometer	Each new run	5	Independent calibration verification within ± 10% except mercury ± 20%.	Every 10 samples	1	Same as initial
Inductively Coupled Plasma Spectrophotometer	Each new run (Max. of 86 samples/run)	1	Independent calibration verification within ± 10%	Every 10 samples	1	Same as initial

Table 8-1
(continued)

	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# of Standard Concentrations	Acceptance Criteria	Frequency	# of Standard Concentrations	Acceptance Criteria
Hydride Generation	Each new run (Max. 1 hour)	3	Independent calibration verification within ± 10%	Every 10 samples	1	Same as initial
Graphite Furnace Atomic Absorption Spectrophotometer	Each new run	5	Independent calibration verification within ± 10%	Every 10 samples	1	Same as initial
Technicon Autoanalyzer	Daily	5	Correlation coefficient > 0.995	Every 10 samples	1	± 10% of original response
TOC Analyzer	Daily	5	± 10% @ STD	Every 10 samples	1	± 10% of true value
TOX Analyzer	Daily	4	± 5% @ STD	Every 8 samples	1	± 5% of true value

Abbreviations

SPCC's are system performance check compounds.

CCC's are calibration check compounds.

RF is response factor.

%RSD is percent relative standard deviation.

%D is percent difference.

Table 8-2

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

DFTPP Key Ions and Ion Abundance Criteria

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

9. Analytical Procedures

The analytical procedures to be used for organics and inorganics are those described in the USEPA SW846 3rd Edition, 1986, for the preparation and analysis of water, sediment, and soil for the client specified compounds. Copies of the analytical procedures are located in the laboratory and available for use by analysts. Copies of analytical methods are available upon request.

Volatiles by GC/MS - This method determines the concentration of volatile (purgeable) organics. The analysis is based on purging the volatiles onto a Tenax/silica gel trap, desorbing the volatiles onto a gas chromatographic column which separates them and identifying the separated components with a mass spectrometer. Method 8240.

Semivolatiles - This method determines the concentration of semivolatile organic compounds that are separated into an organic solvent and are amenable to gas chromatography. The method involves solvent extraction of the sample to isolate analytes and GC/MS analysis to determine semivolatile (BNA) compounds present in the sample. Method 8270.

Volatiles by GC - This method determines the concentration of volatile (purgeable) organic compounds. The analysis is based on purging the volatiles from the sample onto an appropriate sorbent trap and desorbing the volatiles onto a gas chromatographic column. Using an appropriate temperature program, the compounds are separated by the column and both qualitative and quantitative detection is achieved with a Photoionization or Electrolytic Conductivity detector. Methods 8010/8020.

Pesticides & Herbicides - These methods determine the concentration of organochloride pesticides, polychlorinated biphenyls, herbicides, and organophosphate pesticides. The procedure includes solvent extraction of the sample, analysis of the extract on a gas chromatograph/electron capture detector (GC/EC) using a packed column, and confirmation on a GC/EC using a second packed column. If the compound concentration is sufficient, confirmation may be done on GC/MS upon request. Pesticide Method 8080. Herbicide Method 8150.

Inductively Coupled Plasma (ICP) - This is a technique for the simultaneous determination of elements in solution after acid digestion. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique. Characteristic atomic line emission spectra are produced by excitation of the sample in a radio frequency inductively coupled plasma. Because the temperature of the plasma is considerably higher, it is especially useful for refractory metals. Method 6010.

Graphite Furnace Atomic Absorption (GFAA) - This is a method of analysis designed to detect trace amounts of the analyte through electrothermal atomization. Samples are digested before analysis. The Graphite Furnace is an AA Spectrophotometer that heats the sample within a graphite tube using an electrical current (ie flameless furnace) and measures the absorption of specific metallic elements at discrete wavelengths. (See attached list for method number.)

Flame Atomic Absorption - This method is also suited to metals analysis. A solution of the sample to be analyzed is sprayed into a flame which generates sufficient heat to decompose the sample into its constituent atoms directly in the optical path of the light. The intensity and frequency of the radiation are measured photoelectrically, using a spectrometer. (See attached list for method number.)

Cold Vapor Atomic Absorption - Organic mercury compounds are oxidized and the mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an AA spectrophotometer and absorbance (peak height) is measured. Method 7470/7471.

Hydride Generation Atomic Absorption - Arsenic and selenium compounds are oxidized, then reduced to arsenic (3+) and selenium (4+). The arsenic (3+) and selenium (4+) are then converted to a volatile hydride with hydrogen produced from a sodium borohydride/HCl reaction. The volatile hydride is swept into a heated quartz flow cell located in the optical path of an atomic absorption spectrophotometer. The resulting absorbance is proportional to the arsenic or selenium concentration. Arsenic Method 7061. Selenium Method 7741.

Total Cyanide Analysis - Digestion and flash distillation of the sample aid in breaking down the complex cyanides to HCN. Simple cyanides are converted to cyanogen chloride by reaction with Chloramine T. This reacts with pyridine and barbituric acid reagent to give a red colored complex. The absorbance is read at 570 nm and is compared to a standard curve. A Technicon Autoanalyzer II is used. Method 9012.

Moisture - A known sample weight is placed in a drying oven maintained at 103°-105°C for 12-24 hours. The sample is reweighed after drying and this value is divided by the original weight. The result is used to calculate analytical concentration on a dry weight basis.

Sulfide Analysis - The sample is acidified and a known excess of iodine is added. The iodine reacts with sulfide in acid solution, oxidizing sulfide to sulfur. The excess iodine is back-titrated with sodium thiosulfate. Method 9030.

Phenols - This method is based on automated distillation of phenol and the subsequent reaction with 4-aminoantipyrine in basic buffer to produce a red colored complex. The absorbance is read at 505 nm and is compared to a standard curve. A Technicon Autoanalyzer II is used. Method 9066.

Total Organic Carbon (TOC) - Following acidification, the sample is purged with nitrogen to remove inorganic carbon. Persulfate is injected to oxidize organic carbon to carbon dioxide which is detected by IR. An OI Model 700 TOC Analyzer is used. Method 9060.

Total Organic Halogen (TOX) - Organic Halogen is adsorbed onto an activated carbon column and combusted in an oxygen furnace. The resulting hydrogen halide gases are collected in an acetic acid buffer. The halides are titrated microcolormetrically through the generation of Ag+ ions. A Mitsubishi Model TOX-10 TOX analyzer is used. Method 9020.

Inorganic Method Numbers

	ICP	GFAA	Flame AA	Hydride AA	Cold Vapor
Aluminum	6010		7020		
Antimony	6010		7040		
Arsenic		7060		7061	
Barium	6010		7080		
Beryllium	6010		7090		
Cadmium	6010		7130		
Calcium	6010		7140		
Chromium	6010		7190		
Cobalt	6010		7200		
Copper	6010		7210		
Iron	6010		7380		
Lead		7421	7420		
Magnesium	6010		7450		
Manganese	6010		7460		
Mercury					7470/7471
Molybdenum	6010		7480		
Nickel	6010		7520		
Potassium	6010		7610		
Selenium		7740		7741	
Silver	6010		7760		
Sodium	6010		7770		
Thallium	6010	7841	7840		
Tin	6010				
Vanadium	6010		7910		
Zinc	6010		7950		

The number of parameters analyzed and the methods used will be determined by the site specific requirements.

Appendix IX Volatile Compounds

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Chloromethane	10.	10.
Bromomethane	10.	10.
Vinyl chloride	10.	10.
Dichlorodifluoromethane	5.	5.
Chloroethane	10.	10.
Methyl iodide	5.	5.
Acrolein	100.	100.
Acrylonitrile	100.	100.
Acetonitrile	100.	100.
Methylene chloride	5.	5.
Acetone	100.	100.
Trichlorofluoromethane	5.	5.
Carbon disulfide	100.	100.
Propionitrile	100.	100.
1,1-Dichloroethene	5.	5.
Allyl chloride	5.	5.
1,1-Dichloroethane	5.	5.
trans-1,2-Dichloroethene	5.	5.
Chloroform	5.	5.
1,2-Dichloroethane	5.	5.
Methacrylonitrile	100.	100.
2-Butanone	100.	100.
Dibromomethane	5.	5.
1,1,1-Trichloroethane	5.	5.
1,4-Dioxane	100.	100.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Volatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Carbon tetrachloride	5.	5.
Isobutyl alcohol	100.	100.
Vinyl acetate	50.	50.
Bromodichloromethane	5.	5.
2-Chloro-1,3-butadiene	5.	5.
1,2-Dichloropropane	5.	5.
trans-1,3-Dichloropropene	5.	5.
Trichloroethene	5.	5.
Dibromochloromethane	5.	5.
1,1,2-Trichloroethane	5.	5.
1,2-Dibromoethane	5.	5.
Benzene	5.	5.
cis-1,3-Dichloropropene	5.	5.
Methyl methacrylate	5.	5.
1,1,1,2-Tetrachloroethane	5.	5.
Bromoform	5.	5.
trans-1,4-Dichloro-2-butene	100.	100.
1,2,3-Trichloropropane	5.	5.
2-Hexanone	50.	50.
4-Methyl-2-pentanone	50.	50.
Tetrachloroethene	5.	5.
1,1,2,2-Tetrachloroethane	5.	5.
Toluene	5.	5.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Volatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Ethyl methacrylate	5.	5.
Chlorobenzene	5.	5.
Pentachloroethane [1]	10.	10.
Ethylbenzene	5.	5.
1,2-Dibromo-3-chloropropane	100.	100.
Styrene	5.	5.
Xylenes (total)	5.	5.

[1] Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semiquantitative data only is reported.

For samples preserved with 1 + 1 HCl to pH <2, low recovery of acid labile compounds, such as 2-chloroethyl vinyl ether, is likely to occur.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Semivolatile Compounds

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Acenaphthene	10.	330.
Acenaphthylene	10.	330.
Acetophenone	10.	330.
2-Acetylaminofluorene	10.	330.
4-Aminobiphenyl	10.	330.
Aniline	10.	330.
Anthracene	10.	330.
Benzo (a) anthracene	10.	330.
Benzo (b) fluoranthene	10.	330.
Benzo (K) fluoranthene	10.	330.
Benzo (ghi) perylene	10.	330.
Benzo (a) pyrene	10.	330.
Benzyl alcohol	10.	330
bis (2-Chloroethoxy) methane	10.	330.
bis (2-Chloroethyl) ether	10.	330.
bis(2-Chloro-1-methylethyl)ether	10.	330.
bis (2-Ethylhexyl) phthalate	10.	330.
4-Bromophenyl phenyl ether	10.	330.
Butyl benzyl phthalate	10.	330.
4-Chloroaniline	10.	330.
Chlorobenzilate	10.	330.
4-Chloro-3-methylphenol	10.	330.
2-Chloronaphthalene	10.	330.
2-Chlorophenol	10.	330.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Semivolatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
4-Chlorophenyl phenyl ether	10.	330.
Chrysene	10.	330.
o-Cresol	10.	330.
m-Cresol and p-Cresol	10.	330.
Diallate	10.	330.
Dibenzofuran	10.	330.
Di-n-butyl phthalate	10.	330.
Dibenz (a,h) anthracene	10.	330.
1,2-Dichlorobenzene	10.	330.
1,3-Dichlorobenzene	10.	330.
1,4-Dichlorobenzene	10.	330.
3,3'-Dichlorobenzidine	20.	670.
2,4-Dichlorophenol	10.	330.
2,6-Dichlorophenol	10.	330.
Diethyl phthalate	10.	330.
Dimethoate [1]	10.	330.
p-(Dimethylamino)azobenzene	10.	330.
7,12-Dimethylbenz(a)anthracene [1]	10.	330.
3,3'-Dimethylbenzidine	10.	330.
2,4-Dimethylphenol	10.	330.
Dimethyl phthalate	10.	330.
m-Dinitrobenzene	10.	330.
2-Methyl-4,6-dinitrophenol	25.	830.

[1] Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semiquantitative data only is reported.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Semivolatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
2,4-Dinitrophenol	25.	830.
2,4-Dinitrotoluene	10.	330.
2,6-Dinitrotoluene	10.	330.
Di-n-octyl phthalate	10.	330.
Diphenylamine	10.	330.
Ethyl methanesulfonate	10.	330.
Fluoranthene	10.	330.
Fluorene	10.	330.
Hexachlorobenzene	10.	330.
Hexachlorobutadiene	10.	330.
Hexachlorocyclopentadiene	10.	330.
Hexachloroethane	10.	330.
Hexachloropropene [1]	10.	330.
Indeno (1,2,3-cd) pyrene	10.	330.
Isodrin	10.	330.
Isophorone	10.	330.
Isosafrole	10.	330.
3-Methylchloranthrene	10.	330.
Methyl methanesulfonate	10.	330.
2-Methylnaphthalene	10.	330.
Naphthalene	10.	330.
1,4-Naphthoquinone [1]	10.	330.

[1] Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semiquantitative data only is reported.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Semivolatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
1-Naphthylamine	10.	330.
2-Naphthylamine	20.	670.
2-Nitroaniline	50.	1,700.
3-Nitroaniline	50.	1,700.
4-Nitroaniline	50.	1,700.
Nitrobenzene	10.	330.
2-Nitrophenol	10.	330.
4-Nitrophenol	50.	1,700.
4-Nitroquinoline 1-oxide [1]	10.	330.
N-Nitrosodi-n-butylamine	10.	330.
N-Nitrosodiethylamine	10.	330.
N-Nitrosodimethylamine	10.	330.
N-Nitrosodiphenylamine	10.	330.
N-Nitrosodi-n-propylamine	10.	330.
N-Nitrosomethylethylamine	10.	330.
N-Nitrosomorpholine	20.	670.
N-Nitrosopiperidine	10.	330.
N-Nitrosopyrrolidine	10.	330.
5-Nitro-o-toluidine	10.	330.
Pentachlorobenzene	10.	330.
Pentachloronitrobenzene	10.	330.
Pentachlorophenol	50.	1,700.

[1] Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semiquantitative data only is reported.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Semivolatile Compounds (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Phenacetin	10.	330.
Phenanthrene	10.	330.
Phenol	10.	330.
p-Phenylenediamine [1]	10.	330.
2-Picoline	10.	330.
Pronamide	10.	330.
Pyrene	10.	330.
Pyridine	10.	330.
Safrole	10.	330.
1,2,4,5-Tetrachlorobenzene	10.	330.
2,3,4,6-Tetrachlorophenol	10.	330.
Tetraethyl dithiopyrophosphate	10.	330.
o-Toluidine	10.	330.
1,2,4-Trichlorobenzene	10.	330.
2,4,5-Trichlorophenol	25.	830.
2,4,6-Trichlorophenol	10.	330.
0,0,0-Triethylphosphorothioate	10.	330.
sym-Trinitrobenzene	20.	670.

[1] Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semiquantitative data only is reported.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Herbicide Compounds

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (mg/kg)
2,4-D	1.	1.
Dinoseb	1.	1.
2,4,5-TP	1.	1.
2,4,5-T	1.	1.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Organophosphates

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (mg/kg)
Disulfoton	0.05	0.05
Methyl parathion	0.02	0.02
Ethyl parathion	0.02	0.02
Famphur	2.	2.
Phorate	0.1	0.1

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Organochlorines

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (mg/kg)
Aldrin	0.01	0.01
alpha-BHC	0.01	0.01
beta-BHC	0.01	0.01
delta-BHC	0.01	0.01
gamma-BHC (Lindane)	0.01	0.01
Chlordane	0.05	0.05
4,4-DDT	0.01	0.01
4,4-DDE	0.01	0.01
4,4-DDD	0.01	0.01
Dieldrin	0.01	0.01
Endosulfan I	0.01	0.01
Endosulfan II	0.01	0.01
Endosulfan sulfate	0.03	0.03
Endrin	0.01	0.01
Endrin aldehyde	0.1	0.1
Heptachlor	0.01	0.01
Heptachlor epoxide	0.01	0.01
Kepone	0.05	0.05
Methoxychlor	0.05	0.05
PCB-1016	1.	0.2
PCB-1221	1.	0.2
PCB-1232	1.	0.2
PCB-1242	1.	0.2

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Appendix IX Organochlorines (continued)

Compounds	Limits of Quantitation* Waters (ug/l)	Soils** (mg/kg)
PCB-1248	1.	0.2
PCB-1254	1.	0.2
PCB-1260	1.	0.2
Toxaphene	2.	0.1

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Inorganic Appendix IX Analyte List

Analyte	Limits of Quantitation* Waters (mg/l)	Soils** (mg/kg)
Antimony	0.05	5
Arsenic (GFAA) [1,2]	0.01	1
Barium	0.2	20
Beryllium	0.005	0.5
Cadmium	0.005	0.5
Chromium	0.05	5
Cobalt	0.05	5
Copper	0.02	2
Lead (GFAA)	0.005	0.5
Mercury	0.0005	0.1
Selenium (GFAA) [1,2]	0.005	0.5
Silver	0.01	1
Thallium	0.1	10
Tin	0.5	100
Vanadium	0.05	5
Zinc	0.02	2
Cyanide	0.005	0.1
Sulfide	0.1	5.0
[1] Arsenic (hydride generation)	0.01	1
Selenium (hydride generation)	0.005	0.5
[2] Arsenic (ICP-EP Tox. & TCLP Leachates only)	0.05	--
Selenium (ICP-EP Tox. & TCLP Leachates only)	0.05	--

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Volatile Priority Pollutant Compound List (GC/MS)

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Chloromethane	10.	10.
Bromomethane	10.	10.
Vinyl chloride	10.	10.
Chloroethane	10.	10.
Acrolein	100.	100.
Acrylonitrile	100.	100.
Methylene chloride	5.	5.
Trichlorofluoromethane	5.	5.
1,1-Dichloroethene	5.	5.
1,1-Dichloroethane	5.	5.
trans-1,2-Dichloroethene	5.	5.
Chloroform	5.	5.
1,2-Dichloroethane	5.	5.
1,1,1-Trichloroethane	5.	5.
Carbon tetrachloride	5.	5.
Bromodichloromethane	5.	5.
1,1,2,2-Tetrachloroethane	5.	5.
1,2-Dichloropropane	5.	5.
trans-1,3-Dichloropropene	5.	5.
Trichloroethene	5.	5.
Dibromochloromethane	5.	5.
1,1,2-Trichloroethane	5.	5.
Benzene	5.	5.
cis-1,3-Dichloropropene	5.	5.
2-Chloroethylvinyl ether	10.	10.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Volatile Priority Pollutant Compound List (GC/MS) (continued)

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Bromoform	5.	5.
Tetrachloroethene	5.	5.
Toluene	5.	5.
Chlorobenzene	5.	5.
Ethylbenzene	5.	5.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Semivolatile Priority Pollutant Compound List

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
2-Chlorophenol	10	330
Phenol	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
2,4-Dichlorophenol	10	330
4-Chloro-3-methylphenol	10	330
2,4,6-Trichlorophenol	10	330
2,4-Dinitrophenol	25	830
4-Nitrophenol	25	830
2-Methyl-4,6-dinitrophenol	25	830
Pentachlorophenol	50	830

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Semivolatile Priority Pollutant Compound List

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
N-nitrosodimethylamine	10.	330.
bis (2-Chloroethyl) ether	10.	330.
1,3-Dichlorobenzene	10.	330.
1,4-Dichlorobenzene	10.	330.
1,2-Dichlorobenzene	10.	330.
bis (2-Chloroisopropyl) ether	10.	330.
Hexachloroethane	10.	330.
N-nitrosodi-n-propylamine	10.	330.
Nitrobenzene	10.	330.
Isophorone	10.	330.
bis (2-Chloroethoxy) methane	10.	330.
1,2,4-trichlorobenzene	10.	330.
Naphthalene	10.	330.
Hexachlorobutadiene	10.	330.
Hexachlorocyclopentadiene	10.	330.
2-Chloronaphthalene	10.	330.
Acenaphthylene	10.	330.
Dimethyl phthalate	10.	330.
2,6-Dinitrotoluene	10.	330.
Acenaphthene	10.	330.
2,4-Dinitrotoluene	10.	330.
Fluorene	10.	330.
4-Chlorophenyl phenyl ether	10.	330.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Semivolatile Priority Pollutant Compound List (continued)

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Diethyl phthalate	10.	330.
1,2-Diphenylhydrazine	10.	330.
N-nitrosodiphenylamine	10.	330.
4-Bromophenyl phenyl ether	10.	330.
Hexachlorobenzene	10.	330.
Phenanthrene	10.	330.
Anthracene	10.	330.
Di-n-butyl phthalate	10.	330.
Fluoranthene	10.	330.
Pyrene	10.	330.
Benzidine	25.	830.
Butyl benzyl phthalate	10.	330.
Benzo (a) anthracene	10.	330.
Chrysene	10.	330.
3,3'-Dichlorobenzidine	25.	830.
bis (2-Ethylhexyl) phthalate	10.	330.
Di-n-octyl phthalate	10.	330.
Benzo (b) fluoranthene	10.	330.
Benzo (K) fluoranthene	10.	330.
Benzo (a) pyrene	10.	330.
Ideno (1,2,3-cd) pyrene	10.	330.
Dibenz (a,h) anthracene	10.	330.
Benzo (ghi) perylene	10.	330.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Pesticide/PCB Priority Pollutant Compound List

Compound	Limits of Quantitation* Waters (ug/l)	Soils** (mg/kg)
alpha-BHC	0.01	0.01
beta-BHC	0.01	0.01
gamma-BHC (Lindane)	0.01	0.01
delta-BHC	0.01	0.01
Heptachlor	0.01	0.01
Aldrin	0.01	0.01
Heptachlor epoxide	0.01	0.01
4,4-DDE	0.01	0.01
4,4-DDD	0.01	0.01
4,4-DDT	0.01	0.01
Dieldrin	0.01	0.01
Endrin	0.01	0.01
Chlordane	0.05	0.05
Toxaphene	1.	0.1
Endosulfan I	0.01	0.01
Endosulfan II	0.01	0.01
Endosulfan sulfate	0.03	0.03
Endrin aldehyde	0.1	0.1
PCB-1016	1.	0.2
PCB-1221	1.	0.2

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Inorganic Priority Pollutants List (PPL)

Analyte	Limits of Quantitation* Waters (mg/l)	Soils** (mg/kg)
Antimony	0.05	5
Arsenic [3]	0.01	1
Beryllium	0.005	0.5
Cadmium	0.005	0.5
Chromium	0.05	5
Copper	0.02	2
Lead [1]	0.005	0.5
Mercury [2]	0.0005	0.1
Nickel	0.04	4
Selenium [3]	0.005	0.5
Silver	0.01	1
Thallium	0.1	10
Zinc	0.02	2
Cyanide	0.005	0.1

[1] Graphite Furnace
[2] Cold Vapor
[3] Hydride Generation

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Volatiles by GC
Volatile Organics List

Analyte	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
Chloromethane	5	5
Bromomethane	5	5
Dichlorodifluoromethane	2	2
Vinyl chloride	1	1
Chloroethane	1	1
Methylene chloride	1	1
Trichlorofluoromethane	1	1
1,1-Dichloroethene	1	1
1,1-Dichloroethane	1	1
trans-1,2-Dichloroethene	1	1
Chloroform	1	1
1,2-Dichloroethane	1	1
1,1,1-Trichloroethane	1	1
Carbon tetrachloride	1	1
Dichlorobromomethane	1	1
1,2-Dichloropropane	1	1
trans-1,3-Dichloropropene	1	1
Trichloroethene	1	1
Dibromochloromethane	1	1
1,1,2-Trichloroethane	1	1
cis-1,3-Dichloropropene	1	1
2-Chloroethylvinyl ether	10	10
Bromoform	2	2

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Volatiles by GC
Volatile Organics List
(continued)

Analyte	Limits of Quantitation* Waters (ug/l)	Soils** (ug/kg)
1,1,2,2-Tetrachloroethane	2	2
Tetrachloroethene	1	1
Chlorobenzene	1	1
Benzene	1	1
Toluene	1	1
Ethylbenzene	1	1
o-Dichlorobenzene	1	1
m-Dichlorobenzene	1	1
p-Dichlorobenzene	1	1

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

Parameter	Limits of Quantitation* Waters (mg/l)	Soils** (mg/kg)
Phenols	0.01	0.2
TOC	0.5	50
TOX	5	100

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis will be higher.

10. Data Reduction, Validation and Reporting

Raw analytical data generated in the laboratories is collected on printouts from the instruments and associated data system or manually in bound notebooks. Analysts review data as it is generated to determine that the instruments are performing within specifications. This review includes calibration checks, surrogate recoveries, blank checks, retention time reproducibility, and other QC checks described in Section No. 11. If any problems are noted during the analytical run, corrective action is taken and documented.

Each analytical run is reviewed by a chemist for completeness prior to interpretation and data reduction. The following calculations are used to reduce raw data to reportable results.

GC/MS calculation used by the data system to determine concentration in extract for semivolatiles or in the sample itself for volatiles:

$$Q = (Ax)\ (Is)\ /\ (AIs)\ (RRF)\ (Vi)$$

Where Ax = peak area
AIs = internal standard peak area
Is = amount of internal standard injected (ng)
RRF = relative response factor
Vi = volume of extract injected (ul) or volume sample purged (ml)

The extract concentration is further reduced by considering the initial sample weight or volume and the final extract volume:

Concentration = (Q) (D) (F) (1000) / (I)

Where Q = concentration determined by the data system (mg/l)
D = dilution factor if needed
F = final extract volume (ml)
I = initial sample weight (grams) or volume (ml)

Results are reported in ug/l for water samples and ug/kg for solid samples. Soil samples are reported on a dry weight basis as well as an as received basis. The results are reported on LLI Analysis Report Forms shown in Appendix A.

For Volatiles by GC, a five-point external calibration procedure is used. The resulting point-to-point calibration curve is used by the data system to calculate analyte concentrations. The equations that the data system uses for calculating analyte concentrations are shown below.

A. When analyte peak height, Hx, falls between the peak heights of two calibration points, Hn and Hn+1, the analyte concentration is calculated as follows:

Concentration = {[(Hx -Hn) / S] + An} x (DF)

S = (Hn+1 - Hn) / (An+1 - An)

Where Hx = analyte peak height
Hn = analyte peak height in the nth calibration level
Hn+1 = analyte peak height in the n+1 calibration level
S = slope between the n and n+1 calibration points for the analyte
An = the concentration of the analyte in the nth calibration level
An+1 = the concentration of the analyte in the n+1 calibration level
DF = dilution factor

B. When the analyte peak height is below the peak height for the lowest calibration standard, the analyte concentration is calculated as follows:

Concentration = [(Hx) x (A1 / H1)] x (DF)

Where Hx = analyte peak height
A1 = concentration of analyte in the first calibration level
H1 = analyte peak height in first calibration level
DF = dilution factor

Results are reported in ug/l for water samples and in ug/kg for solid samples. Soil samples are reported on an as received and on a dry weight basis.

The results for the Pesticides/PCB's analysis are calculated using the following equation:

Concentration = (Ax) (Is) (Vt) (DF) / (As) (Vi) (Vs)

Where Ax = peak height for the parameter being measured
Is = amount of standard injected (ng)
Vt = volume of total extract (ul)
DF = dilution factor, if needed
As = peak height for the external standard
Vi = volume of extract injected (ul)
Vs = volume (ml) or weight (gm) of sample extracted

Results are reported as ug/l for water samples and mg/kg for solid samples. Soil samples are reported on a dry weight basis. Results are reported on LLI Analysis Report Forms shown in Appendix A.

The results for inorganic analyses are calculated using the following equation:

Concentration = (A) (D) (E) / (F)

Where A = the concentration determined by AA or ICP using calibration data programmed into the instrument (mg/l)
D = dilution factor if needed
E = final extract volume (ml)
F = initial sample volume (ml) or weight (gm)

Results are usually reported in mg/l for water samples and in mg/kg for solid samples. Alternate units are available upon request. Soil samples are reported on a dry weight basis. The results are reported on LLI Analysis Report Forms shown in Appendix A.

The principle criteria used to validate data will be the acceptance criteria described in Section No. 11. Following interpretation and data reduction by an analyst, data is transferred to the laboratory sample management system either by direct data upload from the analytical data system or manually. The data is reviewed by the Group Leader or another analyst and verified on the sample management system. The person performing the verification step reviews all data including quality control information prior to verifying the data. If data package deliverables have been requested, the laboratory will complete the appropriate forms (see Appendix A) summarizing the quality control information, and transfer copies of all raw data (instrument print-outs, spectra, chromatograms, laboratory notebooks, etc.) to the Data Packages Group. This group will combine the information from the various analytical groups and the analytical reports from the laboratory sample management system into one package. This package is reviewed by the Quality Assurance Department for conformance with SOP's and to ensure that all QC goals have been met. Any analytical problems are discussed in the case narrative, which is also included with the data package deliverables.

The validation of the data by the Quality Assurance Department includes spot checking raw data versus the final report, checking that all pertinent raw data is included and does refer to the samples analyzed, review of all QC results for conformance with the method, and review of the case narrative for description of any unusual occurrences during analysis. This validation is performed using techniques similar to those used by the Sample Management Office for the USEPA's Contract Laboratory Program. The validation performed by the laboratory does not address useability of the data, which usually requires some knowledge of the site. The laboratory will make every attempt to meet the requirements of this QAPP, thus reducing the need to assess useability of the data.

The laboratory sample management system is programmed to accept and track the results of quality control samples including blanks, surrogates, recoveries, duplicates, controls, and reference materials. The computer is programmed with the acceptance criteria for each type of QC sample and will display an out-of-spec message if the data is not within specifications. All data outside of specifications appears on a report to the Quality Assurance Department on the next working day. These are reviewed by the Quality Assurance Department for severity of the problems and trends in the data. The reports are then sent to the analytical groups for the purpose of documenting the corrective action taken. The sample management system also produces control charts and has searching capabilities to aid in data review. The flow of data from the time the samples enter the laboratory until the data is reported are summarized in Table 10-1. Any data recorded manually will be collected in bound notebooks. All entries will be in ink, with no erasures

or white-out being permitted. Any changes in data will be made using a single line to avoid obliteration of the original entry and will be dated and signed. Any data resulting from instrument printouts will be dated and will contain the signature and/or identification of the analyst responsible for its generation. After copies of the data are incorporated into the data package deliverables, the originals will be stored in locked archives at the laboratory for a period of ten years.

Table 10-1

SAMPLE AND DATA ROUTING AT LANCASTER LABORATORIES, INC.

Action	Personnel Involved
Sample received at LLI	Sample Administration
Sample is entered onto sample management system (lab ID number assigned, analyses scheduled, chain-of-custody started, storage location assigned)	Sample Administration
Sample stored in assigned location (refrigerator, freezer, etc.)	Sample Administration
Acknowledgement sent to client	Sample Administration
Removed from storage for analysis; necessary aliquot taken and sample returned to storage	Technical Personnel
Analysis is performed according to selected analytical method; raw data recorded in notebook and transferred to computer by chemist or technician*	Technical Personnel
Computer performs calculations as programmed according to methods	Data Processing
Chemist or supervisor verifies raw data	Technical Personnel
Data package deliverables are assembled	Data Package Group
Data packages are reviewed prior to mailing	Quality Assurance Dept. Laboratory Management

*Analyses requiring the chemist's interpretation may involve manual data reduction prior to entry onto the computer.

11. Internal Quality Control Checks

The particular types and frequencies of quality control checks analyzed with each sample are defined in USEPA SW846 3rd Edition, 1986. The quality control checks routinely performed during sample analysis include surrogates, matrix spikes, duplicates, blanks, internal standards, and laboratory control samples. In addition to these checks, some inorganic analyses employ serial dilutions and interference check samples.

Surrogates (used for organic analysis only) - Each sample, matrix spike, matrix spike duplicate, and blank are spiked with surrogate compounds prior to purging and extraction in order to monitor preparation and analysis. Surrogates are used to evaluate analytical efficiency by measuring recovery.

Matrix Spikes - A matrix (soil or water) is spiked with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

Duplicates (matrix spike duplicate - organics and inorganic hydride generation; duplicate - inorganics) - A second aliquot of a matrix/sample is analyzed at the same time as the original sample in order to determine the precision of the method. Recovery of the original compared to the duplicate is expressed as relative percent differences (RPD).

Blanks (Method, Preparation) - Blanks are an analytical control consisting of a volume of deionized, distilled laboratory water for water samples, or a purified solid matrix for soil/sediment samples. (Metals use a digested reagent blank with soils.) They are treated with the same reagents, internal standards, and surrogate standards and carried through the entire analytical procedure. The blank is used to define the level of laboratory background contamination.

Internal Standards (used for GC/MS analysis) - Internal standards are compounds added to every standard, blank matrix, spike, matrix spike duplicate, and sample at a know concentration, prior to analysis. Comparison of the peak areas of the internal standards are used for internal standard quantitation as well as to determine when changes in the instrument response will adversely affect quantification of target compounds.

Serial Dilutions (used for inorganics ICP only) - If the analyte concentration is sufficiently high ($\geq$50 x IDL) an analysis of a 5 fold dilution must agree within 10% of the original determination. If the dilution analysis is not within 10%, a chemical or physical interference effect should be suspected.

Interference Check Sample (ICP) - To verify interelement and background correction factors a solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analysis run or a minimum of twice per 8 hours.

Laboratory Control Samples - Aqueous and solid control samples of known composition are analyzed using the same sample preparation, reagents, and analytical methods employed for the sample. For inorganics LCS recovery must fall within established control limits (± 20%). For organics, an LCS is run when MS/MSD recovery falls outside established limits. The LCS recovery must fall within acceptance limits based on statistical evaluation of past lab data.

The results of all quality control samples are entered into the computer along with sample results. The computer is programmed to compare the individual values with the acceptance limits. If the results are not within the acceptance criteria, appropriate corrective action is taken where necessary. Management is kept informed by daily reports of QC outliers generated by the computerized system. Monthly reports on results of all QC analyses showing mean and standard deviation will indicate trends or method bias. Control Charts are plotted via computer and may be accessed at any time by all analysts.

The charts that follow show the types and frequency of QC performed, along with the acceptance limits.

QC Charts

Organics

Type	Acceptance Limits (%) Water	Soil	Frequency
Surrogates:			
Volatiles (GC/MS)			
Toluene-d8	88-110	81-117	Each sample, MS,
Bromofluorobenzene	86-115	74-121	MSD, and Blank
1,2 Dichloroethane-d4	76-114	70-121	
Semivolatiles			
Nitrobenzene-d5	35-114	23-120	Each sample, MS,
2-Fluorobiphenyl	43-116	30-115	MSD, and Blank
Terphenyl-d14	33-141	18-137	
Phenol-d6	10- 94	24-113	
2-Fluorophenol	21-100	25-121	
2,4,6-Tribromophenol	10-123	19-122	
Volatiles (GC)			
Bromochloromethane	70-125	70-125	Each sample, MS,
Fluorochlorobenzene	70-125	70-125	MSD, and Blank
Trifluorotoluene	70-125	70-125	
n-Propylbenzene	70-125	70-125	
Organochlorine Pesticides			
Dibutylchlorendate	47-138	52-142	Each sample, MS, MSD, and Blank
Herbicides			
2,4-DB	59-95	Not estab.	Each sample, MS, MSD, and Blank
Organophosphate Pesticides			
Chorpyrifos	80-115	80-115	Each sample, MS, MSD, and Blank
Matrix Spikes:			
Volatiles (GC/MS)			
Spike all compounds	See Table 6 (p. 13)		Each group (≤20) of samples per matrix/level
Semivolatiles			
Spike all compounds	See Table 6 (p.14-15)		Each group (≤20) of samples per matrix/level

Organics
(continued)

ype	Acceptance Limits (%) Water	Soil	Frequency
Matrix Spikes:			
olatiles (GC)			
Chloromethane	65-130	D-193	Each group (≤20)
Bromomethane	65-130	D-144	of samples per
Vinyl chloride	65-130	28-163	matrix/level
Chloroethane	65-130	46-137	
Methylene chloride	75-125	25-163	
1,1-Dichloroethene	61-145	28-167	
1,1-Dichloroethane	75-125	47-132	
trans-1,2-Dichloroethene	75-125	38-155	
Chloroform	75-125	49-133	
1,2-Dichloroethane	75-125	51-147	
1,1,1-Trichloroethane	75-125	41-138	
Carbon Tetrachloride	75-125	43-143	
Bromodichloromethane	75-125	42-172	
1,2-Dichloropropane	75-125	44-156	
Trichloroethene	71-120	35-146	
Chlorodibromomethane	75-125	24-191	
Bromoform	75-125	13-159	
Tetrachloroethene	75-125	26-162	
Chlorobenzene	75-130	38-150	
Benzene	76-127	39-150	
Toluene	76-125	46-148	
Ethylbenzene	75-125	40-148	
o-Dichlorobenzene	75-125	37-154	
m-Dichlorobenzene	75-125	50-141	
p-Dichlorobenzene	75-125	42-143	
Benzene	76-127	39-150	
Toluene	76-125	46-148	
Ethylbenzene	75-125	32-160	
o-Xylene	75-125	50-150	
m-Xylene	75-125	50-150	
p-Xylene	75-125	50-150	
Organochlorine Pesticides			
gamma-BHC (Lindane)	66-103	74-114	Each group (≤20)
Heptachlor	60-104	52-120	of samples per
Aldrin	40-107	73-128	matrix/level
Dieldrin	75-109	71-122	
Endrin	72-121	61-135	
4,4'-DDT	79-119	56-144	

Organics
(continued)

Type	Acceptance Limits (%) Water	Soil	Frequency
Matrix Spikes:			
Herbicides			
2,4-D	71-113	Not	Each group (≤20)
2,4,5-TP	69-107	estab.	of samples per
2,4,5-T	72-107		matrix/level
Dinoseb	40-98		
Organophosphate Pesticides			
Phorate	36-89		Each group (≤20)
Disulfoton	55-109		of samples per
Famphur	Not Established		matrix/level
Methyl Parathion	80-112		
Ethyl Parathion	80-112		
Laboratory Control Sample:			
Volatiles & Semivolatiles	See Table 6 (p.13-15)		Each group (≤20) When MS/MSD falls outside established limits.
Check Standard (GC Volatiles)	%D ≤15%		Each group (≤20) When MS/MSD falls outside established limits.
Pesticides	95% Confidence Interval		Each group (≤20) When MS/MSD falls outside established limits.
Matrix Spike Duplicates (RPD):			
Volatiles			
Spike all compounds	30		Each group (≤20) of samples per matrix/level
Semivolatiles			
Spike all compounds	Not Established		Each group (≤20) of samples per matrix/level

Organics
(continued)

ype	Acceptance Limits (%) Water	Soil	Frequency
Matrix Spike Duplicates (RPD):			
olatiles (GC)			
Chloromethane	20	22	Each group (≤20)
Bromomethane	20	22	of samples per
Vinyl chloride	20	22	matrix/level
Chloroethane	20	22	
Methylene chloride	15	20	
1,1-Dichloroethene	14	22	
1,1-Dichloroethane	15	22	
trans-1,2-Dichloroethene	15	20	
Chloroform	15	20	
1,2-Dichloroethane	15	20	
1,1,1-Trichloroethane	15	22	
Carbon Tetrachloride	15	22	
Bromodichloromethane	15	22	
1,2-Dichloropropane	15	22	
Trichloroethene	14	24	
Chlorodibromomethane	15	22	
Bromoform	15	22	
Tetrachloroethene	15	20	
Chlorobenzene	13	21	
Benzene	11	21	
Toluene	13	21	
Ethylbenzene	15	22	
o-Dichlorobenzene	15	21	
m-Dichlorobenzene	15	21	
p-Dichlorobenzene	15	21	
Benzene	14	21	
Toluene	14	21	
Ethylbenzene	14	20	
o-Xylene	14	20	
m-Xylene	14	20	
p-Xylene	14	20	
Organochlorine Pesticides			
gamma-BHC (Lindane)	15	50	Each group (≤20)
Heptachlor	20	31	of samples per
Aldrin	22	43	matrix/level
Dieldrin	18	38	
Endrin	21	45	
4,4'-DDT	27	50	

Organics
(continued)

Type	Acceptance Limits (%) Water	Soil	Frequency
Herbicides			
2,4-D	25	Not estab.	Each group (≤20) of samples per matrix/level
2,4,5-TP	25		
2,4,5-T	25		
Dinoseb	25		
Organophosphate Pesticides			
Phorate	30		Each group (≤20) of samples per matrix/level
Disulfoton	30		
Famphur	Not established		
Methyl Parathion	30		
Ethyl Parathion	30		
Blanks:			
Volatiles (GC/MS)	≤ (5x) LOQ For: methylene chloride, acetone, toluene, 2-butanone		Once for each 12-hr. time period
	≤ LOQ For all other TCL compounds		
Semivolatiles	≤ (5x) LOQ for the phthalate esters		Once per case or group (≤ 20) of samples, each matrix, level, instrument
	≤ LOQ for all other compounds		
Volatiles (GC)	< LOQ for all compounds		Every 8-10 hours
Pesticides	≤ LOQ for all compound		Once per case or group (≤20) of samples each matrix, level, instrument

Organics
(continued)

ype	Acceptance Limits (%) Water	Soil	Frequency
Internal Standards:			
olatiles			
Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d5	-50% to +100% of internal standard area of 12 Hr. STD RT change ≤30 seconds		Each sample, MS, MSD, and Blank
emivolatiles			
1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	-50% to +100% of internal standard area of 12 Hr. STD RT change ≤30 seconds		Each sample, MS, MSD, and Blank

QC Charts

Inorganics

Type	Acceptance Limits	Frequency
Spikes	75 - 125% Except where sample conc. exceeds spike conc. by ≥4 x	Each group of samples of similar matrix/level (≤20) each method Exception: As/Se by Hydride Generation (≤10)
Duplicates (RPD)	± 20% RPD for sample values ≥5 x LOQ	Each group of samples of similar matrix/level (≤20) each method
Blanks Initial Calibration (ICB) Continuing Calibration (CCB)	≤LOQ	Each wavelength immediately after calibration verification at 10% frequency or every 2 hrs. (beginning and end of run min.
Preparation Blank	≤LOQ >LOQ then lowest conc. in sample must be 10x blk. conc.	Each SDG or batch (≤20 samples) Exception: As/Se by Hydride Generation ≤10 samples
Serial Dilutions	Within ± 10% of the original determination	Each group of samples (≤20) of similar matrix/leve
Interference Check Sample	± 20% of the true value for the analytes	Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2X per 8 hour
Laboratory Control Sample	Aqueous 80 - 120% (except Ag and Sb) Solids 80 - 120%	Each SDG or batch (≤20 samples), each method

Inorganics
(continued)

Type	Acceptance Limits	Frequency
Matrix Spike Duplicate (RPD)	± 20 % RPD	Each group of samples of similar matrix/level (≤10) for As/Se by Hydride Generation

Quality Control Acceptance Criteria

Parameter	Blank	Spike Recovery	Duplicate RPD (%)	Lab Control Recovery (%)
Phenols	<LOQ	75-125	≤20	80-120
TOC	<LOQ	75-125	≤20	80-120
TOX	<LOQ	75-125	≤20	80-120
Sulfide	<LOQ	75-125	≤20	80-120

Unless marked NA (not applicable), each type of QC is performed at least once with each batch of samples.

Maximum batch size is 20 field samples.

TABLE 6.
CALIBRATION AND QC ACCEPTANCE CRITERIA[a]

Parameter	Range for Q (ug/L)	Limit for s (ug/L)	Range for x (ug/L)	Range p,Ps (%)
Benzene	12.8-27.2	6.9	15.2-26.0	37-151
Bromodichloromethane	13.1-26.9	6.4	10.1-28.0	35-155
Bromoform	14.2-25.8	5.4	11.4-31.1	45-169
Bromomethane	2.8-37.2	17.9	D-41.2	D-242
Carbon tetrachloride	14.6-25.4	5.2	17.2-23.5	70-140
Chlorobenzene	13.2-26.8	6.3	16.4-27.4	37-160
2-Chloroethylvinyl ether	D-44.8	25.9	D-50.4	D-305
Chloroform	13.5-26.5	6.1	13.7-24.2	51-138
Chloromethane	D-40.8	19.8	D-45.9	D-273
Dibromochloromethane	13.5-26.5	6.1	13.8-26.6	53-149
1,2-Dichlorobenzene	12.6-27.4	7.1	11.8-34.7	18-190
1,3-Dichlorobenzene	14.6-25.4	5.5	17.0-28.8	59-156
1,4-Dichlorobenzene	12.6-27.4	7.1	11.8-34.7	18-190
1,1-Dichloroethane	14.5-25.5	5.1	14.2-28.4	59-155
1,2-Dichloroethane	13.6-26.4	6.0	14.3-27.4	49-155
1,1-Dichloroethene	10.1-29.9	9.1	3.7-42.3	D-234
trans-1,2-Dichloroethene	13.9-26.1	5.7	13.6-28.4	54-156
1,2-Dichloropropane	6.8-33.2	13.8	3.8-36.2	D-210
cis-1,3-Dichloropropene	4.8-35.2	15.8	1.0-39.0	D-227
trans-1,3-Dichloropropene	10.0-30.0	10.4	7.6-32.4	17-183
Ethyl benzene	11.8-28.2	7.5	17.4-26.7	37-162
Methylene chloride	12.1-27.9	7.4	D-41.0	D-221
1,1,2,2-Tetrachloroethane	12.1-27.9	7.4	13.5-27.2	46-157
Tetrachloroethene	14.7-25.3	5.0	17.0-26.6	64-148
Toluene	14.9-25.1	4.8	16.6-26.7	47-150
1,1,1-Trichloroethane	15.0-25.0	4.6	13.7-30.1	52-162
1,1,2-Trichloroethane	14.2-25.8	5.5	14.3-27.1	52-150
Trichloroethene	13.3-26.7	6.6	18.5-27.6	71-157
Trichlorofluoromethane	9.6-30.4	10.0	8.9-31.5	17-181
Vinyl chloride	0.8-39.2	20.0	D-43.5	D-251

Q = Concentration measured in QC check sample, in ug/L.
s = Standard deviation of four recovery measurements, in ug/L.
x = Average recovery for four recovery measurements, in ug/L.
p, P_s = Percent recovery measured.
D = Detected; result must be greater than zero.

[a]Criteria from 40 CFR Part 136 for Method 624 and were calculated assuming a QC check sample concentration of 20 ug/L. These criteria are based directly upon the method performance data in Table 7. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 7.

TABLE 6.
QC ACCEPTANCE CRITERIA[a]

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for x (ug/L)	Range p, p_s (%)
Acenaphthene	100	27.6	60.1-132.3	47-145
Acenaphthylene	100	40.2	53.5-126.0	33-145
Aldrin	100	39.0	7.2-152.2	D-166
Anthracene	100	32.0	43.4-118.0	27.133
Benz(a)anthracene	100	27.6	41.8-133.0	33-143
Benzo(b)fluoranthene	100	38.8	42.0-140.4	24-159
Benzo(k)fluoranthene	100	32.3	25.2-145.7	11-162
Benzo(a)pyrene	100	39.0	31.7-148.0	17-163
Benzo(ghi)perylene	100	58.9	D-195.0	D-219
Benzyl butyl phthalate	100	23.4	D-139.9	D-152
β-BHC	100	31.5	41.5-130.6	24-149
δ-BHC	100	21.6	D-100.0	D-110
Bis(2-chloroethyl)ether	100	55.0	42.9-126.0	12-158
Bis(2-chloroethoxy)methane	100	34.5	49.2-164.7	33-184
Bis(2-chloroisopropyl)ether	100	46.3	62.8-138.6	36-166
Bis(2-ethylhexyl)phthalate	100	41.1	28.9-136.8	8-158
4-Bromophenyl phenyl ether	100	23.0	64.9-114.4	53-127
2-Chloronaphthalene	100	13.0	64.5-113.5	60-118
4-Chlorophenyl phenyl ether	100	33.4	38.4-144.7	25-158
Chrysene	100	48.3	44.1-139.9	17-168
4,4'-DDD	100	31.0	D-134.5	D-145
4,4'-DDE	100	32.0	19.2-119.7	4-136
4,4'-DDT	100	61.6	D-170.6	D-203
Dibenzo(a,h)anthracene	100	70.0	D-199.7	D-227
Di-n-butyl phthalate	100	16.7	8.4-111.0	1-118
1,2-Dichlorobenzene	100	30.9	48.6-112.0	32-129
1,3-Dichlorobenzene	100	41.7	16.7-153.9	D-172
1,4-Dichlorobenzene	100	32.1	37.3-105.7	20-124
3,3'-Dichlorobenzidine	100	71.4	8.2-212.5	D-262
Dieldrin	100	30.7	44.3-119.3	29-136
Diethyl phthalate	100	26.5	D-100.0	D-114
Dimethyl phthalate	100	23.2	D-100.0	D-112
2,4-Dinitrotoluene	100	21.8	47.5-126.9	39-139
2,6-Dinitrotoluene	100	29.6	68.1-136.7	50-158
Di-n-octylphthalate	100	31.4	18.6-131.8	4-146
Endosulfan sulfate	100	16.7	D-103.5	D-107
Endrin aldehyde	100	32.5	D-188.8	D-209
Fluoranthene	100	32.8	42.9-121.3	26-137
Fluorene	100	20.7	71.6-108.4	59-121
Heptachlor	100	37.2	D-172.2	D-192
Heptachlor epoxide	100	54.7	70.9-109.4	26.155

TABLE 6.
(Continued)

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for x (ug/L)	Range p, p_s (%)
Hexachlorobenzene	100	24.9	7.8-141.5	D-152
Hexachlorobutadiene	100	26.3	37.8-102.2	24-116
Hexachloroethane	100	24.5	55.2-100.0	40-113
Indeno(1,2,3-cd)pyrene	100	44.6	D-150.9	D-171
Isophorone	100	63.3	46.6-180.2	21-196
Naphthalene	100	30.1	35.6-119.6	21-133
Nitrobenzene	100	39.3	54.3-157.6	35-180
N-Nitrosodi-n-propylamine	100	55.4	13.6-197.9	D-230
PCB-1260	100	54.2	19.3-121.0	D-164
Phenanthrene	100	20.6	65.2-108.7	54-120
Pyrene	100	25.2	69.6-100.0	52-115
1,2,4-Trichlorobenzene	100	28.1	57.3-129.2	44-142
4-Chloro-3-methylphenol	100	37.2	40.8-127.9	22-147
2-Chlorophenol	100	28.7	36.2-120.4	23-134
2,4-Chlorophenol	100	26.4	52.5-121.7	39-135
2,4-Dimethylphenol	100	26.1	41.8-109.0	32-119
2,4-Dinitrophenol	100	49.8	D-172.9	D-191
2-Methyl-4,6-dinitrophenol	100	93.2	53.0-100.0	D-181
2-Nitrophenol	100	35.2	45.0-166.7	29-182
4-Nitrophenol	100	47.2	13.0-106.5	D-132
Pentachlorophenol	100	48.9	38.1-151.8	14-176
Phenol	100	22.6	16.6-100.0	5-112
2,4,6-Trichlorophenol	100	31.7	52.4-129.2	37-144

s = Standard deviation of four recovery measurements, in ug/L.

x = Average recovery for four recovery measurements, in ug/L.

p, p_s = Percent recovery measured.

D = Detected; result must be greater than zero.

[a]Criteria from 40 CFR Part 136 for Method 625. These criteria are based directly on the method performance data in Table 7. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 7.

12. Performance and System Audits

System audits are conducted on each department at Lancaster Laboratories, Inc. (LLI) by members of the Quality Assurance Department. The audits include checks on methodology, reagent preparation, equipment calibration and maintenance, quality control results, and training of personnel. The results of the audits and corrective action, where necessary are communicated to laboratory personnel and management by means of a written report. Audits by outside organizations including clients, regulatory personnel and the USEPA are permitted by arrangement with the Quality Assurance Department.

On a monthly basis, the Quality Assurance Department reviews summaries of the quality control data entered onto the computerized sample management system by analysts. Control charts and statistics are reviewed for trends which may indicate problems with the analytical data. In this way, small problems are identified before they have any significant impact on laboratory results.

Performance audits consist of both intralaboratory and interlaboratory check samples. Blind samples containing known amounts of target analytes are prepared by the Quality Assurance Department and submitted to the laboratories under fictitious client names. In addition, QC samples from EMSL-Cinncinnati are analyzed quarterly to assess laboratory accuracy. LLI also participates in a number of interlaboratory performance evaluation studies which involve analysis of samples with concentrations of analytes that are known to the sponsoring organization, but unknown to the laboratory. Inorganics,

pesticide/herbicides, trihalomethanes; volatile organic compounds, semivolatile organic compounds and traditional wet chemistry analyses are analyzed by LLI for studies conducted by the USEPA and the New York Department of Health. LLI is a contractor to the USEPA under the Contract Laboratory Program which provides laboratory analysis in support of the Superfund program. Part of maintaining this contract includes analysis of quarterly blind samples. Representative results from some of these studies are attached to this section.

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
TRACE METALS IN MICROGRAMS PER LITER:						
ALUMINUM	1	1500	1560	1260- 1820	1330- 1750	ACCEPTABLE
	2	34.7	51.9	20.2- 107	31.1- 95.9	ACCEPTABLE
ARSENIC	1	160	152	118- 181	126- 173	ACCEPTABLE
	2	9.4	7.20	4.06- 10.1	4.81- 9.30	CHECK FOR ERRO
BERYLLIUM	1	487	500	434- 553	450- 538	ACCEPTABL
	2	9.24	13.9	8.15- 20.0	9.68- 18.5	CHECK FOR ERR
CADMIUM	1	131	133	112- 149	117- 144	ACCEPTABLE
	2	3.59	3.55	1.42- 5.43	1.92- 4.93	ACCEPTABLE
COBALT	1	8.57	8.48	2.73- 14.9	4.30- 13.3	ACCEPTABLE
	2	148	150	121- 175	128- 168	ACCEPTABLE
CHROMIUM	1	849	834	696- 974	731- 940	ACCEPTABLE
	2	7.16	6.65	2.17- 10.5	3.21- 9.43	ACCEPTABLE
COPPER	1	568	578	497- 633	514- 616	ACCEPTABLE
	2	15.1	15.0	11.6- 20.5	12.7- 19.4	ACCEPTABLE
IRON	1	1760	1704	1500- 1890	1550- 1840	ACCEPTABLE
	2	14.3	14.0	2.76- 25.8	5.63- 22.9	ACCEPTABLE
MERCURY	1	27.9	30.0	21.5- 39.8	23.8- 37.5	ACCEPTABLE
	2	3.56	3.59	2.56- 4.66	2.83- 4.40	ACCEPTABLE
MANGANESE	1	715	700	630- 752	645- 737	ACCEPTABLE
	2	17.0	16.3	9.00- 22.2	10.7- 20.6	ACCEPTABLE
NICKEL	1	612	606	532- 675	550- 657	ACCEPTABLE
	2	12.2	12.4	3.83- 21.5	5.04- 19.3	ACCEPTABLE
LEAD	1	1100	1108	942- 1270	983- 1230	ACCEPTABLE
	2	16.7	16.3	10.6- 23.7	12.2- 22.1	ACCEPTABL

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 12/26/8

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
TRACE METALS IN MICROGRAMS PER LITER:						
SELENIUM	1	141	140	99.4- 160	107- 152	ACCEPTABLE
	2	11.8	11.1	5.81- 15.2	6.99- 14.0	ACCEPTABLE
VANADIUM	1	22.6	22.4	13.6- 31.0	15.9- 28.7	ACCEPTABLE
	2	1440	1459	1270- 1650	1320- 1600	ACCEPTABLE
ZINC	1	1210	1267	1110- 1420	1150- 1380	ACCEPTABLE
	2	9.37	12.6	7.71- 16.8	8.84- 15.7	ACCEPTABLE
ANTIMONY	3	131	135	83.5- 169	94.6- 158	ACCEPTABLE
	4	14.0	15.0	7.57- 20.4	9.24- 18.7	ACCEPTABLE
SILVER	3	< 1	0.560	0.250-0.827	0.324-0.753	UNUSABLE DATA
	4	8.2	8.12	6.16- 10.0	6.65- 9.55	ACCEPTABLE
THALLIUM	3	16.1	13.8	9.25- 19.5	10.6- 18.1	ACCEPTABLE
	4	40.5	40.0	30.1- 51.7	32.9- 48.9	ACCEPTABLE
MOLYBDENUM	3	28.1	28.2	15.5- 38.4	18.6- 35.3	ACCEPTABLE
	4	5.7	5.79	2.12- 9.19	3.09- 8.22	ACCEPTABLE
STRONTIUM	3	5.09	5.14	2.40- 7.83	3.13- 7.09	ACCEPTABLE
	4	29.7	30.4	22.7- 37.8	24.7- 35.8	ACCEPTABLE
TITANIUM	3	172	175	136- 215	146- 204	ACCEPTABLE
	4	46.7	45.7	30.7- 60.5	34.7- 56.4	ACCEPTABLE
MINERALS IN MILLIGRAMS PER LITER: (EXCEPT AS NOTED)						
PH-UNITS	3	7.79	7.9	7.62- 8.12	7.68- 8.06	ACCEPTABLE
	4	4.23	4.2	4.12- 4.28	4.14- 4.26	ACCEPTABLE
SPEC. COND. (UMHOS/CM AT 25 C)	1	235	234	214- 257	220- 252	ACCEPTABLE
	2	1030	1030	922- 1140	949- 1110	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
MINERALS IN MILLIGRAMS PER LITER: (EXCEPT AS NOTED)						
TDS AT 180 C	1	130	133	90.2- 179	101- 168	ACCEPTABLE
	2	620	647	380- 967	453- 894	ACCEPTABLE
TOTAL HARDNESS (AS CACO3)	1	52.0	50.6	43.4- 58.0	45.2- 56.2	ACCEPTABLE
	2	335	342	312- 368	319- 361	ACCEPTABLE
CALCIUM	1	20.4	19.0	16.5- 22.2	17.2- 21.5	ACCEPTABLE
	2	98.0	93.3	80.9- 108	84.2- 104	ACCEPTABLE
MAGNESIUM	1	0.819	0.771	0.599-0.934	0.641-0.892	ACCEPTABLE
	2	26.8	26.5	22.5- 30.5	23.5- 29.5	ACCEPTABLE
SODIUM	1	15.0	14.9	12.9- 16.9	13.4- 16.4	ACCEPTABLE
	2	34.8	35.2	31.3- 39.2	32.3- 38.2	ACCEPTABLE
POTASSIUM	1	13.8	14.0	11.7- 15.8	12.2- 15.3	ACCEPTABLE
	2	33.8	36.6	30.9- 41.7	32.2- 40.3	ACCEPTABLE
TOTAL ALKALINITY (AS CACO3)	1	24.0	23.4	20.4- 27.9	21.3- 27.0	ACCEPTABLE
	2	70.0	69.0	63.4- 77.1	65.1- 75.4	ACCEPTABLE
CHLORIDE	1	37.6	38.6	33.5- 44.6	34.9- 43.3	ACCEPTABLE
	2	240	244	220- 267	226- 261	ACCEPTABLE
FLUORIDE	1	3.56	3.40	2.92- 3.91	3.04- 3.79	ACCEPTABLE
	2	0.210	0.219	0.149-0.304	0.168-0.285	ACCEPTABLE
SULFATE	1	11.4	13.6	9.94- 16.5	10.8- 15.7	ACCEPTABLE
	2	44.0	50.0	40.7- 57.7	42.8- 55.6	ACCEPTABLE
NUTRIENTS IN MILLIGRAMS PER LITER:						
AMMONIA-NITROGEN	1	0.690	0.692	0.446-0.975	0.510-0.911	ACCEPTABLE
	2	2.981	3.50	2.65- 4.33	2.85- 4.13	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
NUTRIENTS IN MILLIGRAMS PER LITER:						
NITRATE-NITROGEN	1	0.419	0.451	0.320-0.573	0.350-0.542	ACCEPTABLE
	2	2.203	2.41	1.83- 2.92	1.96- 2.79	ACCEPTABLE
ORTHOPHOSPHATE	1	0.294	0.299	0.244-0.356	0.257-0.342	ACCEPTABLE
	2	1.09	1.11	0.932- 1.28	0.973- 1.24	ACCEPTABLE
KJELDAHL-NITROGEN	3	0.230	0.451	D.L.- 1.05	0.121-0.927	ACCEPTABLE
	4	3.20	3.50	2.35- 4.60	2.62- 4.33	ACCEPTABLE
TOTAL PHOSPHORUS	3	0.366	0.351	0.273-0.455	0.294-0.433	ACCEPTABLE
	4	2.965	2.75	2.23- 3.41	2.37- 3.27	ACCEPTABLE
DEMANDS IN MILLIGRAMS PER LITER:						
COD	1	190	201	161- 221	168- 213	ACCEPTABLE
	2	33.7	26.3	15.3- 33.5	17.5- 31.2	NOT ACCEPTABLE
TOC	1	78.1	79.6	65.7- 91.0	69.0- 87.6	ACCEPTABLE
	2	10.2	10.4	8.24- 13.3	8.90- 12.6	ACCEPTABLE
5-DAY BOD	1	141	127	78.9- 176	91.0- 164	ACCEPTABLE
	2	21.9	19.0	9.42- 26.5	11.5- 24.4	ACCEPTABLE
CARBONACEOUS BOD	3	131	110	48.7- 171	63.8- 156	ACCEPTABLE
	4	18.1	14.2	4.92- 23.4	7.20- 21.1	ACCEPTABLE
PCB'S IN MICROGRAMS PER LITER:						
PCB-AROCLOR 1016/1242	2	11.7	12.7	5.89- 17.2	7.35- 15.8	ACCEPTABLE
PCB-AROCLOR 1260	1	1.18	1.20	0.558- 1.79	0.716- 1.63	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.
D.L. STANDS FOR DETECTION LIMIT

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
PCB'S IN OIL IN MILLIGRAMS PER KILOGRAM:						
PCB IN OIL- 1016/1242	2	18.0	21.2	1.80- 30.8	5.53- 27.1	ACCEPTABLE
PCB IN OIL- 1260	1	8.13	9.20	0.727- 12.2	2.20- 10.7	ACCEPTABLE
PESTICIDES IN MICROGRAMS PER LITER:						
CHLORDANE	3	2.68	2.83	1.38- 3.74	1.68- 3.44	ACCEPTABLE
	4	12.3	13.7	6.07- 18.5	7.66- 16.9	ACCEPTABLE
ALDRIN	1	0.074	0.100	.0171-0.155	.0347-0.137	ACCEPTABLE
	2	0.368	0.450	0.132-0.621	0.194-0.558	ACCEPTABLE
DIELDRIN	1	0.080	0.117	.0531-0.187	.0702-0.170	ACCEPTABLE
	2	0.284	0.400	0.178-0.633	0.236-0.575	ACCEPTABLE
DDD	1	0.240	0.250	0.100-0.396	0.138-0.358	ACCEPTABLE
	2	0.648	0.625	0.286-0.875	0.361-0.800	ACCEPTABLE
DDE	1	0.110	0.142	.0501-0.223	.0720-0.201	ACCEPTABLE
	2	0.404	0.492	0.232-0.678	0.289-0.621	ACCEPTABLE
DDT	1	0.126	0.133	.0349-0.237	.0607-0.211	ACCEPTABLE
	2	0.597	0.633	0.279-0.915	0.360-0.834	ACCEPTABLE
HEPTACHLOR	1	0.191	0.233	.0757-0.328	0.108-0.295	ACCEPTABLE
	2	0.441	0.517	0.149-0.747	0.226-0.670	ACCEPTABLE
HEPTACHLOR EPOXIDE	1	0.168	0.175	.0916-0.241	0.111-0.222	ACCEPTABLE
	2	0.665	0.625	0.360-0.825	0.420-0.766	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
VOLATILE HALOCARBONS IN MICROGRAMS PER LITER:						
1,2 DICHLOROETHANE	1	13.2	10.3	6.01- 15.2	7.18- 14.0	ACCEPTABLE
	2	52.9	47.9	29.8- 68.5	34.8- 63.5	ACCEPTABLE
CHLOROFORM	1	17.7	15.9	10.1- 22.1	11.6- 20.6	ACCEPTABLE
	2	56.7	52.0	35.8- 68.1	39.9- 64.0	ACCEPTABLE
1,1,1 TRICHLOROETHANE	1	8.15	6.74	3.59- 10.6	4.49- 9.72	ACCEPTABLE
	2	46.4	42.0	24.4- 57.4	28.6- 53.2	ACCEPTABLE
TRICHLOROETHENE	1	8.40	7.55	4.24- 10.8	5.07- 9.94	ACCEPTABLE
	2	29.2	28.1	17.2- 38.8	20.0- 36.1	ACCEPTABLE
CARBONTETRACHLORIDE	1	5.79	4.89	2.33- 7.53	3.00- 6.87	ACCEPTABLE
	2	57.6	52.1	30.3- 76.6	36.2- 70.7	ACCEPTABLE
TETRACHLOROETHENE	1	13.3	10.2	5.68- 14.6	6.82- 13.5	ACCEPTABLE
	2	43.2	39.1	21.7- 51.7	25.5- 47.9	ACCEPTABLE
BROMODICHLOROMETHANE	1	10.2	8.48	5.29- 11.1	6.02- 10.3	ACCEPTABLE
	2	39.8	37.0	24.3- 45.3	27.1- 43.6	ACCEPTABLE
DIBROMOCHLOROMETHANE	1	6.20	5.30	2.68- 8.10	3.37- 7.41	ACCEPTABLE
	2	41.3	42.3	27.3- 58.0	31.2- 54.1	ACCEPTABLE
BROMOFORM	1	10.2	8.63	4.16- 12.9	5.28- 11.8	ACCEPTABLE
	2	66.1	58.0	31.0- 86.4	38.0- 79.4	ACCEPTABLE
METHYLENE CHLORIDE	1	9.47	9.24	4.29- 15.3	5.70- 13.9	ACCEPTABLE
	2	68.6	64.0	36.9- 92.5	44.0- 85.4	ACCEPTABLE
CHLOROBENZENE	1	8.29	6.95	4.12- 9.70	4.83- 8.98	ACCEPTABLE
	2	38.8	36.0	21.8- 48.7	25.2- 45.3	ACCEPTABLE
VOLATILE AROMATICS IN MICROGRAMS PER LITER:						
BENZENE	1	61.8	66.1	42.9- 87.5	48.6- 81.9	ACCEPTABLE
	2	4.35	4.27	2.31- 6.48	2.94- 5.94	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

PERFORMANCE EVALUATION REPORT DATE: 12/26/89

WATER POLLUTION STUDY NUMBER WP023

LABORATORY: PA009

ANALYTES	SAMPLE NUMBER	REPORT VALUE	TRUE VALUE*	ACCEPTANCE LIMITS	WARNING LIMITS	PERFORMANCE EVALUATION
VOLATILE AROMATICS IN MICROGRAMS PER LITER:						
ETHYLBENZENE	1	85.3	87.0	54.4- 115	62.0- 107	ACCEPTABLE
	2	15.8	16.0	8.41- 23.7	10.4- 21.8	ACCEPTABLE
TOLUENE	1	83.0	85.1	60.8- 107	66.7- 101	ACCEPTABLE
	2	9.86	10.1	6.21- 13.9	7.19- 13.0	ACCEPTABLE
1,2-DICHLOROBENZENE	1	81.2	84.0	49.2- 115	57.6- 107	ACCEPTABLE
	2	21.6	22.2	13.4- 30.7	15.7- 28.4	ACCEPTABLE
1,3-DICHLOROBENZENE	1	61.2	63.2	36.8- 87.9	43.3- 81.4	ACCEPTABLE
	2	14.9	15.0	8.69- 20.2	10.2- 18.7	ACCEPTABLE
1,4-DICHLOROBENZENE	1	73.9	78.0	47.1- 109	55.0- 101	ACCEPTABLE
	2	17.7	18.0	10.7- 26.3	12.8- 24.2	ACCEPTABLE
MISCELLANEOUS PARAMETERS:						
TOTAL CYANIDE	1	0.260	0.270	0.164-0.347	0.187-0.324	ACCEPTABLE
(IN MG/L)	2	0.770	0.800	0.561- 1.01	0.618-0.955	ACCEPTABLE
NON-FILTERABLE RESIDUE	1	93.8	90.7	83.1- 95.6	84.7- 94.1	ACCEPTABLE
(IN MG/L)	2	31.2	29.2	24.0- 32.4	25.1- 31.4	ACCEPTABLE
OIL AND GREASE	1	39.8	43.9	20.9- 54.5	25.1- 50.3	ACCEPTABLE
(IN MG/L)	2	17.2	16.0	6.97- 21.5	8.79- 19.7	ACCEPTABLE
TOTAL PHENOLICS	1	0.370	0.406	0.206-0.607	0.257-0.556	ACCEPTABLE
(IN MG/L)	2	1.727	1.99	1.07- 2.91	1.30- 2.68	ACCEPTABLE
TOTAL RESIDUAL CHLORINE	1	0.540	0.602	0.374-0.788	0.429-0.733	ACCEPTABLE
(IN MG/L)	2	1.26	1.41	0.832- 1.82	0.961- 1.69	ACCEPTABLE

* BASED UPON THEORETICAL CALCULATIONS, OR A REFERENCE VALUE WHEN NECESSARY.

ORGANIC PERFORMANCE EVALUATION SAMPLE
INDIVIDUAL LABORATORY SUMMARY REPORT
FOR QB 3 FY 90

LABORATORY: Lancaster Laboratories (PA) % SCORE: 88.6
PERFORMANCE: ACCEPTABLE - Response Explaining Deficiency(ies) Required REPORT DATE: 07/03/9(
RANK: Above = 18 Same = 1 Below = 26 MATRIX: WATER

COMPOUND	CONFIDENCE INTERVALS WARNING LOWER	WARNING UPPER	ACTION LOWER	ACTION UPPER	LABORATORY DATA CONC	Q	#LABS MIS-QNT	PROGRAM #LABS NOT-ID	DATA #LABS ID-CPD	TOTAL #LABS
TCL VOLATILE										
VINYL CHLORIDE	22	36	20	38	25		6	0	46	46
CHLOROETHANE	23	35	21	37	26		2	0	46	46
ACETONE	52	133	40	145	130		3	1	45	46
CARBON DISULFIDE	35	55	32	58	33	$	6	0	46	46
1,2-DICHLOROETHENE (TOTAL)	73	102	69	106	88		6	0	46	46
BROMODICHLOROMETHANE	47	58	45	60	43	X	4	0	46	46
DIBROMOCHLOROMETHANE	61	78	58	80	56	X	8	0	46	46
BROMOFORM	43	58	40	60	42	$	1	0	46	46
1,1,2,2-TETRACHLOROETHANE	16	22	15	23	15	$	6	0	46	46
STYRENE	67	96	62	100	78		4	0	46	46
TCL SEMIVOLATILE										
BIS(2-CHLOROETHYL)ETHER	29	50	26	53	36		1	1	45	46
2-CHLOROPHENOL	80	128	73	154	100		0	0	46	46
1,2-DICHLOROBENZENE	46	84	41	104	46		2	0	46	46
BIS(2-CHLOROISOPROPYL)ETHER	38	67	34	71	41		1	0	46	46
4-METHYLPHENOL	43	64	40	76	53		2	0	46	46
N-NITROSO-DI-N-PROPYLAMINE	49	78	44	82	58		2	0	46	46
2,4-DIMETHYLPHENOL	45	74	40	90	42	$	1	0	46	46
BIS(2-CHLOROETHOXY)METHANE	30	50	28	52	36		3	0	46	46
2-METHYLNAPHTHALENE	30	56	26	60	31		3	0	46	46
HEXACHLOROCYCLOPENTADIENE	11	54	10	78	10	U $	0	7	39	46
2,4,6-TRICHLOROPHENOL	50	74	47	86	59		0	0	46	46
2,6-DINITROTOLUENE	31	46	29	54	34		2	0	46	46
ACENAPHTHENE	44	67	41	70	43	$	4	0	46	46
2,4-DINITROPHENOL	50	95	50	102	24		0	2	44	46
DIBENZOFURAN	65	97	60	101	61	$	4	0	46	46
DIETHYLPHTHALATE	27	103	15	115	70		10	3	43	46
FLUORENE	55	80	51	83	54	$	3	0	46	46
4-NITROANILINE	56	115	50	123	56		3	1	45	46
PHENANTHRENE	68	102	63	107	71		3	0	46	46
FLUORANTHENE	68	105	62	111	75		1	0	46	46
BUTYL BENZYL PHTHALATE	22	83	13	92	54		9	3	43	46
3,3'-DICHLOROBENZIDINE	47	125	35	136	55		6	0	46	46
BIS(2-ETHYLHEXYL)PHTHALATE	52	90	46	96	67		4	0	46	46
DI-N-OCTYL PHTHALATE	52	88	47	94	66		3	0	46	46
INDENO(1,2,3-CD)PYRENE	63	99	58	104	75		7	0	46	46
DIBENZ(A,H)ANTHRACENE	64	102	58	108	77		6	0	46	46
BENZO(G,H,I)PERYLENE	65	101	60	106	76		5	0	46	46
TCL PESTICIDES										
ALPHA-BHC	0.38	0.72	0.33	0.77	0.49		5	0	46	46
BETA-BHC	0.3	0.56	0.26	0.6	0.38		4	0	46	46
DELTA-BHC	0.25	0.5	0.21	0.54	0.3		3	0	46	46
GAMMA-BHC (LINDANE)	0.34	0.64	0.29	0.69	0.44		4	0	46	46
ENDOSULFAN I	0.34	0.59	0.3	0.62	0.43		1	1	45	46

ORGANIC PERFORMANCE EVALUATION SAMPLE
INDIVIDUAL LABORATORY SUMMARY REPORT
FOR QB 3 FY 90

LABORATORY: Lancaster Laboratories (PA) % SCORE: 88.6
PERFORMANCE: ACCEPTABLE - Response Explaining Deficiency(ies) Required REPORT DATE: 07/03/90
RANK: Above = 18 Same = 1 Below = 26 MATRIX: WATER

COMPOUND	CONFIDENCE INTERVALS WARNING LOWER	WARNING UPPER	ACTION LOWER	ACTION UPPER	LABORATORY DATA CONC	Q	#LABS MIS-QNT	PROGRAM DATA #LABS NOT-ID	#LABS ID-CPD	TOTAL #LABS
AROCLOR-1260	3.3	5.2	3	5.5	3.8		5	0	46	46
NON-TCL VOLATILE										
PROPANE,1,2-DIBROMO-3-CHLORO-					12			14	32	46
METHANE,IODO-					77			3	43	46
NON-TCL SEMIVOLATILE										
BENZOPHENONE					58			3	43	46
BENZILATE,CHLORO-					14			24	22	46
PYRENE,BENZO(E)-					110			40	6	46
PYRIDINE					30			35	11	46
QUINONE,1,4-NAPHTHO-					0			37	9	46
TCL SEMIVOLATILE (Contaminants)										
BENZYL ALCOHOL					3			22	24	46
NON-TCL SEMIVOLATILE (Contaminants)										
UNKNOWN					18	C		38	8	46
UNKNOWN					14	C		42	4	46

OF TCL COMPOUNDS NOT-IDENTIFIED: 0
OF TCL COMPOUNDS MIS-QUANTIFIED: 2
OF TCL CONTAMINANTS: 0

OF NON-TCL COMPOUNDS NOT-IDENTIFIED: 0
OF NON-TCL CONTAMINANTS: 2

Program Summary Data (cont.):

Header	Definition
# LABS NOT-ID:	The number of CLP contractors who did not identify a TCL or non-TCL compound added to the PEM.
# LABS ID-CPD:	The number of CLP contractors who identified a TCL or non-TCL compound in the PEM.
TOTAL # LABS:	The number of CLP contractors who analyzed the PEM.
ILSR CODES:	The following codes are used on the ILSR.

U -- Compound analyzed for but not detected.

& -- Compound not identified -- points deducted for identification.

X -- Compound correctly identified but the reported value is not within the action limit -- points deducted for quantification.

$ -- The reported value for the compound is not within the warning limit but is within the action limit -- points not deducted.

C -- Contaminant -- points deducted.

CO -- Contaminant which may have been introduced during preparation of the PEM or during shipment -- points not deducted.

NS -- Data required but not submitted -- points deducted.

NR -- Data not required.

NU -- Data not used; insufficient amount of usable data for scoring submitted by the contractors.

13. Preventive Maintenance

In order to ensure timely production of data, Lancaster Laboratories, Inc. (LLI) schedules routine preventive maintenance of instruments based on manufacturer's recommendations. Maintenance of the laboratory instruments is the responsibility of the technical group using the equipment in conjunction with our in-house equipment maintenance group. A schedule of routinely performed instrument maintenance tasks is attached as Table 13-1. All preventive maintenance, as well as maintenance performed as corrective action, is recorded in instrument logs.

Critical spare parts are kept in supply at the laboratory by the equipment maintenance group. Most items not kept in stock at the laboratory are available through overnight delivery from the manufacturer. In addition, LLI maintains multiple numbers of most of the critical instruments used in our laboratory operations. A recent equipment inventory may be found in the Qualification Manual. Because we are a large laboratory with redundant capacity, the problems of instrument downtime are minimized.

Table 13-1
Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS	Change septum	Weekly or AN*
	Check fans	Monthly
	Check cool flow	Monthly
	Clean source	Bimonthly or AN
	Change oil in vacuum pump	Semiannually
	Change oil in turbo pump	Semiannually
	Column maintenance	AN
GC/Volatiles	Check propanol level	Semiweekly
	Check all flows	Semiweekly
	Conductivity Detector Maint.	Bimonthly
	Clean cell	Bimonthly
	Change reaction tube	Bimonthly
	Change Teflon line	Bimonthly
	Change resin	Semiannually
	Replace trap	Semiannually
	Column Maintenance	AN
	Change PID Lamp	AN
GC	Septum change	Each run
	Column maintenance	AN
	Clean detector	AN
	Vacuum filters	Semiannually
	Leak check ECD's	Semiannually
Flame AA	Rinse burner head, chamber & trap	AN: Minimum Weekly
	Clean nebulizer	Weekly
	Inspect tubing and O-rings	Monthly
	Replace lamp	AN
GFAA	Rinse workhead assembly	Weekly
	Clean windows	Weekly
	Replace probe tubing	AN
	Check rinse bottle and drain	Daily
ICP	Clean torch	Every other day
	Clean nebulizer & spray chamber	Every other day
	Replace pump winding	After 4 runs
	Lubricate autosampler	After 4 runs
	Check mirror	After 4 runs
	Check tubing to torch	After 4 runs
	Check fan filters, clean if needed	Biweekly
	Check cool flow, clean if needed	Biweekly
	Check water filter, replace if needed	Quarterly

Table 13-1
Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
Technicon Autoanalyzer	Clean sample probe	Weekly
	Clean proportioning pump	Weekly
	Inspect pump tubing, replace if worn	AN
	Oil proportioning pump	Monthly
	Inspect silicone tubing, replace if worn	Monthly
	Clean optical system	Monthly
	Clean wash receptacles	Monthly
	Inspect condition of distillation head	Monthly
	Oil distillation head	Bimonthly
	Oil chain and bearings	Quarterly
Total Organic Carbon Analyzer	Check IR zero	Weekly
	Check for leaks	Weekly
	Check acid pump calibration	Bimonthly
	Check persulfate pump calibration	Bimonthly
	Inspect 6-port rotary valve	Monthly
	Inspect sample pump head	Monthly
	Wash molecular sieve	Quarterly
	Check sample loop calibration	Monthly
	Clean gas permeation tube	Quarterly
	Inspect digestion vessel o-rings	6 Months
	Check activated carbon scrubber	6 Months
	Dust back and clean circuit boards	6 Months
	Check IR cell	Annually
Total Organic Halogen Analyzer	Polish counter electrode	Daily
	Polish sensor electrode	Biweekly
	Clean loaders and pistons	AN
	Replace agar bridge	Monthly

* AN means as needed. Any of these items may be performed more frequently if response during operation indicates this is necessary.

14. Specific Routine Procedures Used to Assess Data Precision, Accuracy and Completeness

Precision - Precision refers to the reproducibility of a method when it is repeated on a second aliquot of the same sample. The degree of agreement is expressed as the Relative Percent Difference (RPD). The RPD will be calculated according to the following equation:

$$RPD = \frac{D_2 - D_1}{(D_1 + D_2)/2} \times 100$$

D_1 = First sample value
D_2 = Second sample value (Duplicate)

Duplicates will be run on at least 5% of the samples. Acceptance criteria shall be based on statistical evaluation of past lab data. (See Section No. 11.) All Quality Control sample results are entered into the computer and compared with acceptance limits. In addition, there is a monthly review of values on the computer QC system. Data obtained from quality control samples is entered onto our computer system which charts the data, and calculates a mean and standard deviation on a monthly basis. The Quality Assurance Department then reviews this data for trends which may indicate analytical problems. The control charts are graphical methods for monitoring precision and bias over time.

Accuracy - Accuracy refers to the agreement between the amount of a compound measured by the test method and the amount actually present. Accuracy is usually expressed as a percent Recovery (R). Recoveries will be calculated according to the following equations:

$$\text{Surrogate Recovery} = \frac{Qd}{Qa} \times 100$$

Qd = quantity determined by analysis
Qa = quantity added to sample

$$\text{Matrix Spike Recovery} = \frac{SSR - SR}{SA} \times 100$$

SSR = Spiked Sample Results
SR = Sample Results
SA = Spike added

$$\text{Laboratory Control Sample Recovery} = \frac{\text{LCS Found}}{\text{LCS True}} \times 100$$

Surrogate standards are added to each sample analyzed for organics. Spikes and Laboratory Control Samples will be run on at least 5% of the samples (each batch or SDG, $\leq$ 20 samples). Acceptance criteria for the accuracy recoveries shall be based on statistical evaluation of past lab data. (See Section No. 11.) The computer is programmed to compare the individual values with the acceptance limits and inform the analyst if the results meet specification. If the results are not within the acceptance criteria, corrective action suitable to the situation will be taken. This may include, but is not limited to, checking calculations and instrument performance, reanalysis of the associated samples, examining other QC analyzed with the same batch of samples, and qualifying results with documentation of any QC problems in the Case Narrative.

Where available, EPA Quality Control materials are run at least quarterly to ensure accuracy of the analytical procedure. Repetitive analysis of a reference material will also yield precision data. Accuracy information determined from reference materials is valuable because variables specific to sample matrix are eliminated.

The QC program is capable of charting data for surrogates, spikes, control materials and reference materials. The Quality Assurance Department reviews these charts for any indication of possible problems (ie shift in the mean and standard deviation).

Completeness - Completeness is the percentage of valid data acquired from a measurement system compared to the amount of valid measurements that were planned to be collected. The objective is analysis of all samples submitted intact, and to ensure that sufficient sample weight/volume is available should the initial analysis not meet acceptance criteria. The laboratory's Sample Management System will assign a unique identification number to the sample which tracks and controls movement of samples from the time of receipt until disposal. All data generated will be recorded referencing the corresponding sample identification number. The completeness of an analysis can be documented by including in the data deliverables sufficient information to allow the data user to assess the quality of the results. This information will include, but is not limited to, summaries of QC data and sample results, chromatograms, spectra, and instrument tune and calibration data. Additional information will be stored in the laboratory's archives, both hard copy and magnetic tape.

15. Corrective Action

Whenever any of the data generated falls outside of the established acceptance criteria outlined for instrument tune and calibration (Section No. 8) and Internal QC (Section No. 11), the cause of this irregularity must be investigated, corrected and documented. The documentation will be used to prevent a recurrence of the problem and to inform management of the situation.

If the results are not within acceptance criteria, the appropriate corrective action will be initiated. This may include, but is not limited to, checking calculation and instrument performance, reanalysis of the associated samples, examining other QC analyzed with the same batch of samples, and qualifying results with a comment stating the observed deviation.

A Standard Operating Procedure is in place which outlines the procedures to be followed when quality control data for an analysis falls outside of previously established acceptance limits. All QC data must be entered onto the computerized QC system promptly after its generation and daily "out-of-spec" data is reported via this system. Any data outside the acceptance criteria will be reviewed by the Quality Assurance Department. Where appropriate, the Quality Assurance Department will place outliers in one of three categories:

A. Marginal Outlier
   Data that are outside the 95% confidence interval but within the 99% confidence interval. This category may also be used for QC samples subject to matrix interferences or sample inhomogeneity.

B. Outlier

Data outside the 99% confidence interval and/or observable trends such as a shift in mean and standard deviation.

C. Extreme Outlier

Such data would indicate the system is out of control and no results should be reported to clients; an example would be more than one reference or control falling outside the 99% confidence interval.

The daily out-of-spec reports are then distributed to Group Leaders or their QC Coordinator who will check all supporting data and document their findings and any corrective action taken. Documentation of QC Data will be filed in the departmental QC notebook. In the case of Outliers or Extreme Outliers the Quality Assurance Department may issue a formal request for investigation and corrective action (see sample form that follows). The Quality Assurance Department is responsible for initiating the corrective actions, insuring that the actions are taken in a timely manner, and that the desired results are produced.

The Quality Assurance Department is also responsible for conducting periodic audits which ensure compliance with laboratory SOP's and assist in identifying and correcting any deficiencies. These audits may entail observation as procedures are carried out or a review of records to demonstrate traceability and compliance with all documented record keeping procedures. Follow-up audits verify that proper corrective action has been taken for the identified discrepancy.

No. _____

INVESTIGATION AND CORRECTIVE ACTION FOR QC OUTLIERS

Part I (to be filled out by QA Director)

1. Date
2. LLI sample number(s) involved
3. Nature of QC outlier

4. _____ Check if investigation must be complete before reporting further data to clients.

Signed _____
Quality Assurance Director

Part II

1. Steps taken to investigate outlier:
2. Explanation of probable cause of outlier:
3. Steps taken to prevent future occurrence:
4. Name of analyst who performed work:
5. Signed _____ Date _____

Return by _____

16. Quality Assurance Reports to Management

Reports of quality status from the Quality Assurance Department to management are made frequently and in various forms. All results from internal or external performance evaluation samples are circulated to management. A report of each audit performed is prepared and copied to management. Monthly summaries of data obtained from analysis of quality control check samples are generated via the computerized sample management system. These summaries include mean and standard deviation to aid in assessment of data accuracy and precision. Forms summarizing problems which require investigation and corrective action are completed by Group Leaders and circulated to management. Through these channels, laboratory management is kept apprised of QA/QC activities.

Any problems or unusual observations that occur during the analysis of samples for a specific project will be listed on the laboratory report and/or in the case narrative delivered with the data package. The items often discussed in this manner include samples with surrogate recovery outside of the acceptance criteria and samples with matrix problems requiring dilution and causing increased detection limits. Where applicable, any corrective action attempted or performed to address the problem will also be presented.

The laboratory will contact the client for direction regarding major problems such as samples listed on the chain of custody but missing form the shipping container, samples which arrive broken or are accidentally broken in the laboratory, and samples with severe matrix problems. The client will be contacted if it is necessary to change any item in the original project plan.

Appendix A

Example Reporting Forms

Tier I Data Package

Title Page
Table of Contents
Sample Analysis Request Form, Field Chain of Custody
Internal Chain of Custody
Laboratory Chronicle
Method Summary/References
Analytical Reports for Samples and QC Samples
Case Narrative
QC Summary
    GC/MS tuning summary
    Surrogate recovery summary
    Blank results
    Matrix spike/matrix spike duplicate/duplicate results
    LCS results (if applicable)
    Internal standard area summary (GC/MS)
Sample Data
    All raw sample data including instrument printouts (i.e., chromatograms, quant. reports, spectra, etc.)
Standards Data
    Initial calibration summary and supporting raw data
    Continuing calibration summary and supporting raw data
    Standardization data
Raw QC Data
    Raw tune data (GC/MS)
    Blank raw data
    Matrix spike/matrix spike duplicate/duplicate raw data
    LCS raw data (if applicable)
Extraction/Digestion Logs

Tier II Data Package

Title Page
Table of Contents
Sample Analysis Request Form, Field Chain of Custody
Internal Chain of Custody
Laboratory Chronicle
Method Summary/References
Analytical Reports for Samples and QC Samples
Case Narrative
QC Summary
- GC/MS tuning summary
- Surrogate recovery summary
- Blank results
- Matrix spike/matrix spike duplicate/duplicate results
- LCS results (if applicable)
- Internal standard area summary (GC/MS)

Sample Data
- All raw sample data including instrument printouts (i.e., chromatograms, quant. reports, spectra, etc.)

Raw QC Data
- Blank raw data

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WLK1586 D 1 4

LLI Sample No. WW 1335799

Smith Engineering, Inc.
1000 Any Street
Lancaster, PA 17601-5994
Water Sample from Monitoring Well #5
Collected on 12/8/89 at 1547 by MLH

Date Reported 12/16/89
Date Submitted 12/08/89
Discard Date 01/16/90
Collected by MLH
P.O.
Rel.

ANALYSIS	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Total Coliform	< 2.2	/100ml	2.2	030301500
Nitrite Nitrogen	< 0.05	mg/l	0.05	021900800
Nitrate Nitrogen	11.	mg/l	0.5	022000700
Ammonia Nitrogen	4.1	mg/l	0.1	022202600
Ortho-Phosphate as P	2.1	mg/l	0.25	022601100
Total Organic Carbon	8.5	mg/l	0.5	027302500
The Total Organic Carbon (TOC) result reported above was determined by measuring total carbon by a persulfate digestion/infrared detection method on an acidified sample which has been purged of inorganic carbon using nitrogen. It represents "nonpurgeable TOC."				
Pesticides/PCB's		attached		017819500
Lead	0.25	mg/l	0.05	025501200
Trichloroethene	12.	mg/l	1.	041800500

1 COPY TO Smith Engineering, Inc. ATTN: John Smith

Questions? Contact Environmental
Technical Services at (717) 656-2301
00649 10.00 2700

Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Marty Casstevens
Manager, Water Quality

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

Lancaster Laboratories
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07:46:19 269394
DIS000 D 1 2
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

ANALYSIS	RESULT AS RECEIVED	LIMIT OF QUANTITATION	LAB CODE
Appendix IX Volatile Compounds	attached		126541500
AppendixIX Vol.Compounds con't	attached		126600000
Appendix IX Semi-volatiles	attached		130980000
App. IX Semi-volatiles con't	attached		131000000
App. IX Semi-volatiles con't	attached		131100000
App. IX Semi-volatiles con't	attached		131200000
AppendixIX Herbicide Compounds	attached		131619000
Appendix IX Organophosphates	attached		132016500
Appendix IX Organochlorines	attached		132225000

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

135 00649 0.00 182000

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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07:46:20 269394
DIS000 D 1 2
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Appendix IX Volatile Compounds	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Chloromethane	< 10.	ug/l	10.	125800000N
Bromomethane	< 10.	ug/l	10.	125700000N
Vinyl Chloride	< 10.	ug/l	10.	082900000N
Dichlorodifluoromethane	< 5.	ug/l	5.	049800000N
Chloroethane	< 10.	ug/l	10.	083000000N
Methyl iodide	< 5.	ug/l	5.	126000000N
Acrolein	< 100.	ug/l	100.	082400000N
Acrylonitrile	< 100.	ug/l	100.	082500000N
Acetonitrile	< 100.	ug/l	100.	124900000N
Methylene Chloride	< 5.	ug/l	5.	083100000N
Acetone	< 100.	ug/l	100.	091400000N
Trichlorofluoromethane	< 5.	ug/l	5.	126400000N
Carbon Disulfide	< 100.	ug/l	100.	091500000N
Propionitrile	< 100.	ug/l	100.	126300000N
1,1-Dichloroethene	< 5.	ug/l	5.	083200000N
Allyl chloride	< 5.	ug/l	5.	125000000N
1,1-Dichloroethane	< 5.	ug/l	5.	083300000N
trans-1,2-Dichloroethene	< 5.	ug/l	5.	083400000N
Chloroform	< 5.	ug/l	5.	083500000N
1,2-Dichloroethane	< 5.	ug/l	5.	083600000N
Methacrylonitrile	< 100.	ug/l	100.	125600000N
2-Butanone	< 100.	ug/l	100.	031600000N
Dibromomethane	< 5.	ug/l	5.	125900000N
1,1,1-Trichloroethane	< 5.	ug/l	5.	083700000N
1,4-dioxane	< 100.	ug/l	100.	125300000N

* Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported. The sample was preserved with 1 + 1 HCl to pH < 2. Low recovery of acid labile compounds, such as 2-chloroethyl vinyl ether, is likely to occur.

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

See reverse side for explanation of symbols and abbreviations.

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07:46:26 269394
DIS000 D 1 2
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

AppendixIX Vol.Compounds con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Carbon Tetrachloride	< 5.	ug/l	5.	083800000N
Isobutyl alcohol	< 100.	ug/l	100.	125500000N
Vinyl Acetate	< 50.	ug/l	50.	091700000N
Bromodichloromethane	< 5.	ug/l	5.	083900000N
2-Chloro-1,3-Butadiene	< 5.	ug/l	5.	125100000N
1,2-Dichloropropane	< 5.	ug/l	5.	084000000N
trans-1,3-Dichloropropene	< 5.	ug/l	5.	084100000N
Trichloroethene	< 5.	ug/l	5.	084200000N
Dibromochloromethane	< 5.	ug/l	5.	084600000N
1,1,2-Trichloroethane	< 5.	ug/l	5.	084500000N
1,2-Dibromoethane	< 5.	ug/l	5.	113000000N
Benzene	< 5.	ug/l	5.	084300000N
cis-1,3-Dichloropropene	< 5.	ug/l	5.	084400000N
Methyl methacrylate	< 5.	ug/l	5.	126100000N
1,1,1,2-Tetrachloroethane	< 5.	ug/l	5.	032800000N
Bromoform	< 5.	ug/l	5.	084700000N
trans-1,4-dichloro-2-butene	< 100.	ug/l	100.	125200000N
1,2,3-Trichloropropane	< 5.	ug/l	5.	098800000N
2-Hexanone	< 50.	ug/l	50.	091800000N
4-Methyl-2-Pentanone	< 50.	ug/l	50.	091900000N
Tetrachloroethene	< 5.	ug/l	5.	084800000N
1,1,2,2-Tetrachloroethane	< 5.	ug/l	5.	084900000N
Toluene	< 5.	ug/l	5.	085000000N
Ethyl methacrylate	< 5.	ug/l	5.	125400000N
Chlorobenzene	< 5.	ug/l	5.	085100000N
Pentachloroethane *	< 10.	ug/l	10.	126200000N
Ethylbenzene	< 5.	ug/l	5.	085200000N
1,2-Dibromo-3-chloropropane	< 100.	ug/l	100.	100100000N
Styrene	< 5.	ug/l	5.	092000000N
Xylenes (total)	< 5.	ug/l	5.	092100000N

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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07:46:31 269394
DIS000 D 1 2
~~00649~~ 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Appendix IX Semi-volatiles	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
acenaphthene	< 10.	ug/l	10.	065700000N
acenaphthylene	< 10.	ug/l	10.	065800000N
acetophenone	< 10.	ug/l	10.	126700000N
2-acetylaminofluorene	< 10.	ug/l	10.	126800000N
4-aminobiphenyl	< 10.	ug/l	10.	126900000N
aniline	< 10.	ug/l	10.	092500000N
anthracene	< 10.	ug/l	10.	065900000N
benzo (a) anthracene	< 10.	ug/l	10.	066100000N
benzo (b) fluoranthene	< 10.	ug/l	10.	066300000N
benzo (K) fluoranthene	< 10.	ug/l	10.	066500000N
benzo (ghi) perylene	< 10.	ug/l	10.	066400000N
benzo (a) pyrene	< 10.	ug/l	10.	066200000N
benzyl alcohol	< 10.	ug/l	10.	092600000N
bis (2-chloroethoxy) methane	< 10.	ug/l	10.	066600000N
bis (2-chloroethyl) ether	< 10.	ug/l	10.	066700000N
bis(2chloro1methylethyl)ether	< 10.	ug/l	10.	127100000N
bis (2-ethylhexyl) phthalate	< 10.	ug/l	10.	066900000N
4-bromophenyl phenyl ether	< 10.	ug/l	10.	067000000N
butyl benzyl phthalate	< 10.	ug/l	10.	067100000N
4-chloroaniline	< 10.	ug/l	10.	093000000N
chlorobenzilate	< 10.	ug/l	10.	127200000N
4-chloro-3-methylphenol	< 10.	ug/l	10.	065300000N
2-chloronaphthalene	< 10.	ug/l	10.	067200000N
2-chlorophenol	< 10.	ug/l	10.	064600000N
4-chlorophenyl phenyl ether	< 10.	ug/l	10.	067300000N
chrysene	< 10.	ug/l	10.	067400000N
o-cresol	< 10.	ug/l	10.	032900000N
m-cresol and p-cresol	< 10.	ug/l	10.	033000000N

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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07:46:37 269394
DIS000 D 1 2
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
diallate	< 10.	ug/l	10.	131300000N
dibenzofuran	< 10.	ug/l	10.	093500000N
di-n-butyl phthalate	< 10.	ug/l	10.	068200000N
dibenz (a,h) anthracene	< 10.	ug/l	10.	067500000N
1,2-dichlorobenzene	< 10.	ug/l	10.	067600000N
1,3-dichlorobenzene	< 10.	ug/l	10.	067700000N
1,4-dichlorobenzene	< 10.	ug/l	10.	067800000N
3,3'-dichlorobenzidine	< 20.	ug/l	20.	067900000N
2,4-dichlorophenol	< 10.	ug/l	10.	064700000N
2,6-dichlorophenol	< 10.	ug/l	10.	127300000N
diethyl phthalate	< 10.	ug/l	10.	068000000N
dimethoate *	< 10.	ug/l	10.	127400000N
p-(dimethylamino)azobenzene	< 10.	ug/l	10.	127500000N
7,12-dimethlbenz(a)anthracene*	< 10.	ug/l	10.	127600000N
3,3'-dimethylbenzidine	< 10.	ug/l	10.	127700000N
2,4-dimethylphenol	< 10.	ug/l	10.	064800000N
dimethyl phthalate	< 10.	ug/l	10.	068100000N
m-dinitrobenzene	< 10.	ug/l	10.	127800000N
2-methyl-4,6-dinitrophenol	< 25.	ug/l	25.	064900000N
2,4-dinitrophenol	< 25.	ug/l	25.	065000000N
2,4-dinitrotoluene	< 10.	ug/l	10.	068300000N
2,6-dinitrotoluene	< 10.	ug/l	10.	068400000N
di-n-octyl phthalate	< 10.	ug/l	10.	068500000N
diphenylamine	< 10.	ug/l	10.	132700000N
ethyl methanesulfonate	< 10.	ug/l	10.	127900000N
fluoranthene	< 10.	ug/l	10.	068700000N
fluorene	< 10.	ug/l	10.	068800000N

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
hexachlorobenzene	< 10.	ug/l	10.	068900000N
hexachlorobutadiene	< 10.	ug/l	10.	069000000N
hexachlorocyclopentadiene	< 10.	ug/l	10.	069100000N
hexachloroethane	< 10.	ug/l	10.	069200000N
hexachloropropene *	< 10.	ug/l	10.	128100000N
indeno (1,2,3-cd) pyrene	< 10.	ug/l	10.	069300000N
isodrin	< 10.	ug/l	10.	128200000N
isophorone	< 10.	ug/l	10.	069400000N
isosafrole	< 10.	ug/l	10.	128300000N
3-methylcholanthrene	< 10.	ug/l	10.	128400000N
methyl methanesulfonate	< 10.	ug/l	10.	128500000N
2-methylnaphthalene	< 10.	ug/l	10.	093100000N
naphthalene	< 10.	ug/l	10.	069500000N
1,4-naphthoquinone *	< 10.	ug/l	10.	128600000N
1-naphthylamine	< 10.	ug/l	10.	128700000N
2-naphthylamine	< 20.	ug/l	20.	128800000N
2-nitroaniline	< 50.	ug/l	50.	093300000N
3-nitroaniline	< 50.	ug/l	50.	093400000N
4-nitroaniline	< 50.	ug/l	50.	093600000N
nitrobenzene	< 10.	ug/l	10.	069600000N
2-nitrophenol	< 10.	ug/l	10.	065100000N
4-nitrophenol	< 50.	ug/l	50.	065200000N
4-nitroquinoline 1-oxide *	< 10.	ug/l	10.	128900000N
N-nitrosodi-n-butylamine	< 10.	ug/l	10.	129000000N
N-nitrosodiethylamine	< 10.	ug/l	10.	129100000N
N-nitrosodimethylamine	< 10.	ug/l	10.	069700000N

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Revieved and Approved by:

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Manager, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

See reverse side for explanations of codes and abbreviations.

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Lancaster Laboratories, Inc.
2425 Nev Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
N-nitrosodiphenylamine	< 10.	ug/l	10.	069900000N
N-nitrosodi-n-propylamine	< 10.	ug/l	10.	069800000N
N-nitrosomethylethylamine	< 10.	ug/l	10.	129200000N
N-nitrosomorpholine	< 20.	ug/l	20.	129300000N
N-nitrosopiperidine	< 10.	ug/l	10.	129400000N
N-nitrosopyrrolidine	< 10.	ug/l	10.	129500000N
5-nitro-o-toluidine	< 10.	ug/l	10.	129600000N
pentachlorobenzene	< 10.	ug/l	10.	129700000N
pentachloronitrobenzene	< 10.	ug/l	10.	129800000N
pentachlorophenol	< 50.	ug/l	50.	065400000N
phenacetin	< 10.	ug/l	10.	129900000N
phenanthrene	< 10.	ug/l	10.	070000000N
phenol	< 10.	ug/l	10.	065500000N
p-phenylenediamine *	< 10.	ug/l	10.	130000000N
2-picoline	< 10.	ug/l	10.	130100000N
pronamide	< 10.	ug/l	10.	130200000N
pyrene	< 10.	ug/l	10.	070100000N
pyridine	< 10.	ug/l	10.	033100000N
safrole	< 10.	ug/l	10.	130300000N
1,2,4,5-tetrachlorobenzene	< 10.	ug/l	10.	130400000N
2,3,4,6-Tetrachlorophenol	< 10.	ug/l	10.	043800000N
tetraethyl dithiopyrophosphate	< 10.	ug/l	10.	130500000N
o-toluidine	< 10.	ug/l	10.	130600000N
1,2,4-trichlorobenzene	< 10.	ug/l	10.	070200000N
2,4,5-trichlorophenol	< 25.	ug/l	25.	093200000N
2,4,6-trichlorophenol	< 10.	ug/l	10.	065600000N
0,0,0-triethylphosphorothioate	< 10.	ug/l	10.	130700000N
sym-trinitrobenzene	< 20.	ug/l	20.	130800000N

* Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported.

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Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
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717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
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AppendixIX Herbicide Compounds	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
2,4-D	< 1.	ug/l	1.	028800000N
Dinoseb	< 1.	ug/l	1.	131400000N
2,4,5-TP	< 1.	ug/l	1.	028900000N
2,4,5-T	< 1.	ug/l	1.	131500000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCB's

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLB
Time Collected 0800
P.O.
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Appendix IX Organophosphates	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Disulfoton	< 0.05	ug/l	0.05	131700000N
Methyl Parathion	< 0.02	ug/l	0.02	063400000N
Ethyl Parathion	< 0.02	ug/l	0.02	063500000N
Famphur	< 2.	ug/l	2.	131800000N
Phorate	< 0.1	ug/l	0.1	131900000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCB's

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Aqueous Sample

LLI Sample No. WW 1562477
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLB
Time Collected 0800
P.O.
Rel.

	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Appendix IX Organochlorines				
Aldrin	< 0.01	ug/l	0.01	045500000N
Alpha BHC	< 0.01	ug/l	0.01	060900000N
Beta BHC	< 0.01	ug/l	0.01	061000000N
Delta BHC	< 0.01	ug/l	0.01	061200000N
Gamma BHC - Lindane	< 0.01	ug/l	0.01	061100000N
Chlordane	< 0.05	ug/l	0.05	062500000N
DDT	< 0.01	ug/l	0.01	047800000N
DDE	< 0.01	ug/l	0.01	061600000N
DDD	< 0.01	ug/l	0.01	061700000N
Dieldrin	< 0.01	ug/l	0.01	046900000N
Endosulfan I	< 0.01	ug/l	0.01	062700000N
Endosulfan II	< 0.01	ug/l	0.01	062800000N
Endosulfan Sulfate	< 0.03	ug/l	0.03	062900000N
Endrin	< 0.01	ug/l	0.01	047700000N
Endrin Aldehyde	< 0.1	ug/l	0.1	063800000N
Heptachlor	< 0.01	ug/l	0.01	045400000N
Heptachlor Epoxide	< 0.01	ug/l	0.01	061500000N
Kepone	< 0.05	ug/l	0.05	132100000N
Methoxychlor	< 0.05	ug/l	0.05	062100000N
PCB-1016	< 1.	ug/l	1.	063900000N
PCB-1221	< 1.	ug/l	1.	064000000N
PCB-1232	< 1.	ug/l	1.	064100000N
PCB-1242	< 1.	ug/l	1.	064200000N
PCB-1248	< 1.	ug/l	1.	064300000N
PCB-1254	< 1.	ug/l	1.	064400000N
PCB-1260	< 1.	ug/l	1.	064500000N
Toxaphene	< 2.	ug/l	2.	062600000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCBs

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

ANALYSIS	RESULT AS RECEIVED	LIMIT OF QUANTITATION	LAB CODE
Appendix IX Volatile Compounds	attached		126541500
AppendixIX Vol.Compounds con't	attached		126600000
Appendix IX Semi-volatiles	attached		130980000
App. IX Semi-volatiles con't	attached		131000000
App. IX Semi-volatiles con't	attached		131100000
App. IX Semi-volatiles con't	attached		131200000
AppendixIX Herbicide Compounds	attached		131619000
Appendix IX Organophosphates	attached		132016500
Appendix IX Organochlorines	attached		132225000

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Questions? Contact Environmental Client Services at (717) 656-2301

135 00649 0.00 182000

Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Example Report - Solid Sample

Appendix IX Volatile Compounds	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Chloromethane	< 10.	ug/kg	10.	125800000N
Bromomethane	< 10.	ug/kg	10.	125700000N
Vinyl Chloride	< 10.	ug/kg	10.	082900000N
Dichlorodifluoromethane	< 5.	ug/kg	5.	049800000N
Chloroethane	< 10.	ug/kg	10.	083000000N
Methyl iodide	< 5.	ug/kg	5.	126000000N
Acrolein	< 100.	ug/kg	100.	082400000N
Acrylonitrile	< 100.	ug/kg	100.	082500000N
Acetonitrile	< 100.	ug/kg	100.	124900000N
Methylene Chloride	< 5.	ug/kg	5.	083100000N
Acetone	< 100.	ug/kg	100.	091400000N
Trichlorofluoromethane	< 5.	ug/kg	5.	126400000N
Carbon Disulfide	< 100.	ug/kg	100.	091500000N
Propionitrile	< 100.	ug/kg	100.	126300000N
1,1-Dichloroethene	< 5.	ug/kg	5.	083200000N
Allyl chloride	< 5.	ug/kg	5.	125000000N
1,1-Dichloroethane	< 5.	ug/kg	5.	083300000N
trans-1,2-Dichloroethene	< 5.	ug/kg	5.	083400000N
Chloroform	< 5.	ug/kg	5.	083500000N
1,2-Dichloroethane	< 5.	ug/kg	5.	083600000N
Methacrylonitrile	< 100.	ug/kg	100.	125600000N
2-Butanone	< 100.	ug/kg	100.	031600000N
Dibromomethane	< 5.	ug/kg	5.	125900000N
1,1,1-Trichloroethane	< 5.	ug/kg	5.	083700000N
1,4-dioxane	< 100.	ug/kg	100.	125300000N

* Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported. The sample was preserved with 1 + 1 HCl to pH < 2. Low recovery of acid labile compounds, such as 2-chloroethyl vinyl ether, is likely to occur.

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

AppendixIX Vol.Compounds con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Carbon Tetrachloride	< 5.	ug/kg	5.	083800000N
Isobutyl alcohol	< 100.	ug/kg	100.	125500000N
Vinyl Acetate	< 50.	ug/kg	50.	091700000N
Bromodichloromethane	< 5.	ug/kg	5.	083900000N
2-Chloro-1,3-Butadiene	< 5.	ug/kg	5.	125100000N
1,2-Dichloropropane	< 5.	ug/kg	5.	084000000N
trans-1,3-Dichloropropene	< 5.	ug/kg	5.	084100000N
Trichloroethene	< 5.	ug/kg	5.	084200000N
Dibromochloromethane	< 5.	ug/kg	5.	084600000N
1,1,2-Trichloroethane	< 5.	ug/kg	5.	084500000N
1,2-Dibromoethane	< 5.	ug/kg	5.	113000000N
Benzene	< 5.	ug/kg	5.	084300000N
cis-1,3-Dichloropropene	< 5.	ug/kg	5.	084400000N
Methyl methacrylate	< 5.	ug/kg	5.	126100000N
1,1,1,2-Tetrachloroethane	< 5.	ug/kg	5.	032800000N
Bromoform	< 5.	ug/kg	5.	084700000N
trans-1,4-dichloro-2-butene	< 100.	ug/kg	100.	125200000N
1,2,3-Trichloropropane	< 5.	ug/kg	5.	098800000N
2-Hexanone	< 50.	ug/kg	50.	091800000N
4-Methyl-2-Pentanone	< 50.	ug/kg	50.	091900000N
Tetrachloroethene	< 5.	ug/kg	5.	084800000N
1,1,2,2-Tetrachloroethane	< 5.	ug/kg	5.	084900000N
Toluene	< 5.	ug/kg	5.	085000000N
Ethyl methacrylate	< 5.	ug/kg	5.	125400000N
Chlorobenzene	< 5.	ug/kg	5.	085100000N
Pentachloroethane *	< 10.	ug/kg	10.	126200000N
Ethylbenzene	< 5.	ug/kg	5.	085200000N
1,2-Dibromo-3-chloropropane	< 100.	ug/kg	100.	100100000N
Styrene	< 5.	ug/kg	5.	092000000N
Xylenes (total)	< 5.	ug/kg	5.	092100000N

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Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Appendix IX Semi-volatiles	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
acenaphthene	< 330.	ug/kg	330.	065700000N
acenaphthylene	< 330.	ug/kg	330.	065800000N
acetophenone	< 330.	ug/kg	330.	126700000N
2-acetylaminofluorene	< 330.	ug/kg	330.	126800000N
4-aminobiphenyl	< 330.	ug/kg	330.	126900000N
aniline	< 330.	ug/kg	330.	092500000N
anthracene	< 330.	ug/kg	330.	065900000N
benzo (a) anthracene	< 330.	ug/kg	330.	066100000N
benzo (b) fluoranthene	< 330.	ug/kg	330.	066300000N
benzo (K) fluoranthene	< 330.	ug/kg	330.	066500000N
benzo (ghi) perylene	< 330.	ug/kg	330.	066400000N
benzo (a) pyrene	< 330.	ug/kg	330.	066200000N
benzyl alcohol	< 330.	ug/kg	330.	092600000N
bis (2-chloroethoxy) methane	< 330.	ug/kg	330.	066600000N
bis (2-chloroethyl) ether	< 330.	ug/kg	330.	066700000N
bis(2chlorolmethylethyl)ether	< 330.	ug/kg	330.	127100000N
bis (2-ethylhexyl) phthalate	< 330.	ug/kg	330.	066900000N
4-bromophenyl phenyl ether	< 330.	ug/kg	330.	067000000N
butyl benzyl phthalate	< 330.	ug/kg	330.	067100000N
4-chloroaniline	< 330.	ug/kg	330.	093000000N
chlorobenzilate	< 330.	ug/kg	330.	127200000N
4-chloro-3-methylphenol	< 330.	ug/kg	330.	065300000N
2-chloronaphthalene	< 330.	ug/kg	330.	067200000N
2-chlorophenol	< 330.	ug/kg	330.	064600000N
4-chlorophenyl phenyl ether	< 330.	ug/kg	330.	067300000N
chrysene	< 330.	ug/kg	330.	067400000N
o-cresol	< 330.	ug/kg	330.	032900000N
m-cresol and p-cresol	< 330.	ug/kg	330.	033000000N

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Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
diallate	< 330.	ug/kg	330.	131300000N
dibenzofuran	< 330.	ug/kg	330.	093500000N
di-n-butyl phthalate	< 330.	ug/kg	330.	068200000N
dibenz (a,h) anthracene	< 330.	ug/kg	330.	067500000N
1,2-dichlorobenzene	< 330.	ug/kg	330.	067600000N
1,3-dichlorobenzene	< 330.	ug/kg	330.	067700000N
1,4-dichlorobenzene	< 330.	ug/kg	330.	067800000N
3,3'-dichlorobenzidine	< 670.	ug/kg	670.	067900000N
2,4-dichlorophenol	< 330.	ug/kg	330.	064700000N
2,6-dichlorophenol	< 330.	ug/kg	330.	127300000N
diethyl phthalate	< 330.	ug/kg	330.	068000000N
dimethoate *	< 330.	ug/kg	330.	127400000N
p-(dimethylamino)azobenzene	< 330.	ug/kg	330.	127500000N
7,12-dimethlbenz(a)anthracene*	< 330.	ug/kg	330.	127600000N
3,3'-dimethylbenzidine	< 330.	ug/kg	330.	127700000N
2,4-dimethylphenol	< 330.	ug/kg	330.	064800000N
dimethyl phthalate	< 330.	ug/kg	330.	068100000N
m-dinitrobenzene	< 330.	ug/kg	330.	127800000N
2-methyl-4,6-dinitrophenol	< 830.	ug/kg	830.	064900000N
2,4-dinitrophenol	< 830.	ug/kg	830.	065000000N
2,4-dinitrotoluene	< 330.	ug/kg	330.	068300000N
2,6-dinitrotoluene	< 330.	ug/kg	330.	068400000N
di-n-octyl phthalate	< 330.	ug/kg	330.	068500000N
diphenylamine	< 330.	ug/kg	330.	132700000N
ethyl methanesulfonate	< 330.	ug/kg	330.	127900000N
fluoranthene	< 330.	ug/kg	330.	068700000N
fluorene	< 330.	ug/kg	330.	068800000N

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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07:47:55 269394
DIS000 D 1 2
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
hexachlorobenzene	< 330.	ug/kg	330.	068900000N
hexachlorobutadiene	< 330.	ug/kg	330.	069000000N
hexachlorocyclopentadiene	< 330.	ug/kg	330.	069100000N
hexachloroethane	< 330.	ug/kg	330.	069200000N
hexachloropropene *	< 330.	ug/kg	330.	128100000N
indeno (1,2,3-cd) pyrene	< 330.	ug/kg	330.	069300000N
isodrin	< 330.	ug/kg	330.	128200000N
isophorone	< 330.	ug/kg	330.	069400000N
isosafrole	< 330.	ug/kg	330.	128300000N
3-methylcholanthrene	< 330.	ug/kg	330.	128400000N
methyl methanesulfonate	< 330.	ug/kg	330.	128500000N
2-methylnaphthalene	< 330.	ug/kg	330.	093100000N
naphthalene	< 330.	ug/kg	330.	069500000N
1,4-naphthoquinone *	< 330.	ug/kg	330.	128600000N
1-naphthylamine	< 330.	ug/kg	330.	128700000N
2-naphthylamine	< 670.	ug/kg	670.	128800000N
2-nitroaniline	< 1,700.	ug/kg	1,700.	093300000N
3-nitroaniline	< 1,700.	ug/kg	1,700.	093400000N
4-nitroaniline	< 1,700.	ug/kg	1,700.	093600000N
nitrobenzene	< 330.	ug/kg	330.	069600000N
2-nitrophenol	< 330.	ug/kg	330.	065100000N
4-nitrophenol	< 1,700.	ug/kg	1,700.	065200000N
4-nitroquinoline 1-oxide *	< 330.	ug/kg	330.	128900000N
N-nitrosodi-n-butylamine	< 330.	ug/kg	330.	129000000N
N-nitrosodiethylamine	< 330.	ug/kg	330.	129100000N
N-nitrosodimethylamine	< 330.	ug/kg	330.	069700000N

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Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

App. IX Semi-volatiles con't	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
N-nitrosodiphenylamine	< 330.	ug/kg	330.	069900000N
N-nitrosodi-n-propylamine	< 330.	ug/kg	330.	069800000N
N-nitrosomethylethylamine	< 330.	ug/kg	330.	129200000N
N-nitrosomorpholine	< 670.	ug/kg	670.	129300000N
N-nitrosopiperidine	< 330.	ug/kg	330.	129400000N
N-nitrosopyrrolidine	< 330.	ug/kg	330.	129500000N
5-nitro-o-toluidine	< 330.	ug/kg	330.	129600000N
pentachlorobenzene	< 330.	ug/kg	330.	129700000N
pentachloronitrobenzene	< 330.	ug/kg	330.	129800000N
pentachlorophenol	< 1,700.	ug/kg	1,700.	065400000N
phenacetin	< 330.	ug/kg	330.	129900000N
phenanthrene	< 330.	ug/kg	330.	070000000N
phenol	< 330.	ug/kg	330.	065500000N
p-phenylenediamine *	< 330.	ug/kg	330.	130000000N
2-picoline	< 330.	ug/kg	330.	130100000N
pronamide	< 330.	ug/kg	330.	130200000N
pyrene	< 330.	ug/kg	330.	070100000N
pyridine	< 330.	ug/kg	330.	033100000N
safrole	< 330.	ug/kg	330.	130300000N
1,2,4,5-tetrachlorobenzene	< 330.	ug/kg	330.	130400000N
2,3,4,6-Tetrachlorophenol	< 330.	ug/kg	330.	043800000N
tetraethyl dithiopyrophosphate	< 330.	ug/kg	330.	130500000N
o-toluidine	< 330.	ug/kg	330.	130600000N
1,2,4-trichlorobenzene	< 330.	ug/kg	330.	070200000N
2,4,5-trichlorophenol	< 830.	ug/kg	830.	093200000N
2,4,6-trichlorophenol	< 330.	ug/kg	330.	065600000N
0,0,0-triethylphosphorothioate	< 330.	ug/kg	330.	130700000N
sym-trinitrobenzene	< 670.	ug/kg	670.	130800000N

* Since this is either a highly reactive compound or because uncontaminated neat material is unavailable, semi-quantitative data only is reported.

1 COPY TO Louise Hess

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Timothy S. Oostdyk, B.A.
Manager GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

See reverse side for explanation of symbols and abbreviations.

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Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Example Report - Solid Sample

AppendixIX Herbicide Compounds	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
2,4-D	< 1.	mg/kg	1.	028800000N
Dinoseb	< 1.	mg/kg	1.	131400000N
2,4,5-TP	< 1.	mg/kg	1.	028900000N
2,4,5-T	< 1.	mg/kg	1.	131500000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Revieved and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCB

Lancaster Laboratories, Inc.
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00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

Example Report - Solid Sample

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Appendix IX Organophosphates	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Disulfoton	< 0.05	mg/kg	0.05	131700000N
Methyl Parathion	< 0.02	mg/kg	0.02	063400000N
Ethyl Parathion	< 0.02	mg/kg	0.02	063500000N
Famphur	< 2.	mg/kg	2.	131800000N
Phorate	< 0.1	mg/kg	0.1	131900000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCBs

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717-656-2301

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~~DIS000 D 1 2~~
00649 0

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

LLI Sample No. SW 1562478
Date Reported 8/20/90
Date Submitted 8/17/90
Discard Date 8/17/90
Collected 8/16/90 by MLH
Time Collected 0800
P.O.
Rel.

Example Report - Solid Sample

Appendix IX Organochlorines	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Aldrin	< 0.01	mg/kg	0.01	045500000N
Alpha BHC	< 0.01	mg/kg	0.01	060900000N
Beta BHC	< 0.01	mg/kg	0.01	061000000N
Delta BHC	< 0.01	mg/kg	0.01	061200000N
Gamma BHC - Lindane	< 0.01	mg/kg	0.01	061100000N
Chlordane	< 0.05	mg/kg	0.05	062500000N
DDT	< 0.01	mg/kg	0.01	047800000N
DDE	< 0.01	mg/kg	0.01	061600000N
DDD	< 0.01	mg/kg	0.01	061700000N
Dieldrin	< 0.01	mg/kg	0.01	046900000N
Endosulfan I	< 0.01	mg/kg	0.01	062700000N
Endosulfan II	< 0.01	mg/kg	0.01	062800000N
Endosulfan Sulfate	< 0.03	mg/kg	0.03	062900000N
Endrin	< 0.01	mg/kg	0.01	047700000N
Endrin Aldehyde	< 0.1	mg/kg	0.1	063800000N
Heptachlor	< 0.01	mg/kg	0.01	045400000N
Heptachlor Epoxide	< 0.01	mg/kg	0.01	061500000N
Kepone	< 0.05	mg/kg	0.05	132100000N
Methoxychlor	< 0.05	mg/kg	0.05	062100000N
PCB-1016	< 0.2	mg/kg	0.2	063900000N
PCB-1221	< 0.2	mg/kg	0.2	064000000N
PCB-1232	< 0.2	mg/kg	0.2	064100000N
PCB-1242	< 0.2	mg/kg	0.2	064200000N
PCB-1248	< 0.2	mg/kg	0.2	064300000N
PCB-1254	< 0.2	mg/kg	0.2	064400000N
PCB-1260	< 0.2	mg/kg	0.2	064500000N
Toxaphene	< 0.1	mg/kg	0.1	062600000N

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Respectfully Submitted
Lancaster Laboratories, Inc.
Reviewed and Approved by:

Charles J. Neslund, B.S.
Group Leader, Pesticides/PCB

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

5A

VOLATILE ORGANIC GC/MS TUNING AND MASS CALIBRATION - BROMOFLUOROBENZENE (BFB)

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >G131T BFB Injection Date: 08/13/90

Instrument ID: 03459 BFB Injection Time: 07:18

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) PACK

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	21.3
75	30.0 - 60.0% of mass 95	50.4
95	Base peak, 100% relative abundance	100.
96	5.0 - 9.0% of mass 95	6.2
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	Greater than 50.0% of mass 95	76.2
175	5.0 - 9.0% of mass 174	5.5 (7.2)1
176	Greater than 95.0%, but less than 101.0% of mass 174	75.7 (99.4)1
177	5.0 - 9.0% of mass 176	5.4 (7.1)2

1-Value is % mass 174 2-Value is % mass 176

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	CC	20PPB CHK	>G131S	08/13/90	07:55
02	METHODBLK	METHOD BLK	>G132B	08/13/90	09:22
03	WT107DL	1557718	>G1301	08/13/90	10:21
04	WTPTB	1558026	>G1302	08/13/90	11:03
05	WTPFB	1557722	>G1303	08/13/90	11:41
06	WT201	1557719	>G1304	08/13/90	12:18
07	WT014	1557720	>G1305	08/13/90	13:25
08	WT106	1557721	>G1307	08/13/90	14:31
09	GGSCN	1557937	>G1308	08/13/90	15:38
10	WTP13DL	1558025	>G1319	08/13/90	17:37
11	WT201	1557719	>G1314	08/13/90	18:55
12					
13					
14					
15					
16					
17					
18					
19					
20					

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2A

Lab Name: LANCASTER LABS Contract:

Lab Code: Case No: SAS No: SDG No:

	LLI SAMPLE NO.	S1 (DCE) #	S2 (TOL) #	S3 (BFB) #	OTHER	TOT OUT	COMMENTS
01	1559905	108	103	107			
02							
03	LAB QC						
04							
05	1559906	105	103	103			METHOD BLANK
06	1559899	106	104	108			UNSPIKED
07	1559900	109	101	104			MATRIX SPIKE
08	1559901	113	106	107			MATRIX SPIKE DUP
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

				QC LIMITS
S1	(DCE)	=	1,2-Dichloroethane-d4	76 - 114
S2	(TOL)	=	Toluene-d8	88 - 110
S3	(BFB)	=	Bromofluorobenzene	86 - 115

\# Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

METHODBLK

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: METHOD BLK

Sample wt/vol: 5.0(g/mL) mL Lab File ID: >G132B

Level: (low/med) LOW Date Received: 08/13/90

% Moisture: not dec. _____. Date Analyzed: 08/13/90

Column: (pack/cap) PACK Dilution Factor: 1.000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3--------	CHLOROMETHANE	10	U
74-83-9--------	BROMOMETHANE	10	U
75-01-4--------	VINYL CHLORIDE	10	U
75-00-3--------	CHLOROETHANE	10	U
107-08-8-------	ACROLEIN	100	U
107-13-1-------	ACRYLONITRILE	100	U
75-09-2--------	METHYLENE CHLORIDE	1	J
75-69-4--------	TRICHLOROFLUOROMETHANE	5	U
75-35-4--------	1,1-DICHLOROETHENE	5	U
75-34-3--------	1,1-DICHLOROETHANE	5	U
540-59-0-------	TRANS-1,2-DICHLOROETHENE	5	U
67-66-3--------	CHLOROFORM	5	U
107-06-2-------	1,2-DICHLOROETHANE	5	U
71-55-6--------	1,1,1-TRICHLOROETHANE	5	U
56-23-5--------	CARBON TETRACHLORIDE	5	U
75-27-4--------	BROMODICHLOROMETHANE	5	U
78-87-5--------	1,2-DICHLOROPROPANE	5	U
10061-02-6-----	TRANS-1,3-DICHLOROPROPENE	5	U
79-01-6--------	TRICHLOROETHENE	5	U
124-48-1-------	DIBROMOCHLOROMETHANE	5	U
79-00-5--------	1,1,2-TRICHLOROETHANE	5	U
10061-01-5-----	CIS-1,3-DICHLOROPROPENE	5	U
71-43-2--------	BENZENE	5	U
100-75-8-------	2-CHLOROETHYLVINYLETHER	10	U
75-25-2--------	BROMOFORM	5	U
79-34-5--------	1,1,2,2-TETRACHLOROETHANE	5	U
127-18-4-------	TETRACHLOROETHENE	5	U
108-88-3-------	TOLUENE	5	U
108-90-7-------	CHLOROBENZENE	5	U
100-41-4-------	ETHYLBENZENE	5	U

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS

SW846 METHOD 8240 SPIKE LEVEL: 20 UG/L AMT USED: 5.0

SAMPLE SPIKE LEVEL: 20.UG/L % MOISTURE 0. DILUTION: 1

SAMPLE: 1572095 R2N11 MS SAMPLE: 1572097 R2N11MS MSD SAMPLE: 1572099 R2N11MSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
CHLOROMETHANE	0.	24.	22.	118	108	9.00	1.0-273.0	YES
BROMOMETHANE	0.	7.	6.	35	28	22.00	1.0-242.0	YES
VINYL CHLORIDE	0.	20.	18.	98	92	6.00	1.0-251.0	YES
CHLOROETHANE	0.	19.	18.	96	91	5.00	NOT GIVEN	
ACROLEIN	0.	78.	93.	29	35	-19.00	NOT GIVEN	
ACRYLONITRILE	0.	199.	210.	75	80	-6.00	NOT GIVEN	
METHYLENE CHLORIDE	0.	21.	21.	103	107	-4.00	1.0-221.0	YES
TRICHLOROFLUOROMETHANE	0.	19.	20.	96	98	-2.00	17.0-181.0	YES
1,1-DICHLOROETHENE	0.	19.	20.	93	98	-5.00	1.0-234.0	YES
1,1-DICHLOROETHANE	2.	22.	23.	103	106	-3.00	59.0-155.0	YES
TRANS-1,2-DICHLOROETHENE	0.	19.	19.	94	95	-1.00	54.0-156.0	YES
CHLOROFORM	11.	31.	32.	98	103	-5.00	51.0-138.0	YES
1,2-DICHLOROETHANE	0.	21.	22.	105	112	-6.00	49.0-155.0	YES
1,1,1-TRICHLOROETHANE	15.	33.	35.	90	100	-10.00	52.0-162.0	YES
CARBON TETRACHLORIDE	0.	20.	21.	100	105	-5.00	70.0-140.0	YES
BROMODICHLOROMETHANE	0.	20.	21.	102	104	-2.00	35.0-155.0	YES
1,2-DICHLOROPROPANE	0.	22.	23.	109	113	-4.00	1.0-210.0	YES
TRANS-1,3-DICHLOROPROPENE	0.	8.	8.	76	71	7.00	17.0-183.0	YES
TRICHLOROETHENE	0.	20.	21.	102	107	-5.00	71.0-157.0	YES
DIBROMOCHLOROMETHANE	0.	19.	19.	97	96	1.00	53.0-149.0	YES
1,1,2-TRICHLOROETHANE	0.	21.	22.	106	108	-2.00	52.0-150.0	YES
CIS-1,3-DICHLOROPROPENE	0.	10.	9.	52	44	17.00	1.0-227.0	YES
BENZENE	0.	21.	21.	104	107	-3.00	37.0-151.0	YES
2-CHLOROETHYLVINYLETHER	0.	26.	28.	128	138	-8.00	1.0-305.0	YES
BROMOFORM	0.	19.	19.	94	97	-3.00	45.0-169.0	YES
1,1,2,2-TETRACHLOROETHANE	0.	21.	21.	106	107	-1.00	46.0-157.0	YES
TETRACHLOROETHENE	0.	21.	21.	104	107	-3.00	64.0-148.0	YES
TOLUENE	0.	23.	24.	115	120	-4.00	47.0-150.0	YES
CHLOROBENZENE	0.	22.	22.	110	112	-2.00	37.0-160.0	YES
ETHYLBENZENE	0.	24.	24.	120	119	1.00	37.0-162.0	YES

WATER VOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS

SW846 METHOD 8240 SPIKE LEVEL: 100 UG/L ANALYSIS 1508 = XYLENE

LCS SAMPLE NO: LCS 081790 LCS 08/17/90 BATCH 90223-413-12-83460-4

COMPOUND NAME	QCREF CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
CHLOROMETHANE	25.34	127	1.0- 273.0	YES
BROMOMETHANE	19.67	98	1.0- 242.0	YES
VINYL CHLORIDE	24.52	123	1.0- 251.0	YES
CHLOROETHANE	23.35	117	NOT GIVEN	
ACROLEIN	153.37	58	NOT GIVEN	
ACRYLONITRILE	252.11	95	NOT GIVEN	
METHYLENE CHLORIDE	16.46	82	1.0- 221.0	YES
TRICHLOROFLUOROMETHANE	20.77	104	17.0- 181.0	YES
1,1-DICHLOROETHENE	20.99	105	1.0- 234.0	YES
1,1-DICHLOROETHANE	22.43	112	59.0- 155.0	YES
TRANS-1,2-DICHLOROETHENE	21.25	106	54.0- 156.0	YES
CHLOROFORM	22.31	112	51.0- 138.0	YES
1,2-DICHLOROETHANE	22.60	113	49.0- 155.0	YES
1,1,1-TRICHLOROETHANE	19.58	98	52.0- 162.0	YES
CARBON TETRACHLORIDE	20.71	104	70.0- 140.0	YES
BROMODICHLOROMETHANE	20.48	102	35.0- 155.0	YES
1,2-DICHLOROPROPANE	21.31	107	1.0- 210.0	YES
TRANS-1,3-DICHLOROPROPENE	18.35	94	17.0- 183.0	YES
TRICHLOROETHENE	20.53	103	71.0- 157.0	YES
DIBROMOCHLOROMETHANE	18.56	93	53.0- 149.0	YES
1,1,2-TRICHLOROETHANE	20.28	101	52.0- 150.0	YES
CIS-1,3-DICHLOROPROPENE	19.10	95	1.0- 227.0	YES
BENZENE	20.93	105	37.0- 151.0	YES
2-CHLOROETHYLVINYLETHER	19.20	96	1.0- 305.0	YES
BROMOFORM	16.73	84	45.0- 169.0	YES
1,1,2,2-TETRACHLOROETHANE	19.05	95	46.0- 157.0	YES
TETRACHLOROETHENE	20.76	104	64.0- 148.0	YES
TOLUENE	22.57	113	47.0- 150.0	YES
CHLOROBENZENE	21.62	108	37.0- 160.0	YES
ETHYLBENZENE	21.71	109	37.0- 162.0	YES
XYLENE(TOTAL)	20.62	103	NOT GIVEN	

8A

VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID (Standard): PG2251 Date Analyzed: 08/22/90

Instrument ID: 03460 Time Analyzed: 11:29

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) PACK

		IS1(BCM) AREA #	RT	IS2(DFB) AREA #	RT	IS3(CBZ) AREA #	RT
	12 HOUR STD	39197	6.67	131292	14.81	103937	18.70
	UPPER LIMIT	78394		262584		207874	
	LOWER LIMIT	19598		65646		51968	
	EPA SAMPLE NO.						
01	MDBLK	31634	6.71	106727	14.84	86566	18.73
02	00040	30626	6.70	104964	14.83	84823	18.72
03	040MS	28505	6.68	99552	14.81	82060	18.71
04	40MSD	28284	6.66	104799	14.84	80612	18.69
05	041SW	28229	6.70	97601	14.84	79476	18.69
06	041FB	26954	6.72	96445	14.85	78180	18.71
07	CHDTB	26904	6.68	96135	14.85	77409	18.71
08	W2GGS	27689	6.71	98072	14.85	80456	18.74
09	W3GGS	27139	6.69	96426	14.82	78687	18.71
10	ASEWS	26290	6.70	91816	14.84	75534	18.69
11	OTWGS	27084	6.70	94747	14.83	80840	18.68
12							
13							
14							
15							
16							
17							
18							
19							
20							

IS1 (BCM) = Bromochloromethane
IS2 (DFB) = 1,4-Difluorobenzene
IS3 (CBZ) = Chlorobenzene-d5

UPPER LIMIT = + 100% of internal standard area.
LOWER LIMIT = - 50% of internal standard area.

Column used to flag internal standard area values with an asterisk

6A

VOLATILE ORGANICS INITIAL CALIBRATION DATA

ab Name: LANCASTER LABS Contract: _____.

.ab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

nstrument ID: 03459 Calibration Date(s): 08/20/90 08/20/90

atrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) PACK

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF20 = >G205S RRF50 = >G204S
RRF100= >G203S RRF150= >G202S RRF200= >G201S

COMPOUND	RRF20	RRF50	RRF100	RRF150	RRF200	RRF	% RSD
CHLOROMETHANE #	.533	.462	.463	.439	.449	.469	7.9#
BROMOMETHANE	1.101	.884	.755	.737	.730	.841	18.8
VINYL CHLORIDE *	.682	.610	.609	.575	.567	.608	7.5*
CHLOROETHANE	.436	.393	.396	.393	.400	.404	4.6
ACROLEIN	.080	.075	.074	.092	.098	.084	12.8
ACRYLONITRILE	.211	.179	.200	.200	.174	.193	8.0
METHYLENE CHLORIDE	.695	.566	.608	.614	.594	.615	7.8
TRICHLOROFLUOROMETHANE	2.412	2.229	2.477	2.491	2.380	2.398	4.4
1,1-DICHLOROETHENE *	.858	.790	.863	.873	.835	.844	3.9*
1,1-DICHLOROETHANE #	1.710	1.494	1.656	1.662	1.607	1.626	5.1#
TRANS-1,2-DICHLOROETHENE	1.006	.893	.994	.994	.980	.973	4.7
CHLOROFORM *	2.432	2.125	2.308	2.355	2.300	2.304	4.9*
1,2-DICHLOROETHANE	1.640	1.449	1.583	1.596	1.532	1.560	4.7
1,1,1-TRICHLOROETHANE	.569	.525	.573	.594	.599	.572	5.1
CARBON TETRACHLORIDE	.550	.522	.578	.600	.600	.570	5.9
BROMODICHLOROMETHANE	.648	.602	.652	.672	.687	.652	4.9
1,2-DICHLOROPROPANE *	.282	.251	.271	.274	.267	.269	4.3*
TRANS-1,3-DICHLOROPROPENE	.437	.389	.432	.444	.442	.429	5.3
TRICHLOROETHENE	.375	.342	.369	.374	.374	.367	3.8
DIBROMOCHLOROMETHANE	.649	.595	.670	.695	.689	.659	6.2
1,1,2-TRICHLOROETHANE	.334	.297	.319	.326	.312	.318	4.4
CIS-1,3-DICHLOROPROPENE	.453	.414	.461	.489	.485	.461	6.5
BENZENE	.682	.601	.639	.647	.632	.640	4.6
2-CHLOROETHYLVINYLETHER	.104	.125	.130	.150	.138	.129	13.3
BROMOFORM #	.432	.411	.473	.493	.483	.458	7.7#
1,1,2,2-TETRACHLOROETHANE #	.656	.572	.626	.630	.560	.609	6.7#
TETRACHLOROETHENE	.393	.352	.379	.385	.379	.378	4.1
TOLUENE *	.637	.541	.580	.583	.567	.581	6.0*
CHLOROBENZENE #	.947	.822	.882	.902	.893	.889	5.1#
ETHYLBENZENE *	.427	.381	.412	.420	.408	.410	4.3*

6A

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Instrument ID: 03459 Calibration Date(s): 08/20/90 08/20/90

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) PACK

Min $\overline{RRF}$ for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF20 = >G205S RRF50 = >G204S
RRF100= >G203S RRF150= >G202S RRF200= >G201S

COMPOUND	RRF20	RRF50	RRF100	RRF150	RRF200	$\overline{RRF}$	% RSD
METHYL-T-BUTYL ETHER	2.355	2.084	2.321	2.356	2.177	2.259	5.4
T-BUTYL ALCOHOL	.090	.078	.084	.084	.069	.081	9.7
DICHLORODIFLUOROMETHANE	2.093	1.703	1.840	1.739	1.677	1.811	9.4
3-CHLORO-1-PROPENE	.893	.722	.839	.841	.833	.826	7.6
2-BUTANONE	.096	.077	.087	.088	.070	.083	12.1
1,4-DIOXANE	.003	.003	.003	.003	.002	.003	7.9
1,2-DIBROMOETHANE	.575	.477	.554	.562	.541	.542	7.0
DI-ISOPROPYL ETHER	.750	.607	.705	.677	.684	.685	7.6
1,1,1,2-TETRACHLOROETHANE	.420	.351	.409	.428	.440	.410	8.5
1,2,3-TRICHLOROPROPANE	.406	.338	.368	.375	.338	.365	7.8
4-METHYL-2-PENTANONE	.278	.244	.290	.298	.259	.274	8.1
1,2-DIBROMO-3-CHLOROPROPANE	.181	.163	.191	.198	.182	.183	7.1
CUMENE	1.647	1.379	1.534	1.601	1.620	1.556	6.9
XYLENE(TOTAL)	.499	.410	.471	.480	.491	.470	7.5
1,3-DICHLOROBENZENE	.958	.787	.929	.920	.958	.910	7.8
1,2-DICHLOROBENZENE	.918	.749	.917	.887	.895	.873	8.1
1,4-DICHLOROBENZENE	.990	.795	.893	.936	.962	.915	8.3
1,2-DICHLOROETHANE-D4	1.532	1.498	1.467	1.489	1.450	1.487	2.1
TOLUENE-D8	1.158	1.094	1.081	1.097	1.075	1.101	3.0
4-BROMOFLUOROBENZENE	.804	.747	.729	.725	.729	.747	4.4

7A

VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Instrument ID: 03459 Calibration Date: 09/18/90 Time: 09:13

Lab File ID: >S181S Init. Calib. Date(s): 08/20/90 08/20/90

Matrix: (soil/water) WATER Level: (low/med) LOW Column: (pack/cap) PACK

On RRF100 for SPCC(#) = 0.300 (0.250 for Bromoform) Mx %D for CCC(*) = 25.0%

COMPOUND		RRF	RRF100	%D	
CHLOROMETHANE	#	.469	.443	5.6	#
BROMOMETHANE		.841	.948	-12.7	
VINYL CHLORIDE	*	.608	.584	4.0	*
CHLOROETHANE		.404	.381	5.7	
ACROLEIN		.084	.065	22.6	
ACRYLONITRILE		.193	.185	4.1	
METHYLENE CHLORIDE		.615	.556	9.6	
TRICHLOROFLUOROMETHANE		2.398	2.677	-11.7	
1,1-DICHLOROETHENE	*	.844	.924	-9.6	*
1,1-DICHLOROETHANE	#	1.626	1.620	.3	#
TRANS-1,2-DICHLOROETHENE		.973	1.010	-3.8	
CHLOROFORM	*	2.304	2.386	-3.5	*
1,2-DICHLOROETHANE		1.560	1.477	5.3	
1,1,1-TRICHLOROETHANE		.572	.652	-14.0	
CARBON TETRACHLORIDE		.570	.614	-7.7	
BROMODICHLOROMETHANE		.652	.678	-3.9	
1,2-DICHLOROPROPANE	*	.269	.285	-5.9	*
TRANS-1,3-DICHLOROPROPENE		.429	.425	.9	
TRICHLOROETHENE		.367	.416	-13.5	
DIBROMOCHLOROMETHANE		.659	.726	-10.1	
1,1,2-TRICHLOROETHANE		.318	.343	-7.9	
CIS-1,3-DICHLOROPROPENE		.461	.475	-3.1	
BENZENE		.640	.673	-5.1	
2-CHLOROETHYLVINYLETHER		.129	.178	-37.4	
BROMOFORM	#	.458	.510	-11.1	#
1,1,2,2-TETRACHLOROETHANE	#	.609	.659	-8.2	#
TETRACHLOROETHENE		.378	.452	-19.7	
TOLUENE	*	.581	.627	-7.8	*
CHLOROBENZENE	#	.889	.939	-5.7	#
ETHYLBENZENE	*	.410	.426	-4.0	*
1,2-DICHLOROETHANE-D4		1.487	1.429	3.9	
TOLUENE-D8		1.101	1.130	-2.6	
4-BROMOFLUOROBENZENE		.747	.820	-9.7	

5B

SEMIVOLATILE ORGANIC GC/MS TUNING AND MASS CALIBRATION - DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >U8400 DFTPP Injection Date: 06/22/90

Instrument ID: 02861 DFTPP Injection Time: 13:36

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 60.0% of mass 198	43.0
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	62.5
70	Less than 2.0% of mass 69	0.0 (0.0)1
127	40.0 - 60.0% of mass 198	41.4
197	Less than 1.0% of mass 198	0.0
198	Base Peak, 100% relative abundance	100.
199	5.0 to 9.0% of mass 198	6.4
275	10.0 - 30.0% of mass 198	23.6
365	Greater than 1.00% of mass 198	1.96
441	Present, but less than mass 443	6.0
442	Greater than 40.0% of mass 198	41.8
443	17.0 - 23.0% of mass 442	7.9 (19.0)2

1-Value is % mass 69 2-Value is % mass 442

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	SSTD160	APP9	>U8401	06/22/90	14:01
02	SSTD120	APP9	>U8402	06/22/90	14:59
03	SSTD80	APP9	>U8403	06/22/90	15:57
04	SSTD20	APP9	>U8404	06/22/90	16:55
05	SSTD50	APP9	>U8405	06/22/90	17:53
06	SBLKWC1736	SBLKWC173	>F8400	06/22/90	18:52
07	173WACLCS	173WACLCS	>F8401	06/22/90	19:50
08	173WACUS	173WACUS	>F8402	06/22/90	20:48
09	173WACMS	173WACMS	>F8403	06/22/90	21:46
10	173WACMSD	173WACMSD	>F8404	06/22/90	22:44
11	WE13A	1536723	>F8405	06/22/90	23:42
12	2886-103	1537917	>F8406	06/23/90	00:41
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

2C

WATER SEMIVOLATILE SURROGATE RECOVERY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
01	SBLKWC2561	85	65	109	39	60	102		0
02	R2N11	93	87	109	41	63	108		0
03	R2N11MS	95	93	113	36	58	122		0
04	R2N11MSD	91	92	114	36	58	118		0
05	777A	93	86	105	38	60	83		0
06									
07									
08									
09									
10									
11									
12									
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28									
29									
30									

	QC LIMITS
S1 (NBZ) = Nitrobenzene-d5	(35-114)
S2 (FBP) = 2-Fluorobiphenyl	(43-116)
S3 (TPH) = Terphenyl-d14	(33-141)
S4 (PHL) = Phenol-d6	(10-94)
S5 (2FP) = 2-Fluorophenol	(21-100)
S6 (TBP) = 2,4,6-Tribromophenol	(10-123)

Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogates diluted out

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWC2265

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: 1559886

Sample wt/vol: 1000.(g/mL) ML Lab File ID: >E2600

Level: (low/med). LOW Date Received: 08/10/90

% Moisture: not dec. _____. dec. _____. Date Extracted: 08/14/90

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/15/90

GPC Cleanup: (Y/N) N pH: _____. Dilution Factor: 1.000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
110-86-1	Pyridine	10	U
109-06-8	2-Picoline	10	U
10595-95-6	N-Nitrosomethylethylamine	10	U
66-27-3	Methylmethanesulfonate	10	U
55-18-5	N-Nitrosodiethylamine	10	U
62-50-0	Ethyl methanesulfonate	10	U
62-53-3	Aniline	10	U
95-53-4	o-Toluidine	10	U
930-55-2	N-Nitrosopyrolidine	10	U
59-89-2	N-Nitrosomorpholine	20	U
98-86-2	Acetophenone	10	U
100-75-4	N-Nitrosopiperdine	10	U
126-68-1	O,O,O-triethylphosphorothioa	10	U
1888-71-7	Hexachloropropene	10	U
106-50-3	1,4-Phenylenediamine	10	U
924-16-3	N-Nitrosodi-n-butylamine	10	U
94-59-7	Safrole	10	U
95-94-3	1,2,4,5-Tetrachlorobenzene	10	U
62-44-2	Phenacetin	10	U
120-58-1	Isosafrole	10	U
130-15-4	1,4-Naphthaquinone	10	U
608-93-5	Pentachlorobenzene	10	U
134-32-7	1-Naphthylamine	10	U
91-59-8	2-Naphthylamine	20	U
58-90-2	2,3,4,6-Tetrachlorophenol	10	U
99-55-8	5-Nitro-o-toluidine	10	U
122-39-4	Diphenylamine	10	U
3689-24-5	Tetraethyldithiopyrophosphat	10	U
2303-16-4	Diallate TRANS/CIS	10	U
99-35-4	1,3,5-Trinitrobenzene	20	U
60-51-5	Dimethoate	10	U
92-67-1	4-Aminobiphenyl	10	U
56-57-5	4-Nitroquinoline 1-oxide	20	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWC2265

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: 1559886

Sample wt/vol: 1000.(g/mL) ML Lab File ID: >E2600

Level: (low/med) LOW Date Received: 08/10/90

% Moisture: not dec. _____. dec. _____. Date Extracted: 08/14/90

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/15/90

GPC Cleanup: (Y/N) N pH: _____. Dilution Factor: 1.000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
82-63-8--------	Pentachloronitrobenzene	10	U
23950-58-5-----	Pronamide	10	U
465-73-6-------	Isodrin	10	U
510-15-6-------	Chlorobenzilate	10	U
53-96-3--------	2-Acetylaminofluorene	10	U
57-97-6--------	7,12-Dimethylbenz[a]anthrace	10	U
56-49-5--------	3-Methylcholanthrene	10	U

(1) - Cannot be separated from Diphenylamine

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWC2261

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: 1559886

Sample wt/vol: 1000.(g/mL) ML Lab File ID: >A5750

Level: (low/med) LOW Date Received: 08/10/90

% Moisture: not dec. _____. dec. _____. Date Extracted: 08/14/90

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/14/90

GPC Cleanup: (Y/N) N pH: _____. Dilution Factor: 1.000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
62-75-9	N-Nitrosodimethylamine	10	U
108-95-2	Phenol	10	U
111-44-4	bis(2-Chloroethyl)ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
100-51-6	Benzyl alcohol	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	bis(2-Chloroisopropyl)ether	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
65-85-0	Benzoic acid	50	U
111-91-1	bis(2-Chloroethoxy)methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	50	U
131-11-3	Dimethylphthalate	10	U
208-96-8	Acenaphthylene	10	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWC2261

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: 1559886

Sample wt/vol: 1000.(g/mL) ML Lab File ID: >A5750

Level: (low/med) LOW Date Received: 08/10/90

% Moisture: not dec. _____. dec. _____. Date Extracted: 08/14/90

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 08/14/90

GPC Cleanup: (Y/N) N pH: _____. Dilution Factor: 1.000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	50	U
83-32-9	Acenaphthene	10	U
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethylphthalate	10	U
7005-72-3	4-Chlorophenyl-phenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	50	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-Nitrosodiphenylamine (1)	10	U
101-55-3	4-Bromophenyl-phenylether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
84-74-2	Di-n-butylphthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butylbenzylphthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	20	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	bis(2-Ethylhexyl)phthalate	10	U
117-84-0	Di-n-octylphthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenz(a,h)anthracene	10	U
191-24-2	Benzo(g,h,i)perylene	10	U

(1) - Cannot be separated from Diphenylamine

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/ML AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L % MOISTURE 0. DILUTION: 1

US SAMPLE: 173WCUS 173WCUS MS SAMPLE: 173WCMS 173WCMS MSD SAMPLE: 173WCMSD 173WCMSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
N-Nitrosodimethylamine	0.	56.	44.	56	44	24.00	NOT GIVEN	
Phenol	0.	37.	32.	37	32	14.00	5.0-112.0	YES
bis(2-Chloroethyl)ether	0.	71.	65.	71	65	9.00	12.0-158.0	YES
2-Chlorophenol	0.	73.	64.	73	64	13.00	23.0-134.0	YES
1,3-Dichlorobenzene	0.	67.	54.	67	54	21.00	1.0-172.0	YES
1,4-Dichlorobenzene	0.	66.	56.	66	56	16.00	20.0-124.0	YES
1,2-Dichlorobenzene	0.	69.	57.	69	57	19.00	32.0-129.0	YES
2-Methylphenol	0.	48.	66.	48	66	-32.00	NOT GIVEN	
bis(2-Chloroisopropyl)ether	0.	72.	63.	72	63	13.00	36.0-166.0	YES
N-Nitroso-di-n-propylamine	0.	69.	63.	69	63	9.00	1.0-230.0	YES
Hexachloroethane	0.	54.	44.	54	44	20.00	40.0-113.0	YES
Nitrobenzene	0.	83.	74.	83	74	11.00	35.0-180.0	YES
Isophorone	0.	84.	80.	84	80	5.00	21.0-196.0	YES
2-Nitrophenol	0.	79.	70.	79	70	12.00	29.0-182.0	YES
2,4-Dimethylphenol	0.	64.	60.	64	60	6.00	32.0-119.0	YES
bis(2-Chloroethoxy)methane	0.	84.	81.	84	81	4.00	33.0-184.0	YES
2,4-Dichlorophenol	0.	77.	69.	77	69	11.00	39.0-135.0	YES
1,2,4-Trichlorobenzene	0.	74.	65.	74	65	13.00	44.0-142.0	YES
Naphthalene	0.	82.	74.	82	74	10.00	21.0-133.0	YES
Hexachlorobutadiene	0.	58.	48.	58	48	19.00	24.0-116.0	YES
4-Chloro-3-methylphenol	0.	81.	77.	81	77	5.00	22.0-147.0	YES
Hexachlorocyclopentadiene	0.	39.	37.	39	37	5.00	NOT GIVEN	
2,4,6-Trichlorophenol	0.	83.	79.	83	79	5.00	37.0-144.0	YES
2,4,5-Trichlorophenol	0.	75.	84.	75	84	-11.00	NOT GIVEN	
2-Chloronaphthalene	0.	100.	105.	100	105	-5.00	60.0-118.0	YES
2-Nitroaniline	0.	81.	92.	81	92	-13.00	NOT GIVEN	
Dimethylphthalate	0.	71.	73.	71	73	-3.00	1.0-112.0	YES
Acenaphthylene	0.	83.	84.	83	84	-1.00	33.0-145.0	YES
2,6-Dinitrotoluene	0.	90.	92.	90	92	-2.00	50.0-158.0	YES
3-Nitroaniline	0.	83.	94.	83	94	-12.00	NOT GIVEN	
Acenaphthene	0.	84.	86.	84	86	-2.00	47.0-145.0	YES
2,4-Dinitrophenol	0.	143.	140.	143	140	2.00	1.0-191.0	YES
4-Nitrophenol	0.	47.	40.	47	40	16.00	1.0-132.0	YES
2,4-Dinitrotoluene	0.	89.	91.	89	91	-2.00	39.0-139.0	YES
Diethylphthalate	0.	81.	86.	81	86	-6.00	1.0-114.0	YES
4-Chlorophenyl-phenylether	0.	77.	78.	77	78	-1.00	25.0-158.0	YES
Fluorene	0.	86.	87.	86	87	-1.00	59.0-121.0	YES
4-Nitroaniline	0.	106.	125.	106	125	-16.00	NOT GIVEN	
4,6-Dinitro-2-methylphenol	0.	118.	108.	118	108	9.00	1.0-181.0	YES

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/ML AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L % MOISTURE 0. DILUTION: 1

US SAMPLE: 173WCUS 173WCUS MS SAMPLE: 173WCMS 173WCMS MSD SAMPLE: 173WCMSD 173WCMSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
N-Nitrosodiphenylamine	0.	152.	156.	152	156	-3.00	NOT GIVEN	
4-Bromophenyl-phenylether	0.	86.	83.	86	83	4.00	53.0-127.0	YES
Hexachlorobenzene	0.	85.	80.	85	80	6.00	1.0-152.0	YES
Pentachlorophenol	0.	108.	104.	108	104	4.00	14.0-176.0	YES
Phenanthrene	0.	90.	86.	90	86	5.00	54.0-120.0	YES
Anthracene	0.	85.	83.	85	83	2.00	27.0-133.0	YES
Di-n-butylphthalate	0.	87.	85.	87	85	2.00	1.0-118.0	YES
Fluoranthene	0.	96.	97.	96	97	-1.00	26.0-137.0	YES
Pyrene	0.	85.	75.	85	75	13.00	52.0-115.0	YES
Butylbenzylphthalate	0.	79.	72.	79	72	9.00	1.0-152.0	YES
3,3'-Dichlorobenzidine	0.	105.	107.	105	107	-2.00	1.0-262.0	YES
Benzo(a)anthracene	0.	97.	90.	97	90	7.00	33.0-143.0	YES
Chrysene	0.	89.	86.	89	86	3.00	17.0-168.0	YES
bis(2-Ethylhexyl)phthalate	0.	87.	81.	87	81	7.00	8.0-158.0	YES
Di-n-octylphthalate	0.	100.	91.	100	91	9.00	4.0-146.0	YES
Benzo(b)fluoranthene	0.	98.	95.	98	95	3.00	24.0-159.0	YES
Benzo(k)fluoranthene	0.	94.	87.	94	87	8.00	11.0-163.0	YES
Benzo(a)pyrene	0.	96.	93.	96	93	3.00	17.0-163.0	YES
Indeno(1,2,3-cd)pyrene	0.	94.	93.	94	93	1.00	1.0-171.0	YES
Dibenz(a,h)anthracene	0.	100.	99.	100	99	1.00	1.0-227.0	YES
Benzo(g,h,i)perylene	0.	92.	92.	92	92	0.00	1.0-219.0	YES

COMMENTS:

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/ML AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L % MOISTURE 0. DILUTION: 1

US SAMPLE: 173WACUS 173WACUS MS SAMPLE: 173WACMS 173WACMS MSD SAMPLE: 173WACMSD 173WACMSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
Pyridine	0.	43.	35.	43	35	21.00	NOT GIVEN	
2-Picoline	0.	52.	47.	52	47	10.00	NOT GIVEN	
N-Nitrosomethylethylamine	0.	65.	59.	65	59	10.00	NOT GIVEN	
Methylmethanesulfonate	0.	63.	57.	63	57	10.00	NOT GIVEN	
N-Nitrosodiethylamine	0.	67.	69.	67	69	-3.00	NOT GIVEN	
Ethyl methanesulfonate	0.	71.	69.	71	69	3.00	NOT GIVEN	
Aniline	0.	105.	98.	105	98	7.00	NOT GIVEN	
N-Nitrosopyrolidine	0.	71.	69.	71	69	3.00	NOT GIVEN	
N-Nitrosomorpholine	0.	77.	72.	77	72	7.00	NOT GIVEN	
Acetophenone	0.	64.	66.	64	66	-3.00	NOT GIVEN	
N-Nitrosopiperdine	0.	83.	92.	83	92	-10.00	NOT GIVEN	
O,O,O-triethylphosphorothioate	0.	54.	61.	54	61	-12.00	NOT GIVEN	
2,6-Dichlorophenol	0.	76.	76.	76	76	0.00	NOT GIVEN	
Hexachloropropene	0.	41.	38.	41	38	8.00	NOT GIVEN	
1,4-Phenylenediamine	0.	0.	0.	0	0	32767.0	NOT GIVEN	
N-Nitrosodi-n-butylamine	0.	70.	82.	70	82	-16.00	NOT GIVEN	
Safrole	0.	60.	72.	60	72	-18.00	NOT GIVEN	
1,2,4,5-Tetrachlorobenzene	0.	49.	55.	49	55	-12.00	NOT GIVEN	
Phenacetin	0.	92.	104.	92	104	-12.00	NOT GIVEN	
Isosafrole	0.	61.	72.	61	72	-17.00	NOT GIVEN	
1,4-Naphthaquinone	0.	37.	45.	37	45	-20.00	NOT GIVEN	
1,3-Dinitrobenzene	0.	90.	99.	90	99	-10.00	NOT GIVEN	
Pentachlorobenzene	0.	62.	74.	62	74	-18.00	NOT GIVEN	
1-Naphthylamine	0.	47.	58.	47	58	-21.00	NOT GIVEN	
2-Naphthylamine	0.	71.	85.	71	85	-18.00	NOT GIVEN	
2,3,4,6-Tetrachlorophenol	0.	101.	101.	101	101	0.00	NOT GIVEN	
5-Nitro-o-toluidine	0.	97.	107.	97	107	-10.00	NOT GIVEN	
Diphenylamine	0.	130.	135.	130	135	-4.00	NOT GIVEN	
Tetraethyldithiopyrophosphate	0.	70.	81.	70	81	-15.00	NOT GIVEN	
Diallate TRANS/CIS	0.	157.	175.	157	175	-11.00	NOT GIVEN	
1,3,5-Trinitrobenzene	0.	58.	69.	58	69	-17.00	NOT GIVEN	
Dimethoate	0.	61.	66.	61	66	-8.00	NOT GIVEN	
4-Aminobiphenyl	0.	97.	106.	97	106	-9.00	NOT GIVEN	
4-Nitroquinoline 1-oxide	0.	143.	174.	143	174	-20.00	NOT GIVEN	
Pentachloronitrobenzene	0.	63.	73.	63	73	-15.00	NOT GIVEN	
Pronamide	0.	73.	80.	73	80	-9.00	NOT GIVEN	
Isodrin	0.	73.	78.	73	78	-7.00	NOT GIVEN	
p-Dimethylaminoazobenzene	0.	103.	107.	103	107	-4.00	NOT GIVEN	
Chlorobenzilate	0.	89.	87.	89	87	2.00	NOT GIVEN	

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/ML AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L % MOISTURE 0. DILUTION: 1

US SAMPLE: 173WACUS 173WACUS MS SAMPLE: 173WACMS 173WACMS MSD SAMPLE: 173WACMSD 173WACMSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
3,3'-Dimethylbenzidine	0.	39.	43.	39	43	-10.00	NOT GIVEN	
2-Acetylaminofluorene	0.	90.	96.	90	96	-6.00	NOT GIVEN	
7,12-Dimethylbenz[a]anthracene	0.	43.	46.	43	46	-7.00	NOT GIVEN	
3-Methylcholanthrene	0.	73.	81.	73	81	-10.00	NOT GIVEN	

COMMENTS: RECOVERY OF 1,4-PHENYLENE DIAMINE AT ZERO. TOTAL OXIDATION OF COMPOUND SUSPECTED DURING EXTRACTION PROCEDURES.

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 173WCLCS 173WCLCS

COMPOUND NAME	QCREF CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
N-Nitrosodimethylamine	59.43	59	NOT GIVEN	
Phenol	35.68	36	5.0- 112.0	YES
bis(2-Chloroethyl)ether	75.45	75	12.0- 158.0	YES
2-Chlorophenol	72.63	73	23.0- 134.0	YES
1,3-Dichlorobenzene	66.16	66	1.0- 172.0	YES
1,4-Dichlorobenzene	66.07	66	20.0- 124.0	YES
1,2-Dichlorobenzene	69.92	70	32.0- 129.0	YES
2-Methylphenol	57.15	57	NOT GIVEN	
bis(2-Chloroisopropyl)ether	75.49	75	36.0- 166.0	YES
N-Nitroso-di-n-propylamine	71.56	72	1.0- 230.0	YES
Hexachloroethane	51.44	51	40.0- 113.0	YES
Nitrobenzene	84.20	84	35.0- 180.0	YES
Isophorone	85.90	86	21.0- 196.0	YES
2-Nitrophenol	79.18	79	29.0- 182.0	YES
2,4-Dimethylphenol	69.24	69	32.0- 119.0	YES
bis(2-Chloroethoxy)methane	88.63	89	33.0- 184.0	YES
2,4-Dichlorophenol	76.69	77	39.0- 135.0	YES
1,2,4-Trichlorobenzene	73.64	74	44.0- 142.0	YES
Naphthalene	83.33	83	21.0- 133.0	YES
Hexachlorobutadiene	53.59	54	24.0- 116.0	YES
4-Chloro-3-methylphenol	80.30	80	22.0- 147.0	YES
Hexachlorocyclopentadiene	37.39	37	NOT GIVEN	
2,4,6-Trichlorophenol	83.18	83	37.0- 144.0	YES
2,4,5-Trichlorophenol	84.99	85	NOT GIVEN	
2-Chloronaphthalene	110.96	111	60.0- 118.0	YES
2-Nitroaniline	92.31	92	NOT GIVEN	
Dimethylphthalate	55.37	55	1.0- 112.0	YES
Acenaphthylene	87.77	88	33.0- 145.0	YES
2,6-Dinitrotoluene	93.58	94	50.0- 158.0	YES
3-Nitroaniline	89.28	89	NOT GIVEN	
Acenaphthene	88.64	89	47.0- 145.0	YES
2,4-Dinitrophenol	154.80	155	1.0- 191.0	YES
4-Nitrophenol	40.54	41	1.0- 132.0	YES
2,4-Dinitrotoluene	91.87	92	39.0- 139.0	YES
Diethylphthalate	78.27	78	1.0- 114.0	YES
4-Chlorophenyl-phenylether	82.63	83	25.0- 158.0	YES
Fluorene	89.72	90	59.0- 121.0	YES
4-Nitroaniline	113.38	113	NOT GIVEN	
4,6-Dinitro-2-methylphenol	118.08	118	1.0- 181.0	YES

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 173WCLCS 173WCLCS

COMPOUND NAME	QCREF CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
N-Nitrosodiphenylamine	163.78	164	NOT GIVEN	
4-Bromophenyl-phenylether	91.11	91	53.0- 127.0	YES
Hexachlorobenzene	86.44	86	1.0- 152.0	YES
Pentachlorophenol	111.23	111	14.0- 176.0	YES
Phenanthrene	92.50	92	54.0- 120.0	YES
Anthracene	88.92	89	27.0- 133.0	YES
Di-n-butylphthalate	87.27	87	1.0- 118.0	YES
Fluoranthene	97.76	98	26.0- 137.0	YES
Pyrene	86.83	87	52.0- 115.0	YES
Butylbenzylphthalate	75.29	75	1.0- 152.0	YES
3,3'-Dichlorobenzidine	108.24	108	1.0- 262.0	YES
Benzo(a)anthracene	98.24	98	33.0- 143.0	YES
Chrysene	91.07	91	17.0- 168.0	YES
bis(2-Ethylhexyl)phthalate	83.70	84	8.0- 158.0	YES
Di-n-octylphthalate	92.62	93	4.0- 146.0	YES
Benzo(b)fluoranthene	103.27	103	24.0- 159.0	YES
Benzo(k)fluoranthene	87.94	88	11.0- 163.0	YES
Benzo(a)pyrene	98.15	98	17.0- 163.0	YES
Indeno(1,2,3-cd)pyrene	100.69	101	1.0- 171.0	YES
Dibenz(a,h)anthracene	106.16	106	1.0- 227.0	YES
Benzo(g,h,i)perylene	98.84	99	1.0- 219.0	YES

COMMENTS:

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 173WACLCS 173WACLCS

COMPOUND NAME	QCREF CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
Pyridine	48.12	48	NOT GIVEN	
2-Picoline	62.74	63	NOT GIVEN	
N-Nitrosomethylethylamine	67.44	67	NOT GIVEN	
Methylmethanesulfonate	62.54	63	NOT GIVEN	
N-Nitrosodiethylamine	72.93	73	NOT GIVEN	
Ethyl methanesulfonate	72.41	72	NOT GIVEN	
Aniline	112.89	113	NOT GIVEN	
N-Nitrosopyrolidine	78.75	79	NOT GIVEN	
N-Nitrosomorpholine	85.72	86	NOT GIVEN	
Acetophenone	74.93	75	NOT GIVEN	
N-Nitrosopiperdine	99.02	99	NOT GIVEN	
O,O,O-triethylphosphorothioate	68.97	69	NOT GIVEN	
2,6-Dichlorophenol	80.37	80	NOT GIVEN	
Hexachloropropene	47.54	48	NOT GIVEN	
N-Nitrosodi-n-butylamine	86.85	87	NOT GIVEN	
Safrole	80.25	80	NOT GIVEN	
1,2,4,5-Tetrachlorobenzene	62.32	62	NOT GIVEN	
Phenacetin	107.49	107	NOT GIVEN	
Isosafrole	76.19	76	NOT GIVEN	
1,4-Naphthaquinone	5.84	6	NOT GIVEN	
1,3-Dinitrobenzene	102.47	102	NOT GIVEN	
Pentachlorobenzene	76.27	76	NOT GIVEN	
1-Naphthylamine	56.65	57	NOT GIVEN	
2-Naphthylamine	80.38	80	NOT GIVEN	
2,3,4,6-Tetrachlorophenol	108.32	108	NOT GIVEN	
5-Nitro-o-toluidine	112.31	112	NOT GIVEN	
Diphenylamine	142.39	142	NOT GIVEN	
Tetraethyldithiopyrophosphate	78.62	79	NOT GIVEN	
Diallate TRANS/CIS	170.60	171	NOT GIVEN	
1,3,5-Trinitrobenzene	60.15	60	NOT GIVEN	
Dimethoate	30.02	30	NOT GIVEN	
4-Aminobiphenyl	106.28	106	NOT GIVEN	
4-Nitroquinoline 1-oxide	156.61	157	NOT GIVEN	
Pentachloronitrobenzene	70.69	71	NOT GIVEN	
Pronamide	80.31	80	NOT GIVEN	
Isodrin	78.24	78	NOT GIVEN	
p-Dimethylaminoazobenzene	105.49	105	NOT GIVEN	
Chlorobenzilate	67.83	68	NOT GIVEN	
3,3'-Dimethylbenzidine	41.50	41	NOT GIVEN	

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 173WACLCS 173WACLCS

COMPOUND NAME	QCREF CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
2-Acetylaminofluorene	102.00	102	NOT GIVEN	
7,12-Dimethylbenz(a)anthracene	53.13	53	NOT GIVEN	
3-Methylcholanthrene	85.26	85	NOT GIVEN	

COMMENTS: 1,4-PHENYLENEDIAMINE NOT DETECTED
TOTAL OXIDATION OF COMPOUND SUSPECTED DURING EXTRACTION PROCEDURE

8B

SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID (Standard): >X8001 Date Analyzed: 09/13/90

Instrument ID: 01597 Time Analyzed: 10:41

		IS1(DCB) AREA	#	RT	IS2(NPT) AREA	#	RT	IS3(ANT) AREA	#	RT
	12 HOUR STD	38076		8.55	137790		12.23	75515		17.63
	UPPER LIMIT	76152			275580			151030		
	LOWER LIMIT	19038			68895			37758		
	EPA SAMPLE NO.									
01	SBLKWC2561	38972		8.55	152290		12.22	84900		17.63
02	R2N11	32611		8.54	132744		12.22	75310		17.64
03	R2N11MS	27574		8.55	99984		12.23	51404		17.64
04	R2N11MSD	31178		8.55	113624		12.23	56009		17.64
05										
06										
07										
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22										

IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

UPPER LIMIT = + 100% of internal standard area.
LOWER LIMIT = - 50% of internal standard area.

Column used to flag internal standard area values with an asterisk

8C

SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Name: LANCASTER LABS Contract: _____.

Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

File ID (Standard): >X8001 Date Analyzed: 09/13/90

trument ID: 01597 Time Analyzed: 10:41

		IS4(PHN) AREA	#	RT	IS5(CRY) AREA	#	RT	IS6(PRY) AREA	#	RT
	12 HOUR STD	126545		22.25	92137		30.56	81168		34.70
	UPPER LIMIT	253090			184274			162336		
	LOWER LIMIT	63273			46069			40584		
	EPA SAMPLE NO.									
01	SBLKWC2561	143333		22.25	102139		30.56	95303		34.70
02	R2N11	133444		22.26	92531		30.56	82316		34.70
03	R2N11MS	85774		22.27	63341		30.56	59840		34.71
04	R2N11MSD	98414		22.26	67595		30.56	70108		34.70
05										
06										
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20										
21										
22										

IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

UPPER LIMIT = + 100% of internal standard area.
LOWER LIMIT = - 50% of internal standard area.

Column used to flag internal standard area values with an asterisk

Initial Calibration Data
HSL Compounds

Case No: Instrument ID: 03189

Contractor: Lancaster Labs, Inc. Calibration Date: 06/22/90

Contract No:

Minimum $\overline{RF}$ for SPCC is 0.05 Maximum % RSD for CCC is 30.%

Laboratory ID: >U8404 >U8405 >U8403 >U8402 >U8401

Compound	RF 20.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CCC	SPCC
Pyridine	.86262	.85126	.83032	.87415	.77815	.377	.83930	4.506		
2-Picoline	.94397	.91665	.89512	.89338	.81517	.541	.89286	5.377		
N-Nitrosomethylethylamine	.37694	.39611	.41385	.43566	.38397	.585	.40130	5.921		
Methylmethanesulfonate	.68878	.62850	.69101	.70519	.62605	.665	.66791	5.634		
2-Fluorophenol	.76676	.71556	.75084	.72939	.63706	.688	.71992	6.989		
N-Nitrosodiethylamine	.54608	.49101	.54451	.63699	.47637	.751	.53899	11.700		
Ethyl methanesulfonate	.95655	.86408	.89984	.95664	.83745	.833	.90291	5.956		
Aniline	1.50255	1.43376	1.34841	1.35887	1.23127	.930	1.37497	7.394		
Phenol-d6	1.06887	1.06793	1.00510	1.03929	.87662	.924	1.01156	7.890		
o-Toluidine	1.48169	1.40545	1.25907	1.24374	1.10012	1.136	1.29802	11.485		
N-Nitrosopyrolidine	.55850	.54908	.56507	.60008	.49407	1.129	.55336	6.928		
N-Nitrosomorpholine	.71382	.68090	.65108	.71108	.55403	1.135	.66218	9.911		
Acetophenone	1.33038	1.25423	1.17745	1.18990	1.05415	1.122	1.20122	8.512		
Nitrobenzene-d5	.38618	.43916	.42507	.43533	.39310	.859	.41577	5.898		
N-Nitrosopiperdine	.35578	.34799	.34897	.41952	.36761	.895	.36797	8.115		
O,O,O-triethylphosphorothioate	.17006	.16475	.15055	.13895	.12651	.962	.15016	11.979		
2,6-Dichlorophenol	.30257	.28798	.28608	.27765	.24808	1.024	.28047	7.206		
Hexachloropropene	.29246	.24542	.23156	.22418	.18439	1.029	.23560	16.573		
1,4-Phenylenediamine	.22818	.26269	.23916	.23183	.20104	1.101	.23258	9.528		
N-Nitrosodi-n-butylamine	.32263	.30677	.29202	.30072	.27782	1.103	.29999	5.564		
Safrole	.04454	.04790	.04845	.04997	.04882	1.203	.04793	4.295		
1,2,4,5-Tetrachlorobenzene	.40100	.37683	.38356	.30863	.27999	1.198	.35000	15.024		
Phenacetin	.36400	.42105	.48330	.46720	.47031	1.166	.44117	11.140		
Isosafrole	.47725	.50132	.43498	.43819	.40914	.903	.45218	8.116		
2-Fluorobiphenyl	1.25506	1.24543	1.07447	1.04146	.91860	.895	1.10701	12.929		
1,4-Naphthaquinone	.44802	.45472	.42951	.40347	.33783	.941	.41471	11.416		
1,3-Dinitrobenzene	.28872	.32499	.40088	.36947	.34927	.973	.34667	12.317		
Pentachlorobenzene	.67174	.62422	.66084	.54447	.46879	1.033	.59401	14.471		
1-Naphthylamine	1.11724	1.03795	1.08612	1.08289	.95654	1.046	1.05615	5.913		
2-Naphthylamine	.83152	.71707	.85825	.81660	.73615	1.057	.79192	7.807		

RF - Response Factor (Subscript is amount in NG/L)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Case No: Instrument ID: 03189

Contractor: Lancaster Labs, Inc. Calibration Date: 06/22/90

Contract No:

Minimum $\overline{RF}$ for SPCC is 0.05 Maximum % RSD for CCC is 30.%

Laboratory ID: >U8404 >U8405 >U8403 >U8402 >U8401

Compound	RF 20.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CCC	SPCC	
2,3,4,6-Tetrachlorophenol	.17844	.19690	.21832	.18454	.16594	1.058	.18883	10.542			
5-Nitro-o-toluidine	.21271	.26044	.28509	.27903	.28002	1.096	.26346	11.338			
Diphenylamine	.85166	.91170	.92264	.80027	.74625	1.108	.84651	8.813			
2,4,6-Tribromophenol	.17097	.15121	.15130	.15659	.13766	.913	.15355	7.812			
Tetraethyldithiopyrophosphate	.23172	.20202	.19510	.17692	.16120	.934	.19339	13.814			
Diallate TRANS/CIS	.22645	.19484	.19884	.19269	.18536	.951	.19964	7.898			(Conc=40.0,100.0,
1,3,5-Trinitrobenzene	.04416	.06404	.06851	.07125	.06108	.942	.06181	17.181			(Conc=40.0,100.0,
Dimethoate	.46620	.29755	.31802	.34412	.31422	.967	.34802	19.579			
4-Aminobiphenyl	.51897	.51050	.54617	.57090	.54435	.979	.53818	4.464			
4-Nitroquinoline 1-oxide	.01767	.04006	.04267	.04851	.05493	1.110	.04077	34.649			(Conc=40.0,100.0,
Pentachloronitrobenzene	.06423	.06714	.06849	.05623	.05268	.995	.06176	11.257			
Pronamide	.40418	.37580	.36082	.33557	.30921	.991	.35712	10.228			
Isodrin	.17807	.15272	.14811	.11830	.12251	1.139	.14394	16.931			
Terphenyl-d14	1.18096	1.21654	1.25054	1.28064	1.05438	.900	1.19661	7.338			
p-Dimethylaminoazobenzene	.47540	.44764	.57899	.54824	.53200	.916	.51645	10.419			
Chlorobenzilate	1.78095	1.58837	1.65627	1.52257	1.32113	.921	1.57386	10.838			
3,3'-Dimethylbenzidine	.46063	.55917	.54718	.56177	.53936	.948	.53362	7.834			
2-Acetylaminofluorene	.27258	.31995	.29805	.31187	.34178	.973	.30884	8.332			
7,12-Dimethylbenz[a]anthracene	.62085	.63390	.76091	.71923	.64752	.961	.67648	8.962			
3-Methylcholanthrene	.49064	.51429	.52326	.56124	.54331	1.039	.52655	5.145			

RF - Response Factor (Subscript is amount in NG/L)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Lab No: _____ Instrument ID: 01598

Contractor: LANCASTER LABS Calibration Date: 06/22/90

Contract No: _____

Minimum $\overline{RF}$ for SPCC is 0.050 Maximum % RSD for CCC is 30.0%

Laboratory ID:	>Y6805	>Y6803	>Y6804	>Y6802	>Y6801					
	RF	RF	RF	RF	RF					
Compound	20.00	50.00	80.00	120.00	160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CCC	SPCC
N-Nitrosodimethylamine	.65115	.60619	.62081	.63810	.66379	.307	.63601	3.624		
Phenol	1.61975	1.44795	1.50355	1.38610	1.47495	.933	1.48646	5.801	*	
bis(2-Chloroethyl)ether	1.25440	1.08225	1.05840	1.05160	1.06032	.950	1.10139	7.836		
2-Chlorophenol	1.29375	1.21926	1.15324	1.05986	1.10423	.949	1.16607	7.953		
1,3-Dichlorobenzene	1.48068	1.46001	1.41365	1.38915	1.38244	.988	1.42918	3.368		
1,4-Dichlorobenzene	1.50371	1.50466	1.42787	1.39357	1.40150	1.005	1.44527	3.795	*	
Benzyl alcohol	.58801	.61775	.61189	.59367	.63838	1.064	.60994	3.258		
1,2-Dichlorobenzene	1.41086	1.38840	1.31085	1.27490	1.29954	1.061	1.33671	4.432		
2-Methylphenol	1.09074	1.10797	1.05877	1.04766	1.02957	1.110	1.06554	3.075		
bis(2-Chloroisopropyl)ether	3.35101	3.06656	3.08147	3.06011	3.05248	1.113	3.12633	4.035		
4-Methylphenol	1.10160	1.11561	1.03210	1.03445	1.04589	1.159	1.06593	3.717		
N-Nitroso-di-n-propylamine	1.29036	1.15469	1.16184	1.20549	1.22076	1.161	1.20663	4.523		**
Hexachloroethene	.66493	.68164	.66037	.65042	.65480	1.152	.66243	1.821		
2-Fluorophenol	1.00564	1.09029	1.07905	1.02658	1.05917	.649	1.05214	3.575		
Phenol-d6	1.47278	1.58143	1.46324	1.41509	1.44876	.929	1.47626	4.249		
Nitrobenzene	.38760	.39358	.38186	.38116	.37685	.850	.38421	1.688		
Isophorone	.76522	.75187	.73093	.74164	.74855	.904	.74764	1.696		
2-Nitrophenol	.22057	.22463	.21542	.21180	.21825	.921	.21813	2.242	*	
2,4-Dimethylphenol	.38748	.39186	.37977	.35857	.36972	.941	.37744	3.598		
Benzoic acid	.13320	.17351	.08531	.21074	.20726	.982	.16200	32.761		
bis(2-Chloroethoxy)methene	.52653	.46702	.47802	.46589	.46526	.966	.48054	5.459		
2,4-Dichlorophenol	.35414	.35274	.34660	.32304	.33036	.976	.34137	4.083	*	
1,2,4-Trichlorobenzene	.40834	.39545	.39414	.37595	.38195	.992	.38716	4.705		
Naphthalene	1.07839	1.00275	.97159	.90213	.89754	1.005	.97048	7.759		
4-Chloroaniline	.42364	.43143	.42818	.40766	.41190	1.035	.41960	2.865		
Hexachlorobutadiene	.29236	.29446	.28110	.27494	.26175	1.049	.28093	4.767	*	
4-Chloro-3-methylphenol	.35683	.37338	.36117	.34632	.35175	1.154	.35789	2.875	*	
2-Methylnaphthalene	.74200	.66684	.63608	.58707	.59070	1.169	.64458	9.888		
Nitrobenzene-d5	.37669	.39610	.38627	.39085	.39066	.845	.38811	1.874		
Hexachlorocyclopentadiene	.37872	.41931	.43074	.43251	.43687	.859	.41963	5.665		**

RF - Response Factor (Subscript is amount in MG/L)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Case No: ---------- Instrument ID: 01568 ----------

Contractor: LANCASTER LABS Calibration Date: 06/22/90

Contract No: ----------

Minimum $\overline{RF}$ for SPCC is 0.050 Maximum % RSD for CCC is 30.0%

Laboratory ID:	>Y6B05	>Y6B03	>Y6B04	>Y6B02	>Y6B01					
Compound	RF 20.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CCC	SPCC
2,4,6-Trichlorophenol	.44613	.45118	.45905	.45326	.45514	.877	.43655	5.570	*	
2,4,5-Trichlorophenol	.42669	.44597	.43938	.44583	.44464	.882	.44210	2.164		
2-Chloronaphthalene	1.16316	1.14116	1.07190	1.04495	1.02878	.903	1.08599	5.442		
2-Nitroaniline	.41414	.43371	.43316	.42545	.45184	.934	.43166	3.197		
Dimethylphthalate	1.57556	1.31505	1.27964	1.26315	1.29522	.975	1.34552	9.671		
Acenaphthylene	1.97215	1.74930	1.63567	1.42524	1.49915	.974	1.65630	15.051		
3-Nitroaniline	.22552	.23979	.23241	.21285	.23640	1.006	.22959	4.649		
Acenaphthene	1.35178	1.19142	1.13365	1.01714	1.02800	1.006	1.14429	11.956	*	
2,4-Dinitrophenol	.13488	.08785	.10572	.10697	.13554	1.023	.11419	18.064		**
4-Nitrophenol	.19034	.09811	.11239	.11524	.14152	1.040	.13148	27.693		**
Dibenzofuran	1.75132	1.59915	1.57055	1.47028	1.51673	1.033	1.58160	6.768		
2,4-Dinitrotoluene	.40970	.44794	.43542	.45194	.47882	1.050	.44476	5.664		
2,6-Dinitrotoluene	.31987	.33738	.32715	.33092	.34529	.986	.33212	2.925		
Diethylphthalate	1.79524	1.48727	1.43153	1.34649	1.31099	1.096	1.47450	13.047		
4-Chlorophenyl-phenylether	.63337	.57789	.53526	.49492	.46310	1.097	.54091	12.442		
Fluorene	1.39039	1.27945	1.19881	1.11625	1.13242	1.092	1.22347	9.264		
4-Nitroaniline	.15546	.17409	.20552	.21068	.26038	1.112	.20079	20.265		
2-Fluorobiphenyl	1.31280	1.27388	1.20347	1.16047	1.15161	.891	1.22045	5.795		
2,4,6-Tribromophenol	.30595	.34483	.34443	.33195	.33760	1.157	.33295	4.807		
4,6-Dinitro-2-methylphenol	.22389.	.10580	.11824	.11651	.12800	.893	.13849	34.940		
N-Nitrosodiphenylamine	.50805	.45011	.43334	.40911	.38414	.897	.43695	10.738	*	
4-Bromophenyl-phenylether	.29614	.25646	.25503	.25390	.24087	.943	.26048	8.019		
Hexachlorobenzene	.35893	.37622	.36685	.35287	.32852	.958	.36464	7.220		
Pentachlorophenol	.32115	.16968	.19576	.18888	.20187	.986	.21466	28.270	*	
Phenanthrene	1.08147	1.02939	.98275	.90326	.91268	1.003	.98195	7.742		
Anthracene	1.01544	.93621	.93167	.85196	.85254	1.009	.91757	7.445		
Di-n-butylphthalate	1.68155	1.47313	1.41665	1.27457	1.16364	1.099	1.40151	14.111		
Fluoranthene	1.06520	.98768	.97911	.91389	.85344	1.167	.98585	5.726	*	
Pyrene	2.20665	1.97980	1.66720	1.77868	1.59570	.877	1.84761	15.467		
Butylbenzylphthalate	.97576	.85838	.78382	.83731	.76545	.955	.84026	9.805		

RF - Response Factor (Subscript is amount in MG/L)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Case No: ---------- Instrument ID: 01578 ----------

Contractor: LANCASTER LABS Calibration Date: 06/22/90 ----------

Contract No: ----------

Minimum $\overline{RF}$ for SPCC is 0.050 Maximum % RSD for CCC is 30.0%

Laboratory ID:	>Y6B05	>Y6B03	>Y6B04	>Y6B02	>Y6B01					
	RF	RF	RF	RF	RF					
Compound	20.00	50.00	80.00	120.00	160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CCC	SPCC
3,3'-Dichlorobenzidine	.29844	.30786	.32056	.34539	.40216	1.002	.33488	12.403		
Benzo(a)anthracene	1.23763	1.16567	1.15726	1.11942	1.16099	.998	1.16819	3.676		
bis(2-Ethylhexyl)phthalate	1.19589	1.03080	.96207	1.03313	1.00380	1.015	1.04514	8.516		
Chrysene	1.13144	1.07688	1.06560	1.01893	1.03530	1.003	1.06563	4.079		
Terphenyl-d14	1.23190	1.24053	1.06138	1.20120	1.03551	.898	1.15410	8.490		
Di-n-octylphthalate	1.86457	1.76806	1.76409	1.91729	1.85907	.946	1.83462	3.629	*	
Benzo(b)fluoranthene	1.39614	1.29988	1.30058	1.30962	1.30836	.970	1.32292	3.112		
Benzo(k)fluoranthene	1.25702	1.19710	1.20100	1.08508	1.10301	.972	1.16864	6.194		
Benzo(a)pyrene	1.07770	1.07768	1.10324	1.07298	1.08609	.995	1.08354	1.106	*	
Indeno(1,2,3-cd)pyrene	1.04950	1.12189	1.15432	1.12821	1.16114	1.110	1.12301	3.949		
Dibenz(a,h)anthracene	.74765	.82996	.87314	.84532	.88575	1.114	.83641	6.479		
Benzo(g,h,i)perylene	.85244	.88827	.91364	.87712	.91535	1.143	.88736	2.964		

RF - Response Factor (Subscript is amount in MG/L)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Surrogate Recovery
Pesticide -WATER

Pesticide Batch Number:90241 572 112

LLI Sample No.	Client Designation	S1 (DBC)	S2 (OXY)	S3 (245T)	OTHER
1566349		94	86		

	QC REC Limits Low	High
S1 (DBC) Dibutylchlorendate	47	138
S2 (OXY) Oxychlordane	70	119
S3 (245T) 2,4,5-T		

* = Surrogate Recovery outside advisory QC limits
# = No established limits
D = Surrogates diluted out
The stated QC limits are advisory limits only.

Comments:

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Method Blank
Pesticides

Pesticide Batch No....:90241 572 112

Matrix.....: WATER
Method Reference: A

Sample Information		Blank Contamination Information					
LLI Sample No.	Client Designation	CAS Number	Compound	Analysis Date	Blank Result	Units	LOQ
1566349		319-84-6	alpha-BHC	08/29/90	ND	ug/l	0.01
		319-85-7	beta-BHC	08/29/90	ND	ug/l	0.01
		319-86-8	delta-BHC	08/29/90	ND	ug/l	0.01
		58-89-9	gamma-BHC (Lindane)	08/29/90	ND	ug/l	0.01
		76-44-8	Heptachlor	08/29/90	ND	ug/l	0.01
		309-00-2	Aldrin	08/29/90	ND	ug/l	0.01
		1024-57-3	Heptachlor epoxide	08/29/90	ND	ug/l	0.01
		959-98-8	Endosulfan I	08/29/90	ND	ug/l	0.01
		60-57-1	Dieldrin	08/29/90	ND	ug/l	0.01
		72-55-9	4,4'-DDE	08/29/90	ND	ug/l	0.01
		72-20-8	Endrin	08/29/90	ND	ug/l	0.01
		33213-65-9	Endosulfan II	08/29/90	ND	ug/l	0.01
		72-54-8	4,4'-DDD	08/29/90	ND	ug/l	0.01
		1031-07-8	Endosulfan sulfate	08/29/90	ND	ug/l	0.03
		50-29-3	4,4'-DDT	08/29/90	ND	ug/l	0.01
		72-43-5	Methoxychlor		---		
		7421-93-4	Endrin aldehyde	08/29/90	ND	ug/l	0.1
		53494-70-5	Endrin ketone		---		
		12789-03-6	Chlordane-Technical	08/29/90	ND	ug/l	0.05
		5103-71-9	alpha-Chlordane		---		
		5103-74-2	gamma-Chlordane		---		
		8001-35-2	Toxaphene	08/29/90	ND	ug/l	1
		12674-11-2	PCB-1016	08/29/90	ND	ug/l	1
		11104-28-2	PCB-1221	08/29/90	ND	ug/l	1
		11141-16-5	PCB-1232	08/29/90	ND	ug/l	1
		53469-21-9	PCB-1242	08/29/90	ND	ug/l	1
		12672-29-6	PCB-1248	08/29/90	ND	ug/l	1
		11097-69-1	PCB-1254	08/29/90	ND	ug/l	1
		11096-82-5	PCB-1260	08/29/90	ND	ug/l	1
		94-75-7	2,4-D		---		
		93-72-1	2,4,5-TP		---		

Method Key	Abbreviation Key
A - EPA 608	--- = Analysis not requested
B - SW846 3510/8080	ND = None detected
C - SW846 3540/8080	J = Estimated value below LOQ
D - SW846 3550/8080	LOQ = Limit of Quantitation
E - SW846 3510/8150	* = Outside QC Limits
F - Standard Methods 509A	
G - Standard Methods 509B	
H - EPA CLP Statement of Work, 2/88	
I - SW846 3550/8080/8140	
K - EPA 600/4-81-045, 9/82	

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Quality Control Summary

Matrix Spike\Matrix Spike Duplicate
Pesticides

Unspiked Sample Number :BLK 8/29/90
Spiked Sample Number :SPK 8/29/90
Spiked Dup Sample Number:SPK DUP 8/29/90 Matrix: WATER

Pesticide Batch Number:90241 572 112

This MS/MSD applies to the following samples	Compound	Spike Added (ug/l)	Sample Concentration (ug/l)	MS Concentration (ug/l)	MS % REC	QC Limits (%REC)
1566349	gamma-BHC (Lindane)	0.340	ND	0.330	97	66 -103
	Heptachlor	0.310	ND	0.220	71	60 -104
	Aldrin	0.280	ND	0.200	71	40 -107
	4,4'-DDT	0.640	ND	0.640	100	79 -119
	Dieldrin	0.620	ND	0.560	90	75 -109
	Endrin	0.620	ND	0.580	94	72 -121

Compound	Spike Added (ug/l)	MS Concentration (ug/l)	MSD Concentration (ug/l)	MSD % REC	QC Limits (%REC)	% RPD	QC Limits RPD
gamma-BHC (Lindane)	0.340	0.330	0.350	103	66 -103	-6	15
Heptachlor	0.310	0.220	0.220	71	60 -104	0	20
Aldrin	0.280	0.200	0.200	71	40 -107	0	22
4,4'-DDT	0.640	0.640	0.660	103	79 -119	-3	27
Dieldrin	0.620	0.560	0.580	94	75 -109	-4	18
Endrin	0.620	0.580	0.610	98	72 -121	-5	21

ABBREVIATION KEY

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
* = Outside advisory QC limits
** = Due to high sample conc., accurate QC data could not be obtained.
# = No established limits
N/A = Not Applicable
ND = None Detected
REC = Recovery

The stated QC limits (%REC and %RPD) are advisory limits only.

COMMENTS:

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PESTICIDE RESIDUE ANALYSIS

RETENTION TIME WINDOWS AND INITIAL CALIBRATION

un umber: A90227
olumn: LLI#466 (2401/2250)

Compound	Ret Time Windows RT	RT-3*SD	RT+3*SD	Response Factors (Concentration/Response) DF250 RF	DF200 RF	DF100 RF	DF50 RF	DF25 RF	% RSD	Average RF
CB	1.91	1.91	1.91	2.795E-08	3.068E-08	2.889E-08	3.096E-08	3.203E-08	5.5%	3.010E-08
lpha - BHC	2.07	2.02	2.12	4.300E-08	4.292E-08	3.928E-08	4.022E-08	3.826E-08	5.3%	4.073E-08
ir ne (Gamma - BHC	2.62	2.56	2.68	5.130E-08	5.125E-08	5.052E-08	4.990E-08	4.960E-08	1.5%	5.051E-08
et - BHC	2.98	2.92	3.04	1.331E-07	1.351E-07	1.321E-07	1.439E-07	1.473E-07	5.0%	1.383E-07
eptachlor	3.22	3.14	3.30	7.054E-08	7.032E-08	6.889E-08	6.852E-08	6.819E-08	1.5%	6.929E-08
elta - BHC	3.48	3.40	3.56	7.864E-08	7.870E-08	7.315E-08	7.387E-08	7.007E-08	5.0%	7.489E-08
ldrin	3.90	3.81	3.99	8.260E-08	8.284E-08	8.199E-08	8.120E-08	8.083E-08	1.1%	8.189E-08
or l	4.10	4.02	4.18	8.262E-08	8.939E-08	8.757E-08	9.406E-08	9.824E-08	6.6%	9.037E-08
elodrin	4.35	4.26	4.44	9.289E-08	9.576E-08	9.438E-08	9.875E-08	9.503E-08	2.3%	9.536E-08
xychlordane	5.32	5.22	5.42	1.210E-07	1.229E-07	1.190E-07	1.273E-07	1.254E-07	2.7%	1.231E-07
ep chlor Epoxide	5.87	5.75	5.99	1.210E-07	1.208E-07	1.225E-07	1.238E-07	1.240E-07	1.3%	1.224E-07
,p - DDE	6.93	6.82	7.04	2.012E-07	2.195E-07	2.134E-07	2.259E-07	2.322E-07	5.5%	2.184E-07
amma - Chlordane	6.49	6.38	6.60	1.482E-07	1.501E-07	1.420E-07	1.518E-07	1.456E-07	2.6%	1.475E-07
lp - Chlordane	7.09	6.98	7.20	1.598E-07	1.610E-07	1.526E-07	1.652E-07	1.603E-07	2.8%	1.598E-07
,p - DDE	8.46	8.32	8.60	1.760E-07	1.790E-07	1.693E-07	1.811E-07	1.755E-07	2.5%	1.762E-07
,p - DDD	9.97	9.79	10.15	3.505E-07	3.597E-07	3.478E-07	3.783E-07	3.705E-07	3.6%	3.614E-07
,p - DDT	11.89	11.71	12.07	3.769E-07	3.928E-07	3.328E-07	3.537E-07	3.649E-07	6.3%	3.642E-07
,p - DDD	12.99	12.79	13.19	3.127E-07	3.148E-07	3.211E-07	3.398E-07	3.286E-07	3.4%	3.234E-07
,p - DDT	15.64	15.35	15.93	4.697E-07	4.523E-07	4.714E-07	4.612E-07	4.523E-07	2.0%	4.614E-07
thion	16.03	15.77	16.29	7.306E-07	7.193E-07	8.446E-07	8.798E-07	9.154E-07	10.8%	8.179E-07
rithion	17.06	16.81	17.31	5.451E-07	5.761E-07	6.513E-07	6.621E-07	6.872E-07	9.7%	6.244E-07
di c	23.50	23.08	23.92	5.593E-07	5.839E-07	5.905E-07	6.411E-07	6.548E-07	6.7%	6.059E-07
de...oxychlor	29.84	29.34	30.34	1.531E-06	1.493E-06	1.379E-06	1.382E-06	1.403E-06	4.8%	1.438E-06
50% Florisil Fracti										
Di inon	2.50	2.44	2.56	1.391E-06	1.462E-06	1.413E-06	1.472E-06	1.439E-06	2.3%	1.435E-06
de l Parathion	5.30	5.22	5.38	3.017E-07	3.161E-07	3.227E-07	3.441E-07	3.456E-07	5.8%	3.261E-07
alathion	6.04	5.98	6.10	1.798E-06	2.111E-06	1.760E-06	2.059E-06	1.988E-06	8.1%	1.943E-06
thyl Parathion	6.79	6.68	6.90	4.288E-07	4.535E-07	4.581E-07	4.888E-07	4.942E-07	5.8%	4.647E-07
Endosulfan I	7.39	7.24	7.54	1.554E-07	1.550E-07	1.586E-07	1.593E-07	1.610E-07	1.6%	1.579E-07
Dieldrin	9.02	8.85	9.19	1.844E-07	1.860E-07	1.813E-07	1.835E-07	1.814E-07	1.1%	1.833E-07
Endrin	10.97	10.79	11.15	3.682E-07	3.715E-07	3.568E-07	3.661E-07	3.482E-07	2.6%	3.621E-07
Endosulfan II	13.27	13.02	13.52	2.578E-07	2.536E-07	2.912E-07	2.909E-07	2.993E-07	7.6%	2.786E-07
Endosulfan Sulfate	21.25	21.02	21.48	9.490E-07	9.684E-07	9.135E-07	9.727E-07	9.478E-07	2.5%	9.503E-07
Endrin Aldehyde	17.42	17.22	17.62	7.145E-07	7.236E-07	7.533E-07	7.427E-07	7.620E-07	2.7%	7.392E-07
Endrin Ketone										
Dicofol	27.82	27.36	28.28	7.133E-07	7.253E-07	7.364E-07	7.405E-07	7.430E-07	1.7%	7.317E-07

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PESTICIDE RESIDUE ANALYSIS
CONTINUING CALIBRATION

Run Number: A90227
Column: LLI#466 (2401/2250)

Compound	Injection # 73 DF100 RF	RPD	+/-15% Flag	Injection # 85 DF100 RF	RPD	+/-15% Flag	Injection #_____ DF100 RF	RPD	+/-15% Flag
HCB									
Alpha - BHC				3.691E-08	6.4%				
Lindane (Gamma - BHC)	4.748E-08	6.4%							
Beta - BHC				1.283E-07	2.9%				
Heptachlor	6.307E-08	9.2%							
Delta - BHC				6.678E-08	9.5%				
Aldrin	7.585E-08	8.1%		7.660E-08	7.0%				
Ronnel									
Heptachlor									
Chlordane				1.159E-07	2.6%				
Heptachlor Epoxide	1.105E-07	10.9%							
o,p - DDE									
Gamma - Chlordane				1.356E-07	4.7%				
Alpha - Chlordane				1.473E-07	3.6%				
p,p - DDE				1.668E-07	1.5%				
o,p - DDD									
o,p - DDT									
p,p - DDD				3.020E-07	6.3%				
p,p - DDT	5.049E-07	6.6%							
Fenthion									
Dursban									
Dieldrex									
Methoxychlor	1.357E-06	1.6%							
(5% Florisil Fraction)									
Dasinon									
Methyl Parathion									
Malathion									
Ethyl Parathion									
Endosulfan I	1.419E-07	11.7%							
Dieldrin	1.656E-07	9.5%							
Endrin				2.927E-07	21.9%	**			
Endosulfan II	2.608E-07	11.7%							
Endosulfan Sulfate				8.135E-07	12.3%				
Endrin Aldehyde	7.701E-07	2.2%							
Endrin Ketone									
Methylchlorendate	6.834E-07	7.7%		5.965E-07	23.4%	**			

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Quality Control Summary
Method Blank
Metals

Sample Information		Blank Contamination Information						Matrix: WATER			
LLI Sample No.	Client Designation	CAS Number	Metal	Meth	Analysis Date	Meth Blank Desig.	Blank Batch Number	Blank Result	Units	LOQ
		7429-90-5	Aluminum					---	mg/l	0.1
		7440-36-0	Antimony					---	mg/l	0.05
		7440-38-2	Arsenic					---	mg/l	0.01
		7440-39-3	Barium					---	mg/l	0.1
		7440-41-7	Beryllium					---	mg/l	0.005
		7440-42-8	Boron					---	mg/l	0.05
		7440-43-9	Cadmium					---	mg/l	0.005
		7440-70-2	Calcium					---	mg/l	0.05
		7440-47-3	Chromium					---	mg/l	0.05
		7440-48-4	Cobalt					---	mg/l	0.05
		7440-50-8	Copper					---	mg/l	0.02
		7439-89-6	Iron					---	mg/l	0.05
		7439-92-1	Lead					---	mg/l	0.05
		7439-93-2	Lithium					---	mg/l	0.05
		7439-95-4	Magnesium					---	mg/l	0.05
		7439-96-5	Manganese					---	mg/l	0.01
		7439-97-6	Mercury					---	mg/l	0.0005
		7439-98-7	Molybdenum					---	mg/l	0.1
		7440-02-0	Nickel					---	mg/l	0.04
		7440-09-7	Potassium					---	mg/l	0.5
		7782-49-2	Selenium					---	mg/l	0.005
		7440-22-4	Silver					---	mg/l	0.01
		7440-23-5	Sodium					---	mg/l	0.5
		7440-24-6	Strontium					---	mg/l	0.05
		7440-28-0	Thallium					---	mg/l	0.1
		7440-31-5	Tin					---	mg/l	0.5
		7440-32-6	Titanium					---	mg/l	0.5
		7440-62-2	Vanadium					---	mg/l	0.05
		7440-66-6	Zinc					---	mg/l	0.02

Comments:

ABBREVIATION KEY

A=Flame Atomic Absorption
P=Inductively Coupled Plasma
HY=Hydride Generation
F=Graphite Furnace
CV=Cold Vapor

---=Analysis not requested
ND=Not Detected
J=Estimated Value below LOQ
LOQ=Limit of Quantitation

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Quality Control Summary
Matrix Spike Analysis
Metals

Sample Information		Matrix Spike Analysis									Matrix: WATER		
LLI Sample No.	Client Designation	Metal	Meth	Analysis Date	Unspiked Desig.	Unspiked Result	LOQ	Spiked Desig.	Spike Added	Spike Result	Units	%REC	
		Aluminum				---	0.1			---	mg/l		
		Antimony				---	0.05			---	mg/l		
		Arsenic				---	0.01			---	mg/l		
		Barium				---	0.1			---	mg/l		
		Beryllium				---	0.005			---	mg/l		
		Boron				---	0.05			---	mg/l		
		Cadmium				---	0.005			---	mg/l		
		Calcium				---	0.05			---	mg/l		
		Chromium				---	0.05			---	mg/l		
		Cobalt				---	0.05			---	mg/l		
		Copper				---	0.02			---	mg/l		
		Iron				---	0.05			---	mg/l		
		Lead				---	0.05			---	mg/l		
		Lithium				---	0.05			---	mg/l		
		Magnesium				---	0.05			---	mg/l		
		Manganese				---	0.01			---	mg/l		
		Mercury				---	0.0005			---	mg/l		
		Molybdenum				---	0.1			---	mg/l		
		Nickel				---	0.04			---	mg/l		
		Potassium				---	0.5			---	mg/l		
		Selenium				---	0.005			---	mg/l		
		Silver				---	0.01			---	mg/l		
		Sodium				---	0.5			---	mg/l		
		Strontium				---	0.05			---	mg/l		
		Thallium				---	0.1			---	mg/l		
		Tin				---	0.5			---	mg/l		
		Titanium				---	0.5			---	mg/l		
		Vanadium				---	0.05			---	mg/l		
		Zinc				---	0.02			---	mg/l		

Comments:

% Recovery Control Limit (LOW) 75
% Recovery Control Limit (HIGH) 125

ABBREVIATION KEY

A=Flame Atomic Absorption	---=Analysis Not Requested
P=Inductively Coupled Plasma	J=Estimated Value below LOQ
HY=Hydride Generation	LOQ=Limit of Quantitation
F=Graphite Furnace	ND=Not Detected
CV=Cold Vapor	* = Out of specification
OK=Sample Conc. greater than 4 times Spike Conc.	

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Quality Control Summary
Duplicate Analysis
Metals

Sample Information		Duplicate Analysis								Matrix: WATER			
LL1 Sample No.	Client Designation	Metal	Meth	Analysis Date	1st Dup Desig.	1st Dup Result	LOQ	2nd Dup Desig.	2nd Dup Result	Units	RPD (%)	Control Limit
		Aluminum				---	0.1		---	mg/l	ERR	20
		Antimony				---	0.05		---	mg/l	ERR	20
		Arsenic				---	0.01		---	mg/l	ERR	20
		Barium				---	0.1		---	mg/l	ERR	20
		Beryllium				---	0.005		---	mg/l	ERR	20
		Boron				---	0.05		---	mg/l	ERR	20
		Cadmium				---	0.005		---	mg/l	ERR	20
		Calcium				---	0.05		---	mg/l	ERR	20
		Chromium				---	0.05		---	mg/l	ERR	20
		Cobalt				---	0.05		---	mg/l	ERR	20
		Copper				---	0.02		---	mg/l	ERR	20
		Iron				---	0.05		---	mg/l	ERR	20
		Lead				---	0.05		---	mg/l	ERR	20
		Lithium				---	0.05		---	mg/l	ERR	20
		Magnesium				---	0.05		---	mg/l	ERR	20
		Manganese				---	0.01		---	mg/l	ERR	20
		Mercury				---	0.0005		---	mg/l	ERR	20
		Molybdenum				---	0.1		---	mg/l	ERR	20
		Nickel				---	0.04		---	mg/l	ERR	20
		Potassium				---	0.5		---	mg/l	ERR	20
		Selenium				---	0.005		---	mg/l	ERR	20
		Silver				---	0.01		---	mg/l	ERR	20
		Sodium				---	0.5		---	mg/l	ERR	20
		Strontium				---	0.05		---	mg/l	ERR	20
		Thallium				---	0.1		---	mg/l	ERR	20
		Tin				---	0.5		---	mg/l	ERR	20
		Titanium				---	0.5		---	mg/l	ERR	20
		Vanadium				---	0.05		---	mg/l	ERR	20
		Zinc				---	0.02		---	mg/l	ERR	20

Comments:

ABBREVIATION KEY

A=Flame Atomic Absorption	---=Analysis Not Requested
P=Inductively Coupled Plasma	J=Estimated Value below LOQ
HY=Hydride Generation	LOQ=Limit of Quantitation
F=Graphite Furnace	ND=Not Detected
CV=Cold Vapor	* = Out of specification
	NR=Not Required

Lancaster Laboratories INCORPORATED
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Quality Control Summary
Initial and Continuing Calibration
Metals

Matrix: Water

Lancaster Laboratory Sample ID: 1565012

Initial Calibration			Units: mg/l					Calibration Verification				Units: mg/l						Calibration Blank	Units: mg/l		
Metal	M	Calib Date	Std 1 Concen	Std 2 Concen	Std 3 Concen	Std 4 Concen	Std 5 Concen	True Value	Result 1	%REC 1	True Value	Result 2	%REC 2	Result 3	%REC 3	Limits LOW	Limits HIGH	LOQ	Blnk 1	Blnk 2	Blnk 3
Aluminum																					
Antimony																					
Arsenic																					
Barium																					
Beryllium																					
Boron																					
Cadmium																					
Calcium																					
Chromium																					
Cobalt																					
Copper																					
Iron																					
Lead																					
Lithium																					
Magnesium																					
Manganese																					
Mercury																					
Molybdenum																					
Nickel																					
Potassium																					
Selenium	F	08/29/90	0.005	0.020	0.040			0.025	0.0257	103	0.025	0.0254	102	0.0264	106	90	110	0.005	<0.0008	<0.0008	<0.0008
Silver																					
Sodium																					
Strontium																					
Thallium																					
Tin																					
Titanium																					
Vanadium																					
Zinc																					

ABBREVIATION KEY

AA=Atomic Absorption
ICP=Inductively Coupled Plasma
HY=Hydride Generation
GFAA=Graphite Furnace
CV=Cold Vapor
IDL=Instrument Detection Limit
ANR=Analysis Not Requested
J=Estimated Value below LOQ and above IDL
LOQ=Limit of Quantitation
ND=Not Detected
* = Out of specification

Comments:

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Quality Control Summary
ICP Interference Check Sample
Metals

Lancaster Laboratory Sample ID: 1565012

Date: 08/27/90, 08/28/90
Units: mg/L

Metal	True Sol A	True Sol AB	Initial Found Sol A	Initial Found Sol AB	Initial Found %REC	Final Found Sol A	Final Found Sol AB	Final Found %REC
Aluminum								
Antimony	0	0.5	-0.01750	0.45825	91.6	0.00044	0.45142	90.3
Arsenic								
Barium	0	0.5	-0.00560	0.47835	95.7	-0.00570	0.47918	95.8
Beryllium	0	0.5	0.00378	0.47015	94.0	0.00380	0.47597	95.2
Boron								
Cadmium	0	1	0.00144	0.90859	90.9	0.00291	0.92139	92.1
Calcium								
Chromium	0	0.5	-0.02960	0.42206	84.4	-0.02780	0.42856	85.7
Cobalt								
Copper	0	0.5	0.01817	0.49596	99.2	0.01844	0.49188	98.4
Iron								
Lead								
Lithium								
Magnesium								
Manganese								
Molybdenum								
Nickel								
Potassium								
Silver	0	0.5	0.00570	0.45758	91.5	0.00641	0.46146	92.3
Sodium								
Strontium								
Thallium								
Tin								
Titanium								
Vanadium	0	0.5	0.02248	0.47550	95.1	0.02015	0.48150	96.3
Zinc	0	1	0.05247	0.94397	94.4	0.05468	0.95853	95.9

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Quality Control Summary
Surrogate Recovery
Volatiles by GC - Water

LLI Sample No.	Client Designation	Dilution Factor	S1 (MeBrCl)	S2 (FClBn)	S3 (FClBn)	S4 (F3Tol)	S5 (ProBn)	Other	TOT OUT	Comment
1234567	Well 2a	1	55 *	78	133 *	22 *	98		3	a
										b

	QC Limits LOW	HIGH
S1 (MeBrCl) = Bromochloromethane (Hall Det)	70	125
S2 (FClBn) = Fluorochlorobenzene (Hall Det)	70	125
S3 (FClBn) = Fluorochlorobenzene (PID Det)	70	125
S4 (F3Tol) = Trifluorotoluene (PID Det)	70	125
S5 (ProBn) = n-Propylbenzene (PID Det)	70	125

* Values outside QC limits

D Surrogates diluted out

Comments: a) The surrogate standard recovery was outside the acceptable range due to the high level of components present in the sample.

b) This surrogate standard recovery for CHANGEABLE NAME was outside the acceptable range due to the nature of the sample matrix. The analysis was repeated giving the same response.

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Quality Control Summary
Method Blank
Volatiles by GC

*** BLANK INFORMATION ***
Matrix...(Water/Solid).....: Water
Batch Number.....:
Injection number.....:
Analysis date.....:
Concentration Units.....:

Sample Information			
LLI Sample No.	Client Designation	Analysis Date	Time

Blank Contamination Information			
CAS Number	Compound	Blank Result	LOQ
71-43-2	Benzene	ND	1
108-88-3	Toluene	ND	1
108-90-7	Chlorobenzene	ND	1
100-41-4	Ethylbenzene	ND	1
74-87-3	Chloromethane	ND	5
74-83-9	Bromomethane	ND	5
110-75-8	2-Chloroethylvinyl ether	ND	10
75-01-4	Vinyl chloride	ND	1
75-00-3	Chloroethane	ND	1
75-09-2	Methylene chloride	ND	1
75-35-4	1,1-Dichloroethene	ND	1
75-34-3	1,1-Dichloroethane	ND	1
540-59-0	trans-1,2-Dichloroethene	ND	1
67-66-3	Chloroform	ND	1
107-06-2	1,2-Dichloroethane	ND	1
71-55-6	1,1,1-Trichloroethane	ND	1
56-23-5	Carbon tetrachloride	ND	1
75-27-4	Dichlorobromoethane	ND	1
78-87-5	1,2-Dichloropropane	ND	1
10061-02-6	trans-1,3-Dichloropropene	ND	1
79-1-6	Trichloroethene	ND	1
124-48-1	Dibromochloromethane	ND	1
79-00-5	1,1,2-Trichloroethane	ND	1
10061-01-5	cis-1,3-Dichloropropene	ND	1
75-25-2	Bromoform	ND	2
79-34-5	1,1,2,2-Tetrachloroethane	ND	2
127-18-4	Tetrachloroethene	ND	1
75-69-4	Trichlorofluoromethane	ND	1

Comments:

LOQ = Limit of Quantitation
ND = None Detected
NR = Not Reported

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Quality Control Summary
Matrix Spike\Matrix Spike Duplicate
Volatiles by GC - Water

Unspiked Sample Number : Inj.:
Spiked Sample Number : Inj.:
Spiked Dup Sample Number: Inj.:

Batch Number: Date :

This MS/MSD applies to the following samples	Compound	Spike Added (ug/l)	Sample Concentration (ug/l)	MS Concentration (ug/l)	MS % REC	QC Limits REC	Comments abc
	Benzene	50	50	100	100	76 -127	
	Toluene					76 -125	
	Chlorobenzene					75 -130	a
	Methylene Chloride					75 -125	
	1,1-Dichloroethene					61 -145	
	trans-1,2-Dichloroethene					75 -125	
	Chloroform					75 -125	b
	1,2-Dichloroethane					75 -125	
	Trichloroethene					71 -120	c
	Tetrachloroethene					75 -125	

Compound	Spike Added (ug/l)	MSD Concentration (ug/l)	MSD % REC	QC Limits REC	% RPD	QC Limit RPD
Benzene	50	95.00	90	76 -127	10.5	11
Toluene	0			76 -125		13
Chlorobenzene	0			75 -130		13
Methylene Chloride	0			75 -125		15
1,1-Dichloroethene	0			61 -145		14
trans-1,2-Dichloroethene	0			75 -125		15
Chloroform	0			75 -125		15
1,2-Dichloroethane	0			75 -125		15
Trichloroethene	0			71 -120		14
Tetrachloroethene	0			75 -125		15

a) Analysis of background MS and MSD samples showed levels which differed for unspiked aliquots. This is the source in the variability in the recovery or reproducibility.

b) CHANGEABLE NAME is not part of the routine spiking standard, and no acceptance criteria have been developed.

c) The MS and MSD results are outside the acceptance criteria, A QC reference sample was analyzed, and the responses are within the QC acceptance criteria.

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Quality Control Summary
Initial Calibration
Volatiles by GC - Halocarbons

Calibration Date.....:

Instrument Identification..:

This IC applies to samples:	Compound	Laboratory Standard ID							
		Rf STD 1	Rf STD 2	Rf STD 3	Rf STD 4	Rf STD 5	AVE RF	%RSD	%RSD QC Limi
	Chloromethane	0.663	0.541	0.750	0.594	0.437	0.597	19.9	20
	Bromomethane								20
	Vinyl chloride								20
	Chloroethane								20
	Methylene chloride								2(
	1,1-Dichloroethene								2(
	1,1-Dichloroethane								20
	trans-1,2-Dichloroethene								20
	Chloroform								2(
	1,2-Dichloroethane								2(
	1,1,1-Trichloroethane								20
	Carbon tetrachloride								2
	Dichlorobromoethane								2
	1,2-Dichloropropane								20
	trans-1,3-Dichloropropene								2
	Trichloroethene								2
	Dibromochloromethane								20
	1,1,2-Trichloroethane								2
	cis-1,3-Dichloropropene								2
	2-Chloroethylvinyl ether								2(
	Bromoform								20
	1,1,2,2-Tetrachloroethane								2
	Tetrachloroethene								2
	Chlorobenzene								20
	Trichlorofluoromethane								2

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Quality Control Summary
Continuing Calibration
Volatiles by GC - Halocarbons

Calibration Date.....:

Instrument Identification..: Inj #..:

Continuing Calibration Date: Units:

Compound	Reference Concentration	Continuing Calib Result	Acceptance Range 85%-	115%	Out of Range
Chloromethane	20.0		17.0	23.0	
Bromomethane	20.0		17.0	23.0	
Vinyl chloride	20.0		17.0	23.0	
Chloroethane	20.0		17.0	23.0	
Methylene chloride	20.0		17.0	23.0	
1,1-Dichloroethene	20.0		17.0	23.0	
1,1-Dichloroethane	20.0		17.0	23.0	
trans-1,2-Dichloroethene	20.0		17.0	23.0	
Chloroform	20.0		17.0	23.0	
1,2-Dichloroethane	20.0		17.0	23.0	
1,1,1-Trichloroethane	20.0		17.0	23.0	
Carbon tetrachloride	20.0		17.0	23.0	
Dichlorobromoethane	20.0		17.0	23.0	
1,2-Dichloropropane	20.0		17.0	23.0	
trans-1,3-Dichloropropene	20.0		17.0	23.0	
Trichloroethene	20.0		17.0	23.0	
Dibromochloromethane	20.0		17.0	23.0	
1,1,2-Trichloroethane	20.0		17.0	23.0	
cis-1,3-Dichloropropene	20.0		17.0	23.0	
2-Chloroethylvinyl ether	20.0		17.0	23.0	
Bromoform	20.0		17.0	23.0	
1,1,2,2-Tetrachloroethane	20.0		17.0	23.0	
Tetrachloroethene	20.0		17.0	23.0	
Chlorobenzene	20.0		17.0	23.0	
Trichlorofluoromethane	20.0		17.0	23.0	

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Quality Control Summary
Method Blank .
Instrumental Analysis Data

Sample Information		Method Blank Analysis				Matrix: WATER			
LLI Sample No.	Client Designation	Parameter	Method	Analysis Date	Meth Blank Desig.	Batch Number	Blank Result	Units	LOQ
		Anion Scan							
		Fluoride	IC				---	mg/L	0.1
		Chloride	IC				---	mg/L	0.2
		Nitrite-N	IC				---	mg/L	0.1
		Bromide	IC				---	mg/L	0.5
		Nitrate-N	IC				---	mg/L	0.1
		Phosphate	IC				---	mg/L	1
		Sulfate	IC				---	mg/L	0.5
		Ammonia-N	TAA				---	mg/L	0.1
		Chloride	IC				---	mg/L	1
		Chlorine	IC				---	%	0.2
		Cyanide	TAA				---	mg/L	0.005
		Cyanide Reactivity	TAA				---	mg/Kg	100
		Nitrite - N	TAA				---	mg/L	0.02
		Nitrate - N	TAA				---	mg/L	0.05
		Phenol	TAA				---	mg/L	0.01
		Phosphorus	TAA				---	mg/L	0.1
		Sulfate	IC				---	mg/L	0.5
		TOC	TOC				---	mg/L	0.5
		TOX	TOX				---	ug/L	5
		Kjeldahl Nitrogen	TAA				---	mg/L	0.2

Comments:

ABBREVIATION KEY

IC = Ion Chromatography	--- = Analysis not requested
TAA = Technicon AutoAnalyzer	ND = Not Detected
D = Distillation	J = Estimated Value below LOQ
TOC = Total Organic Carbon	LOQ = Limit of Quantitation
TOX = Total Organic Halogens	NA = Not Applicable

Lancaster Laboratories
Where quality is a science

Quality Control Summary
Matrix Spike Analysis
Instrumental Analysis Data

Sample Information		Matrix Spike Analysis										Matrix: WATER	
LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	Unspiked Desig.	Unspiked Result	LOQ	Spiked Desig.	Spike Added	Spiked Result	Units	%REC
		Anion Scan										
		Fluoride	IC			---	0.1			---	mg/L	
		Chloride	IC			---	0.2			---	mg/L	
		Nitrite-N	IC			---	0.1			---	mg/L	
		Bromide	IC			---	0.5			---	mg/L	
		Nitrate-N	IC			---	0.1			---	mg/L	
		Phosphate	IC			---	1			---	mg/L	
		Sulfate	IC			---	0.5			---	mg/L	
		Ammonia-N	TAA			---	0.1			---	mg/L	
		Chloride	IC			---	1			---	mg/L	
		Chlorine	IC			---	0.2			---	%	
		Cyanide	TAA			---	0.005			---	mg/L	
		Cyanide Reactivity	TAA			---	100			---	mg/Kg	
		Nitrite - N	TAA			---	0.02			---	mg/L	
		Nitrate - N	TAA			---	0.05			---	mg/L	
		Phenol	TAA			---	0.01			---	mg/L	
		Phosphorus	TAA			---	0.1			---	mg/L	
		Sulfate	IC			---	0.5			---	mg/L	
		TOC	TOC			---	0.5			---	mg/L	
		TOX	TOX			---	5			---	ug/L	
		Kjeldahl Nitrogen	TAA			---	0.2			---	mg/L	

Comments:

% Recovery Control Limit 75
% Recovery Control Limit 125

ABBREVIATION KEY

IC = Ion Chromatography	--- = Analysis Not Requested
TAA = Technicon AutoAnalyzer	ND = Not Detected
D = Distillation	J = Estimated Value below LOQ
TOC = Total Organic Carbon	LOQ = Limit of Quantitation
TOX = Total Organic Halogens	NA = Not Applicable
	* = Out Of Specification

Lancaster Laboratories
Where quality is a science

Quality Control Summary
Duplicate Analysis
Instrumental Analysis Data

Sample Information		Duplicate Analysis										Matrix: WATER	
LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	1st Dup Desig.	1st Dup Result	LOQ	2nd Dup Desig.	2nd Dup Result	Units	RPD (%)	Cont Limit
		Anion Scan										
		Fluoride	IC			---	0.1		---	mg/L		2
		Chloride	IC			---	0.2		---	mg/L		20
		Nitrite-N	IC			---	0.1		---	mg/L		2
		Bromide	IC			---	0.5		---	mg/L		2
		Nitrate-N	IC			---	0.1		---	mg/L		2
		Phosphate	IC			---	1		---	mg/L		20
		Sulfate	IC			---	0.5		---	mg/L		2
		Ammonia-N	TAA			---	0.1		---	mg/L		20
			IC			---	1		---	mg/L		20
		Chlorine	IC			---	0.2		---	%		2
		Cyanide	TAA			---	0.005		---	mg/L		2
		Cyanide Reactivity	TAA			---	100		---	mg/Kg		
		Nitrite - N	TAA			---	0.02		---	mg/L		
		Nitrate - N	TAA			---	0.05		---	mg/L		20
		Phenol	TAA			---	0.01		---	mg/L		20
		Phosphorus	TAA			---	0.1		---	mg/L		
		Sulfate	IC			---	0.5		---	mg/L		
		TOC	TOC			---	0.5		---	mg/L		20
		TOX	TOX			---	5		---	ug/L		---
		Kjeldahl Nitrogen	TAA			---	0.2		---	mg/L		---

Comments:

ABBREVIATION KEY

IC = Ion Chromatography	---= Analysis Not Request
TAA = Technicon AutoAnalyzer	ND = Not Detected
D = Distillation	J = Estimated Value belo LOQ
TOC = Total Organic Carbon	LOQ= Limit of Quantitation
TOX = Total Organic Halogens	NA = Not Applicable
NR = Not Required	* = Out Of Specification

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Quality Control Summary
Method Blank
Miscellaneous Wet Chemistry

Sample Information		Method Blank Analysis				Matrix: WATER			
LLI Sample No.	Client Designation	Parameter	Method	Analysis Date	Meth Blank Desig.	Batch Number	Blank Result	Units	LOQ
		Alkalinity							
		to pH 8.3	M				---	mg/L	1
		to pH 4.5	M				---	mg/L	1
		Ammonia Nitrogen	TI				---	mg/L	0.5
		BOD	M				---	mg/L	6
		COD	TI				---	mg/L	50
		Free Cyanide	CO				---	mg/L	0.005
		Hexavalent Chromium	CO				---	mg/L	0.01
		MBAS	CO				---	mg/L	0.02
		Oil and Grease	G				---	mg/L	2
		Orthophosphate	CO				---	mg/L	0.05
		pH	M				---		0.01
		Petroleum Hydrocarbons	IR				---	mg/L	0.2
		Total Solids	OD				---	mg/L	10
		Total Dissolved Solids	OD				---	mg/L	10
		Total Suspended Solids	OD				---	mg/L	4
		Sulfide	TI				---	mg/L	0.1
		Total Hardness	TI				---	mg/L	1

Comments:

ABBREVIATION KEY

TI	= Titration	---	= Analysis not requested
TU	= Turbidimetric	ND	= Not Detected
CO	= Colorimetric	J	= Estimated Value below LOQ
IR	= Infrared Spectrophotometry	LOQ	= Limit of Quantitation
G	= Gravimetric	NA	= Not Applicable
D	= Distillation	M	= Meter
OD	= Oven Dried		

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Quality Control Summary
Matrix Spike Analysis
Miscellaneous Wet Chemistry

Sample Information		Matrix Spike Analysis								Matrix: WATER		
LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	Unspiked Desig.	Unspiked Result	LOQ	Spiked Desig.	Spike Added	Spiked Result	Units	%REC
		Alkalinity										
		to pH 8.3	M			---	1			---	mg/L	
		to pH 4.5	M			---	1			---	mg/L	
		Ammonia Nitrogen	TI			---	0.5			---	mg/L	
		BOD	M			---	6			---	mg/L	
		COD	TI			---	50			---	mg/L	
		Free Cyanide	CO			---	0.005			---	mg/L	
		Hexavalent Chromium	CO			---	0.01			---	mg/L	
		MBAS	CO			---	0.02			---	mg/L	
		Oil and Grease	G			---	2			---	%	
		Orthophosphate	CO			---	0.05			---	mg/L	
		pH	M			---	0.01			---		
		Petroleum Hydrocarbons	IR			---	0.2			---	mg/L	
		Total Solids	OD			---	10			---	mg/L	
		Total Dissolved Solids	OD			---	10			---	mg/L	
		Total Suspended Solids	OD			---	4			---	mg/L	
		Sulfide	TI			---	0.1			---	mg/L	
		Total Hardness	TI			---	1			---	mg/L	

% Recovery Control Limit 75
% Recovery Control Limit 125

Comments:

ABBREVIATION KEY

TI = Titration	--- = Analysis Not Requested
TU = Turbidimetric	ND = Not Detected
CO = Colorimetric	J = Estimated Value below LOQ
IR = Infrared Spectrophotometry	LOQ = Limit of Quantitation
G = Gravimetric	NA = Not Applicable
D = Distillation	M = Meter
OD = Oven Dried	* = Out Of Specification

Lancaster Laboratories INCORPORATED
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Quality Control Summary
Duplicate Analysis
Miscellaneous Wet Chemistry

Sample Information		Duplicate Analysis									Matrix: WATER		
LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	1st Dup Desig.	1st Dup Result	LOQ	2nd Dup Desig.	2nd Dup Result	Units	RPD (%)	Control Limit
		Alkalinity										
		to pH 8.3	M			---	1		---	mg/L		20
		to pH 4.5	M			---	1		---	mg/L		20
		Ammonia										
		Nitrogen	TI			---	0.5		---	mg/L		20
		BOD	M			---	6		---	mg/L		20
		COD	TI			---	50		---	mg/L		20
		Free Cyanide	CO			---	0.005		---	mg/L		20
		Hexavalent										
		Chromium	CO			---	0.01		---	mg/L		20
		MBAS	CO			---	0.02		---	mg/L		20
		Oil and Grease	G			---	2		---	%		20
		Orthophosphate	CO			---	0.05		---	mg/L		20
		pH	M			---	0.01		---			20
		Petroleum										
		Hydrocarbons	IR			---	0.2		---	mg/L		20
		Total Solids	OO			---	10		---	mg/L		20
		Total										
		Dissolved										
		Solids	OO			---	10		---	mg/L		20
		Total										
		Suspended										
		Solids	OO			---	4		---	mg/L		20
		Sulfide	TI			---	0.1		---	mg/L		20
		Total Hardness	TI			---	1		---	mg/L		20

Comments:

ABBREVIATION KEY

TI = Titration	---= Analysis Not Requested
TU = Turbidimetric	ND = Not Detected
CO = Colorimetric	J = Estimated Value below LOQ
IR = Infrared Spectrophotometry	LOQ= Limit of Quantitation
G = Gravimetric	NA = Not Applicable
D = Distillation	M = Meter
OO = Oven Dried	* = Out Of Specification
NR = Not Required	

APPENDIX C

MSDS SHEETS FOR CHEMICALS OF CONCERN

CREOSOTE, COAL TAR

CCT

Common Synonyms	Liquid	Yellow to black	Tarry odor
Creosote oil Dead oil	May float or sink in water.		

Stop discharge if possible
Call fire department
Isolate and remove discharged material
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemicals, foam or carbon dioxide
Water may be ineffective on fire

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials
Notify operators of nearby water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Phenols, creosote
3.2 Formula: Mixture
3.3 EEC/UN Designation: 9/1883
3.4 DOT ID No.: 1999
3.5 CAS Registry No.: 8001-58-9

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Yellow to brown to black
4.3 Odor: Creosote or tarry; aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: All-service canister mask; rubber gloves; chemical safety goggles and/or face shield; overalls or a neoprene apron; barrier creams.

5.2 Symptoms Following Exposure: Vapors cause moderate irritation of nose and throat. Liquid causes severe burns of eyes and reddening and itching of skin. Prolonged contact with skin can cause burns. Ingestion causes convulsion, vomiting, respiratory difficulties, greasy pulse, vertigo, headache, loss of pupillary reflexes, hypothermia, cyanosis, mild convulsions.

5.3 Treatment of Exposure: INHALATION: remove victim to fresh air; if he is not breathing, give artificial respiration, preferably mouth-to-mouth; if breathing is difficult, give oxygen; call a physician. EYES: flush immediately with plenty of water for at least 15 min. and call a physician. SKIN: wipe with vegetable oil or margarine, then wash with soap and water. INGESTION: have victim drink water or milk; do NOT induce vomiting.

5.4 Threshold Limit Value: 0.2 mg/m³

5.5 Short Term Inhalation Limits: Data not available

5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg

5.7 Late Toxicity: Repeated exposure may cause cancer of skin.

5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

5.9 Liquid or Solid Irritant Characteristics: Fairly severe skin irritant. May cause pain and second-degree burns after a few minutes' contact.

5.10 Odor Threshold: Data not available

5.11 IDLH Value: 400 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: >165°F C.C.
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Dry chemical, carbon dioxide or foam
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Data not available
6.6 Behavior in Fire: Heavy, irritating black smoke is formed.
6.7 Ignition Temperature: 637°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Groups: 21

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Whole creosote or various fractions, depending on boiling point. All have similar properties.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor hazard	2
Liquid or Solid hazard	3
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	3
Aesthetic Effect	4
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Mixture
12.3 Boiling Point at 1 atm: >356°F = >180°C = >353°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.05-1.09 at 15°C (liquid)
12.8 Liquid Surface Tension (est.): 15 dynes/cm = 0.015 N/m at 20°C
12.9 Liquid Water Interfacial Tension (est.): 20 dynes/cm = 0.020 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: (est.) −12,500 Btu/lb = −6,900 cal/g = −289 X 10³ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Low

NOTES

CCT	CREOSOTE, COAL TAR

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot (estimate)	Temperature (degrees F)	British thermal unit per pound-F (estimate)	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
51	67.379	51	.400		NOT PERTINENT	67.73	12.000
52	67.349	52	.400				
53	67.309	53	.400				
54	67.280	54	.400				
55	67.240	55	.400				
56	67.209	56	.400				
57	67.169	57	.400				
58	67.139	58	.400				
59	67.099	59	.400				
60	67.070	60	.400				
61	67.030	61	.400				
62	67.000	62	.400				
63	66.969	63	.400				
64	66.929	64	.400				
65	66.900	65	.400				
66	66.860	66	.400				
67	66.830	67	.400				
68	66.790	68	.400				
69	66.759	69	.400				
70	66.719	70	.400				
71	66.690	71	.400				
72	66.650	72	.400				
73	66.620	73	.400				
74	66.580	74	.400				
75	66.549	75	.400				
76	66.509	76	.400				

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

Occupational Health Guideline for Coal Tar Pitch Volatiles

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

Anthracene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Pale green solid with a faint aromatic odor.

Phenanthrene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Pyrene

- Formula: $C_{16}H_{10}$
- Synonyms: None
- Appearance: Bright yellow solid

Carbazole

- Formula: $C_{12}H_9N$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Benzo(a)pyrene

- Formula: $C_{20}H_{12}$
- Synonyms: BaP, 3,4-benzopyrene
- Appearance and odor: Colorless solid with a faint aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for coal tar pitch volatiles is 0.2 milligram of coal tar pitch volatiles per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit for coal tar products be reduced to 0.1 mg/m^3 (cyclohexane-extractable fraction) averaged over a work shift of up to 10 hours per day, 40 hours per week, and that coal tar products be regulated as occupational carcinogens. The NIOSH Criteria Document for Coal Tar Products and NIOSH Criteria Document for Coke Oven Emissions should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Coal tar pitch volatiles can affect the body if they are inhaled or if they come in contact with the eyes or skin.

- **Effects of overexposure**

Repeated exposure to coal tar pitch volatiles has been associated with an increased risk of developing bronchitis and cancer of the lungs, skin, bladder, and kidneys. Pregnant women may be especially susceptible to exposure effects associated with coal tar pitch volatiles. Repeated exposure to these materials may also cause sunlight to have a more severe effect on a person's skin. In addition, this type of exposure may cause an allergic skin rash.

- **Reporting signs and symptoms**

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to coal tar pitch volatiles.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to coal tar pitch volatiles at potentially hazardous levels:

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the oral cavity, respiratory tract, bladder, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity.

—Urinalysis: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. A urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment, as well as a test for red blood cells.

—Urinary cytology: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology examination.

—Sputum cytology: Coal tar pitch volatiles are associated with an excess of lung cancer. Employees having 10 or more years of exposure or who are 45 years of age or older should have a sputum cytology examination.

—14" x 17" chest roentgenogram: Coal tar pitch volatiles are associated with an excess of lung cancer. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Coal tar pitch volatiles are reported to cause an excess of bronchitis. Periodic surveillance is indicated.

—A complete blood count: Due to the possibility of benzene exposure associated with coal tar pitch volatiles, a complete blood count is considered necessary to search for leukemia and aplastic anemia.

—Skin disease: Coal tar pitch volatiles are defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis, and semi-annually for employees 45 years of age or older or with 10 or more years' exposure to coal tar pitch volatiles.

• **Summary of toxicology**

Coal tar pitch volatiles (CTPV) are products of the destructive distillation of bituminous coal and contain polynuclear aromatic hydrocarbons (PNA's). These hydrocarbons sublime readily, thereby increasing the amounts of carcinogenic compounds in working areas. Epidemiologic evidence suggests that workers intimately exposed to the products of combustion or distillation of bituminous coal are at increased risk of cancer at many sites. These include cancer of the respiratory tract, kidney, bladder, and skin. In a study of coke oven workers, the level of exposure to CTPV and the length of time exposed were related to the development of cancer. Coke oven workers with the highest risk of cancer were those employed exclusively at topside jobs for 5 or more years, for whom the increased risk of dying from lung cancer was 10-fold; all coke oven workers had a 7-½-fold increase in risk of dying from kidney cancer. Although the causative agent or agents of the cancer in coke oven workers is unidentified, it is suspected that several PNA's in the CTPV generated during the coking process are involved. Certain industrial populations exposed to coal tar products have a demonstrated risk of skin cancer. Substances containing PNA's which may produce skin cancer also produce contact dermatitis; examples are coal tar, pitch, and cutting oils. Although allergic dermatitis is readily induced by PNA's in guinea pigs, it is only rarely reported in humans from occupational contact with PNA's; these have resulted largely from the therapeutic use of coal tar preparations. Components of pitch and coal tar produce cutaneous photosensitization; skin eruptions are usually limited to areas exposed to the sun or ultraviolet light. Most of the phototoxic agents will induce hypermelanosis of the skin; if chronic photodermatitis is severe and prolonged, leukoderma may occur. Some oils containing PNA's have been associated with changes of follicular and sebaceous glands which commonly take the form of acne. There is evidence that exposures to emissions at coke ovens and gas retorts may be associated with an increased occurrence of chronic bronchitis. Coal tar pitch volatiles may be associated with benzene, an agent suspected of causing leukemia and known to cause aplastic anemia.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data—Anthracene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.24
4. Vapor density (air = 1 at boiling point of anthracene): 6.15
5. Melting point: 217 C (423 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Phenanthrene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.18
4. Vapor density (air = 1 at boiling point of phenanthrene): 6.15
5. Melting point: 100.5 C (213 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Pyrene**

1. Molecular weight: 202.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)

3. Specific gravity (water = 1): 1.28
4. Vapor density (air = 1 at boiling point of pyrene): 6.9
5. Melting point: 150.4 C (303 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Carbazole**

1. Molecular weight: 167.2
2. Boiling point (760 mm Hg): 355 C (671 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of carbazole): 5.8
5. Melting point: 246 C (475 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Benzo(a)pyrene**

1. Molecular weight: 252.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of benzo(a)pyrene): 8.7
5. Melting point: 179 C (354 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**

1. Conditions contributing to instability: None hazardous
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

• **Flammability**

1. Flash point: Anthracene: 121 C (250 F) (closed cup); Others: Data not available
2. Autoignition temperature: Anthracene: 540 C (1004 F); Others: Data not available
3. Flammable limits in air, % by volume: Anthracene: Lower: 0.6; Others: Data not available
4. Extinguishant: Foam, dry chemical, and carbon dioxide

• **Warning properties**

Grant states that "coal tar and its various crude fractions appear principally to cause reddening and squamous eczema of the lid margins, with only small erosions of the corneal epithelium and superficial changes in the stroma, which disappear in a month following exposure. Chronic exposure of workmen to tar fumes and dust has been reported to cause conjunctivitis and discoloration of the cornea in the palpebral fissure, either near the limbus or, in extreme cases, across the whole cornea. Occasionally, epithelioma of the lid margin has been attributed to contact with coal tar."

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

Coal tar products may be sampled by collection on a glass fiber filter with subsequent ultrasonic extraction and weighing. An analytical method for coal tar pitch volatiles is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 1, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00267-3).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent skin contact with condensed coal tar pitch volatiles, where skin contact may occur.

• If employees' clothing may have become contaminated with coal tar pitch volatiles, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with coal tar pitch volatiles

should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of coal tar pitch volatiles from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the coal tar pitch volatiles, the person performing the operation should be informed of coal tar pitch volatiles's hazardous properties.

• Employees should be provided with and required to use splash-proof safety goggles where condensed coal tar pitch volatiles may contact the eyes.

SANITATION

• Workers subject to skin contact with coal tar pitch volatiles should wash with soap or mild detergent and water any areas of the body which may have contacted coal tar pitch volatiles at the end of each work day.

• Employees who handle coal tar pitch volatiles should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

• Areas in which exposure to coal tar pitch volatiles may occur should be identified by signs or other appropriate means, and access to these areas should be limited to authorized persons.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to coal tar pitch volatiles may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from extraction and packaging from coal tar fraction of coking	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a binding agent in manufacture of coal briquettes used for fuel; use as a dielectric in the manufacture of battery electrodes, electric-arc furnace electrodes, and electrodes for alumina reduction	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture of roofing felts and papers and roofing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use for protective coatings for pipes for underground conduits and drainage; use as a coating on concrete as waterproofing and corrosion-resistant material; use in road paving and sealing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and repair of refractory brick; use in production of foundry cores; use in manufacture of carbon ceramic items	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• **Eye Exposure**

If condensed coal tar pitch volatiles get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with these chemicals.

• **Skin Exposure**

If condensed coal tar pitch volatiles get on the skin, wash the contaminated skin using soap or mild detergent and water. Be sure to wash the hands before eating or smoking and to wash thoroughly at the close of work.

• **Breathing**

If a person breathes in large amounts of coal tar pitch volatiles, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.

• If coal tar pitch volatiles are released in hazardous concentrations, the following steps should be taken:

1. Ventilate area of spill.

RESPIRATORY PROTECTION FOR COAL TAR PITCH VOLATILES

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m³
Particulate and Vapor Concentration	
2 mg/m³ or less	A chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high-efficiency filter. Any supplied-air respirator. Any self-contained breathing apparatus.
10 mg/m³ or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high-efficiency filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
200 mg/m³ or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode. A powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter.
400 mg/m³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 400 mg/m³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

safe manner for reclamation or for disposal in sealed containers in a secured sanitary landfill.

- Waste disposal method:

Coal tar pitch volatiles may be disposed of in sealed containers in a secured sanitary landfill.

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- Scala, R. A.: "Toxicology of PPOM," *Journal of Occupational Medicine*, 17:784-788, 1975.
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Material Safety Data Sheet

Section I - Manufacturer's Information

INDCO Inc.
N. Railroad & Essex Sts.
Gloucester City, N.J. 08030

Emergency Phone Number: (609) 456-6100
Information Phone Number: (609) 456-6100
Updated: 08/14/1988

Section II - Hazardous Ingredients/Identity Information

Hazardous Components	CAS Number	OSHA PEL	ACGIH TLV	%
********** NO HAZARDOUS COMPONENTS **********				

Section IIa - Regulatory Information

DOT Proper Shipping Name:
NA
DOT Class: NONE DOT Number: NA
RCLA Status:
NA
CERLA Status:
NA
SARA/Title III - CERLA List:
Mild Cleaning Comp

Material Name	CAS Number	%	Reportable Quantity

SARA/Title III - Toxic Chemical List:
NA

Material Name	CAS Number	%	Reportable Quantity

TSCA Inventory Status: All components listed on TSCA Inventory.

Section III - Physical/Chemical Characteristics

Boiling Point: > 212.0 F
Specific Gravity (H2O=1): 0.8650
Vapor Pressure (mm Hg): NA
Melting Point: NA
Vapor Density (air=1): NA
Evaporation Rate (water=1): > 1.00
Solubility in Water:
pH: 7.00
Complete
Appearance and Odor:
Yellow - Orange clear liquid
Citrus blend odor, orange predominates.

Section IV - Fire and Explosion Hazard Data

Flash Point: > 140.0 F Flammable Limits LEL: NA UEL: NA
Method Used:

TOC

Extinquishing Media:

CO2, Water, Foam, Dry Chemical

Special Fire Fighting Procedures:

Protective clothing and pressure-demand,self-contained breathing apparatus should be worn by firefighters in areas where these products are stored, especially in a confined area.

Unusual Fire and Explosion Hazards:

NONE SPECIAL

Section V - Reactivity Data

Stability: Stable

Conditions to Avoid:

NA

Incompatibility (Materials to Avoid):

Strong acids and oxidizing agents

Hazardous Decomposition or Byproducts:

CO, CO2, plus misc. unknowns in small amounts.

Hazardous Polymerization: May Not Occur

Conditions to Avoid:

NA

Section VI - Health Hazard Data

Route(s) of Entry:

Inhalation? Moderate Skin? Moderate Ingestion? Moderate

Health Hazards (Acute and Chronic):

Acute and chronic health hazards are difficult to accurately assess for mixtures. In general see the first aid section for acute effects and long term effects would have to be derived from these immediate results. Specific chronic effects can be studied from the individual hazardous chemicals as indicated under Section II as the best guess without extensive laboratory studies.

Carcinogenicity:

NTP? None known IARC Monographs? None known OSHA Regulated? None known

Signs and Symptoms of Exposure:

Skin contact will cause itching and redness. Eyes will start to feel a strong burning sensation, as will mucous membranes.

Medical Conditions Generally Aggravated by Exposure:

A knowledge of the available toxicology information and of the physical properties of the material suggests that exposure is unlikely to aggravate existing medical conditions. However, due to the widely varying uses and personal exposures possible, an individual will have to evaluate his/her particular situation.

Emergency and First Aid Procedures:

EYES: Wash with water for 15 minutes, see a doctor.

SKIN: Wash with water,apply skin lotion if redness persists.

OTHER:Wash mouth and other areas with water.
See a doctor if ingested.

INGESTION: Wash out mouth and other contacted parts with water.
Never give anything to an unconscious person. If conscious give one or two glasses of water and.....
INDUCE VOMITING BY:
-Place finger at back of victim's throat, or

-Use 2 teaspoons of salt in a glass of warm water, or
(10 gms salt in 200 ml warm water)
-use one ounce of syrup of ipecac

When retching and vomiting begin, place the victim's face down with head lower than hips. This prevents vomitus from entering the lungs and causing further damage.

SEE A DOCTOR !

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled:

Wash small spills with water to local sanitary sewer as permitted.

ALTERNATIVE METHOD
Asborb small spills with suitable material (sand, clays, sawdust, earth) and place into leak-proof container for later disposal. Flush balance of area with water to remove residues. Dispose of all material in accordance with Federal, State, and Local laws.
Confine all spilled material with diking material. Suck up all material as quickly as possible with a vacuum truck. Smaller spills can be absorbed directly with clays, sand or other suitable materials. Place all collected materials into appropriate drums for transportation to an approved landfill or waste disposal site.
Follow all Federal, State, and local laws when disposing.

Waste Disposal Method:

This material is biodegradable, therefore small amounts when flushed with water are not anticipated to harm the environment, when sent to a sanitary sewer and properly processed.
Since Federal, State, and local laws vary greatly from situation to situation, and since these materials are mixtures, no one preferred waste disposal method can be given. However one must keep in mind that all of these type products are ultimately destined to go " down the drain " since they are cleaning compounds of one sort or another. Generally, in a highly diluted or completely neutralized state they present no particular environmental hazard, they can be treated as ordinary waste, which is piped to a sanitary sewer for proper waste treatment.

Neither the product nor its effluent should be discharged into any river, lake, stream, creek, or watershed that might contaminate drinking water or well water. Any discharge must be specifically permitted by the proper authority like the DEP or DER depending on your state laws. Re-evaluation of the product may be required by the user at the time of disposal, since the product uses, tranformations, mixtures, and processes may change classification . Consult your hazardous waste consultant to be sure that the method chosen addresses the applicable problems.

Precautions to Be Taken in Handling and Storing:

Do not freeze product. Do not subject product to excessive heat. Keep out of the reach of children. Do not contaminate food stuffs. Do not mix with any other chemicals except under direct supervision of a chemist, or technically trained supervisior. Mix only with water. During storage and transport of the product keep dry at all times, and do not exceed container integrity (i.e. improperly double or triple decking of pallitized goods).

If sensitivity or aggravation of allergy, or unanticipated personal health problems become evident, stop use and see your supervisor.

Keep in mind that often the use solution and the concentrate will have different safety precautions.

Other Precautions:

Launder contaminated clothing before re-use. Discard all contaminated gloves, boots, and other articles that can not be properly cleaned.

Section VIII - Control Measures

Respiratory Protection (Specific Type):

Usually none needed.

Ventilation:

Local Exhaust:	Recommended	Special:	Recommended
Mechanical (General):	Recommended	Other:	None known

Protective Gloves:

Light rubber gloves for long use are recommended, i.e. Playtex type.

Eye Protection:

Safety glasses or chemical splash goggles are always recommended, as are eyewash fountains in all industrial processing areas.

Other Protective Clothing or Equipment:

Wear long sleeve shirts and pants. Launder dirty uniforms regularly. Wash or shower daily to maintain good cleanliness when in contact with various cleaning or water treating chemicals.

Work/Hygienic Practices:

Non-slip safety shoes with a splash apron are good practices to follow. ---Start Clean----Stay Clean----End Clean = Work Safely.

Section IX - Documentary Information

Comments:

Section II Hazardous Material Section Percentage Key. If no hazardous chemicals are present then this section is not applicable.

Nil	-> 0.0%	to	0.1%
Trace	-> 0.1%	to	1.0%
Some	-> 1.0%	to	5.0%
Minor Comp	-> 5.0%	to	25.0%
Substantial	->25.0%	to	50.0%
Major Comp	->50.0%	to	100.0%

Substances listed in Section II are those identified as being present at a concentration of 1% or greater, or 0.1% if the substance is on the list of potential carcinogens cited in OSHA Hazard Communication Std.

If Section II does not contain any hazardous chemicals as presently defined in our applicable tables the message ....

********** NO HAZARDOUS CHEMICALS**********

.... will appear in this section above.

NOTE: For solid products, pH is taken of a 2% solution.

The information presented herein has been compiled from sources considered to be dependable and is accurate to the best of seller's knowledge, or has been generated to the best of our ability without extensive research beyond our understanding or economical feasibility. Seller makes no warranty whatsoever, expressed, implied or of merchantability of the product or of results obtained from this report.

If you determine that the data does not meet your needs or that

questions remain, consult your supplier before you purchase, store, transport or use this product.

Consult a technically trained service-person or salesman for use of this product as it specifically pertains to your situation. Seller assumes no responsibility for injury to buyer or to third persons or for any damage to any property and buyer assumes all such risks.

PREPARED BY: Frederick Binter Jr., President, BSCHE,BSEAdm. and
David Telefus Ph.D., Organic Chemistry, Administrative Assistant for Regulatory Affairs

MONTGOMERY CHEMICAL CO.

MARINE & INDUSTRIAL CHEMICALS

PRODUCT INFORMATION SHEET

MONCOSOLVE 210

Specifications: THIS PRODUCT IS UNIQUE

Odor:	Pleasant citrus odor
Emulsifers:	Yes
Water Content (as is):	NONE
Free Caustic	None
Free acid:	None
Enzymes:	None
Solvent type:	Terpenes (Alpha Pinene, Sabinene, Myrcene, Limonene, Octane and some high & low boilers > 2.5%)
Effect on Beneficial Digestive Bacteria In Sewage Systems	None
Biodegradable solvent:	Yes
Flash point:	Moncosolve 210, 145 °F
FACTS THAT FAVOR MONCOSOLVE 210	No petroleum solvents, food or medical type solvent used
	No chlorinated solvents
	No ortho dichlorinated products
	No acid
	No caustic
	Non-corrosive to metal pipes, not for most plastic pipes

Major use is for degreasing with improved safety and to be environmentally non-polluting Major areas of use are food plants, sewage plants, industrial cleaning, drain maintance, oil refineries and commercial cleaning soil remedition, silicone and adhesive removal.

WARNINGS

USE IN A WELL VENTILATED AREA. HARMFUL IF SWALLOWED! CONTACT WITH SKIN OR EYES CAN CAUSE IRRITATION ! KEEP OUT OF THE REACH OF CHILDREN ! Do not store or use near open flame or high heat. If allergic reaction should occur consult a physician at once. FIRST AID: EYES: Immediately wash eyes with water for at least 15 minutes. Seek medical attention as soon as possible. SKIN: Wash with soap and water, apply lotion if irritation continues. INHALATION: Remove to fresh air, give oxygen if needed, or artificial respiration to maintain breathing. INGESTION: Wash out mouth and other contacted parts with water. Never give anything to an unconscious person. If conscious give one or two glasses of water and induce vomiting. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs. Place head between the knees before beginning of self inducement and inducement should be supervised. Get medical attention at once.

Moncosolve 210 is based on a 100% natural organic solvent that is formulated in a very different way than other products for one-step degreasing and deodorizing. The unique part of this is that it is not a petroleum distillate and has special additives to greatly improve performance! The major problem of petroleum solvent use is that of environmental impact of waste disposal. This new approach is the first effective formulation alternative to effectively replace the older solvent systems. This product replaces a very large number of solvent cleaners used by industry, and in particular makes possible the cleaning of many oils not previously considered possible.

APPLICATION, DOSAGE AND CONTROL

For Road and Roof Equipment: Oil, Tar & Asphalt: For asphalt, bituminous asphalt and plastic cement apply undiluted to surface by spray, foam or mop. Allow 3 to 5 minutes for penetration, agitate as needed and rinse off with high pressure. Use in parts washers and reclaim oil and good solvent is used again and again, just let the solvent sit and decant oils off and use again and again. Dispose of oil in an approved manner.

Commercial Spotting: Fabric, Rug & Upholstery Degreasing: Apply with a cloth or sponge to soiled area , let stand for 2 minutes and blot off, wash in normal manner. For use in commercial washers use 10 oz per each 75 lbs of fabric in the first wash for 5 min. at 90 degrees and follow with a regular detergent in hot water. Pre-spotter for extraction cleaning.

Commercial Food Plants: USDA APPROVED FOR FOOD PLANT USE: Use on kitchen vents, greasefilter and adhesive box sealers, for degreasing of bearings on high temperature ovens, kettles and vats,food elevators and transport equipment.. Spray all of the surface or dip in tank and soak for 5 min. remove and flush off, steam or pressure rinse.

Tire Mark Remover: Soak area with diluted solution and agitate, let stand for 2 minutes and flush to drain or vacuum up. Will also remove rubber and plastic burns and food varnish from common grills and pans.

Tankwagons and Pipilnes: (Roplex Emulsion type) Spray on and let stand for 2 minutes then pressure hose off. Circulate rinse water under pressure in any pipe for at least 5 minutes before using to effectively rinse.

Soil Remediation: Wash soil in a 100% solution, agitate for 10 minutes and flood to over flow the container removing the light oils and drain vessel to remove the real heavy oils. Then wash with water and drain to tank for bio degradition. Reuse solution after decanting. Dispose of oils in an approved manner only. Soil is then sun dried and returned after inspection. This is also effective on metal parts and chips contaminated with silcone, oils and many DDT type pesticides which use special oils as binders.

Montgomery Chemical Co

Moncosolve 210

Moncosolve 210 is based on a 100% natural organic solvent for one-step degreasing and deodorizing. The unique part of this is that it is not a petroleum distillate! The major problem of petroleum solvent use is that of environmental impact of waste disposal. This new approach is the first effective formulation alternitive to effectively replace the older solvent systems. This one product group replaces a very large number of solvent cleaners used by industry, natural solvent systems for commercial cleaning.

Use Instructions:

Tar & Asphalt; For asphalt, bitman asphalt/plastic cement apply undiluted to surface by spray, foam or mop. Allow 3 to 5 minutes for penetration, agitate as needed and rinse off with high pressure.

Fabric, Rug & Upholstery Degreasing; Apply with a cloth or sponge to soiled area ,let stand for 2 minutes and blot off, wash in normal manner. For use in commercial washers use 10 oz per each 75 lbs of fabric in the first wash for 5 min. at 90 degrees and follow with a regular detergent in hot water. Always pretest fabric. To remove chewing gum, soak area and letstand for 3 min. and scrap up gum and repeat for final details of gum.

Kitchen Vent Grease Filters; Spray all of the surface or dip in tank andsoak for 5 min. remove and flush off, steam or pressure rinse.

Tire Mark Remover: Soak area with diluted solution and agitate, let stand for 2 minutes and flush to drain or vacuum up.

Garbage Truck and Dumpster Cleaning; Mix one to two gallons with 20 gallons of water and spray or foam on surface, let stand or agitate as needed for 2 to 5 minutes and pressure rinse off.

Paint: For use with fresh paint clean up of brushes, put 8 oz in a quart bottle with the paint brush to be cleaned, work concentrate into brush and wash brush out in warm water, repeat if paint has dryed on in some areas extending soak time. Save solution in the bottle. Works on oil and laytex paints.

Gloucester City NJ 08030 5 gal

Occupational Health Guideline for Naphthalene

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $C_{10}H_8$
- Synonyms: White tar; naphthalin
- Appearance and odor: Colorless to brown solid with the odor of mothballs.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for naphthalene is 10 parts of naphthalene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 50 milligrams of naphthalene per cubic meter of air (mg/m³).

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Naphthalene can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may enter the body through the skin.

- **Effects of overexposure**

1. Short-term Exposure: Inhalation or ingestion of naphthalene may cause abdominal cramps, nausea, vomiting, diarrhea, headache, tiredness, confusion, painful urination, and bloody or dark urine. Swallowing large amounts may cause convulsions or coma. Inhalation, ingestion, and possibly skin absorption of naphthalene may cause destruction of red blood cells with anemia, fever, yellow jaundice, bloody urine, kidney and liver damage. Naphthalene, on contact with the eyes, has produced irritation. Naphthalene, on contact with the skin, has produced skin irritation.

2. Long-term Exposure: Repeated skin exposure to naphthalene may cause an allergic rash. Repeated exposure may cause cataracts.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to naphthalene.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to naphthalene at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Persons with a deficiency of glucose-6-phosphate dehydrogenase in erythrocytes may be at increased risk from exposure. Examination of the eyes, blood, liver and kidneys should be stressed. The skin should be examined for evidence of chronic disorders.

—A complete blood count: Naphthalene has been shown to cause red blood cell hemolysis. A complete blood count should be performed, including a red cell count, a white cell count, and a differential count of a stained smear, as well as hemoglobin and hematocrit.

—Urinalysis: Since kidney damage may also occur from exposure to naphthalene, a urinalysis should be performed, including at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis.

- **Summary of toxicology**

Naphthalene vapor causes hemolysis and eye irritation; it may cause cataracts. Severe intoxication from ingestion of the solid results in characteristic manifestations of marked intravascular hemolysis and its consequences, including potentially fatal hyperkalemia. Initial symptoms include eye irritation, headache, confu-

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

sion, excitement, malaise, profuse sweating, nausea, vomiting, abdominal pain, and irritation of the bladder; there may be progression to jaundice, hematuria, hemoglobinuria, renal tubular blockage, and acute renal shutdown. Hematologic features include red cell fragmentation, icterus, severe anemia with nucleated red cells, leukocytosis, and dramatic decreases in hemoglobin, hematocrit, and red cell count; sometimes there is formation of Heinz bodies and methemoglobin. Individuals with a deficiency of glucose-6-phosphate dehydrogenase in erythrocytes may be more susceptible to hemolysis by naphthalene. Cataracts and ocular irritation have been produced experimentally in animals and have been described in humans; of 21 workers exposed to high concentrations of fume or vapor for 5 years, 8 had peripheral lens opacities; in other studies no abnormalities of the eyes have been detected in workers exposed to naphthalene for several years. The vapor causes eye irritation at 15 ppm; eye contact with the solid may result in conjunctivitis, superficial injury to the cornea, chorioretinitis, scotoma, and diminished visual acuity. Naphthalene on the skin may cause hypersensitivity dermatitis; chronic dermatitis is rare.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 128.2
2. Boiling point (760 mm Hg): 218 C (424 F)
3. Specific gravity (water = 1): 1.14
4. Vapor density (air = 1 at boiling point of naphthalene): 4.4
5. Melting point: 74– 80 C (165 – 176 F)
6. Vapor pressure at 20 C (68 F): 0.05 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.003
8. Evaporation rate (butyl acetate = 1): Much less than 1

- **Reactivity**

1. Conditions contributing to instability: None.
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as dense acrid smoke and carbon monoxide) may be released in a fire involving naphthalene.
4. Special precautions: Melted naphthalene will attack some forms of plastics, rubber, and coatings.

- **Flammability**

1. Flash point: 79 C (174 F) (closed cup)
2. Autoignition temperature: 526 C (979 F)
3. Flammable limits in air, % by volume: Lower: 0.9; Upper: 5.9
4. Extinguishant: Carbon dioxide, dry chemical, foam

- **Warning properties**

1. Odor Threshold: The AIHA *Hygienic Guide* reports that the odor threshold of naphthalene is "at least as low as 0.3 ppm."
2. Eye Irritation Level: The *Hygienic Guide* states that "naphthalene vapor is reported to cause eye irritation at 15 ppm or above in air."
3. Evaluation of Warning Properties: Through its odor and irritant effects, naphthalene can be detected at or below the permissible exposure limit. Naphthalene, therefore, is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

- **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

- **Method**

Sampling and analyses may be performed by collection of vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure naphthalene may be used. An analytical method for naphthalene is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 4, 1978, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00317-3).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with naphthalene or liquids containing naphthalene.
- If employees' clothing may have become contaminated with solid naphthalene, employees should change into uncontaminated clothing before leaving the work premises.
- Clothing contaminated with naphthalene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of naphthalene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the naphthalene, the person performing the operation should be informed of naphthalene's hazardous properties.
- Non-impervious clothing which becomes contaminated with naphthalene should be removed promptly and not reworn until the naphthalene is removed from the clothing.
- Employees should be provided with and required to use dust- and splash-proof safety goggles where solid naphthalene or liquids containing naphthalene may contact the eyes.

SANITATION

- Skin that becomes contaminated with naphthalene should be promptly washed or showered with soap or mild detergent and water to remove any naphthalene.
- Eating and smoking should not be permitted in areas where solid naphthalene is handled, processed, or stored.
- Employees who handle naphthalene or liquids containing naphthalene should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to naphthalene may occur and control methods which may be effective in each case:

Operation	Controls
Formulation of insecticide and moth repellant as flakes, powder, balls, or cakes	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a fumigant for moth repellant and insecticide	General dilution ventilation; personal protective equipment
Use in manufacture of chemical intermediates for production of pharmaceuticals, resins, dyes, plasticizers, solvents, coatings, insecticides, pigments, rubber chemicals, tanning agents, surfactants, waxes, cable coatings, textile spinning lubricants, rodenticides, and in storage batteries	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Manufacture of naphthalene	Local exhaust ventilation; process enclosure; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Eye Exposure**

If naphthalene or liquids containing naphthalene get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

- **Skin Exposure**

If molten naphthalene gets on the skin, immediately flush the skin with large amounts of water. Get medical attention immediately. If naphthalene or liquids containing naphthalene get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If naphthalene or liquids containing naphthalene penetrate through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

- **Breathing**

If a person breathes in large amounts of naphthalene, move the exposed person to fresh air at once.

- **Swallowing**

When naphthalene has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify some-

one else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills until cleanup has been completed.

• If naphthalene is spilled, the following steps should be taken:

1. Ventilate area of spill.
2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber.

• Waste disposal methods:

Naphthalene may be disposed of:

1. By making packages of naphthalene in paper or other flammable material and burning in a suitable combustion chamber.
2. By dissolving naphthalene in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber.

ADDITIONAL INFORMATION

To find additional information on naphthalene, look up naphthalene in the following documents:

• Medical Surveillance for Chemical Hazards
• Respiratory Protection for Chemical Hazards
• Personal Protection and Sanitation for Chemical Hazards

These documents are available through the NIOSH Division of Technical Services, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

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RESPIRATORY PROTECTION FOR NAPHTHALENE

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Particulate and Vapor Concentration	
500 ppm or less	A chemical cartridge respirator with a full facepiece, organic vapor cartridge(s), and dust filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and dust filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 500 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.