WORK PLAN

FOR THE

FOCUSED GROUND-WATER INVESTIGATION

AND

FOCUSED GROUND-WATER FEASIBILITY STUDY

AT THE

570 MAIN STREET PROPERTY
WESTBURY, NEW YORK

OCTOBER 1997
(ADDENDUM 2, MAY 1998)

Prepared For:

IMC MAGNETICS CORP.

Prepared By:

HULL & ASSOCIATES, INC.
6130 WILCOX ROAD
DUBLIN, OHIO 43016
(614) 793-8777

LAND TECH REMEDIAL, INC.
31 DUBON COURT
FARMINGDALE, NEW YORK 11735
(516) 694-4040

WORK PLAN
FOR THE
FOCUSED GROUND-WATER INVESTIGATION
AND
FOCUSED GROUND-WATER FEASIBILITY STUDY
AT THE
570 MAIN STREET PROPERTY
WESTBURY, NEW YORK

(HAI DOCUMENT #NMB004.300.0076 (ADDENDUM 2))

DISTRIBUTION:

Dr. Chittibabu Vasudevan, P.E., NYSDEC
Joseph Jones, NYSDEC
Jeanna E. Hussey, Esq., NYSDEC
Ray Cowen, NYSDEC
G. Anders Carlson, Ph.D., NY State Department of Health
Chris M. Rawnsley, IMC, c/o New Hampshire Ball Bearings, Inc.
J. Brian Molloy, Esq., Piper & Marbury, L.L.P.
Timothy L. Douthit, LTR
Michael C. Harvell, Esq., Sheehan, Phinney, Bass + Green
Mr. John Lovejoy, Nassau County Department of Health
HAI Internal Copies

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (cont.)

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 General

Hull & Associates, Inc. (HAI) and Land Tech Remedial, Inc. (LTR) have been retained by IMC Eastern Corp. (IMC) to conduct a focused ground-water investigation at 570 Main Street in Westbury, New York (Site). The Site is within the New Cassel Industrial Area (NCIA), a Class 2 inactive hazardous waste site as designated by the New York State Department of Environmental Conservation (NYSDEC).

This Work Plan has been prepared for IMC, the NYSDEC, HAI, LTR, and their subcontractors and is supported by the documents described in Section 1.9.

This report is arranged in four sections. Section 1.0 describes the Site, project objectives, project management, and organization of the Work Plan and supporting documents. Section 2.0 describes the proposed work activities. Section 3.0 provides a schedule of implementation and Section 4.0 lists the references used to prepare this document. All figures, tables, and plates referenced in this document are located at the end of the text.

1.2 Site Description

The Site is located at 570 Main Street in Westbury, New York, and is within the 170-acre NCIA. A Site Location Map is presented on Figure 1. The Site was occupied by IMC from the early 1950s until 1992. The property is slightly over two acres with one manufacturing building and a paved parking lot covering most of the area. The Site is currently occupied by Castle Collision, an entity unrelated to IMC.

1.3 Previous Investigations

1.3.1 Anson Environmental, Ltd.

Anson Environmental, Ltd. (Anson) performed preliminary investigative activities associated with the closure of the IMC manufacturing operation at the Site.[1] Anson reportedly developed a closure

---

[1] 1993 *Closure Plan Implementation, Volume I, IMC Magnetics, Corp.*, Anson Environmental, Ltd. undated; an untitled report from Anson Environmental, Ltd. to representatives of IMC Magnetics Corp., July 21, 1993; *Closure Plan, History, IMC Magnetics Corp.*, Anson Environmental, Ltd., December 3, 1993; and *Closure Plan, IMC Magnetics Corp.*, Anson Environmental, Ltd., December 3, 1993.

plan for the IMC facility in 1992; however, this closure plan was not available for review. Implementation of this closure plan began in March 1993, and consisted of exposing abandoned leaching pools and septic tanks from three areas of the Site, designated as Area 1, Area 2, and Area 3. Sediment and soil samples were collected from these locations for laboratory analyses. Sediment samples were also collected from four floor drains in the building for laboratory analyses. Finally, a composite sample of water was collected during power washing of floors in the building and samples of concrete floors were submitted for laboratory analyses.

The findings of these field activities are discussed in Anson's 1993 *Closure Plan Implementation* report, the untitled July 21, 1993 report, and the undated *Closure Plan, Final Report.* Anson identified three main potential source areas that include:

1. Area 1, located outside the building in the Site's northeast corner;
2. Area 2, located outside the building in the Site's northwest corner; and
3. Area 3, located outside the building near the Site's southwest corner.

In addition to these areas, Anson identified five probable floor drains that were also considered potential source areas.

1.3.2 Lawler, Matusky & Skelly Engineers, February 1995

Lawler, Matusky & Skelly Engineers (LMS) was contracted by NYSDEC to conduct a site investigation of the NCIA.[2] The investigation consisted of a file review, ground-water sampling and analysis from 56 existing monitoring wells, and ground-water sampling and analysis from *Geoprobe* soil boring locations installed during the investigation. The Site was identified as a potential source of ground-water contamination in the plume designated as the "570 Main Street plume"; however, this was never confirmed by investigations conducted by LMS or Anson.

---

[2] *Site Investigation Report, New Cassel Industrial Area Site, North Heampstead, Nassau County,* Lawler, Matusky & Skelly Engineers, February 1995.

1.3.3 Interim Remedial Measure, February 1997

Hull & Associates, Inc. and Land Tech Remedial, Inc. conducted an IRM at the Site from May to July 1996. The activities conducted at the Site are detailed in the work plan for the IRM and included a detailed file review and source and release identification study, collection of unsaturated soil samples at various depths and areas of the Site, collection of a limited number of ground-water samples, and a soil vapor extraction (SVE) pilot test.[3] The Final Investigation Report documents the results of the IRM.[4]

Based on a file review and source and release identification study, four areas of concern were identified including Areas 1, 2, and 3 and several dry well-type floor drains identified by previous investigations.

Soils encountered at the Site consist primarily of a heterogeneous mixture of brown to tan fine sands with lessor amounts of silt, medium sands, coarse sands, and gravels. Clay lenses or other impermeable features were not encountered during the investigation. Total organic carbon (TOC) content was generally low averaging approximately 0.2 percent with values as high as 0.8 percent. The depth to ground water measured in the existing monitoring wells was approximately 54 to 55 feet below grade with an apparent ground-water flow direction to the southwest.

Based on the distribution of VOCs detected at the Site, active intervention outside of Area 2 was determined unnecessary because there is not a complete exposure pathway to the identified VOCs. Additionally, the data indicate that migration of VOCs from the vadose zone to ground water is not likely.

Based on the distribution of metals detected at the Site, active intervention was deemed unnecessary because there is not a complete exposure pathway to the identified metals and the data indicates that leaching of the metals from the vadose zone to ground water is not likely.

Based on the distribution of VOCs and metals at the Site and the pathway completeness analysis, Area 2 was the only area considered for active remediation. The primary constituent at this location

---

[3] *Work Plan for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone* (HAI Document # NMB004D.009), March 1996.

[4] *Final Investigation Report* (HAI Document # NMB004D.032), February 1997.

was PCE. Based on the volatility of the constituents and the results of the soil vapor extraction (SVE) pilot test, SVE technology was selected as the interim remedial measure for the vadose zone at the Site. A plan was prepared to describe the operation, monitoring and maintenance of the SVE system.[5]

1.4 Geology/Hydrogeology Summary

1.4.1 Regional Geology/Hydrogeology

The majority of the ground water underlying New Cassel Industrial area is in unconsolidated glacial deposits of Pleistocene age and coastal-plain deposits, of both continental and marine origin, of late Cretaceous age. These unconsolidated deposits consist of gravel, sand, silt, and clay and are underlain by bedrock of lower Paleozoic and/or Precambrian age. The bedrock, which is virtually impermeable, forms the base of the ground-water reservoir. The two primary aquifers in the area of the Site are the Upper Glacial Aquifer and the Magothy aquifer. The Magothy aquifer is underlain by the Raritan clay.

The Upper Glacial Aquifer consists of outwash deposits of late Pleistocene age. The Upper Glacial Aquifer overlies the Magothy aquifer in the investigation area, and its deposits form the present land surface. The upper Pleistocene glacial outwash deposits consist of stratified deposits of sand and gravel with some cobbles and may locally contain thin clay beds. These deposits are highly permeable and allow recharge water to percolate downward with relative ease to the water table and, subsequently, to the underlying aquifers.

The Upper Glacial Aquifer, as defined and used by the USGS on Long Island, includes both the unsaturated and saturated portions of the upper Pleistocene deposits. USGS maps indicate that the thickness of the Upper Glacial Aquifer in the area of the Site is approximately 50 feet. Background data also indicate that the upper Pleistocene deposits in the New Cassel area are unsaturated; therefore, the water table may locally occur in the underlying Magothy aquifer approximately 55 feet below grade. Regional ground-water flow direction local to the New Cassel area, as determined by the USGS and the Nassau County Department of Public Works is towards the southwest.

---

[5] *Operation, Monitoring, and Maintenance Plan* (HAI Document # NMB004D.040), February 1997.

The Magothy aquifer is the principal aquifer underlying Long Island and is the island's main source of potable water. The aquifer is composed of upper Cretaceous sediments that overlie the Raritan clay. Its deposits consist primarily of lenticular and discontinuous beds of very fine to medium sand, commonly clayey or containing thin clay lenses, that are interbedded with clay and sandy clay, silt, and some sand and gravel. Coarse beds of sand and gravel commonly occur in the lower 100 to 150 feet of the aquifer. Previous investigations have indicated that the aquifer sediments appear to grade upward from coarser grained at the base to finer grained at the top. The greater proportion of the clay and sandy clay occurs in the upper half of the aquifer. Beds of clay occur locally towards the top of the aquifer and seem to be distributed irregularly throughout the Town of North Hempstead. This is evident in the well completion logs generated for public supply well numbers N-8956 and N-8957 in the Bowling Green Water District, which is located approximately 3,000 feet southeast of the Site. A solid brown clay layer was logged during the drilling of well number N-8956 at 95 feet below grade. This same clay layer was not encountered during the drilling of well number N-8957, which was installed only 140 feet to the southeast of N-8956.

The Magothy aquifer is approximately 500 feet thick in the New Cassel area, and is encountered at a depth of approximately 50 feet below grade. According to the USGS it is quite possible that the uppermost part of the Magothy contains deposits of Pleistocene age, or, conversely, that the lower part of the upper glacial aquifer contains deposits of Cretaceous age. The boundary between the Cretaceous and Pleistocene deposits is often indistinguishable in Nassau County because the sediments are of similar composition and show no significant lithological difference.

1.4.2 Site-Specific Geology/Hydrogeology

Soils at the Site consist primarily of a heterogeneous mixture of brown to tan fine sands with lessor amounts of silt, medium sands, coarse sands and gravels. A discontinuous layer with increased silt content exists in the interval between grade and approximately 10 feet below grade. Below this silty layer, soil composition remains generally constant with a slight fining-downward trend (progressive loss of coarse sands and gravels with depth) to approximately 50 feet below grade. No clay lenses, or other impermeable features were encountered at the Site.

Soil organic carbon content averages approximately 0.2 percent TOC. Higher TOC values were detected in the silty layer encountered in the near-surface sediments, with values as high as approximately 0.8 percent.

Please get this out to

Heather Ganges
Piper + Marbury
L.L.P
1200 Nineteenth St., N.W.
Washington D.C. 20036

with a letter reading

Dear Ms. Ganges,

Depth to water at the Site, as measured in site monitoring wells (MW-1, MW-2 and MW-3), was approximately 54 to 55 feet below grade. Based on the surveyed measuring point elevations for the wells (averaging approximately 122 feet above sea level), apparent ground-water flow at the Site is to the southwest, which is consistent with the regional ground-water flow direction in the New Cassel Industrial Area. The ground-water gradient measured at the Site is approximately 0.0015 ft/ft.

1.5 Potential Source Areas and Contaminant Distribution

Detected VOCs outside of Area 2, with the exception of PCE, were detected at concentrations below 100 parts per billion (ppb). In addition, VOCs were not detected above method detection limits at most locations outside of Area 2 and, with the exception of PCE, were not detected above method detection limits at a depth greater than 10 feet. No constituents, except PCE, were detected above Site-specific screening levels at any location outside of Area 2.[6] At locations outside of Area 2 where PCE was detected above Site-specific screening levels, it occurred at a depth of ten feet or less and was not detected at depths greater than 15 feet.

In Area 2, all constituents (BTEX, 1,1-DCE, 1,1,1-TCA, TCE, and PCE) were present above Site-specific screening levels. In SB-25, PCE was detected above the Site-specific screening level from five to 50 feet. All other constituents were detected above Site-specific screening levels from approximately ten to thirty feet and generally were below method detection limits above and below this interval. Consequently, the only potential source area to ground water at the Site is Area 2.

VOCs in ground water were below method detection limits at SB-29 located at the eastern edge of Site (downgradient direction). At Area 1, PCE was the only constituent detected at concentrations of 7 and 172 ppb, respectively. Four constituents were detected at Area 2, including toluene (33 ppb), ethylbenzene (4 ppb), m&p xylenes (9 ppb), and PCE (2680 ppb). At Area 3, TCE (<55 ppb), PCE (<64 ppb), 1,1,1-TCA (<2 ppb), and 1,1-DCE (<1 ppb) were detected. Three constituents were detected at MW-2 located at the northern edge of the Site (upgradient direction) including 1,1,1-TCA

---

[6] Based on soil cleanup objectives detailed in the NYSDEC technical and administrative guidance memorandum (TAGM) titled "Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels." November 16, 1992. The soil cleanup objectives from NYSDEC's November 16, 1992 TAGM are only being used as a basis for comparison and are not to be construed as the cleanup goals for the IRM.

(7 ppb), TCE (206 ppb), and PCE (899 ppb). At the western edge (downgradient direction) of Site, two constituents were detected including TCE (102 ppb) and PCE (55 ppb).

The Final Investigation Report concluded that leaching of metals detected in the vadose zone at the Site into ground water is unlikely an ongoing source of contamination to ground water. The available information was not sufficient to determine if leaching had occurred.

1.6 Project Description and Objectives

Subsurface investigations will be conducted to gather data for the evaluation of the vertical and horizontal distribution of contaminants in ground water upgradient and downgradient of Area 2. These contaminants include selected VOCs and metals. The objective is to provide sufficient data to determine any potential on-site migration of contaminants from off-site sources, and determine if ground water beneath the Site has been impacted by contaminants detected in the vadose zone in Area 2. In addition, the vertical distribution of potential contaminants will be determined in the upper portion of the ground water. Finally, the potential for biodegradation of dissolved chlorinated solvents beneath the Site will be identified.

1.7 Project Organization

The project will be jointly managed from HAI's Dublin, Ohio office and LTR's Farmingdale, New York office. During implementation, HAI and LTR will assure that the type and quality of work conforms with this Work Plan and supporting documents.

1.7.1 Project Team

The work will be performed, on behalf of IMC, by HAI, LTR, and several subcontractors. LTR will assist HAI with preparing work plans and reports and will perform a majority of the field investigations. Other subcontractors include:

1. Lancaster Labs (Division of Thermo Analytical Inc.) in Lancaster, Pennsylvania (fixed laboratory analyses);
2. Total Quality Drilling LLC in Mullica Hill, New Jersey;
3. Frank O'Connor PLS, P.E., in Locust Valley, New York and;
4. Microbe Inotech Labs, Inc., in St. Louis, Missouri.

The above list identifies the subcontractors that are intended to be used. Other subcontractors may be used as necessary.

1.7.2 Project Staff

A brief description of the project staff and their responsibilities is given below. Figure 2 is a graphical representation of the project management structure.

Project Manager

The Project Manager, Tim Douthit, will be responsible for the overall management of the project, including:

1. administering work, quality assurance and health and safety plans;
2. interpreting data and fulfilling reporting requirements;
3. helping to identify circumstances which necessitate interim actions and communicating to IMC when such circumstances are suspected or encountered;
4. providing communication between project personnel, subcontractors, and IMC; and
5. meeting the time requirements specified herein.

Technical Project Supervisor

The Project Hydrogeologist, Mr. Tim Douthit of LTR, will serve as the technical project supervisor. Mr. Douthit will also serve as the Project Manager, and, in many instances, may communicate directly with IMC.

Site Health and Safety Officer

The Site Health and Safety Officer is Mr. Russel DiRenzo of LTR. Duties of the Health and Safety Officer are included in the Health and Safety Plan (HASP), Appendix C.

Quality Assurance Officer

The Quality Assurance Officer is Mr. Don Anderson, LTR. Duties and responsibilities of the Quality Assurance Officer are discussed in the Quality Assurance Project Plan (QAPP), Appendix B.

Laboratory Project Manager

The Analytical Laboratory Project Manager is Mr. Tim Oostdyk, an employee of Lancaster Labs. Mr. Bruce Hemming, Ph.D., an employee of Microbe Inotech Laboratories, Inc., will act as the Microbiological Laboratory Project Manager. The Laboratory Project Managers will communicate with the Quality Assurance Officer, and reports to the respective Laboratory Directors. In addition, responsibilities of the Laboratory Project Manager include:

1. communicating between the laboratory and the field Quality Assurance Officer and Project Manager;
2. relating special needs of the field operations personnel to the laboratory
3. performing final review of all data packages before reporting results;
4. coordinating the sample load with the laboratory's available resources; and
5. providing appropriate glassware and equipment to meet sampling objectives.

Technical Advisors

Mr. W. Lance Turley, PG and Mr. Mark J. Bonifas, P.E. of HAI will serve as the technical advisors for the project. They will assist primarily in evaluating contaminant distribution and fate and transport.

1.8 Organization of Work Plan and Supporting Documents

1.8.1 General

This Work Plan is supported by a Field Sampling and Analysis Plan (FSAP), a QAPP, a HASP and well logs for the existing on-site monitoring wells. These supporting documents are included along with the Focused Ground-Water Feasibility Work Plan as bound appendices to this Work Plan. Specifically, the FSAP is included as Appendix A, the QAPP is included as Appendix B, the HASP is included as Appendix C, and the well logs are included as Appendix D.

Data obtained from the Focused Ground-Water Investigation will be used to complete a Focused Ground-Water Feasibility Study. The Focused Feasibility Work Plan is included in Appendix E.

Brief descriptions of the Work Plan, supporting documents, and the Focused Feasibility Study Work Plan are provided below.

1.8.2 Work Plan

This Work Plan provides the overall approach for the proposed investigative tasks. Rationale for gathering data, sampling locations and frequencies, and activities necessary to obtain the data are described.

1.8.3 Field Sampling and Analysis Plan

The FSAP in Appendix A provides guidelines for field sampling and analysis of ground water. Specifically, the FSAP includes discussions on:

1. sample locations and frequency;
2. sample designation;
3. soil sampling equipment and procedures;
4. field analytical procedures;
5. sample handling procedures;
6. decontamination of equipment;
7. documentation procedures;
8. field quality control procedures; and
9. management of investigation-derived materials.

1.8.4 Quality Assurance Project Plan

The QAPP in Appendix B is Lancaster Labs' *Laboratory Quality Assurance Project Plan.* This document describes the policies, organization, and specific quality assurance and control activities required to meet the data quality objectives for the project. The QAPP also includes documentation of Lancaster Labs' certification for analysis metals and volatiles pursuant to the New York State Department of Health Environmental Laboratory Approval Program Contract Laboratory Protocol.

Microbe Inotech Labs, Inc. Standard Operating Procedures for Total Heterotrophic Plate Count, Strain Preparation and Analysis by Chromatography Fatty–acid Methyl Ester (GC-FAME) Method, and 24 hour Endpoint Assay are also included within the QAPP.

1.8.5 Health and Safety Plan

The HASP in Appendix C has been prepared to address the procedures required to perform the field activities in a safe manner, and includes such items as:

1. project organization structure;
2. hazard assessment;
3. hazard communication and training;
4. contaminant monitoring;
5. safety considerations;
6. communications;
7. decontamination and cleanup procedures;
8. emergency response;
9. medical surveillance; and
10. Site management.

1.8.6 Focused Ground-Water Feasibility Study Work Plan

The Focused Ground-Water Feasibility Study Work Plan in Appendix E briefly describes activities to be completed following the Focused Ground-Water Investigation to select the most practicable remedial approach for addressing contaminated ground water beneath the Site.

2.0 FOCUSED GROUND-WATER INVESTIGATION

2.1 General

Ground-water sampling and analysis will be conducted to assess the vertical and horizontal extent of VOCs and metals in ground water beneath and adjacent to the Site, evaluate the potential for biodegradation of dissolved chlorinated solvents, and to test the ability of indigenous microbial strains to degrade chlorinated solvents. The focused ground-water investigation will include installation of four sets of nested monitoring wells, sampling of the new nested wells and existing on-site wells for analysis of VOCs and selected heavy metals, sampling of selected wells for analysis of biodegradation indicators and completion of microbial studies, and preparation of a report documenting the investigation and presenting all collected data. A brief description of the tasks is presented in sections 2.2 through 2.3.

2.2 Task 1 - Focused Ground-Water Investigation

2.2.1 Current Water Table Measurements

Prior to installing the new wells, the ground-water elevation will be measured in existing on-Site monitoring wells MW-1, MW-2 and MW-3 to confirm the current water table elevation is within the range of historic elevations. If the current elevation falls outside the historic range, the upper screened interval of the proposed well nests, which is intended to be screened at the water table, will be adjusted accordingly. The midpoint of the middle and lower screened intervals will be at forty and eighty feet below the mean water table elevation and will be determined based upon the location of the upper screened interval.

The Field Sampling and Analysis Plan (FSAP) in Appendix A describes procedures for water and non-aqueous phase liquid (NAPL) interface measurement. Plate 1 shows the location of existing monitoring wells and Appendix D contains the existing monitoring well logs.

2.2.2 Ground-water Monitoring Well Locations and Depths

The proposed locations of the new nested wells form a relatively straight line through Area 2 which is approximately parallel to the reported ground-water flow direction. The proposed monitoring wells will be generally located in the following areas:

1. one nest immediately upgradient of Area 2 on the north side of Main Street and in the right-of-way;

2. one nest immediately downgradient of Area 2 within the Site property boundary;
3. one nest near the location of SB-54 within the Site property boundary; and
4. one nest near the location SB-53 on the western side of Swalm Avenue and in the right-of-way.

The proposed location for the monitoring wells is presented on Plate 1. The exact location of the wells will be determined in the field based upon several factors, which may include, but is not limited to, drill rig and support equipment accessibility, local and state entity right-of-way restrictions, and utility locations. The monitoring well installation contractor will be responsible for obtaining all required permits and easements for the proposed drilling, ensuring all utility companies are contacted, and properly marking and avoiding utilities.

Each proposed monitoring well nest will be installed to allow ground-water sampling at three depth intervals to assess the vertical distribution of constituents in ground water. One well will be screened across the ground-water table (upper interval), one approximately forty feet below the ground-water table (middle interval), and one approximately eighty feet below the ground-water table (lower interval). The upper interval will have a fifteen-foot screen length and the middle and lower intervals will each have a ten-foot screen length. The monitoring well numbers will have a suffix (U, M, L) to designate upper, middle and lower screen intervals.

Based upon water table elevations collected by Lawler, Matusky & Skelly Engineers (1993) at surrounding properties and by Anson (1994) and HAI (1996) at the Site, the mean elevation of the water table at the Site is approximately 68.5 feet above mean sea level (MSL). The water table has historically fluctuated from 70.3 feet MSL to 66.8 feet MSL. Therefore, the targeted elevation for the center of the upper-screened interval at all locations is 69 feet above MSL.

The following table presents the target screened intervals for all proposed monitoring wells *provided* that current water table elevation, as measured prior to well installation, is within the historical range.

Proposed Well	Elevation of Center of Screen (feet above MSL)	Screened Interval (feet above MSL)	Depth Below Grade[1] (feet)
MW-4U MW-5U MW-6U MW-7U	69	61.5 to 76.5	45.5 to 60.5
MW-4M MW-5M MW-6M MW-7M	29	24 to 34	88.5 to 98.5
MW-4L MW-5L MW-6L MW-7L	-11	-16 to -6	128.5 to 138.5

1. Depth below grade is based on a surface elevation of 122 feet MSL.

All wells will be surveyed by a surveyor registered in the State of New York and referenced to the same benchmark and coordinate system used in previous investigations.

During the soil boring process, three soil samples will be collected from each distinct stratigraphic zone for analysis of total organic carbon (TOC). In addition, hydrophobic dye will be used as a field-screening tool for detection of non-aqueous phase liquids (NAPL). Soil boring and monitoring well installation procedures are detailed in the FSAP in Appendix A.

2.2.3 Ground-water Sampling and Analytical Procedures

The newly installed wells will be developed and sampled following the procedures described in the FSAP located in Appendix A. The existing monitoring wells will also be sampled.

One ground-water sample from each new well and existing well will be submitted to a Lancaster Labs and analyzed for BTEX, PCE, TCE, 1,1,1-TCA, 1,1-DCE, trans 1,2-DCE in accordance with U.S. EPA SW-846 methods 8010 and 8020. Additionally, ground-water samples will be analyzed for total concentrations of lead, mercury, barium, cadmium, and chromium in accordance with the appropriate U.S. EPA SW-846 7000 series methods. Field blanks, trip blanks, and duplicate ground-water samples will be analyzed. All analytical procedures and detection limits are fully described in the QAPP located in Appendix B.

Lancaster Labs' reporting of analytical results for volatiles and metals will be provided in a NYSDEC ASP Category B deliverables data package. Review of the analytical report will be documented via a Data Usability Summary Report.

Following receipt and evaluation of analytical results from the above sampling and analysis, selected monitoring wells will be sampled for geochemical characterization and microcosm studies. At a minimum, one upgradient monitoring well (from the PMW-4 well cluster) will be sampled along with a well from each of the other three clusters that are situated downgradient of Area 2. At a given cluster, the well exhibiting the highest concentrations of PCE daughter products (i.e., TCE, DCEs and vinyl chloride) will be selected for sampling. If all wells show similar concentrations of daughter products, a set of wells screened at similar elevations will be sampled.

Ground water collected from the wells will be subjected to geochemical characterization using the following methods:

Test	Methods
Temperature	Field (flow-through cell)
pH	Field (flow-through cell)
Conductivity	Field (flow-through cell)
Redox Potential	Field (flow-through cell)
Dissolved Oxygen	Field (flow-through cell)
Dissolved Methane	AMG18G
Dissolved Ethane	AMG18G
Dissolved Ethene	AMG18G
Chloride	9056
Total Organic Carbon	9060
Iron (II)	HACH Colorimetric
Nitrate	9056
Sulfate	9056
Alkalinity	HACH Alk. Test

Aliquots of ground water collected during the above sampling activities will be submitted to Microbe Inotech Laboratories, Inc. for microbial studies. The studies will consist of Total Heterotrophic Plate Counts (Standard Methods 9215A, 9215B.2, and 9215C), 24 hour Endpoint Assays, and Gas Chromatography Fatty Acid Methyl Ester (GC-FAME). Testing methods are described in the QAPP, located in Appendix B.

2.2.4 Investigation-Derived Materials Management

Auger cuttings from the drilling operations will be collected and stockpiled separately on-site based on field screening results. If soils do not contain VOCs above background concentrations, as determined by headspace readings with a PID, the soils will be stockpiled on-site and secured under polyethylene sheeting. If the soils contain VOCs above background concentrations, the soils will be stored on-site in NYS DOT-approved 55-gallon steel drums and labeled in accordance with the FSAP. After the completion of drilling activities, the stockpiled and drummed soils will be analyzed for waste characterization. The waste characterization analyses will be used to determine the disposition of the stockpiled and/or drummed soils.

Ground water purged during drilling operations, well development or prior to sampling will be collected and stored on-site in NYS DOT-approved 55-gallon steel drums and labeled in accordance with the FSAP. After completion of drilling and sampling activities, the containerized water will be properly disposed of as determined by waste characterization analyses.

2.3 Task 2 - Focused Ground-water Investigation Report

Following completion of the focused ground-water investigation, a report will be prepared and submitted to NYSDEC and will include:

1. a brief discussion of the local geology/hydrogeology at the Site and immediate vicinity, with an emphasis on new information gathered during proposed monitoring well installation and well development;
2. a discussion of field activities performed under Task 1;
3. a scaled base map showing Site structures and existing and newly installed monitoring well locations;
4. a water table contour map showing flow direction and gradient;
5. a tabulated ground water analytical data and, as appropriate, two dimensional isoconcentration maps showing lateral and vertical distribution of VOCs and heavy metals for each screened interval;
6. a discussion of dissolved-phase VOCs and heavy metals migration patterns onto, off and within the Site, as appropriate;
7. boring logs and well construction diagrams for newly constructed monitoring wells;

8. if appropriate, VOC fate and transport evaluation for Area 2 to assess the need for an additional well downgradient of Area 3;

9. tabulated saturated soil analytical data showing distribution of TOC for each stratigraphic zone encountered;

10. a discussion of the vertical groundwater gradients based upon static water levels in the nested wells~~.~~;

11. tabulated geochemical characterization data and, as appropriate, isopleth maps showing distribution of the data;

12. tabulated results and text describing findings from the microbial studies; and

13. a discussion of apparent biodegradation processes taking place within the aquifer and, as appropriate, evaluation of the degree to which biodegradation is a limiting factor in the migration and persistence of chlorinated solvents.

3.0 SCHEDULE OF IMPLEMENTATION

An estimated project schedule is presented on Figure 3. The durations estimated for the field work are based on work being conducted during normal business hours Monday through Friday. The schedule may require modification due to unexpected field conditions or NYSDEC review time.

The Focused Ground-Water Feasibility Study, described in Appendix E, will be initiated following NYSDEC's final review of the Focused Ground-Water Investigation Report. The Focused Ground-Water Feasibility Study will be prepared over a six-month time frame.

4.0 REFERENCES

A variety of technical documents and publications were referred to during the course of this project. Some of the references consulted are presented below. Referenced documents and publications may or may not have been reviewed in their entirety. The guidelines and procedures presented in the referenced documents and publications have not been strictly adhered to unless otherwise stated.

Geologic logs for MW-1, MW-2 and MW-3 by Anson Environmental Ltd. dated April 26, 1994.

Final Investigation Report for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone, Hull & Associates, Inc., February 1997.

Revised Draft Preliminary Assessment Report, New Cassel Industrial Area, Lawler Matusky & Skelly Engineers, October, 1994;

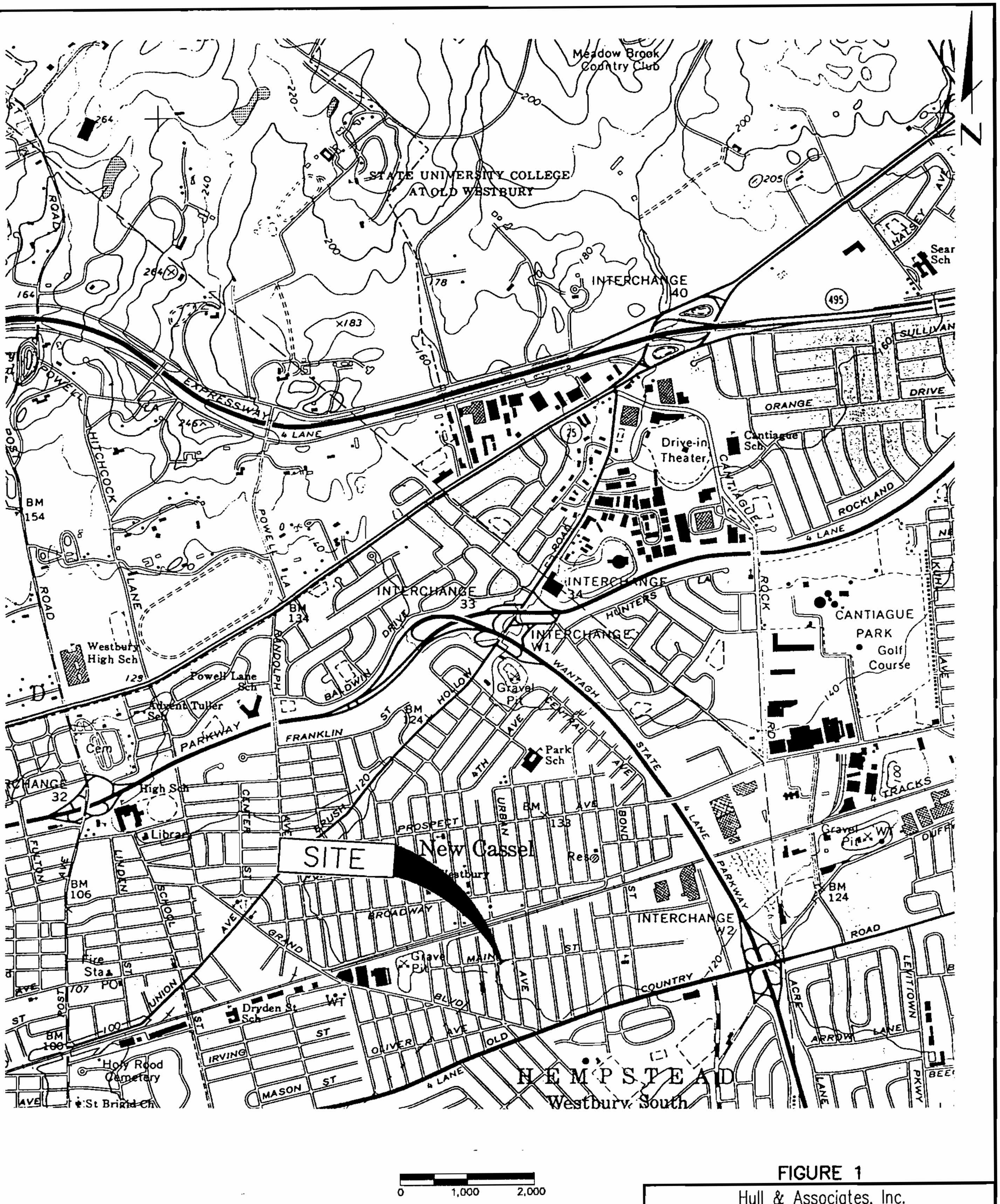
Untitled report from Anson Environmental Ltd. to representatives of IMC Magnetics Corp., dated July 21, 1993;

New York State Statutes, Article 27, Title 13 - Inactive Hazardous Waste Disposal Sites;

New York State Regulations, Title 6, Chapter IV, Subchapter B, Part 375 - Inactive Hazardous Waste Disposal Site Remedial Program;

Letter from Tim Douthit (Land Tech Remedial, Inc.) to Chittibabu Vasudevan, P.E. (NYSDEC) regarding conceptual scope of work for Focused Remedial Investigation (Focused Ground-water Investigation), July 3, 1997.

Letter from Joseph Jones (NYSDEC) to Chris Rawnsley (NMB USA, Inc.) regarding comments to conceptual scope of work for Focused Remedial Investigation (Focused Ground-water Investigation), August 20, 1997.



SOURCE: USGS 7.5 MIN. QUADRANGLE
HICKSVILLE, NEW YORK – 1967
(PHOTOREVISED – 1979)

FIGURE 1

Hull & Associates, Inc.
DUBLIN, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER INVESTIGATION

SITE LOCATION MAP

WESTBURY, NEW YORK

DATE:
OCTOBER 1997 (ADDENDUM 2 MAY 1998) NMB 004

3030D023.DWG
05/06/98 CT

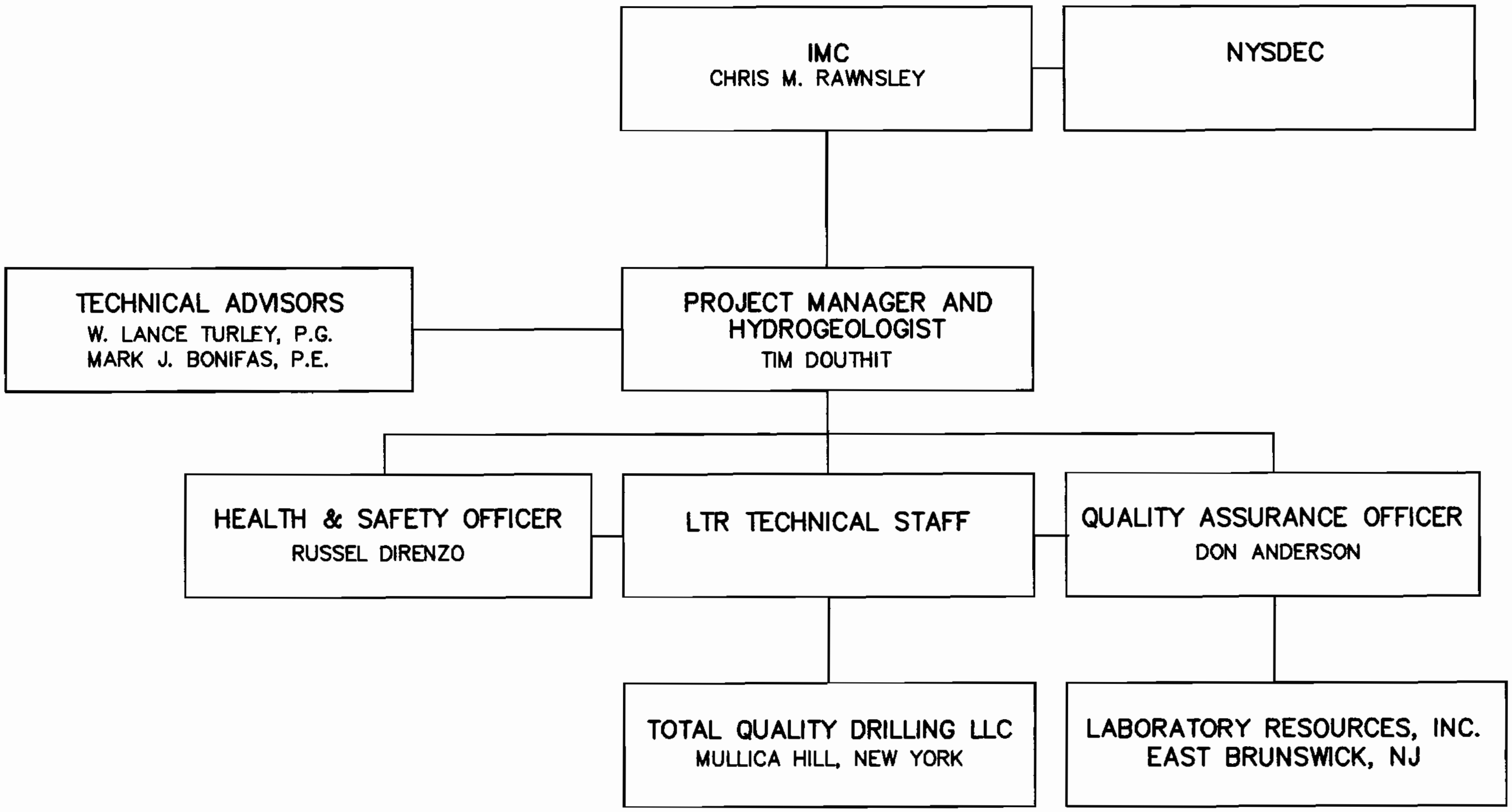


FIGURE 2

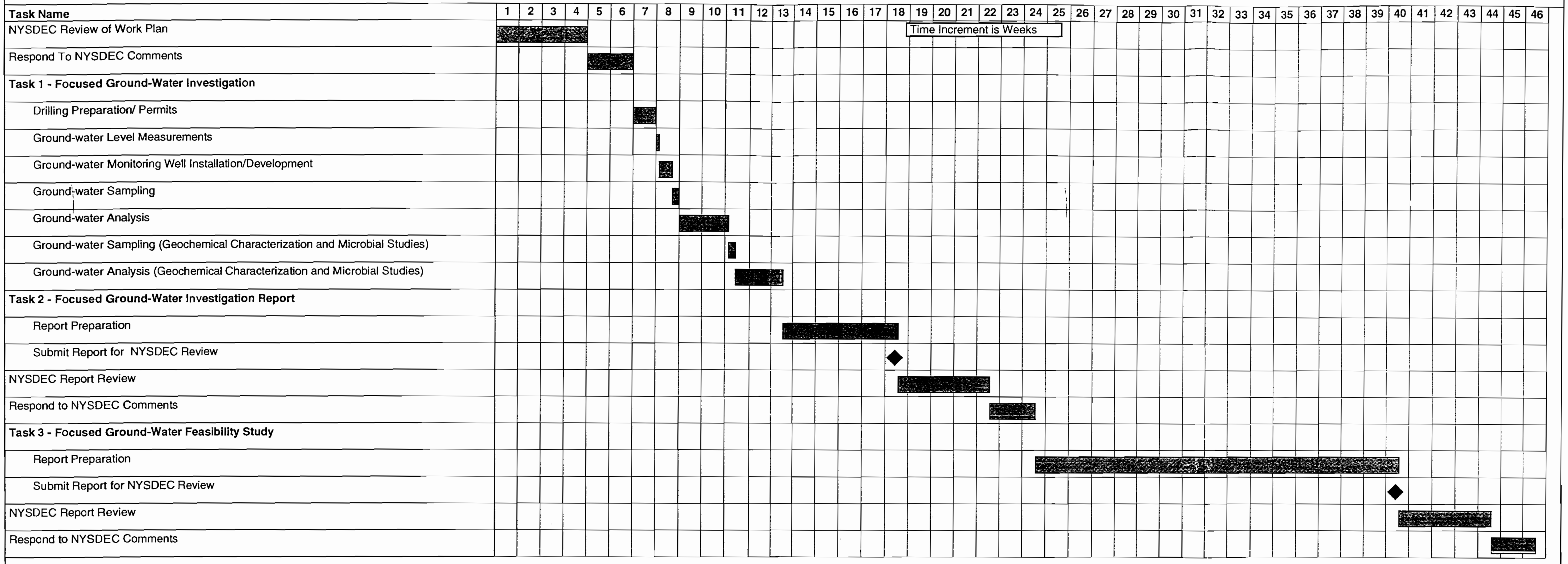
Hull & Associates, Inc.
DUBLIN, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER INVESTIGATION
PROJECT MANAGEMENT
CHART
WESTBURY, NEW YORK

DATE:
OCTOBER 1997 (ADDENDUM 2 MAY 1998) NMB 004

3030D006.DWG
05/06/98 CT

Figure 3
Estimated Project Schedule
Focused Ground-Water Investigation



Project:NMB004
Location: 570 Main Street Property, Westbury, New York
Date: Tue 4/7/98

Task ▬ Milestone ◆

APPENDIX A

Field Sampling and Analysis Plan (FSAP)

FIELD SAMPLING AND ANALYSIS PLAN

FOR THE

FOCUSED GROUND-WATER INVESTIGATION

AT THE

570 MAIN STREET PROPERTY
WESTBURY, NEW YORK

OCTOBER 1997
(ADDENDUM 2, MAY 1998)

Prepared For:

IMC MAGNETICS CORP.

HULL & ASSOCIATES, INC.
6130 WILCOX ROAD
DUBLIN, OHIO 43016
(614) 793-8777

LAND TECH REMEDIAL, INC.
31 DUBON COURT
FARMINGDALE, NEW YORK 11735
(516) 694-4040

FIELD SAMPLING AND ANALYSIS PLAN FOR THE FOCUSED GROUND-WATER INVESTIGATION AT THE 570 MAIN STREET PROPERTY WESTBURY, NEW YORK

(HAI Document # NMB004.300.0077 (ADDENDUM 2))

DISTRIBUTION:

Dr. Chittibabu Vasudevan, P.E., NYSDEC
Joseph Jones, NYSDEC
Jeanna E. Hussey, Esq., NYSDEC
Ray Cowen, NYSDEC
G. Anders Carlson, Ph.D., NY State Department of Health
Chris M. Rawnsley, IMC, c/o New Hampshire Ball Bearings, Inc.
J. Brian Molloy, Esq., Piper & Marbury, L.L.P.
Timothy L. Douthit, LTR
Michael C. Harvell, Esq., Sheehan, Phinney, Bass & Green
Mr. John Lovejoy, Nassau County Department of Health
HAI Internal Copies

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (cont.)

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 General

This Field Sampling and Analysis Plan (FSAP) has been prepared for IMC Magnetics Corp. (IMC); Hull and Associates, Inc. (HAI) field personnel and subcontractors; Land Tech Remedial, Inc. (LTR) field personnel and subcontractors, and other representatives for use during the focused ground-water investigation at 570 Main Street in Westbury, New York (Site). The FSAP is intended to provide field sampling and analysis guidelines. HAI Standard Operating Procedures (SOPs) are located in Appendix A. While this document details sampling and analysis procedures, it is not meant to be a stand alone document and should be used in conjunction with the Work Plan, the Quality Assurance Project Plan (Appendix B of the Work Plan), and the Health and Safety Plan (Appendix C of the Work Plan). These documents are bound with this document and collectively form HAI Document NMB004D.063.

1.2 Project Description

The investigative activities for ground water will consist of the installation of four new monitoring well nests. The location of these nests are shown on Plate 1 of the Work Plan. Each nest will consist of three wells screened to monitor upper, middle, and lower portions of the aquifer. Ground-water samples will be collected from all monitoring wells (newly installed and three existing) and be analyzed for benzene, toluene, ethyl benzene, and xylenes (BTEX), tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene, (1,1-DCE), trans 1,2-dichloroethene (trans 1,2-DCE), and total lead, mercury, barium, cadmium, and chromium.

Following receipt and evaluation of analytical results from the above sampling and analysis, selected monitoring wells will be sampled for geochemical characterization and microcosm studies. At a minimum, one upgradient monitoring well (from the PMW-4 well cluster) will be sampled along with a well from each of the other three clusters that are situated downgradient of Area 2. At a given cluster, the well exhibiting the highest concentrations of PCE daughter products (i.e., TCE, DCEs and vinyl chloride) will be selected for sampling. If all wells show similar concentrations of daughter products, a set of wells screened at similar elevations will be sampled.

Ground water collected from the wells will be field-tested in a flow-through cell for temperature, pH, conductivity, redox potential and dissolved oxygen. Samples will also be tested for dissolved methane, dissolved ethane, dissolved ethene, chloride, total organic carbon, iron (II), nitrate, sulfate and alkalinity. Finally, aliquots of ground water collected for microbial studies. The studies will consist of Total Heterotrophic Plate Counts (Standard Methods 9215A, 9215B.2, and 9215C), 24 hour Endpoint Assays, and Gas Chromatography Fatty Acid Methyl Ester (GC-FAME).

2.0 GROUND WATER

2.1 Objectives

This section discusses the procedures that will be adhered to for construction and installation of all new monitoring wells. Additionally, this section provides sampling and analysis guidelines for the collection of ground-water samples from existing and newly installed monitoring wells

2.2 Monitoring Well Construction and Installation Procedures

2.2.1 New Well Locations

A total of twelve new monitoring wells have been proposed for this investigation. These monitoring wells will be installed in four nests each with three wells. The monitoring wells in each nest will be screened at different depths to discretely monitor the upper, middle, and lower portions of the aquifer. Approximate locations of the proposed monitoring wells are presented on Plate 1 of the Work Plan.

2.2.2 New Well Designation (Numbering)

Each monitoring well will be given a unique well designation for future reference. Monitoring wells MW-1, MW-2, and MW-3 were completed during previous investigations at the Site. Designations for each newly installed monitoring well nest will be sequential starting with PMW-4. Individual wells within a nest will also be suffixed with a -U- for upper, -M- for middle, or -L- for lower depending on which portion of the aquifer is screened. For example, the PMW-4 nest of monitoring wells will include PMW-4U, PMW-4M, and PMW-4L.

2.2.3 Hollow Stem Auger Drilling

Monitoring wells will be installed utilizing hollow stem augers in accordance with HAI SOP No. F2000. All wells within a nest at each location (e.g., PMW-4) will be completed in the same borehole.

2.2.3.1 Sample Locations and Frequencies

The proposed locations of borings/monitoring wells are presented on Plate 1. These locations are designated PMW-4 through PMW-7. Borings PMW-5 and PMW-7 will be continuously sampled at two-foot intervals with either a 1.25 or three-inch diameter split spoon sampler from 50 feet to the completion of the boring. Borings PMW-4 and PMW-6 will be sampled at five-foot intervals with either a 1.25 or three inch diameter split spoon sampler from 50 feet to the completion of the boring.

2.2.3.2 Sample Identification (Labeling) and Designation (Numbering)

Soil samples will be identified using a specified sample identification number (SIN) as follows:

```
NMB004 - SB1 - SS3 - L157
  •       •     •      •••••• Employee Number
  •       •     •••••••••••• Soil Sample Number
  •       •••••••••••••• Soil Boring Location
  ••••••••••••••••••••• Project Number
```

The sample identification of the soil samples will identify the station number (e.g., soil boring location) and the soil sample number. Soil sample numbers are sequential and begin with the number one for each boring.

2.2.3.3 Split Spoon Soil Sampling

Split barrel soil sampling is described in HAI SOP No. F3000 which is in accordance with ASTM Method D 1586-84.

2.2.3.4 Soil Classification and Field Description Log

Samples will be classified in the field according to HAI SOP No. F1006. Samples will be chosen for textural analyses at the discretion of the field hydrogeologist at a minimum of one sample per distinct stratigraphic interval.

2.2.3.5 Visual Methods to Detect NAPL in Soil and Ground Water

In areas where non-aqueous phase liquids (NAPLs) may be present, field methods that may include ultraviolet (UV) fluorescence or hydrophobic dyes will be used to assist in detecting NAPL in soils. At a minimum, these methods will be used during the soil sampling conducted at PMW-5. Ground-water samples will be examined using only the hydrophobic dyes. These methods are described in HAI SOP No. F4010.

2.2.4 Monitoring Well Construction Specifications

All monitoring wells will be constructed of two inch I.D. Schedule 40 PVC with a minimum ten-foot screen. Each monitoring well will be installed in accordance with the procedures detailed in HAI SOP No. F2006 with the exception that all wells within a nest will be completed in the same borehole. All monitoring wells will be finished with a concrete well pad and a flush-mounted protective casing. Additionally, all monitoring wells will be fitted with a locking well cap and will be locked. Typical construction diagrams are also presented in HAI SOP No. F2006.

2.2.5 Monitoring Well Development

All newly installed monitoring wells will be properly developed at least twenty-four (24) hours prior to sampling. The purpose of development is to mitigate the effects of well installation on ground-water quality with respect to yield, chemical characteristics, and amount of suspended particulate matter. Monitoring wells will be developed using a submersible pump. A minimum of three well volumes of water will be evacuated from each monitoring well. Development will continue until the water is visibly free of fines and temperature, pH, conductivity have stabilized. If fines are still present or water quality parameters have not stabilized after five well volumes have been evacuated, development procedures will be discontinued. All information pertaining to well development will be documented on an appropriate form or in a field notebook.

2.3 Ground Water Sampling

2.3.1 Sample Locations and Frequency

Ground-water samples for VOC and selected heavy metal analyses will be collected from all newly installed monitoring wells and existing monitoring wells MW-1, MW-2, and MW-3. Ground-water samples will later be collected from selected monitoring wells within the newly-installed well clusters. Sampling for both events will proceed from the area suspected of having the lowest concentrations of chemicals of concern to areas suspected of having the highest concentrations based on knowledge of the Site and any available historic sampling data.

2.3.2 Sample Designation

Ground-water samples will be identified using a Sample Identification Number (SIN). An example of a valid SIN for a ground-water sample collected from MW-4L would be as follows:

```
NMB004 - MW4L - 001 - L153
  •      •      •     •
  •      •      •     ••• Employee Number
  •      •      ••••••••• First sampling event
  •      •••••••••••••••• Monitoring well MW-4L
  ••••••••••••••••••••••• Project Number
```

2.3.3 Sampling Equipment and Procedures

The procedures that will be performed at each monitoring well include:

1. visual observations;
2. measurement for immiscible layers;
3. measuring the water level within the well;
5. collecting samples; and
6. analysis of field parameters.

These items are discussed below and shall be performed in the order that they are presented in this document.

2.3.3.1 Visual Observations

Visual observations will be documented in the field logbook or on an appropriate field data sheet. These observations include; condition of the monitoring well, integrity of locks, condition of well pad / protective casing, and any repairs that are necessary.

2.3.3.2 Detection of Immiscible Layers

The presence and thickness of light non-aqueous phase liquids (LNAPLs) and dense non-aqueous phase liquids (DNAPLs) will be determined using an interface probe. LNAPLs will be detected by carefully lowering the interface probe down into the well until the approximate static water level is reached (i.e., water/immiscible layer interface). DNAPLs will be detected by carefully lowering the probe to the bottom of the well. Refer to HAI SOP No. F3006 for a detailed description of the procedures that shall be used to detect immiscible layers. The presence or absence of any NAPL (light or dense) will be documented in the field log book or on an appropriate field data sheet. The interface probe shall be decontaminated as described in HAI SOP No. F1000.

2.3.3.3 Water Level Measurements

A electronic water level indicator will be utilized to measure the static water level elevation in each well. As a substitute, the interface probe may also be used to obtain water level measurements. Each measurement shall be taken to the nearest 0.01 foot from the designated reference point on each well (i.e., top of the well riser). The water level indicator shall be lowered until the well bottom is encountered. When measuring the depth of the well it is may be necessary to add a correction factor to account for the distance between the bottom of the probe and the location of the sensor for which the tape is calibrated. For a detailed description of the procedures to be utilized to measure water levels see HAI SOP No. F3005. The water level indicator shall be decontaminated as described in HAI SOP No. F1000.

2.3.3.4 Well Evacuation (Purging)

Each well will be purged prior to sampling to allow representative formation water to enter the well screen. All purging procedures shall be performed in accordance with HAI SOP No. F3007. Clean gloves will be worn by all personnel handling the purging equipment. A clean plastic sheeting will be placed around the well in order to prevent the purging equipment from contacting the ground surface.

A minimum of three well volumes of water will be removed from all wells prior to sampling. The water shall be evacuated at a rate which does not cause recharge water to be excessively agitated. After each well volume is evacuated, water quality parameters will be measured (e.g., pH, conductivity, and temperature). After three well volumes, the measured values will be compared. If they have stabilized to within - 10% of one another, the well is adequately purged. If the parameters have not stabilized to within - 10% of one another, purging will continue until they are stabilized to within -10% over two successive well volumes or until a total of five well volumes have been removed. If a low yielding well is encountered it shall be completely evacuated and then sampled after the well recovers enough to obtain the required volume of sample.

Monitoring wells will typically be purged by bailing with a new disposable or properly decontaminated bailer. Alternate purging equipment (described in HAI SOP No. 3007) may also be utilized. If re-usable purging equipment is used it will be decontaminated as described in HAI SOP No. F1000. All purge water will be containerized for proper disposal. Materials management is discussed in Section 2.7.

2.3.3.5 Sample Withdrawal

Ground water samples for analysis of VOCs and selected heavy metals will be collected using new disposable bailers. Clean gloves will be worn by each individual handling the sampling equipment. The following steps will be adhered to during sampling:

1. The integrity of the check valve for each bailer will be tested with deionized water to assure that no fouling problems exist that may reduce the delivery capability or result in aeration of the sample.
2. The bailer will be slowly lowered into the well to prevent degassing of the water on impact.
3. The bailers contents will be transferred into the proper sample container in a manner which will minimize agitation and aeration.

4. To ensure sample quality, the sampling order shall be as follows: volatile organic compounds, metals, and in-situ parameters (e.g., pH, specific conductance, and temperature.).

All used sampling equipment including string, gloves, or other protective clothing will be properly disposed of following contact with the ground water. Refer to HAI SOP No. F3008 for a more detailed description of ground-water sampling procedures.

Water samples to be collected for geochemical characterization and microbial studies will be collected using a submersible pump. The flow rate for the pump will be adjusted so that less than 100 ml/min. will be extracted. Clean gloves will be worn by the individual handling sampling equipment. The pump and all discharge hose will be decontaminated consistent with HAI SOP No. F1000 prior to initial sample collection and between sampling locations.

2.3.3.6 Field Measurements

During sampling for analysis of VOCs and selected heavy metals, measurements of pH, temperature, and specific conductance will be obtained at each monitoring well after all sample bottles have been filled. These measurements will be independent of purge water measurements. During collection of samples for geochemical characterization and microbial studies, conductivity, pH, dissolved oxygen, redox potential and temperature will be measured throughout the period of sample removal using a flow-through cell. All monitoring equipment will be calibrated according to the manufacturers' specifications.

2.3.4 Sample Handling and Analysis

All sample containers and required preservatives will be provided by the laboratory. Immediately following sample collection, all samples will be immediately placed on ice in a cooler. Refer to the QAPP (Appendix B of the Work Plan) for more specific information on sample containers.

2.3.4.1 Sample Preservation

Any applicable preservatives required to be added to the sample containers will be provided by the laboratory. Refer to the QAPP (Appendix B of the Work Plan) for a more detailed description on the procedures for sample preservation.

2.3.4.2 Special Handling Considerations

Samples that will be analyzed for volatile organic compounds, dissolved constituents (methane, ethane and ethene), iron(II) and microbial study samples will not be transferred from one container to another. Additionally, headspace should not be present in the sample containers for the above analytes.

2.3.4.3 Sample Analysis

Ground-water samples will be analyzed for BTEX, PCE, TCE, 1,1,1-TCA, 1,1-DCE, trans 1,2-DCE in accordance with U.S. EPA SW-846 methods 8010 and 8020. Additionally, ground water samples will be analyzed for total concentrations of lead, mercury, barium, cadmium, and chromium in accordance with the appropriate U.S. EPA SW-846 7000 series methods.

Following receipt and evaluation of analytical results from the above sampling and analysis, selected monitoring wells will be sampled for geochemical characterization and microcosm studies. Ground water collected from the wells will be subjected to geochemical characterization using the following methods:

Test	Methods
Temperature	Field (flow-through cell)
pH	Field (flow-through cell)
Conductivity	Field (flow-through cell)
Redox Potential	Field (flow-through cell)
Dissolved Oxygen	Field (flow-through cell)
Dissolved Methane	AMG18G
Dissolved Ethane	AMG18G
Dissolved Ethene	AMG18G
Chloride	9056
Total Organic Carbon	9060
Iron (II)	HACH Colorimetric
Nitrate	9056
Sulfate	9056
Alkalinity	HACH Alk. Test

Aliquots of ground water collected during the above sampling activities will undergo microbial studies. The studies will consist of Total Heterotrophic Plate Counts (Standard Methods 9215A, 9215B.2, and 9215C), 24 hour Endpoint Assays, and Gas Chromatography Fatty Acid Methyl Ester (GC-FAME).

2.4 Field Quality Control Samples

Both trip blanks and field blanks will be collected during sampling for VOCs and selected heavy metals to verify that sample handling procedures and equipment have not effected the integrity of the field samples. If contaminants are found in the equipment or trip blanks, the source of the contamination will (if possible) be identified and corrective action such as modifying the procedure and/or re-sampling will be initiated. At no time will results of quality control samples be used to adjust field sample results.

2.4.1 Trip Blank Samples

Trip blanks will be prepared by the laboratory. The trip blank will be prepared by filling the bottles to be used for volatile organic analyses with laboratory supplied reagent water. The trip blank will be subject to the same handling and transportation procedures as the samples. Trip blanks will be required at the rate of one per shipping container. Trip blanks must remain in the sample shipping containers during sample collection and transportation. A trip blank is required for each sample cooler containing samples to be analyzed for volatile organic compounds.

2.4.2 Equipment Blanks

Equipment blanks will be collected to provide a check on the cleanliness of the sampling equipment. Equipment blanks will be collected by filling the bailer with laboratory supplied reagent water and transferring the sample to appropriate sample containers. Equipment blanks will be analyzed for ALL parameters that field samples are being analyzed for.

The number of equipment blanks analyzed for a class of compounds will be equal to at least ten percent of the total samples to be analyzed for that class, with a minimum of one per day. It will be the sampler's responsibility to collect the appropriate number of equipment blanks for the day's sampling efforts.

2.4.3 Duplicate Samples

Field duplicates will be required at the rate of one per every ten investigative samples collected with a minimum of one per day. It will be the sampler's responsibility to collect the appropriate number of duplicate samples. A duplicate sample is collected by repeating the sampling procedure after an initial sample has been collected from a monitoring point.

2.5 Chain-of-Custody

The chain-of-custody will trace possession and handling of individual samples from the time of field collection through laboratory analysis. The chain-of-custody program will include: sample labels, sample seals, and the chain-of-custody record.

Sample Labels

All sample labels will contain the following information:

1. sample I.D. number;
2. name of collector;
3. date and time of collection;
4. place of collection; and
5. required analyses.

Sample Seal

A seal will be placed on the sample container or on the shipping container to ensure that samples have not been disturbed during transportation.

Chain-of-Custody Record

The chain-of-custody record will be maintained to trace sample possession and time of collection for samples submitted to fixed laboratories. The chain-of-custody will accompany each sample and record the:

1. sample number;
2. signature of collectors;
3. date and time of collection;
4. sample type;

5. number of containers;
6. analytical parameters requested;
7. signature of relinquishee and dates of possession by each party; and
8. preservatives.

2.6 Decontamination of Equipment

All non-disposable sampling equipment shall be decontaminated prior to initially being used and after each subsequent use in accordance with HAI SOP No. F1000 (Appendix A). All decontamination rinse water shall be collected and containerized for disposal in accordance with Section 2.7.

2.7 Management of Investigation-Derived Materials

Auger cuttings from the drilling operations will be collected and stockpiled separately on-site based on field screening results. If soils do not contain VOCs above background concentrations, as determined by headspace readings with a PID, the soils will be stockpiled on-site and secured under polyethylene sheeting. If the soils contain VOCs above background concentrations, the soils will be stored on-site in NYS DOT-approved 55-gallon steel drums and labeled in accordance with the FSAP. Each drum will have the date generated and soil boring location clearly written on both the lid and side with a permanent marker or paint pen.

Waste water generated during decontamination activities, drilling operations, well development, or sampling will be collected and stored on-site in NYS DOT-approved 55-gallon steel drums. Each drum will have the date generated, contents, and origin of contents clearly written on both the lid and side with a permanent marker or paint pen

All containerized materials will be transported to and staged in a designated area with limited access on-site. The containerized materials will then be characterized for disposal. Waste characterization will be based on the analytical results of the ground water investigation and the requirements of the disposal facility. All wastes will be properly disposed of based on the results of the waste characterization.

3.0 REFERENCES

A variety of technical documents, administrative documents, and publications were referred to during the preparation of this document. Some of the references consulted are presented below. Referenced documents and publications may or may not have been reviewed in their entirety. The guidelines and procedures presented in the documents and publications referenced may not have been strictly adhered to unless otherwise stated.

"RCRA Ground-Water Monitoring and Technical Enforcement Guidance Document," EPA, 1986.

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," EPA, 1983.

"A Compendium of Superfund Field Operations Methods," EPA, 1987.

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," USEPA, SW-846, 3rd Edition, September 1986.

"Methods for Chemical Analysis of Water and Wastes," EPA 600/4-79-020/March 1983.

"Methods for the Determination of Organic Compounds in Drinking Water," EPA/600/4-88/039, December 1988; modified for U.S. EPA Region I.

Field Sampling and Analysis Plan

APPENDIX A

Hull & Associates, Inc.
Standard Operating Procedures

List of Standard Operating Procedures

F1000 - Decontamination of Field Equipment

F1006 - Field Soil Classification/Description

F2000 - Overburden/Glacial Drilling - Utilizing Hollow Stem Augers

F2006 - Monitoring Well Installation - Overburden Wells

F2012 - Procedure for Proper Containment/Storage of Used Drilling Fluids, Decon Fluids, and Purged Ground Water

F2013 - Procedure for Proper Containment/Storage of Soil Produced from Drilling Operations (Auger Cuttings) & Soil Excavations

F3000 - Subsurface Soil Sampling Utilizing a Split Spoon Sampler

F3005 - Ground-water Level Measurement

F3006 - Immiscible Layer Detection and Measurement

F3007 - Monitoring Well Purging

F3008 - Ground-water Sample Collection

F4010 - Visual Detection of Non-Aqueous Phase Liquids (NAPL) in Soils and Ground Water

SOP No. F1000
DECONTAMINATION OF FIELD EQUIPMENT

1.0 Purpose

This section documents the procedures that will be followed when decontaminating field equipment. The equipment may include split spoon soil samplers, bailers, trowels, shovels, hand augers, drilling rigs, soil vapor sampling equipment, or any other type of reusable equipment used during field investigations.

When appropriate, decontamination will be performed as a quality assurance measure and safety precaution. Proper decontamination will be performed to minimize cross contamination between sampling locations or sampling intervals and transporting potentially contaminated materials off-site.

Decontamination of the drilling rigs, if appropriate, will be conducted in a designated decontamination area. Most smaller equipment (e.g., submersible pumps, etc.) can be decontaminated at the sampling location or between collection points. All decontamination materials that cannot be recycled will be properly packaged and disposed of based upon the nature of contamination.

2.0 Equipment and Materials

- High-pressure steam cleaner
- Cleaning fluids: non-phosphatic soap and/or detergents, potable water, distilled/deionized water, hydrochloric/nitric acid, isopropanol, acetone, methanol, and/or hexane
- Shovels and brushes
- Paper towels
- Disposable gloves
- Waste storage containers: plastic bags, drums, boxes
- Cleaning containers: plastic buckets, etc.
- Plastic sheeting
- Personal protective equipment

3.0 General

A. All decontamination will be performed under the assumption that the equipment is contaminated.

B. An adequate supply of all decontamination equipment and materials will be available on site.

4.0 Procedures

The following sections present the decontamination procedures that will be followed during the performance of all field tasks. If different or more extensive procedures are required, they will be pre-approved by the Project Manager and Quality Assurance Officer.

4.1 Drilling Rig and Associated Equipment

A. All equipment associated with the selected drilling method coming in contact with potential contamination, both as part of subsurface equipment advancement and due to aboveground contact with drilling fluids, extracted soils, drill rig lubricants and fuels, etc., will be decontaminated prior to use of this equipment for soil boring advancement. At the discretion of the Project Manager, the entire drilling rig may be decontaminated due to foreign substances adhering two the rig as a result of operations, transplant from off-site, or travel between soil boring locations.

B. A high-pressure steam cleaner should be used to remove foreign material from inside and outside of drilling equipment that will not come into contact with test samples. Decontamination of sampling equipment (e.g., split-spoon samplers) is described in section 4.2.

C. All liquid and solid material produced from this operation will be collected and properly contained.

D. The date, time, and decontamination procedure used will be recorded on the boring log or daily field report or in a field notebook.

4.2 Split Spoon Barrel Sampler

To ensure that the potential for cross contamination is minimized during subsurface investigations, the split spoon sampler will be decontaminated between sampling intervals.

A. After collecting the split spoon sample, the sampler will be disassembled and decontaminated by first physically removing any adhering soil material from the sampler.

B. The sampler will be placed in a bucket containing a non-phosphatic soap solution (e.g., *Liquinox*) and scrubbed until visibly clean.

C. The sampler will then be thoroughly rinsed with potable water until all soap solution is removed.

D. The sampler will be reassembled.

4.3 Submersible Pump

This procedure will be employed to decontaminate the submersible pumps that are used in well purging and/or development operations.

A. After removing the pump from the well, all exterior surfaces (the housing and hose) will be wiped with clean paper towels and placed on clean plastic. If any extraneous material is present on the outside of the pump or hose, it will be removed using a stiff brush.

B. The pump will then be placed in a suitably sized container of non-phosphatic soap solution (e.g., *Liquinox*) and potable water. If possible, the pump will be turned on to circulate the solution through the pump.

C. If sampling for metals, local sampling protocol may require that the pump will be placed in a bucket containing ten percent hydrochloric or nitric acid and, if possible, turned on to circulate the acid through the pump. If sampling for organics, local sampling protocol may also require placing the pump in solvent pesticide grade isopropanol, acetone, methanol, and/or hexane alone, or if required, in some combination, and turned on to circulate the solution through the pump. **The compatibility of any corrosive materials with the internal or external parts of the pump must be verified prior to their use. In addition, the use of flammable materials for decontamination is prohibited unless the pump is certified to be intrinsically safe.**

D. Following each cleaning sequence described in B and C above, the pump will then be placed in a suitably sized container of clean potable or distilled water and then thoroughly rinsed. The pump will be turned on until the internal portion of the pump and tubing is free of cleaning solution; otherwise, the pump will be hand-circulated around the container and clean water will be cascaded into the pump. The outside of the pump housing will also be thoroughly rinsed with potable or distilled water. The last rinse applied to the pump system will always be distilled water.

E. The pump and hosing will be properly stored to ensure that the system remains clean during transportation to other well heads. The pump and hosing will not be allowed to come in contact with the ground at any time during handling and transportation. If this occurs, the pump and tubing will be recleaned.

F. All liquids and waste materials produced during this operation will be properly stored and disposed as determined by the Project Manager.

4.4 Bailers

This section documents the procedures that will be followed during the decontamination of re-useable bailers employed during purging or sampling operations.

A. After removing a dedicated bailer from the well, or a non-dedicated bailer from its transport packaging, it will be wiped with clean paper towels and placed on clean plastic.

B. The bailer will be scrubbed with non-phosphatic soap solution inside and out. The inside of the bailer will be scrubbed with a cylinder brush to ensure that interior walls are thoroughly cleaned.

C. If sampling for metals, local sampling protocol may require that the bailer is rinsed with ten percent hydrochloric or nitric acid. If sampling for organic, local sampling protocol may also require that the bailer be rinsed with solvent-grade isopropanol, acetone, methanol, and/or hexane alone, or if required, in some combination.

D. Following completion of each cleaning sequence described above in B and C, the bailer will be rinsed with potable (as approved by the Project Manager) or distilled water until it is free of the soap solution.

E. The bailer will then be wiped dry using paper towels.

F. The bailer will be properly stored and the bailer cord properly disposed of to prevent contamination from occurring between sampling locations. To properly store the bailer, the entire bailer will be placed in its dedicated PVC storage tube or wrapped in inert material (e.g., *Saran* wrap, aluminum foil, etc.).

G. All paper towels and plastic sheeting used during decontamination procedures will be placed in a trash bag and properly disposed. Liquids used for decontamination of the bailers will be collected, properly stored, and disposed of as directed by the Project Manager.

4.5 Soil Gas Sampling Equipment

This section documents the procedures that will be adhered to during the decontamination of soil gas survey equipment between sampling locations.

A. Any extraneous soil material on the sampling rods will be removed prior to washing the rods.

B. The collection rods, nipples, and shield point adapter will be placed in a suitably sized container and thoroughly scrubbed with a brush and non-phosphatic soap (e.g., *Liquinox*) solution.

C. The parts will be completely rinsed with distilled water until all residue of the soap solution is removed.

D. The collection rods will be wiped dry with paper towels and properly stored to prevent contamination between sampling locations.

4.6 Sampling Spoons, Trowels, or Scoops

A. All buckets, brushes, spoons, spades or trowels will be cleaned with a non-phosphate detergent (e.g., *Liquinox*) solution and rinsed well with distilled water prior to sample collection.

B. Two decontamination buckets will be prepared with an adequate amount of cleaning solution and one decontamination brush will be dedicated to each bucket.

C. Vinyl, latex, or nitrile gloves will be worn.

D. A two-stage decontamination process will be used. The grossly soiled sampling device will first be cleaned in the first bucket, rinsed with distilled water, then cleaned again in the second bucket and finally rinsed thoroughly with distilled water. The first bucket will be dedicated for removing the gross soil, sludge, or sediment.

E. When the cleaning solution in the first bucket becomes dirty, the solution shall be properly discarded and the second bucket will replace the first. A new cleaning solution will be prepared in the original first bucket and it will now become the second bucket.

4.7 Monitoring Well/Piezometer/Ground-Water Extraction Well/Soil Vapor Probe/Vacuum Extraction Well Casing and Screen Pre-Installation Decontamination Procedures

This section documents the procedures that will be adhered to during the pre-installation decontamination of a monitoring well, piezometer, ground-water extraction well, soil vapor probe, and vacuum extraction well casings and screens and bottom caps. The following procedures apply to both PVC and Type 304 stainless steel casing and screen materials.

A. All personnel handling the well materials will be wearing clean vinyl, nitrile or latex protective gloves.

B. When the well casing and screen is removed from the packaging, the well materials will be placed on clean saw horses or an equivalent support device. The well materials shall be washed with a clean stiff brush and a non-phosphatic soap solution (e.g., *Liquinox*).

C. After the well materials are washed, they will be rinsed with potable water.

D. A high pressure steam cleaner may then be used to thoroughly remove any remaining soap or soiled areas.

E. The final step will be to rinse the well materials with distilled water. The well materials shall remain on the saw horses until well construction commences.

4.8 Interface Probe and Water Level Indicator

The entire length of the probe and tape that was inserted into the well will be decontaminated by washing with a non-phosphate detergent (e.g., *Liquinox*) and then rinsing with distilled water.

5.0 Documentation

The procedure(s) employed, date(s), and time(s) will be recorded on the appropriate documentation (e.g., daily field reports, field notebooks, boring logs, etc.). Any deviation from these procedures must be noted. Deviations must be approved by the Project Manager and Quality Assurance Officer.

6.0 Special Notes

None

7.0 Applicable Standards and References

None

SOP No. F1006
FIELD SOIL CLASSIFICATION/DESCRIPTION

1.0 Purpose

This section documents the procedures to visually classify soils in the field. All descriptions shall follow ASTM D653 and D2488. As a field guide, the attached table summarizes the parameters to properly classify a soil sample.

2.0 Equipment and Materials

- Pocket penetrometer
- Visual soil classification reference (e.g., attached table)
- Dropper bottle with diluted HCl

3.0 Procedures

In general, soil descriptions shall be written in the following format:

- density or consistency classification/color/second major constituent (adjective)/major constituent (principle noun)/minor constituents/moisture content/other characteristics

For example: hard brown silty clay with a trace of sand and gravel, moist, fractured.

Moisture contents may be written as: saturated, wet, very moist, moist, slightly moist, and dry.

Damp may be substituted for moist.

Other characteristics that should be mentioned are: fractures, fracture fillings, laminations, varves, organic content, oxidation, mineral fillings, sorting, and any evidence of potential contamination.

See attached Table.

4.0 Documentation

A sample identification will be documented on the soil boring logs.

5.0 Special Notes

None

6.0 Applicable Standards and References

None

HULL & ASSOCIATES, INC.
PROCEDURES FOR VISUAL SOIL CLASSIFICATION

TERMINOLOGY

Unless otherwise noted, all terms utilized herein refer to the Standard Definitions presented in ASTM D 653 and D 2488.

PARTICLE SIZES

Boulders		-	Greater than 12 inches (305mm)
Cobbles		-	3 inches (76.2mm) to 12 inches (305mm)
Gravel:	Coarse	-	3/4 inches (19.05mm) to 3 inches (76.2mm)
	Fine	-	No. 4 - 3/16 inches (4.75mm) to 3/4 inches (19.05mm)
Sand:	Coarse	-	No. 10 (2.00mm) to No. 4 (4.75mm)
	Medium	-	No. 40 (0.425mm) to No. 10 (2.00mm)
	Fine	-	No. 200 (0.074mm) to No. 40 (0.425mm)
Silt		-	0.005mm to 0.074mm
Clay		-	Less than 0.005mm

COHESIONLESS SOILS

Classification

The major soil constituent is the principle noun, i.e. sand, silt, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)			Minor Constituents (percent by weight)		
Trace	-	1 to 12%	Trace	-	1 to 12%
Adjective (clayey, silty, etc.)	-	12 to 35%	Little	-	12 to 23%
And	-	Over 35%	Some	-	23 to 33%

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0-15	0-4
Loose	16-35	5-10
Medium Dense	36-65	11-30
Dense	66-85	31-50
Very Dense	86-100	Over 50

Relative Density of Cohesionless Soils is based upon an evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier; i.e., silty clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils; i.e., silty clay, trace of sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)			Approximate Range of (N)
Very Soft	Below		500	0 - 2
Soft	500	-	1000	3 - 4
Medium Stiff	1000	-	2000	5 - 8
Stiff	2000	-	4000	9 - 15
Very Stiff	4000	-	8000	16 - 30
Hard	8000	-	16000	31 - 50
Very Hard	Over		16000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

SAMPLE DESIGNATIONS

AS - Auger Sample - Directly from auger flight.
BS - Miscellaneous Samples - Bottle or Bag.
S - Split Spoon Sample - ASTM D 1586-67.
LS - Liner Sample S with liner insert 3 inches in length.
ST - Shelby Tube Sample - 3 inch diameter unless otherwise noted.
PS - Piston Sample - 3 inch diameter unless otherwise noted.
RC - Rock Core - NX core unless otherwise noted.

STANDARD PENETRATION TEST (ASTM D1586): A 2.0" outside-diameter, 1-3/8" inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The second and third blows are added to determine the Standard Penetration Resistance (N).

SOP No. F2000
OVERBURDEN/GLACIAL DRILLING - UTILIZING HOLLOW STEM AUGERS

1.0 Purpose

This section documents the procedures to advance hollow stem augers in the overburden/glacial material to collect geotechnical and hydrogeologic data and install ground-water monitoring wells.

2.0 Equipment and Materials

The driller shall be capable of providing power-driven sectional hollow stem auger flights with a minimum inside diameter of four inches. In addition, the following equipment will be on-site and provided by the drilling contractor:

- Drill rods, minimum size equivalent to the "A" rod, with an O.D. of 1 5/8 inch and an I.D. of 1 1/8 inch
- Hollow stem augers with a minimum of four-inch I.D.
- Hollow stem auger plug
- Drive hammer (1) 300 pound and (1) 140 pound ± 5 pounds
- Eighteen and twenty-four inch split-spoon barrel samplers
- Tri-cone roller and diamond core bit
- Water tank and pump
- Steam cleaner

3.0 Procedures

The boring will be advanced by rotating the hollow stem augers to the desired depth to collect a sample or install a well. For sample collection, the augers will be advanced to a particular depth and samples collected from the material ahead of the augers. The hole will then be advanced to the maximum penetration point of the sampler with the hollow stem plug in place. During the drilling operations for installating the monitoring wells, the borehole will be drilled using a hollow stem plug or auger plug. This will prevent drilling material from entering the augers.

To advance further into the borehole, additional flights of augers will be added one at a time to meet the required depth. If an obstruction is encountered, the driller must attempt to penetrate the obstruction using the tri-cone roller bit, coring device, or other acceptable equipment. If attempts to penetrate the obstruction are unsuccessful, the boring will be abandoned in accordance with HAI SOP No. F2002, and relocated upgradient of the decommissioned boring. It should be noted that the spoil material and unused soil samples produced from the drilling operation will be properly stored in DOT approved open-top steel drums or covered with visqueen in accordance with HAI SOP No. F2013.

Hollow stem augering will be employed **without** the use of drilling fluids unless approval is given by the Project Manager. When water is used in the drilling operations, it will not be recirculated back into boring unless approval is given by the Project Manager. Water produced from this operation will be properly contained in accordance with SOP No. F2012.

Upon completion and if a monitoring well is not installed, each boring will be abandoned in accordance with HAI SOP No. F2002.

4.0 Documentation

The details of the boring operations will be recorded on the HAI boring logs which will contain all pertinent data. Any deviations from this SOP and the reason for the deviation shall be documented.

5.0 Special Notes

Hollow stem augering is often the simplest technique for performing soil investigations and sampling. However, certain physical site characteristics often preclude the use of this technique. These characteristics may include: depth to ground water, soil characteristics (e.g., heaving sands) and the equipment used.

6.0 Applicable Standards and References

None

SOP No. F2006
MONITORING WELL INSTALLATION - OVERBURDEN WELLS

1.0 Purpose

Monitoring wells in the glacial/overburden material will be installed at a specific depth to provide access for the collection of representative ground-water samples, to determine ground-water elevations, and to provide observation points for aquifer testing. These wells will be constructed of inert materials to eliminate the effect of construction material on the ground-water quality.

2.0 Equipment and Materials

- Two or four-inch diameter, Type 304 stainless steel or Schedule 40 PVC riser pipe, flush-threaded joints with O-ring[1]
- Two or four-inch diameter, 0.01-inch continuously slotted Type 304 stainless steel or Schedule 40 PVC well screen[2], flush-threaded joints with O-ring
- Type 304 stainless steel or PVC bottom cap
- Sodium-bentonite clay pellets or chips
- Clean filter sand[3]
- Sodium-bentonite or cement-bentonite slurry
- Locking water-tight cap
- Steel aboveground locking protector, six-inch diameter (minimum), and a five foot length
- Eight-inch diameter (minimum) flush-mount protective bolted manhole
- Concrete
- Pipe Cutter

3.0 Procedures

A. Generally, once the specified depth has been reached, approximately one foot of clean filter sand will be placed into the borehole by pouring the sand and simultaneously withdrawing the augers or casing. The thickness of the sand pack will be measured and recorded.

---

[1] Well construction materials, PVC or Type 304 stainless steel, will be selected by the Project Manager.

[2] The actual-opening size for the continuously slotted screen will be determined in the field by the Project Manager and will be dependant on the grain-size distribution of the screened formation.

[3] The size of clean filter sand used for the filter pack will be determined by the size of the slot openings and the formation.

B. After the sand cushion is in place, the well column will be assembled and installed. Prior to assembly, all well casing and screen will be properly decontaminated as per HAI SOP No. F1000, if appropriate. As an added protection, Teflon tape may be wrapped around the joint threads during assembly. **No glue, solvent, or lubricating compound shall be used to make up the connection.** The well column will be constructed through the augers or drilling casing and carefully lowered to ensure it is properly centered. Once construction of the well column is completed, the top will be fitted with a locking water tight cap to prevent the introduction of foreign materials during later well construction procedures. All construction information will be recorded.

C. After the well column is placed, a filter sand pack will be carefully placed around the well screen for the purpose of reducing the introduction of fines during purging and sampling procedures. The sand will be poured through the augers or casings which are periodically withdrawn to allow the sand to settle. The filter pack will generally extend two feet above the top of the screen. The grain size chosen for the filter sand will be consistent with the slot size of the screen. The depth to and thickness of the sand pack will be measured and recorded.

D. After the sand pack is firmly placed, approximately two feet of sodium-bentonite pellets or chips will be placed above the sand pack. This material will be added slowly to prevent bridging inside the augers. Approximately two to five gallons of potable water will be added to the pellets or chips for hydration and then they will be firmly tamped to ensure that an adequate seal is achieved. All construction data will be recorded.

E. A clean tremie pipe will then be placed inside the augers or casing for the placement of a thick, smooth bentonite or cement-bentonite slurry (cement-bentonite slurry will only be used with approval of the Project Manager). The slurry will be pumped under pressure until the augers or casing are full. The augers or casing will then be withdrawn and additional slurry will be added as needed. The slurry will fill the annular space between the well column and borehole to approximately three feet below ground surface. The slurry will be allowed to settle and stabilize for approximately 18 to 24 hours at which time the hole is re-inspected for subsidence. If additional slurry is needed, it will be added. The amount of sodium-bentonite slurry, the mixture ratios of the slurry, the thickness of the slurry and any significant subsidence in the slurry level will be recorded.

F. Prior to installing the protective casing, the well casing will be cut level with a pipe cutter. The finished height of the well will depend on the type of protective device to be used (e.g., flush-mount or aboveground protective casing).

G. After the bentonite slurry has reached a static level, a protective casing or flush-mount manhole will be installed in concrete (if field construction conditions permit, the concrete will extend to a depth of approximately three feet). The concrete will extend approximately one foot from the edge of the casing. This concrete pad will be constructed so the surface slopes away from the casing enhancing surface water run-off from the wellhead. As an added precaution, the annular space between the well column and protective casing can be filled with a granular material and a small hole drilled near the base of protective pipe to discharge any water that may enter the protective casing.

H. If the well will be completed in a traffic area, a flush-mount protective casing will be utilized. Like the aboveground protective casing, it will be installed in concrete (if field construction conditions permit, the concrete will extend to a depth of approximately three feet) and finished with a slope that drains surface water away from the well.

I. If required, the final step will be to paint the protective casing using a highly visible and durable paint and to permanently attach a well designation marker.

4.0 Documentation

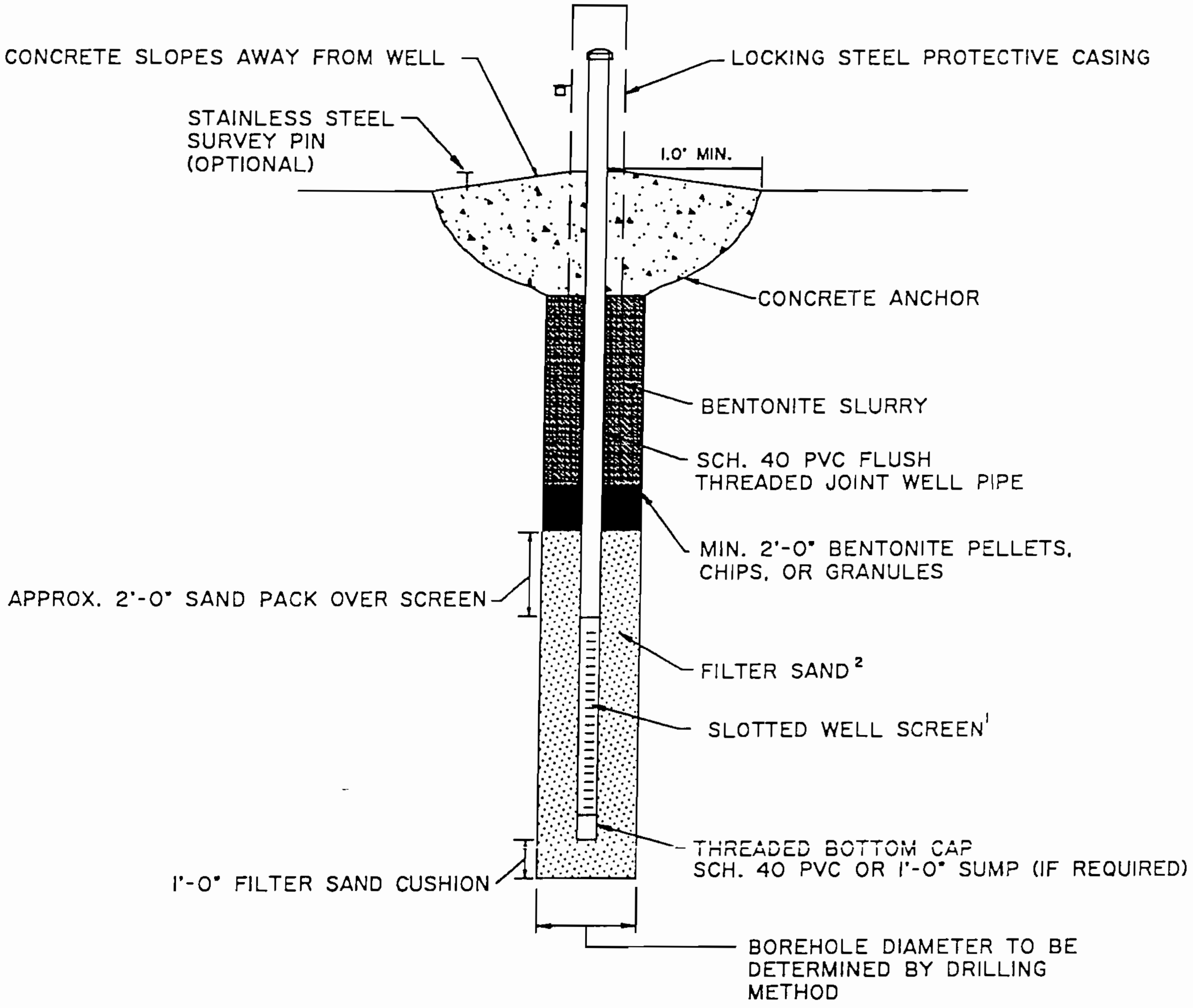
Well installation data will be recorded on the soil boring log or appropriate form. Installation details will include the total depth of the boring, the depth to the top and bottom of the well screen, the type of sand pack, the depth to top and bottom of the sand pack, the type of grout, the depth to top and bottom of the bentonite seal, the top and bottom of the bentonite slurry, the mixture ratios for the bentonite slurry, the depth to the bottom of the concrete, and any problems occurring during the installation of the well.

5.0 Special Notes

Water will not be added to the borehole during drilling activities unless it is approved by the Project Manager. The attached Figures F2007-1 and F2007-2 are examples of well installation construction.

6.0 Applicable Standards and References

ASTM D5092 Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers.



[1] SCREEN SLOT SIZE WILL VARY DEPENDING UPON FORMATION CHARACTERISTICS.

[2] FILTER PACK GRAIN SIZE WILL VARY DEPENDING UPON SCREEN SLOT SIZE.

FIGURE F2006-1

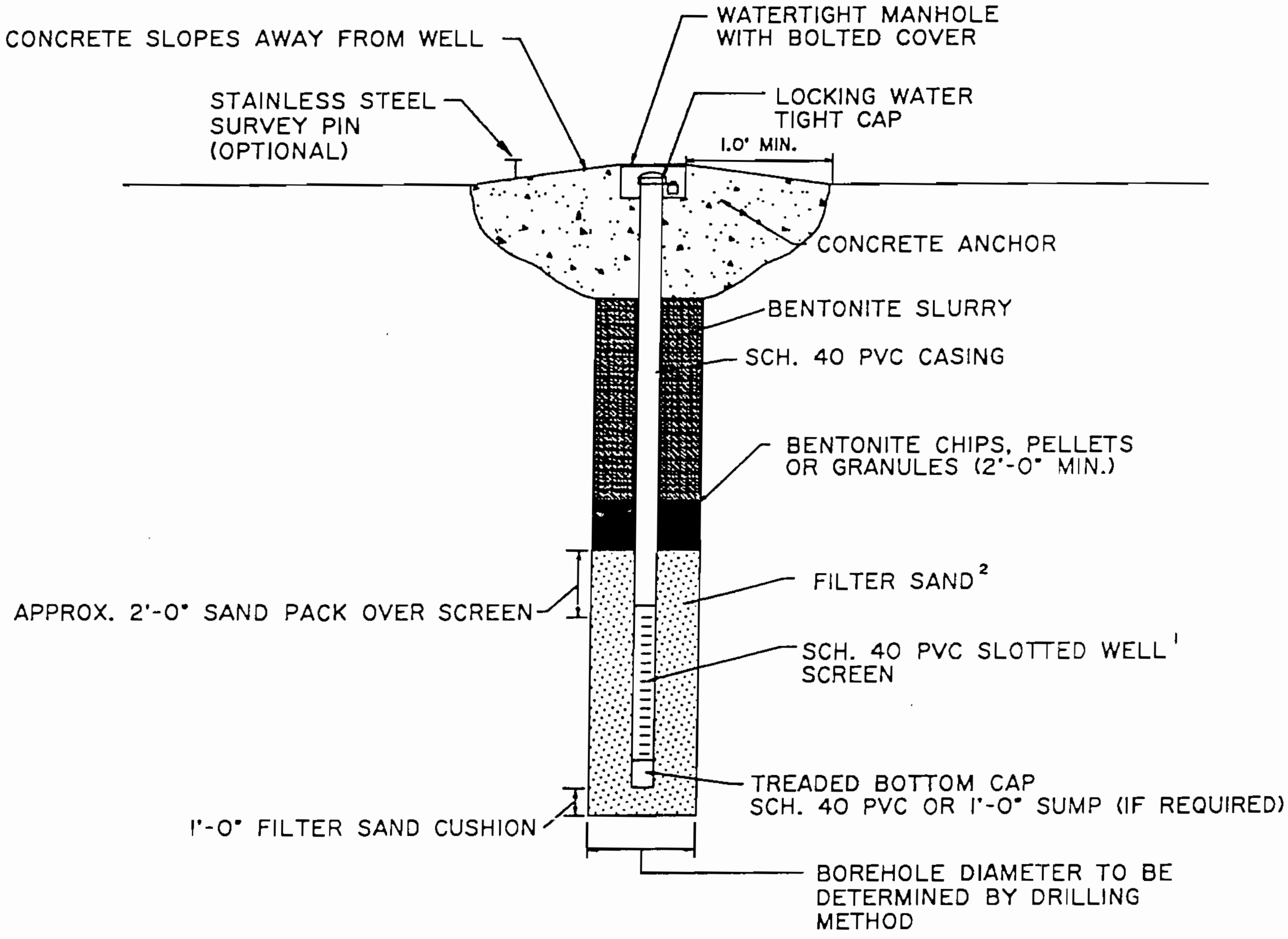
Hull & Associates Engineering, Inc.

BEDROCK
GROUND-WATER MONITORING WELL
CONSTRUCTION DIAGRAM
(WITH STEEL PROTECTIVE CASING)

DATE:
AUGUST 1995

STD

HAI\10000046
08/14/96 SCHOONOV
UNIT 1 DISK 1



[1] FILTER PACK GRAIN SIZE WILL VARY DEPENDING UPON SCREEN SLOT SIZE.

[2] SCREEN SLOT SIZE WILL VARY DEPENDING UPON FORMATION CHARACTERISTICS.

FIGURE F2006-2

Hull & Associates Engineering, Inc.

GROUND-WATER MONITORING WELL
CONSTRUCTION DIAGRAM
(WITH FLUSH-MOUNT MANHOLE)

DATE:
AUGUST 1995

STD

HA\J0000046
06/14/96 SCHOONOV
UNIT 1 DISK 1

SOP No. F2012
PROCEDURE FOR PROPER CONTAINMENT/STORAGE OF USED DRILLING FLUIDS, DECON FLUIDS, AND PURGED GROUND WATER

1.0 Purpose

This section documents the procedures to properly contain or store drilling fluids that will be recirculated from a borehole, fluids extracted from a monitoring well, and decontamination fluids.

2.0 Equipment and Materials

- Five-gallon buckets
- Thirty-gallon trash can
- Portable water tank (of appropriate size)
- Dot approved, closed-top, 55-gallon steel drum, Type 17E
- Paint pen or permanent marker (indelible)

3.0 Procedures

A. Monitoring Wells/Extraction Wells Purge Water -All ground water that is extracted from a monitoring well/extraction well and not utilized for laboratory analysis must be temporarily stored in a DOT-approved fifty-five gallon steel drum with a closed top. The drum will be marked with the date of generation, the identification of the well the water was purged from, and the words "Purge Water". Purge water shall never be disposed of on the ground, into a sewer, or into a nearby stream unless permits are obtained. Water may only be discharged to a sewer or stream if permission has been granted from the appropriate agency.

B. Drilling Fluids - All water that is introduced to a boring by the drill rig to aid in the drilling procedure will not be recirculated back through the boring unless approval is given by the Project Manager. If water must be collected for disposal, the fluids shall be directed from the augers into a portable storage tank or tub via an overflow adaptor. The contents of the portable tank will then be disposed of as directed by the Project Manager.

C. Aquifer Test Purge Water - Water that is removed from the aquifer during a long duration or step-drawdown aquifer test will be disposed of as directed by the Project Manager.

Water that is extracted from a monitoring well to determine in-situ aquifer characteristics will be stored in a portable container near the test well and then disposed of as directed by the Project Manager. The portable container will be marked with the date of generation and the identification of the test well that water was extracted from.

D. Decontamination Fluids - Any fluids generated from decontamination procedures will be stored in DOT-approved fifty-five gallon steel drums with a closed top. The date of generation and the words "Decon Fluids" will be clearly marked on the drum.

4.0 Documentation

The volume of water extracted from a well from developing or purging activities will be recorded on the Ground-Water Data Sheet and in the field notebook.

The volume of ground water that is extracted from a monitoring well/extraction well will be recorded on the Aquifer Test Data Sheet and in the field notebook.

The volume of water collected from a boring during drilling procedures will be recorded on the Soil Boring Log. The volume of decon fluids shall be recorded in a field notebook, soil boring log, or Ground-Water Data Sheet.

5.0 Special Notes

None

6.0 Applicable Standards and References

None

SOP No. F2013
PROCEDURE FOR PROPER CONTAINMENT/STORAGE OF SOIL PRODUCED FROM DRILLING OPERATIONS (AUGER CUTTINGS) AND SOIL EXCAVATIONS

1.0 Purpose

This section documents the procedures to be followed to properly contain auger cuttings or soils excavated in areas of known or suspected contamination.

2.0 Equipment and Materials

- Shovel
- DOT-approved 55-gallon steel drums with locking open-top lids, Type 17H
- Visqueen
- Straw bales
- Stakes or concrete blocks
- Paint pen or permanent marker (indelible)

3.0 General

A. Auger cuttings - All soil produced from drilling operations (auger cuttings) that is not saved for physical or chemical analysis will be containerized on-site in DOT approved 55-gallon drums or stockpiled on and covered with visqueen in accordance with the procedures described in Section 4.0.

B. Excavated Soils - All soil excavated from areas of known or suspected contamination will be stockpiled on and covered with visqueen in accordance with the procedures described in Section 4.0.

4.0 Procedures

A. Drum Storage - Drums used to containerize auger cuttings will be clean DOT-approved 55-gallon steel drums with locking open-top lids.

Auger cuttings will be placed in drums as soon as possible to avoid contaminating the ground surface near the boring. Each drum shall be clearly labeled to identify the date of generation and the boring it was generated from. If multiple drums are needed for a particular boring, they will be consecutively numbered as they are generated. An example of proper drum labeling is as follows:

8/6/94
SB5-001
(Soil Boring 5 - Drum No. 001)

Drums may also be labeled with a self-adhesive label which may include the following information:

Generator's Name and Address
Site Number
Date
Soil Boring Number(s)

Soil from different soil boring locations will not be mixed unless otherwise directed by the Project Manager. After the drums of soil are properly labeled and secured with a tight fitting lid, drums will be moved to a drum staging area. The location of the drum staging area will be coordinated with the site owner/operator. The location selected should be away from traffic patterns, but accessible for future pick-up.

B. Stockpiling - Excavated soils will be stockpiled in accordance with Figure F2013-1. Mixing auger cuttings from different locations will be verified with the Project Manager and the location of the stockpile will be coordinated with the site owner/operator. Prior to selecting a location, the volume of soil to be stockpiled will be estimated to determine the space requirements for stockpiling. The location selected should be away from traffic patterns, but accessible for future pick-up. It may be appropriate to form separate stockpiles for soils generated from different sources.

C. Soil Disposal - Prior to beginning the project, if possible, the Project Manager will determine the soil disposal alternatives. If required, the sampling procedure and list of parameters for analysis will be in accordance with the selected disposal facility's requirements.

5.0 Documentation

A. If auger cuttings are placed in drums, the following information will be included on the soil boring log, field notebook, or in the daily field report:

- the number of drums generated
- labeling procedures
- the type of drums used

B. If auger cuttings or excavated soils are stockpiled, this will be noted on the soil boring log, field notebook, or the daily field report. The estimated volume of soil produced from each source should also be noted.

C. Photographs will be taken of the drum staging area or the soil stockpile to document that proper handling procedures were followed.

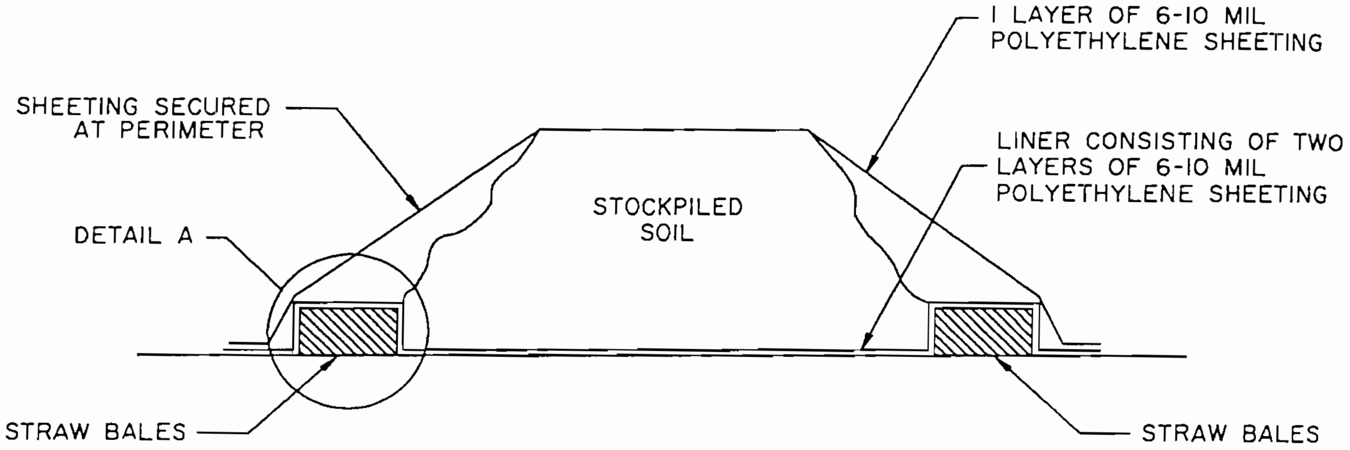
D. Chain-of-custody records will be completed for composite soil samples sent to the laboratory for analysis.

6.0 Special Notes

None

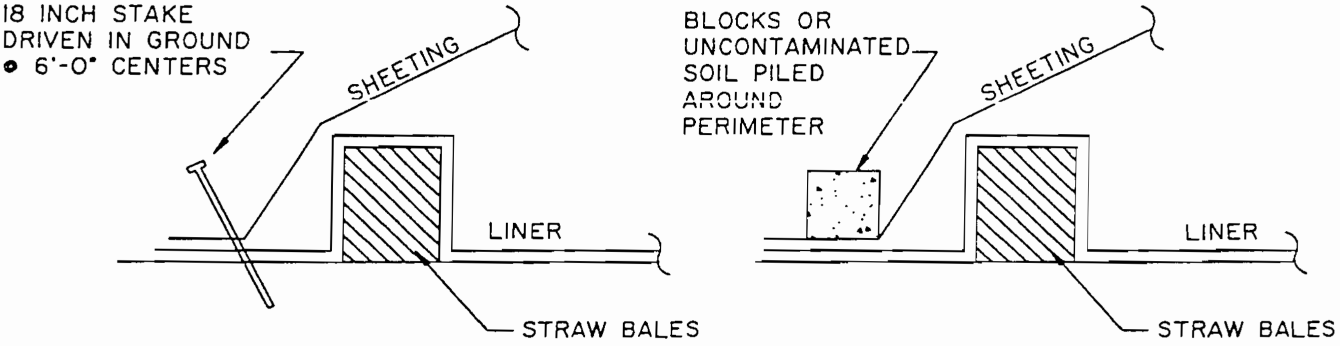
7.0 Applicable Standards and References

None



SECTION

SCALE: NONE



DETAIL A
SHEETING AND LINER ANCHORING DETAILS

SCALE: NONE

FIGURE F2013-1

Hull & Associates Engineering, Inc.

STOCKPILED SOIL DETAILS

DATE:
AUGUST 1993

STD

INF\10000018
08/25/93
WILSON

SOP No. F3000
SUBSURFACE SOIL SAMPLING UTILIZING A SPLIT SPOON SAMPLER

1.0 Purpose

Subsurface soil samples will be collected at discrete intervals to determine the physical and textural characteristics of the overburden/glacial material. Additionally, selected soil samples may be used to evaluate levels of contamination at various depths and aerial extent depending on the objectives of the project.

2.0 Equipment and Materials

- Analytical method-specified sample jars, if required
- One pint mason jars and/or ZipLoc bag
- 18 or 24-inch split-spoon sampling barrel with an appropriate drill rod assembly
- Drill rig with 140-pound drive weight system that allows for a 30-inch free fall
- Stainless steel laboratory spoon or spatula
- Clean disposable wipes
- Drill rig capable of utilizing a hollow stem auger system or drive and wash system

3.0 Procedures

A. After the borehole has been advanced to the desired sampling depth with the auger system or casing system, the split-spoon sampler will be assembled and lowered carefully into the bottom of the hole.

B. With the 18-inch or 24-inch split spoon set securely at the bottom of the augers or casing, the drill rod will be marked at consecutive six-inch intervals for the purpose of recording the number of blows to drive the sampler six inches. The length of sampler will depend on subsurface conditions (e.g., compactness, etc.) and will be subject to the approval of the Project Manager. If the sampler does not reach the base of the augers or casing, the sampler will be withdrawn and the borehole will be cleaned out to ensure that the sampler collects a representative sample of the overburden/glacial material for the particular sampling interval.

C. The split spoon sampling barrel, independent of the length of the sampler, will be driven by a free-falling drop hammer weighing 140 pounds and falling thirty inches (ASTM D 1586-84). The sampler will be driven using Standard A drilling rods or equivalent connected between the sampler and the driving weight. The number of blows to drive the sampler for each six-inch interval will be recorded. The sampler will be driven at least the length of sampler (e.g., 24 inches), unless sampler refusal occurs or the blow count exceeds 100 per six-inch drive. If greater than 100 blows per six-inch drive occurs, then the driving will stop and the sampler retrieved. Prior to removal, the sampler may have to be rotated clockwise to free the sampler from dense soils. Upon removal, the amount of bumping or banging on the drill rods will be minimized to reduce disturbance to the sample and the possibility of losing a sandy sample.

D. If conditions necessitate, the drilling fluids (e.g., potable water, etc.) will be added to mitigate the problem of "heaving" sand. If this problem occurs, the augers or casing will be kept full during sampling and sampling recovery. This procedure will only be followed under the approval of the Project Manager. In cases where samples are collected for chemical analyses, no drilling fluid will be added to the borehole. This procedure must be followed to protect the chemical integrity of the soil sample.

E. The sampler will be retrieved and immediately opened to measure the length of recovery. Recovery will then be recorded on the soil boring log. Any loose material at the top of the sampler will not be included in the measurement of recovery and will be discarded (this is usually material that has fallen into the borehole). The samples will immediately be visually described utilizing the parameters described in HAI SOP No. F1006. All pertinent data will be recorded on the soil boring log corresponding to the particular soil boring.

F. If the sample recovery is insufficient, the sampler will be reassembled and placed back into the borehole. The sampling procedure will then be repeated.

G. If headspace analysis is required, the sample will be placed into a clean one-half or one-pint sample jar after it has been visually described in accordance with HAI SOP No. 1006. Headspace analysis will be performed on soil samples in accordance with HAI SOP No. F4008.

H. The collected soil samples will be placed in a properly labeled sample jar. The labeling will include, but is not limited to, the date of collection, project number, boring designation, sample number, and sampling interval.

I. After each sampling interval, the split spoon barrel sampler will be decontaminated in accordance with HAI SOP No. F1000.

4.0 Documentation

All sampling information will be recorded on a properly labeled soil boring log. Any additional comments or problems incurred during the sampling event will also be recorded.

5.0 Special Notes

None

6.0 Applicable Standards and References

None

SOP No. F3005
GROUND-WATER LEVEL MEASUREMENT

1.0 Purpose

This section contains the procedures for collecting ground-water level data.

2.0 Equipment and Materials

- A water level indicator with a tape graduated to 0.01 feet (e.g., *Sample Pro* 6000, *Solinst*, etc.).

3.0 Procedures

A. The interface probe or water level indicator will be decontaminated according to SOP No. F1000 prior to water level measurements. The probe will also be thoroughly decontaminated between each well. Decontamination shall include appropriate cleaning of the tape length lowered into the well, as well as the end probe.

B. The probe will be slowly and carefully lowered into the well column until the water level is encountered. A clear, audible sound will be indicated when the water level is reached. The tape will be slowly raised and lowered a number of times to find the exact measurement, to within 0.01 feet. The measurement will be recorded on the Ground-Water Data Sheet.

C. Measurements will be taken from the black survey mark indicated on the top of the well casing. If a mark is not already indicated, then the north side of the casing should be used as the measurement point. The measuring point, if not already marked, should be indicated with a black paint pencil. The measuring point will be recorded on the Ground-Water Data Sheet.

D. The probe or tape should not come in contact with the ground prior to measurement.

4.0 Documentation

All relevant data collected during this operation will be recorded on the Ground-water Sampling Data Sheet.

5.0 Special Notes

Special care must be taken to prevent the tape from rubbing on the edge of the well casing when lowering or placing the probe in the well. In addition, when winding the tape, be sure to reel without twisting the tape so that internal damage to the tape does not occur.

6.0 Applicable Standards and References

None

SOP No. F3006
IMMISCIBLE LAYER DETECTION AND MEASUREMENT

1.0 Purpose

This SOP documents the procedures used to detect immiscible layer(s) in water.

2.0 Equipment and Materials

- An interface probe with a tape graduated to 0.01 feet (e.g., *Solinst* Model No. 121 or *ORS* Model No. 1068013).

3.0 Procedures

Solinst Interface Probe

A. Prior to use, the probe will be decontaminated using a mild soap solution (e.g., *Liquinox*) and a distilled water rinse.

B. The reel switch will be flipped "on" (the reel switch is the toggle switch on the reel faceplate). The instrument should indicate a steady tone, and the red light on the side of the reel should remain lit. This indicates that the instrument is working properly and that the battery is charged. The probe will be turned on next by sliding the corrogated metal ring at the top of the metal probe to the number 1 (when in the off position, the ring should be turned towards the zero). When the reel switch is on and the probe switch is turned on, the steady tone will cease and the reel light will not be lit. When not taking a measurement, the reel switch will be turned off. Following use, both the reel and the probe will be turned to the off position.

C. The measurement "zero point" of the probe is the junction between the stainless steel body and the brown delrin base plug. This is approximately 0.2 feet above the base of the probe. The operation of the probe will be checked by inserting the probe to the measurement zero point in a bucket of water. This causes a single central light to be activated. The product detecting sensor of the probe will be checked by inserting the cleaning brush into the base of the probe until it reaches the measurement zero point. This blocks the infrared beam and causes both central lights and the buzzer to activate.

D. The probe will be slowly lowered into the well until the central lights are illuminated and an audible tone signal, either steady or pulsating, is activated. The difference in tone indicates whether or not a floating non-aqueous layer exists in the well. If such a layer does exist, then a steady tone will sound and both red lights will be steadily lit. If no floating layer exists, then a pulsating tone will be indicated and a red light will blink. When a tone sounds, the probe will be gently raised and lowered to determine the exact upper level of the non-conductive floating layer, if present, or if not present, the water level within the well. The level will be determined to the nearest hundredth of a foot from the marked tape.

If no floating layer exists, the buzzer will be activated briefly when first entering the water and will continue a pulsating tone until the probe is removed from the water. If a thin non-aqueous layer exists, the buzzer will indicate a steady tone briefly when entering the immiscible layer, but will begin to pulsate when exiting the immiscible layer and contacting the water.

E. After a steady tone indicates that a free-floating layer is present in the well. The probe will be slowly raised and lowered until the exact measuring point is located (to the nearest hundredth). After the initial tone, the probe will continue to be lowered until a pulsating tone sounds to indicate the bottom of the immiscible layer and the beginning of the water. The water level will also be measured to the nearest hundredth of a foot.

F. Step E will be repeated to confirm the measurements. The initial reading will be subtracted from the second reading to determine the floating immiscible layer thickness. All measurements will be recorded.

G. The probe will be lowered to determine if a sinking immiscible layer exists is in the well. If both lights and the buzzer come on, the top of the sinking layer will be determined by using the same technique as described in Step E.

H. The bottom of the well will be measured by further lowering the probe until it hits the bottom and the tape slackens. **NOTE:** For the bottom of the well measurement, 0.2 feet must be added to the reading on the tape to obtain the true depth measurement (0.02 feet is the difference between the measurement point and the bottom of the probe).

I. After this procedure is complete, the probe and all measuring tape lowered into the well will be thoroughly decontaminated following each measurement taken. First, the system will be scrubbed with a non-phosphatic soap (e.g., *Liquinox*) solution followed by a complete rinse with distilled water.

J. The decontaminated system will not be allowed to come into contact with the ground or other objects.

ORS Interface Probe

A. Prior to use, the probe will be decontaminated using a mild soap solution (e.g. *Liquinox*) and a distilled water rinse.

B. The unit will be turned on by unfolding the crank handle away from the reel housing. This activates a power switch inside the reel. To verify that the unit is operational, press the test button on the face plate. If the power is ON, the visual/audible alarm will be activated. A low battery condition will cause the Low Battery Indicator to be illuminated.

C. The probe will be released by pulling the protector tube outward from the reel casing. The probe will be lowered by tilting the front of the reel housing forward and pressing the brake release. The brake release is located just forward of the handle. The tape will reel out as long as the brake release is depressed. The probe will be lowered into the well taking care not to allow the probe or tape to rub against the well casing.

D. When the probe contacts liquid, the visual/audible alarm on the reel will be activated. An oscillating alarm will indicate water. A continuous alarm will indicate an immiscible layer. To determine the exact thickness of the immiscible layer, the probe will be slowly lowered to the air/immiscible layer interface until the alarm is activated. With the probe at the exact point where the alarm comes on, the distance to the top of the immiscible layer will be determined to the nearest hundredth of a foot on the marked tape. The probe will be lowered through the immiscible layer into the water. An oscillating alarm will be heard after entering the water. The probe will then be raised very slowly to the immiscible layer/water interface until the point is reached where the alarm changes from oscillating to continuous. The distance to the bottom of the immiscible layer will be determined to the nearest hundredth of a foot on the marked tape. The thickness of the immiscible layer will be determined by subtracting the first reading from the second reading. The immiscible layer thickness, the interface, and water level measurements will be recorded on a Ground-Water Data Sheet.

E. It is difficult to determine the total depth of the well using the ORS interface probe, because the probe is not heavy enough to accurately determine when the well bottom has been reached. The bottom of the well should be checked with a suitable device (e.g., a water level indicator).

F. After a measurement is complete, the probe and all measuring tape lowered into the well will be thoroughly decontaminated following each measurement taken. First, the system will be scrubbed with a non-phosphatic soap (e.g., Liquinox) solution followed by a complete rinse with distilled water.

G. The decontaminated system will not be allowed to come into contact with the ground or other objects.

H. After proper decontamination, the protector tube will be snapped shut so that the wiper rests against the tape. The brake will be released and the probe will be slowly reeled two-thirds of the way into the tube. Using force when reeling the probe all the way into the tube may stress or break the measuring tape. The entire interface probe assembly will be turned upside down so that the probe falls the rest of the way into the protector tube making sure that the probe is entirely within the protector tube. Finally, the protector tube will be closed.

I. The *ORS* interface probe is equipped with an automatic shut off circuit. If the probe has not sensed liquid within three minutes from the time power is applied, the unit will automatically switch to a lower power mode. This prevents battery drain should the power be left on accidentally. To restore power, place the handle in the OFF position and then back to the ON position.

4.0 Documentation

All pertinent data collected during this procedure will be recorded on the Ground-Water Monitoring Well Data sheet. Any deviation from the SOP should be noted on the sheet.

5.0 Special Notes

Take special care to prevent the tape from rubbing on the edge of the well casing when lowering or placing the probe in the well. When winding the tape on the reel, make sure that it is not twisted as this may damage the tape.

6.0 Applicable Standards and References

None

SOP No. F3007
MONITORING WELL PURGING

1.0 Purpose

This SOP documents the procedures to follow when purging monitoring wells prior to ground-water sample collection. Additionally, this SOP describes the hydraulic conditions which govern the selection of a particular purging device.

2.0 Equipment and Materials

- Submersible pump
- Bailer
- pH/temperature meter
- Conductivity meter
- Storage container for purge water
- Calibrated container with a capacity of at least five gallons
- Discharge tubing, generators, etc.
- Polypropylene rope

3.0 Procedures

The purpose of purging is to evacuate stagnant water that may be present in the well column and filter pack and introduce representative formation water into the well casing. Well purging should not be confused with well development as the latter is performed to enhance yield by cleaning the well and sand pack following well installation. Purging is completed utilizing a variety of bailers and/or pumps which are described below. The Project Manager or Quality Assurance Officer will determine the most appropriate purging method. The device that is used to purge the well is dependent upon the well construction and hydraulic conditions of the screened interval. The selected purging device will provide an adequate discharge rate that will not have a deleterious effect on the ground-water quality.

The U.S.EPA recommends that three to five well volumes be purged from a well in order to obtain a representative ground-water sample. Typically, monitoring wells are purged by extracting three well volumes. Occasionally, it is advisable to purge less that three well volumes (e.g., in conditions where excessive purging may cause contaminant migration). Under these conditions, the well will be purged until the temperature, conductivity and pH of the purge water have stabilized. The temperature, pH, and conductivity will be measured initially, as well as after each well volume purged. The last two values obtained must be within 10 percent of each other. If these conditions are not met, then another well volume will be purged until the appropriate conditions are met or until a maximum of five well volumes is met. The values are recorded on HAI's Ground-Water Sampling Data Sheet.

Low yielding wells, from which at least three well volumes cannot be removed, will be completely evacuated before sampling. All wells will be sampled within 24 hours of purging. If a sufficient volume of ground water does not recharge in the well within 24 hours, no sample will be collected. A sample collected after 24 hours will not be considered representative of ambient ground-water quality. If the project requires that a sample be collected after 24 hours from purging, a sample will be collected and a footnote added to the laboratory report indicating that the sample was collected after 24 hours from purging.

In order to reduce the possibility of error, purge and well volumes will be calculated in the field based on a conversion factor that represents the gallons of water in the well per foot of standing water. Typical conversion factors used are listed in the table below:

VOLUME PER LINEAR FOOT OF STANDING WATER

Well Diameter	Cubic Feet	Gallons
2.0	.022	.16
4.0	.087	.65
6.0	.196	1.47
8.0	.349	2.61

The following formula was utilized to determine the conversion factors:

$$\text{Gals/ft. of water} = C \times (\pi \times d^2/4 \times 1 \text{ ft.})$$

Where:
$\pi = 3.1416$
d = Diameter of Well Casing (feet)
$C = 7.48$ (constant for converting ft^3 to gallons)

Then the volume to be purged will be:

$$V = (\text{gals/ft. of water}) \times L \times n$$

Where:
V = Volume to be purged (gallons)
L = Column of standing water in well (feet)
n = Number of well volumes to be removed (3 to 5)

A. Bailing

Depending on the hydraulic characteristics, depth, and recharge rate of an individual well, bailing is normally the most applicable method for well purging. Bailers utilized during this operation will be constructed of PVC, stainless steel, or Teflon. The selection of the type of material will be determined by the Project Manager or Quality Assurance Officer based on known geochemical conditions at the site and regional regulatory variances. If dedicated bailers are installed in the wells, they will be utilized for purging, unless otherwise authorized by the Project Manager.

When using this purging technique, the bailer will be slowly lowered into the water column to prevent excessive agitation of fines and to prevent aeration of the ground water. The well will be bailed from the top of the water column to the bottom. When the bailer is full, it will be retrieved and the contents carefully transferred into a holding container of known volume to determine the purge volume (e.g., five gallon bucket). A new rope will be attached to the bailer when purging each well. All water removed during purging will be stored in DOT-approved fifty-five gallon drums (closed-top, Type 17E) and properly disposed as directed by the Project Manager.

B. Mechanical and Manual Pumps

In some cases, factors such as depth to water, total depth of the well, and/or well diameter make the use of a bailer inefficient. In these instances, the use of submersible pumps will be employed to maximize the efficiency of purging. Any pump utilized will be properly decontaminated prior to, and after purging, in accordance with HAI SOP No. F1000. The use of any pump to purge a well will be performed according to manufacturer's instructions. In no instance will any purge pump be used in any other phase of sample collection.

1. Submersible Pumps

Submersible pumps provide an effective means of well purging for deep wells where bailing would be inefficient. Submersible pumps are particularly useful for situations where the depth to the water is greater than twenty feet, or the depth or diameter of the well requires that a large volume of water be removed.

HAI currently utilizes three submersible pumps, a 1.75 inch diameter SP-81 Keck Submersible Pump, which can be used to purge wells that have a diameter of two inches or greater, a two inch diameter Grundfos pump which can be used in wells with a diameter greater than or equal to two inches, and a four inch diameter Grundfos pump which is utilized in wells that required a large purge volume with casing diameters of four inches or greater. The Keck pump offers a low-pumping rate which makes its use advantageous in wells that are subject to introduction of fines under a high purging rate. The two inch Grundfos pump has the capacity to pump at approximately six gallons per minute (gpm) at fifty feet of head. It is recommended that this pump be used in deep wells with a high recharge rate. The four inch Grundfos pump can yield up to eighteen gpm at fifty feet of head. It should be noted that after the completion of any purging operation, the submersible pump will be decontaminated in accordance with HAI SOP No. F1000.

These pumps will only be utilized with approval of the Project Manager for purging operations and will not be used for the collection of ground-water samples.

2. Waterra

In some instances, where wells are difficult to access, waterra tubing will be used. A waterra valve is attached to the end of the tubing and lowered into the well. The tubing is then moved up and down at a constant rate to allow water to flow through the column of tubing. Once the correct amount of water is purged, the valve shall be removed and the tubing discarded. A new piece of tubing will be used in each subsequent well. The valve will be decontaminated according to HAI SOP NO. F1000.

3. Alternate Mechanical Pumps

Peristaltic Pumps - Peristaltic pumps typically provide a low rate of flow in the range of 0.02 - 0.2 gpm. For this reason, these pumps will be suitable for purging situations where recharge rates are low and/or disturbance of the water column must be kept at a minimum. This may be employed for particularly sensitive analyses or to avoid introduction of excessive fine material.

Positive Displacement Piston Pumps - This type of pump can be utilized to purge a well at an intermediate rate (up to four gpm at a variety of depths). For this reason, the pump can be utilized to purge wells at intermediate depths and intermediate or high recharge rates in an efficient manner. The intermediate flow rates allow for only a minimal introduction of fines into the well column.

4.0 Documentation

All pertinent data including, but not limited to, the type of purging device, the volume purged, pH, conductivity, and the temperature for each well volume will be recorded on the Ground-Water Monitoring Data Sheet. Any deviation from the above described procedures will be performed only under prior approval of the Project Manager.

5.0 Special Notes

When bailing or using the submersible pump, the well shall be evacuated from the top of the water column to the bottom. The pump shall not be allowed to remain close to the bottom of the well screen where sediment may clog the pump.

6.0 Applicable Standards and References

None

SOP No. F3008
GROUND-WATER SAMPLE COLLECTION

1.0 Purpose

This SOP documents the procedures that will be followed during the collection of representative ground-water samples.

2.0 Equipment and Materials

- Dedicated bailers, reusable Teflon or stainless steel bailers, or disposable polyethylene bailers
- Bailer cord
- Latex sample gloves

3.0 Procedures

A. In most instances, a two-inch diameter disposable polyethylene bailer will be used when sampling each well. Acceptable sampling collection equipment include a disposable bailer, dedicated bailer, or a properly decontaminated Teflon or stainless steel bailer. A spool of nylon, polypropylene, or equivalent rope will be used as the bailer cord. If a Teflon or stainless steel bailer will be reused, it will be properly decontaminated in accordance HAI SOP No. F1000 prior to use in each well. The bailer cord will then be attached to the bailer and the bailer knot tested to ensure that the knot and all parts of the bailer are securely intact prior to placement in the well.

B. It should be noted that the bailer cord should never touch the ground surface or the protective well casing at any time during the sample collection. If the bailer cord cannot be prevented from touching the ground, protective plastic sheeting will be placed around the well area to prevent rope contact with the ground.

C. During sample collection, the bailer will be slowly lowered into the well to prevent agitation of the water to minimize the volatilization of any volatile organic compounds. The bailer will then be slowly and smoothly raised to the surface in a manner that will not agitate the sample.

D. The contents will be transferred into properly preserved sample bottles. Sample bottles containing the proper preservatives will be prepared by the laboratory prior to sample collection. These bottles will be properly labelled in accordance with the quality assurance plan for the project.

E. All sample containers will be immediately placed on ice and properly packed in the shipping coolers following sample collection. Samples will remain at 4°C from collection time until analysis or the sample will be discarded and another collected.

F. Finally, all materials used during sample collection will be either properly disposed, or in the case of reusable equipment, will be properly decontaminated following the procedures documented in HAI SOP No. F1000.

4.0 Documentation

A number of different documents must be completed and maintained as part of the ground-water sampling effort. The documents will provide a summary of the sample collection procedures and conditions, shipment method, the analyses requested and the custody history. The following is a list of the documents that will be filled out:

- Ground-Water Sampling Data Sheets for each well
- Sample labels
- Chain-of-Custody records

5.0 Special Notes

None

6.0 Applicable Standards and References

None

SOP NO. F4010
VISUAL DETECTION OF NON-AQUEOUS PHASE LIQUIDS (NAPL) IN SOILS AND GROUND WATER

1.0 Purpose

The purpose of this procedure is to evaluate soil and ground-water samples in the field for non-aqueous phase liquid (NAPL) using ultraviolet (UV) fluorescence examination and hydrophobic dye soil-water shake test. In most cases, light NAPL (LNAPL) is readily detected by visual examination or by using a photoionization detector (PID). Dense NAPL (DNAPL) however, is generally more difficult to detect by visual and PID methods. The ability to detect DNAPL pooling or interfaces in strata during drilling and prevent "dragdown" of these contaminants is very important. Discrete vertical profiling within saturated strata with DNAPL contamination is paramount to accurately assess plume configurations.

2.0 Equipment and Materials

- portable battery-powered UV light capable of emitting longwave UV (3000-4000 A) light
- viewbox with protective viewing glasses
- hydrophobic dye (Sudan IV)
- (optional) 50 ml polypropylene test tubes with caps
- flat toothpicks
- quart size and gallon size *Ziploc* bags
- distilled water or clean potable tap water
- 4 oz. glass jars with lids
- 40 ml glass vials

3.0 Procedures

Evaluation of Soil Samples

A. Sample Preparation

This procedure assumes that samples will be collected with a 24 inch split spoon sampler. The sample will be split into two representative halves to facilitate both analytical and headspace analysis requirements. One-half of the sample will be placed in the appropriate laboratory-supplied analytical containers. The remaining half will be used to log the physical soil characteristics, to perform headspace analysis, and for visual NAPL detection analyses as described herein. Use of a three inch diameter split spoon sampler to provide adequate sample volume for all analyses may be appropriate.

Once the sample has been examined and the physical soil characteristics described on the soil boring log, the sample will be examined for fluorescence and tested with a hydrophobic dye as described below.

B. Fluorescence Examination

1. Assuming full sample recovery, the sample will be split into upper and lower halves and each half placed in separate one gallon *Ziploc* bags. Headspace analyses will be performed on each bag, as required.

2. Each sample will then be examined in the viewing box by manipulating the sample with your hands to break apart portions of the sample. **Note: protective eyeware must be worn when viewing the sample with UV light.** Most hydrocarbons fluoresce milky white to yellow under the UV light. The results will be recorded on the soil boring log.

C. Hydrophobic Dye Soil-Water Shake Test

1. The portion of the sample that exhibits the highest potential for contamination based on normal visual observations (e.g., staining or discoloration), elevated PID readings or by fluorescence will be used for this test. A portion of the soil sample will be transferred with a stainless steel spoon/spatula to an appropriate container as described below. Equal proportions of soil and water (clean potable tap or distilled) should be placed in double bagged *Ziploc* bags or a 4 oz glass jar. Polypropylene or polyethylene (plastic) containers are better suited for this test because hydrophobic NAPLs wet plastic better than glass, thereby enhancing detection on the container wall. [Alternate method- a graduated 50 ml test tube can be used to estimate the volume of NAPL in the sample. Approximately 20 cm^3 (20 ml) of soil and 20 ml of water (clean potable tap or distilled) will then be added to the tube and a cap will be placed on the tube.] Shake the container chosen above for approximately 10 seconds to create a soil-water suspension. An unaided visual inspection will be made for NAPL presence and categorized as:

    1. present;
    2. suspected; or
    3. no visual evidence.

2. Following the procedure described above, approximately 2 mg (i.e., an amount that would rest on the edge of a flat toothpick) of hydrophobic dye (Sudan IV) will be added to the container. The container will be sealed and then shaken for 10 to 30 seconds. The sample will be examined for the presence of NAPL. NAPLs will dye a red color. The dye is hydrophobic thus is insoluble in water. **Note: Sudan IV is an irritant and a possible**

mutagen; therefore, skin or eye contact must be avoided. The results of this test will be recorded on the boring log.

Evaluation of Ground-water Samples

D. Hydrophobic Dye Water Shake Test

Approximately 20 ml of ground water will be decanted from a bailer into a 40 ml vial. [Alternate method- decant ground water from a bailer into double bagged *Ziploc* bags or a glass jar with a lid. Polypropylene or polyethylene (plastic) containers are better suited for this test because hydrophobic NAPLs wet plastic better than glass, thereby enhancing detection on the container wall.] Approximately 2 mg of hydrophobic dye will be added to the water. The sample will be observed for color change (NAPL will dye a red color) and interfaces caused by phase separation. If no interface is present, the cap will be placed on the vial/jar and then shaken vigorously for 10 to 30 seconds. The sample will be examined for a re-evaluation of the presence of NAPL. All observations will be recorded on the boring log.

4.0 Documentation

All data collected during this procedure will be recorded on the boring log.

5.0 Special Notes

Prior to employing these techniques in the field, personnel will be trained in the use of the equipment. A set of standards will be viewed with the fluoroscope and dye test to familiarize the examiner with typical responses to these tests. Although these techniques can be used at LNAPL sites, it is primarily intended to detect colorless DNAPL and organics with ionization potentials higher than the upper range of most PIDs (e.g., 11.7 eV).

6.0 Applicable Standards and References

Cohen, R.M., Bryda, A.P., Shaw, S.T., and Spalding. Evaluation of Visual Methods to Detect NAPL in Soil and Water. Ground Water Monitoring Review, v.xii, no. 4, pp. 132-141. C.P. 1992.

APPENDIX B

Quality Assurance Project Plan (QAPP)

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. Box 509 Albany, New York 12201-0509

Barbara A. DeBuono, M.D., M.P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

MAR 20 1998

MARCH 18, 1998

Dear Laboratory Director:

Please note that although your ELAP Certificate of Approval expires on 12:01 AM April 1, 1998, it is still valid until June 30, 1998, as per ELAP Certification Manual, No. 140, Page 13 of 42, dated 12/6/95, Part 55-2.4e NYCRR. "...during any extension or grace period permitted by this Subpart, a laboratory approval shall remain in force beyond the expiration date of the certificate of approval, unless such approval is specifically terminated or suspended in writing."

Notification regarding the issuance of 1998-99 ELAP Certificate(s) of Approval is pending receipt of all non-governmental laboratories' Total Adjusted Volumes and Approval of the 1998-99 ELAP Budget by the New York State Legislature.

Further verification of your laboratory's approved ELAP status is available by calling the Program Office at (518) 485-5570.

Sincerely,

Linda L. Madlin
Administrative Assistant
Environmental Laboratory
Approval Program

LLM:saw

NEW YORK STATE DEPARTMENT OF HEALTH

BARBARA A. DEBUONO, M.D., M.P.H. Commissioner

Expires 12:01 AM April 1, 1998
ISSUED April 1, 1997
REVISED October 2, 1997

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10670

Director: DR. TIMOTHY OOSTDYK
Lab Name: LANCASTER LABORATORIES INC
Address : 2425 NEW HOLLAND PIKE
LANCASTER PA 17601-5994

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER

All approved subcategories and/or analytes are listed below:

Chlor. Hydrocarbon Pesticides :
- 4'-DDD
- 4'-DDE
- ,4'-DDT
- alpha-BHC
- drin
- ta-BHC
- lordane Total
- delta-BHC
- Dieldrin
- drin aldehyde
- drin
- dosulfan I
- Endosulfan II
- dosulfan sulfate
- ptachlor
- ptachlor epoxide
- Lindane
- Mirex
- thoxychlor
- xaphene

Wastewater Miscellaneous :
- Boron, Total
- Cyanide, Total
- Color
- Phenols
- Oil & Grease Total Recoverable
- Hydrogen Ion (pH)
- Specific Conductance
- Sulfide (as S)
- Surfactant (MBAS)
- Organic Carbon, Total

Priority Pollutant Phenols (ALL)
Residue (ALL)

Wastewater Metals III :
- Cobalt, Total
- Molybdenum, Total
- Tin, Total
- Titanium, Total
- Thallium, Total

Wastewater Metals I (ALL)
Mineral (ALL)
Nitrosoamines (ALL)
Organophosphate Pesticides (ALL)
Polychlorinated Biphenyls (ALL)
Purgeable Aromatics (ALL)
TCLP Additional Compounds (ALL)

Acrolein and Acrylonitrile (ALL)
Benzidines (ALL)
Chlorophenoxy Acid Pesticides (ALL)
Chlorinated Hydrocarbons (ALL)
Demand (ALL)
Haloethers (ALL)
Wastewater Metals II (ALL)
Nitroaromatics and Isophorone (ALL)
Nutrient (ALL)
Polynuclear Aromatics (ALL)
Phthalate Esters (ALL)
Purgeable Halocarbons (ALL)

erial No.: 100580

Wadsworth Center

roperty of the New York State Department of Health. Valid only at the address shown.
ust be conspicuously posted. Valid certificate has a red serial number.

OH-3317 (3/97)

NEW YORK STATE DEPARTMENT OF HEALTH

BARBARA A. DEBUONO, M.D., M.P.H. Commissioner

Expires 12:01 AM April 1, 199
ISSUED April 1, 1997
REVISED October 2, 1997

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10670

Director: DR. TIMOTHY OOSTDYK
Lab Name: LANCASTER LABORATORIES INC
Address : 2425 NEW HOLLAND PIKE
LANCASTER PA 17601-5994

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/SOLID AND HAZARDOUS WASTE

All approved subcategories and/or analytes are listed below:

Characteristic Testing :
- Ignitability
- Reactivity
- TCLP
- E.P. Toxicity

Phthalate Esters (ALL)

Miscellaneous :
- Cyanide, Total
- Hydrogen Ion (pH)
- Sulfide (as S)

Organophosphate Pesticides (ALL)
Priority Pollutant Phenols (ALL)
Acrolein and Acrylonitrile (ALL)
Chlor. Hydrocarbon Pesticides (ALL)
Haloethers (ALL)
Metals II (ALL)
Polynuclear Arom. Hydrocarbon (ALL)
Purgeable Aromatics (ALL)
Chlorophenoxy Acid Pesticides (ALL)
Chlorinated Hydrocarbons (ALL)
Metals I (ALL)
Nitroaromatics Isophorone (ALL)
Polychlorinated Biphenyls (ALL)
Purgeable Halocarbons (ALL)

Serial No.: 100583

Wadsworth Center

Property of the New York State Department of Health. Valid only at the address shown.
Must be conspicuously posted. Valid certificate has a red serial number.

DOH-3317 (3/97)

SUMMARY OF NYSDEC ASP CATEGORY B DATA PACKAGE

The following is a summary of NYSDEC ASP Category B data packs. These packs can reference either SW846 or NYSDEC methods (wet chem and GC volatiles may reference EPA methods also). NYSDEC methods are basically CLP methods, and are already in your CLP analysis numbers as a reference (for example, method 7156 for volatiles has NYSDEC method 95-1 as a reference - this is the NY CLP method). Metals and Cyanide should use the CLP-M methods. If the samples are referencing a CLP method, the NYSDEC method should show up on the lab chron.

For those groups which cannot generate form I, please make a comment in the narrative that a Form I could not be generated due to limitations of the data package software, but the results are summarized on the analytical reports in the beginning of the package.

Note: ALL case narratives need to include calculations!!!

1. Client chain of custody
2. Analytical Reports
3. Laboratory Chronicles
4. Internal Chain of Custody Forms (if requested by the client)
5. GC/MS VOA Data:

   QC Summary
   - Surrogate Form II
   - MS/MSD Form III
   - LCS/LFB Form
   - Method Blank Form IV
   - BFB Tune Form V
   - Internal Standard Form VIII
   - Method Detection Limits

   Sample Data
   - Form I/TIC Form/Raw Data for each sample

   Standards Data
   - ICAL Form VI
   - ICAL Raw Data
   - CCAL Form VII
   - CCAL Raw Data

   Raw QC Data
   - BFB data
   - Blank Form I/TIC Form/Raw Data
   - LCS/LFB Form I/Raw Data
   - MS/MSD Form I/TIC Form/Raw Data

Copies of Extraction Logs

6. GC/MS SVOA Data:

QC Summary
- Surrogate Form II
- MS/MSD Form III
- LCS/LFB Form
- Method Blank Form IV
- Tune Form V
- Internal Standard Form VIII B and C
- Method Detection Limits

Sample Data
- Form I/TIC Form/Raw Data for each sample

Standards Data
- ICAL Form VI
- ICAL Raw Data
- CCAL Form VII
- CCAL Raw Data
- GPC Calibration Data

Raw QC Data
- DFTPP data
- Blank Form I/TIC Form/Raw Data
- LCS/LFB Form I/Raw Data
- MS/MSD Form I/TIC Form/Raw Data

Copies of Extraction Logs

7. GC Pesticide/PCB Data:

QC Summary
- Surrogate Form II
- MS/MSD Form III
- LCS/LFB Form
- Method Blank Form IV
- Method Detection Limits

Sample Data
- Form I/Raw Data for each sample

Standards Data (as applicable for method used)
- ICAL Form VI for Single and Multicomponent Analytes and Resolution summary
- CCAL Form VII
- Analytical Sequence Form VIII
- GPC Calibration Form IX
- Pesticide Identification Summary Form X (Single and Multicomponent)
- All ICAL and CCAL Raw Data including:
  - Resolution Check Mixture
  - Performance Evaluation Mixtures, all

Individual Standard Mix A, at three concentrations, each initial calibration
Individual Standard Mix B, at three concentrations, each initial calibration
All Multicomponent analytes
All mid-point concentrations of Individual Standard Mixtures A and B used form calibration verification
Florisil cartridge check solution, all lots
Pesticide GPC Calibration Check Solution, all calibrations relating to samples in the SDG
All multicomponent analyte standards analyzed for confirmation

- GPC Calibration Data

Raw QC Data

- Instrument, Method and Cleanup Blank Form I/Raw Data
- LCS/LFB Form I/Raw Data
- MS/MSD Form I/TIC Form/Raw Data

Copies of Extraction Logs

8. Inorganic Data

Data should be presented in the following order: ICP, Flame AA, Furnace AA, Mercury

Form I
ICV/CCV form
CRDL form
ICB/CCB form
ICSA/B form
MS recovery form
PDS form
Duplicate RPD form
LCS form
MSA form
Serial dilution form
IDL form
Interelement correction form
Linear range form
Instrument Run Log
All instrument Raw Data, with 5-digit codes marked on samples
Prep log form and raw prep data

9. GC Volatiles

Arrange as a type I, with comment in narrative that Form I could not be generated

10. Wet Chemistry

Arrange as a type I, with comment in narrative that Form I could not be generated

LABORATORY QUALITY ASSURANCE PLAN

OCTOBER 9, 1990
REVISED: October 7, 1996

WARNING: The information contained herein is of a highly confidential and proprietary nature. Lancaster Laboratories specifically prohibits the dissemination or transfer of this information to any person or organization not directly affiliated with the project for which it was prepared.

Lancaster Laboratories
A division of Thermo Analytical Inc.

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 through 5.16 as revised December 29, 1980, and EPA-600/4-83-004, February 1983. Guidance was also obtained from *Preparation Aids for the Development of Category 1 Quality Assurance Project Plans*, Office of Research and Development, USEPA, EPA/600/8-91/003, February 1991.

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.

Quality Assurance Officer: Kathleen M. Loewen

Section	Pages	Revision	Date
1. Title Page	1	5	10/07/96
2. Table of Contents	1	5	10/07/96
3. Project Description	1	4	10/07/96
4. Project Organization and Responsibility	4	4	10/07/96
5. QA Objectives for Measurement Data, in terms of precision, accuracy, completeness, representativeness, and comparability	3	3	07/24/95
6. Sampling Procedures	3	3	07/24/95
7. Sample Custody	26	4	10/07/96
8. Calibration Procedures and Frequency	5	4	07/24/95
9. Analytical Procedures	29	4	10/07/96
10. Data Reduction, Validation, and Reporting	10	4	10/07/96
11. Internal Quality Control Checks	34	4	10/07/96
12. Performance and Systems Audits	13	5	10/07/96
13. Preventive Maintenance	3	3	07/24/95
14. Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness	4	4	07/24/95
15. Corrective Action	3	3	07/24/95
16. Quality Assurance Reports to Management	1	3	07/24/95
Appendix A - Example Reporting Forms	117	4	10/16/95

3. Project Description

This quality assurance project plan provides specific quality assurance and quality control procedures involved in the generation of data of acceptable quality and completeness. Tests will be performed according to the analytical methodology set forth in the USEPA SW-846 3rd Edition, Update II, 1994. SW-846 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*, SW-846, 3rd Edition, Update II, September 1994.

4. Project Organization

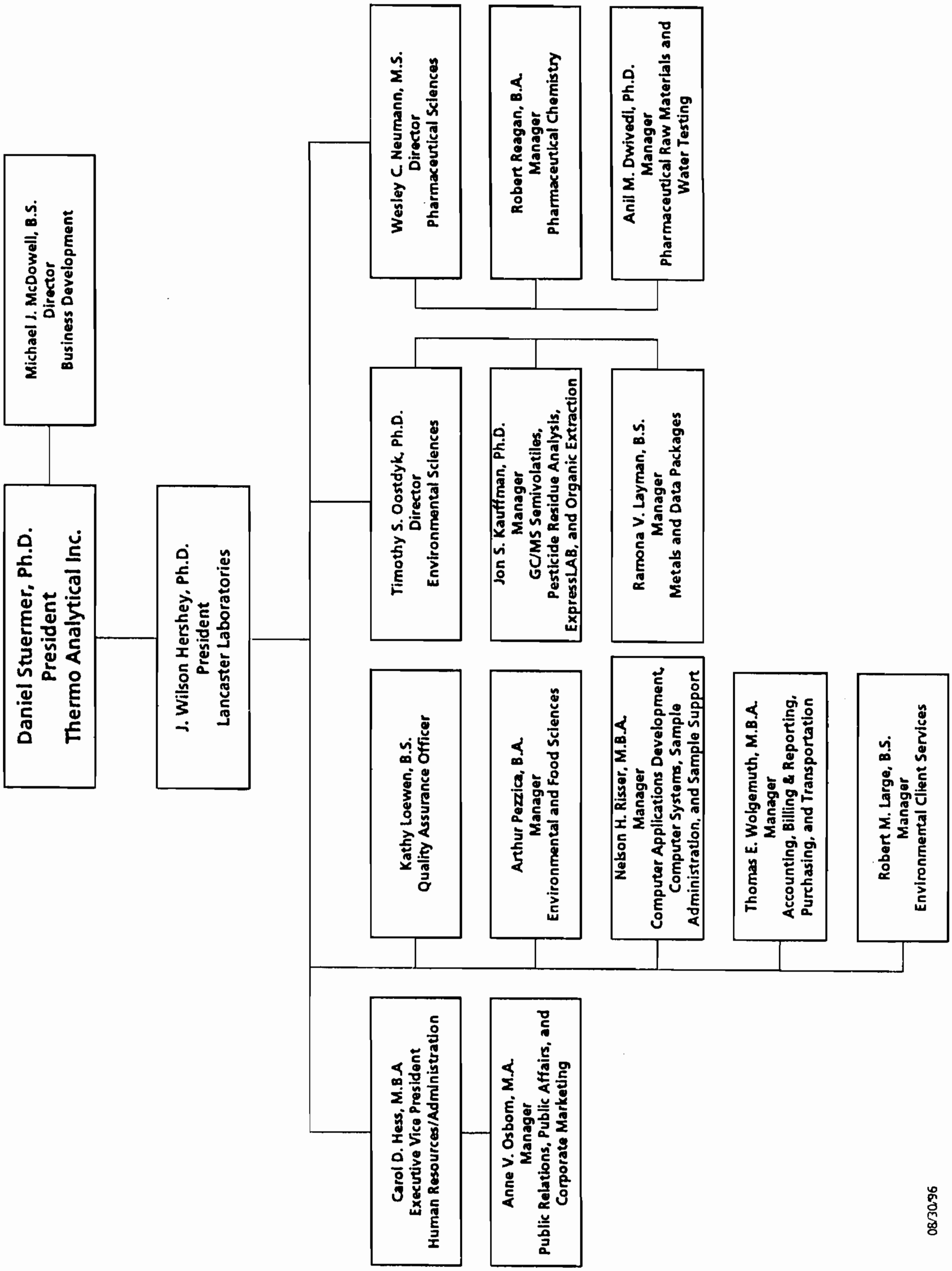
The objectives of the laboratory Quality Assurance Program are to establish procedures which will ensure that data generated in the laboratory are within acceptable limits of accuracy and precision, to ensure that quality control measures are being carried out, and to ensure accountability of the data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

The attached organizational charts show key managerial personnel. Resumes of key individuals may be found in the enclosed *Qualifications 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, and initiating internal chain-of-custody forms. Sample Support personnel will be responsible for assigning storage locations, checking and adjusting preservation, homogenizing the sample as needed, and sample discard.

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.


Daniel Stuermer, Ph.D.
President
Thermo Analytical Inc.
Michael J. McDowell, B.S.
Director
Business Development
J. Wilson Hershey, Ph.D.
President
Lancaster Laboratories
Wesley C. Neumann, M.S.
Director
Pharmaceutical Sciences
Robert Reagan, B.A.
Manager
Pharmaceutical Chemistry
Anil M. Dwivedi, Ph.D.
Manager
Pharmaceutical Raw Materials and Water Testing
Timothy S. Oostdyk, Ph.D.
Director
Environmental Sciences
Jon S. Kauffman, Ph.D.
Manager
GC/MS Semivolatiles, Pesticide Residue Analysis, ExpressLAB, and Organic Extraction
Ramona V. Layman, B.S.
Manager
Metals and Data Packages
Kathy Loewen, B.S.
Quality Assurance Officer
Arthur Pezzica, B.A.
Manager
Environmental and Food Sciences
Nelson H. Risser, M.B.A.
Manager
Computer Applications Development, Computer Systems, Sample Administration, and Sample Support
Thomas E. Wolgemuth, M.B.A.
Manager
Accounting, Billing & Reporting, Purchasing, and Transportation
Robert M. Large, B.S.
Manager
Environmental Client Services
Carol D. Hess, M.B.A
Executive Vice President
Human Resources/Administration
Anne V. Osbom, M.A.
Manager
Public Relations, Public Affairs, and Corporate Marketing

08/30/96

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. These specifications will be met through precision and accuracy criteria as specified in Section 11. Detection limits are presented in Section 9.

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 or guidelines within the methods 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.

Table 5-1

Document #	Document Title
QA-101	Sample Collection
QA-102	Sample Log-in
QA-103	Sample Storage and Disposal
QA-104	Chain-of-Custody Documentation
QA-105	Analytical Methods Manual
QA-106	Validation and Authorization of Analytical Methods
QA-107	Analytical Methods for Nonstandard Analyses
QA-108	Subcontracting to Other Laboratories
QA-109	Laboratory Notebooks and Documentation
QA-110	Reagents
QA-111	Instrument and Equipment Calibration
QA-112	Instrument and Equipment Maintenance
QA-113	Data Entry and Verification
QA-114	Data Storage and Security
QA-115	Quality Control Records
QA-116	Investigation and Corrective Action of Unacceptable Quality Control Data
QA-117	Personnel Training Records
QA-118	Quality Assurance Audits
QA-119	Proficiency Samples
QA-120	Documentation of Programming for the Sample Management System
QA-121	Guidelines for the Development, Validation, Implementation, and Maintenance of Computer Systems Used with CLP, GLP, and GMP Data
QA-122	Investigation and Corrective Action Reporting for Laboratory Problems

6. Sampling Procedures

In order for meaningful analytical data to be produced, the samples 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.

The laboratory will provide the appropriate sample containers, required preservative, chain-of-custody forms, shipping containers, labels, and seals. The majority of sample containers are purchased 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, 1 month prior notice is required.

Each lot of preservative will be documented and checked for contaminants before use. The appropriate bottle will be preserved with the new preservative and filled with deionized water to represent a sample. A similar container (that does not contain preservative) will be filled with deionized water to be used as a blank check. Analysis results are documented for each preservative lot number.

Trip blanks will be prepared by the laboratory and accompany sample containers at the project required frequency. Analyte free water will also be provided for field blanks.

A list of containers, preservatives, and holding times follows in Table 6-1.

[a] pH Adjustment with acid/base is performed on water samples only.

[b] Sodium thiosulfate needed for chlorinated water samples

[c] Due to the inaccurate recovery of 2-chloroethyl vinyl ether in the presence of HCl, Halocarbon samples analyzed for this compound should not be preserved.

[d] Samples will be analyzed as soon as possible after collection. The times listed are the maximum times that samples will be held before analysis and still be considered valid.

[e] Analysis 40 days from extraction.

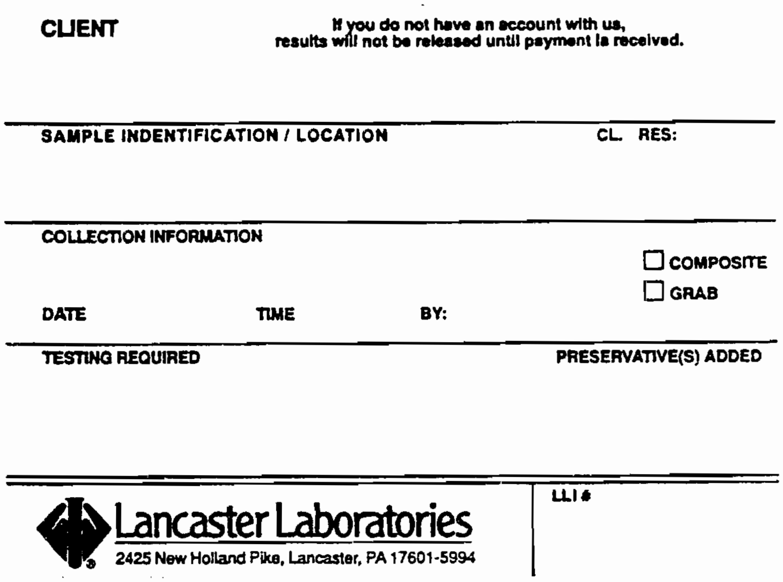
NOTE: For volatiles analysis, the container should be filled completely, with no headspace. **All sample containers, preservatives, and mailers will be supplied at no additional charge upon request, except for the special containers with traceability documentation. There is an additional charge for this type of container.**

7. Sample Custody

Samples are unpacked and inspected in the sample receipt area. At this time, the samples are examined for breakage and agreement with the associated client paperwork. The cooler temperatures will be checked upon receipt and recorded. As the samples are unpacked, the sample label information will be compared to the chain-of-custody record and any discrepancies or missing information will be documented. If necessary, the cooler will be closed and placed in cold storage until instructions and resolution of any discrepancies are received from the client.

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, with the exception of samples designated for volatile analysis. Samples requiring refrigeration will be stored in our walk-in cooler which is maintained at 2° to 4°C. The use of our computer system in tracking samples (by the Lancaster Labs sample number 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. If requested, hand-to-hand chain of custody will be provided as per attached SOP-QA-104, "Chain-of-Custody Documentation." The laboratory chain of custody will begin with the preparation of bottles. The procedures for sample log-in, storage, and chain-of-custody documentation are detailed in the QA standard operating procedures included in Section No. 7 (SOP-QA-102, SOP-QA-103, and SOP-QA-104). Examples of sample labels and a custody seal are shown in Figure 7.1.

Figure 7.1



CLIENT

If you do not have an account with us,
results will not be released until payment is received.

SAMPLE INDENTIFICATION / LOCATION **CL. RES:**

COLLECTION INFORMATION

☐ COMPOSITE
☐ GRAB

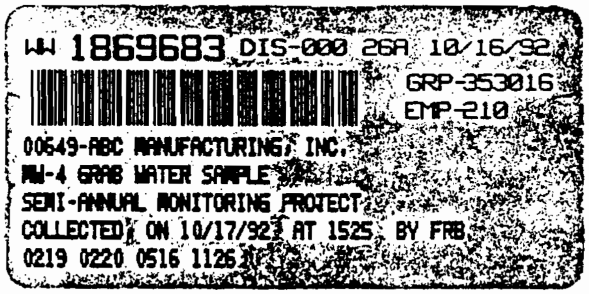
DATE **TIME** **BY:**

TESTING REQUIRED **PRESERVATIVE(S) ADDED**

Lancaster Laboratories
2425 New Holland Pike, Lancaster, PA 17601-5994

LLI #

Sample Label (Field)



WW 1869683 DIS-000 26A 10/16/92
GRP-353016
EMP-210
00649-ABC MANUFACTURING, INC.
MW-4 GRAB WATER SAMPLE
SEMI-ANNUAL MONITORING PROJECT
COLLECTED ON 10/17/92 AT 1525 BY FRB
0219 0220 0516 1126

Sample Label (Laboratory)

Lancaster Laboratories
Where quality is a science

CUSTODY SEAL
2425 New Holland Pike, Lancaster, PA 17601-5994 (717) 656-2301

DATE:
SIGNATURE:

Laboratory Custody Seal

Initiated Date: 03/87
Effective Date: FEB 15 1996

QUALITY ASSURANCE OPERATIONS MANUAL
SOP-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 samples into the computerized sample management system (SMS) which are 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. The only exception to this requirement will be samples which are not tracked using the SMS. There are only a few cases where samples will be not be tracked using the SMS. These include samples which will be stored for a long period of time prior to analysis, (e.g., stability storage) and samples for special projects that will be reported in a narrative R&D report instead of on the usual computerized analytical reports.

   The procedures for sample log-in described in this SOP apply only to samples which are logged into the SMS. However, a written procedure for tracking any samples not entered into the SMS must be developed by the technical department responsible for the project or analysis of those samples.

2. All client correspondence relating to samples shall also be transferred to the Sample Administration Group. This includes purchase orders, quotes, letters, and analysis 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 on a holiday will not be logged-in until the next normal work day. Samples received from 6 p.m. on Saturday through 11 p.m. on Sunday will be logged-in Sunday evenings by third shift Sample Administration.

   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. These samples will be tracked in a Q&A hold database. This database is maintained by the Sample Administration Group.

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

4. Upon assignment of a sample number, the computer will generate a label which shall be attached to the sample container. Every effort will be made as to not obscure the client label. The information on the label will include the Lancaster Laboratories' 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, a unique bar code, and any notes to laboratory personnel.

5. Adjustment of sample pH, if necessary, will be the responsibility of the Sample Support Group. Preservation should be performed immediately after log-in. A list of preservatives required for routine analyses may be found in the Schedule of Services.

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

7. After samples are logged-in (or preserved, homogenized, subsampled, 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.

8. The Lancaster Laboratories' sample number assigned to each sample shall be used to identify the sample in all records, including laboratory notebooks, instrument printouts, and laboratory reports. The sample number will also be used to identify all additional containers of the sample which may be created during the sample preparation and analysis. This includes subsamples, extracts, and digestates.

SOPQA102.W60
012496

Prepared by: Kathy L. DiNunzio Date: 1/25/96

Approved by: Date: 1/26/96

Approved by: Date: 2/2/96

Initiated Date: 03/87
Effective Date: OCT 0 1 1996

QUALITY ASSURANCE OPERATIONS MANUAL
SOP-QA-103

Title: Sample Storage and Disposal

Purpose:

Sample integrity can be compromised by improper storage conditions. The objective of these procedures is to prevent samples from deteriorating prior to analysis. The computerized sample management system (CSMS) is used to assign storage locations and to monitor the orderly storage of samples in locations from which they are easily retrieved for analysis or discard at the appropriate date.

Scope:

This SOP will outline procedures used in storing samples, retrieving and returning samples for analysis, and discarding samples when their holding time expires.

Procedures:

1. Personnel from Sample Administration will designate the approximate size and type (e.g., refrigerator, freezer or room temperature) of sample storage required for each group of samples as they are logged onto the CSMS. The computer will assign the storage location and record the length of time the sample must be retained after the analysis report has been issued. Samples will be stored in the assigned location. If the location is not suitable (e.g., insufficient space), the storage location may be changed using the manual override on the computer. If refrigerated space has been requested and all the computerized refrigerator locations are occupied, samples will be assigned locations in overflow refrigerators and will be tracked using a manual system until computerized locations are available.

2. Analysts requiring the use of a sample may determine its location by referring to the daily sample status sheet. There are varying degrees of security on sample storage locations. The procedures for removal of samples from these locations are as follows:

   a. Free access locations are those which are neither locked nor attended by a sample custodian. These areas are usually located within an individual group's laboratory and samples may be removed from and returned to these locations without documentation. However, if the sample must be taken out of the laboratory, documentation may be requested. Care shall be exercised in returning the sample to its appropriate location.

   b. Controlled access areas are attended by a sample custodian and are usually large areas used by more than one group. Samples stored in controlled access areas can be removed only after requisitioning the sample via the CSMS. The sample custodian will retrieve the requisitioned samples from the storage locations and scan the bar code label. This process documents the sample transfer from the sample custodian to laboratory personnel. After use, the samples are returned to the sample storage center, scanned by the sample custodian and returned to the designated storage location. Only Sample Administration personnel shall be admitted to controlled access areas. The only exception to this rule will be during weekend hours when no sample custodians are on duty. During these hours, samples must be requisitioned as above, but analysts must retrieve the samples themselves by obtaining a key to the controlled access area from the security desk. Samples must be scanned out as above. After use, samples must be scanned in and placed on the return cart inside WK. Sample custodians will return these samples to their location when they come on duty.

c. Locked storage areas are available in several individual lab areas. Access to these storage areas is limited to analysts who are responsible for the analysis of the samples stored there. These areas are locked when the laboratories are unattended; keys are available from members of the department where they are located. Samples are removed and returned as needed by analysts.

d. Forensic storage areas are locked and admission to these areas is permitted only to sample custodians. Most of the samples stored in these areas require strict chain-of-custody documentation as outlined in SOP-QA-104, "Internal Chain-of-Custody Documentation," and should be requisitioned as described in b. above. Samples may not be removed or returned to these areas without signing chain-of-custody forms.

3. To prevent unnecessary deterioration of the samples, the aliquots needed for analysis shall be removed and the sample returned to storage with a minimum of delay.

4. Sample Administration will generate a discard list of samples with retention dates that have expired. The retention dates are based upon client requirements or defaulted to a given number of days past the date when the report is generated, if no client requirements were given. These samples will be removed from storage by a member of Sample Support or a member of the department responsible for the given storage location. Hazardous samples shall either be returned to clients, decontaminated or disposed of at the direction of supervisory personnel. Other samples will be discarded or returned to the client, if requested. Prior to discarding each sample, the bar code will be scanned to prevent discard of the wrong sample.

5. The temperature of each refrigerator or freezer used for storing samples or reagents requiring temperature control should be checked during each normal working day by an assigned member of the group responsible for the

samples stored within and recorded on a log posted on the outside of the unit. Units containing samples requiring more complete documentation of storage conditions are monitored by use of a computerized recording device or a temperature wheel. Refrigerator temperatures should be maintained at 2° to 4°C and freezer temperatures should be maintained at -15° ± 5°C, unless otherwise specified in a client-supplied method or protocol. If the temperature recorded does not fall within these ranges, the Maintenance Department should be contacted. Any repairs should be recorded and filed with the temperature log. All documentation of temperature checks and maintenance shall be kept in ink and any changes made shall follow the error correction procedure given in SOP-QA-109, "Laboratory Notebooks and Documentation."

SOPQA103.DOC
091196

Prepared by: 972 Date: 9/16/96

Approved by: Kathleen M. Date: 9/18/96

Approved by: Date: 9/17/96

Lancaster Laboratories
A Thermo Analytical Laboratory
Where quality is a science

Initiated Date: 03/87
Effective Date: DEC 0 1 1995

QUALITY ASSURANCE OPERATIONS MANUAL

SOP-QA-104

Title: Internal 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 or client, an accurate written record tracing the possession of samples must be maintained from the time they are received at the laboratory until the last requested analysis is verified. The chain of custody is to ensure traceability of samples while they are in the possession of the laboratory.

Scope:

Procedures for initiating and maintaining chain-of-custody (COC) documentation are described in this procedure.

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. Locked up so no one can tamper with it.

4. In a secured area, restricted to authorized personnel (e.g., in the ASRS system).

A. Procedure

1. Chain-of-custody documentation shall be kept upon the 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 this documentation is filled out completely and accurately with every sample transfer. **Everyone who handles the COC has the responsibility to check for documentation compliance to the point of their acquisition.** If changes need to be made to the form, they shall be made in accordance to the error correction procedure addressed in SOP-QA-109, "Laboratory Notebooks and Documentation." It will be the responsibility of the person who made an error in documentation to correct the error.

2. If requested by the client, the COC documentation will begin with the preparation of sampling containers. A form (Figure 1, attached) will be initiated by the person packing the bottle order for shipment to the client. If the delivery of containers is via Lancaster Laboratories Transportation Department, the driver shall sign the form when they relinquish the bottles to the client. Drivers must also sign COC forms when they pick up samples for analysis.

3. When samples arrive at the laboratory for analysis, a member of the Sample Administration Group will receive them and sign the external COC form that accompanies the samples, if provided. If the samples were picked up by our Transportation Department, the driver must sign the COC to relinquish the samples to sample administration.

4. The Sample Administration Group will track the custody of samples between receipt and entry into the Sample Management System on the SA Receipt Documentation Log (Figure 2, attached). The client's sample designation will be used for identification purposes until a unique Lancaster Laboratories' number is assigned.

5. Samples will be entered into the Sample Management System as described in SOP-QA-102, "Sample Log-in." Sample Administration will enter an analysis number for "Laboratory Chain of Custody" if requested. A lab note will print to inform analysts of the need for COC documentation. This note will also be automatically added to the sample labels.

B. Creating the Internal Chain of Custody

1. Sample Administration personnel shall initiate an internal Laboratory Chain of Custody form at the time of sample entry (Figure 3, attached) for each type of container in the sample group. A master list of all chains created will also be initiated for each sample group at the time of entry (Figure 4, attached). The samples will then be relinquished to a sample custodian who will store the samples in an assigned secure location. This change of custody from sample entry to storage shall be documented on the chain, as well as any interim exchanges for rush analysis, preservation, homogenization, or temporary storage in the SA HOLD. The internal COC forms will then accompany the samples from storage to the laboratory for analysis.

2. If samples need to be checked out from the Sample Administration Group before Lancaster Laboratories' numbers have been assigned to them, SA will be responsible for starting a COC form. They will note the available header information, the samples being relinquished (documented by the client sample designation), and the reason for transfer.

3. After sample entry, the original copy of the external client COC/analysis request form will be filed with Accounts Receivable, to be returned to the client with their invoice. Other copies of the external form will stay within SA to be filed within the client's paperwork file.

C. Documentation of Custody Changes

1. An example of how to document changes in sample custody is shown in Figures 3 and 5. Each change of sample custody must be accurately documented in a consistent format. All signatures documenting changes of custody will use the following format:

Signatures: first initial, full last name, employee number
Date: Month/day/year
Time: Documented as military time
Ink: Black ink is preferred, red ink and pencil are not acceptable

a. When sample support releases samples to an analyst they must:

Note the sample number(s) released, and sign the released by column of the chain.

b. When an analyst receives samples from sample support they must:

Sign the received by column, note the date and time samples are received and note the reason why they are taking the samples (reason for change of custody).

c. When an analyst returns samples to sample support they must:

Note all sample numbers being returned, sign the released by column, and note time and date of return.

d. When sample support receives samples from an analyst they must:

Sign the received by column and note the reason for sample transfer.

2. 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 when sample support is manned by sample custodians, a custodian will receive the computerized requisition and remove the sample from storage. The custodian will ensure that the bottle type listed on the COC form matches the bottle type being distributed. It will **be the shared responsibility of the analyst and sample custodian to insure that forms are signed, dated, and reason for sample transfer are recorded with each change of custody, as directed by Item C1 above.**

3. Each specific test that an analyst performed in conjunction with the associated sample number(s) must be accurately documented by the analyst before the samples are returned to a sample custodian in the sample storage area.

4. When an analyst requires the use of samples when a sample custodian will not be on duty, they must requisition samples earlier in the day or on the previous day. These samples and associated COCs will be pulled by a sample custodian and placed in the locked SA HOLD storage area. The sample custodian will note on the COC the change in transfer to the SA HOLD in addition to the time, date, and the sample numbers. The analyst picking up the samples will document the specific samples being checked out, record SA HOLD in the "Released by" column, sign the Received by column, note the time, date and reason for transfer. When the analyst returns the samples to the SA HOLD, they must sign the samples back into the SA HOLD.

5. The following changes of custody will be handled in the following manner:

   a. Documentation is required for all shift changes. Signatures involving transfers from one shift to another shall be the responsibility of the analyst who originally acquired the samples from sample support.

   b. Occasionally a sample container will be needed for analysis by an analyst in a department while it is in the custody of an analyst in another department. It will be the responsibility of the first person who received the sample to note on the COC the specific sample numbers requested by the second person, and to sign the released by column. The second person will sign the received by column and note the time, date, and reason for sample transfer. After the second person is finished with the sample, the sample will be returned back to the first person or to the sample storage area.

c. In situations where a sample group must be split between departments working on different analyses, a supplemental COC must be initiated by the Sample Support Group. The supplemental chain will be used to accompany that portion of the sample group which is needed by a second department, when another department has part of the sample group and the COC for the entire group. This supplemental COC will be created only when absolutely necessary to minimize paperwork and confusion. This chain must also be documented on the master list of chains initiated for the sample group.

d. Some original samples are released by Sample Support or Sample Administration to be stored in other areas of the laboratory (e.g. GC/MS Volatiles, Foods, Pharmaceuticals). During this time they may be accessed by several people in that area. Each of these people must note the specific sample numbers in their custody in addition to date, time, and reason for removal from storage. An example of a COC is attached as Figure 6.

It will be the responsibility of the department who held the samples to assure that all necessary, signatures, dates, times, and reasons for sample custody are noted on the COC forms. It is also very important to return all samples and COCs to storage as soon as possible after data verification, because the chains may be required for a client data packages.

e. If COC samples are stored in other areas of the laboratory or in a specific department, they must be stored in a locked area. When samples are taken from a departmental storage area, the released by column of the COC is documented as "department XX storage." If samples are returned to this area when complete the received by column will be noted as department XX storage.

D. Additional Chain-of-Custody Issues

1. Analysts in possession of samples shall remove the aliquot required for their analysis and return the samples to the Sample Support Group with a minimum of delay. During this time of possession, samples must fall under the definition of sample custody.

2. If additional containers of the sample are created (e.g. subsamples, extracts, distillates, leachates, digests, etc.), an additional COC form must be created by the department if they do not document this information on the original COC form (Figure 5, attached). This form will be marked with the container type and will be initiated to accompany the new sample container. Each department in the lab has specifically designed COC forms which will be used if new containers are created. All changes of custody involving handling of new containers in the department (e.g. analysis, storage, vials on instruments, etc.) will be documented on the departmental specific COC form or on the original COC form. Any specific handling or documentation requirements for departmental chains can be described in a departmental SOP.

E. When Sample Analysis is Complete

1. After sample analysis, samples shall be returned to the Sample Support Group as soon as possible. Original COC forms shall also be returned with the samples and this change of custody noted. At this time it will be the responsibility of the Sample Support Group to review the COC forms to ensure that all documentation on the forms is complete before they file the forms in their area. Sample custodians will not return a sample to its assigned storage location without signing the accompanying chain and performing this completeness check. All chains should either end with a note of "Discard" or "Storage" for the final reason of transfer.

2. All completed COC forms for the original sample containers will be retained in files within Sample Support. The Data Package Group will retrieve these forms so a copy can be included in the data package. All departmental created COC forms will be collected by the department's data package group so a copy can be included in the data package. These forms will not be returned to the Sample Support Group since these sample containers will not be returned to the Sample Support Group. The original copy of all COC forms will be retained on file by the laboratory.

3. All personnel who handle sample containers shall make every attempt to ensure that all changes of custody are accurately and completely documented. **Disciplinary action may be taken for employees who fail to comply with these important requirements.**

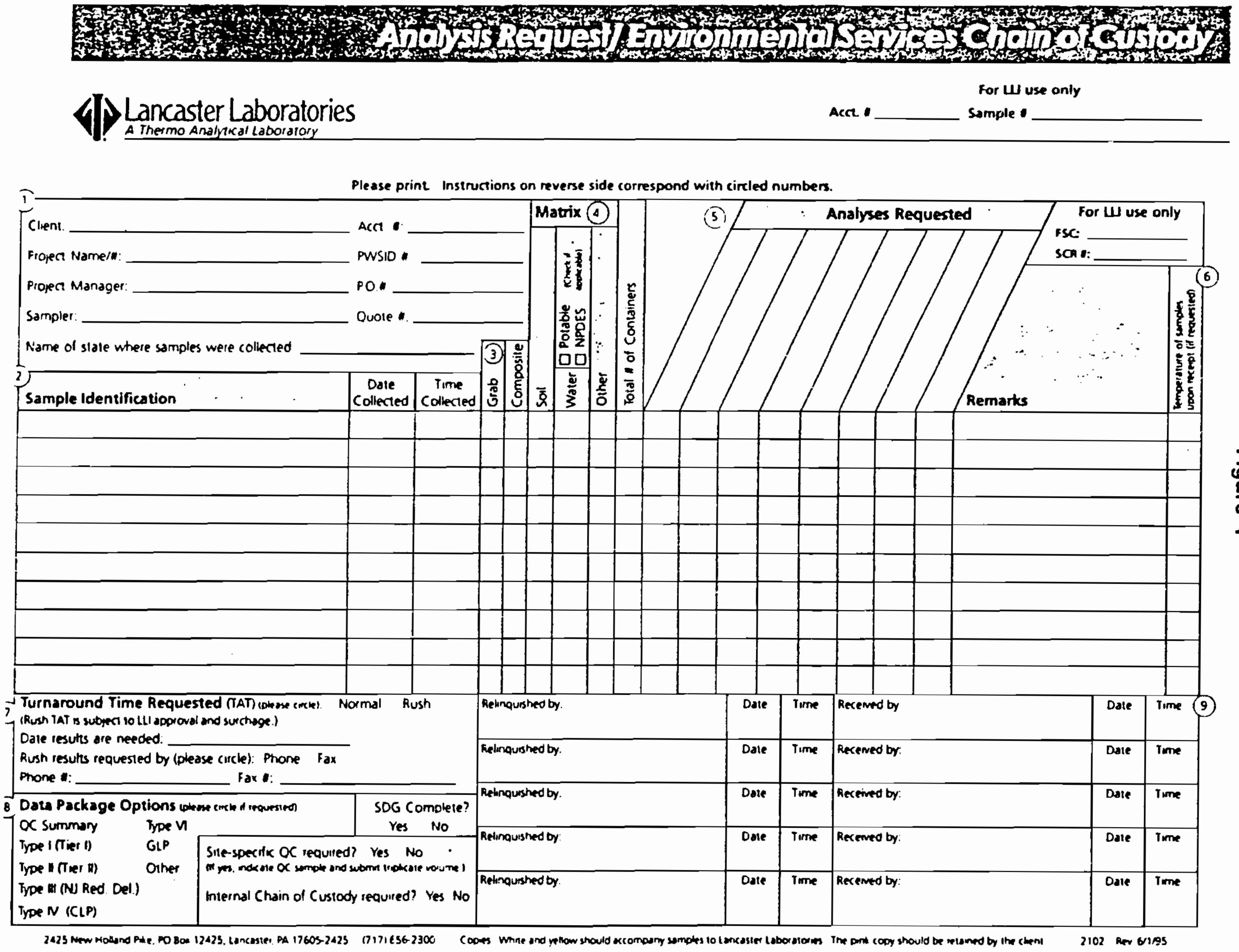
4. In the event that a signature or other information is inadvertently not recorded on a COC form, the Sample Support and Data Package Groups in conjunction with the technical centers shall determine what information is missing by checking computer requisition records, raw data, or the sample support work schedule. The responsible party shall add the missing information or make the necessary correction at the bottom of the COC form, in addition to noting the situation that caused the error in documentation. The person making this note needs to sign and date the information using the current date. Any errors in COC documentation that cause noncompliances must be noted in the case narrative of the sample data package. Examples of specific cases are on file in the data package department.

Prepared by: Kathy L. DiNunzio Date: 11/28/95

Approved by: M Louise [illegible] Date: 11/29/95

Approved by: Date: 11/30/95

Figure 1



Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories
A Thermo Analytical Laboratory

For LLI use only
Acct. # __________ Sample # __________

Please print. Instructions on reverse side correspond with circled numbers.

①
Client: __________ Acct. #: __________
Project Name/#: __________ PWSID #: __________
Project Manager: __________ P.O. #: __________
Sampler: __________ Quote #: __________
Name of state where samples were collected __________

Matrix ④ | ⑤ Analyses Requested | For LLI use only
FSC: __________
SCR #: __________

② Sample Identification	Date Collected	Time Collected	③ Grab	Composite	Soil	Water ☐ Potable ☐ NPDES (Check if applicable)	Other	Total # of Containers									Remarks	⑥ Temperature of samples upon receipt (if requested)

⑦ **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to LLI approval and surchage.)
Date results are needed: __________
Rush results requested by (please circle): Phone Fax
Phone #: __________ Fax #: __________

⑧ **Data Package Options** (please circle if requested)
QC Summary Type VI
Type I (Tier I) GLP
Type II (Tier II) Other
Type III (NJ Red. Del.)
Type IV (CLP)

SDG Complete? Yes No

Site-specific QC required? Yes No
(If yes, indicate QC sample and submit triplicate volume.)

Internal Chain of Custody required? Yes No

					⑨
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 (717) 656-2300 Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client. 2102 Rev 6/1/95

Figure 1 - (Continued)

DIRECTIONS FOR COMPLETING THIS FORM

(1) **Client:** Your company's name

Acct. #: Your account number with Lancaster Laboratories

Project Name/#: The way your company refers to the work involved with these samples. You may want to include project location as part of the description

PWSID: Potable Water Source ID#

Project Manager: The person at your company responsible for overseeing the project

P.O. #: Your company's purchase order number

Sampler: The name of the person who collected the samples

Quote #: The reference number that appears on your quote (if Lancaster Laboratories gave you a number)

State where sample was collected: Please indicate where the sample was taken, e.g., Pa., N.J., etc

(2) **Sample Identification:** The unique sample description you want to appear on the analytical report

Date Collected/Time Collected: When the sample was collected

(3) **Grab:** Check here if sample was taken at one time from a single spot.

Composite: Check here if samples were taken from more than one spot, or periodically, and combined to make one sample.

(4) **Matrix:** Check the type of sample you are submitting. If it is a water sample, please indicate if it is a potable water or if it is an NPDES sample.

Number of Containers: Indicate the total number of containers for each sampling point.

(5) **Analyses Requested:** Write the name of each analysis (or an abbreviation of it) here, and use the **catalog number** that appears at the beginning of each line in the *Schedule of Services*. Be sure to indicate which analyses are to be performed on which samples

(6) **Remarks:** List special instructions about the sample here (e.g., hazardous elements, high levels of analyte, etc.). The space can also be used (if needed) for listing additional analyses

(7) **Turnaround time Requested:** Circle **Normal** if you want routine TAT, which is usually within 10-15 days. If you need your results faster, call ahead to schedule **Rush** work.

Rush Results Requested by: Circle **Fax** or **Phone** and include the number

(8) **Data Package Options:** Call our Client Services Group (717-656-2301) if you have questions about these choices.

SDG Complete? Indicate **Yes** if this is a complete sample delivery group or **No** if you will be submitting additional samples to be included in the same data package.

Note: We need to have one quality control (QC) sample for every 20 samples you send, if you are requesting site-specific QC. Please give us this sample in triplicate volume and identify it by writing "QC" in the **Remarks** column.

The internal chain of custody is a hand-to-hand documentation recording a sample's movement throughout the company. We routinely start a chain of custody for data-package samples unless we are told otherwise. There is a $25 **per sample** charge for the chain-of-custody documentation.

(9) **Relinquished by/Received by:** The form must be signed each time the sample changes hands. We can supply chain-of-custody seals for the outside of your packages if you require them.

Thank you for using Lancaster Laboratories.
Please call our Client Services Group (717-656-2301) if you have any questions about completing this form.

Figure 2

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

Sample Administration Receipt Documentation Log

Client/Project: XYZ Associates/ Well Monitoring Project

COC Seal: [✓ Present] / Not Present on cooler

Broken / [✓ Intact]

Date of Receipt: 11/27/95

Time of Receipt: 1350

Package: [✓ Chilled] / Not Chilled

Source Code: 60

Unpacker Emp. No.: 210

Temperature of Samples		
#1	#2	#3
Thermometer ID: 123	Thermometer ID:	Thermometer ID:
Corrected Temp.: N/A	Corrected Temp.:	Corrected Temp.:
[✓ Bottle] / Air	Bottle / Air	Bottle / Air
[✓ Wet Ice] / Ice Packs	Wet Ice / Ice Packs	Wet Ice / Ice Packs
Ice Present? [✓ Yes] No	Ice Present? Yes No	Ice Present? Yes No
#4	#5	#6
Thermometer ID:	Thermometer ID:	Thermometer ID:
Corrected Temp.:	Corrected Temp.:	Corrected Temp.:
Bottle / Air	Bottle / Air	Bottle / Air
Wet Ice / Ice Packs	Wet Ice / Ice Packs	Wet Ice / Ice Packs
Ice Present? Yes No	Ice Present? Yes No	Ice Present? Yes No

Paperwork Discrepancy/Unpacking Problems: 40 ml Vial broken upon Receipt Client ID# ABC-1. Client Called 11/27/95

Sample Administration Chain of Custody				
Released by	Received by	Date	Time	Reason for Transfer
A. Hutchison 210	SA Hold	11/27/95	1400	Storage
SA Hold	D. Nesland 208	11/27/95	1600	Entry

Rev. 2174 09/13/95

Figure 3

Lancaster Laboratories
2425 New Holland Pike • Lancaster PA 17601 5994

Locked Storage Chain of Custody
Original Sample

Client/Project: XYZ Associated

Preservative: HCl Matrix: Water SDG: XYZ01

Sample # Range of Entry Group: 2420632-39 Bottle Type: #38 40 ml vial

Sample Number(s) in Custody	Released By	Received By	Date of Transfer	Time of Transfer	Reason for Change of Custody	Dist., Extr., or Digest Chain Created (X)
2420638-39	D. 208 Neslund	SS Storage	11/27/95	1600	Entry & Storage	
2420638-39	SS Storage	B. 705 Weaver	11/28/95	700	Remove from SS Storage	
2420638-39	B. 705 Weaver	dept 21 Storage	11/28/95	715	VOA Storage	
2420638-39	dept 21 Storage	K. 396 Witman	11/29/95	1315	VOA Analysis	X
2420638-39	K. Witman 396	L. 513 Taylor	11/29/95	1700	VOA Analyst Shift Change	
2420638-39	L. 513 Taylor	dept 21 Storage.	11/29/95	2100	VOA Storage	
2420638-39	dept 21 Storage.	C. 26 Aupard	12/3/95	800	Transfer to SS Storage	
2420638-39	C. Aupard 266	L. 630 Kessler	12/3/95	815	Storage	

2016 Rev. 09/05/95

Page ____ of ____

Figure 4

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

Master List of Chain of Custodies

Client/Project: XYZ Associates

Sample # Range of Entry Group: 2420632-39

SDG: XYZ01 Matrix: [✓ Liquid] Solid Mixed Other ________

Original Sample Chains		
Bottle Type	**Started By**	**Date Started**
40 ml Glass Vial (#33)	D. Neclund 208	11/27/95
1000 ml Amber Glass (#45)	↓	↓
1000 ml Plastic (#09)	↓	↓
1000 ml Amber Glass (#29)	↓	↓

Supplemental Chains		
Bottle Type	**Started By**	**Date Started**
77	C. Ayars 366	11/27/95
21	C. Ayars 366	11/27/95

Extraction, Digestion, Distillates, Etc.		
Bottle Type	**Started By**	**Date Started**

Figure 5

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

Locked Storage Chain of Custody
Metals

Client/Project: XYZ Associates

Sample #: 2420632-39

SDG: XYZ01

Digest Type (circle one): Hg [✓ Metals] GF Hydrides

Trial No: 2 (If not 1, fill in)

Batch No: 95305 1849 004

Sample Number(s) in Custody	Released By	Received By	Date of Transfer	Time of Transfer	Reason for Change of Custody	Dist., Extr., or Digest Chain Created (X)
3420632, 34, 36	S. Correa 5:33	J. Garrett 4:38	12/1/95	1631	Metals Prep Shift Change	
2420632, 34, 36	J. Garrett 4:28	B. Strocko 811	12/1/95	1930	ICP Storage	
3420632, 34, 36	ICP Storage	DR Sackett 142	12/1/95	2115	ICP analysis	
2420632, 34, 36	DR Sackett 142	ICP Storage	12/1/95	2135	ICP Storage	

SOP-QA-104
Initiated Date: 03/87
Effective Date: DEC 01 1995
Page 17 of 17

Figure 6

Lancaster Laboratories
2425 New Holland Pike • Lancaster PA 17601 5994

Pharmaceutical
Locked Storage Chain of Custody
Original Sample

Client/Project: Smith Pharmaceutical.

Preservative: N/A Matrix: Tablets

Sample # Range of Entry Group: 2420320-30

Bottle Type: 40ml Vial

Sample Number(s) in Custody	Released By	Received By	Date of Transfer	Time of Transfer	Reason for Change of Custody
2420320-30	K. 074 Carruthers	M. 589 Coho	12/1/95	1300	Entry/Transfer to Pharm. Storage
2420320-30	M. 589 Coho	Pharm. Storage	12/1/95	1315	Storage
2420320-30	Pharm. Storage.	E. 572 ortiz	12/3/95	800	PH Analysis
2420320-30	E. 572 ortiz	Pharm. Storage	12/3/95	1000	Storage
2420320-30	Pharm Storage	D. 330 Wright	12/5/95	930	GC assay Analysis
2420320-30	D. 330 Wright	Pharm Storage	12/5/95	1400	Storage

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 are purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards is verified through documentation provided by these commercial sources. 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, name of solution, concentration, date prepared, expiration date, and the initials of the preparer. Shelf life and storage conditions for standards are included in the standard operating procedures and old standards are replaced before their 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 unacceptable 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 printouts. 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 printout includes the date, instrument ID, 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	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	5	RF for SPCCs >0.300 except for bromoform >0.10 Max %RSD for CCCs <30%	Every 12 hours	1	RF for SPCCs >0.300 except for bromoform >0.10 %Drift for CCCs <20
GC/MS Semivolatiles*	After C-cal fails	5	RF for SPCC's >0.050 Max %RSD for CCC's <30%	Every 12 hours	1	RF for SPCCs 0.050 %Drift for CCCs <20
GC VOA Halocarbons and/or Aromatics	After C-cal fails	5	%RSD of <20% Otherwise use calibration curve	Every 8-10 hours, or every 10 samples	1	%D ± 15%
GC Pesticides	Each new run After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Degradation for DDT, endrin 15% initially	Every 10 samples Every 20 samples for Method 8081	1	≤15% difference from initial response for quantitation
HPLC	Each new run or after C-cal fails	5	20% RSD of RFs of initial calibration to use average RF, otherwise use curve fit	Every 10 samples	1	≤15% difference from initial response for quantitation
GC TPH-GRO	After C-cal fails	5	%RSD of <20% otherwise use calibration curve	Every 8 to 10 hours or every 10 samples	1	%D ±15%
GC TPH-DRO	After C-cal fails	5	% RSD of <20% otherwise use calibration curve	Every 10 samples	1	%D ±15%
ICP/Trace ICP	Each new run Max. 86 samples-run	2	Independent calibration verification within ±10%	Every 10 samples	1	Same as initial
CVAA	Each new run	5	Independent calibration verification within ±10%	Every 10 samples	1	±20% of true value
GFAA	Each new run	5	Independent calibration verification within ±10%	Every 10 samples	1	±20% of true value
Flame AA	Each new run	5	Independent calibration verification within ±10%	Every 10 samples	1	±20% of true value
Hydride Generation	Every new run Max. 1 hr.	3	Independent calibration verification within ±10%	Every 10 samples	1	±20% of true value
Autoanalyzer	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value

*All compounds with %RSD >15 must use first or second order regression fit of the five calibration points. If %RSD is <15%, use of calibration curves is an alternative to average response factor calibration.

Table 8-1

	Initial Calibration			Continuing Calibration Verification		
Instrument	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
Infrared Spectrophotometer (FTIR)	Daily	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value
TOC Analyzer	Daily	5	±10% @ STD	Every 10 samples	1	±10% of true value
TOX Analyzer	Each Batch	4	±5% @ STD	Every 8 samples	1	±5% of true value
Balance	Daily	4	±.5%	N/A	N/A	N/A

Abbreviations

Std Conc - The number of standard concentrations used

SPCCs - System performance check compounds

CCCs - Calibration check compounds

RF - Response factor

%RSD - Percent relative standard deviation

%D - Percent difference

C-cal - Continuing calibration

CVAA - Cold vapor atomic absorption spectrophotometer

HPLC - High Performance Liquid Chromatography

ICP - Inductively coupled plasma spectrophotometer; ICP run also includes interelement correction check standard (beginning and end of run)

GFAA - Graphite furnace atomic absorption spectrophotometer

Table 8-2

Mass	Ion Abundance Criteria
BFB Key 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:	
51	30% to 60% of mass 198
68	less than 2% of mass 69
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 SW-846 3rd Edition, Update II, 1994, 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 8240B or 8260A.

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 compounds present in the sample. Method 8270B.

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 and/or electrolytic conductivity detector. Method 5030A/8010B/8020A/8021A. Non-halogenated organics are analyzed by flame ionization detectors. Method 5030A/8015A.

Pesticides, PCBs, & Herbicides - This method determines 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 megabore capillary column, and confirmation on a GC/EC using a second megabore capillary column. A nitrogen-phosphorus detector is used for organophosphates. If the compound concentration is sufficient, confirmation may be done on GC/MS upon request. Pesticides Methods 8081 and 8141A. Herbicides Method 8151.

PAHs by HPLC - The sample aliquot is extracted with methylene chloride. The extract is filtered (soils), dried, concentrated by evaporation and exchanged into acetonitrile. Silica gel cleanup is used if necessary. The extract is analyzed by reverse-phase HPLC with both UV and fluorescence detectors. Methods 3550A/3630B/8310.

TPH-GRO - This method determines the concentration of gasoline range organics (pentane to naphthalene or methylpentane to trimethylbenzene depending on the protocol, California or API respectively). 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 flame ionization detector. BTEX may be determined simultaneously on systems equipped with a photoionization detector in tandem with the FID.

Method 5030A/8000A/8020; API "Method for Determination of GRO," Revision 5, 02/02/95; or California Department of Health Services LUFT Task Force TPH Analysis - Gasoline Method, California Modified 8015 Method.

TPH-DRO - This method determines the concentration of diesel range organics (C-10 to C-28 hydrocarbons). The procedure includes solvent extraction of the sample analysis of the extract on a gas chromatograph/flame ionization detector (GC/FID) using a megabore capillary column.

Method API "Method for Determination of Diesel Range Organics," Revision 2, 02/05/95; or California Department of Health Services LUFT Task Force TPH Analysis - Diesel Method (Modified), California Modified 8015 Method.

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 6010A.

The Trace ICP is the same technique as the ICP listed above except for the orientation of the plasma (horizontal instead of vertical) and upgraded optical and sample introduction systems, resulting in instrument detection limits approximately a magnitude lower than the traditional ICP.

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 AA spectrophotometer heats the sample within a graphite tube using an electrical current (i.e., flameless furnace) and measures the absorption of specific metallic elements at discrete wavelengths. (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 a spectrophotometer and absorbance (peak height) is measured. Method 7470A/7471A.

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. The difference in light intensity is measured at specific wavelengths using a spectrophotometer. (See attached list for method number.)

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 7061A. Selenium Method 7741A.

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. An autoanalyzer is used. Method 9012.

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. An autoanalyzer is used. Method 9066.

Moisture - A known sample weight is placed in a drying oven maintained at 103° to 105°C for 12 to 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. *Methods for the Chemical Analysis of Water and Wastes*, Office of R&D, USEPA-EMSL, Cincinnati, OH, USEPA 600/4-79-020. Method 160.3.

Total Petroleum Hydrocarbons - Samples are extracted with freon and the resulting solution is treated with silica gel to remove fatty acids and other polar compounds. The remaining nonpolar compounds are designated as petroleum hydrocarbons and are quantitatively measured using infrared spectroscopy. *Methods for the Chemical Analysis of Water and Wastes*, Office of R&D, USEPA-EMSL, Cincinnati, OH, March 1979, USEPA 600/4-79-020. Method 418.1 (modified for soils).

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 9030A.

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 TOX analyzer is used. Method 9020B.

Inorganic Method Numbers					
	ICP	GFAA	Flame AA	Hydride AA	Cold Vapor
Aluminum	6010A		7020		
Antimony	6010A	7041	7040		
Arsenic	6010A	7060A		7061A	
Barium	6010A		7080A		
Beryllium	6010A	7091	7090		
Cadmium	6010A	7131A	7130		
Calcium	6010A		7140		
Chromium	6010A	7191	7190		
Cobalt	6010A		7200		
Copper	6010A	7211	7210		
Iron	6010A		7380		
Lead	6010A	7421	7420		
Magnesium	6010A		7450		
Manganese	6010A		7460		
Mercury					7470A/ 7471A
Molybdenum	6010A		7480		
Nickel	6010A		7520		
Potassium	6010A		7610		
Selenium	6010A	7740		7741A	
Silver	6010A	7761	7760A		
Sodium	6010A		7710		
Thallium	6010A	7841	7840		
Tin	6010A				
Vanadium	6010A		7910		
Zinc	6010A		7950		

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

Volatile Priority Pollutant Compound List (GC/MS - 8240B)				
	Waters		**Soils****	
Compounds	**LOQ* (µg/L)**	**J-Value (µg/L)**	**LOQ* (µg/kg)**	**J-Value (µg/kg)**
Chloromethane	5.	3.	5.	2.
Bromomethane	5.	3.	5.	3.
Vinyl chloride	5.	2.	5.	2.
Chloroethane	5.	3.	5.	3.
Acrolein	100.	40.	100.	20.
Acrylonitrile	50.	10.	50.	10.
Methylene chloride	5.	2.	5.	2.
Trichlorofluoromethane	5.	2.	5.	2.
1,1-Dichloroethene	5.	1.	5.	2.
1,1-Dichloroethane	5.	2.	5.	1.
trans-1,2-Dichloroethene	5.	2.	5.	2.
Chloroform	5.	1.	5.	1.
1,2-Dichloroethane	5.	2.	5.	2.
1,1,1-Trichloroethane	5.	1.	5.	1.
Carbon tetrachloride	5.	1.	5.	1.
Bromodichloromethane	5.	1.	5.	2.
1,1,2,2-Tetrachloroethane	5.	2.	5.	1.
1,2-Dichloropropane	5.	1.	5.	3.
trans-1,3-Dichloropropene	5.	1.	5.	1.
Trichloroethene	5.	1.	5.	1.
Dibromochloromethane	5.	2.	5.	1.
1,1,2-Trichloroethane	5.	2.	5.	2.
Benzene	5.	1.	5.	1.
cis-1,3-Dichloropropene	5.	1.	5.	1.
2-Chloroethylvinyl ether	10.	2.	10.	2.
Bromoform	5.	1.	5.	1.
Tetrachloroethene	5.	1.	5.	1.
Toluene	5.	2.	5.	1.
Chlorobenzene	5.	1.	5.	1.
Ethylbenzene	5.	2.	5.	1.
Xylene (total)	5.	1.	5.	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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Appendix IX Volatile Compounds (GC/MS 8240B)

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Chloromethane	5.	3.	5.	2.
Bromomethane	5.	3.	5.	3.
Vinyl chloride	5.	2.	5.	2.
Dichlorodifluoromethane	5.	2.	5.	2.
Chloroethane	5.	3.	5.	3.
Methyl iodide	5.	1.	5.	3.
Acrolein	100.	40.	100.	20.
Acrylonitrile	50.	10.	50.	10.
Acetonitrile	100.	25.	100.	25.
Methylene chloride	5.	2.	5.	2.
Acetone	20.	6.	20.	7.
Trichlorofluoromethane	5.	2.	5.	2.
Carbon disulfide	5.	3.	5.	3.
Propionitrile	100.	30.	100.	30.
1,1-Dichloroethene	5.	1.	5.	2.
Allyl chloride	5.	1.	5.	1.
1,1-Dichloroethane	5.	2.	5.	1.
trans-1,2-Dichloroethene	5.	2.	5.	2.
Chloroform	5.	1.	5.	1.
1,2-Dichloroethane	5.	2.	5.	2.
Methacrylonitrile	50.	10.	50.	5.
2-Butanone	10.	3.	10.	7.
Dibromomethane	5.	1.	5.	1.
1,1,1-Trichloroethane	5.	1.	5.	1.
1,4-Dioxane	250.	70.	250.	70.
Carbon tetrachloride	5.	1.	5.	1.
Isobutyl alcohol	250.	100.	250.	100.
Vinyl acetate	10.	2.	10.	3.
Bromodichloromethane	5.	1.	5.	2.
2-Chloro-1,3-butadiene	5.	2.	5.	2.
1,2-Dichloropropane	5.	1.	5.	3.
trans-1,3-Dichloropropene	5.	1.	5.	1.
Trichloroethene	5.	1.	5.	1.
Dibromochloromethane	5.	2.	5.	1.
1,1,2-Trichloroethane	5.	2.	5.	2.
1,2-Dibromoethane	5.	1.	5.	1.

Appendix IX Volatile Compounds (GC/MS 8240B)				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Benzene	5.	1.	5.	1.
cis-1,3-Dichloropropene	5.	1.	5.	1.
Methyl methacrylate	5.	1.	5.	1.
1,1,1,2-Tetrachloroethane	5.	1.	5.	2.
Bromoform	5.	1.	5.	1.
trans-1,4-Dichloro-2-butene	50.	15.	50.	10.
1,2,3-Trichloropropane	5.	1.	5.	1.
2-Hexanone	10.	7.	10.	3.
4-Methyl-2-pentanone	10.	5.	10.	3.
Tetrachloroethene	5.	1.	5.	1.
1,1,2,2-Tetrachloroethane	5.	2.	5.	1.
Toluene	5.	2.	5.	1.
Ethyl methacrylate	5.	1.	5.	1.
Chlorobenzene	5.	1.	5.	1.
Pentachloroethane	5.	1.	5.	1.
Ethylbenzene	5.	2.	5.	1.
1,2-Dibromo-3-chloropropane	5.	3.	5.	2.
Styrene	5.	1.	5.	1.
Xylenes (total)	5.	1.	5.	1.

For samples preserved with 1 + 1 HCl to pH <2, low recovery of acid labile compounds 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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

GC/MS Volatile Compound List (8260A)

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Dichlorodifluoromethane	5.	2.	5.	2.
Chloromethane	5.	3.	5.	2.
Vinyl Chloride	5.	2.	5.	2.
Bromomethane	5.	3.	5.	3.
Chloroethane	5.	3.	5.	3.
Trichlorofluoromethane	5.	2.	5.	2.
1,1-Dichloroethene	5.	1.	5.	2.
1,1-Dichloroethane	5.	1.	5.	1.
Methylene Chloride	5.	2.	5.	2.
trans-1,2-Dichloroethene	5.	2.	5.	2.
2,2-Dichloropropane	5.	1.	5.	1.
cis-1,2-Dichloroethene	5.	2.	5.	2.
Chloroform	5.	1.	5.	1.
Bromochloromethane	5.	1.	5.	1.
1,1,1-Trichloroethane	5.	1.	5.	1.
Carbon Tetrachloride	5.	1.	5.	1.
1,1-Dichloropropene	5.	1.	5.	1.
Benzene	5.	1.	5.	1.
1,2-Dichloroethane	5.	2.	5.	2.
Trichloroethene	5.	1.	5.	1.
1,2-Dichloropropane	5.	1.	5.	3.
Dibromomethane	5.	1.	5.	1.
Bromodichloromethane	5.	1.	5.	2.
Toluene	5.	2.	5.	1.
1,1,2-Trichloroethane	5.	2.	5.	2.
Tetrachloroethene	5.	1.	5.	1.
1,3-Dichloropropane	5.	1.	5.	1.
Dibromochloromethane	5.	2.	5.	1.
1,2-Dibromoethane	5.	1.	5.	1.
Chlorobenzene	5.	1.	5.	1.
1,1,1,2-Tetrachloroethane	5.	1.	5.	2.
Ethylbenzene	5.	2.	5.	1.
m+p-Xylene	5.	1.	5.	1.
o-Xylene	5.	1.	5.	1.
Styrene	5.	1.	5.	1.

GC/MS Volatile Compound List (8260A)

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Bromoform	5.	1.	5.	1.
Isopropylbenzene	5.	2.	5.	3.
1,1,2,2-Tetrachloroethane	5.	2.	5.	1.
Bromobenzene	5.	1.	5.	1.
1,2,3-Trichloropropane	5.	1.	5.	1.
n-Propylbenzene	5.	1.	5.	1.
2-Chlorotoluene	5.	1.	5.	1.
1,3,5-Trimethylbenzene	5.	1.	5.	1.
4-Chlorotoluene	5.	1.	5.	1.
tert-Butylbenzene	5.	1.	5.	1.
1,2,4-Trimethylbenzene	5.	1.	5.	1.
sec-Butylbenzene	5.	1.	5.	1.
p-Isopropyltoluene	5.	1.	5.	1.
1,3-Dichlorobenzene	5.	2.	5.	2.
1,4-Dichlorobenzene	5.	2.	5.	2.
n-Butylbenzene	5.	1.	5.	1.
1,2-Dichlorobenzene	5	2.	5.	2.
1,2-Dibromo-3-chloropropane	5.	3.	5.	2.
1,2,4-Trichlorobenzene	5.	1.	5.	1.
Hexachlorobutadiene	5.	2.	5.	2.
Naphthalene	5.	1.	5.	1.
1,2,3-Trichlorobenzene	5.	1.	5.	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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Semivolatile Priority Pollutant Compound List

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
2-Chlorophenol	10.	1.	330.	33.
Phenol	10.	1.	330.	33.
2-Nitrophenol	10.	2.	330.	67.
2,4-Dimethylphenol	10.	1.	330.	67.
2,4-Dichlorophenol	10.	2.	330.	33.
4-Chloro-3-methylphenol	10.	2.	330.	67.
2,4,6-Trichlorophenol	10.	1.	330.	67.
2,4-Dinitrophenol	25.	5.	830.	167.
4-Nitrophenol	25.	5.	830.	167.
2-Methyl-4,6-dinitrophenol	25.	5.	830.	167.
Pentachlorophenol	25.	1.	830.	167.
N-nitrosodimethylamine	10.	2.	330.	67.
bis (2-Chloroethyl) ether	10.	1.	330.	67.
1,3-Dichlorobenzene	10.	1.	330.	33.
1,4-Dichlorobenzene	10.	1.	330.	33.
1,2-Dichlorobenzene	10.	1.	330.	33.
bis (2-Chloroisopropyl) ether	10.	2.	330.	100.
Hexachloroethane	10.	2.	330.	67.
N-nitrosodi-*n*-propylamine	10.	2.	330.	67.
Nitrobenzene	10.	1.	330.	33.
Isophorone	10.	1.	330.	67.
bis (2-Chloroethoxy) methane	10.	1.	330.	33.
1,2,4-trichlorobenzene	10.	1.	330.	33.
Naphthalene	10.	1.	330.	33.
Hexachlorobutadiene	10.	1.	330.	67.
Hexachlorocyclopentadiene	10.	3.	330.	167.
2-Chloronaphthalene	10.	1.	330.	33.
Acenaphthylene	10.	1.	330.	33.
Dimethyl phthalate	10.	3.	330.	33.
2,6-Dinitrotoluene	10.	1.	330.	67.
Acenaphthene	10.	1.	330.	33.
2,4-Dinitrotoluene	10.	2.	330.	67.
Fluorene	10.	1.	330.	33.
4-Chlorophenyl phenyl ether	10.	2.	330.	67.
Diethyl phthalate	10.	2.	330.	67.
1,2-Diphenylhydrazine	10.	1.	330.	67.

Semivolatile Priority Pollutant Compound List				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
N-nitrosodiphenylamine	10.	2.	330.	67.
4-Bromophenyl phenyl ether	10.	2.	330.	100.
Hexachlorobenzene	10.	1.	330.	100.
Phenanthrene	10.	1.	330.	33.
Anthracene	10.	1.	330.	33.
Di-n-butyl phthalate	10.	1.	330.	33.
Fluoranthene	10.	1.	330.	33.
Pyrene	10.	1.	330.	67.
Benzidine	100.	20.	3300.	833.
Butyl benzyl phthalate	10.	2.	330.	67.
Benzo (a) anthracene	10.	1.	330.	33.
Chrysene	10.	1.	330.	33.
3,3'-Dichlorobenzidine	20.	2.	670.	133.
bis (2-Ethylhexyl) phthalate	10.	2.	330.	67.
Di-n-octyl phthalate	10.	2.	330.	67.
Benzo (b) fluoranthene	10.	2.	330.	67.
Benzo (k) fluoranthene	10.	2.	330.	133.
Benzo (a) pyrene	10.	2.	330.	67.
Indeno (1,2,3-cd) pyrene	10.	2.	330.	67.
Dibenz (a,h) anthracene	10.	2.	330.	67.
Benzo (ghi) perylene	10.	2.	330.	67.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Appendix IX Semivolatile Compounds				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Acenaphthene	10.	1.	330.	33.
Acenaphthylene	10.	1.	330.	33.
Acetophenone	10.	2.	330.	33.
2-Acetylaminofluorene	10.	2.	330.	67.
4-Aminobiphenyl	10.	1.	330.	133.
Aniline	10.	2.	330.	100.
Anthracene	10.	1.	330.	33.
Benzo (a) anthracene	10.	1.	330.	33.
Benzo (b) fluoranthene	10.	2.	330.	67.
Benzo (k) fluoranthene	10.	2.	330.	133.
Benzo (ghi) perylene	10.	2.	330.	67.
Benzo (a) pyrene	10.	2.	330.	67.
Benzyl alcohol	20.	2.	670.	100.
bis (2-Chloroethoxy) methane	10.	1.	330.	33.
bis (2-Chloroethyl) ether	10.	1.	330.	67.
bis (2-Ethylhexyl) phthalate	10.	2.	330.	67.
4-Bromophenyl phenyl ether	10.	2.	330.	100.
Butyl benzyl phthalate	10.	2.	330.	67.
4-Chloroaniline	10.	2.	330.	100.
Chlorobenzilate	10.	4.	330.	67.
4-Chloro-3-methylphenol	10.	2.	330.	67.
2-Chloronaphthalene	10.	1.	330.	33.
2-Chlorophenol	10.	1.	330.	33.
4-Chlorophenyl phenyl ether	10.	2.	330.	67.
Chrysene	10.	1.	330.	33.
2-methyl phenol	10.	2.	330.	67.
3 and 4 methyl phenol	10.	2.	330.	100.
Diallate	10.	2.	330.	100.
Dibenzofuran	10.	1.	330.	33.
Di-n-butyl phthalate	10.	1.	330.	33.
Dibenz (a,h) anthracene	10.	2.	330.	67.
1,2-Dichlorobenzene	10.	1.	330.	33.
1,3-Dichlorobenzene	10.	1.	330.	33.
1,4-Dichlorobenzene	10.	1.	330.	33.
3,3'-Dichlorobenzidine	20.	2.	670.	133.
2,4-Dichlorophenol	10.	2.	330.	33.

Appendix IX Semivolatile Compounds				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
2,6-Dichlorophenol	10.	1.	330.	67.
Diethyl phthalate	10.	2.	330.	67.
Dimethoate	10.	2.	330.	100.
p-(Dimethylamino) azobenzene	10.	1.	330.	133.
7,12-Dimethylbenz(a) anthracene	10.	2.	330.	33.
3,3'-Dimethylbenzidine	20.	2.	670.	100.
a,a-dimethyl-1-phenethylamine	20.	1.	670.	67.
2,4-Dimethylphenol	10.	1.	330.	67.
Dimethyl phthalate	10.	3.	330.	33.
m-Dinitrobenzene	10.	2.	330.	67.
2-Methyl-4,6-dinitrophenol	25.	5.	830.	167.
2,4-Dinitrophenol	25.	5.	830.	167.
2,4-Dinitrotoluene	10.	2.	330.	67.
2,6-Dinitrotoluene	10.	1.	330.	67.
Di-n-octyl phthalate	10.	2.	330.	67.
Ethyl methanesulfonate	20.	1.	670.	67.
Fluoranthene	10.	1.	330.	33.
Fluorene	10.	1.	330.	33.
Hexachlorobenzene	10.	1.	330.	100.
Hexachlorobutadiene	10.	1.	330.	67.
Hexachlorocyclopentadiene	10.	3.	330.	167.
Hexachloroethane	10.	2.	330.	67.
Hexachloropropene	10.	2.	330.	67.
Indeno (1,2,3-cd) pyrene	10.	2.	330.	67.
Isodrin	20.	1.	670.	33.
Isophorone	10.	1.	330.	67.
Isosafrole	10.	1.	330.	33.
Methapyrilene	20.	1.	670.	133.
3-Methylchloranthene	10.	2.	330.	67.
Methyl methanesulfonate	10.	1.	330.	33.
Methylnaphthalene	10.	1.	330.	33.
Naphthalene	10.	1.	330.	33.
1,4-Naphthoquinone	10.	1.	330.	100.
1-Naphthylamine	10.	2.	330.	33.
2-Naphthylamine	10.	2.	330.	33.
2-Nitroaniline	10.	1.	330.	67.

Appendix IX Semivolatile Compounds				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
3-Nitroaniline	10.	1.	330.	67.
4-Nitroaniline	10.	2.	330.	100.
Nitrobenzene	10.	1.	330.	33.
2-Nitrophenol	10.	2.	330.	67.
4-Nitrophenol	25.	5.	830.	167.
4-Nitroquinoline 1-oxide	100.	10.	3300.	330.
N-Nitrosodi-n-butylamine	10.	2.	330.	67.
N-Nitrosodiethylamine	10.	2.	330.	100.
N-Nitrosodimethylamine	10.	2.	330.	67.
N-Nitrosodiphenylamine1	10.	2.	330.	67.
N-Nitrosodi-n-propylamine	10.	2.	330.	67.
N-Nitrosomethylethylamine	10.	2.	330.	133.
N-Nitrosomorpholine	10.	1.	330.	67.
N-Nitrosopiperidine	10.	2.	330.	67.
N-Nitrospyrrolidine	10.	2.	330.	100.
5-Nitro-o-toluidine	10.	2.	330.	100.
Pentachlorobenzene	10.	1.	330.	67.
Pentachloronitrobenzene	10.	2.	330.	100.
Pentachlorophenol	25.	1.	830.	167.
Phenacetin	10.	2.	330.	67.
Phenanthrene	10.	1.	330.	33.
Phenol	10.	1.	330.	33.
1,4-Phenylenediamine	200.	20.	6700.	667.
2-Picoline	10.	1.	330.	67.
Pronamide	10.	1.	330.	100.
Pyrene	10.	1.	330.	67.
Pyridine	10.	2.	330.	33.
Safrole	10.	2.	330.	67.
1,2,4,5-Tetrachlorobenzene	10.	1.	330.	67.
2,3,4,6-Tetrachlorphenol	10.	2.	330.	33.
Tetraethyl dithiopyrophosphate	10.	2.	330.	67.
Thionazin	20.	2.	670.	200.
o-Toluidine	10.	2.	330.	100.
1,2,4-Trichlorobenzene	10.	1.	330.	33.
2,4,5-Trichlorophenol	10.	1.	330.	67.
2,4,6-Trichlorophenol	10.	1.	330.	67.

Appendix IX Semivolatile Compounds				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
0,0,0-Triethylphosphorothioate	10.	2.	330.	67.
1,3,5-Trinitrobenzene	10.	5.	330.	167.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client if a valid mass spectrum is obtained. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

[1] N-Nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-Nitrosodiphenylamine represents the combined total of both compounds.

LOQ and J-values are evaluated annually and subject to change.

Volatiles by GC
Volatile Organics List

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Chloromethane	5.	0.09	5.	0.5
Bromomethane	5.	1.18	5.	0.5
Dichlorodifluoromethane	2.	0.2	2.	0.2
Vinyl chloride	1.	0.2	1.	0.1
Chloroethane	1.	0.52	1.	0.1
Methylene chloride	1.	0.25	1.	0.1
Trichlorofluoromethane	1.	0.1	1.	0.1
1,1-Dichloroethene	1.	0.13	1.	0.1
1,1-Dichloroethane	1.	0.07	1.	0.1
1,2-Dichloroethene (cis/trans)	1.	0.1	1.	0.1
Chloroform	1.	0.05	1.	0.1
1,2-Dichloroethane	1.	0.1	1.	0.1
1,1,1-Trichloroethane	1.	0.03	1.	0.1
Carbon tetrachloride	1.	0.12	1.	0.1
Bromodichloromethane	1.	0.09	1.	0.1
1,2-Dichlorpropane	1.	0.04	1.	0.1
trans-1,3-Dichloropropene	1.	0.2	1.	0.1
Trichloroethene	1.	0.12	1.	0.1
Dibromochloromethane	1.	0.09	1.	0.1
1,1,2-Trichloroethane	1.	0.105	1.	0.1
cis-1,3-Dichloropropene	1.	0.34	1.	0.1
2-Chloroethylvinyl-ether	10.	0.9	10.	1.
Bromoform	2.	0.2	2.	0.2
1,1,2,2-Tetrachloroethane	2.	0.05	2.	0.2
Tetrachloroethene	1.	0.04	1.	0.1
Chlorobenzene	1.	0.25	1.	0.1
Benzene	1.	0.2	1.	0.2
Toluene	1.	0.2	1.	0.1
Ethylbenzene	1.	0.1	1.	0.2
o-Xylene	1.	0.2	1.	0.2
m-Xylene	1.	0.2	1.	0.2
p-Xylene	1.	0.2	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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Pesticide/PCB Priority Pollutant Compound List				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
alpha-BHC	0.01	0.001	0.01	0.00042
beta-BHC	0.01	0.0011	0.01	0.0011
gamma-BHC (Lindane)	0.01	0.001	0.01	0.00055
delta-BHC	0.01	0.003	0.01	0.00061
Heptachlor	0.01	0.0016	0.01	0.00077
Aldrin	0.01	0.0063	0.01	0.0014
Heptachlor epoxide	0.01	0.001	0.01	0.00059
4,4-DDE	0.01	0.001	0.01	0.00068
4,4-DDD	0.01	0.0048	0.01	0.0002
4,4-DDT	0.01	0.009	0.01	0.0006
Dieldrin	0.01	0.001	0.01	0.00042
Endrin	0.01	0.0071	0.01	0.0004
Chlordane	0.3	0.02	0.05	0.013
Toxaphene	4.	0.40	2.	0.019
Endosulfan I	0.01	0.002	0.01	0.0012
Endosulfan II	0.01	0.0049	0.01	0.00079
Endosulfan sulfate	0.03	0.003	0.03	0.00065
Endrin aldehyde	0.1	0.0048	0.1	0.0011
Methoxychlor	0.05	0.016	0.05	0.0016
PCB-1016	1.	0.043	0.2	0.034
PCB-1221	1.	0.12	0.2	0.049
PCB-1232	1.	0.048	0.2	0.026
PCB-1242	1.	0.10	0.2	0.013
PCB-1248	1.	0.038	0.2	0.035
PCB-1254	1.	0.14	0.2	0.028
PCB-1260	1.	0.036	0.2	0.032

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Appendix IX Organochlorines

Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Aldrin	0.01	0.0063	0.01	0.0014
alpha-BHC	0.01	0.001	0.01	0.0042
beta-BHC	0.01	0.0011	0.01	0.0011
delta-BHC	0.01	0.003	0.01	0.00061
gamma-BHC (Lindane)	0.01	0.001	0.01	0.00055
Chlordane	0.3	0.02	0.05	0.013
4,4-DDT	0.01	0.009	0.01	0.0006
4,4-DDE	0.01	0.001	0.01	0.00068
4,4-DDD	0.01	0.0048	0.01	0.0002
Dieldrin	0.01	0.001	0.01	0.00042
Endosulfan I	0.01	0.002	0.01	0.0012
Endosulfan II	0.01	0.0049	0.01	0.00072
Endosulfan sulfate	0.03	0.003	0.03	0.00065
Endrin	0.01	0.0071	0.01	0.0004
Endrin aldehyde	0.1	0.0048	0.1	0.0011
Heptachlor	0.01	0.0016	0.01	0.00077
Heptachlor epoxide	0.01	0.001	0.01	0.00059
Kepone	0.7	0.3	0.7	0.1
Methoxychlor	0.05	0.016	0.05	0.0016
PCB-1016	1.	0.043	0.2	0.034
PCB-1221	1.	0.12	0.2	0.049
PCB-1232	1.	0.048	0.2	0.026
PCB-1242	1.	0.10	0.2	0.013
PCB-1248	1.	0.038	0.2	0.035
PCB-1254	1.	0.14	0.2	0.028
PCB-1260	1.	0.036	0.2	0.032
Toxaphene	4.	0.40	2.	0.019

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Appendix IX Herbicide Compounds				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
2,4-D	1.	0.071	0.2	0.02
Dinoseb	1.	0.016	0.2	0.005
2,4,5-TP	0.1	0.011	0.05	0.002
2,4,5-T	0.1	0.0059	0.05	0.002

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Appendix IX Organophosphates				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Disulfoton	0.3	0.065	0.3	0.066
Methyl parathion	0.2	0.046	0.08	0.016
Ethyl parathion	0.2	0.064	0.08	0.016
Famphur	0.5	0.077	0.1	0.024
Phorate	0.3	0.063	0.1	0.019

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

PAHs by HPLC 8310				
	Waters		Soils**	
Compound	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Naphthalene	10.	0.9	0.67	0.059
Acenapthylene	20.	0.7	0.67	0.049
Acenaphthene	20.	2.	0.67	0.180
Fluorene	2.	1.	0.67	0.011
Phenanthrene	2.	0.04	0.167	0.017
Anthracene	1.	0.03	0.167	0.0017
Fluoranthene	0.5	0.02	0.067	0.00078
Pyrene	2.	0.5	0.067	0.0041
Benzo(a)anthracene	0.1	0.04	0.003	0.00063
Chrysene	1.	0.2	0.03	0.0018
Benzo(b)fluoranthene	0.2	0.03	0.0067	0.00035
Benzo(k)fluoranthene	0.1	0.01	0.0067	0.00034
Benzo(a)pyrene	0.2	0.02	0.0067	0.00097
Dibenzo(a,h)anthracene	0.2	0.04	0.0067	0.003
Benzo(g,h,i)perylene	0.5	0.2	0.0167	0.01
Indeno(1,2,3-cd)pyrene	0.5	0.1	0.0167	0.0027

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

TPH GRO/DRO				
	Waters		Soils**	
Compound	LOQ* (mg/L)	J-Value (mg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
TPH-GRO	0.05	0.02	1.	0.2
TPH-DRO	0.4	0.2	7.	4.

NOTE: J-values listed are higher than determined MDLs. This is because the method sums total detectable area under the chromatographic plot in region of interest, instead of actual fuel peak area as the respective fuel.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Inorganic Appendix IX Analyte List

Analyte	Waters LOQ* (mg/L)	Waters J-Value (mg/L)	Soils** LOQ* (mg/kg)	Soils** J-Value (mg/kg)
Antimony	0.2	0.015	20.	2.2
Arsenic[1]	0.01	0.0027	1.	0.25
Barium	0.1	0.0022	10.	2.2
Beryllium	0.01	0.0013	0.5	0.074
Cadmium	0.01	0.0027	2.	0.13
Chromium	0.03	0.0043	4.	0.47
Cobalt	0.05	0.0055	5.	0.52
Copper	0.025	0.0038	4.	0.50
Lead[1]	0.005	0.0020	0.5	0.16
Mercury[2]	0.0002	0.000043	0.1	0.028
Nickel	0.05	0.0054	5.	0.46
Selenium[1]	0.01	0.0027	0.5	0.18
Silver	0.02	0.0036	2.	0.45
Thallium[1]	0.02	0.0045	2.	0.39
Tin	0.3	0.025	25.	2.2
Vanadium	0.02	0.0070	2.	0.68
Zinc	0.025	0.012	10.	0.40
Cyanide	0.005	0.004	0.1	0.08
Sulfide	2.	0.49	30.	8.61

[1] Analysis by Trace ICP

[2] Analysis by Cold Vapor

Except for cyanide and sulfide, all other elements analyzed by ICP.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Inorganic Priority Pollutants List (PPL)				
	Waters		Soils**	
Analyte	LOQ* (mg/L)	J-Value (mg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Antimony	0.2	0.015	20.	2.2
Arsenic[1]	0.01	0.0027	1.	0.25
Beryllium	0.01	0.0013	0.5	0.074
Cadmium	0.01	0.0027	2.	0.13
Chromium	0.03	0.0043	4.	0.47
Copper	0.025	0.0038	4.	0.50
Lead[1]	0.005	0.0020	0.5	0.16
Mercury[2]	0.0002	0.000043	0.1	0.028
Nickel	0.05	0.0054	5.	0.46
Selenium[1]	0.01	0.0027	0.5	0.18
Silver	0.02	0.0036	2.	0.45
Thallium[1]	0.02	0.0045	2.	0.39
Zinc	0.025	0.012	10.	0.40
Cyanide	0.005	0.004	0.1	0.08

[1] Analyzed by Trace ICP

[2] Analyzed by Cold Vapor

Except for cyanide, all other elements analyzed by ICP.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

Parameter	Waters		Soils**	
	LOQ* (mg/L)	J-Value (mg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Phenols	0.005	0.004	0.1	0.0007
TOC	1.0	10.	50.	10.
TOX	5. µg/L	5. µg/L	100.	100.
TPH	0.3	0.1	20.	7.

*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.

The laboratory routinely reports at the limit of quantitation (LOQ) but can estimate down to the J-value when requested by the client. Values reported below the LOQ are reported with a J-flag and are defined as estimated values.

LOQ and J-values are evaluated annually and subject to change.

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 Sections No. 8 and 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 and accuracy 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 (L) 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 µg/L for water samples and µg/kg for solid samples. Soil samples are reported on an as received and on a dry-weight basis. The results are reported on Lancaster Labs 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 when using a point-to-point calibration curve:

$$Concentration = ([(Hx - Hn) / S] + An) \times (DF)$$
$$S = (Hn + 1 - Hn) / (An + 1 - An)$$

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 when using a point-to-point calibration curve with extrapolation to zero:

$$Concentration = [(Hx) \times (A1 / H1)] \times (DF)$$

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 µg/L for water samples and in µg/kg for solid samples. Soil samples are reported on an as received and on a dry weight basis.

The results for the **pesticides/PCBs** 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 (L)

DF = Dilution factor, if needed

As = Peak height for the external standard

Vi = Volume of extract injected (L)

Vs = Volume (mL) or weight (gm) of sample extracted

Results are reported as µg/L for water samples and mg/kg for solid samples. Soil samples are reported on an as received and on a dry weight basis. Results are reported on Lancaster Labs Analysis Report Forms shown in Appendix A.

For **Herbicides**, a five-point calibration curve is constructed for each compound. The results are calculated from the curve when the %RSD is >20%. Otherwise, the results are calculated using the average response factor.

A. Curve

$$\text{Sample Concentration, } mg / kg \text{ or } \mu g / L = \text{Extract Concentration} \times \frac{DF \times FV}{IW\ (or\ IV)}$$

Where:

Extract Conc., = (peak ht. - Y-intercept)/slope

FV = final volume = 100 mL (solids), 10 mL (waters)

IW or IV = initial weight = 10 g, initial volume 1000 mL

DF = Dilution Factor

B. Average response factor

The calculation performed by single point is the same as above except the extract concentration is calculated as follow:

$$Extract\ Conc.,\ \mu g / mL = \frac{pk\ ht\ in\ sample}{Average\ Response\ Factor\ (ARF)} \times \frac{Int\ std\ ht\ in\ L3\ std}{Int\ std\ ht\ in\ sample}$$

Where:

ARF = Average Response Factor [(RF Calib1 + ... + RF Calib 5)/5]

The results for the **PAHs by HPLC** analysis are calculated using the following equation:

$$\frac{Pk\ Ht \times RF \times FV \times DF \times AF}{IV\ (or\ IW)} = Concentration\ (\mu g / L)\ or\ mg / kg$$

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 (L)

IW = Initial weight of the sample extracted (gm)

**AF = Additional factor

*Please note that the final volume of the extract is 3 mL for aqueous and 10 mL for solids

**Additional factor is five to compensate for the dilution into ACN

Results are reported as µg/L for water samples and mg/kg for solid samples. Soil samples are reported on an as received and on a dry weight basis. Results are reported on Lancaster Labs Analysis Report Forms shown in Appendix A.

For **TPH-GRO and TPH-DRO**, 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:

$$Concentration = (Ax \mathbin{/} Rf) \times (DF)$$

Where:

Ax = Total peak area under the curve in region defined as analyte

DF = Dilution factor

RF = Average response factor from the calibration curve, calculated as shown below:

$$RF = [(As1 \mathbin{/} Qs1) + (As2 \mathbin{/} Qs2) + (As3 \mathbin{/} Qs3) + (As4 \mathbin{/} Qs4) + (As5 \mathbin{/} Qs5)] \mathbin{/} 5$$

Where:

As# = Analyte peak sum area for all components of calibration level #

Qs# = Analyte concentration sum for all components of calibration level #

Results are reported in mg/L for water samples and in mg/kg for solid samples. Soil samples are reported on an as received an on a dry weight basis.

For DRO, calculation also includes the Factor "F/I"

Where:

F = Final extract volume (mL)

I = Initial sample weight (grams) or volume (mL)

The results for **Inorganic** analyses are calculated using the following equation:

$$Concentration = (A)\,(D)\,(E)\;/\;(F)$$

Where:

A = The concentration determined by AA, ICP, or FTIR 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 an as received and on a dry weight basis. The results are reported on Lancaster Labs Analysis Report Forms shown in Appendix A.

The principle criteria used to validate data will be the acceptance criteria described in Sections No. 8 and 11 and protocols specified in laboratory SOPs. Following review, interpretation, and data reduction by the analyst, data is transferred to the laboratory sample management system either by direct data upload from the analytical data system or manually. This system stores client information, sample results, and QC results. A security system is in place to control access of laboratory personnel and to provide an audit trail for information changes. The data is again reviewed by the group leader or another analyst whose function is to provide an independent review 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. Any errors identified and corrected during the review process are documented and addressed with appropriate personnel to ensure generation of quality 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 printouts, 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 in the client requested format. This package is reviewed by the Quality Assurance Department for conformance with SOPs 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 usability 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 usability 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 7 years.

Project files will be created per client/project and will contain chain-of-custody records, analysis requirements, and laboratory acknowledgments which document samples received, laboratory sample number assignment, and analysis requested. Raw data is filed per batch number assignment and laboratory sample number which correlates to the sample receipt documents. When the project is complete, all documentation is archived in a limited access area and retained for 5 years.

Table 10-1

Sample and Data Routing at Lancaster Laboratories

Action	Personnel Involved
Sample received at Lancaster Labs	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 Support
Acknowledgment 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, reviewed, 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 SW-846 3rd Edition, Update II, 1994. 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 inorganics; 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 and some GC analysis) - Internal standards are compounds added to every standard, blank matrix, spike, matrix spike duplicate, and sample at a known 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 GFAA and ICP only) - If the analyte concentration is sufficiently high an analysis of a five-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. 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 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 tables that follow show the types and frequency of QC performed, along with the acceptance limits and corrective action.

Table 11-1

Quality Control
GC/MS Volatiles (8240B)

Type	Acceptance Limits(%) WATERS	 SOILS	Frequency	Corrective Action
Surrogates:			Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Toluene-d8	88 - 110	81 - 117		
Bromofluorobenzene	86 - 115	74 - 121		
1,2-Dichloroethane-d4	76 - 114	70 - 121		
Matrix Spikes: Spike all compounds of interest	See Table 11-2 and 11-3 for acceptance criteria		Each group (≤20) of samples per matrix/level	LCS run for compounds outside acceptance limits
Laboratory Control Samples: Spike all compounds of interest	Same as for matrix spikes		Each group (≤20) when MS/MSD falls outside established limits	Reanalyze LCS and associated samples for compounds outside acceptance limits
Matrix Spike Duplicates (RPD): Spike all compounds of interest	≤30%		Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for all compounds		Once for each 12-hour time period	Reanalyze blank and associated samples if blank outside limits
Internal Standards: Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d5	-50% to +100% of internal standard area of 12-hour STD RT Change ≤30 sec.		Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Accuracy is subject to change over time.

Table 11-2

GC/MS Statistical Acceptance Limits for Volatile Compounds not Included in Table 11-3

Compound Name	Acceptance Limit (%)
Dichlorodifluoromethane	24 - 157
Ethyl Ether	67 - 123
Acrolein	22 - 169
Freon 113	72 - 174
Acetone	19 - 150
Methyl Iodide	45 - 130
Carbon Disulfide	29 - 183
Acetonitrile	1 - 199
Allyl Chloride	55 - 142
Acrylonitrile	51 - 138
Vinyl Acetate	19 - 190
2-Chloro-1,3-butadiene	77 - 129
2-Butanone	22 - 167
Propionitrile	56 - 139
Ethyl Acetate	69 - 147
Methacrylonitrile	69 - 128
Isobutyl Alcohol	1 - 234
Methyl Methacrylate	66 - 131
Dibromomethane	76 - 136
1,4-Dioxane	3 - 164
2-Nitropropane	54 - 106
4-Methyl-2-pentanone	50 - 124
Ethyl Methacrylate	68 - 270
2-Hexanone	52 - 140
1,2-Dibromoethane	45 - 135
1,1,1,2-Tetrachloroethane	23 - 149
Xylene (total)	61 - 165
Styrene	74 - 136
Cyclohexanone	43 - 123
1,2,3-Trichloropropane	72 - 125
trans-1,4-Dichloro-2-butene	56 - 141
Pentachloroethane	56 - 132
1,2-Dibromo-3-chloropropane	40 - 154
n-Pentane	27 - 195
1,2-Diethylbenzene	56 - 148

Table 11-2

GC/MS Statistical Acceptance Limits for Volatile Compounds not Included in Table 11-3

Compound Name	Acceptance Limit (%)
1,3-Diethylbenzene	57 - 147
1,4-Diethylbenzene	57 - 149
Methyl Tertiary Butyl Ether	80 - 123
Tertiary Butyl Alcohol	25 - 195

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Table 11-3

TABLE 6.
CALIBRATION AND QC ACCEPTANCE CRITERIA[a]

Parameter	Range for Q (µg/L)	Limit for s (µg/L)	Range for $\bar{x}$ (µg/L)	Range p, p_s (%)
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-Chloroethyl vinyl 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 µg/L.
s = Standard deviation of four recovery measurements, in µg/L.
$\bar{x}$ = Average recovery for four recovery measurements, in µg/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 µg/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 11-4

Quality Control
GC/MS Volatiles (8260A)

Type	Acceptance Limits(%) WATERS	SOILS	Frequency	Corrective Action
Surrogates:			Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Toluene-d8	88 - 110	81 - 117		
Bromofluorobenzene	86 - 115	74 - 121		
1,2-Dichloroethane-d4	80 - 120	80 - 120		
Dibromofluoromethane	86 - 118	80 - 120		
Matrix Spikes: Spike all compounds of interest	See Table 11.4 for acceptance criteria		Each group (≤20) of samples per matrix/level	LCS run for compounds outside acceptance limits
Laboratory Control Samples: Spike all compounds of interest	Same as for matrix spikes		Each group (≤20) when MS/MSD falls outside established limits	Reanalyze LCS and associated samples for compounds outside acceptance limits
Matrix Spike Duplicates (RPD): Spike all compounds of interest	≤30%		Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for all compounds		Once for each 12-hour time period	Reanalyze blank and associated samples if blank outside limits
Internal Standards: Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d5	-50% to +100% of internal standard area of 12-hour STD RT Change ≤30 sec.		Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

Accuracy is subject to change over time.

Table 11-5

GC/MS Statistical Acceptance Limits for Volatile Compounds (8260A)

Compound Name	Acceptance Limit (%)
Dichlorofluoromethane	11 - 215
Chloromethane	22 - 172
Vinyl Chloride	28 - 172
Bromomethane	29 - 155
Chloroethane	21 -171
Trichlorofluoromethane	3 - 201
1,1-Dichloroethene	38 - 170
Methylene Chloride	4 -196
trans-1,2-Dichloroethene	42 - 150
1,1-Dichloroethane	42 - 156
2,2-Dichloropropane	32 - 182
cis-1,2-Dichloroethene	37 - 151
Chloroform	44 - 152
Bromochloromethane	35 - 155
1,1,1-Trichloroethane	49 - 163
Carbon Tetrachloride	49 - 163
1,1-Dichloropropene	38 - 164
Benzene	42 - 150
1,2-Dichloroethane	48 - 150
Trichloroethane	43 - 163
1,2-Dichloropropane	49 - 145
Dibromomethane	38 - 164
Bromodichloromethane	48 - 150
Toluene	49 - 151
1,1,2-Trichloroethane	46 - 142
Tetrachloroethene	45 - 171
1,3-Dichloropropane	37 - 157
Dibromochloromethane	48 - 144
1,2-Dibromomethane	37 - 151
Chlorobenzene	49 - 145
1,1,1,2-Tetrachloroethane	39 - 159
Ethylbenzene	50 - 152
m+p-Xylene	78 - 138
o-Xylene	41 - 161
Styrene	50 - 140

Table 11-5

GC/MS Statistical Acceptance Limits for Volatile Compounds (8260A)

Compound Name	Acceptance Limit (%)
Bromoform	41 - 143
Isopropylbenzene	0 - 210
1,1,2,2-Tetrachloroethane	44 - 140
Bromobenzene	41 - 155
1,2,3-Trichloropropane	37 - 157
1,2-Dichloroethene	43 - 163
Acetone	60 - 132
Carbon Disulfide	12 - 174
n-Propylbenzene	40 - 166
2-Chlorotoluene	42 - 162
1,3,5-Trimethylbenzene	38 - 170
4-Chlorotoluene	40 - 160
tert-Butylbenzene	41 - 167
1,2,4-Trimethylbenzene	43 - 163
sec-Butylbenzene	39 - 171
p-Isopropyltoluene	38 - 176
1,3-Dichlorobenzene	42 - 150
1,4-Dichlorobenzene	42 - 150
n-Butylbenzene	33 - 177
1,2-Dichlorobenzene	49 -139
1,2-Dibromo-3-chloropropane	23 - 143
1,2,4-Trichlorobenzene	16 - 154
Hexachlorobutadiene	0 - 211
Naphthalene	0 - 156
1,2,3-Trichlorobenzene	0 - 162
trans-1,3-Dichloropropene	26 - 152
4-Methyl-1,2-pentanone	73 - 121
cis-1,3-Dichloropropene	68 - 122
Xylene	76 - 118
2-Hexanone	77 - 119
2-Butanone	66 - 126

Table 11-6

Quality Control
GC/MS Semivolatiles

Type	Acceptance Limits (%) WATERS	Acceptance Limits (%) SOILS	Frequency	Corrective Action
Surrogate:			Each sample, MS, MSD, LCS, and blank	Repeat analysis if more then one surrogate out per fraction (acid/base) or any recovery <10%; if reanalysis confirms originals, document on report and/or case narrative
Nitrobenzene-d5	35 - 114	23 - 120		
2-Fluorobiphenyl	43 - 116	30 - 115		
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		
Matrix Spikes: Spike all compounds of interest	See Table 11-7 for acceptance limits		Each group (≤20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Laboratory Control Sample: Spike all compounds of interest	Same as for spikes		Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits
Matrix Spike Duplicates (RPD): Same as for matrix spikes	≤30%		Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for all compounds		Once per case or group (≤20) of samples, each matrix, level, instrument	Re-extract and reanalyze blank and associated samples
Internal Standards: 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	-50 to +100 of internal standard area of 12-hour STD RT change ≤30 sec.		Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative

Accuracy is subject to change over time.

Table 11-7

Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery

Compound Name	Acceptance Limits (%)
N-Nitrosodimethylamine	35.0 - 100.8
Phenol	5.0 - 112.0
bis (2-Chloroethyl) ether	12.0 - 158.0
2-Chlorophenol	23.0 - 134.0
1,3-Dichlorobenzene	1.0 - 172.0
1,4-Dichlorobenzene	20.0 - 124.0
1,2-Dichlorobenzene	32.0 - 129.0
bis (2-Chloroisopropyl) ether	36.0 - 166.0
N-Nitroso-di-*n*-propylamine	1.0 - 230.0
Hexachloroethane	40.0 - 113.0
Nitrobenzene	35.0 - 180.0
Isophorone	21.0 - 196.0
2-Nitrophenol	29.0 - 182.0
2,4-Dimethylphenol	32.0 - 119.0
bis (2-Chloroethoxy) methane	33.0 - 184.0
2,4-Dichlorophenol	39.0 - 135.0
1,2,4-Trichlorobenzene	44.0 - 142.0
Naphthalane	21.0 - 133.0
Hexachlorobutadiene	24.0 - 116.0
4-Chloro-3-methylphenol	22.0 - 147.0
Hexachlorocyclopentadiene	1.0 - 100.0
2,4,6-Trichlorophenol	37.0 - 144.0
2-Chloronaphthalene	60.0 - 118.0
Dimethylphthalate	1.0 - 112.0
Acenaphthylene	33.0 - 145.0
2,6-Dinitrotoluene	50.0 - 158.0
Acenaphthene	47.0 - 145.0
2,4-Dinitrophenol	1.0 - 191.0
4-Nitrophenol	1.0 - 132.0
2,4-Dinitrotoluene	39.0 - 139.0
Diethylphthalate	1.0 - 114.0
4-Chlorophenyl-phenylether	25.0 - 158.0
Fluorene	59.0 - 121.0
4,6-Dinitro-2-methylphenol	1.0 - 181.0
N-Nitrosodiphenylamine	37.8 - 147.0

Table 11-7

Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery

Compound Name	Acceptance Limits (%)
1,2-Diphenylhydrazine	25.7 - 124.9
4-Bromophenyl-phenylether	53.0 - 127.0
Hexachlorobenzene	1.0 - 152.0
Pentachlorophenol	14.0 - 176.0
Phenanthrene	54.0 - 120.0
Anthracene	27.0 - 133.0
Di-*n*-butylphthalate	1.0 - 118.0
Fluoranthene	26.0 - 137.0
Benzidine	1.0 -155.0
Pyrene	52.0 - 115.0
Butylbenzylphthalate	1.0 - 152.0
3,3'-Dichlorobenzidine	20.8 - 100.0
Benzo(a)anthracene	33.0 - 143.0
Chrysene	17.0 - 168.0
bis(2-Ethylhexyl)phthalate	8.0 - 158.0
Di-*n*-octylphthalate	4.0 - 146.0
Benzo(b)fluoranthene	24.0 - 159.0
Benzo(k)fluoranthene	11.0 - 163.0
Benzo(a)pyrene	17.0 - 163.0
Indeno(1,2,3-cd)pyrene	1.0 - 171.0
Dibenz(a,h)anthracene	1.0 - 227.0
Benzo(g,h,i)perylene	1.0 - 219.0
Aniline	28.0 - 100.0
Acetophenone	37.7 - 118.3
Ethyl methanesulfonate	37.8 - 123.2
Methyl methanesulfonate	4.7 - 100.0
N-nitrosodiethyalmine	37.4 - 135.0
N-nitrosomethylethylamine	37.3 - 132.9
N-nitrosomorpholine	33.0 - 129.6
N-nitrosopiperidine	36.7 - 128.5
N-nitrosopyrrolidine	36.2 - 129.0
2-picoline	1.0 - 140.0
o-Toluidine	37.3 - 109.1
Benzyl Alcohol	65.9 - 100.0
2-chlorophenol	23.0 - 134.0

Table 11-7

Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery

Compound Name	Acceptance Limits (%)
2-methylphenol	45.9 - 122.5
3- or 4-methylphenol	53.6 - 175.2
Pyridine	28.1 - 100.0
2,6-dichlorophenol	36.6 - 126.8
1,3-dinitrobenzene	41.3 - 133.1
Hexachloropropene	1.0 - 100.0
Isosafrole	32.5 - 123.7
1,4-naphthoquinone	1.0 - 100.0
N-nitrosodi-*n*-butylamine	35.9 - 131.1
1,4-phenylenediamine	1.0 - 100.0
Safrole	32.3 - 122.1
1,2,4,5-tetrachlorobenzene	35.2 - 119.6
O,O,O-triethylphosphorothioate	34.0 - 122.8
a,a-dimethylphenethylamine	3.9 - 100.0
4-chloroaniline	17.4 - 116.0
2-methylnaphthalene	27.6 - 123.2
2-nitroaniline	53.1 - 142.9
2,4,5-trichlorophenol	39.2 - 151.4
2,3,4,6-tetrachlorophenol	36.7 - 150.5
Dimethoate	1.0 - 105.1
1-naphthylamine	1.0 - 100.0
2-naphthylamine	1.0 - 100.0
5-nitro-*o*-toluidine	40.7 - 107.1
Pentachlorobenzene	37.0 - 122.4
Phenacetin	35.1 - 135.7
Tetraethyl dithiopyrophosphate	25.6 - 125.6
1,3,5-trinitrobenzene	35.4 - 130.6
Diallate (trans/cis)	34.6 - 131.2
Diphenylamine	37.8 - 147.0
Thionazin	34.0 - 132.1
Dibenzofuran	28.4 - 131.4
3-nitroaniline	7.0 - 143.0
4-nitroaniline	38.0 - 122.0
2-acetylaminofluorene	32.4 - 148.6
4-aminobiphenyl	3.8 - 104.2

Table 11-7

Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery

Compound Name	Acceptance Limits (%)
Chlorobenzilate	18.2 - 135.8
p-(dimethylamino) azobenzene	29.0 - 139.3
7,12-dimethylbenz(a) anthracene	18.8 - 127.2
3,3'-dimethylbenzidine	20.8 - 100.0
Isodrin	29.0 - 135.8
3-methylcholanthrene	34.2 - 135.8
4-nitroquinoline-1-oxide	1.0 - 275.2
Pentachloronitrobenzene	50.4 - 127.6
Pronamide	39.3 - 122.7
Methapyrilene	4.8 - 127.2

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Acceptance limits for semivolatile compounds not included in Table 11-5 will be evaluated when enough points can be generated to make a statistical determination.

Table 11-8

Quality Control
Pesticides/PCBs

Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Surrogate:			Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	At least one surrogate must be in spec unless matrix related problems are evident; if matrix related problems are evident, report results and comment in case narrative
Organochlorine Pesticides;				
DCB	60 - 120	50 - 120		
TCMX	60 - 120	50 - 120		
Herbicides;				
2,4-DB or	60 - 120	50 - 120		
DCAA	60 - 120	50 - 120		
Organophosphate Pesticides;				
2NMX	60 - 120	50 - 120		
Matrix Spikes:			Each extraction group (≤20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	See Table 11-9			
Herbicides;				
2,4-D	72 - 151	0 - 165		
2,4,5-TP	64 - 146	38 - 120		
2,4,5-T	55 - 154	23 - 135		
Dinoseb	11 - 124	D - 120		
Organophosphate Pesticides;				
Phorate	72 - 120	55 - 120		
Disulfoton	70 - 120	58 - 121		
Famphur	80 - 120	60 - 128		
Methyl Parathion	62 - 120	48 - 129		
Ethyl Parathion	80 - 120	82 - 120		

Table 11-8

Quality Control
Pesticides/PCBs

Type	Acceptance Limits (%) WATERS	SOILS	Frequency	Corrective Action
Laboratory Control Sample:			Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	See attached Table 11-9			
Herbicides;				
2,4-D	72 - 151	0 - 165		
2,4,5-TP	64 - 146	38 - 120		
2,4,5-T	55 - 154	23 - 135		
Dinoseb	11 - 124	D - 120		
Organophosphate Pesticides;				
Phorate	72 - 120	55 - 120		
Disulfoton	70 - 120	58 - 121		
Famphur	80 - 120	66 - 128		
Methyl Parathion	62 - 120	48 - 129		
Ethyl Parathion	80 - 120	82 - 120		
Matrix Spike Duplicates (RPD):	Water ≤30%		Each group (20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	Soils ≤50%			
Herbicides;				
2,4-D				
2,4,5-TP				
2,4,5-T				
Dinoseb				
Organophosphate Pesticides;				
Phorate				
Disulfoton				
Famphur				
Methyl Parathion				
Ethyl Parathion				

Table 11-8

Quality Control
Pesticides/PCBs

Type	Acceptance Limits (%) WATERS	SOILS	Frequency	Corrective Action
Blanks:	≤LOQ for all compounds		Once per case or extraction group (≤20) of samples, each matrix, level, instrument	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Table 11-9

Quality Control
Pesticides/PCBs

Organochlorine Pesticides Spike Acceptance Limits

Compound Name	Matrix Spike and Laboratory Control Sample Limits	
	Waters (%)	Soils (%)
Lindane	66 - 120	73 - 120
Heptachlor	54 - 120	69 - 120
Aldrin	42 - 120	67 - 120
DDT	71 - 120	61 - 121
Dieldrin	83 - 120	79 - 130
Endrin	73 - 129	68 - 126
Methoxychlor	57 - 140	57 - 141
Delta-BHC	69 - 126	62 - 120
Heptachlor Epoxide	64 - 120	60 - 120
Endosulfanl	60 - 120	60 - 120
Endrin Aldehyde	59 - 126	57 - 123
Alpha-BHC	67 - 122	45 - 127
Beta-BHC	74 - 120	50 - 137
DDE	60 - 120	72 - 120
DDD	67 - 121	72 - 123
Endosulfan II	67 - 120	62 - 120
Endosulfan Sulfate	53 - 128	66 - 120

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Table 11-10

Quality Control
Volatiles by GC

Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Surrogates:			Each sample, MS, MSD, and blank	Results would not be reported if the surrogate recovery is outside the limits unless matrix related problems are evident
Halocarbons;				
Bromochloromethane (Hall)	75 - 125	70 - 130		
1-Chloro-3-fluorobenzene (Hall)	75 - 125	70 - 130		
Aromatics;				
n-propylbenzene (PID)	75 - 125	70 - 130		
1,2,3-Trichloropropane (Hall)	75 - 125	70 - 130		
Halocarbons/Aromatics;				
Bromochloromethane (Hall)	75 - 125	70 - 130		
1-Chloro-3-fluorobenzene (Hall)	75 - 125	70 - 130		
1-Chloro-3-fluorobenzene (PID)	75 - 125	70 - 130		
Non-halogenated;				
2-hexanone (FID)	75 - 125	70 - 130		
Matrix Spikes: Spike all compounds of interest except: Dichlorodifluoromethane *trans*-1,2- Dichloroethene *trans*-1,3- Dichloropropene 1,1,2-Trichloroethane *cis*-1,3-Dichloropropene 2-Chloroethylvinylether 1,1,2,2- Tetrachloroethane	See Table 11-7 for acceptance limits		Each group of samples of similar matrix/level (≤20) each method	See Table 11-11
Laboratory Control Sample/Check Standard: Spike all compounds of interest except: Dichlorodifluoromethane *trans*-1,2-Dichloroethene *trans*-1,3-Dichloropropene 1,1,2-Trichloroethane *cis*-1,3-Dichloropropene 1,1,2,2-Tetrachloroethane	See Table 11-7 for acceptance limits		Each group (≤20) when MS/MSD falls outside established limits	See Table 11-10B

Table 11-10

Quality Control
Volatiles by GC

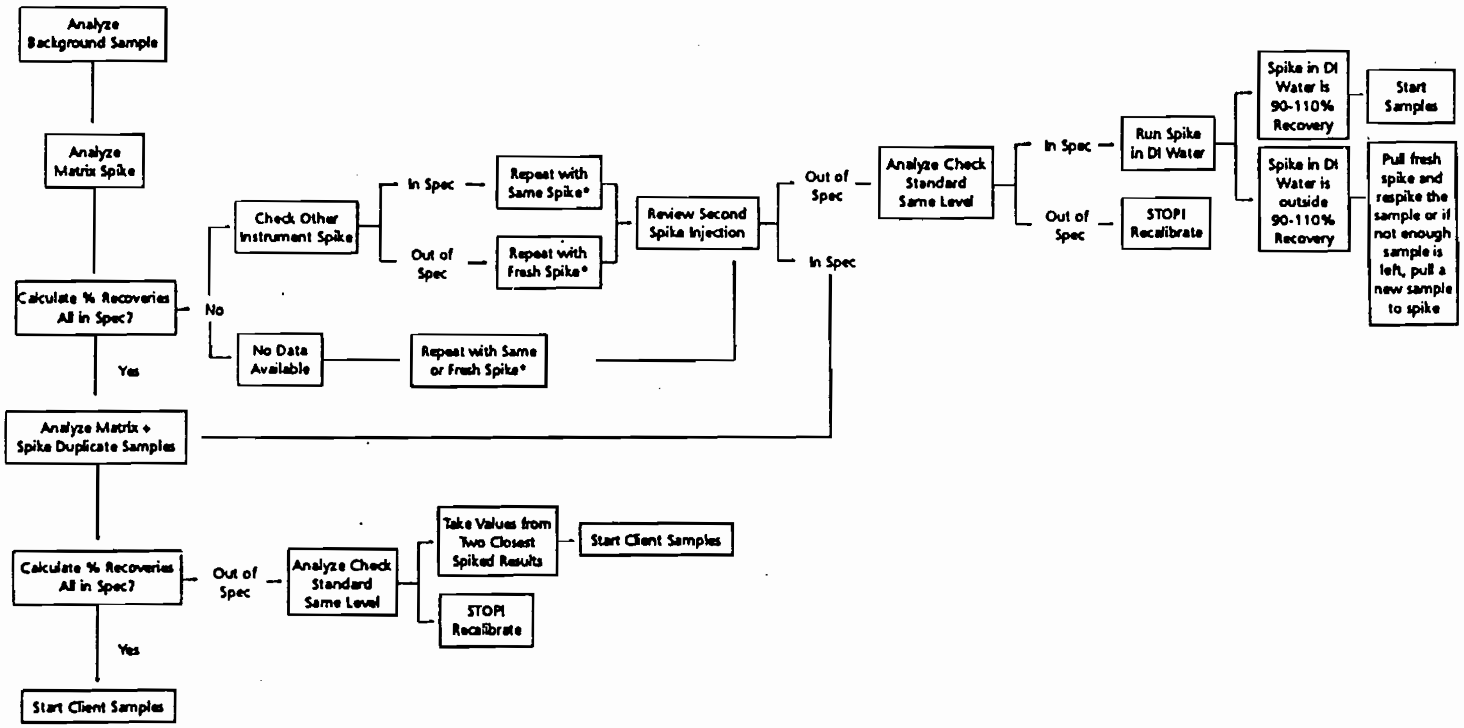
Type	Acceptance Limits (%) WATERS SOILS	Frequency	Corrective Action
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	See Table 11-9 for acceptance limits	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for all compounds	Every 8 to 10 hours	Reanalyze blank and associated samples if blank is outside limits

Accuracy is subject to change over time.

Table 11-10A
Volatiles by GC

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

Batch QC Protocol Flowchart

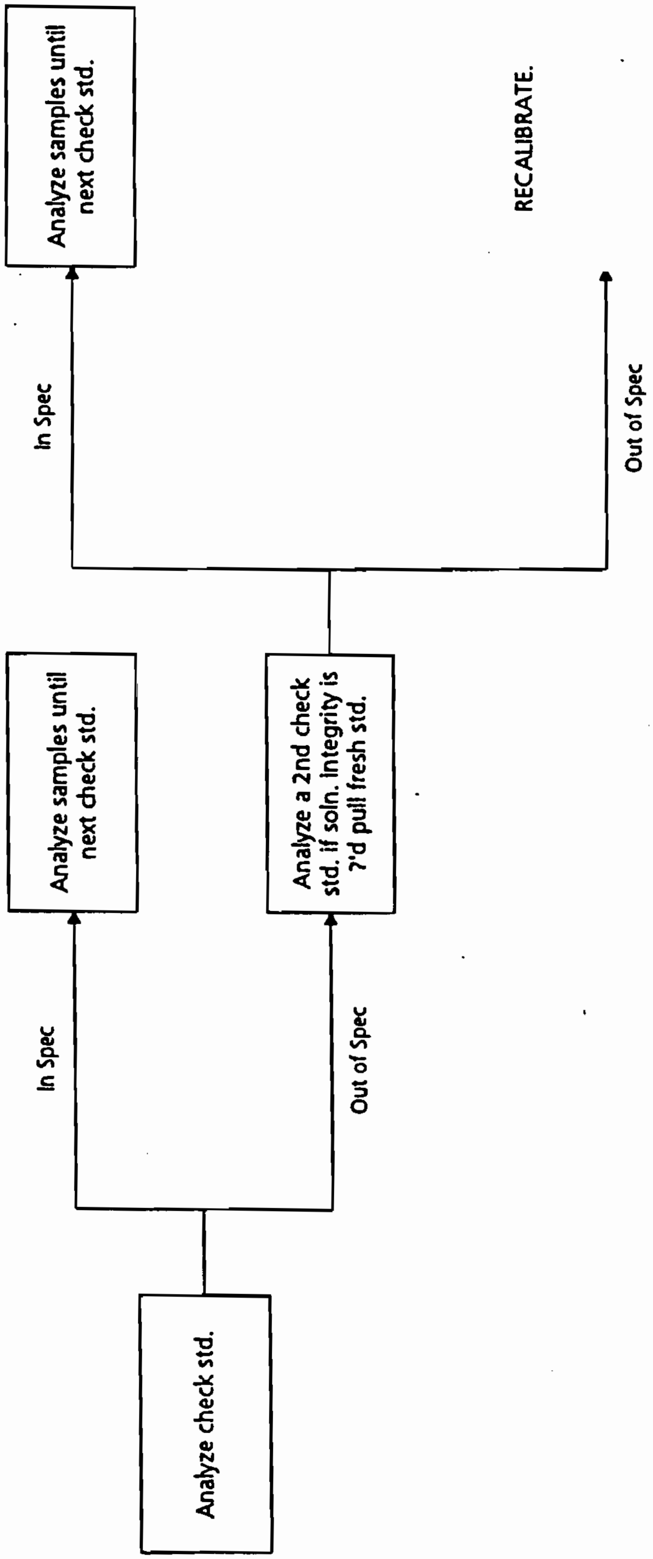


For data package groups with the background, spike, and spike dup. as independent LLI numbers, the 2nd injection of the spiked sample (*) should be from the matrix spike dup. vial. If the result of the 2 spikes match but are both out of spec. (values), run a check std. and a spike in deionized water. 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

Table 11-10B
Volatiles by GC

Check Std. Analysis Protocol Flowchart



Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

**Table 11-11
Quality Control
Volatiles by GC
Spike Acceptance Limits**

Compound Name	MS% Waters	MS% Soils	Max. % RPD Waters	Max. % RPD Soils	LCS%
Chloromethane	25 - 168	65 - 135	20	25	59.5 - 140.5
Bromomethane	46 - 136	65 - 135	20	25	58.5 - 141.5
Vinyl Chloride	48 - 163	65 - 135	20	25	68.5 - 131.5
Chloroethane	46 - 137	65 - 135	20	25	77.0 - 123.0
Methyl Chloride	78 - 128	70 - 130	20	25	77.5 - 122.5
Trichlorofluoromethane	75 - 143	70 - 130	20	25	66.5 - 133.5
1,1-Dichloroethene	74 - 137	70 - 130	15	20	63.0 - 137.0
1,1-Dichloroethane	91 - 130	70 - 130	15	20	84.0 - 116.0
1,2-Dichloroethene (cis/trans)	92 - 126	70 - 130	15	20	64.0 - 136.0
Chloroform	91 - 127	70 - 130	15	20	75.0 - 125.0
1,2-Dichloroethane	80 - 130	70 - 130	15	20	71.5 - 128.5
1,1,1-Trichloroethane	87 - 138	70 - 130	15	20	71.0 - 129.0
Carbon Tetrachloride	91 - 134	70 - 130	15	20	68.5 - 131.5
Bromodichloromethane	87 - 123	70 - 130	15	20	76.0 - 124.0
1,2-Dichloropropane	87 - 128	70 - 130	15	20	74.0 - 126.0
Trichloroethene	91 - 131	70 - 130	15	20	77.0 - 123.0
Dibromochloromethane	88 - 131	70 - 130	15	20	65.5 - 134.5
Bromoform	74 - 119	70 - 130	15	20	73.5 - 126.5
Tetrachloroethene	91 - 129	70 - 130	15	20	70.0 - 130.0
Chlorobenzene	90 - 125	70 - 130	15	20	72.0 - 128.0
Benzene (Hall)	93 - 124	70 - 130	15	20	77.0 - 123.0
Toluene (Hall)	92 - 120	70 - 130	15	20	77.5 - 122.5
Ethylbenzene (Hall)	94 - 119	70 - 130	15	20	63.0 - 137.0
o-Dichlorobenzene	84 - 114	70 - 130	15	20	68.0 - 132.0
m-Dichlorobenzene	85 - 116	70 - 130	15	20	72.5 - 127.5
p-Dichlorobenzene	82 - 113	70 - 130	15	20	69.5 - 130.5
o-Xylene	88 - 116	70 - 130	15	20	80.0 - 120.0
m-Xylene	87 - 117	70 - 130	15	20	80.0 - 120.0
p-Xylene	88 - 116	70 - 130	15	20	80.0 - 120.0
Benzene (PID)	86 - 118	70 - 130	15	20	77.0 - 123.0
Toluene (PID)	85 - 115	70 - 130	15	20	77.5 - 122.5
Ethylbenzene (PID)	88 - 116	70 - 130	15	20	63.0 - 137.0

Acceptance limits are based on statistical evaluation of compiled laboratory data and/or the referenced method and subject to change.

Table 11-12

Quality Control
PAHs by HPLC (8310)

Type	Acceptance Limits (%) WATERS	Acceptance Limits (%) SOILS	Frequency	Corrective Action
Surrogate: Nitrobenzene	60 - 120	50 - 120	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	Surrogate must be in spec unless matrix related problems are evident. If matrix related problems are evident, report results and comment in case narrative.
Matrix Spike: Spike all compounds of interest	See Table 11-13		Each group (≤20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Laboratory Control Sample: Spike all compounds of interest	See Table 11-13		Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits
Matrix Spike Duplicates (RPD): Spike all compounds of interest	≤30%	≤50%	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for all compounds		Once per case or extraction group (≤20) of samples, each matrix, level, instrument	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Table 11-13

Quality Control

PAHs by HPLC Spike Acceptance Limits

Compound Name	Matrix Spike and Laboratory Control Sample Limits	
	Waters (%)	Soils (%)
Naphthalene	64 - 120	62 - 120
Acenapthylene	70 - 120	68 - 120
Acenapthene	67 - 120	69 - 120
Fluorene	71 - 120	71 - 120
Phenanthrene	75 - 120	77 - 120
Anthracene	65 - 120	64 - 120
Fluoranthene	73 - 120	71 - 124
Pyrene	69 - 120	68 - 120
Benzo(a)anthracene	74 - 120	70 - 120
Chrysene	75 - 120	67 - 121
Benzo(b)fluoranthene	76 - 120	67 - 123
Benzo(k)fluoranthene	76 - 120	66 - 122
Benzo(a)pyrene	75 - 120	62 - 120
Dibenzo(a,h)anthracene	75 - 120	64 - 123
Benzo(g,h,i)perylene	71 - 120	54 - 122
Indeno(1,2,3-CD)pyrene	77 - 120	62 - 123

Acceptance limits are based on statistical evaluation of compiled laboratory data and are subject to change.

Table 11-14

Quality Control
TPH-DRO

Type	Acceptance Limits(%) WATERS	Acceptance Limits(%) SOILS	Frequency	Corrective Action
Surrogate:			Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	At least one surrogate must be in spec unless matrix related problems are evident. If matrix related problems are evident, report results and comment in case narrative.
Chlorobenzene	50 - 150	50 - 150		
o-Terphenyl	50 - 150	50 - 150		
Matrix Spike:			Each group (≤20) of samples per matrix/level	Reinject if surrogates appear low. If still out of spec, evaluate for matrix effect. If matrix effect, accept based on LCS data. If no matrix effect, repeat batch.
No. 2 Fuel:				
API California	60 - 120	60 - 120		
Laboratory Control Sample:			Each group ≤20	Reinject if surrogates appear low. If still out of spec, repeat batch.
No. 2 Fuel	60 - 120	60 - 120		
Laboratory Control Duplicates (RPD):			Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
No. 2 Fuel	≤20% for waters and soils			
Blanks:	≤LOQ for analyte		Once per case or extraction group (≤20) of samples, each matrix, level, instrument	Inject a solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected, if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be re-extracted.

Table 11-15

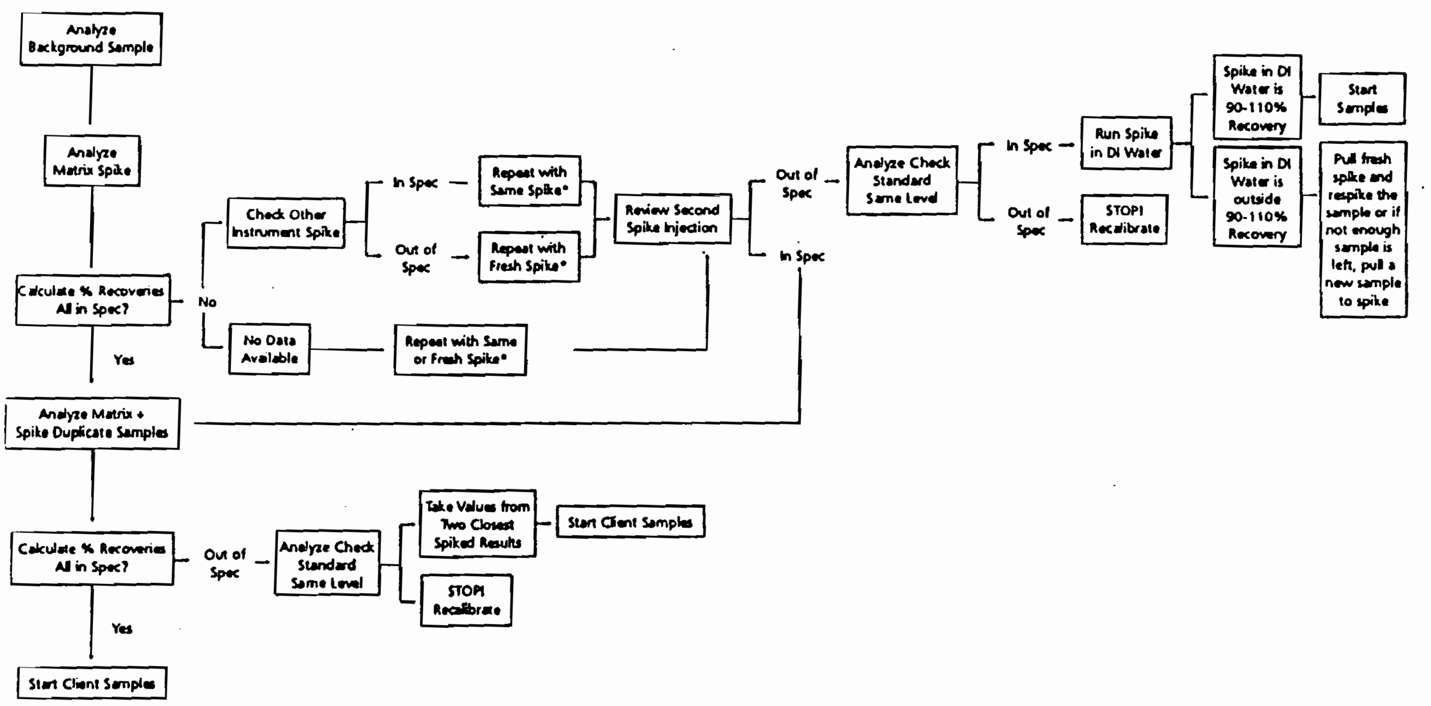
Quality Control
TPH-GRO

Type	Acceptance Limits(%) WATERS	SOILS	Frequency	Corrective Action
Surrogate:			Each sample, MS/MSD, and blank	Results would not be reported if the surrogate recovery is outside the limits unless matrix related problems are evident
n-propylbenzene (FID)	75 - 125	70 - 130		
trifluorotoluene (FID)	75 - 125	70 - 130		
Matrix Spike:			Each group of samples of similar matrix/level (≤20) each method	See Table 11-15A
Gasoline:				
API	50 - 100	50 - 100		
California	75 - 125	70 - 130		
Laboratory Control Sample/Check Standard:			Each group (≤20) when MS/MSD falls outside established limits	See Table 11-15B
2-methylpentane	85 - 115	85 - 115		
benzene/iso-octane	85 - 115	85 - 115		
n-heptane	85 - 115	85 - 115		
toluene	85 - 115	85 - 115		
ethylbenzene	85 - 115	85 - 115		
p/*m*-xylene	85 - 115	85 - 115		
o-xylene	85 - 115	85 - 115		
1,2,4-trimethylbenzene	85 - 115	85 - 115		
Matrix Spike Duplicate (RPD): Same compounds as matrix spikes	Maximum RPD 20%	Maximum RPD 25%	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	≤LOQ for analytes		Every 8 to 10 hours	Reanalyze blank and associated samples if blank is outside limits

Table 11-15A
Volatiles by GC and TPH-GRO

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

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 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

Table 11-15B
TPH-GRO

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

Check Std. Analysis Protocol Flowchart

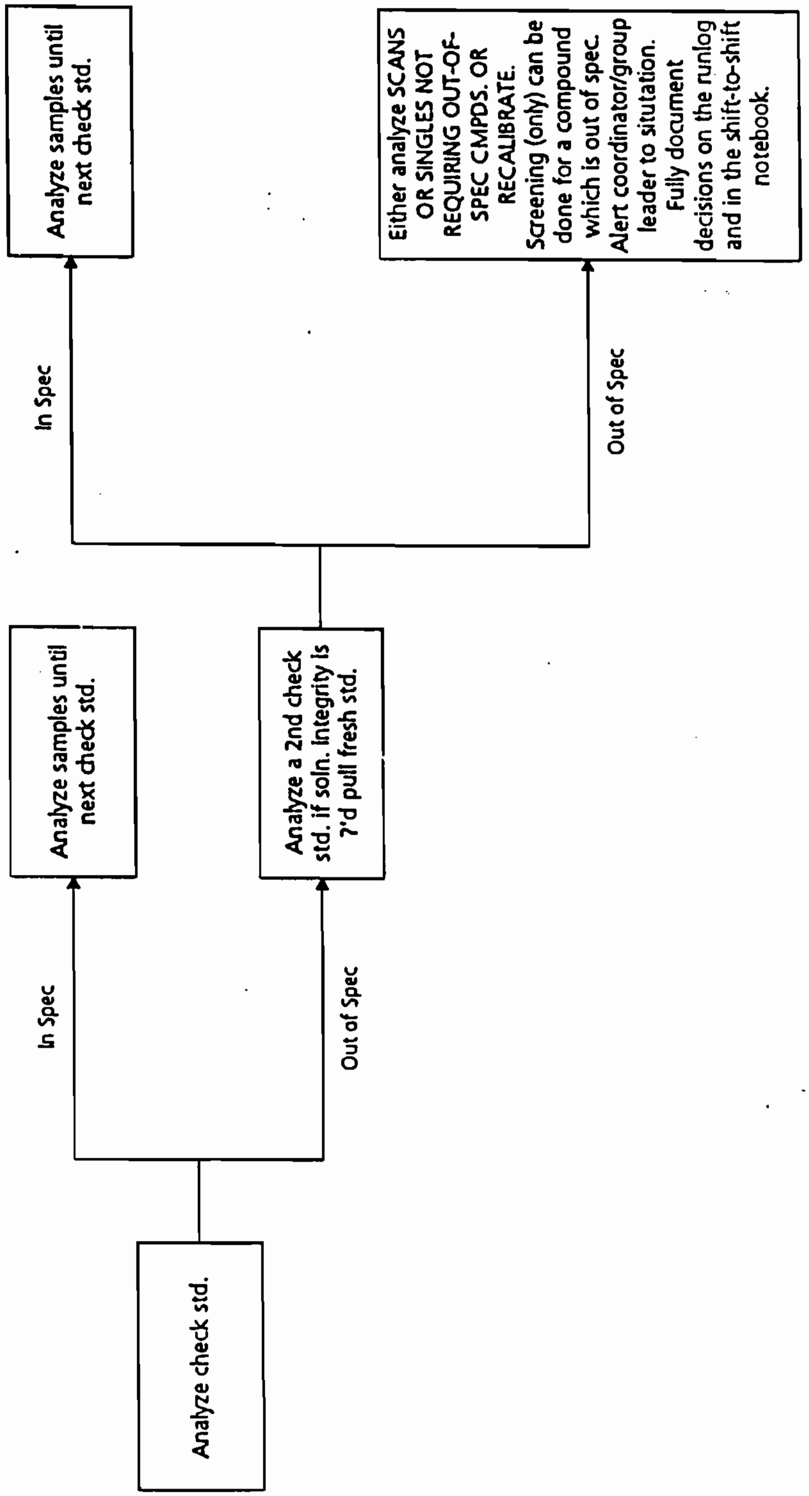


Table 11-16

Quality Control
Inorganics

Type	Acceptance Limits (%) WATERS SOILS	Frequency	Corrective Action
Matrix Spikes:	80% to 120% except where sample conc. exceeds spike conc. by ≥4x	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Same as above ±20% RPD	Each group of samples of similar matrix/level (20) each method	Analyze post-digestion spike sample if not already run for MS, flag the data
Duplicates (RPD):	±20% RPD for sample values ≥5x LOQ	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Blanks:			
Initial Calibration (ICB) Continuing Calibration (CCB)	≤LOQ	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)	Correct problem, recalibrate, and rerun
Preparation Blank	≤LOQ >LOQ then lowest conc. in sample must be 20x blk. conc.	Each SDG or batch (≤20 samples) Exception: As/Se by Hydride Generation ≤10 samples	Redigest and reanalyze blank and associated samples if sample result <20x blank result
Serial Dilutions (ICP & GFAA only):	Within ±10% of the original determination	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample (ICP only):	±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	Recalibrate the instrument

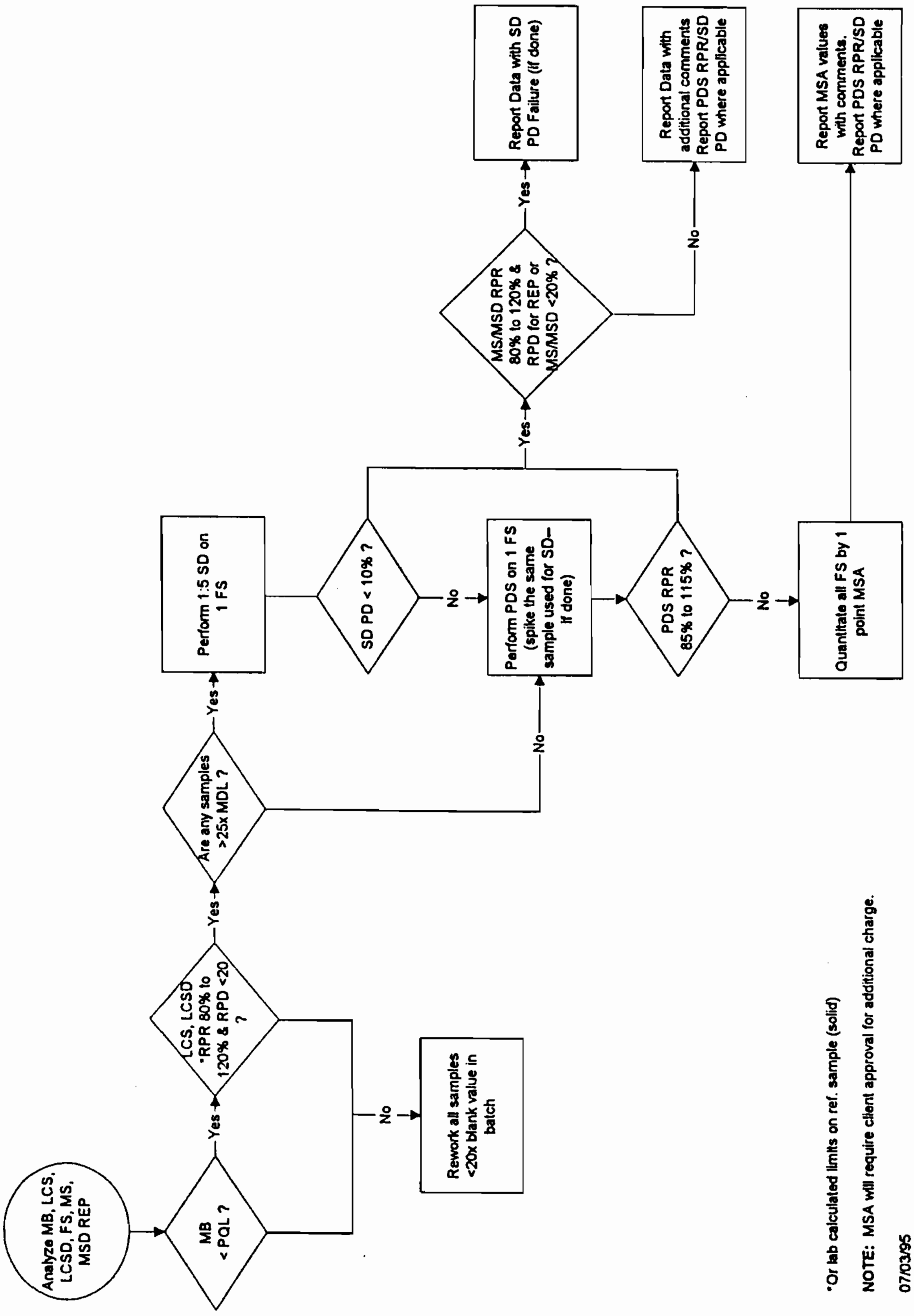
Table 11-16

Quality Control
Inorganics

Type	Acceptance Limits (%) WATERS SOILS	Frequency	Corrective Action
Laboratory Control Sample:	Aqueous 80% to 120% (except Ag and Sb) Solids commercial certified standard advisory range See Table 11-17	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples
Post Digestion Spike:	85% to 115%	When matrix spikes are outside 80% to 120% range (not performed on Hg or GFAA analyses)	Flag the data
Analytical Spike:	85% to 115%	One per 20 field samples	See Table 11-16A

Table 11-16A

SW846 Method 7000A GFAA
Batch QC Decision Tree



*Or lab calculated limits on ref. sample (solid)

NOTE: MSA will require client approval for additional charge.

07/03/95

Table 11-17

ENVIRONMENTAL
RESOURCE ASSOCIATES
ARVADA, COLORADO 1-800-372-0122

Certification

PriorityPollutnT™/CLP Inorganic Soils Quality Control Standards

Catalog N° PPS-46 Lot N° 229

Parameter	Certified Value	Performance Acceptance Limits™
TRACE METALS PriorityPollutnT™ (Catalog No 540)	mg/Kg	mg/Kg
aluminum	4590	2280 - 7590
antimony	39.8	8.37 - 119
arsenic	75.4	37.1 - 112
barium	106	74.3 - 139
beryllium	51.0	11.7 - 90.3
boron	94.1	26.9 - 161
cadmium	45.4	11.9 - 79.0
calcium	1290	875 - 1750
chromium	71.0	38.0 - 100
cobalt	49.6	29.6 - 70.5
copper	112	63.9 - 162
iron	9160	5560 - 13000
lead	53.5	28.1 - 75.9
magnesium	1160	691 - 1670
manganese	154	107 - 208
mercury	1.50	0.389 - 2.35
molybdenum	47.4	29.2 - 70.2
nickel	39.4	21.5 - 57.5
potassium	1420	880 - 1870
selenium	72.3	37.8 - 108
silver	116	58.2 - 170
sodium	198	111 - 287
strontium	109	46.3 - 173
thallium	40.0	20.0 - 60.0
tin	102	35.9 - 168
titanium	230	60.0 - 400
vanadium	65.9	32.0 - 88.9
zinc	134	72.2 - 199
CYANIDE PriorityPollutnT™ (Catalog No 541)	mg/Kg	mg/Kg
total cyanide	323	123 - 559

The ***Trace Metals Certified Values*** are equal to the mean recoveries for each parameter as determined in an interlaboratory round robin study. The standard was digested using Method 3050, SW-846 and the digest analyzed by ICP and atomic absorption spectroscopy.

The ***Cyanide Certified Value*** is equal to the mean recovery as determined in an interlaboratory round robin study. The standard was distilled and analyzed following the procedure outlined in Method 9010, SW-846.

The ***Performance Acceptance Limits (PALs™)*** are listed as guidelines for acceptable analytical results given the limitations of the USEPA methodologies commonly used to determine these parameters and closely approximate the 95% confidence interval. The PALs™ are based on data generated by your peer laboratories in ERA's InterLaB™ program using the same samples you are analyzing and data from USEPA methods, WP, WS and CLP interlaboratory studies. If your result falls outside of the PALs™, ERA recommends that you investigate potential sources of error in your preparation and/or analytical procedures. For further technical assistance, call ERA at 1-800-372-0122.

For users of internal standards, ERA has determined that scandium is present in this soil at 1.66 mg/Kg and that yttrium is present at 9.43 mg/Kg.

*Each lot of standards will have different certified values and the advisory range will be adjusted accordingly.

Table 11-18

Quality Control Acceptance Criteria

Parameter	Blank	Spike Recovery (%)	Duplicate RPD (%)	Lab Control Recovery
Phenols	<LOQ	75 - 125	≤20	80 - 120%
Total Petroleum Hydrocarbons	<LOQ	20.4 - 150.0	≤64.18	9.3 - 12.7 mg/L
TOC	<LOQ	75 - 125	≤20	80 - 120%
TOX	<LOQ	75 - 125	≤20	80 - 120%
Sulfide	<LOQ	88.2 - 99.2	≤20	80 - 120%

Corrective Action: If either the LCS or Blank are outside the criteria, the QC and associated samples will be reprepped and reanalyzed.

Maximum batch size is 20 field samples.

Acceptance limits are based on statistical evaluation of compiled laboratory data and/or the referenced method and subject to change.

12. Performance and System Audits

System audits are conducted on each department at Lancaster Laboratories 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.

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. QC samples from commercial suppliers are analyzed quarterly to assess laboratory accuracy including a double blind program. The Laboratory 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 Lancaster Labs for studies conducted by the USEPA and the New York Department of Health. Lancaster Labs has participated in the USEPA 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.

LANCASTER LABORATORIES
Account # 7176562301 ID # LANC
LANCASTER PA QCL

Report: PE004
Page: 1
Date: 06SEP96

Performance Evaluation Report
USEPA Water Supply Study WS037

Participant ID: PA00009 Type: OTHER Requesting Office: UT

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS PER LITER:					
001-ARSENIC	001	049.0	49.3	41.9- 56.3	Accept.
002-BARIUM	002	0771.	773	657- 889	Accept.
003-CADMIUM	001	010.2	10.2	8.16- 12.2	Accept.
004-CHROMIUM	001	071.5	72.9	62- 83.8	Accept.
005-LEAD	001	013.2	13.8	9.66- 17.9	Accept.
006-MERCURY	001	07.70	8.16	5.71- 10.6	Accept.
007-SELENIUM	001	051.3	57.9	46.3- 69.5	Accept.
091-COPPER	001	054.0	55.7	50.1- 61.3	Accept.
140-ANTIMONY	002	021.4	18.0	12.6- 23.4	Accept.
141-BERYLLIUM	001	03.27	4.26	3.62- 4.9	Not Accept.
142-NICKEL	001	055.9	55.0	46.8- 63.3	Accept.
143-THALLIUM	002	02.40	2.38	1.67- 3.09	Accept.
226-BORON	002	0953.	929	876- 1030	Accept.
236-MANGANESE	001	047.0	48.1	43- 51.4	Accept.
237-MOLYBDENUM	002	053.1	54.0	42.6- 65.4	Accept.
239-ZINC	001	0588.	600	536- 652	Accept.
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
009-NITRATE AS N	001	08.45	8.30	7.47- 9.13	Accept.
092-NITRITE AS N	001	0.493	0.502	0.427-0.577	Accept.
261-ORTHOPHOSPHATE AS P	001	01.11	1.10	0.957- 1.21	Accept.
INSECTICIDES IN MICROGRAMS PER LITER:					
011-ENDRIN	001	0.301	0.231	0.162- 0.3	Not Accept.

```
                                                                 Report: PE005
                          Performance Evaluation Report          Page:       3
                          USEPA Water Supply Study WS037         Date: 06SEP96

Participant ID: PA00009          Type: OTHER     Requesting Office: UT
-----------------------------------------------------------------------------
                 Sample     Reported    True       Acceptance      Performance
                 Number     Value       Value*      Limits          Evaluation
-----------------------------------------------------------------------------
012-LINDANE
                   001       0.353      0.381      0.21-0.552        Accept.
013-METHOXYCHLOR
                   001       015.5      18.5       10.2- 26.8        Accept.
014-TOXAPHENE
                   002       07.04      8.81       4.85- 12.0        Accept.
093-ALACHLOR
                   005       05.36      4.87       2.68- 7.06        Accept.
094-ATRAZINE
                   005       07.30      6.80       3.74- 9.06        Accept.
095-HEPTACHLOR
                   004       0.367      0.563      0.31-0.816        Accept.
096-HEPTACHLOR EPOXIDE
                   004       0.406      0.403      0.222-0.584       Accept.
097-CHLORDANE (TOTAL)
                   003       02.39      4.44       2.44- 6.44        Not Accept.
113-SIMAZINE
                   005       06.30      5.56       1.04- 9.77        Accept.
172-HEXACHLOROBENZENE
                   004       0.618      0.806      0.323- 1.14       Accept.
241-METOLACHLOR
                   006       021.7      19.4       7.87- 29.5        Accept.
242-METRIBUZIN
                   006       014.9      14.1       D.L.  - 22.4      Accept.
243-PROMETON
                   006       023.0      18.8       6.48- 28.3        Accept.
256-ALDRIN
                   004       0.433      0.567      0.186-0.725       Accept.
257-BUTACHLOR
                   006       022.3      20.5       5.93- 31.3        Accept.
258-DIELDRIN
                   004       0.554      0.530      0.358-0.708       Accept.
259-PROPACHLOR
                   004       01.16      1.20       0.566- 1.86       Accept.

   CARBAMATES IN MICROGRAMS PER LITER:
098-ALDICARB
                   001       036.4      34.3       24.3- 44.4        Accept.
099-ALDICARB SULFONE
                   001       034.1      32.[illegible]       28.7- 40.1        Accept.
100-ALDICARB SULFOXIDE
                   001       027.6      25.9       20.3-   33        Accept.
101-CARBOFURAN
                   001       042.4      48.9       26.9- 70.9        Accept.
114-OXAMYL (VYDATE)
                   001       044.0      46.4       36.3- 54.9        Accept.
```

```
                                                         Report: PE005
                     Performance Evaluation Report       Page:       1
                     USEPA Water Supply Study WS037      Date: 06SEP96

Participant ID: PA00009          Type: OTHER     Requesting Office: CT
------------------------------------------------------------------------
                Sample    Reported   True       Acceptance    Performance
                Number    Value      Value*     Limits        Evaluation
------------------------------------------------------------------------
245-METHOMYL
                 001      060.0      60.7      49.4- 68.4       Accept.

   HERBICIDES IN MICROGRAMS PER LITER:
015-2,4-D
                 001      013.0      14.9      7.45- 22.4       Accept.
016-2,4,5-TP (SILVEX)
                 001      09.53      11.0      5.9- 17.7        Accept.
102-PENTACHLOROPHENOL
                 001      05.07      6.59      3.3- 9.89        Accept.
115-DALAPON
                 002      047.1      56.4      D.L.  - 94.8     Accept.
116-DINOSEB
                 002      014.2      18.6      0.652- 29.6      Accept.
117-PICLORAM
                 002      017.9      23.3      D.L.  - 34.8     Accept.
247-DICAMBA
                 002      031.5      38.4      2.98- 58.7       Accept.

   POLYCHLORINATED BIPHENYLS IN MICROGRAMS PER LITER:
118-DECACHLOROBIPHENYL
                 001      0.305      0.527     D.L.  - 1.05     Accept.

   PAH'S IN MICROGRAMS PER LITER:
122-BENZO(A)PYRENE
                 001      0.754      0.937     0.115- 1.31      Accept.

   ADIPATE/PHTHALATES IN MICROGRAMS PER LITER:
134-DI (2-ETHYLHEXYL)ADIPATE
                 001      026.7      34.3      11.4- 52.3       Accept.
136-DI (2-ETHYLHEXYL)PHTHAL.
                 001      016.6      21.3      6.98- 34.5       Accept.

   MISCELLANEOUS SOC'S IN MICROGRAMS PER LITER:
137-DIQUAT
                 001      003.43     8.41      2.05- 22.4       Accept.
138-ENDOTHALL
                 001      098.6      179       12-   312        Accept.
139-GLYPHOSATE
                 001      0729.      780       630-   903       Accept.

   TRIHALOMETHANES IN MICROGRAMS PER LITER:
017-CHLOROFORM
                 001      024.1      22.3      17.8- 26.8       Accept.
018-BROMOFORM
                 001      018.9      18.6      14.9- 22.3       Accept.
```

```
                                                                  Report: PE005
                     Performance Evaluation Report                Page:       4
                     USEPA Water Supply Study WS037               Date: 06SEP96

Participant ID: PA00009          Type: OTHER     Requesting Office: 07
-----------------------------------------------------------------------------
                 Sample     Reported    True        Acceptance      Performance
                 Number     Value       Value*       Limits          Evaluation
-----------------------------------------------------------------------------
019-BROMODICHLOROMETHANE
                  001       012.2       12.7        10.2- 15.2        Accept.
020-CHLORODIBROMOMETHANE
                  001       015.3       14.2        11.4-   17        Accept.
021-TOTAL TRIHALOMETHANE
                  001       070.5       67.0        54.2- 81.4        Accept.

    VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:
032-VINYL CHLORIDE
                  001       015.5       14.8        8.88- 20.7        Accept.
034-1,1-DICHLOROETHYLENE
                  001       018.3       16.5        13.2- 19.8        Accept.
035-1,2-DICHLOROETHANE
                  001       015.9       13.2        10.6- 15.8        Not Accept.
036-1,1,1-TRICHLOROETHANE
                  001       011.9       10.3        8.24- 12.4        Accept.
037-CARBON TETRACHLORIDE
                  001       014.5       12.7        10.2- 15.2        Accept.
038-TRICHLOROETHYLENE
                  001       08.20       8.70        5.22- 12.2        Accept.
039-BENZENE
                  001       013.0       12.5        10-   15          Accept.
040-TETRACHLOROETHYLENE
                  002       010.1       9.60        5.76- 13.4        Accept.
041-1,4-DICHLOROBENZENE
                  001       06.65       7.31        4.39- 10.2        Accept.
042-T 1,2 DICHLOROETHYLENE
                  002       015.0       14.8        11.8- 17.8        Accept.
043-C 1,2 DICHLOROETHYLENE
                  002       011.4       9.72        5.83- 13.6        Accept.
044-1,2 DICHLOROPROPANE
                  002       015.4       14.2        11.4-   17        Accept.
045-1,2DIBROMO3CHLOROPROPANE
                  004       0.274       0.286       0.172-  0.4       Accept.
046-ETHYLENE DIBROMIDE (EDB)
                  004       0.151       0.138       0.0828-0.193      Accept.
047-TOLUENE
                  002       05.74       5.70        3.42- 7.98        Accept.
048-ETHYLBENZENE
                  002       09.40       9.19        5.51- 12.9        Accept.
049-CHLOROBENZENE
                  002       08.42       8.31        4.99- 11.6        Accept.
053-STYRENE
                  002       07.60       7.40        4.44- 10.4        Accept.
054-1,2 DICHLOROBENZENE
                  002       014.3       14.5        11.6- 17.4        Accept.
```

```
                                                               Report: PE005
                      Performance Evaluation Report            Page:       5
                      USEPA Water Supply Study WS037           Date: 05SEP96

Participant ID: PA00009         Type: OTHER      Requesting Office: UT
---------------------------------------------------------------------------
                  Sample      Reported    True       Acceptance      Performance
                  Number      Value       Value*     Limits          Evaluation
---------------------------------------------------------------------------
055-DICHLOROMETHANE
                  001         09.48       8.41       5.05- 11.8      Accept.
056-1,1-DICHLOROETHANE
                  003         014.8       13.6       11.2- 16.4      Accept.
061-1,1,2-TRICHLOROETHANE
                  001         011.8       10.7       8.56- 12.8      Accept.
063-1,1,1,2TETRACHLOROETHANE
                  003         017.0       15.3       12.8-    18     Accept.
064-1,2,3-TRICHLOROPROPANE
                  003         08.32       8.29       5.53-    11     Accept.
076-1,2,4-TRICHLOROBENZENE
                  002         014.7       14.3       11.4- 17.2      Accept.
077-1,2,3-TRICHLOROBENZENE
                  003         015.7       16.7       10.6- 21.2      Accept.
081-HEXACHLOROBUTADIENE
                  003         011.1       9.50       4.19- 14.4      Accept.
090-TOTAL XYLENES
                  002         015.3       12.9       10.3- 15.5      Accept.
152-C 1,3 DICHLOROPROPENE
                  003         010.9       12.3       8.22- 14.3      Accept.
153-T 1,3 DICHLOROPROPENE
                  003         016.4       17.5       11- 20.5        Accept.

   ORGANIC DISINFECTION BY-PRODUCTS IN MICROGRAMS PER LITER:
157-DIBROMOACETIC ACID
                  001         0.918       8.50       D.L.  - 13.8    Accept.
158-DICHLOROACETIC ACID
                  001         02.82       22.7       6.03- 30.3      Not Accept.
160-MONOBROMOACETIC ACID
                  001         02.74       14.4       1.26- 21.4      Accept.
161-MONOCHLOROACETIC ACID
                  001         01.80       12.8       3.43-    21     Not Accept.
162-TRICHLOROACETIC ACID
                  001         03.77       32.3       5.47- 47.9      Not Accept.
250-BROMOCHLOROACETIC ACID
                  001         02.36       19.8       3.19- 30.8      Not Accept.

   INORGANIC DISINFECTION BY-PRODUCTS IN MICROGRAMS PER LITER:
193-BROMATE
                  002         05.68       4.56       D.L.  -   29    Accept.
194-CHLORATE
                  001         092.1       82.1       62.1-  100      Accept.
195-CHLORITE
                  001         0165.       140        86.6-  213      Accept.
260-BROMIDE
                  002         0157.       140        113-  169       Accept.
```

```
                                                          Report: SE005
                       Performance Evaluation Report      Page:       6
                       USEPA Water Supply Study WS037     Date: 06SEP96

Participant ID: PA00009         Type: OTHER    Requesting Office: UT
-------------------------------------------------------------------------
              Sample    Reported    True       Acceptance      Performance
              Number    Value       Value*     Limits          Evaluation
-------------------------------------------------------------------------

   MISCELLANEOUS ANALYTES:
022-RESIDUAL FREE CHLORINE(MILLIGRAMS PER LITER)
               001      02.64       2.20       2.03- 3.07       Accept.
023-TURBIDITY(NTU'S)
               001      01.40       1.54       1.26- 1.98       Accept.
024-TOTAL FILTERABLE RESIDUE(MILLIGRAMS PER LITER)
               001      0254.       264        188-  434        Accept.
025-CALCIUM HARDNESS(MG. CACO3/L)
               001      0147.       144        137-  158        Accept.
026-PH-UNITS
               001      08.94       9.13       8.88- 9.31       Accept.
027-ALKALINITY(MG. CACO3/L)
               001      028.6       27.4       25.7- 31.5       Accept.
029-SODIUM(MILLIGRAMS PER LITER)
               001      012.9       12.6       11.4- 13.7       Accept.
145-SULFATE(MILLIGRAMS PER LITER)
               001      0263.       280        253-  316        Accept.
146-TOTAL CYANIDE(MILLIGRAMS PER LITER)
               001      0.337       0.380      0.285-0.475      Accept.
263-TOC
               001      03.46       2.80       2.49- 3.24       Not Accept.

********** END OF DATA FOR PA00009 **********
NOTE:  FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR PA00009 **********

-------------------------------------------------------------------------
* Based on gravimetric calculations, or a reference value when necessary.
```

```
                Performance Evaluation Report                    Page: 1
              USEPA Water Pollution Study WP035            Date: 16APR96

Participant ID: PA00000            Type: OTHER        Requesting Office: NJ
--------------------------------------------------------------------------
           Sample  Reported  True     Acceptance     Warning     Performance
           Number   Value    Value*     Limits        Limits      Evaluation
--------------------------------------------------------------------------

    TRACE METALS IN MICROGRAMS/LITER
001-ALUMINUM
             01      330      321     261-  382    276-  367    Accept.
             02     1370     1500    1270- 1700   1330- 1640    Accept.
002-ARSENIC
             01      192      193     167-  231    175-  223    Accept.
             02      569      571     492-  676    515-  653    Accept.
003-BERYLLIUM
             01      178      190     165-  209    170-  204    Accept.
             02      576      541     480-  597    495-  583    Accept.
004-CADMIUM
             01      50.4     52.6    44.5- 60.7   46.5- 58.7   Accept.
             02      388      401     345-  454    359-  440    Accept.
005-COBALT
             01      27.2     28.1    22.9- 32.6   24.1- 31.4   Accept.
             02      603      624     557-  686    574-  670    Accept.
006-CHROMIUM
             01      15.9     17.0    13- 20.5     13.9- 19.5   Accept.
             02      850      880     767-  905    794-  958    Accept.
007-COPPER
             01      83.2     86.7    75.5- 96.9   78.2- 94.2   Accept.
             02      358      370     330-  409    344-  399    Accept.
008-IRON
             01      41.0     30.4    18.8> 42.6   21.8- 39.6   Ck. for Err.
             02      457      464     441-  519    451-  509    Accept.
009-MERCURY
             01      3.36     3.10    2.03- 4.07   2.29- 3.81   Accept.
             02      12.4     11.6    8.65- 14.7   9.41- 13.9   Accept.
010-MANGANESE
             01      385      401     369-  441    378-  432    Accept.
             02      865      891     833-  960    850-  951    Accept.
011-NICKEL
             01      481      494     453-  560    466-  547    Accept.
             02      601      611     557-  690    574-  680    Accept.
012-LEAD
             01      282      297     259-  334    269-  325    Accept.
             02      395      399     356-  446    367-  435    Accept.
013-SELENIUM
             01      487      522     402-  615    429-  588    Accept.
             02      898      973     754- 1150    804- 1100    Accept.
014-VANADIUM
             01      202      211     186-  234    192-  228    Accept.
             02      786      811     724-  880    745-  867    Accept.
015-ZINC
             01      71.9     71.9    62.7- 80.9   65.5- 82.2   Accept.
             02     1730     1800    1610- 2030   1660- 1980    Accept.
```

Performance Evaluation Report Page: 2
USEPA Water Pollution Study WP035 Date: 16APR96

Participant ID: PA00009 Type: OTHER Requesting Office: NJ

	Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
016-ANTIMONY						
	03	349	370	240- 450	266- 422	Accept.
	04	551	570	369- 692	410- 651	Accept.
017-SILVER						
	03	176	180	153- 207	160- 200	Accept.
	04	337	340	298- 391	310- 380	Accept.
018-THALLIUM						
	03	80.0	83.3	63.4- 99.1	67.9- 94.6	Accept.
	04	358	365	301- 425	317- 410	Accept.
074-MOLYBDENUM						
	03	126	130	106- 151	112- 146	Accept.
	04	309	310	257- 358	270- 345	Accept.
075-STRONTIUM						
	03	3.5	3.55	2.56- 4.49	2.81- 4.23	Accept.
	04	94.0	96.0	79.8- 110	83.9- 105	Accept.
076-TITANIUM						
	03	115	115	96.8- 130	101- 126	Accept.
	04	272	270	230- 302	239- 293	Accept.
MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)						
019-PH-UNITS						
	03	4.30	4.30	4.22- 4.4	4.25- 4.38	Accept.
	04	5.57	5.50	5.46- 5.62	5.48- 5.6	Accept.
020-SPEC. COND.(UMHOS/CM AT 25 C)						
	01	907.	916	830- 983	849- 964	Accept.
	02	581.	586	536- 627	547- 616	Accept.
021-TDS AT 180 C						
	01	509.	553	326- 762	380- 708	Accept.
	02	314.	311	226- 398	248- 377	Accept.
022-TOTAL HARDNESS(AS CACO3)						
	01	309.	330	302- 358	309- 351	Accept.
	02	97.2	101	90.8- 110	93.2- 108	Accept.
023-CALCIUM						
	01	105	104	92.8- 120	96.2- 116	Accept.
	02	6.63	6.39	5.53- 7.54	5.79- 7.29	Accept.
024-MAGNESIUM						
	01	16.6	17.0	15.2- 19.3	15.7- 18.7	Accept.
	02	20.3	20.6	18- 23.6	18.7- 22.5	Accept.
025-SODIUM						
	01	14.9	14.7	13.1- 16.2	13.5- 15.8	Accept.
	02	52.5	54.1	49.3- 58.9	50.5- 57.7	Accept.
026-POTASSIUM						
	01	21.4	21.0	18.8- 23.7	19.4- 23.1	Accept.
	02	39.2	38.3	33.3- 41.7	34.3- 40.7	Accept.
027-TOTAL ALKALINITY(AS CACO3)						
	01	21.0	20.0	17.4- 25.1	18.3- 24.1	Accept.
	02	56.9	72.0	64.8- 78.6	66.5- 76.9	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WP035

Participant ID: PA00009   Type: OTHER   Requesting Office: NJ

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
028-CHLORIDE					
01	236.	241	220- 259	228- 250	Accept.
02	68.1	72.7	65.1- 79.8	67- 77.9	Accept.
029-FLUORIDE					
01	3.77	3.50	3.09- 3.8	3.18- 3.71	Ck. for Err.
02	1.39	1.35	1.16- 1.53	1.21- 1.48	Accept.
030-SULFATE					
01	16.9	18.0	13.8- 22.1	14.8- 21.1	Accept.
02	83.3	86.4	72- 97	75.1- 93.9	Accept.
NUTRIENTS IN MILLIGRAMS/LITER					
031-AMMONIA-NITROGEN					
01	19.4	19.0	15- 22.3	15.9- 21.5	Accept.
02	1.62	1.40	1.15- 2.00	1.26- 1.97	Accept.
032-NITRATE-NITROGEN					
01	9.25	8.31	6.76- 9.69	7.11- 9.34	Accept.
02	.340	0.390	0.20-0.495	0.305-0.469	Accept.
033-ORTHOPHOSPHATE					
01	.054	.0560	0.0333-0.076	0.0394-0.071	Accept.
02	2.88	2.90	2.43- 3.19	2.52- 3.1	Accept.
034-KJELDAHL-NITROGEN					
01	.632	0.540	0.115- 1.12	0.235-0.995	Accept.
02	9.38	7.90	5.73- 9.64	6.2- 9.17	Ck. for Err.
035-TOTAL PHOSPHORUS					
01	.590	0.570	0.47-0.705	0.498-0.677	Accept.
02	6.16	6.08	5.16- 7.2	5.41- 6.96	Accept.
DEMANDS IN MILLIGRAMS/LITER					
036-COD					
01	213.	236	189- 259	198- 250	Accept.
02	89.4	101	71.2- 120	77.3- 114	Accept.
037-TOC					
01	91.2	93.1	78.5- 108	82.4- 105	Accept.
02	39.2	40.1	31.6- 47.4	33.6- 45.3	Accept.
038-5-DAY BOD					
01	152.	141	64.1- 218	83.3- 199	Accept.
02	58.7	62.5	29.5- 95.5	37.7- 87.3	Accept.
102-CARBONACEOUS BOD					
01	167.	117	34.3- 199	55.6- 178	Accept.
02	65.4	51.6	20- 83.2	28.2- 75	Accept.
PCB'S IN MICROGRAMS/LITER					
042-PCB-AROCLOR 1232					
01	2.74	2.76	0.709- 4.3	1.17- 3.84	Accept.
044-PCB-AROCLOR 1248					
02	4.34	4.26	1.77- 6.04	2.3- 5.5	Accept.

```
                     Performance Evaluation Report                    Page: 4
                   USEPA Water Pollution Study WP035.          Date: 16APR96

Participant ID: PA00009              Type: OTHER        Requesting Office: NJ
---------------------------------------------------------------------------------
          Sample  Reported  True      Acceptance        Warning     Performance
          Number   Value    Value*      Limits           Limits      Evaluation
---------------------------------------------------------------------------------

    PCB'S IN OIL IN MILLIGRAMS/KILOGRAM
099-PCB IN OIL- 1016/1242
            01      31.1    42.3     6.88- 58.9     13.5- 52.3      Accept.
101-PCB IN OIL- 1260
            02      14.0    12.7     3.17- 20.4     5.37- 18.2      Accept.

    PESTICIDES IN MICROGRAMS/LITER
047-ALDRIN
            01      3.01    3.11     0.522- 5.23    1.12- 4.64      Accept.
            02      0.144   0.243    0.065-0.322    0.0977-0.289    Accept.
048-DIELDRIN
            01      4.39    4.51     2.62- 6.22     3.08- 5.76      Accept.
            02      1.63    1.62     0.858- 2.19    1.03- 2.02      Accept.
049-DDD
            01      6.10    5.67     3.14- 9.33     3.92- 8.55      Accept.
            02      1.87    1.94     1.21- 2.64     1.39- 2.46      Accept.
050-DDE
            01      3.60    3.76     2.14-  5.1     2.51- 4.73      Accept.
            02      1.35    1.42     0.72- 1.85     0.863- 1.71     Accept.
051-DDT
            01      6.61    6.46     3.79- 9.20     4.49- 8.59      Accept.
            02      1.63    1.76     0.865- 2.33    1.05- 2.14      Accept.
052-HEPTACHLOR
            01      2.41    2.95     0.694- 4.14    1.13- 3.71      Accept.
            02      0.232   0.278    0.0899-0.374   0.126-0.338     Accept.
053-CHLORDANE
            03      12.2    12.3     4.69- 17.2     6.27- 15.6      Accept.
            04      1.31    1.36     0.695- 1.81    0.835- 1.67     Accept.
078-HEPTACHLOR EPOXIDE
            01      1.80    2.20     1.13- 2.53     1.31- 2.35      Accept.
            02      0.230   0.244    0.153- 0.37    0.18-0.342      Accept.

    VOLATILE HALOCARBONS IN MICROGRAMS/LITER
054-1,2 DICHLOROETHANE
            01      65.9    56.3     39- 79.4       44.1- 74.4      Accept.
            02      11.4    12.2     8.5- 17.5      9.63- 16.4      Accept.
055-CHLOROFORM
            01      70.6    64.4     47.6- 83.2     52.1- 78.7      Accept.
            02      13.4    14.2     11- 18.4       11.9- 17.4      Accept.
056-1,1,1 TRICHLOROETHANE
            01      63.1    63.7     41- 85.7       46.6- 80.1      Accept.
            02      17.1    16.2     10.4- 22.2     11.9- 20.7      Accept.
057-TRICHLOROETHENE
            01      78.6    72.3     45.7-   93     51.6- 87.1      Accept.
            02      16.3    16.1     10.7- 20.6     11.9- 19.4      Accept.
058-CARBONTETRACHLORIDE
            01      29.7    29.0     16.5-   45     20- 41.4        Accept.
            02      10.4    9.16     5.61- 13.7     6.62- 12.7      Accept.
```

```
                     Performance Evaluation Report                      Page: 5
                   USEPA Water Pollution Study WP035               Date: 16APR96

Participant ID: PA00009                 Type: OTHER        Requesting Office: NJ
--------------------------------------------------------------------------------
          Sample   Reported   True      Acceptance        Warning      Performance
          Number    Value     Value*      Limits          Limits       Evaluation
--------------------------------------------------------------------------------
059-TETRACHLOROETHENE
            01       74.9     71.6     46.5- 96.3     52.7- 90.1       Accept.
            02       10.9     10.4     6.04- 14.5     7.1- 13.4        Accept.
060-BROMODICHLOROMETHANE
            01       60.2     55.6     37- 73.1       41.6- 68.6       Accept.
            02       14.3     14.6     10.2- 18.4     11.2- 17.3       Accept.
061-DIBROMOCHLOROMETHANE
            01       51.0     48.5     33.1- 63.4     37- 59.6         Accept.
            02       13.7     14.6     9.59- 18.9     10.7- 17.7       Accept.
062-BROMOFORM
            01       90.6     68.0     50.4- 95.3     56- 89.7         Accept.
            02       13.3     12.6     8.42- 17.3     9.53- 16.2       Accept.
063-METHYLENE CHLORIDE
            01       52.9     46.7     30.3- 64.1     34.6- 59.9       Accept.
            02       10.6     10.3     6.63- 14.7     7.65- 13.7       Accept.
064-CHLOROBENZENE
            01       76.4     69.1     46.5-   89     51.8- 83.7       Accept.
            02       17.9     17.7     11.7- 24.2     13.2- 22.6       Accept.

     VOLATILE AROMATICS IN MICROGRAMS/LITER
065-BENZENE
            01       56.9     55.9     40.7- 69.9     44.4- 66.2       Accept.
            02       9.25     9.30     6.56- 12.3     7.28- 11.6       Accept.
066-ETHYLBENZENE
            01       57.4     56.4     38.7- 73.3     43-   69         Accept.
            02       10.4     10.4     7.18- 13.6     7.99- 12.8       Accept.
067-TOLUENE
            01       44.6     44.7     30.9- 57.6     34.3- 54.2       Accept.
            02       7.49     7.60     5.29- 9.97     5.88- 9.38       Accept.
094-1,2-DICHLOROBENZENE
            01       49.3     53.0     40.7- 66.5     44- 63.2         Accept.
            02       11.9     11.7     7.82- 16.6     8.92- 15.5       Accept.
095-1,4-DICHLOROBENZENE
            01       47.8     48.3     33.3- 62.2     37- 58.5         Accept.
            02       13.1     13.4     9.37- 17.6     10.4- 16.6       Accept.
096-1,3-DICHLOROBENZENE
            01       37.1     42.7     30.4- 53.1     36.7- 50.7       Accept.
            02       11.1     12.6     8.8- 16.6      9.79- 15.6       Accept.

     MISCELLANEOUS PARAMETERS
071-TOTAL CYANIDE(IN MG/L)
            01       .022     .0301    0.0138-0.046   0.0179-0.042     Accept.
            02       .406     0.410    0.297-0.522    0.325-0.493      Accept.
072-NON-FILTERABLE RESIDUE(IN MG/L)
            01       94.6     80.0     61.9- 98.1     66.4- 93.6       Ck. for Err.
            02       46.0     56.0     42.7- 60.1     44.9- 57.9       Accept.
073-OIL AND GREASE(IN MG/L)
            01       53.4     46.0     29.5- 54.1     32.6-   51       Ck. for Err.
            02       21.5     18.9     12- 23.2       13.4- 21.8       Accept.
```

```
                    Performance Evaluation Report                     Page: 6
                  USEPA Water Pollution Study WP035              Date: 16APR96

Participant ID: PA00009              Type: OTHER        Requesting Office: NJ
-------------------------------------------------------------------------------
         Sample  Reported  True     Acceptance        Warning      Performance
         Number   Value    Value*     Limits           Limits      Evaluation
-------------------------------------------------------------------------------
C97-TOTAL PHENOLICS(IN MG/L)
           01       1.85    2.71    1.47- 3.96     1.79- 3.64      Accept.
           02       .811    1.19    0.519- 1.87    0.692-  1.7     Accept.
C98-TOTAL RESIDUAL CHLORINE(IN MG/L)
           01       3.30    2.80    2.54-  3.6     2.68- 3.46      Accept.
           02       .320    0.410   0.295-0.624    0.338-0.581     Ck. for Err.

********** END OF DATA FOR PA00009 **********
NOTE:  FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR PA00009 **********

-------------------------------------------------------------------------------
* Based on gravimetric calculations, or a reference value when necessary.
```

13. Preventive Maintenance

In order to ensure timely production of data, Lancaster Laboratories 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, Lancaster Labs 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
GC Volatiles	Check propanol level	Semiweekly or AN
	Check all flows	Prior to calib. or AN
	Conductivity detector maintenance:	AN
	Clean cell	AN
	Change reaction tube	AN
	Change Teflon line	AN
	Change resin	AN
	Replace trap	AN
	Column maintenance	AN
	Change PID lamp	AN
	Precalibration instrument settings check	Prior to each calibration
GC	Septum change	Each run
	Column maintenance	AN
	Clean detector	AN
	Vacuum filters	Semiannually
	Leak check ECDs	Semiannually
Flame AA and Hydride Generation AA	Rinse burner head, chamber and trap	AN: Min. 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 & drain	Daily
Cold Vapor AA	Change drying tube	Daily
	Replace pump tubing	AN: Min. weekly
	Lubricate pump head	Weekly
	Lubricate autosampler	Weekly
	Inspect optical cell and windows	Monthly
	Clean	AN
ICP	Clean torch	AN
	Clean nebulizer & spray chamber	AN
	Replace pump winding	Check Daily
	Lubricate autosampler	Check Daily
	Check mirror	Daily
	Checking tubing to torch	Daily
	Check fan filters, clean if needed	Weekly
	Check cool flow, clean if needed	Weekly
	Check water filter, replace if needed	Quarterly
Autoanalyzer	Clean sample probe	AN
	Clean proportioning pump	Weekly
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	Monthly
	Inspect condition of distillation head	Monthly

Table 13-1

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
Infrared Spectrometer (FTIR)	Check on-demand diagnostics	Quarterly
	Check wavenumber with polystyrene film	Quarterly
	Change dessicant	Quarterly
HPLC	Pump lubrication	Annually
	Check pump seals	Annually
	Check valves cleaned or rebuilt	AN
	Detector maintenance:	AN
	Bulb replacement and adjustment	
	Flow cell cleaning	
	Routine column maintenance	AN
	Replace Teflon lines	AN
	Autosampler septa replacement	AN
	In-line filter sonication/cleaning	AN
	System pasivation	AN
	PCRS pump lubrication	AN
Total Organic Carbon Analyzer	Check IR zero	AN
	Check for leaks	AN
	Check acid pump calib.	Bimonthly
	Check persulfate pump calibration	Bimonthly
	Inspect 6-port rotary valve	AN
	Inspect sample pump head	AN
	Wash molecular sieve	AN
	Check sample loop calibration	Monthly
	Clean gas permeation tube	AN
	Inspect digestion vessel O-rings	AN
	Check activated carbon scrubber	AN
	Dust back and clean circuit boards	AN
	Check IR cell	AN
Total Organic Halogen Analyzer	Polish counter electrode	Daily
	Polish sensor electrode	Biweekly
	Clean loaders and pistons	Biweekly
	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:

$$RPD = \frac{D_2 - D_1}{(D_1 + D_2)/2} \times 100$$

Where:

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:

$$\textit{Surrogate Recovery} = \frac{Qd}{Qa} \times 100$$

Where:

Qd = Quantity determined by analysis

Qa = Quantity added to sample

$$\textit{Matrix Spike Recovery} = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample results

SR = Sample results

SA = Spike added

$$\textit{Laboratory Control Sample Recovery} = \frac{\textit{LCS Found}}{\textit{LCS True}} \times 100$$

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, ≤20 samples). Refer to Section 11 for acceptance criteria for accuracy. 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.

Commercial 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 (i.e., 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.

$$Completeness = \frac{Number\ of\ valid\ measurements}{Total\ measurements\ needed} \times 100$$

Method Detection Limit - It is important to ascertain the limit of quantitation that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which limits of quantitation (LOQs) can be extrapolated.

MDL is defined as follows for all measurements:

Where:

$$MDL = t_{(n-1,1-a=0.99)} \times s$$

MDL = Method detection limit

s = Standard deviation of the replicate analyses

$t_{(n-1,1-a=0.99)}$ = Students' t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

Definitions:

<u>Method detection limit (MDL)</u> - The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. It is determined from analysis of a sample in a given matrix containing the analyte.

<u>Limit of quantitation (LOQ)</u> - The limit of quantitation is defined as the level above which quantitative results may be obtained with a specified degree of confidence. The EPA recommends setting quantitation limits at a value of 5× to 10× the MDL.

A list of MDLs and LOQs determined for each sample matrix type will be kept on file in the QA department. MDLs will be verified on an annual basis.

15. Corrective Action

Whenever any of the data generated falls outside of the established acceptance criteria outlined for instrument tune and calibration (Section 8) and internal QC (Section 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 QA Department will circulate all completed Investigation and Corrective Action forms to the appropriate manager.

The Quality Assurance Department is also responsible for conducting periodic audits which ensure compliance with laboratory SOPs 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. The QA Department will then issue a written report which summarizes the audit. The technical centers must respond in writing to the audit report within 30 days of report receipt. The response will address the corrective action that needs to be taken along with an expected completion date. Audit results and the corresponding response are communicated to laboratory personnel and management. Follow-up audits verify that proper corrective action has been taken for the identified discrepancy.

Lancaster Laboratories
2425 New Holland Pike • Lancaster, PA 17601-5994

No. ________________

Investigation and Corrective Action Report

Part I Description of problem

1. Date
2. LLI sample number(s) involved
3. Nature of problem (e.g., QA outlier, procedural deviation, client complaint, etc.)

4. ______________ Check if investigation must be complete before reporting further data to clients

Initiated by: ________________________

Part II (Attach separate sheet if needed)

1. Steps taken to investigate problem.

2. Explanation of probable cause of problem.

3. Steps taken to prevent future occurrence.

4. Besides the sample(s) listed above, would data sent to any clients be affected by this problem? If yes, explain.

5. Signed: ____________________________ Date: ________________

Return by: ________________________________

2064 Rev. 09/01/94

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 from 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

Data Package Content

- Title Page
- Sample Reference
- Table of Contents
- Chain of Custody
- Laboratory Chronicle
- Methodology/Reference Summary
- Laboratory Analysis Reports
- Per Parameter:
  - Case Narrative
  - Quality Control Summary
    - Tune[1]
    - Surrogate Recovery
    - Method Blank
    - Matrix Spike/Matrix Spike Duplicate
    - Duplicate[2]
    - Standard Addition[2]
    - Serial Dilution[2]
    - Laboratory Control Sample Recovery (if applicable)
    - Interference Check[2]
    - Internal Standard[1]
  - Sample Data
    - Sample Result Summary and LOQs
    - Sample Chromatograms
    - Quantitation Reports
    - Mass Spectra[1]
    - Library Searches[1] (if applicable)
    - Confirmatory Chromatogram[3]
    - Confirmatory Quantitation Report[3]
- Standards Data
  - Initial Calibration Summary Forms
  - Initial Calibration Data
  - Continuing Calibration Summary Forms
  - Continuing Calibration Data
  - Chromatograms and Quantitation Reports of Standards
  - Calibration Data for Confirmation Columns[3]
  - Calibration Curve (When quantitating against init. calib.)
  - ICAP Interference Table[2]

- Raw QC Data
  - BFB/DFTPP Spectra and Mass Listing[1]
  - Method Blank Chromatograms, Quantitation Reports,
    - Mass Spectra[1] (GC/MS)
  - Matrix Spike/Matrix Spike Duplicate Chromatograms and Quant.
  - Duplicate Data Printouts[2]
  - Standard Addition Data[2]
  - Serial Dilution Data[2]
  - Laboratory Control Sample (if applicable)
  - Copy of Instrument Run Log
- Extraction/Digestion Logs
- Gel Permeation Chromatography (GPC), if applicable
  - All Peaks Identified
  - % Resolution Calculations

[1] GC/MS only
[2] Inorganics only
[3] GC only (if applicable)

*Amount of documentation is dependent upon client request.

Lancaster Laboratories
Where quality is a science.

LLI Sample No. WW 2300873
Collected:

Submitted: 4/25/95 Reported: 6/14/95
Discard: 6/22/95

Volatile Halocarbons - 1
EPA WP 034

Account No: 00649
Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

P.O.
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
	Purgeable Halocarbons			
0711	Chloromethane	< 5.	5.	ug/l
0712	Bromomethane	< 5.	5.	ug/l
1590	Dichlorodifluoromethane	< 2.	2.	ug/l
0714	Vinyl chloride	< 1.	1.	ug/l
0715	Chloroethane	< 1.	1.	ug/l
0716	Methylene chloride	54.	1.	ug/l
1589	Trichlorofluoromethane	< 1.	1.	ug/l
0717	1,1-Dichloroethene	< 1.	1.	ug/l
0718	1,1-Dichloroethane	< 1.	1.	ug/l
0719	1,2-Dichloroethene (cis/trans)	< 1.	1.	ug/l
0720	Chloroform	57.	1.	ug/l
0721	1,2-Dichloroethane	64.	1.	ug/l
0722	1,1,1-Trichloroethane	50.	1.	ug/l
0723	Carbon tetrachloride	66.	1.	ug/l
0724	Dichlorobromomethane	62.	1.	ug/l
0725	1,2-Dichloropropane	< 1.	1.	ug/l
0726	trans-1,3-Dichloropropene	< 1.	1.	ug/l
0727	Trichloroethene	54.	1.	ug/l
0728	Dibromochloromethane	49.	1.	ug/l
0729	1,1,2-Trichloroethane	< 1.	1.	ug/l
0730	cis-1,3-Dichloropropene	< 1.	1.	ug/l
0713	2-Chloroethylvinyl ether	< 10.	10.	ug/l
0731	Bromoform	50.	2.	ug/l
0732	1,1,2,2-Tetrachloroethane	< 2.	2.	ug/l
0733	Tetrachloroethene	53.	1.	ug/l
0705	Chlorobenzene	54.	1.	ug/l

Under the analytical conditions of EPA methods 601 and 8010B, the cis and trans isomers of 1,2-dichloroethene coelute and cannot be distinguished from one another. The result reported above represents the total for both isomers.

Questions? Contact your Client Services Representative
Kimberly A. Zeeman at (717) 656-2300

Respectfully Submitted
Judy A. Colello, B.S.
Group Leader

MEMBER
ACIL

Lancaster Laboratories
Where quality is a science.

LLI Sample No. WW 2300869
Collected:

Submitted: 4/25/95 Reported: 6/14/95
Discard: 6/22/95

Pesticides - 1
EPA WP 034

Account No: 00649
Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

P.O.
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
	PPL Pesticides in Water			
1600	Alpha BHC	< 0.1	0.1	ug/l
1601	Beta BHC	< 0.1	0.1	ug/l
1602	Gamma BHC - Lindane	< 0.1	0.1	ug/l
1603	Delta BHC	< 0.1	0.1	ug/l
1604	Heptachlor	2.0	0.1	ug/l
1605	Aldrin	1.5	0.1	ug/l
1606	Heptachlor Epoxide	1.9	0.1	ug/l
1607	DDE	2.6	0.1	ug/l
1608	DDD	3.9	0.1	ug/l
1609	DDT	2.9	0.1	ug/l
1610	Dieldrin	4.7	0.1	ug/l
1611	Endrin	< 0.1	0.1	ug/l
1860	Methoxychlor	< 0.5	0.5	ug/l
1612	Chlordane	< 3.	3.	ug/l
1613	Toxaphene	< 40.	40.	ug/l
1616	Endosulfan I	< 0.1	0.1	ug/l
1615	Endosulfan II	< 0.1	0.1	ug/l
1617	Endosulfan Sulfate	< 0.3	0.3	ug/l
1618	Endrin Aldehyde	< 1.	1.	ug/l
1619	PCB-1016	< 10.	10.	ug/l
1620	PCB-1221	< 10.	10.	ug/l
1621	PCB-1232	< 10.	10.	ug/l
1622	PCB-1242	< 10.	10.	ug/l
1623	PCB-1248	< 10.	10.	ug/l
1624	PCB-1254	< 10.	10.	ug/l
1626	PCB-1260	< 10.	10.	ug/l

Questions? Contact your Client Services Representative
Kimberly A. Zeeman at (717) 656-2300

Respectfully Submitted
Jenifer E. Hess, B.S.
Group Leader Pesticides/PCBs

Analysis Repor

Lancaster Laboratories
Where quality is a science.

Page: 1 of 1

LLI Sample No. WW 2300851
Collected:

Submitted: 4/25/95 Reported: 6/14/95
Discard: 6/22/95

Trace Metals - 1
EPA WP 034

Account No: 00649
Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

P.O.
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
1743	Aluminum	0.96	0.20	mg/l
1747	Beryllium	0.012	0.010	mg/l
1749	Cadmium	0.013	0.010	mg/l
1751	Chromium	0.095	0.030	mg/l
1752	Cobalt	0.129	0.050	mg/l
1753	Copper	0.049	0.025	mg/l
1754	Iron	0.65	0.10	mg/l
1755	Lead	0.19	0.10	mg/l
1758	Manganese	0.292	0.010	mg/l
1761	Nickel	0.083	0.050	mg/l
1771	Vanadium	5.21	0.015	mg/l
1772	Zinc	0.446	0.020	mg/l
0243	Aluminum	1.02	0.20	mg/l
0245	Arsenic	0.118	0.0020	mg/l
0247	Beryllium	0.013	0.010	mg/l
0249	Cadmium	0.014	0.010	mg/l
0251	Chromium	0.090	0.030	mg/l
0253	Copper	0.050	0.025	mg/l
0254	Iron	0.59	0.10	mg/l
0255	Lead	0.191	0.050	mg/l
0258	Manganese	0.267	0.010	mg/l
0259	Mercury	0.00143	0.00020	mg/l
0261	Nickel	0.081	0.050	mg/l
0264	Selenium	0.194	0.0020	mg/l
0272	Zinc	0.454	0.025	mg/l

1 COPY TO Susan Shorter

Questions? Contact your Client Services Representative
Kimberly A. Zeeman at (717) 656-2300
03:31:03 D 0001 36 0 0 463245
044 15.00 00040800 ASR000

Respectfully Submitted
Ramona V. Layman, Group Leader
ICP Metals/Leachates

MEMBER ACIL

Analysis Report

Lancaster Laboratories
Where quality is a science.

Page: 1 of 1

LLI Sample No. WW 2300863
Collected:

Submitted: 4/25/95 Reported: 6/14/95
Discard: 6/22/95

Demand - 1
EPA WP 034

Account No: 00649
Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994

P.O.
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
0273	Total Organic Carbon	19.	1.	mg/l
	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 "non-purgeable TOC".			
0235	Biochemical Oxygen Demand	29.	2.	mg/l
1364	Carbonaceous BOD	31.	2.	mg/l
1553	Chemical Oxygen Demand	45.	7.	mg/l

1 COPY TO Susan Shorter

Questions? Contact your Client Services Representative
Kimberly A. Zeeman at (717) 656-2300
03:32:57 D 0001 36 0 0 463245
044 0.00 00012600 ASR000

Respectfully Submitted
Ramona V. Layman, Group Leader
ICP Metals/Leachates

MEMBER ACIL

See reverse side for explanation of symbols and abbreviations.

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: >JULT1 BFB Injection Date: 06/21/95

Instrument ID: HP03047 BFB Injection Time: 00:40

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	19.7
75	30.0 - 60.0% of mass 95	49.1
95	Base peak, 100% relative abundance	100.
96	5.0 - 9.0% of mass 95	5.7
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	Greater than 50.0% of mass 95	70.6
175	5.0 - 9.0% of mass 174	4.9 (6.9)1
176	Greater than 95.0%, but less than 101.0% of mass 174	68.8 (97.5)1
177	5.0 - 9.0% of mass 176	3.7 (5.4)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	VSTD300	300 PPB IC	>JULI1	06/21/95	00:59
02	VSTD050	050 PPB IC	>JULI3	06/21/95	02:06
03	VSTD020	020 PPB IC	>JULI4	06/21/95	02:40
04	VSTD004	004 PPB IC	>JULI5	06/21/95	03:15
05	VSTD100	100 PPB IC	>JULI7	06/21/95	06:19
06	VBLKJ94	VBLKJ94	>JULB3	06/21/95	08:57
07	EXBLKB	2328390	>JUL01	06/21/95	09:44
08	28152	2328152	>JUL02	06/21/95	10:29
09	28152MS	2328152	>JUL03	06/21/95	11:04
10	EXBLKC	2330209	>JUL04	06/21/95	11:39
11	6CYZH	2328898	>JUL05	06/21/95	12:14
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

2A

Lab Name: LANCASTER LABS SDG No:

	EPA SAMPLE NO.	S1 (DCE) #	S2 (TOL) #	S3 (BFB) #	OTHER	TOT OUT
01	62295	101	97	93		
02	04-06	99	98	94		
03						
04	LAB QC					
05	VBLKJ06	103	99	93		
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

				QC LIMITS
S1	(DCA)	=	1,2-Dichloroethane-d4	76 - 114
S2	(TOL)	=	Toluene-d8	88 - 110
S3	(BFB)	=	4-Bromofluorobenzene	86 - 115

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

4A
VOLATILE METHOD BLANK SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >JUQB1 Lab Sample ID: VBLKJ99

Date Analyzed: 06/26/95 Time Analyzed: 08:48

Matrix: (soil/water) WATER Level:(low/med) LOW

Instrument ID: HP03047

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01	EWTB3	2332787	>JUQ01	09:42
02	LEW-3	2332786	>JUQ02	10:25
03	DC-2-	2332785	>JUQ03	11:07
04	UT001	2332790	>JUQ04	11:59
05	GMMW1	2333870	>JUQ05	12:41
06	GMMW1MS	2333870	>JUQ06	13:40
07	GMMW1MSD	2333870	>JUQ07	14:15
08	GMMW2	2333871	>JUQ08	14:50
09	GMMW4	2333872	>JUQ09	15:25
10	GMMW5	2333873	>JUQ10	16:00
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

COMMENTS: ______________________________.
______________________________.

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLKJ99

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: VBLKJ99

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: >JUQB1

Level: (low/med) LOW Date Received: _____.

% Moisture: not dec. _____ Date Analyzed: 06/26/95

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO. COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8---------Dichlorodifluoromethane	5	U
74-87-3---------Chloromethane	5	U
75-01-4---------Vinyl Chloride	5	U
74-83-9---------Bromomethane	5	U
75-00-3---------Chloroethane	5	U
75-69-4---------Trichlorofluoromethane	5	U
60-29-7---------Ethyl Ether	5	U
107-02-8--------Acrolein	100	U
75-35-4---------1,1-Dichloroethene	5	U
76-13-1---------Freon 113	7	J
67-64-1---------Acetone	20	U
74-88-4---------Methyl Iodide	5	U
75-15-0---------Carbon Disulfide	5	U
107-05-1--------Allyl Chloride	5	U
75-09-2---------Methylene Chloride	5	U
75-65-0---------t-Butyl Alcohol	100	U
107-13-1--------Acrylonitrile	50	U
1634-04-4-------Methyl t-Butyl Ether	5	U
156-60-5--------trans-1,2-Dichloroethene	5	U
75-34-3---------1,1-Dichloroethane	5	U
156-59-2--------cis-1,2-Dichloroethene	5	U
107-12-0--------Propionitrile	100	U
141-78-6--------Ethyl Acetate	5	U
126-98-7--------Methacrylonitrile	50	U
109-99-9--------Tetrahydrofuran	5	U
67-66-3---------Chloroform	5	U
110-82-7--------Cyclohexane	5	U
107-06-2--------1,2-Dichloroethane	5	U
108-05-4--------Vinyl Acetate	10	U
78-93-3---------2-Butanone	10	U
71-55-6---------1,1,1-Trichloroethane	5	U
56-23-5---------Carbon Tetrachloride	5	U
78-83-1---------Isobutyl Alcohol	250	U
71-43-2---------Benzene	5	U
79-01-6---------Trichloroethene	5	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLKJ99

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: VBLKJ99

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: >JUQB1

Level: (low/med) LOW Date Received: _____.

% Moisture: not dec. _____ Date Analyzed: 06/26/95

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
78-87-5	1,2-Dichloropropane	5	U
80-62-6	Methyl Methacrylate	5	U
74-95-3	Dibromomethane	5	U
123-91-1	1,4-Dioxane	250	U
109-60-4	n-Propyl Acetate	5	U
75-27-4	Bromodichloromethane	5	U
79-46-9	2-Nitropropane	10	U
110-75-8	2-Chloroethyl Vinyl Ether	10	U
10061-01-5	cis-1,3-Dichloropropene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
79-00-5	1,1,2-Trichloroethane	5	U
124-48-1	Dibromochloromethane	5	U
75-25-2	Bromoform	5	U
110-57-6	trans-1,4-Dichloro-2-Butene	50	U
108-10-1	4-Methyl-2-Pentanone	10	U
108-88-3	Toluene	5	U
97-63-2	Ethyl Methacrylate	5	U
127-18-4	Tetrachloroethene	5	U
591-78-6	2-Hexanone	10	U
106-93-4	1,2-Dibromoethane	5	U
108-90-7	Chlorobenzene	5	U
630-20-6	1,1,1,2-Tetrachloroethane	5	U
100-41-4	Ethylbenzene	5	U
123-92-2	Isoamyl Acetate	5	U
1330-20-7	Xylene (total)	5	U
100-42-5	Styrene	5	U
98-82-8	Cumene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
96-18-4	1,2,3-Trichloropropane	5	U
76-01-7	Pentachloroethane	5	U
541-73-1	1,3-Dichlorobenzene	5	U
106-46-7	1,4-Dichlorobenzene	5	U
95-50-1	1,2-Dichlorobenzene	5	U
96-12-8	1,2-Dibromo-3-Chloropropane	5	U

Lancaster Laboratories, Inc.
GC/MS Volatiles Matrix Spike/Spike Duplicate Recoveries

Unspiked: ^JUQ05
GMMW1 2333870
Method: 1508
Instrument: HP03047

Matrix spike: ^JUQ06
GMMW1MS 2333870
Matrix/Level: WL
Dilution Factor: 1.0

Spike Duplicate: ^JUQ07
GMMW1MSD 2333870
Batch: J951771AA

COMPOUND NAME	SPIKE LEVEL	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
Dichlorodifluoromethane	20.00	0.00	18.84	19.92	94	100	-6	24-157	YES
Chloromethane	20.00	0.00	20.27	20.45	101	102	-1	1-273	YES
Vinyl Chloride	20.00	0.00	22.13	21.66	111	108	3	1-251	YES
Bromomethane	20.00	0.00	21.95	22.66	110	113	-3	1-242	YES
Chloroethane	20.00	0.00	22.52	22.22	113	111	2	14-230	YES
Trichlorofluoromethane	20.00	0.00	17.28	18.16	86	91	-6	17-181	YES
Ethyl Ether	20.00	0.00	19.96	20.88	100	104	-4	67-123	YES
Acrolein	150.00	0.00	129.60	119.77	86	80	7	22-169	YES
1,1-Dichloroethene	20.00	0.00	26.38	27.07	132	135	-2	1-234	YES
Freon 113	20.00	3.03	24.88	26.04	109	115	-5	72-174	YES
Acetone	150.00	21.19	137.78	133.39	78	75	4	19-150	YES
Methyl Iodide	20.00	0.00	22.66	23.01	113	115	-2	45-130	YES
Carbon Disulfide	150.00	0.00	179.79	182.59	120	122	-2	29-183	YES
Allyl Chloride	20.00	0.00	23.97	24.34	120	122	-2	55-142	YES
Methylene Chloride	20.00	5.10	23.97	23.72	94	93	1	1-221	YES
t-Butyl Alcohol	200.00	0.00	178.87	192.71	89	96	-8	25-195	YES
Acrylonitrile	150.00	0.00	135.09	140.29	90	94	-4	51-138	YES
Methyl t-Butyl Ether	20.00	0.00	18.58	20.50	93	102	-9	80-123	YES
trans-1,2-Dichloroethene	20.00	0.00	24.33	24.93	122	125	-2	54-156	YES
1,1-Dichloroethane	20.00	4.57	28.27	29.94	118	127	-7	59-155	YES
cis-1,2-Dichloroethene	20.00	0.00	22.64	22.70	113	114	-1	54-156	YES
Propionitrile	150.00	0.00	122.65	133.30	82	89	-8	56-139	YES
Ethyl Acetate	80.00	0.00	69.23	75.41	86	94	-9	69-147	YES
Methacrylonitrile	150.00	0.00	135.11	143.43	90	96	-6	69-128	YES
Tetrahydrofuran	20.00	0.00	19.55	20.18	98	101	-3	30-200	YES
Chloroform	20.00	0.00	23.77	24.97	119	125	-5	51-138	YES
Cyclohexane	20.00	0.00	23.79	24.66	119	123	-3	30-200	YES
1,2-Dichloroethane	20.00	0.00	22.28	23.63	111	118	-6	49-155	YES
Vinyl Acetate	100.00	0.00	89.38	85.97	89	86	3	19-190	YES
2-Butanone	150.00	7.21	135.81	142.99	86	90	-4	22-167	YES
1,1,1-Trichloroethane	20.00	0.00	24.49	25.45	122	127	-4	52-162	YES
Carbon Tetrachloride	20.00	0.00	25.45	27.23	127	136	-7	70-140	YES
Isobutyl Alcohol	500.00	0.00	374.01	407.06	75	81	-8	1-234	YES
Benzene	20.00	0.00	22.75	22.65	114	113	1	37-151	YES
Trichloroethene	20.00	0.00	22.67	22.92	113	114	-1	71-157	YES

N/C = Could not calculate

Lab Chronicle: ____________________ Ent. by ________

____________________ Ver. by ________

____

* %RPD for this compound exceeds method specified limit.

Lancaster Laboratories, Inc.
GC/MS Volatiles Matrix Spike/Spike Duplicate Recoveries

Unspiked: ^JUQ05	Matrix spike: ^JUQ06	Spike Duplicate: ^JUQ07
GMMW1 2333870	GMMW1MS 2333870	GMMW1MSD 2333870
Method: 1508	Matrix/Level: WL	Batch: J951771AA
Instrument: HP03047	Dilution Factor: 1.0	

COMPOUND NAME	SPIKE LEVEL	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
1,2-Dichloropropane	20.00	0.00	22.82	23.40	114	117	-2	1-210	YES
Methyl Methacrylate	20.00	0.00	18.24	18.58	91	93	-2	66-131	YES
Dibromomethane	20.00	0.00	19.52	20.66	98	103	-5	76-136	YES
1,4-Dioxane	500.00	0.00	363.11	407.32	73	81	-10	3-164	YES
n-Propyl Acetate	20.00	0.00	16.51	18.29	82	91	-10	30-200	YES
Bromodichloromethane	20.00	0.00	23.20	23.61	116	118	-2	35-155	YES
2-Nitropropane	20.00	0.00	19.62	19.34	98	97	1	54-106	YES
2-Chloroethyl Vinyl Ether	20.00	0.00	0.00	0.00	0	0	N/C	1-305	NO
cis-1,3-Dichloropropene	20.00	0.00	21.33	21.61	107	108	-1	1-227	YES
trans-1,3-Dichloropropene	7.60	0.00	7.81	7.91	103	104	-1	17-183	YES
1,1,2-Trichloroethane	20.00	0.00	20.73	21.51	104	108	-4	52-150	YES
Dibromochloromethane	20.00	0.00	20.73	21.57	104	108	-4	53-149	YES
romoform	20.00	0.00	18.91	19.54	94	98	-4	45-169	YES
trans-1,4-Dichloro-2-Buten	150.00	0.00	137.87	146.43	92	98	-6	56-141	YES
4-Methyl-2-Pentanone	100.00	0.00	81.54	88.86	82	89	-8	50-124	YES
oluene	20.00	0.00	24.10	23.04	120	115	4	47-150	YES
thyl Methacrylate	20.00	0.00	18.52	18.76	93	94	-1	68-270	YES
Tetrachloroethene	20.00	1.67	25.38	26.06	118	122	-3	64-148	YES
2-Hexanone	100.00	0.00	81.79	87.59	82	88	-7	52-140	YES
,2-Dibromoethane	20.00	0.00	19.14	19.13	96	96	0	45-135	YES
Chlorobenzene	20.00	0.00	22.78	22.86	114	114	0	37-160	YES
1,1,1,2-Tetrachloroethane	20.00	0.00	21.00	21.78	105	109	-4	23-149	YES
thylbenzene	20.00	0.00	22.73	22.63	114	113	1	37-162	YES
soamyl Acetate	20.00	0.00	17.59	17.97	88	90	-2	30-200	YES
Xylene (total)	60.00	0.00	68.82	68.72	115	114	1	61-165	YES
Styrene	20.00	0.00	22.75	22.79	114	114	0	74-136	YES
umene	20.00	0.00	21.34	22.60	107	113	-5	30-200	YES
1,2,2-Tetrachloroethane	20.00	0.00	19.21	18.91	96	94	2	46-157	YES
1,2,3-Trichloropropane	20.00	0.00	17.75	18.23	89	91	-2	72-125	YES
Pentachloroethane	20.00	0.00	18.69	19.80	93	99	-6	56-132	YES
,3-Dichlorobenzene	20.00	0.00	19.92	21.26	100	106	-6	59-156	YES
4-Dichlorobenzene	20.00	0.00	20.04	21.06	100	105	-5	18-190	YES
1,2-Dichlorobenzene	20.00	0.00	19.29	19.81	96	99	-3	18-190	YES
1,2-Dibromo-3-Chloropropan	150.00	0.00	136.04	145.85	91	97	-6	40-154	YES

N/C = Could not calculate

ib Chronicle: ______________________________ Ent. by ________.

______________________________ Ver. by ________.

____

* %RPD for this compound exceeds method specified limit.

8A
VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _______ SDG No.: _____.

Lab File ID (Standard): >JUQS1 Date Analyzed: 06/26/95

Instrument ID: HP03047 Time Analyzed: 08:00

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

		IS1(BCM) AREA #	RT	IS2(DFB) AREA #	RT	IS3(CBZ) AREA #	RT
	12 HOUR STD	39650	8.97	156921	10.58	108098	14.83
	UPPER LIMIT	79300		313842		216196	
	LOWER LIMIT	19825		78461		54049	
	EPA SAMPLE NO.						
01	VBLKJ99	38149	8.98	150683	10.58	106014	14.83
02	EWTB3	39232	8.97	152211	10.58	106885	14.82
03	LEW-3	36143	8.98	143157	10.58	100632	14.84
04	DC-2-	35620	8.96	142973	10.58	100658	14.84
05	UT001	38087	8.96	150241	10.57	102969	14.83
06	GMMW1	35450	8.97	141034	10.57	99517	14.83
07	GMMW1MS	40327	8.95	155841	10.57	105529	14.82
08	GMMW1MSD	36491	8.97	145197	10.59	100050	14.84
09	GMMW2	34949	8.97	137587	10.58	97706	14.84
10	GMMW4	35770	8.95	138086	10.57	98689	14.82
11	GMMW5	34076	8.98	136630	10.59	96776	14.83
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

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

Lab Name: LANCASTER LABS · Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No. _____. SDG No.: _____.

Instrument ID: HP03047 Calibration Date(s): 06/21/95 06/21/95

Calibration Times: 0059 0619

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.10 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF 4= >JUL15 RRF 20= >JUL14
RRF 50= >JUL13 RRF100= >JUL17 RRF300= >JUL11

COMPOUND		RRF 4	RRF 20	RRF 50	RRF100	RRF300	RRF	% RSD	CAL. METHOD	
Dichlorodifluoromethane		2.667	2.191	2.394	2.595	2.538	2.477	7.6	AVG	
Chloromethane	#	.701	.644	.680	.787	.774	.717	8.6	AVG	#
Vinyl Chloride	*	.819	.709	.772	.912	.874	.817	9.8	AVG	*
Bromomethane		1.427	1.234	1.307	1.444	1.395	1.361	6.5	AVG	
Chloroethane		.523	.500	.546	.645	.594	.562	10.4	AVG	
Trichlorofluoromethane		2.157	2.118	2.355	2.376	2.092	2.220	6.1	AVG	
n-Pentane		1.245	1.043	1.179	1.261	1.216	1.189	7.4	AVG	
Ethyl Ether		.627	.622	.632	.683	.656	.644	3.9	AVG	
Furfuran		.976	.938	1.002	1.105	1.054	1.015	6.5	AVG	
Acrolein		.082	.098	.103	.114	.104	.100	11.7	AVG	
1,1-Dichloroethene	*	.892	.928	1.009	1.083	1.036	.990	7.9	AVG	*
Freon 113		2.865	1.976	2.220	2.655	2.648	2.473	14.7	AVG	
Acetone		.338	.234	.244	.279	.244	.268	16.1	1STDEG	
Methyl Iodide		3.595	3.184	3.411	4.122	4.187	3.700	11.9	AVG	
Carbon Disulfide		2.422	2.094	2.281	2.823	2.913	2.506	14.0	AVG	
2-Propanol		.036	.042	.044	.044	.046	.042	9.3	AVG	
Allyl Chloride		1.257	1.179	1.289	1.383	1.324	1.286	5.9	AVG	
Methylene Chloride		1.097	.970	1.014	1.041	.954	1.015	5.6	AVG	
t-Butyl Alcohol		.089	.088	.092	.092	.104	.093	6.9	AVG	
Acrylonitrile		.168	.187	.195	.201	.195	.189	6.7	AVG	
Methyl t-Butyl Ether		2.450	2.261	2.230	2.185	2.023	2.230	6.9	AVG	
trans-1,2-Dichloroethene		1.030	1.001	1.108	1.166	1.124	1.086	6.3	AVG	
n-Hexane		.970	.854	.983	.988	.983	.956	6.0	AVG	
1,1-Dichloroethane	#	1.732	1.740	1.912	1.899	1.859	1.828	4.7	AVG	#
1-Propanol		.000	.002	.003	.003	.004	.003	53.1	1STDEG	
cis-1,2-Dichloroethene		1.052	1.077	1.129	1.168	1.054	1.096	4.6	AVG	
Propionitrile		.060	.063	.066	.064	.070	.065	5.5	AVG	
Ethyl Acetate		1.167	1.081	1.073	1.036	1.053	1.082	4.7	AVG	
Methacrylonitrile		.233	.221	.239	.229	.254	.235	5.2	AVG	
Tetrahydrofuran		.100	.191	.211	.194	.201	.179	25.2	1STDEG	
Chloroform	*	2.631	2.596	2.758	2.703	2.698	2.677	2.4	AVG	*
Cyclohexane		1.206	1.006	1.131	1.125	1.107	1.115	6.4	AVG	
1,2-Dichloroethane		1.860	1.839	1.953	1.847	1.908	1.881	2.6	AVG	
Vinyl Acetate		.036	.049	.055	.064	.064	.053	22.5	1STDEG	

6A

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No. _____. SDG No.: _____.

Instrument ID: HP03047 Calibration Date(s): 06/21/95 06/21/95

Calibration Times: 0059 0619

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.10 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF 4= >JUL15 RRF 20= >JUL14
RRF 50= >JUL13 RRF100= >JUL17 RRF300= >JUL11

COMPOUND	RRF 4	RRF 20	RRF 50	RRF100	RRF300	$\overline{\text{RRF}}$	% RSD	CAL. METHOD
2-Butanone	.091	.083	.093	.093	.091	.090	4.5	AVG
1,1,1-Trichloroethane	.597	.586	.650	.628	.563	.605	5.7	AVG
Carbon Tetrachloride	.621	.593	.672	.631	.616	.627	4.6	AVG
Isobutyl Alcohol	.006	.006	.007	.006	.007	.006	5.9	AVG
Benzene	.631	.576	.604	.632	.577	.604	4.6	AVG
n-Heptane	.171	.142	.179	.175	.170	.167	8.8	AVG
n-Butanol	.004	.004	.005	.005	.005	.007	28.7	2NDDEG
Trichloroethene	.366	.356	.388	.395	.358	.372	4.8	AVG
1,2-Dichloropropane *	.249	.248	.253	.246	.239	.247	2.1	AVG *
Methyl Methacrylate	.167	.171	.175	.169	.169	.170	1.8	AVG
Dibromomethane	.426	.373	.385	.361	.367	.382	6.7	AVG
1,4-Dioxane	.002	.003	.003	.003	.003	.003	6.1	AVG
n-Propyl Acetate	.479	.416	.435	.412	.424	.433	6.3	AVG
Bromodichloromethane	.655	.673	.714	.694	.711	.689	3.7	AVG
2-Nitropropane	.084	.085	.087	.081	.085	.084	2.7	AVG
2-Chloroethyl Vinyl Ether	.162	.163	.175	.172	.177	.170	4.1	AVG
cis-1,3-Dichloropropene	.438	.445	.464	.466	.441	.451	2.9	AVG
trans-1,3-Dichloropropene	.447	.449	.482	.478	.451	.462	3.7	AVG
1,1,2-Trichloroethane	.287	.281	.295	.282	.279	.285	2.2	AVG
Dibromochloromethane	.672	.720	.757	.711	.719	.716	4.2	AVG
Bromoform #	.508	.546	.573	.550	.554	.546	4.3	AVG #
trans-1,4-Dichloro-2-Butene	.111	.113	.123	.114	.129	.118	6.7	AVG
4-Methyl-2-Pentanone	.356	.370	.397	.396	.391	.382	4.8	AVG
Toluene *	1.033	.965	1.051	1.106	1.023	1.036	4.9	AVG *
Ethyl Methacrylate	.488	.498	.532	.528	.538	.517	4.3	AVG
Tetrachloroethene	.464	.454	.500	.522	.468	.482	5.9	AVG
2-Hexanone	.232	.254	.271	.273	.270	.260	6.6	AVG
1,2-Dibromoethane	.727	.701	.750	.776	.757	.742	3.9	AVG
Chlorobenzene #	.876	.854	.921	.932	.897	.896	3.6	AVG #
1,1,1,2-Tetrachloroethane	.610	.568	.609	.609	.612	.602	3.1	AVG
Ethylbenzene *	.373	.346	.386	.399	.357	.372	5.7	AVG *
m+p-Xylene	.478	.458	.509	.512	.491	.490	4.5	AVG
Isoamyl Acetate	.370	.358	.383	.389	.397	.379	4.1	AVG
o-Xylene	.426	.438	.475	.482	.438	.452	5.5	AVG

6A

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No. _____. SDG No.: _____.

Instrument ID: HP03047 Calibration Date(s): 06/21/95 06/21/95

Calibration Times: 0059 0619

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

___.

Min RRF for SPCC(#) = 0.300 (0.10 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF 4= >JUL15 RRF 20= >JUL14
RRF 50= >JUL13 RRF100= >JUL17 RRF300= >JUL11

COMPOUND		RRF 4	RRF 20	RRF 50	RRF100	RRF300	RRF	% RSD	CAL. METHOD	
Styrene		.769	.782	.849	.851	.838	.818	4.8	AVG	
Cumene		1.464	1.237	1.384	1.436	1.433	1.391	6.5	AVG	
Cyclohexanone		.011	.011	.012	.012	.011	.011	4.6	AVG	
1,1,2,2-Tetrachloroethane	#	.648	.650	.685	.674	.630	.657	3.3	AVG	#
1,2,3-Trichloropropane		.218	.207	.218	.219	.213	.215	2.3	AVG	
Pentachloroethane		.424	.409	.451	.432	.432	.430	3.6	AVG	
1,3-Dichlorobenzene		.853	.746	.813	.833	.809	.811	5.0	AVG	
1,4-Dichlorobenzene		.932	.845	.896	.917	.873	.893	3.9	AVG	
Benzyl Chloride		.839	.804	.903	.957	.939	.888	7.3	AVG	
1,3-Diethylbenzene		.990	.812	.916	.899	.834	.890	7.9	AVG	
1,4-Diethylbenzene		.785	.670	.742	.727	.657	.716	7.4	AVG	
1,2-Dichlorobenzene		.884	.773	.812	.820	.799	.818	5.0	AVG	
1,2-Diethylbenzene		.969	.803	.873	.831	.768	.849	9.1	AVG	
1,2-Dibromo-3-Chloropropane		.185	.195	.207	.190	.168	.189	7.5	AVG	
1,2-Dichloroethane-d4		2.123	1.724	1.858	1.692	1.813	1.842	9.3	AVG	
Toluene-d8		1.212	1.083	1.164	1.129	1.197	1.157	4.5	AVG	
4-Bromofluorobenzene		1.140	.936	.982	.914	.971	.989	9.0	AVG	

7A

VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Instrument ID: HP03047 Calibration Date: 06/26/95 Time: 0800

Lab File ID: >JUQS1 Init. Calib. Date(s): 06/21/95 06/21/95

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF50 for SPCC(#)= 0.300 (0.10 for Bromoform) Max %Drift for CCC(*)= 20.0%

COMPOUND	$\overline{\text{RRF}}$	RRF 50	ACTUAL CONC.	TRUE CONC.	% DRIFT
Dichlorodifluoromethane	2.477	2.750	55.50	50.0	-11.0
Chloromethane #	.717	.741	51.65	50.0	-3.3#
Vinyl Chloride *	.817	.903	55.25	50.0	-10.5*
Bromomethane	1.361	1.429	52.47	50.0	-4.9
Chloroethane	.562	.619	55.15	50.0	-10.3
Trichlorofluoromethane	2.220	2.195	49.45	50.0	1.1
Ethyl Ether	.644	.668	51.86	50.0	-3.7
Acrolein	.100	.090	449.58	500.0	10.1
1,1-Dichloroethene *	.990	1.103	55.75	50.0	-11.5*
Freon 113	2.473	2.872	116.16	100.0	-16.2
Acetone	.268	.220	84.53	100.0	15.5
Methyl Iodide	3.700	3.982	53.81	50.0	-7.6
Carbon Disulfide	2.506	2.519	50.25	50.0	-.5
Allyl Chloride	1.286	1.345	52.29	50.0	-4.6
Methylene Chloride	1.015	1.039	51.17	50.0	-2.3
t-Butyl Alcohol	.093	.068	182.73	250.0	26.9
Acrylonitrile	.189	.166	438.71	500.0	12.3
Methyl t-Butyl Ether	2.230	2.051	45.98	50.0	8.0
trans-1,2-Dichloroethene	1.086	1.145	52.70	50.0	-5.4
1,1-Dichloroethane #	1.828	1.946	53.22	50.0	-6.4#
cis-1,2-Dichloroethene	1.096	1.154	52.62	50.0	-5.2
Propionitrile	.065	.054	207.94	250.0	16.8
Ethyl Acetate	1.082	.887	40.98	50.0	18.0
Methacrylonitrile	.235	.207	110.31	125.0	11.8
Tetrahydrofuran	.179	.144	36.79	50.0	26.4
Chloroform *	2.677	2.908	54.30	50.0	-8.6*
Cyclohexane	1.115	1.141	51.18	50.0	-2.4
1,2-Dichloroethane	1.881	1.885	50.09	50.0	-.2
Vinyl Acetate	.053	.050	42.15	50.0	15.7
2-Butanone	.090	.068	75.50	100.0	24.5
1,1,1-Trichloroethane	.605	.643	53.20	50.0	-6.4
Carbon Tetrachloride	.627	.691	55.15	50.0	-10.3
Isobutyl Alcohol	.006	.004	454.21	625.0	27.3
Benzene	.604	.617	51.08	50.0	-2.2

7A

VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: ______.

Lab Code: LANCAS Case No.: ______. SAS No.: ______. SDG No.: ______.

Instrument ID: HP03047 Calibration Date: 06/26/95 Time: 0800

Lab File ID: >JUQS1 Init. Calib. Date(s): 06/21/95 06/21/95

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF50 for SPCC(#)= 0.300 (0.10 for Bromoform) Max %Drift for CCC(*)= 20.0%

COMPOUND	RRF	RRF 50	ACTUAL CONC.	TRUE CONC.	% DRIFT
Trichloroethene	.372	.383	51.39	50.0	-2.8
1,2-Dichloropropane	* .247	.247	49.99	50.0	.0*
Methyl Methacrylate	.170	.153	45.03	50.0	9.9
Dibromomethane	.382	.370	48.43	50.0	3.1
1,4-Dioxane	.003	.002	400.94	625.0	35.8
n-Propyl Acetate	.433	.354	40.85	50.0	18.3
Bromodichloromethane	.689	.734	53.22	50.0	-6.4
2-Nitropropane	.084	.070	82.75	100.0	17.3
2-Chloroethyl Vinyl Ether	.170	.156	91.83	100.0	8.2
cis-1,3-Dichloropropene	.451	.450	49.87	50.0	.3
trans-1,3-Dichloropropene	.462	.446	18.35	19.0	3.4
1,1,2-Trichloroethane	.285	.273	47.98	50.0	4.0
Dibromochloromethane	.716	.719	50.23	50.0	-.5
Bromoform	# .546	.518	47.41	50.0	5.2#
trans-1,4-Dichloro-2-Butene	.118	.104	110.18	125.0	11.9
4-Methyl-2-Pentanone	.382	.322	84.16	100.0	15.8
Toluene	* 1.036	1.034	49.90	50.0	.2*
Ethyl Methacrylate	.517	.467	45.22	50.0	9.6
Tetrachloroethene	.482	.502	52.07	50.0	-4.1
2-Hexanone	.260	.211	81.27	100.0	18.7
1,2-Dibromoethane	.742	.684	46.07	50.0	7.9
Chlorobenzene	# .896	.914	51.01	50.0	-2.0#
1,1,1,2-Tetrachloroethane	.602	.643	53.41	50.0	-6.8
Ethylbenzene	* .372	.385	51.71	50.0	-3.4*
m+p-Xylene	.490	.501	102.39	100.0	-2.4
Isoamyl Acetate	.379	.344	45.32	50.0	9.4
o-Xylene	.452	.463	51.20	50.0	-2.4
Styrene	.818	.834	51.00	50.0	-2.0
Cumene	1.391	1.391	50.02	50.0	-.0
1,1,2,2-Tetrachloroethane	# .657	.576	43.83	50.0	12.3#
1,2,3-Trichloropropane	.215	.189	44.01	50.0	12.0
Pentachloroethane	.430	.461	53.61	50.0	-7.2
1,3-Dichlorobenzene	.811	.798	49.23	50.0	1.5
1,4-Dichlorobenzene	.893	.888	49.74	50.0	.5

7A
VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Instrument ID: HP03047 Calibration Date: 06/26/95 Time: 0800

Lab File ID: >JUQS1 Init. Calib. Date(s): 06/21/95 06/21/95

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF50 for SPCC(#)= 0.300 (0.10 for Bromoform) Max %Drift for CCC(*)= 20.0%

COMPOUND	$\overline{RRF}$	RRF 50	ACTUAL CONC.	TRUE CONC.	% DRIFT
1,2-Dichlorobenzene	.818	.792	48.42	50.0	3.2
1,2-Dibromo-3-Chloropropane	.189	.160	42.47	50.0	15.1
1,2-Dichloroethane-d4	1.842	1.806	49.02	50.0	2.0
Toluene-d8	1.157	1.128	48.77	50.0	2.5
4-Bromofluorobenzene	.989	.934	47.23	50.0	5.5

5B

SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >Z730Z DFTPP Injection Date: 07/05/95

Instrument ID: HP02550 DFTPP Injection Time: 15:40

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 80.0% of mass 198	58.0
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	66.2
70	Less than 2.0% of mass 69	0.0 (0.0)1
127	25.0 - 75.0% of mass 198	44.0
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	6.6
275	10.0 - 30.0% of mass 198	19.9
365	Greater than 0.75% of mass 198	1.87
441	Present, but less than mass 443	8.8
442	40.0 - 110.0% of mass 198	59.9
443	15.0 - 24.0% of mass 442	11.4 (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	SSTD50	CLP1815	>Z7301	07/05/95	16:08
02	0303BMSD	2337099	>C7301	07/05/95	18:14
03	0400B	2337092	>C7302	07/05/95	19:07
04	0303BMS	2337098	>C7304	07/05/95	21:44
05	0405B	2337094	>C7305	07/05/95	22:45
06					
07					
08					
09					
10					
11					
12					
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	SBLKWA1714	75	78	77	38	54	89		0
02	171WALCS	86	85	88	43	61	108		0
03	171WALCSD	91	85	92	42	60	103		0
04	171WAUS	88	86	73	43	62	103		0
05	171WAMS	93	88	92	44	64	106		0
06	171WAMSD	85	83	94	41	58	106		0
07	SEDFB	81	83	80	37	56	81		0
08	SDFB2	79	81	76	37	58	78		0
09	NVBRM	59	80	70	39	59	90		0
10	2HP6-	80	85	74	38	59	77		0
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
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

4B
SEMIVOLATILE METHOD BLANK SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >D3750 Lab Sample ID:SBLKWA171

Date Extracted: 06/20/95 Extraction:(SepF/Cont/Sonc) SEPF

Date Analyzed: 06/21/95 Time Analyzed: 13:00

Matrix: (soil/water) WATER Level:(low/med) LOW

Instrument ID: HP03301

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	171WALCS	171WALCS	>D3751	06/21/95
02	171WALCSD	171WALCSD	>D3752	06/21/95
03	171WAUS	171WAUS	>D3753	06/21/95
04	171WAMS	171WAMS	>D3754	06/21/95
05	171WAMSD	171WAMSD	>D3755	06/21/95
06	SEDFB	2329395	>D3801	06/22/95
07	SDFB2	2330033	>D3802	06/22/95
08	NVBRM	2325395	>D3803	06/22/95
09	2HP6-	2330176	>D3804	06/22/95

COMMENTS: ____.
____.

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWA1714

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Matrix: (soil/water) WATER Lab Sample ID: SBLKWA171

Sample wt/vol: 1000 (g/mL) ML Lab File ID: >D3750

Level: (low/med) LOW Date Received:

% Moisture: not dec. _____. dec. _____. Date Extracted: 06/20/95

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 06/21/95

GPC Cleanup: (Y/N) N pH: _____. Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
110-86-1--------	Pyridine	10	U
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
95-50-1---------	1,2-Dichlorobenzene	10	U
95-48-7---------	2-Methylphenol	10	U
108-60-1--------	bis(2-Chloroisopropyl)ether	10	U
65794-96-9------	3 or 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
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
87-68-3---------	Hexachlorobutadiene	10	U
59-50-7---------	4-Chloro-3-methylphenol	10	U
77-47-4---------	Hexachlorocyclopentadiene	10	U
88-06-2---------	2,4,6-Trichlorophenol	10	U
95-95-4---------	2,4,5-Trichlorophenol	10	U
91-58-7---------	2-Chloronaphthalene	10	U
131-11-3--------	Dimethylphthalate	10	U
606-20-2--------	2,6-Dinitrotoluene	10	U
208-96-8--------	Acenaphthylene	10	U
83-32-9---------	Acenaphthene	10	U
51-28-5---------	2,4-Dinitrophenol	25	U
100-02-7--------	4-Nitrophenol	25	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLKWA1714

Lab Name: LANCASTER LABS Contract: ______.

Lab Code: LANCAS Case No.: ______. SAS No.: ______. SDG No.: ______.

Matrix: (soil/water) WATER Lab Sample ID: SBLKWA171

Sample wt/vol: 1000 (g/mL) ML Lab File ID: >D3750

Level: (low/med) LOW Date Received:

% Moisture: not dec. ______. dec. ______. Date Extracted: 06/20/95

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 06/21/95

GPC Cleanup: (Y/N) N pH: ______. Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
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
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-Nitrosodiphenylamine (1)	10	U
122-66-7	1,2-Diphenylhydrazine	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
92-87-5	Benzidine	50	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
117-81-7	bis(2-Ethylhexyl)phthalate	10	U
218-01-9	Chrysene	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

3C
WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____.SAS No: _____. SDG No.: _____.

Matrix Spike - EPA Sample No.: SW-04

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC LIMITS REC.
Phenol	75.00	0.00	53.16	71	12-110
2-Chlorophenol	75.00	0.00	52.35	70	27-123
1,4-Dichlorobenzene	50.00	0.00	32.87	66	36- 97
N-Nitroso-di-n-prop.(1)	50.00	0.00	32.76	66	41-116
1,2,4-Trichlorobenzene	50.00	0.00	33.89	68	39- 98
4-Chloro-3-methylphenol	75.00	0.00	46.96	63	23- 97
Acenaphthene	50.00	0.00	35.00	70	46-118
4-Nitrophenol	75.00	0.00	55.06	73	10- 80
2,4-Dinitrotoluene	50.00	0.00	37.31	75	24- 96
Pentachlorophenol	75.00	0.00	63.71	85	9-103
Pyrene	50.00	0.00	39.72	79	26-127

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol	75.00	49.33	66	7	42	12-110
2-Chlorophenol	75.00	48.42	65	7	40	27-123
1,4-Dichlorobenzene	50.00	29.99	60	10	28	36- 97
N-Nitroso-di-n-prop.(1)	50.00	30.13	60	10	38	41-116
1,2,4-Trichlorobenzene	50.00	31.40	63	8	28	39- 98
4-Chloro-3-methylphenol	75.00	44.71	60	5	42	23- 97
Acenaphthene	50.00	32.25	65	7	31	46-118
4-Nitrophenol	75.00	58.37	78	7	50	10- 80
2,4-Dinitrotoluene	50.00	35.96	72	4	38	24- 96
Pentachlorophenol	75.00	64.38	86	1	50	9-103
Pyrene	50.00	39.34	79	0	31	26-127

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 0 out of 11 outside limits
Spike Recovery: 0 out of 22 outside limits

COMMENTS: ____.
____.

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS   Lab Code: LANCAS   Instrument: HP03301

SW846 METHOD 8270   SPIKE LEVEL: 100 UG/ML   AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L   % MOISTURE 0.   DILUTION: 1

US SAMPLE: 171WAUS 171WAUS   MS SAMPLE: 171WAMS 171WAMS   MSD SAMPLE: 171WAMSD 171WAMSD

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	0.00	71.19	63.55	71	64	11.00	35.0-100.8	YES
Phenol	0.00	50.36	47.69	50	48	5.00	5.0-112.0	YES
bis(2-Chloroethyl)ether	0.00	91.95	85.37	92	85	7.00	12.0-158.0	YES
2-Chlorophenol	0.00	93.27	87.54	93	88	6.00	23.0-134.0	YES
1,3-Dichlorobenzene	0.00	87.92	79.61	88	80	10.00	1.0-172.0	YES
1,4-Dichlorobenzene	0.00	89.59	81.76	90	82	9.00	20.0-124.0	YES
1,2-Dichlorobenzene	0.00	92.62	84.48	93	84	9.00	32.0-129.0	YES
bis(2-Chloroisopropyl)ether	0.00	98.40	92.17	98	92	7.00	36.0-166.0	YES
N-Nitroso-di-n-propylamine	0.00	110.79	104.31	111	104	6.00	1.0-230.0	YES
Hexachloroethane	0.00	80.42	73.16	80	73	9.00	40.0-113.0	YES
Nitrobenzene	0.00	100.44	93.63	100	94	7.00	35.0-180.0	YES
Isophorone	0.00	91.13	86.68	91	87	5.00	21.0-196.0	YES
2-Nitrophenol	0.00	97.51	94.45	98	94	3.00	29.0-182.0	YES
2,4-Dimethylphenol	0.00	84.53	77.29	84	77	9.00	32.0-119.0	YES
bis(2-Chloroethoxy)methane	0.00	89.50	84.21	89	84	6.00	33.0-184.0	YES
2,4-Dichlorophenol	0.00	95.88	91.26	96	91	5.00	39.0-135.0	YES
1,2,4-Trichlorobenzene	0.00	89.02	82.33	89	82	8.00	44.0-142.0	YES
Naphthalene	0.00	90.10	83.34	90	83	8.00	21.0-133.0	YES
Hexachlorobutadiene	0.00	82.27	73.61	82	74	11.00	24.0-116.0	YES
4-Chloro-3-methylphenol	0.00	97.77	95.61	98	96	2.00	22.0-147.0	YES
Hexachlorocyclopentadiene	0.00	138.52	88.83	69	44	44.00	1.0-100.0	YES
2,4,6-Trichlorophenol	0.00	97.75	92.93	98	93	5.00	37.0-144.0	YES
2-Chloronaphthalene	0.00	89.52	85.35	90	85	5.00	60.0-118.0	YES
Dimethylphthalate	0.00	90.86	87.84	91	88	3.00	1.0-112.0	YES
2,6-Dinitrotoluene	0.00	86.36	84.61	86	85	2.00	50.0-158.0	YES
Acenaphthylene	0.00	90.55	85.28	90	85	6.00	33.0-145.0	YES
Acenaphthene	0.00	89.05	85.24	89	85	4.00	47.0-145.0	YES
2,4-Dinitrophenol	0.00	94.45	92.15	94	92	2.00	1.0-191.0	YES
4-Nitrophenol	0.00	47.71	46.64	48	47	2.00	1.0-132.0	YES
2,4-Dinitrotoluene	0.00	103.67	102.08	104	102	2.00	39.0-139.0	YES
1-Naphthylamine	0.00	41.80	36.84	42	37	13.00	1.0-100.0	YES
2-Naphthylamine	0.00	55.40	44.65	55	45	22.00	1.0-100.0	YES
Diethylphthalate	0.00	95.85	93.03	96	93	3.00	1.0-114.0	YES
4-Chlorophenyl-phenylether	0.00	92.22	88.60	92	88	4.00	25.0-158.0	YES
Fluorene	0.00	90.96	87.93	91	88	3.00	59.0-121.0	YES
4,6-Dinitro-2-methylphenol	0.00	88.46	86.50	88	86	2.00	1.0-181.0	YES
N-Nitrosodiphenylamine	0.00	86.53	83.21	86	83	4.00	37.8-147.0	YES
1,2-Diphenylhydrazine	0.00	86.10	82.37	86	82	4.00	25.7-124.9	YES
4-Bromophenyl-phenylether	0.00	92.83	88.97	93	89	4.00	53.0-127.0	YES

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS Lab Code: LANCAS Instrument: HP03301

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/ML AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L % MOISTURE 0. DILUTION: 1

US SAMPLE: 171WAUS 171WAUS MS SAMPLE: 171WAMS 171WAMS MSD SAMPLE: 171WAMSD 171WAMSD

COMPOUND NAME	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RPD %	RANGE LOWER-UPPER	IN SPEC
Hexachlorobenzene	0.00	93.90	90.89	94	91	3.00	1.0-152.0	YES
Pentachlorophenol	0.00	71.04	78.11	71	78	-9.00	14.0-176.0	YES
Phenanthrene	0.00	89.59	85.11	90	85	5.00	54.0-120.0	YES
Anthracene	0.00	88.13	84.06	88	84	5.00	27.0-133.0	YES
Di-n-butylphthalate	0.00	97.28	90.78	97	91	7.00	1.0-118.0	YES
Fluoranthene	0.00	97.82	92.76	98	93	5.00	26.0-137.0	YES
Benzidine	0.00	409.22	309.00	82	62	28.00	1.0-155.0	YES
Pyrene	0.00	86.40	89.91	86	90	-4.00	52.0-115.0	YES
Butylbenzylphthalate	0.00	94.76	93.22	95	93	2.00	1.0-152.0	YES
3,3'-Dichlorobenzidine	0.00	95.40	87.15	95	87	9.00	1.0-262.0	YES
Benzo(a)anthracene	0.00	89.52	86.79	90	87	3.00	33.0-143.0	YES
bis(2-Ethylhexyl)phthalate	0.00	94.36	92.14	94	92	2.00	8.0-158.0	YES
Chrysene	0.00	91.49	90.70	91	91	1.00	17.0-168.0	YES
Di-n-octylphthalate	0.00	90.04	93.87	90	94	-4.00	4.0-146.0	YES
Benzo(b)fluoranthene	0.00	88.77	89.34	89	89	-1.00	24.0-159.0	YES
Benzo(k)fluoranthene	0.00	90.41	89.11	90	89	1.00	11.0-163.0	YES
Benzo(a)pyrene	0.00	89.68	86.37	90	86	4.00	17.0-163.0	YES
Indeno(1,2,3-cd)pyrene	0.00	88.00	81.41	88	81	8.00	1.0-171.0	YES
Dibenz(a,h)anthracene	0.00	86.73	81.84	87	82	6.00	1.0-227.0	YES
Benzo(g,h,i)perylene	0.00	86.02	79.43	86	79	8.00	1.0-219.0	YES

COMMENTS:

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS　　LAB CODE: LANCAS　　INSTRUMENT: HP03301

SW846 METHOD 8270　　SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 171WALCS　171WALCS

COMPOUND NAME	EXTRACT CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
N-Nitrosodimethylamine	68.92	69	35.0- 100.8	YES
Phenol	48.72	49	5.0- 112.0	YES
bis(2-Chloroethyl)ether	94.39	94	12.0- 158.0	YES
2-Chlorophenol	92.50	92	23.0- 134.0	YES
1,3-Dichlorobenzene	85.86	86	1.0- 172.0	YES
1,4-Dichlorobenzene	88.26	88	20.0- 124.0	YES
1,2-Dichlorobenzene	91.46	91	32.0- 129.0	YES
bis(2-Chloroisopropyl)ether	101.78	102	36.0- 166.0	YES
N-Nitroso-di-n-propylamine	110.79	111	1.0- 230.0	YES
Hexachloroethane	74.98	75	40.0- 113.0	YES
Nitrobenzene	99.22	99	35.0- 180.0	YES
Isophorone	92.80	93	21.0- 196.0	YES
2-Nitrophenol	91.79	92	29.0- 182.0	YES
2,4-Dimethylphenol	80.92	81	32.0- 119.0	YES
bis(2-Chloroethoxy)methane	90.28	90	33.0- 184.0	YES
2,4-Dichlorophenol	93.31	93	39.0- 135.0	YES
1,2,4-Trichlorobenzene	84.99	85	44.0- 142.0	YES
Naphthalene	88.58	88	21.0- 133.0	YES
Hexachlorobutadiene	71.61	72	24.0- 116.0	YES
4-Chloro-3-methylphenol	96.46	96	22.0- 147.0	YES
Hexachlorocyclopentadiene	115.53	58	1.0- 100.0	YES
2,4,6-Trichlorophenol	93.96	94	37.0- 144.0	YES
2-Chloronaphthalene	88.09	88	60.0- 118.0	YES
Dimethylphthalate	86.59	86	1.0- 112.0	YES
2,6-Dinitrotoluene	87.41	87	50.0- 158.0	YES
Acenaphthylene	87.90	88	33.0- 145.0	YES
Acenaphthene	87.91	88	47.0- 145.0	YES
2,4-Dinitrophenol	99.86	100	1.0- 191.0	YES
4-Nitrophenol	47.64	48	1.0- 132.0	YES
2,4-Dinitrotoluene	104.96	105	39.0- 139.0	YES
1-Naphthylamine	40.76	41	1.0- 100.0	YES
2-Naphthylamine	52.41	52	1.0- 100.0	YES
Diethylphthalate	96.64	97	1.0- 114.0	YES
4-Chlorophenyl-phenylether	91.82	92	25.0- 158.0	YES
Fluorene	91.73	92	59.0- 121.0	YES
4,6-Dinitro-2-methylphenol	88.46	88	1.0- 181.0	YES
N-Nitrosodiphenylamine	82.97	83	37.8- 147.0	YES
1,2-Diphenylhydrazine	87.54	88	25.7- 124.9	YES
4-Bromophenyl-phenylether	92.08	92	53.0- 127.0	YES

WATER SEMIVOLATILE QUALITY CONTROL REFERENCE SAMPLE RECOVERY

LAB NAME: LANCASTER LABS LAB CODE: LANCAS INSTRUMENT: HP03301

SW846 METHOD 8270 SPIKE LEVEL: 100 UG/L

LCS SAMPLE NO: 171WALCS 171WALCS

COMPOUND NAME	EXTRACT CONC UG/L	QCREF REC %	RANGE LOWER-UPPER	IN SPEC
Hexachlorobenzene	94.46	94	1.0- 152.0	YES
Pentachlorophenol	79.44	79	14.0- 176.0	YES
Phenanthrene	88.96	89	54.0- 120.0	YES
Anthracene	89.44	89	27.0- 133.0	YES
Di-n-butylphthalate	98.70	99	1.0- 118.0	YES
Fluoranthene	101.20	101	26.0- 137.0	YES
Benzidine	319.00	64	1.0- 155.0	YES
Pyrene	85.98	86	52.0- 115.0	YES
Butylbenzylphthalate	94.12	94	1.0- 152.0	YES
3,3'-Dichlorobenzidine	91.48	91	1.0- 262.0	YES
Benzo(a)anthracene	91.01	91	33.0- 143.0	YES
bis(2-Ethylhexyl)phthalate	95.20	95	8.0- 158.0	YES
Chrysene	92.76	93	17.0- 168.0	YES
Di-n-octylphthalate	95.22	95	4.0- 146.0	YES
Benzo(b)fluoranthene	92.11	92	24.0- 159.0	YES
Benzo(k)fluoranthene	92.30	92	11.0- 163.0	YES
Benzo(a)pyrene	86.47	86	17.0- 163.0	YES
Indeno(1,2,3-cd)pyrene	87.25	87	1.0- 171.0	YES
Dibenz(a,h)anthracene	87.06	87	1.0- 227.0	YES
Benzo(g,h,i)perylene	84.92	85	1.0- 219.0	YES

COMMENTS:

WATER SEMIVOLATILE LABORATORY CONTROL/LABORATORY CONTROL DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS　Lab Code: LANCAS　Instrument: HP03301

SW846 METHOD 8270　SPIKE LEVEL: 100 UG/ML　AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L　% MOISTURE 0.　DILUTION: 1

LCS SAMPLE: 171WALCS 171WALCS　LCSD SAMPLE: 171WALCSD 171WALCSD

COMPOUND NAME	LCS CONC UG/L	LCSD CONC UG/L	LCS REC %	LCSD REC %	RANGE LOWER-UPPER	IN SPEC	RPD %	RPD MAX	RPD IN SPEC
N-Nitrosodimethylamine	68.92	67.34	69	67	35.0-100.8	YES	2.00	30.0	YES
Phenol	48.72	48.17	49	48	5.0-112.0	YES	1.00	30.0	YES
bis(2-Chloroethyl)ether	94.39	92.54	94	92	12.0-158.0	YES	2.00	30.0	YES
2-Chlorophenol	92.50	92.00	92	92	23.0-134.0	YES	1.00	30.0	YES
1,3-Dichlorobenzene	85.86	83.63	86	84	1.0-172.0	YES	3.00	30.0	YES
1,4-Dichlorobenzene	88.26	85.65	88	86	20.0-124.0	YES	3.00	30.0	YES
1,2-Dichlorobenzene	91.46	90.83	91	91	32.0-129.0	YES	1.00	30.0	YES
bis(2-Chloroisopropyl)ether	101.78	103.45	102	103	36.0-166.0	YES	-2.00	30.0	YES
N-Nitroso-di-n-propylamine	110.79	113.39	111	113	1.0-230.0	YES	-2.00	30.0	YES
Hexachloroethane	74.98	77.08	75	77	40.0-113.0	YES	-3.00	30.0	YES
Nitrobenzene	99.22	103.20	99	103	35.0-180.0	YES	-4.00	30.0	YES
Isophorone	92.80	95.98	93	96	21.0-196.0	YES	-3.00	30.0	YES
2-Nitrophenol	91.79	97.94	92	98	29.0-182.0	YES	-6.00	30.0	YES
2,4-Dimethylphenol	80.92	83.22	81	83	32.0-119.0	YES	-3.00	30.0	YES
bis(2-Chloroethoxy)methane	90.28	91.85	90	92	33.0-184.0	YES	-2.00	30.0	YES
2,4-Dichlorophenol	93.31	95.20	93	95	39.0-135.0	YES	-2.00	30.0	YES
1,2,4-Trichlorobenzene	84.99	85.82	85	86	44.0-142.0	YES	-1.00	30.0	YES
Naphthalene	88.58	89.05	88	89	21.0-133.0	YES	-1.00	30.0	YES
Hexachlorobutadiene	71.61	73.95	72	74	24.0-116.0	YES	-3.00	30.0	YES
4-Chloro-3-methylphenol	96.46	97.65	96	98	22.0-147.0	YES	-1.00	30.0	YES
Hexachlorocyclopentadiene	115.53	117.21	58	59	1.0-100.0	YES	-1.00	30.0	YES
2,4,6-Trichlorophenol	93.96	95.71	94	96	37.0-144.0	YES	-2.00	30.0	YES
2-Chloronaphthalene	88.09	87.54	88	88	60.0-118.0	YES	1.00	30.0	YES
Dimethylphthalate	86.59	82.05	86	82	1.0-112.0	YES	5.00	30.0	YES
2,6-Dinitrotoluene	87.41	88.29	87	88	50.0-158.0	YES	-1.00	30.0	YES
Acenaphthylene	87.90	88.61	88	89	33.0-145.0	YES	-1.00	30.0	YES
Acenaphthene	87.91	89.00	88	89	47.0-145.0	YES	-1.00	30.0	YES
2,4-Dinitrophenol	99.86	99.50	100	99	1.0-191.0	YES	0.00	30.0	YES
4-Nitrophenol	47.64	47.72	48	48	1.0-132.0	YES	0.00	30.0	YES
2,4-Dinitrotoluene	104.96	104.01	105	104	39.0-139.0	YES	1.00	30.0	YES
1-Naphthylamine	40.76	40.49	41	40	1.0-100.0	YES	1.00	30.0	YES
2-Naphthylamine	52.41	52.32	52	52	1.0-100.0	YES	0.00	30.0	YES
Diethylphthalate	96.64	94.19	97	94	1.0-114.0	YES	3.00	30.0	YES
4-Chlorophenyl-phenylether	91.82	89.00	92	89	25.0-158.0	YES	3.00	30.0	YES
Fluorene	91.73	89.46	92	89	59.0-121.0	YES	3.00	30.0	YES
4,6-Dinitro-2-methylphenol	88.46	91.66	88	92	1.0-181.0	YES	-4.00	30.0	YES
N-Nitrosodiphenylamine	82.97	85.90	83	86	37.8-147.0	YES	-3.00	30.0	YES
1,2-Diphenylhydrazine	87.54	91.10	88	91	25.7-124.9	YES	-4.00	30.0	YES
4-Bromophenyl-phenylether	92.08	93.00	92	93	53.0-127.0	YES	-1.00	30.0	YES

WATER SEMIVOLATILE LABORATORY CONTROL/LABORATORY CONTROL DUPLICATE SAMPLE RECOVERY

Lab Name: LANCASTER LABS　　Lab Code: LANCAS　　Instrument: HP03301

SW846 METHOD 8270　　SPIKE LEVEL: 100 UG/ML　　AMT USED: 1000.

SAMPLE SPIKE LEVEL: 100.UG/L　　% MOISTURE 0.　DILUTION: 1

LCS SAMPLE: 171WALCS 171WALCS　　LCSD SAMPLE: 171WALCSD 171WALCSD

COMPOUND NAME	LCS CONC UG/L	LCSD CONC UG/L	LCS REC %	LCSD REC %	RANGE LOWER-UPPER	IN SPEC	RPD %	RPD MAX	RPD IN SPEC
Hexachlorobenzene	94.46	94.31	94	94	1.0-152.0	YES	0.00	30.0	YES
Pentachlorophenol	79.44	75.58	79	76	14.0-176.0	YES	5.00	30.0	YES
Phenanthrene	88.96	89.45	89	89	54.0-120.0	YES	-1.00	30.0	YES
Anthracene	89.44	88.62	89	89	27.0-133.0	YES	1.00	30.0	YES
Di-n-butylphthalate	98.70	95.42	99	95	1.0-118.0	YES	3.00	30.0	YES
Fluoranthene	101.20	95.34	101	95	26.0-137.0	YES	6.00	30.0	YES
Benzidine	319.00	361.12	64	72	1.0-155.0	YES	-12.00	30.0	YES
Pyrene	85.98	89.75	86	90	52.0-115.0	YES	-4.00	30.0	YES
Butylbenzylphthalate	94.12	93.46	94	93	1.0-152.0	YES	1.00	30.0	YES
3,3'-Dichlorobenzidine	91.48	92.89	91	93	1.0-262.0	YES	-2.00	30.0	YES
Benzo(a)anthracene	91.01	89.61	91	90	33.0-143.0	YES	2.00	30.0	YES
bis(2-Ethylhexyl)phthalate	95.20	95.00	95	95	8.0-158.0	YES	0.00	30.0	YES
Chrysene	92.76	90.72	93	91	17.0-168.0	YES	2.00	30.0	YES
Di-n-octylphthalate	95.22	96.92	95	97	4.0-146.0	YES	-2.00	30.0	YES
Benzo(b)fluoranthene	92.11	91.07	92	91	24.0-159.0	YES	1.00	30.0	YES
Benzo(k)fluoranthene	92.30	92.67	92	93	11.0-163.0	YES	0.00	30.0	YES
Benzo(a)pyrene	86.47	86.77	86	87	17.0-163.0	YES	0.00	30.0	YES
Indeno(1,2,3-cd)pyrene	87.25	88.82	87	89	1.0-171.0	YES	-2.00	30.0	YES
Dibenz(a,h)anthracene	87.06	88.33	87	88	1.0-227.0	YES	-1.00	30.0	YES
Benzo(g,h,i)perylene	84.92	86.97	85	87	1.0-219.0	YES	-2.00	30.0	YES

COMMENTS:

8B
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID (Standard): >Z7301 Date Analyzed: 07/05/95

Instrument ID: HP02550 Time Analyzed: 16:08

		IS1(DCB) AREA #	RT	IS2(NPT) AREA #	RT	IS3(ANT) AREA #	RT
	12 HOUR STD	41975	11.65	146677	15.00	76661	19.81
	UPPER LIMIT	83950	12.15	293354	15.50	153322	20.31
	LOWER LIMIT	20988	11.15	73339	14.50	38331	19.31
	EPA SAMPLE NO.						
01	0303BMSD	43212	11.66	147781	15.01	77687	19.81
02	0400B	44648	11.67	148989	15.01	77461	19.81
03	0303BMS	41859	11.67	147450	15.01	79313	19.81
04	0405B	40183	11.66	137070	15.01	73874	19.81
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = +0.50 minutes of internal standard RT
RT LOWER LIMIT = -0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk.
* Values outside of QC limits.

page 1 of 1

8C
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID (Standard): >Z7301 Date Analyzed: 07/05/95

Instrument ID: HP02550 Time Analyzed: 16:08

		IS4(PHN) AREA #	RT	IS5(CRY) AREA #	RT	IS6(PRY) AREA #	RT
	12 HOUR STD	113834	23.91	104503	30.73	48838	35.61
	UPPER LIMIT	227668	24.41	209006	31.23	97676	36.11
	LOWER LIMIT	56917	23.41	52252	30.23	24419	35.11
	EPA SAMPLE NO.						
01	0303BMSD	119527	23.93	68256	30.71	28576	35.62
02	0400B	120999	23.92	72241	30.71	27091	35.61
03	0303BMS	122200	23.93	71578	30.72	26418	35.62
04	0405B	109187	23.93	56771	30.72	25260	35.63
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12
AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = +0.50 minutes of internal standard RT
RT LOWER LIMIT = -0.50 minutes of internal standard RT

Column used to flag internal standard area values with an asterisk
* Values outside of QC limits.

6B
SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____.SAS No.: _____. SDG No.: _____.

Instrument ID: HP03189 Calibration Date(s): 06/27/95 06/28/95

Min $\overline{\text{RRF}}$ for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF5 = >V6255 RRF50 = >V6253
RRF80 = >V6254 RRF120= >V6252 RRF160= >V6251

COMPOUND		RRF5	RRF50	RRF80	RRF120	RRF160	$\overline{\text{RRF}}$	% RSD	CAL. METHOD	
Pyridine		2.209	2.342	2.408	2.388	2.237	2.317	3.9	AVG	
N-Nitrosodimethylamine		1.364	1.415	1.410	1.407	1.337	1.387	2.5	AVG	
2-Picoline		1.926	2.008	2.036	2.130	2.058	2.032	3.7	AVG	
Phenol	*	2.829	2.495	2.447	2.372	2.184	2.465	9.5	AVG	*
Aniline		3.094	2.723	2.510	2.507	2.377	2.642	10.7	AVG	
bis(2-Chloroethyl)ether		1.993	1.711	1.645	1.508	1.364	1.644	14.4	AVG	
2-Chlorophenol		2.142	2.017	1.983	1.899	1.722	1.953	8.0	AVG	
1,3-Dichlorobenzene		2.598	2.319	2.291	2.140	1.982	2.266	10.1	AVG	
1,4-Dichlorobenzene	*	2.597	2.332	2.315	2.141	1.987	2.274	10.1	AVG	*
Benzyl alcohol		1.026	1.024	1.034	1.011	.964	1.012	2.7	AVG	
1,2-Dichlorobenzene		2.410	2.017	1.933	1.749	1.546	1.931	16.7	2NDDEG	
2-Methylphenol		1.710	1.633	1.661	1.621	1.546	1.634	3.7	AVG	
2,2'-oxybis(1-Chloropropane)		4.554	4.381	4.436	4.318	3.919	4.322	5.6	AVG	
bis(2-Chloroisopropyl)ether		4.554	4.381	4.436	4.318	3.919	4.322	5.6	AVG	
4-Methylphenol		2.047	1.659	1.515	1.329	1.176	1.545	21.7	2NDDEG	
3 or 4-Methylphenol		2.047	1.659	1.515	1.329	1.176	1.545	21.7	2NDDEG	
Acetophenone		6.825	5.536	5.590	5.364	4.908	5.645	12.6	AVG	
N-Nitroso-di-n-propylamine	#	1.652	1.502	1.466	1.243	.922	1.357	20.9	2NDDEG	#
o-Toluidine		4.277	3.462	3.154	3.247	2.841	3.396	15.9	2NDDEG	
Hexachloroethane		.982	.991	1.008	.971	.878	.966	5.3	AVG	
Nitrobenzene		.629	.672	.677	.677	.637	.658	3.6	AVG	
Isophorone		1.110	1.151	1.177	1.205	1.177	1.164	3.1	AVG	
2-Nitrophenol	*	.251	.336	.335	.347	.327	.319	12.2	AVG	*
2,4-Dimethylphenol		.594	.599	.603	.455	.581	.566	11.1	AVG	
Benzoic acid		.313	.367	.418	.454	.455	.401	15.2	2NDDEG	
bis(2-Chloroethoxy)methane		.703	.669	.671	.685	.657	.677	2.6	AVG	
2,4-Dichlorophenol	*	.488	.501	.494	.489	.466	.488	2.7	AVG	*
1,2,4-Trichlorobenzene		.582	.575	.561	.553	.509	.556	5.2	AVG	
Naphthalene		1.631	1.540	1.540	1.457	1.320	1.498	7.8	AVG	
4-Chloroaniline		.703	.692	.704	.688	.644	.686	3.6	AVG	
Hexachlorobutadiene	*	.378	.376	.377	.380	.328	.368	6.1	AVG	*
4-Chloro-3-methylphenol	*	.454	.517	.536	.516	.470	.499	7.0	AVG	*
2-Methylnaphthalene		1.056	.971	.979	.916	.842	.953	8.3	AVG	
Hexachlorocyclopentadiene	#	.473	.717	.808	.896	.877	.754	22.8	2NDDEG	#
2,4,6-Trichlorophenol	*	.646	.710	.764	.805	.814	.748	9.4	AVG	*
2,4,5-Trichlorophenol		.688	.768	.806	.832	.800	.779	7.2	AVG	
2-Chloronaphthalene		2.025	1.878	1.968	1.986	1.928	1.957	2.9	AVG	
2-Nitroaniline		.587	.810	.886	.918	.917	.824	16.9	2NDDEG	

6C
SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____.SAS No.: _____. SDG No.: _____.

Instrument ID: HP03189 Calibration Date(s): 06/27/95 06/28/95

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF5 = >V6255 RRF50 = >V6253
RRF80 = >V6254 RRF120= >V6252 RRF160= >V6251

COMPOUND	RRF5	RRF50	RRF80	RRF120	RRF160	$\overline{RRF}$	% RSD	CAL. METHOD
Dimethylphthalate	2.261	2.254	2.330	2.273	2.270	2.278	1.3	AVG
2,6-Dinitrotoluene	.349	.519	.539	.518	.501	.485	15.9	2NDDEG
Acenaphthylene	3.176	3.027	3.096	3.021	2.837	3.032	4.1	AVG
3-Nitroaniline	.430	.579	.588	.575	.580	.550	12.2	AVG
Acenaphthene *	2.043	1.911	1.934	1.941	1.836	1.933	3.8	AVG *
2,4-Dinitrophenol #	.200	.255	.319	.342	.350	.293	21.9	2NDDEG #
4-Nitrophenol #	.247	.330	.356	.329	.305	.313	13.1	AVG #
Dibenzofuran	2.965	2.634	2.573	2.472	2.302	2.589	9.5	AVG
2,4-Dinitrotoluene	.639	.727	.764	.724	.728	.717	6.5	AVG
1-Naphthylamine	2.389	2.081	2.245	2.219	2.082	2.203	5.8	AVG
2-Naphthylamine	1.992	1.750	1.926	1.933	1.867	1.893	4.8	AVG
Diethylphthalate	2.257	2.214	2.285	2.202	2.121	2.216	2.8	AVG
4-Chlorophenyl-phenylether	1.116	1.055	1.095	1.046	1.015	1.065	3.8	AVG
Fluorene	2.127	2.066	2.034	1.971	1.854	2.011	5.2	AVG
4-Nitroaniline	.340	.523	.559	.551	.558	.506	18.6	1STDEG
4,6-Dinitro-2-methylphenol	.164	.228	.243	.230	.214	.216	14.3	AVG
N-Nitrosodiphenylamine (1) *	.913	.878	.901	.884	.826	.880	3.8	AVG *
1,2-Diphenylhydrazine	1.615	1.564	1.623	1.628	1.530	1.592	2.7	AVG
4-Bromophenyl-phenylether	.427	.431	.461	.448	.405	.434	4.9	AVG
Hexachlorobenzene	.622	.598	.606	.596	.536	.592	5.5	AVG
Pentachlorophenol *	.285	.301	.333	.340	.321	.316	7.1	2NDDEG *
Phenanthrene	2.084	1.809	1.839	1.727	1.550	1.802	10.7	AVG
Anthracene	1.974	1.888	1.843	1.768	1.630	1.821	7.1	AVG
Carbazole	1.611	1.704	1.696	1.598	1.453	1.612	6.3	AVG
Di-n-butylphthalate	1.789	2.216	2.170	2.113	1.865	2.031	9.4	AVG
Fluoranthene *	1.773	1.992	1.869	1.749	1.467	1.770	11.0	AVG *
Benzidine	1.272	1.031	1.100	1.092	1.058	1.111	8.5	AVG
Pyrene	2.420	2.464	3.044	3.047	2.917	2.779	11.2	AVG
Butylbenzylphthalate	.725	1.077	1.132	1.102	1.085	1.024	16.5	1STDEG
3,3'-Dichlorobenzidine	.527	.638	.732	.774	.820	.698	16.7	1STDEG
Benzo(a)anthracene	1.751	1.797	1.845	1.953	1.956	1.861	4.9	AVG
bis(2-Ethylhexyl)phthalate	1.073	1.442	1.470	1.452	1.445	1.376	12.4	AVG
Chrysene	1.782	1.738	1.798	1.880	1.888	1.817	3.6	AVG
Di-n-octylphthalate *	2.921	3.449	3.004	3.320	3.296	3.198	7.0	2NDDEG *
7,12-Dimethylbenz[a]anthrace	1.302	1.273	1.261	1.359	1.288	1.297	3.0	AVG
Benzo(b)fluoranthene	2.863	2.440	2.659	2.620	2.739	2.664	5.9	AVG
Benzo(k)fluoranthene	2.657	2.473	2.469	2.609	2.304	2.502	5.5	AVG

(1) Cannot be separated from Diphenylamine

6C Cont.
SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____.SAS No.: _____. SDG No.: _____.

Instrument ID: HP03189 Calibration Date(s): 06/27/95 06/28/95

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF5 = >V6255 RRF50 = >V6253
RRF80 = >V6254 RRF120= >V6252 RRF160= >V6251

COMPOUND	RRF5	RRF50	RRF80	RRF120	RRF160	RRF	% RSD	CAL. METHOD
Benzo(a)pyrene *	2.221	2.245	2.371	2.380	2.215	2.286	3.6	AVG *
Indeno(1,2,3-cd)pyrene	1.379	1.900	1.747	1.782	1.630	1.687	11.7	AVG
Dibenz(a,h)anthracene	1.399	1.881	1.686	1.749	1.631	1.669	10.6	AVG
Benzo(g,h,i)perylene	1.290	1.854	1.643	1.669	1.530	1.597	13.0	AVG
2-Fluorophenol	1.820	1.850	1.874	1.832	1.734	1.822	2.9	AVG
Phenol-d5	2.400	2.227	2.123	2.048	1.895	2.139	8.9	AVG
Phenol-d6	2.400	2.227	2.123	2.048	1.895	2.139	8.9	AVG
Nitrobenzene-d5	.572	.634	.655	.672	.638	.634	6.0	AVG
2-Fluorobiphenyl	2.316	2.138	2.205	2.181	2.162	2.200	3.2	AVG
2,4,6-Tribromophenol	.435	.518	.586	.553	.524	.523	10.8	AVG
Terphenyl-d14	1.380	1.658	1.996	1.897	1.808	1.748	13.7	AVG

FORM VI SV-1 1/87 Rev.

4,6-Dinitro-2-methylphenol and 4-Nitrophenol are at 10 ng/uL in the 5 standard.
2,4-Dinitrophenol and 2 or 4-Chloronitrobenzene levels are 40 and 100 ng/uL respectively in the 5 standard.
Benzoic acid and Pentachlorophenol are at 20 ng/uL in the 5 standard.
Benzidine levels in the 5,50,80,120,160 standards are 95,200,320,480 and 640 ng/uL respectively.

Initial Calibration Data
HSL Compounds

Case No: ______________________   Instrument ID: HP03189

Contractor: LANCASTER LABS   Calibration Date: 06/28/95

Contract No: ______________________

Minimum $\overline{RF}$ for SPCC is 0.05   Maximum % RSD for CCC is 30.0%

Laboratory ID:	>V6255	>V6253	>V6254	>V6252	>V6251							
Compound	RF 5.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CORR1	CORR2	CCC	SPCC
Pyridine	1.38088	1.46399	1.50487	1.49281	1.39794	.259	1.44810	3.862	.998279	.999317		
2-Picoline	1.20375	1.25487	1.27265	1.33115	1.28612	.463	1.26971	3.657	.999470	.999473		
N-Nitrosodimethylamine	.85223	.88437	.88145	.87966	.83543	.256	.86663	2.505	.999003	.999694		
3-Chloropropionitrile	-	-	-	-	-	-	-	-	-	-		
Methyl methanesulfonate	-	-	-	-	-	-	-	-	-	-		
Phenol	1.76798	1.55918	1.52924	1.48261	1.36499	.912	1.54080	9.537	.996933	.999390	*	
Aniline	1.93389	1.70183	1.56847	1.56675	1.48548	.907	1.65128	10.659	.998645	.999650		
bis(2-Chloroethyl)ether	1.24564	1.06949	1.02811	.94230	.85281	.934	1.02767	14.361	.992803	.999484		
2-Chlorophenol	1.33872	1.26047	1.23940	1.18673	1.07652	.939	1.22037	7.966	.995277	.999092		
1,3-Dichlorobenzene	1.62398	1.44936	1.43212	1.33748	1.23856	.982	1.41630	10.127	.995980	.999667		
1,4-Dichlorobenzene	1.62289	1.45768	1.44714	1.33786	1.24186	1.005	1.42148	10.059	.995689	.999672	*	
Benzyl alcohol	.64116	.63989	.64618	.63211	.60274	1.049	.63242	2.742	.998922	.999794		
1,2-Dichlorobenzene	1.50654	1.26080	1.20831	1.09342	.96645	1.047	1.20710	16.743	.989268	.998784		
2-Methylphenol	1.06906	1.02068	1.03824	1.01341	.96625	1.089	1.02153	3.682	.998915	.999754		
2,2'-oxybis(1-Chloropropane)	2.84608	2.73835	2.77272	2.69897	2.44925	1.093	2.70107	5.583	.995947	.998684		
bis(2-Chloroisopropyl)ether	2.84608	2.73835	2.77272	2.69897	2.44925	1.093	2.70107	5.583	.995947	.998684		
4-Methylphenol	1.27931	1.03681	.94716	.83044	.73515	1.135	.96577	21.670	.985430	.999485		
3 or 4-Methylphenol	1.27931	1.03681	.94716	.83044	.73515	1.135	.96577	21.670	.985430	.999485		
N-Methylaniline	-	-	-	-	-	-	-	-	-	-		
Acetophenone	4.26555	3.45993	3.49401	3.35231	3.06730	1.127	3.52782	12.620	.996392	.999046		
N-Nitroso-di-n-propylamine	1.03265	.93870	.91620	.77714	.57599	1.132	.84813	20.925	.940946	.961451		**
o-Toluidine	2.67333	2.16375	1.97112	2.02910	1.77576	1.136	2.12261	15.924	.993679	.996437		
Hexachloroethane	.61351	.61966	.62997	.60694	.54893	1.147	.60380	5.271	.995270	.998633		
2-Fluorophenol	1.13750	1.15613	1.17156	1.14477	1.08383	.636	1.13876	2.923	.998591	.999696		
Phenol-d5	1.50024	1.39209	1.32710	1.28028	1.18458	.908	1.33686	8.869	.996816	.999674		
Phenol-d6	1.50024	1.39209	1.32710	1.28028	1.18458	.908	1.33686	8.869	.996816	.999674		
Nitrobenzene	.39301	.41991	.42313	.42316	.39824	.849	.41149	3.562	.998634	.999481		
N,N-Dimethylaniline	-	-	-	-	-	-	-	-	-	-		

RF - Response Factor (Subscript is amount in ng/ul)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CORRn - Coefficient of Correlation (nth degree)

CCC - Calibration Check Compounds (*)   SPCC - System Performance Check Compounds (**)

6/28/95

Initial Calibration Data
HSL Compounds

Case No: ________________________

Instrument ID: HP03189

Contractor: LANCASTER LABS

Calibration Date: 06/28/95

Contract No: ____________________

Minimum $\overline{\text{RF}}$ for SPCC is 0.05   Maximum % RSD for CCC is 30.0%

Laboratory ID:	>V6255	>V6253	>V6254	>V6252	>V6251								
	RF	RF	RF	RF	RF								
Compound	5.00	50.00	80.00	120.00	160.00	$\overline{\text{RRT}}$	$\overline{\text{RF}}$	% RSD	CORR1	CORR2	CCC	SPCC	
Isophorone	.69355	.71911	.73588	.75335	.73587	.904	.72755	3.098	.999757	.999765			
2-Nitrophenol	.15673	.20999	.20927	.21659	.20464	.918	.19944	12.161	.998905	.999289	*		
2,4-Dimethylphenol	.37144	.37436	.37659	.28416	.36312	.937	.35394	11.115	.979572	.982405			
Benzoic acid	.19591	.22950	.26096	.28403	.28418	.973	.25092	15.160	.999208	.999308			(Conc=20.
bis(2-Chloroethoxy)methane	.43929	.41809	.41920	.42831	.41085	.959	.42315	2.588	.999465	.999608			
1-Methyl-2-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
2,4-Dichlorophenol	.30512	.31282	.30862	.30573	.29118	.973	.30469	2.672	.999009	.999810	*		
1,2,4-Trichlorobenzene	.36356	.35911	.35050	.34562	.31790	.990	.34734	5.153	.997118	.999248			
1,3-Dimethyl-2-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
Naphthalene	1.01932	.96255	.96279	.91047	.82497	1.005	.93602	7.804	.994744	.998998			
1-Methyl-3-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
4-Chloroaniline	.43967	.43258	.44031	.43007	.40257	1.023	.42904	3.601	.998054	.999471			
Hexachlorobutadiene	.23605	.23527	.23559	.23738	.20494	1.038	.22985	6.067	.992078	.995408	*		
1-Methyl-4-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
2 or 4-Choloronitrobenzene	-	-	-	-	-	-	-	-	-	-			
2-Tertbutylphenol	-	-	-	-	-	-	-	-	-	-			
1,4-Dimethyl-2-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
4-Chloro-3-methylphenol	.28401	.32316	.33489	.32269	.29348	1.140	.31165	6.972	.995592	.998662	*		
3 or 4-Tertbutylphenol	-	-	-	-	-	-	-	.	-	-			
2-Methylnaphthalene	.65989	.60717	.61176	.57262	.52622	1.164	.59553	8.341	.995542	.999353			
Nitrobenzene-d5	.35737	.39655	.40945	.41992	.39875	.845	.39641	5.986	.999063	.999292			
Hexachlorocyclopentadiene	.29573	.44824	.50519	.56009	.54839	.858	.47153	22.824	.997953	.998449		**	
2,4,6-Trichlorophenol	.40358	.44376	.47732	.50322	.50866	.879	.46731	9.399	.999136	.999692	*		
2,4,5-Trichlorophenol	.42992	.48022	.50371	.52018	.49977	.884	.48676	7.152	.999308	.999354			
2-Chloronaphthalene	1.26531	1.17375	1.23027	1.24134	1.20491	.910	1.22312	2.871	.999578	.999626			
1,2-Dichloro-4-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
1,2-Dichloro-3-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
2,6-Ditertbutylphenol	-	-	-	-	-	-	-	-	-	-			

RF - Response Factor (Subscript is amount in ng/ul)

$\overline{\text{RRT}}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{\text{RF}}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CORRn - Coefficient of Correlation (nth degree)

CCC - Calibration Check Compounds (*)   SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Case No: ________________________ Instrument ID: HP03189

Contractor: LANCASTER LABS Calibration Date: 06/28/95

Contract No: ____________________

Minimum $\overline{RF}$ for SPCC is 0.05 Maximum % RSD for CCC is 30.0%

Laboratory ID:	>V6255	>V6253	>V6254	>V6252	>V6251								
Compound	RF 5.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CORR1	CORR2	CCC	SPCC	
2-Nitroaniline	.36685	.50597	.55398	.57376	.57317	.930	.51475	16.932	.999486	.999623			
1,4-Naphthoquinone	-	-	-	-	-	-	-	-	-	-			
Dimethylphthalate	1.41281	1.40877	1.45645	1.42087	1.41882	.966	1.42355	1.335	.999865	.999901			
3,4-Dichloro-nitrobenzene	-	-	-	-	-	-	-	-	-	-			
Acenaphthylene	1.98511	1.89204	1.93526	1.88824	1.77331	.976	1.89479	4.139	.998229	.999494			
2,4-Ditertbutylphenol	-	-	-	-	-	-	-	-	-	-			
2,6-Dinitrotoluene	.21818	.32428	.33713	.32363	.31307	.974	.30326	15.933	.998817	.999823			
3-Nitroaniline	.26895	.36198	.36733	.35939	.36245	.999	.34402	12.226	.999889	.999920			
3,4-Dichloroaniline	-	-	-	-	-	-	-	-	-	-			
Acenaphthene	1.27673	1.19417	1.20874	1.21317	1.14745	1.006	1.20805	3.840	.998950	.999486	*		
BHT	-	-	-	-	-	-	-	-	-	-			
2,4-Dinitrophenol	.12489	.15954	.19965	.21350	.21893	1.017	.18330	21.865	.999458	.999958		**	(Conc=40.
4-Nitrophenol	.15438	.20623	.22222	.20557	.19043	1.033	.19577	13.140	.994540	.998997		**	(Conc=10.
3,5-Ditertbutylphenol	-	-	-	-	-	-	-	-	-	-			
Dibenzofuran	1.85327	1.64651	1.60817	1.54503	1.43890	1.035	1.61838	9.455	.997369	.999712			
2,4-Dinitrotoluene	.39948	.45413	.47774	.45246	.45529	1.039	.44782	6.461	.999474	.999619			
1-Naphthylamine	1.49330	1.30071	1.40330	1.38668	1.30136	1.049	1.37707	5.838	.998181	.998845			
2-Naphthylamine	1.24483	1.09370	1.20360	1.20807	1.16657	1.062	1.18335	4.840	.999073	.999124			
Diethylphthalate	1.41047	1.38369	1.42813	1.37648	1.32566	1.085	1.38489	2.821	.999016	.999784			
4-Chlorophenyl-phenylether	.69726	.65907	.68413	.65391	.63413	1.096	.66570	3.767	.999086	.999766			
Fluorene	1.32926	1.29133	1.27131	1.23203	1.15895	1.091	1.25658	5.164	.998082	.999787			
4-Nitroaniline	.21247	.32706	.34919	.34412	.34904	1.100	.31638	18.582	.999836	.999840			
2-Fluorobiphenyl	1.44779	1.33640	1.37809	1.36288	1.35114	.895	1.37526	3.151	.999903	.999920			
2,4,6-Tribromophenol	.27188	.32388	.36653	.34569	.32748	1.130	.32709	10.766	.997152	.998619			
4,6-Dinitro-2-methylphenol	.10236	.14261	.15181	.14347	.13361	.889	.13477	14.267	.995876	.999298			(Conc=10.
N-Nitrosodiphenylamine	.57071	.54875	.56285	.55248	.51625	.898	.55021	3.791	.998071	.999336	*		
1,2-Diphenylhydrazine	1.00912	.97774	1.01429	1.01739	.95595	.902	.99490	2.704	.998583	.999198			
1-Nitronaphthalene	-	-	-	-	-	-	-	-	-	-			

RF - Response Factor (Subscript is amount in ng/ul)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CORRn - Coefficient of Correlation (nth degree)

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

Initial Calibration Data
HSL Compounds

Case No: ________________________ Instrument ID: HP03189

Contractor: LANCASTER LABS Calibration Date: 06/28/95

Contract No: ____________________

Minimum $\overline{RF}$ for SPCC is 0.05 Maximum % RSD for CCC is 30.0%

Laboratory ID:	>V6255	>V6253	>V6254	>V6252	>V6251								
Compound	RF 5.00	RF 50.00	RF 80.00	RF 120.00	RF 160.00	$\overline{RRT}$	$\overline{RF}$	% RSD	CORR1	CORR2	CCC	SPCC	
4-Methyl-3-nitrobenzoic acid	-	-	-	-	-	-	-	-	-	-			
4-Bromophenyl-phenylether	.26716	.26914	.28797	.28002	.25326	.946	.27151	4.875	.995471	.997912			
Hexachlorobenzene	.38890	.37360	.37881	.37219	.33499	.949	.36970	5.540	.995545	.998231			
Pentachlorophenol	.17835	.18836	.20794	.21264	.20060	.977	.19758	7.150	.998091	.998821	*		(Conc=20.
Phenanthrene	1.30231	1.13074	1.14906	1.07919	.96863	1.003	1.12599	10.749	.993780	.998476			
Anthracene	1.23366	1.17976	1.15214	1.10502	1.01880	1.010	1.13787	7.139	.996521	.999554			
Carbazole	1.00677	1.06470	1.06005	.99880	.90799	1.035	1.00766	6.279	.994617	.999200			
Di-n-butylphthalate	1.11785	1.38509	1.35616	1.32072	1.16592	1.091	1.26915	9.424	.992858	.997819			
Diphenyl sulfone	-	-	-	-	-	-	-	-	-	-			
Fluoranthene	1.10814	1.24518	1.16830	1.09288	.91712	1.161	1.10632	10.987	.982971	.994920	*		
Benzidine	.79530	.64462	.68744	.68233	.66132	.878	.69420	8.506	.998910	.998932			(Conc=95.
Pyrene	1.51267	1.54018	1.90263	1.90440	1.82332	.881	1.73664	11.224	.997316	.997391			
Butylbenzylphthalate	.45305	.67294	.70737	.68846	.67829	.954	.64002	16.459	.999558	.999854			
3,3′-Dichlorobenzidine	.32924	.39869	.45773	.48361	.51241	1.001	.43634	16.749	.997334	.999560			
Benzo(a)anthracene	1.09443	1.12340	1.15327	1.22088	1.22224	.999	1.16284	4.945	.999403	.999756			
Chrysene	1.11392	1.08629	1.12381	1.17478	1.17991	1.003	1.13574	3.560	.999513	.999833			
bis(2-Ethylhexyl)phthalate	.67037	.90094	.91858	.90758	.90337	1.014	.86017	12.360	.999907	.999982			
Terphenyl-d14	.86274	1.03648	1.24725	1.18543	1.12976	.902	1.09233	13.725	.996937	.997799			
Di-n-octylphthalate	1.82533	2.15541	1.87757	2.07480	2.05971	.952	1.99856	7.023	.998195	.998346	*		
7,12-Dimethylbenz[a]anthracene	.81365	.79566	.78786	.84968	.80496	.973	.81036	2.964	.998711	.998713			
Benzo(b)fluoranthene	1.78963	1.52473	1.66213	1.63769	1.71180	.972	1.66520	5.865	.998972	.999625			
Benzo(k)fluoranthene	1.66053	1.54548	1.54306	1.63048	1.44016	.975	1.56394	5.524	.995044	.996068			
Benzo(a)pyrene	1.38819	1.40317	1.48194	1.48731	1.38459	.996	1.42904	3.587	.998038	.998808	*		
Indeno(1,2,3-cd)pyrene	.86170	1.18761	1.09197	1.11352	1.01853	1.087	1.05466	11.716	.996458	.998741			
Dibenz(a,h)anthracene	.87427	1.17539	1.05383	1.09305	1.01953	1.091	1.04321	10.628	.997517	.998805			
Benzo(g,h,i)perylene	.80602	1.15883	1.02677	1.04306	.95595	1.113	.99813	13.000	.995775	.998692			

RF - Response Factor (Subscript is amount in ng/ul)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT Istd)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CORRn - Coefficient of Correlation (nth degree)

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

7B
SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: ______.

Lab Code: LANCAS Case No.: ______. SAS No.: ______. SDG No.: ______.

Instrument ID: HP03189 Calibration Date: 06/28/95 Time: 13:03

Lab File ID: >V6303 Init. Calib. Date(s): 06/27/95 06/28/95

Min RRF50 for SPCC(#) = 0.050 Max %Drift for CCC(*) = 20.0

COMPOUND	RRF	RRF80	ACTUAL CONC	TRUE CONC	% DRIFT
Pyridine	2.317	1.488	82.20	80.0	-2.8
N-Nitrosodimethylamine	1.387	.878	81.02	80.0	-1.3
2-Picoline	2.032	1.292	81.41	80.0	-1.8
Phenol *	2.465	1.514	78.60	80.0	1.8*
Aniline	2.642	1.580	76.53	80.0	4.3
bis(2-Chloroethyl)ether	1.644	.969	75.43	80.0	5.7
2-Chlorophenol	1.953	1.238	81.18	80.0	-1.5
1,3-Dichlorobenzene	2.266	1.408	79.53	80.0	.6
1,4-Dichlorobenzene *	2.274	1.404	78.99	80.0	1.3*
Benzyl alcohol	1.012	.635	80.30	80.0	-.4
1,2-Dichlorobenzene	1.931	1.153	76.10	80.0	4.9
2-Methylphenol	1.634	1.039	81.38	80.0	-1.7
2,2'-oxybis(1-Chloropropane)	4.322	2.682	79.45	80.0	.7
bis(2-Chloroisopropyl)ether	4.322	2.682	79.45	80.0	.7
4-Methylphenol	1.545	.885	73.51	80.0	8.1
3 or 4-Methylphenol	1.545	.885	73.51	80.0	8.1
Acetophenone	5.645	3.435	77.89	80.0	2.6
N-Nitroso-di-n-propylamine #	1.357	.872	83.41	80.0	-4.3#
o-Toluidine	3.396	1.872	71.74	80.0	10.3
Hexachloroethane	.966	.606	80.33	80.0	-.4
Nitrobenzene	.658	.427	83.11	80.0	-3.9
Isophorone	1.164	.729	80.17	80.0	-.2
2-Nitrophenol *	.319	.221	88.47	80.0	-10.6*
2,4-Dimethylphenol	.566	.380	86.00	80.0	-7.5
Benzoic acid	.401	.269	81.38	80.0	-1.7
bis(2-Chloroethoxy)methane	.677	.423	79.94	80.0	.1
2,4-Dichlorophenol *	.488	.311	81.53	80.0	-1.9*
1,2,4-Trichlorobenzene	.556	.357	82.19	80.0	-2.7
Naphthalene	1.498	.938	80.19	80.0	-.2
4-Chloroaniline	.686	.439	81.83	80.0	-2.3
Hexachlorobutadiene *	.368	.237	82.48	80.0	-3.1*
4-Chloro-3-methylphenol *	.499	.330	84.71	80.0	-5.9*
2-Methylnaphthalene	.953	.610	81.98	80.0	-2.5
Hexachlorocyclopentadiene #	.754	.534	83.13	80.0	-3.9#
2,4,6-Trichlorophenol *	.748	.475	81.27	80.0	-1.6*
2,4,5-Trichlorophenol	.779	.535	87.97	80.0	-10.0
2-Chloronaphthalene	1.957	1.206	78.91	80.0	1.4
2-Nitroaniline	.824	.564	81.85	80.0	-2.3

7C

SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: ______.

Lab Code: LANCAS Case No.: ______. SAS No.: ______. SDG No.: ______.

Instrument ID: HP03189 Calibration Date: 06/28/95 Time: 13:03

Lab File ID: >V6303 Init. Calib. Date(s): 06/27/95 06/28/95

Min RRF50 for SPCC(#) = 0.050 Max %Drift for CCC(*) = 20.0%

COMPOUND	RRF	RRF80	ACTUAL CONC	TRUE CONC	% DRIFT
Dimethylphthalate	2.278	1.441	81.01	80.0	-1.3
1,3-Dinitrobenzene	0.000	0.000	0.00	80.0	100.0
2,6-Dinitrotoluene	.485	.341	82.33	80.0	-2.9
Acenaphthylene	3.032	1.924	81.21	80.0	-1.5
3-Nitroaniline	.550	.360	83.65	80.0	-4.6
Acenaphthene *	1.933	1.213	80.30	80.0	-.4*
2,4-Dinitrophenol #	.293	.193	78.49	80.0	1.9#
4-Nitrophenol #	.313	.204	83.41	80.0	-4.3#
Dibenzofuran	2.589	1.637	80.93	80.0	-1.2
2,4-Dinitrotoluene	.717	.455	81.37	80.0	-1.7
1-Naphthylamine	2.203	1.373	79.79	80.0	.3
2-Naphthylamine	1.893	1.201	81.17	80.0	-1.5
Diethylphthalate	2.216	1.348	77.87	80.0	2.7
4-Chlorophenyl-phenylether	1.065	.672	80.73	80.0	-.9
Fluorene	2.011	1.256	79.99	80.0	.0
4-Nitroaniline	.506	.319	74.55	80.0	6.8
4,6-Dinitro-2-methylphenol	.216	.143	85.12	80.0	-6.4
N-Nitrosodiphenylamine (1) *	.880	.575	83.66	80.0	-4.6*
1,2-Diphenylhydrazine	1.592	1.032	82.99	80.0	-3.7
4-Bromophenyl-phenylether	.434	.293	86.30	80.0	-7.9
Hexachlorobenzene	.592	.380	82.25	80.0	-2.8
Pentachlorophenol *	.316	.201	77.16	80.0	3.6*
Phenanthrene	1.802	1.116	79.31	80.0	.9
Anthracene	1.821	1.136	79.86	80.0	.2
Carbazole	1.612	.925	73.44	80.0	8.2
Di-n-butylphthalate	2.031	1.136	71.63	80.0	10.5
Fluoranthene *	1.770	.972	70.30	80.0	12.1*
Benzidine	1.111	.615	283.70	320.0	11.3
Pyrene	2.779	1.520	70.02	80.0	12.5
Butylbenzylphthalate	1.024	.617	72.24	80.0	9.7
3,3'-Dichlorobenzidine	.698	.476	79.95	80.0	.1
Benzo(a)anthracene	1.861	1.148	78.96	80.0	1.3
bis(2-Ethylhexyl)phthalate	1.376	.822	76.45	80.0	4.4
Chrysene	1.817	1.134	79.85	80.0	.2
Di-n-octylphthalate *	3.198	2.097	83.38	80.0	-4.2*
7,12-Dimethylbenz[a]anthrace	1.297	.882	87.11	80.0	-8.9
Benzo(b)fluoranthene	2.664	1.754	84.28	80.0	-5.3
Benzo(k)fluoranthene	2.502	1.558	79.71	80.0	.4

(1) Cannot be separated from Diphenylamine

7C cont
SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Instrument ID: HP03189 Calibration Date: 06/28/95 Time: 13:03

Lab File ID: >V6303 Init. Calib. Date(s): 06/27/95 06/28/95

Min RRF50 for SPCC(#) = 0.050 Max %Drift for CCC(*) = 20.0%

COMPOUND		RRF	RRF80	ACTUAL CONC	TRUE CONC	% DRIFT	
Benzo(a)pyrene	*	2.286	1.529	85.57	80.0	-7.0	*
Indeno(1,2,3-cd)pyrene		1.687	1.088	82.51	80.0	-3.1	
Dibenz(a,h)anthracene		1.669	1.074	82.38	80.0	-3.0	
Benzo(g,h,i)perylene		1.597	1.022	81.89	80.0	-2.4	
2-Fluorophenol		1.822	1.151	80.89	80.0	-1.1	
Phenol-d5		2.139	1.296	77.58	80.0	3.0	
Phenol-d6		2.139	1.296	77.58	80.0	3.0	
Nitrobenzene-d5		.634	.421	84.95	80.0	-6.2	
2-Fluorobiphenyl		2.200	1.367	79.51	80.0	.6	
2,4,6-Tribromophenol		.523	.341	83.36	80.0	-4.2	
Terphenyl-d14		1.748	.973	71.24	80.0	11.0	

(1) Cannot be separated from Diphenylamine

Benzidine level in the 50 standard is 200 ng/uL.

Quality Control Summary

Surrogate Recovery
Pesticides

Matrix: WATER

LLI Sample No.	Sample Code	S1 (DCB)	S2 (TCX)	S3 (OXY)	S4 (DCAA)	OTHER
BLK6/9	BLK6/9	86	57 *			
LCS6/9	LCS6/9	100	71			
LCSD6/9	LCSD6/9	55 *	77			
BLK6/12	BLK6/12	83	95			
2326074	WPMW2	60	74			

		QC REC Limits Low	QC REC Limits High
S1 (DCB)	Decachlorobiphenyl	60	120
S2 (TCX)	Tetrachlorometaxylene	60	120
S3 (OXY)	Oxychlordane		
S4 (DCAA)	2,4-Dichlorophenylacetic Acid		
S5 OTHER			

* = Surrogate Recovery is outside specifications.
# = No established limits
D = Surrogates diluted out I = Interferences present

Comments:

Quality Control Summary

Method Blank
Pesticides

Matrix..: WATER

Sample Information		Blank Contamination Information					
LLI Sample No.	Sample Code	CAS Number	Compound	Analysis Date	Blank Result	Units	LOQ
BLK6/9	BLK6/9	319-84-6	alpha-BHC	06/14/95	ND	ug/l	0.01
LCS6/9	LCS6/9	319-85-7	beta-BHC	06/14/95	ND	ug/l	0.01
LCSD6/9	LCSD6/9	319-86-8	delta-BHC	06/14/95	ND	ug/l	0.01
		58-89-9	gamma-BHC (Lindane)	06/14/95	ND	ug/l	0.01
		76-44-8	Heptachlor	06/14/95	ND	ug/l	0.01
		309-00-2	Aldrin	06/14/95	ND	ug/l	0.01
		1024-57-3	Heptachlor epoxide	06/14/95	ND	ug/l	0.01
		959-98-8	Endosulfan I	06/14/95	ND	ug/l	0.01
		60-57-1	Dieldrin	06/14/95	ND	ug/l	0.01
		72-55-9	4,4'-DDE	06/14/95	ND	ug/l	0.01
		72-20-8	Endrin	06/14/95	ND	ug/l	0.01
		33213-65-9	Endosulfan II	06/14/95	ND	ug/l	0.01
		72-54-8	4,4'-DDD	06/14/95	ND	ug/l	0.01
		1031-07-8	Endosulfan sulfate	06/14/95	ND	ug/l	0.03
		50-29-3	4,4'-DDT	06/14/95	ND	ug/l	0.01
		72-43-5	Methoxychlor	06/14/95	ND	ug/l	0.05
		53494-70-5	Endrin ketone	06/14/95	ND	ug/l	0.1
		5103-71-9	alpha-Chlordane	06/14/95	ND	ug/l	0.01
		5103-74-2	gamma-Chlordane	06/14/95	ND	ug/l	0.01
		8001-35-2	Toxaphene	06/14/95	ND	ug/l	4
		12674-11-2	PCB-1016	06/14/95	ND	ug/l	1
		11104-28-2	PCB-1221	06/14/95	ND	ug/l	1
		11141-16-5	PCB-1232	06/14/95	ND	ug/l	1
		53469-21-9	PCB-1242	06/14/95	ND	ug/l	1
		12672-29-6	PCB-1248	06/14/95	ND	ug/l	1
		11097-69-1	PCB-1254	06/14/95	ND	ug/l	1
		11096-82-5	PCB-1260	06/14/95	ND	ug/l	1
		7421-39-4	Endrin aldehyde	06/14/95	ND	ug/l	0.1
		12789-03-6	Technical Chlordane	06/14/95	ND	ug/l	0.3

COMMENTS:

Abbreviation Key
--- = Analysis not requested
ND = None detected
J = Estimated value below LOQ
LOQ = Limit of Quantitation
* = Outside Specifications

Quality Control Summary

Matrix Spike/Matrix Spike Duplicate
Pesticides

Unspiked Sample #....:2331041BKGD
Spiked Sample #......:2331041MS
Spiked Dup Sample #..:2331041MSD

Matrix: water

This MS/MSD applies to the following samples	Compound	Spike Added (ug/l)	Sample Conc (ug/l)	MS Conc (ug/l)	MSD Conc (ug/l)	MS % REC	MSD % REC	QC Limits REC	RPD	QC Limits RPD
1322BLK6/22	alpha-BHC	0.200	ND	0.207	0.194	103	97	80 -132	6	30
2331034	beta-BHC	0.200	ND	0.204	0.200	102	100	74 -120	2	30
2331035	delta-BHC	0.200	ND	0.166	0.173	83	86	76 -126	4	30
2331038	gamma-BHC (Lindane)	0.200	ND	0.201	0.195	101	98	66 -120	3	30
2331039	Heptachlor	0.200	ND	0.190	0.186	95	93	60 -120	2	30
2331040	Aldrin	0.200	ND	0.142	0.141	71	70	58 -120	1	30
2331041BKGD	Heptachlor epoxide	0.200	ND	0.194	0.186	97	93	64 -120	4	30
2331041MS	Endosulfan I	0.200	ND	0.199	0.193	100	97	66 -120	3	30
2331041MSD	Dieldrin	0.200	ND	0.203	0.195	102	98	83 -120	4	30
	4,4'-DDE	0.200	ND	0.206	0.201	103	101	74 -120	2	30
	Endrin	0.200	ND	0.239	0.240	119	120	76 -120	0	30
	Endosulfan II	0.200	ND	0.212	0.212	106	106	67 -120	0	30
	4,4'-DDD	0.200	ND	0.227	0.228	114	114	75 -126	0	30
	Endosulfan sulfate	0.200	ND	0.213	0.210	106	105	74 -120	1	30
	4,4'-DDT	0.200	ND	0.204	0.204	102	102	71 -120	0	30
	Methoxychlor	0.200	ND	0.216	0.231	108	116	63 -120	7	30
	Endrin aldehyde	0.200	ND	0.209	0.208	104	104	68 -120	0	30
	Kepone	10.090	ND	2.937	3.053	29	30	22 -120	4	30

ABBREVIATION KEY
MS = Matrix Spike
MSD = Matrix Spike Duplicate
ND = None Detected
RPD = Relative Percent Difference
--- = Analysis not requested
= No established limits
* = Outside specifications
D = Detection Limit

COMMENTS:

Quality Control Summary

Lab Control Spike/Lab Control Spike Duplicate
Pesticides

Unspiked Sample #....:BLK6/9
Spiked Sample #......:LCS6/9
Spiked Dup Sample #..:LCSD6/9

Matrix: WATER

This LCS/LCSD applies to the following samples	Compound	Spike Added (ug/l)	BKGD Conc (ug/l)	LCS Conc (ug/l)	LCSD Conc (ug/l)	LCS % REC	LCSD % REC	QC Limits REC	RPD	QC Limits RPD
BLK6/9	alpha-BHC	0.205	ND	0.169	0.183	82	89	80 -132	8	30
LCS6/9	gamma-BHC	0.202	ND	0.169	0.175	84	87	66 -120	3	30
LCSD6/9	beta-BHC	0.192	ND	0.179	0.190	93	99	74 -120	6	30
BLK6/12	Heptachlor	0.182	ND	0.153	0.158	84	87	60 -120	3	30
2326074	delta-BHC	0.186	ND	0.166	0.178	89	96	76 -126	7	30
	Aldrin	0.192	ND	0.154	0.159	80	83	58 -120	3	30
	Heptachlor epoxide	0.196	ND	0.169	0.164	86	84	64 -120	3	30
	Endosulfan I	0.200	ND	0.190	0.196	95	98	66 -120	3	30
	4,4'-DDE	0.211	ND	0.180	0.186	85	88	74 -120	3	30
	Dieldrin	0.202	ND	0.176	0.181	87	90	83 -120	3	30
	Endrin	0.232	ND	0.219	0.228	94	98	76 -120	4	30
	4,4'-DDD	0.233	ND	0.199	0.201	85	86	75 -126	1	30
	Endosulfan II	0.199	ND	0.184	0.192	92	96	67 -120	4	30
	4,4'-DDT	0.201	ND	0.192	0.191	96	95	71 -120	1	30
	Endrin aldehyde	0.224	ND	0.185	0.200	83	89	68 -120	8	30
	Endosulfan sulfate	0.215	ND	0.194	0.209	90	97	74 -120	7	30
	Methoxychlor	0.242	ND	0.203	0.219	84	90	63 -120	8	30

ABBREVIATION KEY
LCS = Lab Control Spike   LCSD = Lab Control Spike Duplicate
ND = None Detected   --- = Analysis not requested
RPD = Relative Percent Difference
# = No established limits   * = Outside Specifications

COMMENTS:

Lancaster Laboratories
Where quality is a science.

Initial Calibration Summary for Calibration file C:\CP\DATA1\1C11165.CAL
Last Update 06-16-1995 11:05:48

COMPOUND	FROM RT	MID POINT	TO RT	AVERAGE RESPONSE FACTOR	%RSD
TCX	11.24	11.29	11.34	2913523	7.86%
alpha-BHC	14.81	14.86	14.91	5611629	11.44%
gamma-BHC	16.88	16.93	16.98	4706381	4.33%
beta-BHC	17.21	17.26	17.31	1960863	8.80%
Heptachlor	18.76	18.81	18.86	3744529	3.43%
delta-BHC	19.12	19.17	19.22	4897620	1.69%
Aldrin	20.50	20.55	20.60	3787456	4.39%
Hept.epox exo	23.32	23.39	23.46	3346413	4.08%
g. Chlordane	24.19	24.26	24.33	3369553	5.88%
a. Chlordane	25.02	25.09	25.16	3223094	5.53%
Endosulfan I	25.13	25.20	25.27	2957528	5.32%
4,4'-DDE	26.29	26.36	26.43	3215387	4.74%
Dieldrin	26.68	26.75	26.82	2979424	2.16%
Endrin	28.48	28.55	28.62	2301405	7.84%
4,4'-DDD	29.03	29.10	29.17	2272551	6.00%
Endosulfan II	29.35	29.42	29.49	2419656	3.16%
4,4'-DDT	30.63	30.70	30.77	2195278	25.05%
Endrin aldehyde	31.05	31.12	31.19	1510423	3.23%
Endo. sulfate	31.81	31.88	31.95	1696058	2.57%
Methoxychlor	36.53	36.61	36.69	657429	33.82%
Endrin Ketone	37.31	37.38	37.45	1483419	2.62%
DCB	52.14	52.21	52.28	694011	12.57%

4,4'-DDT Breakdown= 2.4 % Endrin Breakdown= 2 % Total Breakdown= 4.4 % Data File 2

Analyst: ______________________ Date: 6/16/95
Chromperfect Version Lanc

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume = 1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 1  TCX  Min RT= 11.24 Ret Time= 11.29 Max RT= 11.34 Window= .05

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- --------- --------- ------------ ----------------
   1      0.00200     6474  32372.0E+02 1C11165.03A  06-15-1995 08:45
   2      0.00800    24294  30367.7E+02 1C11165.04A  06-15-1995 08:46
   3      0.01600    46155  28846.9E+02 1C11165.05A  06-15-1995 08:46
   4      0.04000   109220  27305.1E+02 1C11165.06A  06-15-1995 08:46
   5      0.08000   214275  26784.4E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9856729  Ave error=6.1071%
 Height = 00.e00 +29.135e05*X^1
 Average CF (EPA method 8000) = 2913522.75  with %RSD = 7.856%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report – Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 2  alpha-BHC  Min RT= 14.81 Ret Time= 14.86 Max RT= 14.91 Window= .05

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt      Source          Date Updated
 ----- --------- --------- ------------ ----------------
   1     0.00100      6723  67227.1E+02 1C11165.03A  06-15-1995 08:45
   2     0.00400     22213  55533.5E+02 1C11165.04A  06-15-1995 08:46
   3     0.00800     43389  54236.9E+02 1C11165.05A  06-15-1995 08:46
   4     0.02000    103789  51894.3E+02 1C11165.06A  06-15-1995 08:46
   5     0.04000    206759  51689.7E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9854131  Ave error=7.5483%
 Height = 00.e00 +56.116e05*X^1
 Average CF (EPA method 8000) = 5611628.5  with %RSD = 11.436%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

```
                                              Run Number: 1C11165

al file = C:\CP\DATA1\1C11165.CAL Version number = 11
al file date = 06-15-1995 08:55:40
xternal standard calibration.
efault injection volume =  1   Area reject =  1500
eference peak area reject =  1500    Sample units = ug/ml


 3  gamma-BHC  Min RT= 16.88 Ret Time= 16.93 Max RT= 16.98 Window= .05

o reference peak for this compound.
o internal standard for this compound.
igh Alarm amount = .1  Low Alarm amount = 0
omponent constant =  0
uantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt   Source        Date Updated
 ----- ---------- -------- ------------ ----------------
  1     0.00100     4989  49892.2E+02 1C11165.03A  06-15-1995 08:45
  2     0.00400    19246  48116.0E+02 1C11165.04A  06-15-1995 08:46
  3     0.00800    37537  46920.9E+02 1C11165.05A  06-15-1995 08:46
  4     0.02000    91366  45683.1E+02 1C11165.06A  06-15-1995 08:46
  5     0.04000   178827  44706.8E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9951826  Ave error=3.2910%
 Height = 00.e00 +47.064e05*X^1
 Average CF (EPA method 8000) = 4706381.0  with %RSD = 4.327%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

```
                                                        Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1    Area reject =   1500
Reference peak area reject =  1500    Sample units = ug/ml


 4  beta-BHC  Min RT= 17.21 Ret Time= 17.26 Max RT= 17.31 Window= .05

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1   Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- --------- -------- ----------- ----------------
   1      0.00100     2232  22322.8E+02 1C11165.03A  06-15-1995 08:45
   2      0.00400     7954  19885.3E+02 1C11165.04A  06-15-1995 08:46
   3      0.00800    15645  19555.6E+02 1C11165.05A  06-15-1995 08:46
   4      0.02000    36841  18420.7E+02 1C11165.06A  06-15-1995 08:46
   5      0.04000    71435  17858.8E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9827707  Ave error=6.0137%
 Height = 00.e00 +19.609e05*X^1
 Average CF (EPA method 8000) = 1960863.375  with %RSD = 8.803%
```

Initial Calibration Report - Single Component

Run Number: 1C11165

```
al file = C:\CP\DATA1\1C11165.CAL Version number = 11
al file date = 06-15-1995 08:55:40
xternal standard calibration.
efault injection volume =  1   Area reject =  1500
eference peak area reject =  1500    Sample units = ug/ml


5  Heptachlor  Min RT= 18.76 Ret Time= 18.81 Max RT= 18.86 Window= .05

o reference peak for this compound.
o internal standard for this compound.
igh Alarm amount = .1  Low Alarm amount = 0
omponent constant =  0
uantitation will be by peak height.
LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source      Date Updated
----- --------- -------- ------------ ----------------
  1     0.00100     3894  38937.2E+02 1C11165.03A 06-15-1995 08:45
  2     0.00400    15372  38430.9E+02 1C11165.04A 06-15-1995 08:46
  3     0.00800    30047  37558.4E+02 1C11165.05A 06-15-1995 08:46
  4     0.02000    72532  36266.2E+02 1C11165.06A 06-15-1995 08:46
  5     0.04000   144135  36033.8E+02 Manual      06-15-1995 08:55

Fit type = Average CF with equal weighting
Coef of determination= .997115  Ave error=2.7731%
Height = 00.e00 +37.445e05*X^1
Average CF (EPA method 8000) = 3744529.25  with %RSD = 3.428%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 6  delta-BHC  Min RT= 19.12 Ret Time= 19.17 Max RT= 19.22 Window= .05

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt     Source         Date Updated
------ --------- -------- ------------ ---------------
  1      0.00100     4971  49707.6E+02 1C11165.03A  06-15-1995 08:45
  2      0.00400    19958  49895.2E+02 1C11165.04A  06-15-1995 08:46
  3      0.00800    39174  48968.0E+02 1C11165.05A  06-15-1995 08:46
  4      0.02000    96375  48187.5E+02 1C11165.06A  06-15-1995 08:46
  5      0.04000   192491  48122.7E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9993891  Ave error=1.3480%
 Height = 00.e00 +48.976e05*X^1
 Average CF (EPA method 8000) = 4897620.5  with %RSD = 1.687%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

```
                                                     Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 7  Aldrin  Min RT= 20.5 Ret Time= 20.55 Max RT= 20.6 Window= .05

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt     Source        Date Updated
 ----- ---------- --------- ------------ ----------------
  1      0.00100      3902  39015.2E+02 1C11165.03A   06-15-1995 08:45
  2      0.00400     15756  39390.7E+02 1C11165.04A   06-15-1995 08:46
  3      0.00800     30950  38687.1E+02 1C11165.05A   06-15-1995 08:46
  4      0.02000     73533  36766.7E+02 1C11165.06A   06-15-1995 08:46
  5      0.04000    142053  35513.2E+02 Manual        06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9924871  Ave error=3.7071%
 Height = 00.e00 +37.875e05*X^1
 Average CF (EPA method 8000) = 3787456.0  with %RSD = 4.391%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
al file = C:\CP\DATA1\1C11165.CAL Version number = 11
al file date = 06-15-1995 08:55:40
xternal standard calibration.
efault injection volume =  1   Area reject =  1500
eference peak area reject =  1500    Sample units = ug/ml


 8  Hept.epox exo  Min RT= 23.32 Ret Time= 23.39 Max RT= 23.46 Window= .07

o reference peak for this compound.
o internal standard for this compound.
igh Alarm amount = .23  Low Alarm amount = 0
omponent constant =  0
uantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- ---------- -------- ------------ ----------------
  1      0.00100      3537  35366.4E+02 1C11165.03A  06-15-1995 08:45
  2      0.00400     13621  34052.7E+02 1C11165.04A  06-15-1995 08:46
  3      0.00800     26877  33596.8E+02 1C11165.05A  06-15-1995 08:46
  4      0.02000     64620  32310.1E+02 1C11165.06A  06-15-1995 08:46
  5      0.04000    127979  31994.6E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9961092  Ave error=3.1333%
 Height = 00.e00 +33.464e05*X^1
 Average CF (EPA method 8000) = 3346413.0  with %RSD = 4.085%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

```
                                                        Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 13
Cal file date = 06-15-1995 12:07:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 9  g. Chlordane  Min RT= 24.19 Ret Time= 24.26 Max RT= 24.33 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source         Date Updated
 ----- --------- --------- ------------ ----------------
   1     0.00100      3661  36610.0E+02 Manual         06-15-1995 12:07
   2     0.00400     13711  34276.8E+02 1C11165.04A    06-15-1995 08:46
   3     0.00800     27116  33895.5E+02 1C11165.05A    06-15-1995 08:46
   4     0.02000     63738  31868.9E+02 1C11165.06A    06-15-1995 08:46
   5     0.04000    127306  31826.5E+02 Manual         06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9931358  Ave error=4.3701%
 Height = 00.e00 +33.696e05*X^1
 Average CF (EPA method 8000) = 3369553.25  with %RSD = 5.88%

Analyst:                   ______________________________Date: 6/15/95
Reviewed & Approved by:    ______________________________Date: 6/16/95
Chromperfect Version Lanc          Reported On 06-15-1995 12:07:53
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

```
                                             Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 12
Cal file date = 06-15-1995 10:41:31
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 10  a. Chlordane  Min RT= 25.02 Ret Time= 25.09 Max RT= 25.16 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- --------- -------- ------------ ----------------
   1     0.00100     3477  34770.0E+02 Manual        06-15-1995 10:41
   2     0.00400    13287  33216.7E+02 1C11165.04A   06-15-1995 08:46
   3     0.00800    25471  31838.7E+02 1C11165.05A   06-15-1995 08:46
   4     0.02000    62027  31013.5E+02 1C11165.06A   06-15-1995 08:46
   5     0.04000   121263  30315.8E+02 Manual        06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9929551  Ave error=4.3490%
 Height = 00.e00 +32.231e05*X^1
 Average CF (EPA method 8000) = 3223093.5  with %RSD = 5.533%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

```
                                              Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 12
Cal file date = 06-15-1995 10:41:31
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 11  Endosulfan I  Min RT= 25.13 Ret Time= 25.2 Max RT= 25.27 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt    Source         Date Updated
 ----- ---------- --------- ------------ ----------------
  1      0.00100      3189  31890.0E+02 Manual         06-15-1995 10:41
  2      0.00400     12082  30205.9E+02 1C11165.04A    06-15-1995 08:46
  3      0.00800     23611  29513.9E+02 1C11165.05A    06-15-1995 08:46
  4      0.02000     56296  28147.9E+02 1C11165.06A    06-15-1995 08:46
  5      0.04000    112475  28118.8E+02 Manual         06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9946629  Ave error=3.9610%
 Height = 00.e00 +29.575e05*X^1
 Average CF (EPA method 8000) = 2957528.25  with %RSD = 5.324%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

```
                                                           Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 12  4,4'-DDE  Min RT= 26.29 Ret Time= 26.36 Max RT= 26.43 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- --------- -------- ----------- ---------------
  1     0.00200     6941  34705.2E+02 1C11165.03A  06-15-1995 08:45
  2     0.00800    25542  31927.1E+02 1C11165.04A  06-15-1995 08:46
  3     0.01600    51261  32037.9E+02 1C11165.05A  06-15-1995 08:46
  4     0.04000   122701  30675.3E+02 1C11165.06A  06-15-1995 08:46
  5     0.08000   251390  31423.8E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9982497  Ave error=3.1134%
 Height = 00.e00 +32.154e05*X^1
 Average CF (EPA method 8000) = 3215387.25  with %RSD = 4.74%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 13  Dieldrin  Min RT= 26.68 Ret Time= 26.75 Max RT= 26.82 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt      Source        Date Updated
 ----- --------- --------- ------------ ----------------
   1     0.00200      6069  30344.1E+02 1C11165.03A  06-15-1995 08:45
   2     0.00800     23950  29937.4E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600     48582  30363.6E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000    115342  28835.6E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000    235924  29490.5E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9993864  Ave error=1.7040%
 Height = 00.e00 +29.794e05*X^1
 Average CF (EPA method 8000) = 2979423.5  with %RSD = 2.161%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 14  Endrin  Min RT= 28.48 Ret Time= 28.55 Max RT= 28.62 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt     Source        Date Updated
 ----- --------- -------- ------------ ----------------
   1     0.00200      5212  26059.1E+02 1C11165.03A  06-15-1995 08:45
   2     0.00800     18502  23127.7E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600     35788  22367.7E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000     88153  22038.2E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000    171820  21477.5E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9909449  Ave error=5.3298%
 Height = 00.e00 +23.014e05*X^1
 Average CF (EPA method 8000) = 2301404.5  with %RSD = 7.838%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

```
                                                  Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 15  4,4'-DDD  Min RT= 29.03 Ret Time= 29.1 Max RT= 29.17 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT     HEIGHTHEIGHT/Amt     Source        Date Updated
 ----- --------- -------- ------------ ----------------
   1     0.00200     5016  25079.9E+02 1C11165.03A  06-15-1995 08:45
   2     0.00800    17849  22311.1E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600    35776  22359.8E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000    86084  21520.9E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000   178846  22355.8E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9983746  Ave error=4.0263%
 Height = 00.e00 +22.726e05*X^1
 Average CF (EPA method 8000) = 2272550.75  with %RSD = 6.0%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 16  Endosulfan II  Min RT= 29.35 Ret Time= 29.42 Max RT= 29.49 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source       Date Updated
 ----- --------- -------- ------------ ----------------
   1    0.00200     5009  25047.1E+02 1C11165.03A  06-15-1995 08:45
   2    0.00800    18532  23164.5E+02 1C11165.04A  06-15-1995 08:46
   3    0.01600    39737  24835.4E+02 1C11165.05A  06-15-1995 08:46
   4    0.04000    96468  24117.0E+02 1C11165.06A  06-15-1995 08:46
   5    0.08000   190550  23818.7E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9995225  Ave error=2.4679%
 Height = 00.e00 +24.197e05*X^1
 Average CF (EPA method 8000) = 2419655.5  with %RSD = 3.165%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

```
                                                Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =    500    Sample units = ug/ml


 17  4,4'-DDT  Min RT= 30.63 Ret Time= 30.7 Max RT= 30.77 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt    Source          Date Updated
 ----- --------- -------- ---- ------- ----------------
   1     0.00200     6356  317  7.9E+02 1C11165.03A  06-15-1995 08:45
   2     0.00800    15850  1981 ?.8E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600    31555  1972  .7E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000    76406  1910  .4E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000   154800  19350  1E+02 Manual       06-15-1995 08:55

 Fit type = Linear with equal weighting. extrapolated to zero
 Coef of determination= .9997122  Ave error=5.6061%
 Height = 11.674e02 +19.118e05*X^1
 Average CF (EPA method 8000) = 21 5278.0  with %RSD = 25.053%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report - Single Component

```
                                                  Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 18  Endrin aldehyde  Min RT= 31.05 Ret Time= 31.12 Max RT= 31.19 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt     Source        Date Updated
 ----- --------- --------- ----------- ----------------
  1     0.00200      3147  15736.9E+02 1C11165.03A  06-15-1995 08:45
  2     0.00800     11637  14546.4E+02 1C11165.04A  06-15-1995 08:46
  3     0.01600     24758  15473.7E+02 1C11165.05A  06-15-1995 08:46
  4     0.04000     59283  14820.7E+02 1C11165.06A  06-15-1995 08:46
  5     0.08000    119547  14943.4E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9996116  Ave error=2.6464%
 Height = 00.e00 +15.104e05*X^1
 Average CF (EPA method 8000) = 1510423.375  with %RSD = 3.234%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report – Single Component

```
                                                  Run Number: 1C11165

Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 19  Endo. sulfate  Min RT= 31.81 Ret Time= 31.88 Max RT= 31.95 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL     AMOUNT      HEIGHTHEIGHT/Amt     Source          Date Updated
 ----- ---------- --------- ------------ ----------------
   1     0.00200      3452  17259.0E+02 1C11165.03A. 06-15-1995 08:45
   2     0.00800     13223  16529.2E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600     27986  17491.3E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000     66041  16510.3E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000    136106  17013.2E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9996347  Ave error=2.0818%
 Height = 00.e00 +16.961e05*X^1
 Average CF (EPA method 8000) = 1696058.25  with %RSD = 2.574%
```

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report – Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 20  Methoxychlor  Min RT= 36.53 Ret Time= 36.61 Max RT= 36.69 Window= .08

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = 1  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt    Source        Date Updated
 ----- --------- -------- ------------ ----------------
   1      0.01000    10550  10550.1E+02 1C11165.03A  06-15-1995 08:45
   2      0.04000    22670  56673.9E+01 1C11165.04A  06-15-1995 08:46
   3      0.08000    45043  56303.9E+01 1C11165.05A  06-15-1995 08:46
   4      0.20000   109753  54876.7E+01 1C11165.06A  06-15-1995 08:46
   5      0.40000   221436  55359.0E+01 Manual       06-15-1995 08:55

 Fit type = Linear with equal weighting, extrapolated to zero
 Coef of determination= .9995268  Ave error=7.3643%
 Height = 22.738e02 +54.532e04*X^1
 Average CF (EPA method 8000) = 657429.0  with %RSD = 33.824%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report – Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


21  Endrin Ketone  Min RT= 37.31 Ret Time= 37.38 Max RT= 37.45 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
LEVEL   AMOUNT    HEIGHTHEIGHT/Amt     Source        Date Updated
----- --------- -------- ------------ ----------------
 1      0.00200     2929  14643.1E+02 1C11165.03A  06-15-1995 08:45
 2      0.00800    12049  15060.7E+02 1C11165.04A  06-15-1995 08:46
 3      0.01600    24427  15266.6E+02 1C11165.05A  06-15-1995 08:46
 4      0.04000    59722  14930.6E+02 1C11165.06A  06-15-1995 08:46
 5      0.08000   114160  14270.0E+02 Manual       06-15-1995 08:55

Fit type = Average CF with equal weighting
Coef of determination= .9974507  Ave error=2.0481%
Height = 00.e00 +14.834e05*X^1
Average CF (EPA method 8000) = 1483418.625  with %RSD = 2.616%
```

Lancaster Laboratories

Where quality is a science.

Initial Calibration Report – Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 11
Cal file date = 06-15-1995 08:55:40
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 22  DCB  Min RT= 52.14 Ret Time= 52.21 Max RT= 52.28 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL   AMOUNT    HEIGHTHEIGHT/Amt    Source       Date Updated
 ----- --------- --------- ------------ ----------------
   1     0.00200     3339  16696.9E+02 1C11165.03A  06-15-1995 08:45
   2     0.00800    11313  14141.4E+02 1C11165.04A  06-15-1995 08:46
   3     0.01600    21772  13607.7E+02 1C11165.05A  06-15-1995 08:46
   4     0.04000    51075  12768.7E+02 1C11165.06A  06-15-1995 08:46
   5     0.08000    97491  12186.4E+02 Manual       06-15-1995 08:55

 Fit type = Average CF with equal weighting
 Coef of determination= .9653278  Ave error=8.6647%
 Height = 00.e00 +13.88e05*X^1
 Average CF (EPA method 8000) = 1388021.25  with %RSD = 12.572%
```

DCB concentrations are 1/2.
files 21-38 were run under these cond.

Analyst: Date: 6/15/95

Reviewed & Approved by: Date: 6/17/95

Chromperfect Version Lanc   Reported On 06-15-1995 08:56:02

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report - Single Component

Run Number: 1C11165

```
Cal file = C:\CP\DATA1\1C11165.CAL Version number = 14
Cal file date = 06-16-1995 11:05:48
External standard calibration.
Default injection volume =  1   Area reject =  1500
Reference peak area reject =  1500    Sample units = ug/ml


 22  DCB  Min RT= 52.14 Ret Time= 52.21 Max RT= 52.28 Window= .07

No reference peak for this compound.
No internal standard for this compound.
High Alarm amount = .2  Low Alarm amount = 0
Component constant =  0
Quantitation will be by peak height.
 LEVEL    AMOUNT    HEIGHTHEIGHT/Amt      Source          Date Updated
 ----- --------- -------- ------------ ----------------
   1    0.00400     3339  83484.7E+01 Manual             06-16-1995 11:05
   2    0.01600    11313  70706.9E+01 Manual             06-16-1995 11:05
   3    0.03200    21772  68038.4E+01 Manual             06-16-1995 11:05
   4    0.08000    51075  63843.5E+01 Manual             06-16-1995 11:05
   5    0.16000    97491  60931.8E+01 Manual             06-16-1995 11:05

 Fit type = Average CF with equal weighting
 Coef of determination= .9653278  Ave error=8.6647%
 Height = 00.e00 +69.401e04*X^1
 Average CF (EPA method 8000) = 694010.625  with %RSD = 12.572%
```

corrected DCB concentrations used for files 39

Analyst: ________________ Date: 6/16/95
Reviewed & Approved by: ________________ Date: 6/16/95
Chromperfect Version Lanc   Reported On 06-16-1995 11:05:58

Initial Calibration Report - Multiple Component

Run Number: 1C11165

Area Files Used for Calibration

Area file directory: ____________ Applies to Injections: ____________

(1)	8	(2)	9	(3)	10	(4)	11
(5)	12	(6)	13	(7)	14	(8)	16
(9)	17	(10)	18	(11)	19	(12)	20
(13)		(14)		(15)		(16)	

Multiple Component: Aroclor-1016
Calibration Levels: 5
Min # Peaks for Quant: 4

Avg Concentration(ug/ml): .86172
Max %RSD for Compnd Id: 15

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	14.660	16.880	18.840	19.650	20.320	22.130				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Average Height	40125	56885	95106	44399	39368	36134				
RF (Height/Conc)	46564	66014	110367	51524	45709	41932				
%RSD for RF	6.857%	5.777%	6.086%	6.529%	5.811%	5.951%				
Level 1 Height	4628	6870	11670	5516	4727	4309				
Conc.	0.1002	0.1002	0.1002	0.1002	0.1002	0.1002				
Level 2 Height	10142	14076	23735	10886	9813	8968				
Conc.	0.2004	0.2004	0.2004	0.2004	0.2004	0.2004				
Level 3 Height	23033	33378	53875	25771	22957	20939				
Conc.	0.5010	0.5010	0.5010	0.5010	0.5010	0.5010				
Level 4 Height	46192	64210	106619	50167	44747	42232				
Conc.	1.0020	1.0020	1.0020	1.0020	1.0020	1.0020				
Level 5 Height	105099	151707	257992	117087	105017	95099				
Conc.	2.5050	2.5050	2.5050	2.5050	2.5050	2.5050				

Lancaster Laboratories
Where quality is a science.

Initial Calibration Report – Multiple Component

Run Number: 1C1165

Multiple Component: **Aroclor-1221**
Calibration Levels: 1
Min # Peaks for Quant: 3
Concentration (ug/ml): .2502
Max %RSD for Compnd Id: 5

- from [illegible] #20

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	13.310	13.530	14.650							
RT Window (mins)	0.10000	0.10000	0.10000							
Height	10346	9054	18449							
RF (Height/Conc)	41351	36187	73737							

Multiple Component: **Aroclor-1232**
Calibration Levels: 1
Min # Peaks for Quant: 4
Concentration (ug/ml): .2502
Max %RSD for Compnd Id: 10

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	13.320	14.660	16.870	18.840	19.640	25.190				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	9509	14646	8192	13388	6560	6813				
RF (Height/Conc)	38006	58537	32742	53509	26219	27230				

Multiple Component: **Aroclor-1242**
Calibration Levels: 1
Min # Peaks for Quant: 4
Concentration (ug/ml): .25
Max %RSD for Compnd Id: 30

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	16.870	18.830	19.640	23.450	23.790	25.180				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	15626	24643	11752	11429	12214	12689				
RF (Height/Conc)	62504	98572	47008	45716	48856	50756				

Initial Calibration Report – Multiple Component

Run Number: 1C11165

Multiple Component: **Aroclor-1260**
Calibration Levels: 5 — Avg Concentration(ug/ml): .86
Min # Peaks for Quant: 4 — Max %RSD for Compnd Id: 40

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	28.040	28.510	30.690	30.930	33.080	34.050				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Average Height	65873	124432	72723	93613	61906	199133				
RF (Height/Conc)	76596	144688	84562	108852	71984	231550				
%RSD for RF	11.154%	7.203%	7.424%	5.427%	6.664%	6.875%				
Level 1 Height	6710	15788	9355	11419	7885	25010				
Conc.	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000				
Level 2 Height	16764	30527	17690	23123	15000	48373				
Conc.	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000				
Level 3 Height	34419	68987	39741	53191	34547	110159				
Conc.	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000				
Level 4 Height	68482	142385	82326	106574	69713	234600				
Conc.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0008				
Level 5 Height	186852	331414	197500	253751	168153	527172				
Conc.	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000				

Multiple Component: **Toxaphene**
Calibration Levels: 1 — Concentration (ug/ml): .5
Min # Peaks for Quant: 4 — Max %RSD for Compnd Id: 30

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	26.820	27.750	28.740	29.080	29.530	30.790				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	7486	7176	9142	11888	13696	10437				
RF (Height/Conc)	14972	14352	18284	23776	27392	20874				

Initial Calibration Report - Multiple Component

Run Number: 1C11165

Multiple Component: **Aroclor-1248**
Calibration Levels: 1
Min # Peaks for Quant: 4
Concentration (ug/ml): .2502
Max %RSD for Compnd Id: 30

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	16.840	20.490	22.120	23.490	23.790	25.180				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	14223	11867	16327	19845	19733	20679				
RF (Height/Conc)	56847	47430	65256	79317	78869	82650				

Multiple Component: **Aroclor-1254**
Calibration Levels: 1
Min # Peaks for Quant: 4
Concentration (ug/ml): .2505
Max %RSD for Compnd Id: 40

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	24.190	24.550	27.130	27.760	28.510	30.680				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	19214	22528	34737	29301	20760	25891				
RF (Height/Conc)	76703	89932	138671	116970	82874	103357				

Initial Calibration Report - Multiple Component

Run Number: 101165

Multiple Component: Chlordane
Calibration Levels: 1
Concentration (ug/ml): .2
Min # Peaks for Quant: 2
Max %RSD for Compnd Id: 20

Peak Data

	1	2	3	4	5	6	7	8	9	10
Retention Time:	17.570	18.820	24.270	24.500	25.090	29.890				
RT Window (mins)	0.10000	0.10000	0.10000	0.10000	0.10000	0.10000				
Height	28659	32321	65343	34456	55517	21580				
RF (Height/Conc)	143295	161605	326715	172280	277585	107900				

Analyst: EF

Date: 6/15/95

Reported on 06-15-1995 13:14:56   Last Calibrated on 06-15-1995 13:13:52   ChromPerfect Version .01   CheckPCB Version 3.22

ck 6/15/95

```
==============================SW846======================================
Sample Name: MIXA395B                       C       1.09516599999937
 Instrument ID: CP11--V3780A           Injected on: Jun 16, 1995   03:03:03
 Volume Inj. per column: 1         GC Column ID: DB608
 Sample Amount: 1                  Dilution Factor: 1
 Raw File: C:\CP\DATA1\1C11165.31R
-------------------------------------------------------------------------
GC Conditions: Injector 250C    Detector 300C   Carrier: He 5.5 ml/min
Oven: 150C HOLD 2 MIN TO 260C @ 4C/MIN HOLD 25 MIN
Analyst: 440
-------------------------------------------------------------------------
Integration & Calculation Parameters:
   Threshold: 7               Width: .05             Area Reject: 1500

   Calib. Type: EXTERNAL     Quantitation: HEIGHT
-------------------------------------------------------------------------
Peak Table:

MIN RT   Ret Time   MAX RT   Peak      Amount
(min)    (min)      (min)    Height    ppb       Peak Name           RPD (%)
 0.00     6.15       0.00       608    0.0000                             0.
 0.00     6.58       0.00       842    0.0000                             0.
 0.00     6.87       0.00      3583    0.0000                             0.
 0.00     8.20       0.00       832    0.0000                             0.
 0.00    10.61       0.00      2208    0.0000                             0.
11.24    11.28      11.34     50829    0.0174   TCX                     -10.
 0.00    12.99       0.00       779    0.0000                             0.
 0.00    13.31       0.00       746    0.0000                             0.
 0.00    13.53       0.00       814    0.0000                             0.
14.81    14.85      14.91     48228    0.0086   alpha-BHC               -11.
16.83    16.92      16.98     41144    0.0087   gamma-BHC               -10.
17.21    17.26      17.31     17938    0.0091   beta-BHC                -15.
 0.00    18.31       0.00      1360    0.0000                             0.
18.76    18.81      18.86     34468    0.0092   Heptachlor              -15.
19.12    19.17      19.22     42856    0.0088   delta-BHC                -9.
20.50    20.55      20.60     34267    0.0090   Aldrin                  -11.
 0.00    21.27       0.00      1239    0.0000                             0.
23.32    23.38      23.46     29790    0.0089   Hept.epox exo           -11.
 0.00    23.79       0.00      1080    0.0000                             0.
24.19    24.25      24.33     29707    0.0088   g. Chlordane            -10.
25.02    25.07      25.16     28573    0.0089   a. Chlordane            -12.
25.13    25.19      25.27     26704    0.0090   Endosulfan I            -13.
26.29    26.36      26.43     57942    0.0180   4,4'-DDE                -13.
26.68    26.74      26.82     53363    0.0179   Dieldrin                -10.
28.48    28.54      28.62     40904    0.0178   Endrin                  -14.
29.03    29.09      29.17     41040    0.0181   4,4'-DDD                -15.
29.35    29.40      29.49     42551    0.0176   Endosulfan II            -7.
 0.00    30.43       0.00      1208    0.0000                             0.
30.63    30.69      30.77     35437    0.0179   4,4'-DDT                -12.
```

```
31.05   31.10    31.19    26708     0.0177  Endrin aldehyde        -8.
 0.00   31.47     0.00     2043     0.0000                          0.
31.81   31.87    31.95    30215     0.0178  Endo. sulfate          -8.
 0.00   33.33     0.00     1538     0.0000                          0.
36.53   36.58    36.69    50670     0.0887  Methoxychlor          -12.
37.31   37.36    37.45    26426     0.0178  Endrin Ketone          -8.
52.14   52.18    52.28    25557     0.0184  DCB                   -17.

---------------------------------------------------------------------------
Calculation for RPD % = (ICAL LVL 3 RF)-(CCAL LVL 3 RF)/(ICAL LVL 3 RF)

* = This component is not contained in this standard mix.

Reviewed by: Jackie Ulrich                 Date: 6-16-95

FILES:
Area file: C:\CP\DATA1\1C11165.31A
Method file: C:\CP\DATA1\PPLCC.MET
Calibration File: C:\CP\DATA1\1C11165.CAL
Format File: C:\CP\DATA1\PESTCC.FMT
Area file created on: 06/16/95 03:04:28 .
File reported on: 06-16-1995at 03:04:37
```

Lancaster Laboratories
Where quality is a science.

```
                                                                        Batch No:  95165999999
     Sample Name: AR16395A                       C
     Injected on: 06-16-1995_04:03:15   Instrument: CP11--V3780A      Analyst: 440    Area File Name:  C:\CP\DATA1\1C11165.32A
                                                                      Sample Amount:  1 G or L   Total Volume:  1 mL
   Units:   uG/L or mG/kG              No Of Peaks                  Maximum
                                              Minimum                  Allowed     Worst
Pattern        Amount Found            Found   Required      %RSD      %RSD       Case**                  Comments
============  ============            =======  ========  =========  =========  ============  ==========================================
Aroclor-1016        0.5382                6        4       2.04180%   15.0000%      0.521583  ÷.5= 108%
Aroclor-1221*       0.2440                2        3      57.96621%    5.0000%      0.144006
Aroclor-1232*       0.9110                4        4      35.07152%   10.0000%      0.059155
Aroclor-1242*       0.5791                3        4       0.74074%   30.0000%      0.031736
Aroclor-1248*       0.5543                3        4      71.76501%   30.0000%      0.019489
Aroclor-1254*       0.1889                3        4      19.30026%   40.0000%      0.023032
Aroclor-1260        0.5163                6        4       1.85200%   40.0000%      0.510270  ÷.5= 103%
Toxaphene    *      0.4543                3        4     130.36842%   30.0000%      0.042186
Chlordane    *      0.0749                3        2      40.38113%   20.0000%      0.041108

Peaks Used To Quantify Above Amount Found Values:
Pattern     Retention Time and Calculated Amount Found for Each Peak
==========================================================================================================================
Aroclor-1016     14.659       16.880       18.843       19.649       20.318       22.126
                  0.5448       0.5453       0.5216       0.5268       0.5440       0.5466
Aroclor-1221     13.535       14.659
                  0.1440       0.3441
Aroclor-1232     14.659       16.880       18.843       19.649
                  0.4334       1.0994       1.0758       1.0353
Aroclor-1242     16.880       18.843       19.649
                  0.5759       0.5840       0.5774
Aroclor-1248     18.843       20.495       22.126
                  1.0127       0.2990       0.3512
Aroclor-1254     24.197       24.562       27.148
                  0.1751       0.1613       0.2302
Aroclor-1260     28.036       28.515       30.679       30.927       33.060       34.046
                  0.5338       0.5104       0.5110       0.5111       0.5103       0.5214
Toxaphene        27.765       29.103       29.494
                  0.1877       0.0422       1.1330
Chlordane        17.988       24.197       24.562
                  0.0994       0.0411       0.0842
Non-Quantitation Peaks with matching retention times:
Aroclor-1232     25.197
                  0.0592
Aroclor-1242     25.197       23.491       23.757
                  0.0317       0.1040       0.1364
Aroclor-1248     25.197       23.491       23.757
                  0.0195       0.0600       0.0845
Aroclor-1254     28.515       30.679       27.765
                  0.8911       0.4181       0.0230
Chlordane        18.843
                  0.3562
```

Reviewed by Jackie Ulrich **Date:** 6-16-95

%SSR(A): ________ %
%SSR(B): ________ %

Lancaster Laboratories

Where quality is a science.

```
==============================SW846=====================================
Sample Name: EVALX95A                        C      1.095165999999937
 Instrument ID: CP11--V3780A          Injected on: Jun 16, 1995  05:03:22
 Volume Inj. per column: 1        GC Column ID: DB608
 Sample Amount: 1                 Dilution Factor: 1
 Raw File: C:\CP\DATA1\1C11165.33R
--------------------------------------------------------------------------
GC Conditions: Injector 250C    Detector 300C   Carrier: He 5.5 ml/min
Oven: 150C HOLD 2 MIN TO 260C @ 4C/MIN HOLD 25 MIN
Analyst: 440
--------------------------------------------------------------------------
Integration & Calculation Parameters:
   Threshold: 7              Width: .05             Area Reject: 1500

   Calib. Type: EXTERNAL     Quantitation: HEIGHT
--------------------------------------------------------------------------
Peak Table:

MIN RT   Ret Time   MAX RT    Peak      Amount
(min)    (min)      (min)    Height     ppb        Peak Name               RPD (%)
 0.00     6.25      0.00      1136     0.0000                                  0.
 0.00     6.87      0.00      2334     0.0000                                  0.
 0.00     7.79      0.00      1110     0.0000                                  0.
 0.00     8.65      0.00       881     0.0000                                  0.
 0.00     9.43      0.00       836     0.0000                                  0.
 0.00    10.29      0.00       963     0.0000                                  0.
11.24    11.28     11.34     61765     0.0212    TCX                         -34.
 0.00    11.87      0.00      1019     0.0000                                  0.
 0.00    12.59      0.00      1131     0.0000                                  0.
 0.00    13.32      0.00       811     0.0000                                  0.
 0.00    14.20      0.00       793     0.0000                                  0.
14.81    14.85     14.91     62120     0.0111    alpha-BHC                   -43.
 0.00    16.46      0.00      2414     0.0000                                  0.
16.88    16.92     16.98     52953     0.0113    gamma-BHC                   -41.
17.21    17.25     17.31     19582     0.0100    beta-BHC                    -25.
 0.00    17.95      0.00       891     0.0000                                  0.
 0.00    18.71      0.00      1159     0.0000                                  0.
 0.00    21.27      0.00       967     0.0000                                  0.
26.29    26.35     26.43      5791     0.0018    4,4'-DDE                     89.
 0.00    27.14      0.00       497     0.0000                                  0.
28.48    28.54     28.62    120117     0.0522    Endrin                     -236.
29.03    29.09     29.17      3464     0.0015    4,4'-DDD                     90.
29.35    29.49     29.49       751     0.0003    Endosulfan II                98.
 0.00    30.41      0.00       953     0.0000                                  0.
30.63    30.69     30.77    206055     0.1072    4,4'-DDT                   -553.
31.05    31.10     31.19      1396     0.0009    Endrin aldehyde              94.
 0.00    31.47      0.00      1058     0.0000                                  0.
 0.00    33.32      0.00      4032     0.0000                                  0.
 0.00    34.04      0.00      3188     0.0000                                  0.
```

```
36.53    36.59     36.69    144272      0.2604  Methoxychlor              -220.
37.31    37.38     37.45      1235      0.0008  Endrin Ketone               95.
 0.00    37.81      0.00      1191      0.0000                               0.
52.14    52.17     52.28     15459      0.0111  DCB                         29.

--------------------------------------------------------------------------------
Calculation for RPD % = (ICAL LVL 3 RF)-(CCAL LVL 3 RF)/(ICAL LVL 3 RF)

* = This component is not contained in this standard mix.
```

Reviewed by: Jackie Ulrich Date: 6-16-95

```
FILES:
Area file: C:\CP\DATA1\1C11165.33A
Method file: C:\CP\DATA1\PPLCC.MET
Calibration File: C:\CP\DATA1\1C11165.CAL
Format File: C:\CP\DATA1\PESTCC.FMT
Area file created on: 06/16/95 05:04:52
File reported on: 06-16-1995at 05:05:01
```

% Breakdown DDT = $\frac{5791 + 3484}{206055 + 5791 + 3484} \times 100 = 4.31\ \%$

% Breakdown Endrin = $\frac{1396 + 1235}{120117 + 1396 + 1235} \times 100 = 2.14\ \%$

JSU
6-16-95

Surrogate Recovery
Volatiles by GC - Water

LLI Sample No.	Sample Designation	Dilution Factor	S1 (MeBrCl)	S2 (1Cl3FBn)	S3 (1Cl3FBn)	S4 (1,2,3-TCP)	S5 (ProBn)	Other	TOT OUT	Comment

	QC Limits LOW	QC Limits HIGH
S1 (MeBrCl) = Bromochloromethane (Hall Det)	75	125
S2 (1Cl3FBn) = 1-Chloro-3-fluorobenzene (Hall Det)	75	125
S3 (1Cl3FBn) = 1-Chloro-3-fluorobenzene (PID Det)	75	125
S4 (1,2,3-TCP) = 1,2,3-Trichloropropane (Hall Det)	75	125
S5 (ProBn) = n-Propylbenzene (PID Det)	75	125

* Values outside QC limits

D Surrogates diluted out

Nominal concentration of the surrogate spike used is 30 ug/l.

Quality Control Summary

Method Blank
Primary Run
Volatiles by GC

*** BLANK INFORMATION ***
Matrix....................: Water
Batch Number..............: 95108/A15
Injection Number..........: 186
Analysis Date.............: 04/20/95
Concentration Units.......: ug/l

Instrument....................: 05586
Column ID.....................: 75m x 0.45mm ID J&W Scientific DB-VRX

Sample Information				Blank Contamination Information			
LLI Sample #	Sample Designation	Analysis Date	Time	CAS Number	Compound	Blank Result	LOQ
				74-87-3	Chloromethane	ND	5
				74-83-9	Bromomethane	ND	5
				75-01-4	Vinyl chloride	ND	1
				75-00-3	Chloroethane	ND	1
				75-09-2	Methylene chloride	ND	1
				75-69-4	Trichlorofluormethane	ND	1
				75-35-4	1,1-Dichloroethene	ND	1
				75-34-3	1,1-Dichloroethane	ND	1
				540-59-0	1,2-Dichloroethene (c/t)	ND	1
				67-66-3	Chloroform	ND	1
				76-13-1	Trichlorotrifluoroethane	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	Bromodichloromethane	ND	1
				78-87-5	1,2-Dichloropropane	ND	1
				10061-02-6	trans-1,3-Dichloropropene	ND	1
				79-01-6	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
				108-90-7	Chlorobenzene	ND	1
				71-43-2	Benzene	ND	1
				108-88-3	Toluene	ND	1

ABBREVIATION KEY

LOQ = Limit of Quantitation
ND = None Detected
* = above detection limit

Quality Control Summary

Matrix Spike/Matrix Spike Duplicate
Primary Run
Volatiles by GC

Unspiked Sample Number : 2120251 Inj. : 529
Spiked Sample Number : 2120252 Inj. : 530
Spiked Dup Sample Number : 2120253 Inj. : 531

Batch Number : 94124/A12 Date : 05/05/94
Matrix : Water

Instrument.....................: 03819
Column.........................: 1% SP-1000 on Carbopack B

This MS/MSD applies to the following samples	Compound	Spike Added (ug/l)	Sample Conc (ug/l)	MS Conc (ug/l)	MSD Conc (ug/l)	MS % REC	MSD % REC	QC Limits REC	RPD	QC Limits RPD
	Chloromethane	20.0	ND					25 -168		20
	Bromomethane	20.0	ND					46 -136		20
	Vinyl chloride	20.0	ND					48 -163		20
	Chloroethane	20.0	ND					46 -137		20
	Methylene chloride	19.3	ND					78 -128		15
	1,1-Dichloroethene	18.6	ND					74 -137		15
	1,1-Dichloroethane		ND					91 -130		15
	1,2-Dichloroethene(cis/trans)		ND					92 -126		15
	Chloroform		ND					91 -127		15
	1,2-Dichloroethane		ND					80 -130		15
	1,1,1-Trichloroethane		ND					87 -138		15
	Carbon Tetrachloride		ND					91 -134		15
	Bromodichloromethane		ND					87 -123		15
	1,2-Dichloropropane		ND					87 -128		15
	Trichloroethene		ND					91 -131		15
	Dibromochloromethane		ND					88 -131		15
	Bromoform		ND					74 -119		15
	Tetrachloroethene		ND					91 -129		15
	Chlorobenzene		ND					90 -125		15
	Benzene		ND					93 -124		15
	Toluene		ND					92 -120		15
	Ethylbenzene		ND					94 -119		15

ABBREVIATION KEY
MS = Matrix Spike
MSD = Matrix Spike Duplicate
ND = None Detected
RPD = Relative Percent Difference

Quality Control Summary

Initial Calibration
Primary Run
Volatiles by GC

Calibration Batch............: 95003/A15

Sample Batch Number......: 95026/A15

Calibration Date.............: 01/03/95

Instrument...................: 05586
Column ID....................: 75m x 0.45mm ID J&W Scientific DB-VRX

Compound	Laboratory Standard ID						AVE RF	%RSD	QC Limit	RT	ID Window
	2.5-500 +12.5 Rf STD 1	4-200 +20 Rf STD 2	10-200 +20 Rf STD 3	10-50 +10 Rf STD 4	35-50 +20 Rf STD 5	70-50 +30 Rf STD 6					
Chloromethane	0.001411	0.001668	0.001307	0.001949	0.001585	0.001394	0.001553	15.2	20	2.10	+/- 0.3 min
Bromomethane	0.003348	0.003280	0.002448	0.002366	0.002576	0.001980	0.002666	20.3	20 *	3.52	+/- 0.3 min
Vinyl chloride	0.001178	0.001732	0.001443	0.001537	0.001511	0.001294	0.001449	13.4	20	4.50	+/- 0.3 min
Chloroethane	0.001072	0.001265	0.001076	0.001064	0.001078	0.001009	0.001094	8.0	20	5.75	+/- 0.3 min
Methylene chloride	0.000695	0.000732	0.000751	0.000729	0.000712	0.000688	0.000718	3.4	20	8.24	+/- 0.2 min
1,1-Dichloroethene	0.001042	0.000907	0.000716	0.000736	0.000684	0.000727	0.000802	17.6	20	11.14	+/- 0.2 min
1,1-Dichloroethane	0.000989	0.000870	0.000791	0.000740	0.000730	0.000754	0.000812	12.4	20	12.46	+/- 0.2 min
cis-1,2-Dichloroethene	0.001391	0.001111	0.000886	0.000852	0.000824	0.000784	0.000974	24.0	20 *	13.22	+/- 0.2 min
Chloroform	0.000770	0.000666	0.000611	0.000565	0.000571	0.000570	0.000626	12.9	20	13.78	+/- 0.2 min
1,2-Dichloroethane	0.001341	0.001096	0.000936	0.000834	0.000825	0.000788	0.000970	22.0	20 *	14.65	+/- 0.2 min
1,1,1-Trichloroethane	0.001002	0.000982	0.000835	0.000809	0.000798	0.000806	0.000872	10.8	20	15.90	+/- 0.2 min
Carbon tetrachloride	0.000845	0.000718	0.000621	0.000597	0.000593	0.000584	0.000660	15.7	20	16.30	+/- 0.2 min
Bromodichloromethane	0.001315	0.001202	0.001001	0.000922	0.000893	0.000836	0.001028	18.5	20	16.85	+/- 0.2 min
1,2-Dichloropropane	0.001566	0.001361	0.000994	0.000985	0.000990	0.000944	0.001140	22.7	20 *	18.30	+/- 0.2 min
Trichloroethene	0.001007	0.000874	0.000717	0.000705	0.000676	0.000676	0.000776	17.4	20	19.06	+/- 0.2 min
Dibromochloromethane	0.002343	0.001957	0.001613	0.001590	0.001456	0.001384	0.001724	21.0	20 *	19.81	+/- 0.2 min
Bromoform	0.006067	0.004307	0.003584	0.003356	0.003115	0.002659	0.003848	31.6	20 *	22.61	+/- 0.4 min
Tetrachloroethene	0.000814	0.000805	0.000619	0.000677	0.000641	0.000646	0.000700	12.3	20	24.73	+/- 0.2 min
Chlorobenzene	0.003257	0.003025	0.002402	0.002333	0.002347	0.002104	0.002578	17.6	20	27.61	+/- 0.2 min
Benzene	0.026492	0.037147	0.033503	0.035573	0.031104	0.029908	0.032288	12.1	20	19.54	+/- 0.2 min
Toluene	0.038457	0.040149	0.037709	0.040768	0.036457	0.035646	0.038198	5.3	20	26.14	+/- 0.2 min
Ethylbenzene	0.071343	0.069934	0.070323	0.078276	0.069296	0.067727	0.071150	5.2	20	30.39	+/- 0.2 min

This initial calibration applies to samples:

2249687 UNSPK	2250495	2250499	Inj #494 BLK
2249688 MS	2250496	2250500	Inj #536 BLK
2249689 MSD	2250497	2250501	Inj #562 BLK
2249690	2250498	2250502	Inj #599 BLK

For initial calibration 01/03/95, the %RSD for bromomethane, cis-1,2-dichloroethene, 1,2-dichloroethene, 1,2-dichloropropane, dibromochloromethane and bromoform is outside the QC limit as set by Lancaster Laboratories, Inc. However, EPA Method SW-846 5030A/8010A & 8020 does not specify QC limits for this parameter when a calibration curve is used. In addition, these compounds were not detected in any of the samples analyzed under this method.

Quality Control Summary

Continuing Calibration
Primary Run
Volatiles by GC

Calibration Date..............: 04/12/95

Continuing Calibration Date...: 05/16/95

Batch Number..................: 95133/A12

Inj #.........................: 766

Instrument....................: 03819
Column........................: 1% SP-1000 on Carbopack B

	Compound	Amount Spiked	Laboratory Control Sample Result	% Recovery	Acceptance Range	Out of Range
2308195	Chloromethane	20.0	25.7	128.4	60 % - 141 %	
Inj #765 BLK	Bromomethane	20.0	20.4	102.1	59 % - 142 %	
	Vinyl chloride	20.0	22.7	113.4	69 % - 132 %	
	Chloroethane	20.0	22.3	111.4	77 % - 123 %	
	Methylene chloride	20.1	22.1	110.1	78 % - 123 %	
	Trichlorofluoromethane	20.1	20.6	102.7	67 % - 134 %	
	1,1-Dichloroethene	20.1	20.7	102.8	63 % - 137 %	
	1,1-Dichloroethane	20.1	23.3	116.1	84 % - 116 %	*
	1,2-Dichloroethene (c/t)	20.1	20.7	102.9	64 % - 136 %	
	Chloroform	20.1	20.7	103.0	75 % - 125 %	
	1,2-Dichloroethane	20.2	18.1	89.5	72 % - 129 %	
	1,1,1-Trichloroethane	20.0	21.5	107.5	71 % - 129 %	
	Carbon tetrachloride	20.1	22.8	113.3	69 % - 132 %	
	Bromodichloromethane	20.0	19.8	98.8	76 % - 124 %	
	1,2-Dichloropropane	20.1	20.2	100.3	74 % - 126 %	
	Trichloroethene	20.1	21.4	106.6	77 % - 123 %	
	Dibromochloromethane	20.1	18.8	93.6	66 % - 135 %	
	2-Chloroethyl vinyl ether	20.1	22.4	111.4	60 % - 140 %	
	Bromoform	20.1	19.8	98.7	74 % - 127 %	
	Tetrachloroethene	20.1	21.0	104.5	70 % - 130 %	
	Chlorobenzene	20.1	21.0	104.5	72 % - 128 %	

Quality Control Summary

Check Standard Summary
Retention Time
Primary Run
Volatiles by GC - Water

Initial Calibration Date......: 01/03/95
Sample Batch..................: 95061/A01
Injection Number..............: 056
Injection Date................: 03/02/95
Method........................: EPA Method 601

Instrument....................: 02030
Column........................: 1% SP-1000 on Carbopack B

Sample Number	Compound	Retention Time	ID Window
2265581 UNSPK	Chloromethane	2.16	+/- 0.3 min
2265584 MS	Bromomethane	3.59	+/- 0.3 min
2265585 MSD	Vinyl chloride	4.62	+/- 0.3 min
Inj #063 BLK	Chloroethane	5.87	+/- 0.3 min
	Methylene chloride	8.29	+/- 0.2 min
	Trichlorofluoromethane	10.47	+/- 0.2 min
	1,1-Dichloroethene	11.18	+/- 0.2 min
	1,1-Dichloroethane	12.48	+/- 0.2 min
	cis-1,2-Dichloroethene	13.26	+/- 0.2 min
	Chloroform	13.79	+/- 0.2 min
	1,2-Dichloroethane	14.71	+/- 0.2 min
	1,1,1-Trichloroethane	15.92	+/- 0.2 min
	Carbon tetrachloride	16.32	+/- 0.2 min
	Bromodichloromethane	16.95	+/- 0.2 min
	1,2-Dichloropropane	18.44	+/- 0.2 min
	Trichloroethene	19.13	+/- 0.2 min
	Dibromochloromethane	19.92	+/- 0.2 min
	2-Chloroethyl vinyl ether	21.16	+/- 0.2 min
	Bromoform	22.62	+/- 0.4 min
	Tetrachloroethene	24.72	+/- 0.2 min
	Chlorobenzene	27.62	+/- 0.2 min

Quality Control Summary

Retention Time Shift Summary
Primary Run
Volatiles by GC - Water

Initial Calibration Date .....: 01/03/95
Initial Calibration Batch.....: 95003/A01
Sample Batch..................: 95003/A01
Method ....: EPA Method SW-846 5030A/8010A

Instrument....................: 02030
Column........................: 1% SP-1000 on Carbopack B

SURROGATE RT FROM INITIAL CALIBRATION
MeBrCl: 11.62 1Cl3FBn (Hall): 28.76

LLI Sample No.	Sample Designation	Date Analyzed	Time Analyzed	RT (MeBrCl)	RT (1Cl3FBn) Hall Det.

(MeBrCl) = Bromochloromethane (Hall Det)
(1Cl3FBn) = 1-Chloro-3-fluorobenzene (Hall Det)

QUALITY ASSURANCE SUMMARY

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: LANCASTER_LABORATORIES__________

SDG No.: TEST___

Client Sample ID	Lab Sample ID

Were ICP interelement corrections applied ?	Yes/No	YES
Were ICP background corrections applied ?	Yes/No	YES
If yes - were raw data generated before application of background corrections ?	Yes/No	NO_

LEGEND:

U = Below MDL B = Below LOQ

FLAGS: (indicate matrix interference)
N = Matrix Spike OOS
* = Duplicate OOS
W = Method F Analytical Spike Recovery <85% or >115% when the sample conc. is <50% of the spike conc.
S = Analysis Determined by MSA
\+ = MSA Correlation Coefficient <0.995
E = Matrix Effects exist as proven by Serial Dilution or Spiked Dilution

Presence of FLAGS does not invalidate data

METHODS:
A = Flame Atomic Absorption
P = Inductively Coupled Plasma
F = Graphite Furnace
AS = Hydride Generation
CV = Cold Vapor
NR = Not Required

TERMS:
MDL = Method Detection Limit
LOQ = Limit Of Quantitation
OOS = Out Of Specification
MSA = Method Of Standard Addition

I certify that this data package is in full compliance with the terms and conditions as specified by the NJDEP, both technically and for completeness, other than the conditions detailed above. Release of the data contained in this data package has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature:____________________ Name:____________________

Date:____________________ Title:____________________

QUALITY ASSURANCE SUMMARY

CLIENT SAMPLE NO.

INORGANIC ANALYSES DATA SHEET

Lab Name: LANCASTER_LABORATORIES
SDG No.: TEST
Matrix (soil/water): WATER
Level (low/med): LOW
% Solids: 0

Lab Sample ID:
Date Received: 10/19/92

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
	Boron				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				P
	Lithium				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury				NR
	Molybdenu				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
	Silicon				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
	Strontium				NR
7440-28-0	Thallium				NR
	Tin				NR
	Titanium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before:
Color After:

Clarity Before:
Clarity After:

Texture:
Artifacts:

Comments:

QUALITY ASSURANCE SUMMARY

BLANKS

Lab Name: LANCASTER_LABORATORIES

SDG No.: TEST

Preparation Blank Matrix (soil/water):

Preparation Blank Concentration Units (ug/L or mg/kg):

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L)						Preparation Blank	C	M
			1	C	2	C	3	C			
Aluminum											NR
Antimony											NR
Arsenic											NR
Barium											NR
Beryllium											NR
Boron											NR
Cadmium											NR
Calcium											NR
Chromium											NR
Cobalt											NR
Copper											NR
Iron											NR
Lead											P
Lithium											NR
Magnesium											NR
Manganese											NR
Mercury											NR
Molybdenu											NR
Nickel											NR
Potassium											NR
Selenium											NR
Silicon											NR
Silver											NR
Sodium											NR
Strontium											NR
Thallium											NR
Tin											NR
Titanium											NR
Vanadium											NR
Zinc											NR

QUALITY ASSURANCE SUMMARY

SPIKE SAMPLE RECOVERY

CLIENT SAMPLE NO.

Lab Name: LANCASTER_LABORATORIES________

SDG No.: TEST__
Matrix: WATER
% Solids for Sample: __0.0

Level (low/med): LOW

Concentration Units (ug/L or mg/kg dry weight): UG/L_

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Boron									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron									NR
Lead	75-125	28.0000		28.0000		2000.00	0.0	N	P
Lithium									NR
Magnesium									NR
Manganese									NR
Mercury									NR
Molybdenu									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silicon									NR
Silver									NR
Sodium									NR
Strontium									NR
Thallium									NR
Tin									NR
Titanium									NR
Vanadium									NR
Zinc									NR

NOTE: An (N) in column "Q" indicates a spike recovery that is not within the control limits. The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample page of the Quality Assurance Summary.

Comments:

QUALITY ASSURANCE SUMMARY

DUPLICATES

CLIENT SAMPLE NO.

Lab Name: LANCASTER_LABORATORIES________

SDG No.: TEST__

Matrix (soil/water): WATER

Level (low/med): LOW

% Solids for Sample: ____0

% Solids for Duplicate: ____0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								NR
Antimony								NR
Arsenic								NR
Barium								NR
Beryllium								NR
Boron								NR
Cadmium								NR
Calcium								NR
Chromium								NR
Cobalt								NR
Copper								NR
Iron								NR
Lead								P
Lithium								NR
Magnesium								NR
Manganese								NR
Mercury								NR
Molybdenu								NR
Nickel								NR
Potassium								NR
Selenium								NR
Silicon								NR
Silver								NR
Sodium								NR
Strontium								NR
Thallium								NR
Tin								NR
Titanium								NR
Vanadium								NR
Zinc								NR

NOTE: An asterisk(*) in column "Q" indicates poor duplicate precision. The data are considered to be valid because the laboratory control sample is within the control limits. See the Laboratory Control Sample page of the Quality Assurance Summary.

QUALITY ASSURANCE SUMMARY

STANDARD ADDITION RESULTS

Lab Name: LANCASTER_LABORATORIES_________

SDG No.: TEST__

Concentration Units: ug/L

EPA Sample No.	An	0 ADD ABS	1 ADD		2 ADD		3 ADD		Final Conc.	r	Q
			CON	ABS	CON	ABS	CON	ABS			

EPA SAMPLE NO.

ICP SERIAL DILUTIONS

Lab Name: ______________________ Contract: __________

Lab Code: ______ Case No.: _____ SAS No.: ______ SDG No.: ______

Matrix (soil/water): ______ Level (low/med): ______

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Calcium							
Chromium							
Cobalt							
Copper							
Iron							
Lead							
Magnesium							
Manganese							
Mercury							
Nickel							
Potassium							
Selenium							
Silver							
Sodium							
Thallium							
Vanadium							
Zinc							

QUALITY ASSURANCE SUMMARY

LABORATORY CONTROL SAMPLE

ab Name: LANCASTER_LABORATORIES________

DG No.: TEST__

olid LCS Source: _____________

queous LCS Source: LLI__________

	Aqueous (ug/L)			Solid (mg/kg)					
Analyte	True	Found	%R(1)	True	Found	C	Control Limits		%R
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Boron									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron									
Lead									
Lithium									
Magnesium									
Manganese									
Mercury									
Molybdenu									
Nickel									
Potassium									
Selenium									
Silicon									
Silver									
Sodium									
Strontium									
Thallium									
Tin									
Titanium									
Vanadium									
Zinc									

(1) Control Limits: All Metals 80-120

ICP INTERFERENCE CHECK SAMPLE

Lab Name: ______________________ Contract: __________

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: ______

ICP ID Number: __________ ICS Source: __________

Concentration Units: ug/L

	True		Initial Found			Final Found		
Analyte	Sol. A	Sol. AB	Sol. A	Sol. AB	%R	Sol. A	Sol. AB	%R
Aluminum								
Antimony								
Arsenic								
Barium								
Beryllium								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Mercury								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								

QUALITY ASSURANCE SUMMARY

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: LANCASTER_LABORATORIES

SDG No.: TEST

Initial Calibration Source: LLI

Continuing Calibration Source: LLI

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum									NR
Antimony									NR
Arsenic									NR
Barium									NR
Beryllium									NR
Boron									NR
Cadmium									NR
Calcium									NR
Chromium									NR
Cobalt									NR
Copper									NR
Iron									NR
Lead	20.0	1.00	5.0	20.0	1.00	5.0			P
Lithium									NR
Magnesium									NR
Manganese									NR
Mercury									NR
Molybdenu									NR
Nickel									NR
Potassium									NR
Selenium									NR
Silicon									NR
Silver									NR
Sodium									NR
Strontium									NR
Thallium									NR
Tin									NR
Titanium									NR
Vanadium									NR
Zinc									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

QUALITY ASSURANCE SUMMARY

Method Detection Limits (Annually)

Lab Name: LANCASTER_LABORATORIES
SDG No.: TEST
ICP Method No.:
Other AA Method No.:
Furnace AA Method No.: GF_1,2,3_AQUEOU

Date: 01/15/92

Analyte	Wave-length (nm)	Back-ground	LOQ ** (ug/L)	MDL (ug/L)	M
Aluminum			200		NR
Antimony			200		NR
Arsenic			5		NR
Barium			100		NR
Beryllium			10		NR
Boron			40		NR
Cadmium			10		NR
Calcium			200		NR
Chromium			50		NR
Cobalt			50		NR
Copper			20		NR
Iron			100		NR
Lead	283.30	BD	3	1.0	F
Lithium			20		NR
Magnesium			100		NR
Manganese			10		NR
Mercury			0.2		NR
Molybdenu			100		NR
Nickel			50		NR
Potassium			500		NR
Selenium			3		NR
Silicon			300		NR
Silver			20		NR
Sodium			400		NR
Strontium			10		NR
Thallium			10		NR
Tin			300		NR
Titanium			10		NR
Vanadium			10		NR
Zinc			40		NR

** The LOQ must be adjusted for % Solids and Sample Weight for samples reporting in mg/Kg.

Comments:

PREPARATION LOG

Lab Name: LANCASTER_LABORATORIES__________

SDG No.:_TEST__

Method: P_

Client Sample No.	Preparation Date	Weight (gram)	Volume (mL)

ANALYSIS RUN LOG

Lab Name: ______________________ Contract: __________

ab Code: _______ Case No.: _______ SAS No.: _______ SDG No.: _______

Instrument ID Number: ____________ Method: __

tart Date: _________ End Date: _________

EPA Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN

Quality Control Summary
TOTAL ORGANIC CARBON
~~Method Blank~~
Instrumental Analysis

Method Blank Analysis   Matrix: SOIL

Method Blank Designation	LLI Sample No.	Client Designation	Method	Analysis Date	Batch Number	Blank Result	Units	LOQ
BLANK	2302108	Q17T1	TOC	5/04/95	95118-201	< LOQ	mg/kg	50
	2302109	Q17T2						
	2302110	Q17T3						
	2302111	Q17T4						
	2302112	Q16T2						
	2302113	Q16T3						
	2302114	Q16T4						
	2302115	Q16T5						
	2302116	Q1652						
	2302108	SPK, DUP						
BLANK	2303628	S20-8	TOC	5/04/95	95122-201	< LOQ	mg/kg	50
	2303629	S20-9						
	2303630	S2010						
	2303631	S2011						
	2303633	S19S5						
BLANK	2303632	R19S4	TOC	5/18/95	95122-201 *	< LOQ	mg/kg	50
	2303634	S19S4						
	2303635	S1942						

Comments: The blank is acceptable when the result is less than the limit of quantitation.

* The blank prepped with the repeated samples retains the original batch number.

ABBREVIATION KEY

IC = Ion Chromatography
D = Distillation
TOC = Total Organic Carbon
TOX = Total Organic Halogens
* = Out of Specification
--- = Analysis Not Requested
ND = Not Detected
AK = AlpKem
LOQ = Limit of Quantitation
NA = Not Applicable

Quality Control Summary
~~Matrix Spike Analysis~~
Instrumental Analysis

Sample Information

Matrix Spike Analysis   Matrix: SOIL

LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	Unspiked Desig.	Unspiked Result	LOQ	Spiked Desig.	Spike Added	Spiked Result	Units	%REC
2302108	Q17T1	Total Organic Carbon	TOC	5/04/95	BKG	33056	4000	SPIKE	17857	51843	mg/kg	105.2
2302109	Q17T2											
2302110	Q17T3											
2302111	Q17T4											
2302112	Q16T2											
2302113	Q16T3											
2302114	Q16T4											
2302115	Q16T5											
2302116	Q1652											
2303628	S20-8											
2303629	S20-9											
2303630	S2010											
2303631	S2011											
2303632	S19S4											
2303633	S19S5											
2303634	S19S4											
2303635	S1942											

% Recovery Control Limit 75
% Recovery Control Limit 125

Comments:

ABBREVIATION KEY

IC = Ion Chromatography
D = Distillation
TOC = Total Organic Carbon
TOX = Total Organic Halogens
* = Out of Specification

--- = Analysis Not Requested
ND = Not Detected
AK = AlpKem
LOQ = Limit of Quantitation
NA = Not Applicable

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

~~Duplicate Analysis~~
Instrumental Analysis

Sample Information

Duplicate Analysis Matrix: SOIL

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 %
2302108	Q17T1	Total										
2302109	Q17T2	Organic										
2302110	Q17T3	Carbon	TOC	5/04/95	BKG	32439	4000	DUP	33673	mg/kg	3.7	35
2302111	Q17T4											
2302112	Q16T2											
2302113	Q16T3											
2302114	Q16T4											
2302115	Q16T5											
2302116	Q1652											
2303628	S20-8											
2303629	S20-9											
2303630	S2010											
2303631	S2011											
2303632	S19S4											
2303633	S19S5											
2303634	S19S4											
2303635	S1942											

Comments: If one or more sample values are less than the limit of quantitation, the RPD is not calculated.

ABBREVIATION KEY

IC = Ion Chromatography
D = Distillation
TOC = Total Organic Carbon
TOX = Total Organic Halogens
* = Out of Specification

--- = Analysis Not Requested
ND = Not Detected
AK = AlpKem
LOQ = Limit of Quantitation
NA = Not Applicable

Quality Control Summary
Laboratory Control Standard
~~Instrumental Analysis~~

Sample Information		Laboratory Control Standard						Matrix: SOIL	
LLI Sample No.	Client Designation	Parameter	Meth	Analysis Date	True LCS Value	LCS Result	LOQ	Units	%REC
2302108	Q17T1	Total							
2302109	Q17T2	Organic							
2302110	Q17T3	Carbon	TOC	5/04/95	25	26.74	50	mg/kg	107.0
2302111	Q17T4	RPD= 5.1%	TOC	5/04/95	25	28.14	50	mg/kg	112.6
2302112	Q16T2								
2302113	Q16T3								
2302114	Q16T4	RPD= 1.7%	TOC	5/04/95	25	26.66	50	mg/kg	106.6
2302115	Q16T5		TOC	5/04/95	25	26.23	50	mg/kg	104.9
2302116	Q1652								
2303628	S20-8	RPD= 3.6%	TOC	5/04/95	25	26.66	50	mg/kg	106.6
2303629	S20-9		TOC	5/04/95	25	26.23	50	mg/kg	104.9
2303630	S2010								
2303631	S2011								
2303632	S19S4								
2303633	S19S5								
2303634	S19S4								
2303635	S1942								

Comments: The recovery range for the LCS is +/- 20%.

ABBREVIATION KEY

IC = Ion Chromatography
D = Distillation
TOC = Total Organic Carbon
TOX = Total Organic Halogens
* = Out of Specification

--- = Analysis Not Requested
ND = Not Detected
AK = AlpKem
LOQ = Limit of Quantitation
NA = Not Applicable

Lancaster Laboratories
Where quality is a science.

Quality Control Summary
Initial Calibration & Linearity Check
~~Instrumental Analysis~~
TOTAL ORGANIC CARBON
Instrument Identification: 5214
Calibration Date: 5/04/95
MATRIX: SOIL

Std mass: 25.0000 ug
Scaling Factor: 0.04080 Cl mV

Batch Numbers: 95118-201

Blank: 41.1680 mv
Blank: 30.9270 mv
Blank: 41.3370 mv
Average: 37.8107 mv

Standard: 624.385 mv
Standard: 610.960 mv
Standard: 602.709 mv
Average: 612.685 mv

This IC applies to samples:	Client Designation	Analysis #	Method Blank	ICV/ 5	ICV/ 10	ICV/ 25	ICV/ 50	ICV/ 75	Units= ug
2302108	Q17T1	138	0.238	4.954	10.441	25.448	51.842	74.583	
2302109	Q17T2								
2302110	Q17T3								
2302111	Q17T4								
2302112	Q16T2								
2302113	Q16T3								
2302114	Q16T4								
2302115	Q16T5								
2302116	Q1652								
2302108	SPK, DUP								
BLANK									
LCSS									
LCSSD									
2303628	S20-8								
2303629	S20-9								
2303630	S2010								
2303631	S2011								
2303633	S19S5								
BLANK									
LCSS									
LCSSD									

Continuing Calibration Dates: 5/04/95
Concentration units: mg/l

Parameter TOC	Reference Concentration	Result Cont. Cal	% Rec.	Acceptance Range -/+ 10%		Out of Specification
CCV	25.0	25.623	102.5	22.5	27.5	
CCV	25.0	25.250	101.0	22.5	27.5	
CCV	25.0	26.023	104.1	22.5	27.5	
CCV	25.0	26.262	105.0	22.5	27.5	

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Method Blank
Miscellaneous Wet Chemistry

Method Blank Analysis
Matrix:

Method Blank Designation	LL Sample No.	Sample Code	Method	Analysis Date	Batch Number	Blank Result	Units	LOQ

Comments: The blank is acceptable when the result is less than the limit of quantitation.

ABBREVIATION KEY

TI = Titration
CO = Colorimetric
IR = Infrared Spectrophotometry
OD = Oven Dried
DI = Distillation
G = Gravimetric
U = Under Method Detection Limit

ND = Not Detected
J = Estimated Value < LOQ
< = Less Than
LOQ = Limit of Quantitation
NA = Not Applicable
M = Meter
* = Out of Specification

Quality Control Summary

Laboratory Control Standard
Laboratory Control Standard Duplicate
Miscellaneous Wet Chemistry

Sample Information		Laboratory Control Standards					Matrix:				
LL Sample No.	Sample Code	Parameter	Analysis Date	True LCS/D Value	LCS Result	LCSD Result	LOQ	Units	LCS/D Acceptance Range	% RPD Result	% RPD Acceptance < / =

Comments: LCS/LCSD values shown may be rounded to be consistent with the limit of quantitation.

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Initial Calibration
Miscellaneous Wet Chemistry
Instrument Identification:

Calibration Date:

Batch Number:

This IC applies to samples:	Sample Code	Parameter	Blank 0.0000	STD 1 0.1000	STD 2 0.2000	STD 3 0.6000	STD 4 1.0000	STD 5 2.0000	STD 6 4.0000	Corr. Coef.

Calibration Date:

Batch Number:

Parameter	Reference Concentration	Result Cont. Cal	% Rec.	Acceptance Range -/+ 10%	Out of Specification

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Matrix Spike Analysis
Miscellaneous Wet Chemistry

Sample Information		Matrix Spike Analysis									Matrix:		
LL Sample No.	Sample Code	Parameter	Meth	Analysis Date	Unspiked Desig.	Unspiked Result	LOQ	Spiked Desig.	Spike Added	Spiked Result	Units	Rec (%)	Acceptance Window (%)

Comments: Sample values shown may be rounded to be consistent with the limit of quantitation.

ABBREVIATION KEY

TI = Titration
CO = Colorimetric
IR = Infrared Spectrophotometry
OD = Oven Dried
DI = Distillation
G = Gravimetric
U = Under Method Detection Limit

ND = Not Detected
J = Estimated Value < LOQ
< = Less Than
LOQ = Limit of Quantitation
NA = Not Applicable
M = Meter
* = Out of Specification

Lancaster Laboratories
Where quality is a science.

Quality Control Summary

Duplicate Analysis
Miscellaneous Wet Chemistry

Sample Information		Duplicate Analysis						Matrix:				
LL Sample No.	Sample Code	Parameter	Meth	Analysis Date	1st Dup Desig.	1st Dup Result	LOQ	2nd Dup Desig.	2nd Dup Result	Units	RPD (%)	Control Limit % </=

Comments: If one or more sample values are less than the limit of quantitation, the RPD is not required.

Sample values shown may be rounded to be consistent with the limit of quantitation.

ABBREVIATION KEY

TI = Titration
CO = Colorimetric
IR = Infrared Spectrophotometry
OD = Oven Dried
DI = Distillation
G = Gravimetric
U = Under Method Detection Limit

ND = Not Detected
J = Estimated Value < LOQ
< = Less Than
LOQ = Limit of Quantitation
NA = Not Applicable
M = Meter
* = Out of Specification

APPENDIX C

Health and Safety Plan (HASP)

HEALTH AND SAFETY PLAN

FOR THE

FOCUSED GROUND-WATER INVESTIGATION

AT THE

570 MAIN STREET PROPERTY
WESTBURY, NEW YORK

LAND TECH REMEDIAL, INCORPORATED DOES NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE POTENTIAL HAZARDS OF THIS SITE AND THE ACTIVITIES OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

TABLE OF CONTENTS PAGE

TABLE OF CONTENTS PAGE

SECTION 1.0
PROJECT IDENTIFICATION

Client:	NMB (USA) Inc.
Site:	570 Main Street Property
Location:	570 Main Street, Westbury, New York
Project:	Focused ground-water investigation
Project No.:	
Project Manager:	______________________
Site Manager:	______________________
Site Safety Officer:	______________________
Date of Plan:	______________________
Expiration Date of Plan:	______________________

SECTION 2.0
INTRODUCTION

This Health and Safety Plan (HASP) establishes guidelines and requirements for safety of personnel during the performance of field activities associated with the referenced project. The procedures and protocols in this plan have been established to ensure that a mechanism is in place to protect project personnel in the event that hazardous materials are found during the project. All employees of Land Tech Remedial, Inc. (LTR), its subcontractors, and other contractors who have adopted this HASP involved in field activities on this project are required to abide by the provisions of this HASP.

Compliance with this HASP is required of all persons who enter the working areas of this project. The content of this HASP may change or undergo revision based upon additional information made available to health and safety (H&S) personnel, monitoring results or changes in the technical scope of work. Any changes proposed must be reviewed by designated Land Tech Remedial, Inc. (LTR) staff.

2.1 SITE DESCRIPTION

The site is located at 570 Main Street in Westbury, New York. The property is slightly over two acres with one manufacturing building and a paved parking lot covering most of the area. The site is currently vacant except for a portion of the building occupied by Castle Collision.

Substances of potential concern which have been detected at the site include volatile aromatic and halogenated organic compounds and metals. Compounds of concern potentially present at the site are listed in Section 4.1.2

2.2 KEY PERSONNEL

	PROJECT MANAGER	HEALTH AND SAFETY OFFICER
NAME:	Timothy L. Douthit	Russel Direnzo
PHONE:	(516) 694-4040	(203) 261-2673

2.2.1 Health and Safety Personnel Designations

The following briefly describes the health and safety personnel designations and general responsibilities which will be employed for this project

LTR PROJECT MANAGER (PM):

The LTR Project Manager will be present on-site during the conduct of all activities and will be responsible for all health and safety activities. The project manager has stop-work authorization which he will execute upon his determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation, such as extreme weather conditions. Authorization to proceed with work will be issued by the HSO after such action. The project manager will initiate and execute all contact with support facilities and personnel when this action is appropriate. Additionally, the project manager has the authority to temporarily suspend an individual from field activities for infractions of the HASP, pending further consideration by the HSO.

LTR HEALTH AND SAFETY OFFICER (HSO)

The HSO has overall responsibility for development and implementation of this HASP. The HSO also shall approve any changes to this plan due to modification of procedures or newly proposed site activities, and will interface with the LTR Project

Manager in matters of health and safety. It is also the responsibility of the HSO to ensure that proper health and safety equipment is available for the project.

The HSO will be responsible for the development of safety protocols and procedures necessary for field operations for the resolution of any outstanding safety issues which arise during the conduct of site work. Health and safety related duties and responsibilities will be assigned only to qualified individuals by the HSO. Before personnel may work on-site, currentness of acceptable medical examination and acceptability of health and safety training (i.e. OSHA-approved 40-hour HAZWOPER training or current 8-hour refresher training) must be approved by the HSO pursuant to all applicable standards.

The LTR HSO has the authority to take the following actions.

- To suspend work or otherwise limit exposures to personnel if a HASP appears to be unsuitable or inadequate.
- To direct personnel to change work practices if they are deemed to be hazardous to health and safety.
- To remove field personnel from the project if their actions or condition endangers their health and safety or the health and safety of coworkers.
- To suspend work in a potential hazardous situation as well as to restart activities as conditions allow.

LTR SITE SAFETY OFFICER

The LTR Site Safety Officer (LTR SSO) and any LTR Alternate Site Safety Officer(s) (Alternate LTR SSO) have the following responsibilities:

- To direct health and safety activities on-site.
- To report safety-related incidents or accidents to the LTR Project Manager and LTR HSO.
- To assist the LTR Project Manager in all aspects of implementing the HASP.
- To maintain health and safety equipment on-site, as specified in the HASP.
- To inspect health and safety activities on-site, as specified in the HASP, and report results to the LTR Project Manager and the LTR HSO.

The LTR SSO has the authority to take the following actions:

- To temporarily suspend field activities, if health and safety of field personnel are endangered, pending further consideration by the LTR HSO.
- To temporarily suspend an individual from field activities for infractions of the HASP, pending further consideration by the LTR HSO.

SECTION 3.0
WORK PLAN

The work activities which may be performed under this HASP are limited to the following:

- Site inspections.
- Installation of narrow-diameter soil borings using a Geoprobe®.
- Collection, classification and field screening of soil samples.
- Field analysis of soil samples via a mobile laboratory.
- Installation of wells and monitoring points using a hollow stem auger drill rig
- Light trenching using hand-held construction and demolition equipment, as well as earth-moving equipment (backhoe).
- Light construction (equipment enclosures, fencing, etc.)
- Remediation system pilot testing.
- Remediation system construction.

This HASP does not cover any site activities other than those specifically listed above Other possible work activities not described above may only be conducted after approval of an appropriate Addendum to this HASP by the LTR HSO.

This HASP is terminated following the completion of Work Plan activities. Use of this HASP after this date to perform the work activities described herein, or other activities in addition to those described herein, is not permitted and constitutes a violation of LTR's Health and Safety Program. If work is to be performed after this date, the HASP must be reviewed and modified, if necessary, by the LTR HSO.

SECTION 4.0
HAZARD ASSESSMENT

An assessment of the hazards has been made for each of the activities specified in Section 3.0. Suspected physical, biological, chemical and flammable hazards were evaluated. The following paragraphs summarize the risks that have been identified.

For the activities listed in Section 3.0, the following hazards have been identified:

- chemical hazards;
- physical hazards;
- heat stress (depending on season work is to be performed);
- cold stress (depending on season work is to be performed);
- biological hazards such as mosquitoes, ticks, snakes, and rabid animals;
- skin and eye contact with contaminants;
- ingestion of contaminants;
- inhalation of organic vapors or contaminated dusts; and,
- flammable hazards.

4.1 CHEMICAL HAZARDS

4.1.1 Description of Chemical Hazards

The chemical hazard evaluation is based on the history of the Site and the initial investigations at the Site and is conducted to identify materials that potentially may be present and to ensure that site activities, personnel protection, and emergency response are consistent with the specific contaminants expected to be encountered. The hazard analysis forms the foundation for this HASP.

4.1.2 Enumeration of Potential Hazardous Chemicals

Based on existing site data, the following is a list of chemicals potentially present at the Site. The list is potentially incomplete, and consists only of chemicals which may be present in various Site media. Materials Safety Data Sheets (MSDS) for each of the listed compounds are included in Appendix II.

- Tetrachloroethylene (PERC)
- Methylene Chloride
- Trichloroethylene (TCE)
- 1,1,1 Trichloroethane (1,1,1 TCA)
- Chloromethane
- Toluene
- Xylenes
- Cadmium
- Chromium
- Lead
- Mercury

4.1.3 Control of Exposure to Chemical Hazards

Ingestion of constituents of concern will be controlled on this site by prohibiting eating and smoking at the Site (see Section 8.0) and by requiring all field personnel to decontaminate themselves upon leaving the Exclusion Zone. Drinking of liquids will take place only after personal decontamination has taken place (except in a heat stress emergency situation). If necessary, drink breaks will be scheduled at least every two hours to avoid heat stress problems.

Skin and eye contact with some of the constituents at the site may cause skin or mucous membrane irritation or severe burns. Many of those constituents can be absorbed into the bloodstream through the skin or eyes.

Any body area which comes in contact with contaminated materials will be washed with soap and rinsed immediately. All field personnel will report any skin or eye contact symptoms to the LTR SSO. The person will be treated by a physician and steps will be taken to eliminate similar exposures.

Potential hazards will be reduced by protecting against exposures to hazardous materials via utilization of appropriate personal protective equipment (PPE). PPE to protect the body against contact with known or anticipated chemical hazards can be divided into five levels of protection categories (Level A, B, C, Modified D, and D) according to the degree of protection afforded. The initial levels of personal protective equipment to be used while performing the activities at the Site described in Section 3.0 are discussed in Section 7.2, Initial PPE Levels for Specific Work Tasks. Personal Protective Equipment and Levels of Protection are discussed in Section 7.0 of this HASP.

4.2 PHYSICAL HAZARDS, HEAT STRESS AND COLD EXPOSURE

There is a risk of physical injury when working near heavy equipment. Field personnel should be aware of these hazards and take steps to avoid contact with them. Physical hazards associated with excavation activities are identified and safety procedures presented in Attachment III, Safety Guidelines for Excavations.

Use of steel-toed steel shank work boots, safety glasses or goggles, and hard hats will be required when in the Exclusion Zone and Contamination Reduction Zone. Personnel should be cognizant that when PPE such as respirators, gloves, and protective clothing are worn, visibility, hearing, and manual dexterity are impaired.

In addition, the PPE required for some activities (coveralls and respirators) places a physical strain on the wearer. A Heat Stress prevention plan will be implemented to deal with this health hazard during warm weather. The plan outlines heat stress identification, treatment, prevention and monitoring. Fluids will be provided at regular intervals during the work periods in order to maintain adequate body fluid levels for the field personnel.

4.3 BIOLOGICAL HAZARDS

Numerous types of pest organisms may be present, including mosquitoes, snakes and ticks. Field personnel are encouraged to use insect repellents before donning PPE. To avoid snake bites, personnel should check for snakes before walking through grassy or debris strewn areas. Also, field personnel may be required to wear knee high boots while at the Site to protect feet and lower leg areas. A first aid kit, insect and tick repellent and treatment will be available for use in the field. In many parts of the northeast United States, tick-borne diseases pose a significant health risk during warm months.

4.4 FLAMMABLE HAZARDS

Flammable hazards are not expected to be significant during the course of this work due to the low levels of flammable materials encountered during previous investigations at the Site. However, as a precaution, air monitoring, as specified in Section 6.0, will be conducted during all intrusive activities.

SECTION 5.0
GENERAL HEALTH AND SAFETY REQUIREMENTS

5.1 MEDICAL EXAMINATION

Before commencing any of the activities defined in Section 3.0, all personnel following this HASP must have a current medical examination as part of a medical surveillance program. This medical surveillance program must meet the requirements of OSHA Regulations 29 CFR 1910.120(f).

5.2 TRAINING

All personnel working on-site and potentially exposed to hazardous substances, health hazards or safety hazards shall be thoroughly trained as specified in OSHA Regulations 29 CFR 1910.120(e). This training program will include: (1) attendance at an initial 40-hour basic health and safety training course off the Site; (2) a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor; (3) on-site, site-specific training; and (4) an 8-hour annual update in the basic health and safety training course.

On-site management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations must have received: (1) 40 hours initial training (in accordance with OSHA Regulations 29 CFR 1910.120(e)); (2) three days of supervised field experience; (3) 8 hours of site supervisor training; (4) additional training at the time of job assignment on such topics as, but not limited to: their company's safety and health program and the associated employee training program; personal protective equipment program; spill containment program; air quality monitoring; emergency response; monitoring equipment usage and calibration; and, health hazardous monitoring procedure and techniques; and (5) an 8-hour annual update in the basic health and safety training course.

Special training will be provided at the time of job assignment to on-site personnel who may be exposed to unique or special hazards not covered by the initial 40-hour basic health and safety course. Since it is not anticipated that any unique or special hazards will be encountered during this project, special training will not be required for the work activities covered by this HASP. If unique or special hazards are unexpectedly encountered, specialized training will be provided.

5.3 INCIDENT REPORTING

Any incident or accident involving personnel working at this Site will require that a LTR Incident/Accident Report be filed. Situations covered by this policy include, but are not limited to, fires, explosions, illnesses, injuries, and automobile accidents. These reports must be sent to the LTR HSO within 24 hours of the incident/accident. Worker's Compensation Insurance reports for LTR employees will be filed within 48 hours of each accident or illness which results from work related activities and requires medical attention. The LTR SSO will complete this form in case of an incident. Any injuries/illnesses requiring medical attention or resulting in lost work time shall be immediately reported to the LTR HSO.

5.4 ILLUMINATION, SANITATION AND CONFINED SPACE ENTRY

5.4.1 Illumination

All major work tasks are expected to occur during daylight hours. The illumination requirements set forth by OSHA Regulations 29 CFR 1910.120 (m) will be met.

5.4.2 Sanitation

The sanitation requirements regarding potable and non-potable waters, toilet facilities and washing facilities will be followed as set forth in OSHA Regulations 29 CFR 1910.120(n). Food handling and temporary sleeping quarters requirements are not applicable to this site.

5.4.3 Confined Space Entry

Confined space entry will not be required in connection with the field work activities to be performed under this HASP.

5.5 WORK PROCEDURES

Whenever possible, field personnel should work from a position upwind of work activities.

5.6 RESPIRATOR MAINTENANCE, FIT-TESTING AND DECONTAMINATION

Respirators, if used, will be cleaned daily according to procedures described herein. Cartridges will be replaced either daily or if breakthrough is detected at any time while in use. The following checks will be performed on a daily basis in addition to the above:

- Exhalation valve - pull off plastic cover and check valve for debris or for tears in the neoprene valve which could cause leakage.
- Inhalation valves - screw off both cartridges and visually inspect neoprene valves for tears. Make sure that the inhalation valves and cartridge receptacle gaskets are in place.
- Make sure a protective lens cover is attached to the lens.

- Make sure you have the right cartridges (see Section 7.1).
- Make sure that the face piece harness is not damaged. The serrated portion of the harness can fragment which will prevent proper face seal adjustment.
- Make sure the speaking diaphragm retainer ring is hand tight.

To don respirator, fit facepiece on nose bridge making sure that you are able to breathe through nose. Then swing bottom of facepiece into contact with the chin. When using elastic or rubber headbands, position headbands with longest straps above the ears and over the crown of the head and headbands with shortest straps below the ears around nape of the neck. When using cradle headband, position cradle headband around the crown of the head; position bottom headbands below the ears and around the nape of the neck. Then, adjust the straps for a comfortable fit by moving adjustment slides to lengthen or shorten straps. Adjust the straps just snug enough so that no air leaks around the facepiece. It is not necessary to pull the straps so tight that the respirator digs into the face.

THE RESPIRATOR MUST BE SUBJECTED TO THE FOLLOWING TIGHTNESS TEST BEFORE EACH USE.

Test respirator for leakage using a positive pressure method. Lightly place palm over exhalation valve cover. Exhale gently. A slight positive pressure should build up inside the respirator. If any leakage is detected around the facial seal, readjust head harness straps and repeat test until there is no leakage. If other than facial seal leakage is detected, the condition must be investigated and corrected before another test is made. A negative pressure test should also be performed. Lightly place palms over cartridges or filter holders. Inhale gently and the facepiece should collapse against the face. The respirator must pass the tightness tests before the respirator is used. The respirator will not furnish protection unless all inhaled air is drawn through suitable cartridges or filters.

To decontaminate respirators, the following steps should be undertaken:

- Wash with Alconox soap and water solution and brush gently. (This step will remove any soil/solid particulate matter that may have been collected on the respirator during field activities.)
- Rinse with distilled/deionized water, making sure that the inhalation valves and exhalation valves are clean and free of obstruction.
- Spray with acetone. NOTE: this step should only be done if the respirator materials will not be degraded by he acetone. (This step will remove any traces of organic material

collected on the respirator during field activities.)

- Rinse with distilled/deionized water.
- Wipe with sanitizing solution. (This step will assure the sterility of the respirator.)
- Allow respirator to dry.
- Place the respirator inside a sealed bag or a clean area away from extreme heat or extreme cold.

5.7 LTR PROJECT MANAGER NOTIFICATION

All field personnel must inform the LTR SSO or the Alternate LTR SSO before entering the Site.

IF ANY PREVIOUSLY UNIDENTIFIED POTENTIAL HAZARDS ARE DISCOVERED DURING ANY FIELD WORK, LEAVE THIS AREA OF THE SITE IMMEDIATELY AND CONTACT THE LTR SSO FOR FURTHER INSTRUCTIONS.

5.8 LTR PROJECT SAFETY LOG

A Project Safety Log will be used to record entry and exit dates and times of all field personnel and visitors to the Site; accidents, injuries, and illnesses, incidences of safety infractions by field personnel; air quality and personal exposure monitoring data; and other information related to safety matters. All accidents, illnesses, or other incidents are to be reported promptly to the LTR SSO. A copy of the LTR Project Safety Log for this Site is provided in Attachment .

5.9 OSHA INFORMATION POSTER

In accordance with the Occupational Safety and Health Act of 1970, a copy of the OSHA information poster must be present at the Site. It will be posted at full size (11" x 17") in a permanent structure or temporary field office, or be distributed to on-site personnel in this HASP.

5.10 PROHIBITIONS

Smoking, eating, drinking, chewing tobacco or toothpicks, application of cosmetics, storing food or food containers, and having open fires will be permitted only in designated areas to be established by the LTR SSO. Under no circumstance shall smoking, eating, drinking, chewing tobacco or toothpicks, or application of cosmetics be permitted in the Exclusion Zone or the Contamination Reduction Zone. Good personal hygiene should be practiced by field personnel to avoid ingestion of contaminants.

5.11 INITIAL SITE SAFETY MEETING AND SIGNING OF HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT

The LTR SSO will hold an initial site safety meeting with LTR, subcontractor and contractor field personnel before work activities start at the Site. During this meeting, it will be verified that all personnel have been provided with or have reviewed a HASP for the work activities to be performed at this Site. For LTR personnel, its subcontractors personnel, and contractor personnel whose employer(s) have adopted this HASP, the HASP shall be reviewed, discussed and questions will be answered. Signed Health and Safety Plan Compliance Agreement Forms of personnel who will be following this HASP will be collected by the LTR SSO and filed. Individuals refusing to sign the Form will not be allowed to work on the Site.

5.12 DAILY SITE SAFETY BRIEFINGS

During field operations, site safety briefings will be held at the start of each day by the LTR SSO to review and plan specific health and safety aspects of scheduled work. All field personnel who are following this HASP are required to attend these briefings. Potential subjects that may be discussed are presented below:

1. Preliminary

- Medical clearances.
  - Training requirements.
  - Written HASP availability.
  - Designation of responsibilities for on-site personnel.
- Identification of on-site personnel trained and certified to administer First Aid.

2. Training topics

- Review of HASP including:
  - types of hazards;
  - pathways of exposure;
  - levels of protection;
  - contamination avoidance;
  - prohibitions;
  - work procedures;
  - confined space entry;
  - work zones.
  - emergency response procedures, and,
  - specific on-site area/work tasks of concern, including excavation safety procedures.
- Decontamination.
- Personnel Protective Equipment.
- Air Quality Monitoring Program.

3. Questions and Answers

5.13 UNDERGROUND STRUCTURES

Caution will be exercised whenever the possibility of encountering subsurface obstructions exists. Before beginning intrusive activities, all available sources of information (such as site utility drawings, "one-call" services, public utility drawings, construction drawings, and discussions with former employees) will be reviewed. The area will be excavated using manual equipment if drilling or digging in the vicinity of suspected underground structures and until the nature of the obstruction is discerned.

SECTION 6.0
AIR QUALITY MONITORING AND MITIGATIVE MEASURES FOR CONTROL OF EMISSIONS

6.1 AIR QUALITY MONITORING INSTRUMENTATION

While performing field activities at the Site, an air quality survey will be performed and the results will be recorded. Several instruments that may be used to monitor air quality are discussed below:

- Photoionization Detector

The HNu Systems Model PI-101 Photoionization Detector (HNu PID) or equivalent will be used to detect trace concentrations of certain organic gases and a few inorganic gases in the air. Methane and the major components of air are not detected by the 11.7 eV HNu PID. The HNu PID probe selected for this project is the 11.7 eV due to its ability to quantify the group of contaminants of concern at the Site. The HNu PID detects mixtures of compounds simultaneously. HNu PID readings do not measure concentrations of any individual compound when a mixture of compounds are present.

The HNu PID will be calibrated twice each day (before start of work and at the conclusion of work) using an isobutylene standard for calibration. Calibrations will be documented. HNu PID readings will be measured in the breathing zone of the most highly exposed worker (i.e., closest to the source) at least hourly.

- Combustible Gas Indicator/Oxygen Meter

The GasTech Triple Range Combustible Gas Indicator/Oxygen Meter (CGI) or equivalent may be used at the discretion of the LTR SSO to measure the concentration of flammable vapors and gases, oxygen, and hydrogen sulfide (in addition to sulfur dioxide) in the air during field activities. Flammable gas concentrations are measured as percentages of the Lower Explosion Limit (LEL). Oxygen content is measured as a percentage of total air. Hydrogen sulfide concentration (which includes sulfur dioxide) is measured in parts per million.

- Multigas Detector Tubes

Draeger Multigas Detector Tubes will be used at the discretion of the LTR SSO to detect and quantify the concentration of selected contaminants in the air. The detector tubes to be employed must be sensitive in the concentration ranges in the OSHA Permissible Exposure Limit (PEL) range for those contaminants. It should be realized that most "compound specific" detector tubes will also detect interference from other aromatic or aliphatic hydrocarbons; readings do not differentiate between which compounds are present. A Draeger pump and detector tubes for benzene, which has a relatively low OSHA PEL, hydrogen sulfide and sulfur dioxide will be present at the Site at all times.

The tube readings will be compared to OSHA PELs to determine what level of protection is required. If HNu PID readings are elevated when compared to background (e.g. 4 ppm or more above background) or if phase product or odorous material is detected, then detector tubes for benzene will be employed. Detector tubes for hydrogen sulfide and sulfur dioxide will be employed when the hydrogen sulfide reading on the CGI exceeds 4 ppm.

- Personal Monitor for Aerosol and Dust

The MIE, Inc. Model PDM-3 MiniRam Personal Monitor for Aerosol and Dust (MiniRam Monitor) will be used at the discretion of the LTR SSO to detect and quantify the concentration of fugitive dust that may be created during ground disrupting operations. The instrument is capable of measuring fugitive dust at concentrations as low as 0.1 mg/m^3.

The MiniRam Monitor will be calibrated twice daily, before start of work and at the conclusion of work.

6.2 AIR QUALITY RESPONSE LEVELS

A number of response levels will be used during field work if contamination is encountered during air monitoring. The LTR HSO will be notified as soon as practical of upgrading from the initial levels of protection. The following response levels will apply to the work activities covered by this HASP.

Air Quality Measurement[1]	**Response**
HNu PID reading less than 5 ppm above background (1 min average)	Level D Protection or Modified Level D Protection (at the discretion of LTR SSO)
CGI reading less than 25% LEL	
Oxygen reading greater than 19.5% and less than 23.5%*	
Hydrogen sulfide reading less than 5 ppm (CGI and Draeger Detector Tubes)	
Benzene reading less than 0.5 ppm (Draeger Detector Tubes)	
MiniRam Monitor reading less than 2.5 mg/m^3	
No dust visible in breathing zone	

[1] All Air Quality Measurements, with the exception of CGI measurements for flammable vapors and gases, should be made in the breathing zone of personnel who, in the opinion of the LTR SSO, are most exposed to airborne contaminants. Measurements of flammable vapor and gas levels should be made in the vicinity of the nearest ignition source.

* Note that combustible gas readings are not valid in atmospheres with <19.5 percent oxygen, and that if such a condition exists, work should be ceased in that area and the LTR HSO contacted.

Air Quality Measurement(1)	**Response**
HNu PID reading greater than 5 ppm and less than 10 ppm above background (1 min average)	Level C Protection
Benzene reading greater than 0.5 ppm and less than 5 ppm (Draeger Detector Tube)	
MiniRam Monitor reading greater than 2.5 mg/m^3 and less than 10 mg/m^3	
Dust visible in breathing zone	

Air Quality Measurement(1)	**Response**
HNu PID reading greater than 10 ppm above background (1 min average)	Level B Protection
Oxygen reading less than 19.5% or greater than 23.5%*	
Hydrogen sulfide reading greater than 5 ppm (CGI and/or Draeger Detector Tube)	
MiniRam Monitor reading greater than 10 mg/m^3	
Excessive dust in breathing zone	

(1) All Air Quality Measurements, with the exception of CGI measurements for flammable vapors and gases, should be made in the breathing zone of personnel who, in the opinion of the LTR SSO, are most exposed to airborne contaminants. Measurements of flammable vapor and gas levels should be made in the vicinity of the nearest ignition source.

* Note that combustible gas readings are not valid in atmospheres with <19.5 percent oxygen, and that if such a condition exists, work should be ceased in that area and the LTR HSO contacted.

Air Quality Measurement(1)	Response
CGI reading greater than 25% LEL	Suspend work in immediate area and notify LTR HSO and LTR Project Manager. Conduct air monitoring periodically to determine when work may be continued. Take mitigative measures as discussed in Section 6.3 to suppress emissions as appropriate. All ignition sources will be shut off. The work zones will be evacuated immediately. Work will not resume until the CGI readings are continuously below 25% LEL for 15 minutes or more.

All Air Quality Measurements, with the exception of CGI measurements for flammable vapors and gases, should be made in the breathing zone of personnel who, in the opinion of the LTR SSO, are most exposed to airborne contaminants. Measurements of flammable vapor and gas levels should be made in the vicinity of the nearest ignition source.

Background HNu PID readings will be taken at least twice per day (before start of work and at the conclusion of work). Background levels will be taken at a location which is not affected by on-site work. Once work at the Site begins, relocation of the original background location may be required.

Should work at the Site be conducted using respiratory protection, the need for a personal exposure monitoring program will be evaluated by the LTR HSO. Details of this program and any monitoring equipment required for its implementation will be specified in an Addendum to this HASP prepared by the LTR HSO.

6.3 MITIGATIVE MEASURES FOR CONTROL OF EMISSIONS

Vapor or dust emissions resulting from field operations, if they were to occur, are not anticipated to exceed the action levels. If the action levels are exceeded at any monitoring location, implementation of mitigative measures to suppress emissions should be investigated. Appropriate mitigative measures would include ceasing operations until the exact cause of the emissions could be identified and corrected. Vapor control actions may include vapor suppression foams, covering exposed soil piles with plastic sheeting and/or spraying exposed soil piles and drilling sites with water. Fugitive dust emission control actions may consist of spraying of water in areas of the Site where dust is generated. The use of water will be supplemented by the use of calcium chloride, if necessary.

SECTION 7.0
PERSONAL PROTECTIVE EQUIPMENT

7.1 DESCRIPTION OF LEVELS OF PROTECTION

The personal protection equipment specified in this HASP will be available to all field personnel. The following requirements will be followed in accordance with OSHA Regulations:

- facial hair will not interfere with the proper fit of respirators;
- contact lenses will not be worn; and,
- eyeglasses that interfere with the proper fit of full-face respirators will not be worn.

Level D Personal Protective Equipment

- Hard hat
- Safety glasses or goggles
- Steel-toed and steel shank work boots (if rubber boots not worn)
- Nitrile-butadiene rubber outer gloves(1)
- Regular Tyvek coveralls(1)
- Latex surgical gloves (to be worn underneath outer gloves)(1)
- Rubber overboots, steel-toed and steel shank rubber boots, or disposable "booties"(1)
- Hearing protection around drilling equipment

(1) Optional, at discretion of LTR SSO.

Modified Level D Personal Protective Equipment

- Hard hat
- Safety glasses or goggles
- Steel-toed and steel shank work boots (if rubber boots not worn)
- Rubber overboots, steel-toed and steel shank rubber boots, or disposable "booties"
- Nitrile-butadiene rubber outer gloves
- Latex surgical gloves (to be work underneath outer gloves)
- Polyethylene coated or Saranex impregnated Tyvek coveralls(1) (taped at cuffs)
- Hearing protection around drilling/heavy equipment

(1) Choice at discretion of LTR SSO

Level C Personal Protective Equipment

- Hard hat
- Full-face MSA respirator with GMC-H combination cartridges
- Steel-toed and steel shank work boots (if rubber boots not worn)
- Rubber overboots, steel-toed and steel shank rubber boots, or disposable "booties"
- Nitrile-butadiene rubber outer gloves
- Latex surgical gloves (to be worn underneath outer gloves)
- Polyethylene coated or Saranex impregnated Tyvek coveralls (taped at cuffs)

Air monitoring equipment described previously will be provided. A first aid kit, multi-purpose dry chemical UL Class 10A-10B-C fire extinguisher, eye wash station, appropriate barricades and alarm horns will be present and maintained at the Site.

A list of personal protective equipment for the levels of protection which might be required at this Site is included as Attachment .

Selection of the PPE specified for this project is based on a review of the identified or suspected hazards, routes of potential exposure to on-site workers (inhalation, skin absorption, ingestion, and skin or eye contact) and the performance of the personal protective equipment in providing a barrier to these hazards. In addition, the choice of PPE has been reviewed to match the work requirements and task-specific conditions to provide adequate protection without causing unnecessary physical impairment to the worker.

7.2 INITIAL PPE LEVELS FOR SPECIFIC WORK TASKS

The following initial PPE levels have been established for the work activities described in Section 3.0, Work Plan:

Work Activity	PPE Level of Protection
All site activities	Modified D

SECTION 8.0
DESIGNATION OF WORK ZONES

To minimize the movement of contaminants from the Site to uncontaminated areas, three work zones will be set up. The three work zones will consist of the following:

Zone 1:	Exclusion Zone
Zone 2:	Contamination Reduction Zone
Zone 3:	Support Zone

The Exclusion Zone is the area where contamination occurs or could occur. Initially, the Exclusion Zone should extend a distance of 25 ft from the edge of intrusive activity unless conditions at the Site warrant either a larger or smaller distance as determined by the LTR SSO. All persons entering the Exclusion Zone must wear the applicable level of protection as set forth in Section 7.1, Personal Protective Equipment and Section 7.2, Initial PPE Levels for Specific Work Tasks. It is anticipated that work zones will be established at each individual area of intrusive work rather than encompass the entire Site.

The Support Zone is the area of the Site where significant exposure to contamination is not expected to occur during non-intrusive activities. The Support Zone is considered to be the "clean area" of the Site.

Between the Exclusion Zone and Support Zone is the Contamination Reduction Zone which provides a transition zone between the contaminated and clean areas of the Site. The Contamination Reduction Zone will be located directly outside of the Exclusion Zone. All personnel must decontaminate when leaving the Exclusion Zone. A Contamination Reduction Zone (decontamination area) will be established adjacent to each individual area of intrusive work.

SECTION 9.0
DECONTAMINATION PROCEDURES

The following steps will be taken for decontamination of personnel:

- Deposit equipment that needs to be decontaminated on plastic drop cloths.
- Wash boots and outer gloves with long handled brushes in wash tub containing Alconox and water.
- Rinse boots and outer gloves with long handled brushes in a wash tub containing clear water or use a sprayer to rinse off boots and gloves
- Remove tape and place in disposal drum
- Remove outer gloves and place in disposal drum.
- Remove suit and place in disposal drum.
- Remove respirator and place on table to be decontaminated.
- Remove inner gloves and place in disposal drum
- Wash hands and face.

All tools or equipment which have been in contact with contaminated materials should be decontaminated after leaving the Exclusion Zone. This decontamination is to be performed using a high pressure/hot water "steam type" cleaner or a spray/rinse decontamination sequence as described in Section 5.6, Respirator Maintenance. Fitting and Decontamination. as appropriate.

Contaminated liquids from the decontamination area and contaminated clothing should be disposed of in accordance with site protocols.

SECTION 10.0
EMERGENCY RESPONSE PLAN

The purpose of this section of the HASP is to address how personnel at the Site will respond to emergencies. The types of potential emergencies that are addressed by this Plan include:

- Fires;
- Chemical exposures; and,
- Physical injuries.

Decontamination procedures as specified in Section 9.0 will be followed to prevent the spread of contamination off-site.

10.1 EMERGENCY RECOGNITION AND PREVENTION

10.1.1 Fires

Fires are possible whenever flammable gases or vapors are present in proper concentrations and an ignition source is present. The construction equipment itself provides an ignition source. To prevent fires, a CGI as specified in Section 6.0 will be used to detect flammable concentrations of gases or vapors. Ignition sources will be turned off and the area evacuated if vapors or gases reach 25% of the Lower Explosion Limit (LEL) as measured by the CGI. Work will not resume until the LTR SSO observes CGI readings below 25% of the LEL for a minimum of 15 consecutive minutes.

10.1.2 Chemical Exposures

Work should always be performed in a manner that minimizes exposure to contaminants through skin or eye contact, inhalation or ingestion. Work practices that shall be followed to reduce the risk of chemical exposure include:

- PPE, as specified in Section 7.0, for the appropriate work activities and areas as defined by the LTR SSO, will be used by all field personnel following this HASP. A formal revision to the HASP must be made by the LTR HSO to modify the PPE specifications.
- Keep hands away from face during work activities.
- Minimize all skin and eye contact with contaminants.

- Stand upwind of possible sources.

Early recognition of the symptoms of chemical exposure is essential for the prevention of serious chemical exposure incidents. Symptoms of exposure to the types of compounds potentially present at the Site include the following: fatigue, weakness; eye, nose, and/or throat irritation; headache; dizziness; nausea; vomiting; malaise; tremors; aggressive confusion; cyanosis (blue color to skin); anemia; and muscle spasms. If a person experiences any of these symptoms, or others, or recognizes any of the symptoms in a fellow worker, the person experiencing the symptoms shall immediately stop work and report his or her symptoms to the LTR SSO. If the symptoms persist or appear to be damaging in any way, the LTR SSO will make arrangements to take the individual to a hospital for medical treatment. If the symptoms are serious, work activities in the area where the person was exposed will be discontinued until more is known about the incident. Incident reporting procedures as specified in Section 5.3 will be initiated.

10.1.3 Physical Injuries

Site personnel should constantly look for potential safety hazards such as holes or ditches; improperly positioned objects, such as drums or equipment that may fall; sharp objects, such as nails, metal shards, and broken glass; protruding objects at eye or head level; slippery surfaces; steep grades; uneven terrain or unstable surfaces, such as walls that may cave in or flooring that may give way. Site personnel should inform the LTR SSO of any potential hazards observed so that corrective action can be taken. Site personnel shall be constantly aware of heavy equipment in area, and shall stay out of pathway of moving equipment or parts.

10.2 EMERGENCY ALERTING PROCEDURES

The LTR SSO will alert the appropriate work groups when an emergency occurs through the use of radios or by directly contacting the work group. The LTR SSO and any isolated work group will carry radios if direct contact cannot be maintained. A single blast from an air horn will be used to signal workers to stop work and assemble in the Contamination Reduction Zone. If evacuation of the Site is necessary, three blasts from an air horn will be used to signal workers.

10.3 EVACUATION PROCEDURES AND ROUTES

Normally, personnel should evacuate through the Contamination Reduction Zone, and from there, to the Support Zone. If a fire blocks entry into the Contamination Reduction Zone, personnel will proceed directly to the Support Zone. Evacuation from the Contamination

Reduction Zone will proceed in an upwind direction from the emergency. If evacuation to the Support Zone does not provide sufficient protection from the emergency, personnel will be advised to evacuate the Site proper.

10.4 TELEPHONE NUMBERS OF EMERGENCY SERVICES

A portable phone shall be located in an on-site vehicle along with the emergency numbers given below (see also Attachment I):

Emergency Service	Telephone Number
Ambulance	911
Fire Department	911
Police Department	911
Hospital	(516) 542-2655
Poison Control Center	(800) 962-1253
USEPA National Response Center	(800) 438-2427

These telephone numbers must be verified by the LTR SSO prior to the start of fieldwork.

10.5 EMERGENCY RESPONSE PERSONNEL

The LTR SSO will have the primary role in responding to all emergencies at the Site. The LTR SSO, or the Alternate LTR SSO, will be present at the Site during all work activities. If any emergency such as a fire, chemical exposure, or physical injury occurs, the LTR SSO shall be notified immediately. *The LTR SSO will have certification in First Aid.* All site personnel will take direction from the LTR SSO in cases of emergency response.

After an emergency has occurred at the Site, the causes and responses to that emergency should be thoroughly investigated and documented by the LTR Project Manager and LTR SSO; this documentation will be submitted to the LTR Corporate Health and Safety Administrator and LTR HSO within 48 hours of the emergency.

10.6 DECONTAMINATION PROCEDURES DURING AN EMERGENCY

Decontamination of an injured or exposed worker or during a site emergency shall be performed only if decontamination does not interfere with essential treatment or evacuation.

If a worker has been injured or exposed and decontamination can be done: wash, rinse, and/or cut off protective clothing and equipment.

If a worker has been injured or exposed and decontamination cannot be done:

- Wrap the victim in blankets, plastic or rubber to reduce contamination of other personnel;
- Alert emergency and off-site medical personnel to potential contamination; and,
- Have the LTR SSO or other personnel familiar with the incident and contaminants at the Site accompany the victim to the hospital.

10.7 EMERGENCY MEDICAL TREATMENT AND FIRST AID PROCEDURES

Emergency medical treatment or First Aid may be administered at the Site by the LTR SSO or other personnel who have been certified in First Aid.

General emergency medical and First Aid procedures are as follows:

- Remove the injured or exposed person(s) from immediate danger.
- Render First Aid, if necessary, decontaminate affected personnel, if necessary.
- Call an ambulance for transport to local hospital immediately. <u>This procedure should be followed even if there is no apparent serious injury.</u>
- Evacuate other personnel at the Site to safe places until the LTR SSO determines that it is safe for work to resume.
- Report the accident to the LTR HSO immediately.

10.8 DIRECTIONS TO THE NASSAU COUNTY MEDICAL CENTER FROM SITE

Directions to the Nassau County Medical Center from the Site are repeated in Attachment I.

The directions to the Nassau County Medical Center from the Site must be verified by the LTR SSO prior to the start of field work. A copy of the directions will be maintained in the LTR SSO's vehicle on site for easy access. A map depicting the route will also be included with the directions.

SECTION 11.0
GEOTECHNICAL LABORATORY CONSIDERATIONS

In accordance with the requirements of OSHA Regulations 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories, and the LTR Hazardous Waste Health and Safety Manual, a Chemical Hygiene Plan must be prepared and approved by the LTR HSO prior to transporting any potentially contaminated sample to a LTR Geotechnical Laboratory.

SECTION 12.0
PERSONNEL ASSIGNMENTS

12.1 PROJECT PERSONNEL

LTR personnel authorized to enter the Site and work on this project subject to compliance with provisions of the HASP, are:

LTR Project Manager	Tim Douthit
LTR Site Manager	Chris Poole
LTR Site Safety Officer	Chris Poole
LTR Corporate Health and Safety Officer	Russel Direnzo

Other personnel who meet HASP requirements, including training and participation in a medical surveillance program, may enter and work on the Site subject to compliance with provisions of the HASP.

12.2 PROJECT SAFETY RESPONSIBILITIES

Personnel responsible for implementing this Health and Safety Plan are the LTR Project Manager and the LTR Site Safety Officer. Their specific responsibilities and authority are described in the LTR Hazardous Waste Health and Safety Manual.

SECTION 13.0
HEALTH AND SAFETY PLAN APPROVALS

LTR Health and Safety Officer — Date

LTR Project Manager — Date

LTR Health and Safety Officer — Date

SECTION 14.0
HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT

I,____________________________________ (print name), have received a copy of the Health and Safety Plan for ____, dated _ ____________________. I have read the HASP, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the Health and Safety Plan.

Signed:

____ ________________

Signature Date

____

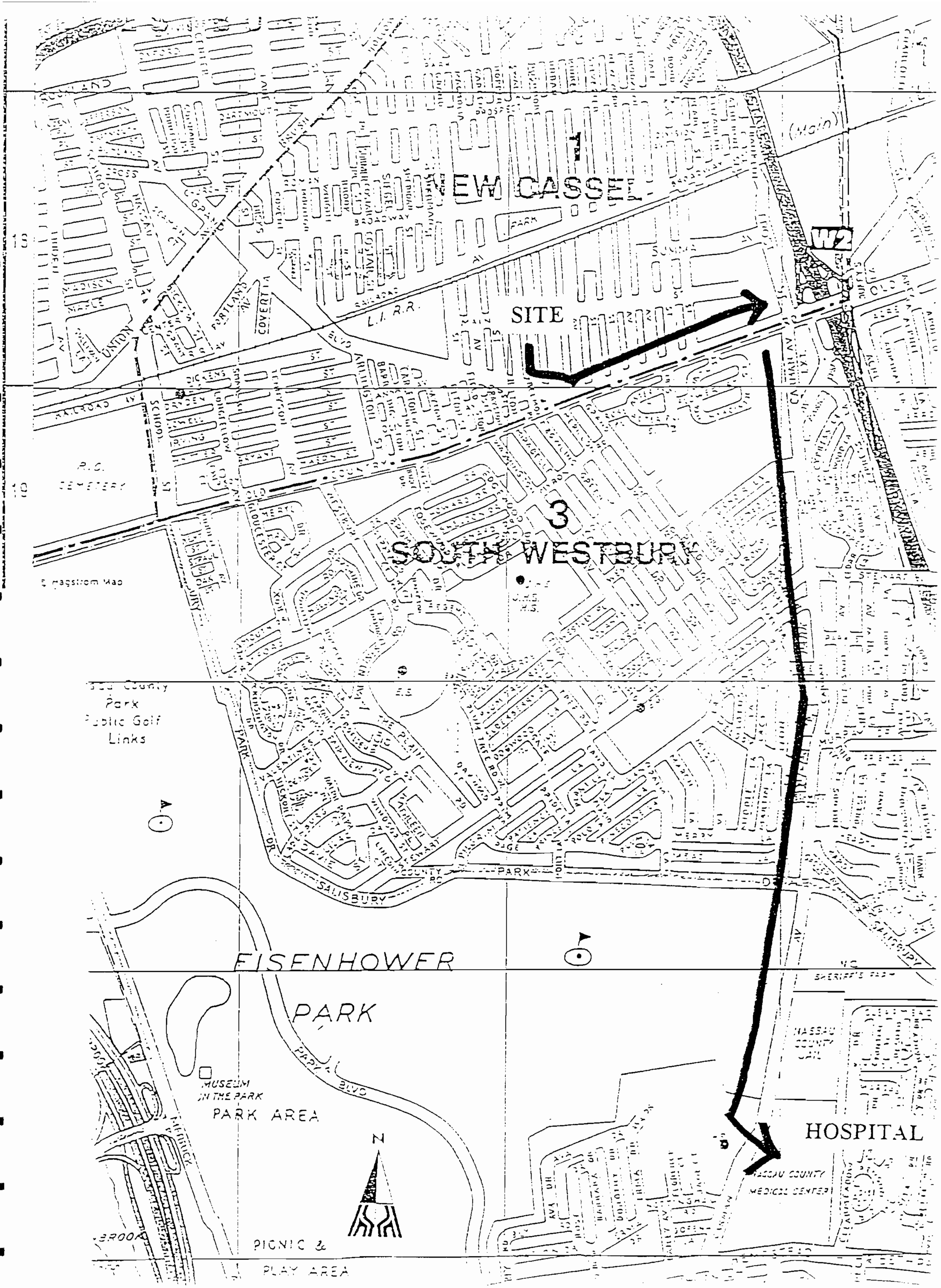
Company

ATTACHMENT I

DIRECTIONS TO NASSAU COUNTY MEDICAL CENTER

DIRECTIONS TO NASSAU COUNTY MEDICAL CENTER

- Proceed south from site along Swalm or Rushmore to Old Country Road.
- Proceed east on Old Country Road to Carman Avenue
- Proceed south on Carman Avenue to the Nassau County Medical Center, which is located on the east side of Carman Avenue, north of Hempstead Turnpike (Route 24).


NEW CASSEL
1
W2
(Main)
BROADWAY
L.I.R.R.
SITE
OLD COUNTRY
R.C. CEMETERY
3
SOUTH WESTBURY
© Hagstrom Map
Park
Public Golf
Links
SALISBURY
PARK
EISENHOWER
PARK
MUSEUM
IN THE PARK
PARK AREA
MERRICK
SHERIFF'S FARM
NASSAU
COUNTY
JAIL
HOSPITAL
NASSAU COUNTY
MEDICAL CENTER
PICNIC &
PLAY AREA
N

ATTACHMENT II

MATERIAL SAFETY DATA SHEETS (MSDS)

Genium Publishing Corporation
One Genium Plaza
Schenectady, NY 12304-4690 USA
(518) 377-8854

Material Safety Data Sheets Collection:
Sheet No. 23
Cadmium Metal/Powder
Issued: 9/77 Revision: D, 5/93

͵ection 1. Material Identification

41

Cadmium Metal/Powder (Cd) Description: Occurs naturally in the mineral greenockite (cadmium sulfide). This form is rare and most cadmium is obtained by extraction from other ores containing it as a mineral (lead, copper, and zinc). Zinc sulfide ores are the main source; by direct distillation or recovery from the electrolytic process. Used in electroplating other metals, fire protection systems, nickel-cadmium storage batteries, power transmission wire, TV phosphors, pigments for ceramic glazes, machinery enamels, baking enamels, photography and lithography, selenium rectifiers, electrodes for cadmium-vapor lamps, and photoelectric cells; as a fungicide and a Weston standard cell control of atomic fission in nuclear reactors.

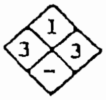
Other Designations: CAS No. 7440-43-9, colloidal cadmium.

Manufacturer: Contact your supplier/distributor. Consult latest *Chemical Week Buyers' Guide*(7) for suppliers list.

Cautions: Cadmium is a highly toxic metal. Symptoms may be delayed several hours and include pulmonary edema (fluid in lungs) which can be fatal. Chronic effects include kidney damage. Cd is considered a carcinogen by several government agencies. The powder is pyrophoric and presents a significant fire/explosion hazard.

Powder

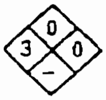
HMIS			
H	3*	R	3
F	1	I	4
R	3	S	2
		K	3



Genium

Solid

HMIS			
H	3*	R	1
F	0	I	4
R	0	S	2
		K	1



*Chronic effects PPE-Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Cadmium, ca 100%

1992 OSHA PEL
8-hr TWA: 5 $\mu g/m^3$

1992 OSHA SECAL*
TWA: 15 or 50 $\mu g/m^3$

1990 IDLH Level
0 mg/m^3

1993-94 ACGIH TLVs
TWA: 0.01 mg/m^3 (total dust), Class A2 carcinogen
TWA: 0.002 mg/m^3 (respirable fraction)

1991 DFG (Germany) MAK
None established

1992 NIOSH REL
Carcinogen, keep as low as possible

1992 Toxicity Data†
Human, inhalation, LC_{Lo}: 39 mg/m^3/20 min caused cardiac changes, thrombosis, and respiratory depression.
Rat, oral, LD_{50}: 225 mg/kg; details not reported.
Woman, inhalation, LC_{Lo}: 129 $\mu g/m^3$ for 20 continuous years produced lung tumors.
Man, TC_{Lo}: 88 $\mu g/m^3$/8.6 years caused kidney and ureter toxicity with protein in the urine.

* Separate engineering control limit: to be achieved in processes and work places where it is not possible to achieve the PEL through engineering and work practices one. The SECAL for Cd is 15 or 50 $\mu g/m^3$ depending on the processes involved. See Federal Register 57 (178): 42222, Table VIII-B1, 9/14/92.

† See NIOSH, *RTECS* (EU9800000), for additional mutation, reproductive, tumorigenic, and toxicity data.

͵ection 3. Physical Data

oiling Point: 1409 °F (765 °C)
elting Point: 610 °F (321 °C)
apor Pressure: 0.095 mm Hg at 609.6 °F (320.9 °C)
efraction Index: 1.13
ohs Hardness: 2.0
olecular Weight: 112.4

Density: 8.642
Water Solubility: Insoluble
Other Solubilities: Soluble in nitric (rapidly), hydrochloric (slowly), and other acids. The solid is soluble in ammonium nitrate solution, but the powdered form undergoes an explosive reaction.

pearance and Odor: Silver-white, blue-tinged, lustrous, odorless, soft metal that is easily cut with a knife. The powder is grayish-white.

ction 4. Fire and Explosion Data

sh Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

tinguishing Media: The solid metal is not flammable, but the finely divided powder is pyrophoric. As a rule, the more finely divided the wder is, the greater the potential for explosion. Use carbon dioxide, dry chemical, or sand. **Unusual Fire or Explosion Hazards:** Processes that ate cadmium dust such as cutting, grinding, or welding present a serious explosion hazard in presence of ignition sources. Avoid creation of mium dust clouds. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained athing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Do not release runoff from fire control hods to sewers or waterways; dike for proper disposal.

ction 5. Reactivity Data

bility/Polymerization: Cadmium easily tarnishes in moist air as it is oxidized to cadmium oxide. The solid is stable in dry air. The powder is phoric. Cd becomes brittle at 176 °F (80 °C). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include ammonium nitrate dered Cd), hydrazoic acid, tellurium, zinc, ammonia, sulfur, selenium, nitryl fluoride, an oxidizing agents. **Conditions to Avoid:** Creation of dust clouds, exposure to heat and ignition sources, and contact with incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative mposition of Cd can produce toxic cadmium oxide (CdO) fumes.

tion 6. Health Hazard Data

inogenicity: The following agencies list Cd as a carcinogen: IARC Class 2A (probably carcinogenic in humans),(183) NTP Class 2 (reasonably ipated to be a carcinogen),(169) and NIOSH Class X (carcinogen defined without further categorization),(183) ACGIH TLV-A2 (suspected human nogen),(183) EPA-B1 (Probable human carcinogen) and DFG MAK-A2 (unmistakably carcinogenic in animal experimentation only).(183) **nary of Risks:** Dust or fume inhalation generally results in acute symptoms delayed up to 24 hr. Effects include a flu-like syndrome similar to fume fever with chills, fever, and muscle pain in the back and limbs. Pulmonary edema (fluid in lungs) can develop after severe exposure and esult in death. If victim recovers, residual changes may include lung fibrosis (thickening) and vascular changes. Long-term exposure to Cd ges the liver and kidneys (accumulates, half-life = 7 to 30 yr). Proteinuria (protein in urine) of low molecular weight is the first sign of tubular iction. Excess urinary glucose is also seen. Bone demineralization similar to osteoporosis (decreased bone density)...

Continue on next page

·tion 6. Health Hazard Data, *continued*

ı *not* as a direct effect of Cd exposure, but indirectly by altering kidney regulation of calcium and phosphorus which are needed for strong, y bones. Some studies show a correlation between anemia (low hemoglobin in blood) and high Cd levels. Selenium (Se) and zinc (Zn) appear ppress Cd toxicity; Se binds up Cd preventing it from entering body tissue and Zn may compete for the same metabolic site. **Medical Condi-** **: Aggravated by Long-Term Exposure:** Kidney, blood, or respiratory disorders. **Target Organs:** Blood, kidney, liver, respiratory system. **ıry Entry Routes:** Inhalation, ingestion. **Acute Effects:** Inhalation may cause irritation of the eyes, nose, and throat, nausea and vomiting, ninal colic, diarrhea, chest tightness, cough, headache, and weakness. Pulmonary edema could develop up to 24 hr post exposure. Kidney ıge may occur after acute exposures but is more likely with chronic exposure. **Chronic Effects:** Symptoms may be delayed several yr after last sure and include perforation of the nasal septum (tissue between the nostrils), loss of smell, chronic bronchitis, severe progressive emphysema, cia, insomnia, fatigue, pallor, anemia, kidney damage, bone demineralization, lung fibrosis and possible cancer of the respiratory tract.

Γ AID

: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of : until transported to an emergency medical facility. Consult a physician immediately.

Quickly remove contaminated clothing. Wash exposed area with soap and water.

ıtion: Remove exposed person to fresh air and support breathing as needed.

ıtion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have *onscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of cadmium's irritating nature.

'o Physicians: ß-2 microglobulin excretion of > 200 µg/g creatinine indicates kidney dysfunction as does a renal cortex [Cd] of 180 to 220 f wet kidney cortex. Blood Cd levels are *not* indicative of exposure.

:ion 7. Spill, Leak, and Disposal Procedures

'eak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should : against inhalation. Carefully scoop up small spills and place in sealed impermeable containers. *Do not* disperse dust by sweeping. nber that Cd powder can be pyrophoric and must be handled carefully. Prevent entry into sewers, drains, and waterways. Follow applicable \ regulations (29 CFR 1910.120).

ıal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

)esignations

as a RCRA Hazardous Waste (40 CFR 261.24): D006, Characteristic of Toxicity; regulatory level = 1.0 mg/L

as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 10 lb (4.54 kg)† [* per CWA, Sec. 307(a)]

Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed

as a SARA Toxic Chemical (40 CFR 372.65)

Designations

as an Air Contaminant (29 CFR 1910.1027)

:porting of releases of this substance is required if the diameter of the pieces of the solid metal is equal to or exceeds 100 µm (0.004 in.)

on 8. Special Protection Data

:s: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concen- use a SCBA or supplied air respirator (with auxiliary SCBA) with a full facepiece operated in pressure-demand or other positive-pressure 'or emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respira- not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that ı at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, storage areas. **Other:** Wear gloves, boots, aprons, and gauntlets to prevent Cd dust from contacting skin. **Ventilation:** Provide general and haust ventilation systems to maintain airborne concentrations below the OSHA PEL or SECAL (Sec. 2). Lunchroom facilities should not ncentrations above 2.5 µg/m³ at any time. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, hing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes; launder before reuse. Remove Cd from ıd clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using Cd, especially before eating, ;, smoking, using the toilet, or applying cosmetics.

›n 9. Special Precautions and Comments

/Handling Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles. Do not allow ı dust to build up in storage area.

ring Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and ıin concentrations at the lowest practical level.

:trative Controls: Prohibit workers from removing Cd from protective clothing and equipment by blowing, shaking, or any other means ırses Cd into the air. Employees must not enter eating facilities while wearing PPE unless it is vacuumed with a HEPA. Consider preplace- : periodic medical exams of exposed workers emphasizing the blood, kidneys, liver, and respiratory system. Educate workers on ı's carcinogenicity.

Transportation Data (49 CFR 172.101)

ppIng Name: Poisonous solids, n.o.s.*,
ric metals, n.o.s.†
zard Class: 6.1*, 4.2†
JN2811*, UN1383†
kIng Group: III*, I†
ıel: Keep away from food*, Spontaneously Combustible†
rovIsIons (172.102): —*, B11†
ıal, † Powder

Packaging Authorizations
a) Exceptions: 173.153*, None†
b) Non-bulk Packaging: 173.213*, .187†
c) Bulk Packaging: 173.240*, .242†

Quantity Limitations
a) Passenger Aircraft or Railcar: 100 kg*, Forbidden†
b) Cargo Aircraft Only: 200 kg*, Forbidder

Vessel Stowage Requirements
a) Vessel Stowage: A*, D†
b) Other:

ıection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 148, 159, 167, 169, 183, 185, 186

ɔy: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** TW Thoburn, MPH, MD

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 83
Chromium Metal/Powder

Issued: 3/81 Revision: A, 11/89

Section 1. Material Identification 30

Chromium Metal/Powder Description: Obtained from chrome ore, chromite ($FeCr_2O_4$), by electrolysis of chromium solutions, by direct reduction (ferrochrome), and by reducing the oxide with finely divided carbon or aluminum. Used for chromeplating other metals; for greatly increasing metal resistance and durability; in manufacturing chrome-steel or chrome-nickel-steel alloys (stainless steel); as a constituent of inorganic pigments; as protective coating for automotive and equipment accessories; and in nuclear and high-temperature research.
Other Designations: Chrome; Cr; CAS No. 7440-47-3.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I 4
S 1
K 1

Genium
1
2 1
-

HMIS
H 2
F 1
R 1
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Chromium metal/powder, ca 100%

OSHA PEL	ACGIH TLV, 1988-89*	NIOSH REL, 1987†	Toxicity Data‡
8-hr TWA: 1 mg/m³	TLV-TWA: 0.5 mg/m³	8-hr TWA (for chromium metal and insoluble salts): 1 mg Cr/m³	Rat, implant, TD_{Lo}: 1200 µg/kg body weight administered intermittently over six weeks

* This TLV is applicable to Cr^{+2} and Cr^{+3} compounds. For water soluble and water-insoluble Cr^{+6}, the 8-hr TWA is 0.05 mg Cr^{+6}/m^3. Certain water-insoluble Cr^{+6} compounds (zinc chromate, calcium chromate, lead chromate, barium chromate, strontium chromate, and sintered chromium trioxide) are designated as A1a (human carcinogen).

† The NIOSH REL (10-hr TWA) for carcinogen Cr^{+6} compounds is 1 µg/m³; for noncarcinogenic Cr^{+6} compounds (including chromic acid), the RELs (10-hr TWAs) are 25 µg/m³ and 50 µg/m³ (15-min ceiling). The noncarcinogenic compounds include mono- and dichromates of hydrogen, cesium, sodium, lithium, potassium, rubidium, ammonia, and Cr^{+6} (chromic acid anhydride). Any and all Cr^{+6} materials excluded from the noncarcinogenic group above are carcinogenic Cr^{+6} compounds.

‡ See NIOSH, *RTECS* (GB4200000), for additional data with references to tumorigenic effects.

Section 3. Physical Data

Boiling Point: 4783 °F (2642 °C)
Melting Point: 3452 °F (1900 °C)
Vapor Pressure: 1 mm Hg at 2941 °F (1616 °C)
Vapor Density (Air = 1): 1.79
Atomic Weight: 51.996 g/mol
Specific Gravity (H_2O = 1 at 39 °F (4 °C)): 7.2 at 68 °F (20 °C)
Water Solubility: Insoluble

Appearance and Odor: Steel-gray, lustrous metal; no odor.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** Cloud, 1076 °F (580 °C); dust layer, 752 °F (400 °C)	**LEL:** Dust cloud explosion, 0.230 oz/ft³	**UEL:** None reported

Extinguishing Media: Use dry chemical or sand.
Unusual Fire or Explosion Hazards: Particle size and dispersion in air determine reactivity. Chromium powder explodes spontaneously in air, while chromium dust suspended in CO_2 is ignitable and explosive when heated.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

*One hundred percent of dust goes through a 74-µm sieve. A 140-mJ spark can ignite a dust cloud.

Section 5. Reactivity Data

Stability/Polymerization: Chromium is stable when properly handled and stored. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Chromium reacts readily with dilute, not nitric, acids to form chromous salts. It is soluble in acids (not nitric) and strong alkalis. Its powder is incompatible with strong oxidizing agents, including high O_2 concentration. Evaporation of mercury (Hg) from Cr amalgam leaves pyrophoric chromium. Finely divided Cr attains incandescence with nitrogen oxide, potassium chlorate, and sulfur dioxide. Molten lithium at 18 °C severely attacks Cr. Fused ammonium nitrate below 200 °C reacts explosively and may ignite or react violently with bromine pentafluoride.
Hazardous Products of Decomposition: Thermal oxidative decomposition of Cr can produce toxic chromium oxide fumes.

No. 83 Chromium Metal/Powder 11/89

Section 6. Health Hazard Data

Carcinogenicity: The NTP and OSHA list chromium as a human carcinogen.

Summary of Risks: When ingested chromium is a human poison, with gastrointestinal (GI) effects. Chromium 3 (Cr^{+3}) compounds show little or no toxicity. Less soluble chromium 6 (Cr^{+6}) compounds are suspected carcinogens and severe irritants of the larynx, nasopharynx, lungs, and skin (Sec. 2). Chromic acid or chromate salts cause irritation of the skin and respiratory passage. Ingestion leads to severe irritation of the gastrointestinal tract, renal damage, and circulatory shock. Chromium metal (when heated to high temperatures) and insoluble salts are said to be involved in histological fibrosis of the lungs, which may progress to clinically evident pneumoconiosis. Exposure to chromate dust and powder can cause skin (dermatitis) and eye irritation (conjunctivitis).

Medical Conditions Aggravated by Long-Term Exposure: An incresed incidence of bronchogenic carcinoma occurs in workers exposed to chromate dust.

Target Organs: Respiratory system.

Primary Entry: Inhalation, percutaneous absorption, and ingestion.

Acute Effects: Acute exposures to dust may cause headache, coughing, shortness of breath, pneumoconiosis, fever, weight loss, nasal irritation, inflammation of the conjunctiva, and dermatitis.

Chronic Effects: Asthmatic bronchitis.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Brush off chromium dust. After rinsing affected area with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person slowly drink 1 to 2 glasses of water to dilute. Do not induce vomoting. A physician should evaluate all ingestion cases.

After first aid, get appropriate in-plant, paramedic, or community medical attention and support.

hysician's Note: Acute toxicity causes a two-phase insult: 1) multisystem shock due to gastrointestinal corrosivity and 2) hepatic, renal, ematopoetic insult. Treatment should use ascorbic acid as a neutralizer with gastric lavage. If the ingestion is substantial, exchange transfusions nd/or consider hemodialysis. Treat allergic dermatitis with local cortisone or 10% ascorbic acid to reduce Cr^{+6} to Cr^{+3}. Ten percent EDTA in a nolin base applied every 24 hr helps heal skin ulcers.

ection 7. Spill, Leak, and Disposal Procedures

pill/Leak: Notify safety personnel of large spills. Cleanup personnel should wear protective clothing and approved respirators. Remove heat and nition sources. Provide adequate ventilation. Keep airborne dust at a minimum. Remove spills quickly and place in appropriate containers for sposal or reuse.

sposal: Reclaim salvageable metal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, ate, and local regulations.

SHA Designations

sted as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

A Designations

RA Hazardous Waste (40 CFR 261.33): Not listed

ted as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]

RA Extremely Hazardous Substance (40 CFR 355): Not listed

ted as a SARA Toxic Chemical (40 CFR 372.65)

ction 8. Special Protection Data

ggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

pirator: Wear a NIOSH-approved respirator if necessary. Wear an SCBA with a full facepiece when the particle concentration's upper limit is ng/m³.

rning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

er: Wear impervious rubber gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

ilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA standard . 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium .03).

ty Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

aminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder minated clothing before wearing. Remove this material from your shoes and equipment.

ments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, ing, using the toilet, or applying cosmetics.

ion 9. Special Precautions and Comments

ge Requirements: Store material in cool, dry, well-ventilated area separate from acids and oxidizing agents. Seal and protect containers hysical damage. Keep away from heat or ignition sources.

eering Controls: Avoid dust inhalation. Practice good housekeeping (vacuuming and wet sweeping) to minimize airborne particulates prevent dust accumulation. Use nonsparking tools and ground electrical equipment and machinery.

portation Data (49 CFR 172.101, .102): Not listed

Collection References: 1, 2, 26, 38, 80, 87, 88, 89, 100, 109, 124, 126

red by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Hardies, MD MB

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification

32

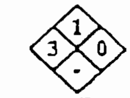
Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.

Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(™) for a suppliers list.

R	0
I	4
S	-
K	0

Genium



HMIS	
H	3
F	1
R	0
PPG*	

* Sec. 8

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 μg/m³
Action Level TWA*: 30 μg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 μg/100 g

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 μg/m³

1988 NIOSH REL
10-hr TWA: <100 μg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 μg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*

Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system . The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

Continue on next page

ion 6. Health Hazard Data, *continued*

: Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
ry Entry Routes: Inhalation, ingestion.
Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term
ures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
nic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irty, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often,
xtensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if
ymptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and
ty in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage
elopmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by headache, convulsions, coma, delirium, and possibly death.

AID

Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical
y. Consult a physician immediately.
Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health
units develop.
tion: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
ion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with
: syrup. Consult a physician immediately.
first aid, get appropriate in-plant, paramedic, or community medical support.
ian's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic
. and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and
l lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

ion 7. Spill, Leak, and Disposal Procedures

eak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of
r fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formadust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled
al into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
al: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

esignations

as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)
as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
Extremely Hazardous Substance (40 CFR 355): Not listed
as a SARA Toxic Chemical (40 CFR 372.65)

Designations

as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

on 8. Special Protection Data

s: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
ator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if neces-
ear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an
. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking
s, pleats, or pockets retain less dust from lead.
tion: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust
ion is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
minated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this
l from your shoes and equipment. Launder contaminated clothing before wearing.
ents: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before drinking, smoking, using the toilet, or applying cosmetics.

on 9. Special Precautions and Comments

: Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct
, and heat and ignition sources.
ering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid in-
n of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a
ory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate
nder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures.
riety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Precautions: Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and
, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies,
g history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for
. surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of
ment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead
ion level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and
ing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and
er you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)

ipping Name: Lead compounds, soluble, n.o.s.
azard Class: 6.1
UN2291
abel: St. Andrews Cross (X, Stow away from foodstuffs)
Packaging Group: III

ollection **References:** 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
d by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR INORGANIC LEAD

INTRODUCTION

"Inorganic lead" is defined as lead oxides, metallic lead, and lead salts (including organic salts such as lead soaps but excluding lead arsenate). This guideline summarizes pertinent information about inorganic lead for workers, employers, and occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; therefore, readers are advised to regard these recommendations as general guidelines.

SUBSTANCE IDENTIFICATION

- **Formula:** Pb
- **Synonyms:** C.I. pigment metal 4, C.I. 77575, KS-4, lead flake, lead S2
- **Identifiers:** CAS 7439-92-1; RTECS OF7525000; DOT 1794
- **Appearance and odor:** Bluish-white, silvery, or gray odorless solid

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 207.19
2. Boiling point (at 760 mmHg): 1,740 °C (3,164°F)
3. Specific gravity (water = 1): 11.34
4. Melting point: 327.5 °C (621.5 °F)
5. Insoluble in water

- **Reactivity**

1. Incompatibilities: Lead reacts vigorously with oxidizing materials. Contact with hydrogen peroxide or active metals such as sodium or potassium may cause fires or explosions.
2. Hazardous decomposition products: Toxic fumes (e.g., lead oxide) may be released in a fire involving inorganic lead.

- **Flammability**

1. Extinguishant: Dry sand, dry dolomite, or dry graphite
2. Caution: Lead is combustible in powder form when exposed to heat or flame

- **Warning properties**

Evaluation of warning properties for respirator selection: Based on lack of information on odor threshold and eye irritation levels, inorganic lead should be treated as a chemical with poor warning properties.

EXPOSURE LIMITS

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for inorganic lead is 50 micrograms of lead per cubic meter of air ($\mu g/m^3$) as a time-weighted average (TWA) concentration over an 8-hour workshift. If a worker is exposed to lead for more than 8 hours in any workday, the PEL, as a TWA for that day, shall be reduced according to the following formula: maximum permissible limit (in $\mu g/m^3$) = 400 divided by hours worked in the day. The National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) is 100 $\mu g/m^3$ as a TWA for up to a 10-hour workshift, 40-hr. workweek. The American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV®) is 0.15 mg/m^3 (150 $\mu g/m^3$) as a TWA for a normal 8-hour workday and a 40-hour workweek (Table 1).

Table 1.—Occupational exposure limits for inorganic lead

	Exposure units $\mu g/m^3$
OSHA PEL TWA	50
NIOSH REL TWA	100*
ACGIH TLV® TWA	150

* Air level to be maintained such that worker blood lead remains $\leqslant 60\ \mu g/100g$.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Inorganic lead may cause adverse health effects following exposure via inhalation or ingestion.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service   Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer

• Summary of toxicology

1. *Effects on animals:* In rats or mice, chronic oral administration or subcutaneous or intraperitoneal injection of lead subacetate, lead acetate, or lead phosphate produced cancer of the kidneys. Intravenous or intraperitoneal injection of lead nitrate, lead acetate, or lead chloride to pregnant mice, rats, or hamsters caused increased fetal mortality and malformations of the posterior extremities and urogenital and intestinal tracts in the offspring.
2. *Effects on humans:* Inhalation or ingestion of inorganic lead has caused peripheral neuropathy with paralysis of the muscles of the wrists and ankles, encephalopathy, anemia (due to decreased red blood cell life and impaired heme synthesis), proximal kidney tubule damage, decreased kidney function, and chronic kidney disease. Lead can accumulate in the soft tissues and bones, with the highest accumulation in the liver and kidneys, and elimination is slow. Lead can penetrate the placental barrier, resulting in neurologic disorders in infants.

• Signs and symptoms of exposure

1. *Short-term (acute):* Exposure to inorganic lead can cause decreased appetite, insomnia, headache, muscle and joint pain, colic, and constipation.
2. *Long-term (chronic):* Exposure to inorganic lead can cause weakness, weight loss, nausea, vomiting, constipation, blue or blue-black dot-like pigmentation on the gums ("lead line"), severe headache and abdominal cramps, delirium, convulsions, and coma.

RECOMMENDED MEDICAL PRACTICES

• Medical surveillance program

Workers with potential exposures to chemical hazards should be monitored in a systematic program of medical surveillance intended to prevent or control occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety and health, earliest possible detection of adverse health effects, and referral of workers for diagnostic confirmation and treatment. The occurrence of disease (a "sentinel health event," SHE) or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace, such measures.

A medical surveillance program should include systematic collection and epidemiologic analysis of relevant environmental and biologic monitoring, medical screening, morbidity, and mortality data. This analysis may provide information about the relatedness of adverse health effects and occupational exposure that cannot be discerned from results in individual workers. Sensitivity, specificity, and predictive values of biologic monitoring and medical screening tests should be evaluated on an industry-wide basis prior to application in any given worker group. Intrinsic to a surveillance program is the dissemination of summary data to those who need to know, including employers, occupational health professionals, potentially exposed workers, and regulatory and public health agencies.

• Preplacement medical evaluation

Prior to placing a worker in a job with a potential for exposure to inorganic lead, the physician should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the kidneys and the hematopoietic (blood cell forming), nervous, gastrointestinal, and reproductive systems.

A preplacement medical evaluation is recommended in order to detect and assess preexisting or concurrent conditions which may be aggravated or result in increased risk when a worker is exposed to inorganic lead at or below the NIOSH REL.

The examining physician should consider the probable frequency, intensity, and duration of exposure, as well as the nature and degree of the condition, in placing such a worker. Such conditions, which should not be regarded as absolute contraindications to job placement, include preexisting neuromuscular disease. In addition to the medical interview and physical examination, the physician should consider obtaining additional baseline electrophysiologic and electromyographic studies and an assessment of fertility, using standardized methods and evaluation criteria. The physician should also obtain baseline values for the complete blood count including the reticulocyte count and for those tests which characterize prior internal exposure (e.g., blood lead level) and the effects of prior exposures (e.g., erythrocyte zinc protoporphyrin and delta-aminolevulinic acid dehydrogenase).

• Periodic medical screening and/or biologic monitoring

Occupational health interviews and physical examinations should be performed at regular intervals. Additional examinations may be necessary should a worker develop symptoms that may be attributed to exposure to inorganic lead. The interviews, examinations, and appropriate medical screening and/or biologic monitoring tests should be directed at identifying an excessive decrease or adverse trend in the physiologic function of the kidneys and the hematopoietic (blood cell forming), nervous, gastrointestinal, and reproductive systems as compared to the baseline status of the individual worker or to expected values for a suitable reference population. The following tests should be used and interpreted according to standardized epidemiologic procedures and evaluation criteria: a complete blood count with reticulocyte count and those tests which characterize prior internal exposure (e.g., blood lead level) and the effects of exposures (e.g., erythrocyte zinc protoporphyrin and delta-aminolevulinic acid dehydrogenase).

• Medical practices recommended at the time of job transfer or termination

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic and laboratory tests which were conducted at the time of placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared to those expected for a suitable reference population. Because occupational exposure to inorganic lead may cause adverse reproductive effects and diseases of prolonged inductionlatency, the need for medical surveillance may extend well beyond termination of employment.

- **Sentinel health events**

1. Acute SHE's include: Acute renal failure.
2. Delayed-onset or reproductive SHE's include: Inflammatory and toxic neuropathy and chronic renal failure.

MONITORING AND MEASUREMENT PROCEDURES

- **TWA exposure evaluation**

Measurements to determine worker exposure to inorganic lead should be taken so that the TWA exposure is based on a single entire workshift sample or an appropriate number of consecutive samples collected during the entire workshift. Under certain conditions, it may be appropriate to collect several short-term interval samples (up to 30 minutes each) to determine the average exposure level. Air samples should be taken in the worker's breathing zone (air that most nearly represents that inhaled by the worker).

- **Method**

Sampling and analysis may be performed by collecting inorganic lead with cellulose membrane filters followed by acid digestion and analysis by atomic absorption. A detailed sampling and analytical method for inorganic lead may be found in the *NIOSH Manual of Analytical Methods* (method number 7082).

PERSONAL PROTECTIVE EQUIPMENT

Chemical protective clothing (CPC) should be selected after utilizing available performance data, consulting with the manufacturer, and then evaluating the clothing under actual use conditions.

Workers should be provided with and required to use CPC, gloves, face shields (8-inch minimum) and other appropriate protective clothing necessary to prevent skin contact with inorganic lead.

Workers should be provided with and required to use dust-proof safety goggles where inorganic lead may come in contact with the eyes.

SANITATION

Clothing which is contaminated with inorganic lead should be removed immediately and placed in closed containers for storage until it can be discarded or until provision is made for the removal of inorganic lead from the clothing. If the clothing is to be laundered or cleaned, the person performing the operation should be informed of inorganic lead's hazardous properties.

Change and shower rooms should be provided with separate locker facilities for street and work clothes.

Skin that becomes contaminated with inorganic lead should be promptly washed with soap and water.

The storage, preparation, dispensing, or consumption of food or beverages, the storage or application of cosmetics, the storage or smoking of tobacco or other smoking materials, or the storage or use of products for chewing should be prohibited in work areas.

Workers who handle inorganic lead should wash their faces, hands, and forearms thoroughly with soap and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

Common operations in which exposure to inorganic lead may occur and control methods which may be effective in each case are listed in Table 2.

Table 2.—Operations and methods of control for inorganic lead

Operations	Controls
During primary (ore) and secondary (scrap) smelting of lead; during the manufacture of storage batteries; during typecasting and remelting of type metal in printing	Process enclosure, local exhaust ventilation, dust control, personal protective equipment
During soldering in the fabrication of metal articles	Process enclosure, local exhaust ventilation, personal protective equipment
During melting and pouring of lead and alloys containing lead; during welding, burning, and cutting of metal structures containing lead or painted with lead containing surface coatings	Local exhaust ventilation, personal protective equipment
During the use of lead in the manufacture of surface coatings, including paints and varnishes; during the manufacture of ceramics and glass	Local exhaust ventilation, personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, remove the victim from further exposure, send for medical assistance, and initiate emergency procedures.

- **Eye exposure**

Where there is any possibility of a worker's eyes being exposed to inorganic lead, an eye-wash fountain should be provided within the immediate work area for emergency use.

If inorganic lead gets into the eyes, flush them immediately with large amounts of water for 15 minutes, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this compound.

- **Skin exposure**

Where there is any possibility of a worker's body being exposed to inorganic lead, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

If inorganic lead gets on the skin, wash it immediately with soap and water. If inorganic lead penetrates the clothing, remove the clothing immediately and wash the skin with soap and water. Get medical attention promptly.

- **Rescue**

If a worker has been incapacitated, move the affected worker from the hazardous exposure. 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.

SPILLS AND LEAKS

Workers not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

If inorganic lead is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities of liquids containing inorganic lead, absorb on paper towels and place in an appropriate container.
4. Large quantities of liquids containing inorganic lead may be bsorbed in vermiculite, dry sand, earth, or a similar material and placed in an appropriate container.
5. If in solid form, inorganic lead may be collected and placed in an appropriate container.

. Inorganic lead may be collected by vacuuming with an appropriate system.

WASTE REMOVAL AND DISPOSAL

U.S. Environmental Protection Agency, Department of Transportation, and/or state and local regulations shall be followed to assure that removal, transport, and disposal are in accordance with existing regulations.

RESPIRATORY PROTECTION

must be stressed that the use of respirators is the least preferred method of controlling worker exposure and should not normally be used as the only means of preventing or minimizing exposure during routine operations. However, there are some exceptions for which respirators may be used control exposure: when engineering and work practice controls are not technically feasible, when engineering controls are in the process of being installed, or during emergencies and certain maintenance operations including those requiring confined-space entry (Table 3).

addition to respirator selection, a complete respiratory protection program should be instituted which as a minimum complies with the requirements found in the OSHA Safety and Health Standards 29 CFR 1910.134. A respiratory protection program should include as a minimum an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic environmental monitoring, maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program, including selection of the correct respirators, requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly.

Only respirators that have been approved by the Mine Safety and Health Administration (MSHA, formerly Mining Enforcement and Safety Administration) and by NIOSH should be used. **Remember! Air-purifying respirators will not protect from oxygen-deficient atmospheres.**

For each level of respirator protection, only those respirators that have the minimum required protection factor and meet other use restrictions are listed. All respirators that have higher protection factors may also be used.

BIBLIOGRAPHY

- American Conference of Governmental Industrial Hygienists: "Lead," *Documentation of the Threshold Limit Values and Biological Exposure Indices* (5th ed.), Cincinnati, 1986.
- American Conference of Governmental Industrial Hygienists: *TLVs® Threshold Limit Values and Biological Exposure Indices for 1987-88*, Cincinnati, 1987.
- American Industrial Hygiene Association: "Lead and Its Inorganic Compounds" (rev. 1964), *Hygienic Guide Series*, Detroit, 1964.
- American Lung Association of San Diego and Imperial Counties: "Taking the Occupational History," *Annals of Internal Medicine*, 99:641-651, November 1983.
- Clayton, G.D., and Clayton, F.E. (eds.): *Toxicology*, Vol. IIA of *Patty's Industrial Hygiene and Toxicology* (3rd rev. ed.), John Wiley & Sons, Inc., New York, 1981.
- *Code of Federal Regulations*, U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR 1910.134, 1910.1025, OSHA 2206, revised July 1, 1986.
- *Code of Federal Regulations*, U.S. Department of Transportation, 49 CFR 172.101, Transportation 49, revised October 1, 1982.
- Goldman, R.H., and Peters, J.M.: "The Occupational and Environmental Health History," *Journal of the American Medical Association*, 246:2831-2836, 1981.
- Halperin, W.E., Ratcliffe, J., Frazier, T.M., Wilson, L., Becker, S.P., and Shulte, P.A.: "Medical Screening in the Workplace: Proposed Principles," *Journal of Occupational Medicine*, 28(8): 547-552, 1986.
- Hankinson, J.L.: "Pulmonary Function Testing in the Screening of Workers: Guidelines for Instrumentation, Performance, and Interpretation," *Journal of Occupational Medicine*, 28(10):1081-1092, 1986.
- Hawley, G.G.: *The Condensed Chemical Dictionary* (10th ed.), Litton Educational Publishing, Inc., New York, 1981.
- International Agency for Research on Cancer: *IARC Monographs on the Carcinogenic Risk of Chemicals to Humans, Some Metals and Metallic Compounds*, Vol. 23, Lyon, France, 1980.

- Leidel, N.A., Busch, K.A., and Lynch, J.R.: *Occupational Exposure Sampling Strategy Manual*, U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, DHEW (NIOSH) Publication No. 77-173, Cincinnati, 1977.
- Levy, B.S., and Wegman, D.H. (eds.): *Occupational Health: Recognizing and Preventing Work-Related Disease*, Little, Brown and Company, Boston, 1983.
- Mark, H.F., Othmer, D.F., Overberger, C.G., Seaborg, G.T., Grayson, M., and Eckroth, D. (eds.): *Kirk-Othmer Encyclopedia of Chemical Technology* (3rd ed.), John Wiley & Sons, Inc., New York, 1981.
- National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control: *Criteria for a Recommended Standard. . . .Occupational Exposure to Inorganic Lead—Revised Criteria 1978*, DHEW (NIOSH) Publication No. 78-158, Cincinnati, 1978.
- National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control: *NIOSH Manual of Analytical Methods* (3rd ed., Vol. 2), Eller, P.M. (ed.), DHHS (NIOSH) Publication No. 84-100, Cincinnati, 1984.
- National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control: *Registry of Toxic Effects of Chemical Substances* (Microfiche Edition), Sweet, D.V., and Lewis, R.J. (eds.), Cincinnati, April 1985.
- Proctor, N.H., and Hughes, J.P.: *Chemical Hazards of the Workplace*, J.B. Lippincott Company, Philadelphia, 1978.
- Rom, W.N. (ed.): *Environmental and Occupational Medicine*, Little, Brown and Company, Boston, 1983.
- Rothstein, M.A.: *Medical Screening of Workers*, Bureau of National Affairs, Washington, DC, 1984.
- Rutstein, D.D., Mullan, R.J., Frazier, T.M., Halperin, W.E., Melius, J.M., and Sestito, J.P.: "Sentinel Health Events (Occupational): A Basis for Physician Recognition and Public Health Surveillance," *American Journal of Public Health*, 73:1054-1062, 1983.
- Sax, N.I. (ed.): *Dangerous Properties of Industrial Materials* (6th ed.), Van Nostrand Reinhold Company, New York, 1984.
- Scientific Assembly on Environmental and Occupational Health: "Evaluation of Impairment/Disability Secondary to Respiratory Disease," *American Review of Respiratory Diseases*, 126:945-951, 1982.
- Scientific Assembly on Environmental and Occupational Health: "Surveillance for Respiratory Hazards in the Occupational Setting," *American Review of Respiratory Diseases*, 126:952-956, 1982.
- Weast, R.C. (ed.): *CRC Handbook of Chemistry and Physics* (64th ed.), CRC Press, Inc., Boca Raton, Florida, 1983.
- Windholz, M. (ed.): *The Merck Index* (10th ed.), Merck & Co., Inc., Rahway, New Jersey, 1983.

Table 3.—Respiratory protection for inorganic lead

Condition	Minimum respiratory protection*†
Concentration:	
Less than or equal to 0.5 mg/m^3	Any supplied air respirator Any air-purifying respirator with a high-efficiency particulate filter Any self-contained breathing apparatus
Less than or equal to 1.25 mg/m^3	Any powered air-purifying respirator with a high-efficiency particulate filter Any supplied-air respirator operated in a continuous flow mode
Less than or equal to 2.5 mg/m^3	Any air-purifying full facepiece respirator with a high-efficiency particulate filter Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter Any self-contained breathing apparatus with a full facepiece Any supplied-air respirator with a full facepiece Any supplied-air respirator with a tight-fitting facepiece and operated in a continuous flow mode
Less than or equal to 50 mg/m^3	Any supplied-air respirator with a half-mask and operated in a pressure-demand or other positive pressure mode
Less than or equal to 100 mg/m^3	Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode
Planned or emergency entry into environments containing unknown concentrations or levels above 100 mg/m^3	Any self-contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive pressure mode
Firefighting	Any self-contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode
Escape only	Any air-purifying full facepiece respirator with a high-efficiency particulate filter Any appropriate escape-type self-contained breathing apparatus

* Only NIOSH/MSHA-approved equipment should be used.

† The respiratory protection listed for any given condition is the minimum required to meet the NIOSH REL of 100 μg/m^3 (TWA).

Genium Publishing Corp.
One Genium Plaza
Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheet Collection

Mercury MSDS No. 26

Date of Preparation: 1/77 Revision: D, 6/94

Section 1 - Chemical Product and Company Identification

44

Product/Chemical Name: Mercury
Chemical Formula: Hg
AS No.: 7439-97-6
Synonyms: colloidal mercury, hydrargyrum, liquid silver, Quicksilver
Derivation: Obtained by roasting cinnabar (mercury sulfide) and purified by distillation, or as a by-product of gold mining.
General Use: Used in agricultural poisons, anti-fouling paint, dental amalgams, mining amalgamation (to remove gold and other metals from ore), thermometers, barometers, dry cell batteries, chlorine and caustic soda production, electrical apparatus, and as neutron absorber in nuclear power plants.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Mercury, ca 100 %wt

OSHA PEL
Ceiling: 0.1mg/m^3 (vapor and inorganic Hg)
8-hr TWA: 0.05 mg/m^3 (vapor), skin; (Vacated 1989 Final Rule Limit)

ACGIH TLVs
TWA: 0.025 mg/m^3 (inorganic compounds), skin

NIOSH REL
10-hr TWA: 0.05 mg/m^3 (vapor), skin

DFG (Germany) MAK
TWA: 0.01 ppm (0.1 mg/m^3)
Category III: Substances with systemic effects
Onset of Effect: > 2 hr
Half-life: > shift length (strongly cumulative)

Peak Exposure Limit:
0.1 ppm (1 mg/m^3), 30 min. average value, 1/shift

IDLH Level
28 mg/m^3

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Mercury exists as a heavy, odorless, silver-white liquid metal. It is highly toxic by both acute and chronic exposure. Exposure can cause corrosion of the eyes, skin, and respiratory tract and may result in irreversible nervous system damage. It readily forms amalgamations with most metals except iron.

Wilson Risk Scale	
R	1
I	4
S	2*
K	1

*Skin absorption

HMIS	
H	4*
F	0
R	0

*Chronic effects
PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, eye and skin contact/absorption.
arget Organs: Central nervous system, eyes, skin, respiratory system, liver, kidneys.
Acute Effects
nhalation: Exposure to high vapor concentrations can cause severe respiratory damage. Other symptoms include wakefulness, muscle weakness, anorexia, headache, ringing in the ear, headache, diarrhea, liver changes, fever, gingivitis, chest pain, difficulty breathing, cough, inflammation of the mouth (stomatitis), salivation, bronchitis, nd pneumonitis. Acrodynia (pink or Swifts disease), characterized by redness and peeling of the skin on the toes nd fingers, was commonly seen in children in the 1950s and is still *infrequently* seen in workers.
Eye: Irritation and corrosion.
Skin: Skin can become severely irritated if allowed to remain in contact with mercury. Skin absorption will occur t 2.2% of the rate of absorption through the lungs.
ngestion: Mercury generally passes through the digestive tract uneventfully. However, large amounts may get aught up in the intestine and require surgical removal. If an abscess or other perforation is present along the igestive tract, absorption into the blood stream with subsequent mercury poisoning is possible.
arcinogenicity: IARC, NTP, and OSHA do not list mercury as a carcinogen.
edical Conditions Aggravated by Long-Term Exposure: Central nervous system disorders.
hronic Effects: Chronic exposure appears more common than acute and is primarily associated with central nervous system amage which can be permanent (ex. paresthesia of the hands, lips, feet). Early signs of toxicity include weakness, fatigue, norexia, weight loss, and gastrointestinal disturbances. If exposure levels are high, characteristic tremors of the fingers, eyelids, nd lips occur with progression to generalized tremors of the entire body. Psychic disorders are noticeable and characterized by ehavior and personality changes, increased excitability, memory loss, insomnia, and depression. In severe cases, delirium and

:inations may occur. Kidney damage is observed with oliguria (decreased urine output) progressing to anuria (urine tion) and may require dialysis. The cornea and lens of the eyes may take on a brownish discoloration and the extraocular les may be damaged. This syndrome has been termed *Asthenic-Vegetative Syndrome* or *Micromercurialism.* Chronic ptoms occur increasingly with exposures to 0.1 mg/m^3 or higher. *Mutation:* Aneuploidy and other chromosomal aberrations been observed in the lymphocytes from whole blood cultures in workers exposed to mercury. *Reproductive:* Mercury has detected in stillborn babies of women treated with mercury for syphilis. In a study of six men acutely exposed pationally) to mercury levels as high as 44 mg/m^3, all suffered impaired sexual function. Repeated skin contact may cause gic dermatitis in some individuals.

: Spilled mercury will release sufficient vapor over time to produce chronic poisoning.

Section 4 - First Aid Measures

ation: Remove exposed person to fresh air and support breathing as needed.

ontact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water and then wash exposed area with . For reddened or blistered skin, consult a physician.

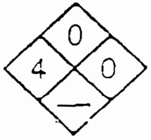
ion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. In general, ury will pass through the digestive tract uneventfully.

first aid, get appropriate in-plant, paramedic, or community medical support.

to Physicians: BEI: *blood* (15 µg/L), *urine*: (35 µg/g creatinine). Extremely high urine levels of 0.5 to 0.85 mg Hg/L are ative of polyneuropathy. 0.4 to 22 µg/L is reported to be the human lethal blood level. Obtain urinalysis including at a mum: albumin, glucose, and a microscopic examination of centrifuged sediment. Use BAL or 2, 3-dimercaptosuccinic acid lelators. *Do not* use calcium sodium EDTA because of nephrotoxicity. An electromyograph may determine extent of nerve unction. It has been noted that exposure to mercury may predispose persons to development of carpal tunnel syndrome.

Section 5 - Fire-Fighting Measures

Genium



Point: Nonflammable

gnition Temperature: Nonflammable

None reported.

None reported.

guishing Media: Use agents suitable for surrounding fire.

ual Fire or Explosion Hazards: None reported.

rdous Combustion Products: Toxic mercury vapor and mercuric oxide.

Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing ratus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Leak Procedures: Keep a mercury spill kit readily available in areas where mercury is used. Notify safety personnel, te and ventilate area, deny entry, and stay upwind.

and Large Spills: Follow instructions on mercury spill kit. Most kits come with an aspiration-driven vacuum trap with a ury "sweeper" (copper or copper-plated brush). Wash spill area with a dilute calcium sulfide or nitric acid solution. If spill ct be taken up readily, dust the top of the spill with flowers of sulfur or preferably, calcium polysulfide. This will produce a ce coating of mercury sulfide which will reduce mercury vapor dispersion into the air.

ulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

ling Precautions: Use appropriate PPE when working with mercury. *Do not* use on porous work surfaces (wood, unsealed rete, etc.) to prevent spills from lodging in cracks.

ge Requirements: Store in a cool, dry, well-ventilated area away from heat and incompatibles (Sec. 10). Store on non-us floors and wash them regularly with a dilute calcium sulfide solution. Because mercury will form amalgamations with metals except iron, metal shelves should be painted with a sufficiently thick coating to prevent this from happening.

Section 8 - Exposure Controls / Personal Protection

eering Controls: Wherever possible, enclose processes to prevent mercury vapor dispersion into work area.

ation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at urce.(103)

istrative Controls: Consider pre-placement and periodic medical exams of exposed workers with emphasis on the skin, central nervous system, liver, and kidneys.

atory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For $\leq$ 0.5 mg/m^3, use any chemical cartridge respirator with cartridges providing protection against mercury and equipped with an ESLI (end of service life indicator), any SCBA, or any SAR (supplied-air respirator). For ≤ 1.25 mg/m^3, use any SAR operated in continuous-flow mode, any PAPR (powered, air-purifying respirator) with an ESLI. For ≤ 2.5 mg/m^3, use any SCBA or SAR with a full facepiece, any SAR with a tight-fitting facepiece and operated in continuous-flow mode, or any chemical cartridge respirator with a full facepiece, chemical cartridges providing protection against mercury, and equipped with an ESLI. For ≤28 mg/m^3, use any SAR operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA with full facepiece and operated in pressure-demand or other positive pressure mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets made of butyl rubber, nitrile rubber, fluorocarbon rubber, neoprene rubber, polyvinyl chloride, chlorinated polyethylene, or polycarbonate to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid metal

Appearance and Odor: Silvery-white, odorless

Vapor Pressure: 0.0018 mm Hg at 77 °F (25 °C)

Formula Weight: 200.59

Density (H_2O=1): 13.534 g/cm^3 at 77 °F (25 °C)

Boiling Point: 674.09 °F (356.72 °C)

Freezing Point: -37.97 °F (-38.87 °C)

Viscosity: 15.5 mP at 77 °F (25 °C)

Electrical Resistivity: 95.76 µohm at 68 °F (20 °C)

Water Solubility: 0.28 µmol/L at 77 °F (25 °C)

Other Solubilities: Soluble in boiling sulfuric acid, nitric acid (reacts); slightly in lipids, and 2.7 mg/L in pentane. Insoluble in alcohol, ether, cold sulfuric acid, hydrogen bromide, and hydrogen iodide.

Surface Tension: 484 dyne/cm at 77 °F (25 °C)

Critical Temperature: 2664 °F (1462 °C)

Critical Pressure: 1587 atm

Section 10 - Stability and Reactivity

Stability: Mercury does not tarnish at ordinary temperatures but when heated to near its boiling point, it slowly oxidizes to mercuric oxide.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Mercury forms alloys (amalgamates) with most metals except iron. It is incompatible with oxidizers such as bromine, 3-bromopropyne, methylsilane + oxygen, chlorine, chlorine dioxide, nitric acid, or peroxyformic acid; tetracarbonyl nickel + oxygen, alkynes + silver perchlorate, ethylene oxide, acetylenic compounds (explosive), ammonia (explosive), boron phosphodiiodide, methyl azide, nitromethane, and ground sodium carbide.

Conditions to Avoid: Exposure to high temperatures, metal surfaces or incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of mercury can produce mercuric oxide.

Section 11- Toxicological Information

Toxicity Data:*

Reproductive:
Rat, inhalation: 890 ng/m^3/24 hr for 16 weeks prior to mating had an effect on spermatogenesis.

Acute Dermal Toxicity:
Man, skin, TD_{Lo}: 129 mg/kg for 5 continuous hours caused ringing in the ears, headache, and allergic dermatitis.

Acute Oral Toxicity:
Man, oral, TD_{Lo}: 43 mg/kg caused tremor and jaundice or other liver changes.

Acute Inhalation Effects:
Woman, inhalation, TC_{Lo}: 150 $\mu g/m^3$/46 days caused anorexia, diarrhea, and wakefulness.
Man, inhalation, TC_{Lo}: 44300 $\mu g/m^3$/8 hr caused muscle weakness, liver changes, and increased body temperature.

Chronic Effects:
Rat, inhalation: 1 mg/m^3/ 24 hr for 5 continuous weeks caused proteinuria.

*See NIOSH, *RTECS* (OV4550000), for additional toxicity data.

Section 12 - Ecological Information

oxicity: Catfish, LC_{50} = 0.35 mg/L/96 hr; mollusk (*Modiolus carvalhoi*), LC_{50} = 0.19 ppm/96 hr: tadpole (*Rana adactyla*), LC_{50} = 0.051 ppm/96 hr. Mercury is transformed to methyl mercury by bacteria in the environment and lergoes bioaccumulation readily. BCF for freshwater fish = 63,000; for saltwater fish = 10,000; and for marine and hwater invertebrates = 100,000.

ronmental Degradation: Mercury is expected to volatilize rapidly when deposited on soil surfaces. Once in the air, it can ransported long distances before being redeposited on soil or in water. In water, mercury appears to bind to particulates ere it eventually becomes deposited on the bed sediment. In general, mercury entering the environment can be deposited and olatilized several times.

Section 13 - Disposal Considerations

osal: Incineration is *not* an appropriate disposal method. Wastewater may be treated by addition of chlorine to oxidize the cury to its ionic state. The water can then be passed through an absorbent (an activated charcoal concentrate with a sulfur ing or peanut shell charcoal) to collect the ionic mercury, followed by distillation to recover the mercury. Sodium ohydride, a reducing agent, can be used to precipitate mercury from waste solutions. Bioremediation, using *Pseudomonas ida*, has also been suggested. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable eral, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

pping Name: Mercury
pping Symbols: A, W
zard Class: 8
No.: UN2809
king Group: III
oel: Corrosive
cial Provisions (172.102): –

Packaging Authorizations
a) Exceptions: 173.164
b) Non-bulk Packaging: 173.164
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 35 kg
b) Cargo Aircraft Only: 35 kg

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40, 97

Section 15 - Regulatory Information

Regulations:
l as a RCRA Hazardous Waste (40 CFR 261.33): U151
l as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001; CWA, Sec. 307(a), CAA, Sec. 112
CLA Reportable Quantity (RQ), 1 lb (0.454 kg)
A 311/312 Codes: 1, 2
l as a SARA Toxic Chemical (40 CFR 372.65)
A EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
A Regulations:
l as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

ences: 73, 103, 124, 132, 136, 148, 149, 159, 167, 176, 187, 189

ared By .... M Gannon, BA
trial Hygiene Review .... RE Langford, PhD, CIH
cal Review .... T Thoburn, MD, MPH

aimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's nsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation s no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such nation for application to the purchaser's intended purpose or for consequences of its use.

METHYL CHLORIDE

MTC

Common Synonyms
Chloromethane
Artic

Gas | Colorless | Odorless or sweet odor

Floats and boils on water. Flammable, visible vapor cloud is formed.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Shut off ignition sources and call fire department
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
POISONOUS GASES ARE PRODUCED IN FIRE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Cool exposed containers and protect men effecting shutoff with water.
Let fire burn.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Not irritating to eyes, nose or throat.
If inhaled, will cause nausea, vomiting, headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration
If breathing is difficult, give oxygen.

LIQUID
Will cause frostbite.
Flush affected areas with plenty of water
DO NOT RUB AFFECTED AREAS.

Water Pollution

Not harmful to aquatic life

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability, air contaminant
Restrict access
Evacuate area

2. LABEL

2.1 **Category:** Flammable gas
2.2 **Class:** 2

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Halogenated hydrocarbon
3.2 **Formula:** CH_3Cl
3.3 **IMO/UN Designation:** 2.0/1063
3.4 **DOT ID No.:** 1063
3.5 **CAS Registry No.:** 74-87-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquefied gas
4.2 **Color:** Colorless
4.3 **Odor:** Faint, sweet, non-irritating; faint ether-like

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister mask; leather or vinyl gloves; goggles or face shield.
5.2 **Symptoms Following Exposure:** Inhalation causes nausea, vomiting, weakness, headache, emotional disturbances; high concentrations cause mental confusion, eye disturbances, muscular tremors, cyanosis, convulsions. Contact of liquid with skin may cause frostbite.
5.3 **Treatment of Exposure:** Remove to fresh air. Call a doctor and have patient hospitalized for observation of slowly developing symptoms.
5.4 **Threshold Limit Value:** 50 ppm
5.5 **Short Term Inhalation Limits:** 100 ppm for 5 min.
5.6 **Toxicity by Ingestion:** Not pertinent
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors are nonirritating to the eyes and throat.
5.9 **Liquid or Solid Irritant Characteristics:** No appreciable hazard. Practically harmless to the skin because it evaporates quickly. May cause frostbite.
5.10 **Odor Threshold:** Data not available
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** <32°F C.C.
6.2 **Flammable Limits in Air:** 8.1%-17.2%
6.3 **Fire Extinguishing Agents:** Dry chemical or carbon dioxide. Stop flow of gas.
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Toxic and irritating gases are generated in fires.
6.6 **Behavior in Fire:** Containers may explode
6.7 **Ignition Temperature:** 1170°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 2.2 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** 4.078 (Est.)
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** Reacts with zinc, aluminum, magnesium, and their alloys; reaction is not violent.
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 Group:** 36

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** None
8.2 **Waterfowl Toxicity:** None
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Technical grade; "Artic" refrigerant grade
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Safety relief

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-B-C-D-E-F-G

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable gas
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	4
Health	
Vapor Irritant	0
Liquid or Solid Irritant	0
Poisons	2
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	1
Aesthetic Effect	0
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Gas
12.2 **Molecular Weight:** 50.49
12.3 **Boiling Point at 1 atm:** —11.6°F = —24.2°C = 249°K
12.4 **Freezing Point:** —143.9°F = 97.7°C = 175.5°K
12.5 **Critical Temperature:** 290.5°F = 143.6°C = 416.8°K
12.6 **Critical Pressure:** 969 psia = 65.9 atm = 6.68 MN/m²
12.7 **Specific Gravity:** 0.997 at —24°C (liquid)
12.8 **Liquid Surface Tension:** 16.2 dynes/cm = 0.0162 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** (est.) 50 dynes/cm = 0.05 N/m at —24°C
12.10 **Vapor (Gas) Specific Gravity:** 1.7
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.259
12.12 **Latent Heat of Vaporization:** 182.3 Btu/lb = 101.3 cal/g = 4.241×10^5 J/kg
12.13 **Heat of Combustion:** —5290 Btu/lb = —2939 cal/g = -123.1×10^5 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:** 116.7 psia

NOTES

METHYL CHLORIDE

12.17
ATURATED LIQUID DENSITY

emperature degrees F)	Pounds per cubic foot
—20	62.170
—15	61.860

12.18
LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
—50	.354
—40	.357
—30	.359
—20	.362

12.19
LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	DATA NOT AVAILABLE

12.20
LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
—30	.332
—20	.320

12.21
SOLUBILITY IN WATER

mperature egrees F)	Pounds per 100 pounds of water
68.02	.600

12.22
SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
—55	4.590
—50	5.298
—45	6.095
—40	6.987
—35	7.985
—30	9.096
—25	10.330
—20	11.700
—15	13.210
—10	14.880
—5	16.720
0	18.730
5	20.940
10	23.350
15	25.980
20	28.840
25	31.950
30	35.320
35	38.960
40	42.890
45	47.140
50	51.700
55	56.610
60	61.880
65	67.520

12.23
SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
—55	.05335
—50	.06083
—45	.06913
—40	.07831
—35	.08843
—30	.09957
—25	.11180
—20	.12520
—15	.13980
—10	.15570
—5	.17300
0	.19170
5	.21200
10	.23390
15	.25740
20	.28280
25	.31000
30	.33920
35	.37040
40	.40380
45	.43930
50	.47720
55	.51740
60	.56000
65	.60530

12.24
IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.177
25	.182
50	.187
75	.192
100	.197
125	.202
150	.207
175	.212
200	.217
225	.221
250	.226
275	.231
300	.236
325	.240
350	.245
375	.249
400	.254
425	.258
450	.263
475	.267
500	.272
525	.276
550	.281
575	.285
600	.289

```
 Number/Trade Name: METHYLENE CHLORIDE
=========================================================================
                          General Information
=========================================================================
n Name: METHYLENE CHLORIDE REAGENT
facturer's Name: FISHER SCIENTIFIC, CHEMICAL DIV.
facturer's Street: 1 REAGENT LANE
facturer's P. O. Box:
facturer's City: FAIR LAWN
facturer's State: NJ
facturer's Country: US
facturer's Zip Code: 07410
facturer's Emerg Ph #: 201-796-7100/800-424-9300(CHEMTREC)
facturer's Info Ph #: 201-796-7100
ributor/Vendor # 1: JOHN J. MCMULLEN ASSOC. (804-873-6500)
ributor/Vendor # 1 Cage: 3P768
ributor/Vendor # 2:
ributor/Vendor # 2 Cage:
ributor/Vendor # 3:
ributor/Vendor # 3 Cage:
ributor/Vendor # 4:
ributor/Vendor # 4 Cage:
ty Data Action Code:
ty Focal Point: D
rd No. For Safety Entry: 001
Safety Entries This Stk#: 002
us: SE
 MSDS Prepared: 27APR92
ty Data Review Date: 04MAR93
ly Item Manager: KX
 Preparer's Name:
arer's Company:
arer's St Or P. O. Box:
arer's City:
arer's State:
arer's Zip Code:
r MSDS Number:
 Serial Number: BPZMQ
ification Number:
 Type, Grade, Class:
rd Characteristic Code: T4
 Of Issue: PG
 Of Issue Container Qty: 4 LITERS
 Of Container: UNKNOWN
Unit Weight: 11.5 POUNDS
State License Number: N/R
Explosive Weight: N/R
Propellant Weight-Ammo: N/R
t Guard Ammunition Code: N/R
```

Ingredients/Identity Information

prietary: NO

redient: METHYLENE CHLORIDE (SARA III)

redient Sequence Number: 01

cent: 100

redient Action Code:

redient Focal Point: D

SH (RTECS) Number: PA8050000

Number: 75-09-2

A PEL: 500 PPM/C,1000; Z2

IH TLV: 50 PPM, A2; 9293

er Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

earance And Odor: CLEAR, COLORLESS LIQUID. MILD, CHLOROFORM-LIKE ODOR.

ling Point: 104F,40C

zing Point: -139F FZ PT

or Pressure (MM Hg/70 F): 400 @ 75F

or Density (Air=1): 2.9

cific Gravity: 1.32

omposition Temperature: UNKNOWN

oration Rate And Ref: 27.5 (BUTYL ACETATE = 1)

ubility In Water: 1.6%

cent Volatiles By Volume: 100

cosity: 0.44 CPS @68F

N/K

oactivity: N/R

n (Radioactive Matl): N/R

netism (Milligauss): N/R

rosion Rate (IPY): UNKNOWN

ignition Temperature: 1033F

Fire and Explosion Hazard Data

h Point: NONE

h Point Method: N/R

r Explosive Limit: 13

r Explosive Limit: 23

nguishing Media: SMALL FIRES: DRY CHEMICAL, CARBON DIOXIDE. LARGE S: WATER SPRAY, FOG, OR REGULAR FOAM.

ial Fire Fighting Proc: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FACED SELF CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED CONTAINERS WATER SPRAY.

ual Fire And Expl Hazrds: COMBUSTION OR HEAT OF FIRE MAY PRODUCE RDOUS DECOMPOSITION PRODUCTS AND VAPORS. KEEP UPWIND. FIGHT FIRE FROM A ANCE.

Reactivity Data

ility: YES

To Avoid (Stability): HIGH HEAT, OPEN FLAMES.

rials To Avoid: ALKALIES, OXIDIZING MATERIALS, WATER, ALUMINUM, ALKALI LS, SODIUM, POTASSIUM AND MAGNESIUM.

rdous Decomp Products: WHEN INVOLVED IN FIRE, METHYLENE CHLORIDE EMITS

```
ILY TOXIC AND IRRITATING HYDROGEN CHLORIDE AND PHOSGENE FUMES.
ardous Poly Occur: NO
ditions To Avoid (Poly): NOT APPLICABLE
===========================================================================
                          Health Hazard Data
===========================================================================
-LC50 Mixture: LD50 ORAL RAT = 1600 MG/KG
e Of Entry - Inhalation: YES
te Of Entry - Skin: YES
te Of Entry - Ingestion: NO
th Haz Acute And Chronic: ACUTE: EYE, SKIN AND RESPIRATORY TRACT
ITATION, POSSIBLE CORNEAL INJURY, NARCOSIS, CENTRAL NERVOUS SYSTEM
ECTS, UNCONSCIOUSNESS, KIDNEY AND LUNG DAMAGE, EVEN DEATH. CHRONIC:
ATITIS, DELAYED LIVER, KIDNEY AND CENTRAL NERVOUS SYSTEM DAMAGE,
AVATION OF ARTERY DISEASE.
cinogenicity - NTP: YES
inogenicity - IARC: YES
inogenicity - OSHA: NO
lanation Carcinogenicity: SUSPECTED CARCINOGEN BY NTP AND IARC.
ns/Symptoms Of Overexp: EYE PAIN, SKIN DRYNESS, HEADACHE, DIZZINESS,
SINESS, NAUSEA, TINGLING OR NUMBNESS OF THE EXTREMITIES, SENSES OF
NESS IN THE HEAD, SENSE OF WARMTH, STUPOR OR DULLNESS, LETHARGY AND
KENESS. VERY HIGH CONCENTRATIONS MAY LEAD TO UNCONSCIOUSNESS OR EVEN
H IN CONFINED OR POORLY VENTILATED AREAS.
Cond Aggravated By Exp: PERSONS WITH SKIN, LIVER, KIDNEY, ANGINA,
T DISEASE, LUNG DISEASE, CORONARY ARTERY DISEASE, ANEMIA OR THOSE WHO
HEAVY DRINKERS OR SMOKERS SHOULD NOT BE EXPOSED TO THIS PRODUCT.
gency/First Aid Proc: INHALATION: REMOVE TO FRESH AIR. IF NOT
THING, GIVE CPR. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A
ICIAN. EYE: FLUSH IMMEDIATELY WITH LARGE AMOUNTS OF WATER FOR 15
TES. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH
 SOAP AND WATER PROMPTLY. INGESTION: DO NOT INDUCE VOMITING. GIVE MILK
ATER TO DRINK ONLY IF CONSCIOUS. GET IMMEDIATE MEDICAL ATTENTION.
===========================================================================
                 Precautions for Safe Handling and Use
===========================================================================
s If Matl Released/Spill: WEAR RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE
CBA AS APPROPIATE. ELIMINATE IGNITION SOURCES. ABSORB IN INERT MATERIAL
PLACE IN APPROPIATE DISPOSAL CONTAINER AND COVER. FLUSH AREA WITH LARGE
NTS OF WATER.
ralizing Agent: NONE.
e Disposal Method: CONTAMINATED SAWDUST, VERMICULITE OR POROUS SURFACE
 BE DISPOSED OF IN A PERMITTED HAZARDOUS WASTE MANAGEMENT FACILITY.
VERED LIQUIDS MAY BE REPROCESSED OR INCINERATED OR MUST BE TREATED IN A
ITTED HAZARDOUS WASTE MANAGEMENT FACILITY.
autions-Handling/Storing: STORE IN A COOL, DRY, WELL-VENTILATED
TION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE. KEEP
AINERS CLOSED WHEN NOT IN USE.
r Precautions: METHYLENE CHLORIDE VAPORS ARE HEAVIER THAN AIR AND WILL
ECT IN LOW AREAS. THIS MATERIAL OR ITS VAPORS WHEN IN CONTACT WITH
ES, HOT GLOWING SURFACES OR ELECTRIC ARCS CAN DECOMPOSE TO FORM
OGEN CHLORIDE GAS AND TRACES OF PHOSGENE.
===========================================================================
                          Control Measures
===========================================================================
iratory Protection: WEAR SCBA OR SUPPLIED AIR RESPIRATOR IF USE
ITIONS GENERATE VAPORS OR MISTS. CANNISTER RESPIRATORS MAY BE
```

EFFECTIVE DUE TO POOR WARNING PROPERTIES OF METHYLENE CHLORIDE.
ntilation: LOCAL EXHAUST RECOMMENDED TO CONTROL VAPORS BELOW 50% OF TLV.
otective Gloves: VITON GLOVES RECOMMENDED.
e Protection: CHEMICAL SAFETY GOGGLES & FACE SHIELD.
her Protective Equipment: APRON AND WORK CLOTHING TO MINIMIZE EXPOSURE.
E WASH STATION & SAFETY SHOWER RECOMMENDED.
rk Hygienic Practices: WASH THOROUGHLY AFTER USE AND BEFORE EATING,
OKING OR USING TOILET FACILITIES. DO NOT BREATH VAPORS OR MIST.
ppl. Safety & Health Data: TARGET ORGANS ARE SKIN, CNS, CVS, AND EYES.
TE TO PHYSICIAN: IF INGESTED, DANGER OF CHEMICAL PNEUMONIA MUST BE
IHGED AGAINST TOXICITY WHEN CONSIDERING EMTYING STOMACH. IF LAVAGE IS
RFORMED, ENDOTRACHEAL AND/OR ESOPHAGOSCOPIC CONTROL IS SUGGESTED. DO NOT
VE EPINEPHRINE OR SIMILAR DRUGS IF AT ALL POSSIBLE.

TRICHLOROETHANE

TCE

Common Synonyms

1,1,1-Trichloroethane
Methylchloroform
Aerothene
Chlorothene

Watery liquid　Colorless　Sweet odor

Sinks in water. Irritating vapor is produced.

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, may produce nausea.
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.
May be dangerous if it enters water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

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: Halogenated hydrocarbon
3.2 Formula: CH_3CCl_3
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2831
3.5 CAS Registry No.: 71-55-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; sweetish

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or polyvinyl-alcohol-type gloves; chemical safety goggles and face shield; neoprene safety shoes (or leather safety shoes plus neoprene footwear); neoprene or polyvinyl alcohol suit or apron for splash protection.

5.2 **Symptoms Following Exposure:** INHALATION: symptoms range from loss of equilibrium and incoordination to loss of consciousness; high concentration can be fatal due to simple asphyxiation combined with loss of consciousness. INGESTION: produces effects similar to inhalation and may cause some feeling of nausea. EYES: slightly irritating and lachrymatory. SKIN: defatting action may cause dermatitis.

5.3 **Treatment of Exposure:** Get medical attention for all eye exposures and any other serious overexposures. Do NOT administer adrenalin or epinephrine; otherwise, treatment is symptomatic. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting. EYES: flush thoroughly with water. SKIN: remove contaminated clothing and wash exposed area thoroughly with soap and warm water.

5.4 **Threshold Limit Value:** 350 ppm
5.5 **Short Term Inhalation Limits:** 1,000 ppm for 60 min. in man
5.6 **Toxicity by Ingestion:** Grade 1; LD_{50} = 5 to 15 g/kg (rat, mouse, rabbit, guinea pig)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 100 ppm
5.11 **IDLH Value:** 1,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** Data not available
6.2 **Flammable Limits in Air:** 7%-16%
6.3 **Fire Extinguishing Agents:** Dry chemical, foam, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Toxic and irritating gases are generated in fires.
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 932°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** (est.) 2.9 mm/min.
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:** Reacts slowly, releasing corrosive hydrochloric acid.
7.2 **Reactivity with Common Materials:** Corrodes aluminum, but reaction is not hazardous.
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 Group:** 36

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
75-150 ppm/*/pinfish/TL_m/salt water
*Time period not specified.
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:** Uninhibited; inhibited; industrial inhibited; white room; cold cleaning
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** ORM-A

11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 133.41
12.3 **Boiling Point at 1 atm:** 165°F = 74°C = 347°K
12.4 **Freezing Point:** <−38°F = <−39°C = <234°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 1.31 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 25.4 dynes/cm = 0.0254 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** (est.) 45 dynes/cm = 0.045 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 4.6
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.104
12.12 **Latent Heat of Vaporization:** 100 Btu/lb = 58 cal/g = 2.4×10^5 J/kg
12.13 **Heat of Combustion:** (est.) 4700 Btu/lb = 2600 cal/g = 110×10^5 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:** 4.0 psia

NOTES

TRICHLOROETHANE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	85.419
10	84.870
20	84.309
30	83.759
40	83.200
50	82.650
60	82.089
70	81.540
80	80.981
90	80.429
100	79.870
110	79.320
120	78.759
130	78.209
140	77.650
150	77.099
160	76.540

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
55	.240
60	.242
65	.244
70	.246
75	.248
80	.250
85	.252
90	.254
95	.256
100	.258
105	.260
110	.262
115	.264
120	.266
125	.268
130	.270
135	.272
140	.274

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	1.363
20	1.295
25	1.231
30	1.172
35	1.117
40	1.065
45	1.017
50	.972
55	.929
60	.889
65	.852
70	.817
75	.784
80	.753
85	.723

12.21 SOLUBILITY IN WATER

emperature degrees F)	Pounds per 100 pounds of water
68.02	.070

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
70	2.099
75	2.364
80	2.657
85	2.980
90	3.335
95	3.725
100	4.152
105	4.619
110	5.130
115	5.686
120	6.292
125	6.950
130	7.663
135	8.437
140	9.273
145	10.180
150	11.150
155	12.200
160	13.330
165	14.540
170	15.840
175	17.240
180	18.730
185	20.330
190	22.030

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
70	.04925
75	.05495
80	.06119
85	.06799
90	.07540
95	.08346
100	.09220
105	.10170
110	.11190
115	.12300
120	.13490
125	.14770
130	.16150
135	.17630
140	.19220
145	.20920
150	.22730
155	.24670
160	.26730
165	.28930
170	.31270
175	.33760
180	.36390
185	.39180
190	.42140

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.146
25	.150
50	.155
75	.159
100	.163
125	.167
150	.171
175	.175
200	.179
225	.183
250	.186
275	.190
300	.193
325	.196
350	.199
375	.202
400	.205
425	.208
450	.210
475	.213
500	.215
525	.217
550	.219
575	.222
600	.223

rt Number/Trade Name: 1,1,1-TRICHLOROETHANE (DIOXANE FREE)

General Information

em Name: TRICHLOROETHANE, TECHNICAL
nufacturer's Name: GREAT WESTERN CHEMICAL CO
ıufacturer's Street: 3595 E WAWONA AVE
ıufacturer's P. O. Box:
nufacturer's City: FRESNO
ıufacturer's State: CA
ıufacturer's Country: US
ıufacturer's Zip Code: 93725
nufacturer's Emerg Ph #: 209-485-4150
ıufacturer's Info Ph #: 209-485-4150
stributor/Vendor # 1: GREAT WESTERN CHEMICAL CO (209-466-0721)
stributor/Vendor # 1 Cage: 5U271
tributor/Vendor # 2:
tributor/Vendor # 2 Cage:
stributor/Vendor # 3:
tributor/Vendor # 3 Cage:
tributor/Vendor # 4:
stributor/Vendor # 4 Cage:
ety Data Action Code: A
ety Focal Point: D
ord No. For Safety Entry: 001
Safety Entries This Stk#: 011
tus: SE
e MSDS Prepared: 02DEC90
ety Data Review Date: 30JUN93
ply Item Manager: CX
S Preparer's Name:
parer's Company:
parer's St Or P. O. Box:
parer's City:
parer's State:
parer's Zip Code:
er MSDS Number:
S Serial Number: BQXSX
cification Number: MIL-T-81533
Type, Grade, Class: N/R
rd Characteristic Code: N1
Of Issue: CN
Of Issue Container Qty: 5 GAL
Of Container: CAN
Unit Weight: 55.0 LBS
State License Number: N/R
Explosive Weight: N/R
Propellant Weight-Ammo: N/R
t Guard Ammunition Code: N/R

Ingredients/Identity Information

oprietary: NO
gredient: METHYL CHLOROFORM (1,1,1-TRICHLOROEHANE) (SARA III)
gredient Sequence Number: 01
rcent: 95 MIN
gredient Action Code: A
gredient Focal Point: D
OSH (RTECS) Number: KJ2975000
S Number: 71-55-6
HA PEL: 350 PPM/450 STEL
GIH TLV: 350 PPM/450STEL;9293
her Recommended Limit: NONE RECOMMENDED

---

opprietary: NO
gredient: SEC-BUTYL ALCOHOL (SARA III)
gredient Sequence Number: 02
cent: 1-2
gredient Action Code: A
gredient Focal Point: D
SH (RTECS) Number: EO1750000
Number: 78-92-2
IA PEL: 100 PPM
IH TLV: 100 PPM; 9293
er Recommended Limit: NONE RECOMMENDED

---

oprietary: NO
redient: 1,3-DIOXOLANE
redient Sequence Number: 03
cent: 2
redient Action Code: A
redient Focal Point: D
SH (RTECS) Number: JH6760000
Number: 646-06-0
A PEL: NOT ESTABLISHED
IH TLV: NOT ESTABLISHED
er Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

earance And Odor: CLEAR, COLORLESS LIQUID WITH A MILD, SWEETISH,
ENT ODOR.
ling Point: 165F,74C
zing Point: <0F,<-18C
or Pressure (MM Hg/70 F): N/K
or Density (Air=1): N/K
cific Gravity: 1.32
mposition Temperature: N/R
oration Rate And Ref: N/K
bility In Water: NEGLIGIBLE
ent Volatiles By Volume: 100
osity: N/K
N/R
oactivity: N/R
(Radioactive Matl): N/R
etism (Milligauss): N/R

rrosion Rate (IPY): UNKNOWN
toignition Temperature: UNKNON

Fire and Explosion Hazard Data

ash Point: DOES NOT FLASH
ash Point Method: N/K
wer Explosive Limit: 7.5
per Explosive Limit: 15.0
tinguishing Media: FOAM, CARBON DIOXDE, AND DRY CHEMICAL. A WATER "FOG" SPRAY SHOULD BE USED TO COOL CONTAINERS ONLY.
ecial Fire Fighting Proc: WHEN FIRE FIGHTING, WEAR FULL PROTECTIVE UIPMENT, INCLUDING SELF-CONTAINED BREATHING APPARATUS.
usual Fire And Expl Hazrds: MAY PRODUCE HAZARDOUS FUMES OR HAZARDOUS OMPOSITION PRODUCTS. VAPORS FROM THIS PRODUCT MAY CONCENTRATE IN NFINED SPACES & FORM AN EXPLOSIVE MIXTURE.

Reactivity Data

ability: YES
d To Avoid (Stability): HOT STORAGE.
erials To Avoid: OXIDIZERS, REACTIVE METALS AND CAUSTICS.
ardous Decomp Products: WHEN HEATED TO DECOMPOSITION, IT EMITS HIGHLY IC CHLORIDE FUMES WITH A SMALL AMOUNT OF PHOSGENE & TOXIC CARBON OXIDES
ardous Poly Occur: NO
ditions To Avoid (Poly): NONE.

Health Hazard Data

0-LC50 Mixture: TLV: 350 PPM
te Of Entry - Inhalation: YES
te Of Entry - Skin: YES
te Of Entry - Ingestion: YES
lth Haz Acute And Chronic: HARMFUL IF SWALLOWED OR INHALED.
cinogenicity - NTP: NO
cinogenicity - IARC: NO
cinogenicity - OSHA: NO
lanation Carcinogenicity: NOT LISTED AS A CARCINOGEN BY NTP, IARC OR
ns/Symptoms Of Overexp: CAUSES EYE AND SKIN IRRITATION.
Cond Aggravated By Exp: INCREASED SENSITIVITY TO ADRENALINE MAY BE SED BY OVER EXPOSURE.
rgency/First Aid Proc: INHALATION: REMOVE TO FRESH AIR. IF NOT THING, GIVE CPR. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A ICIAN. EYE: FLUSH IMMEDIATELY WITH LARGE AMOUNTS OF WATER FOR 15 TES. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH SOAP AND WATER PROMPTLY. INGESTION: DO NOT INDUCE VOMITING. GIVE MILK SP MINERAL OIL. GET IMMEDIATE MEDICAL ATTENTION.

Precautions for Safe Handling and Use

s If Matl Released/Spill: CONTAIN SPILLED LIQUID. (FOR SMALL SPILLS, DRY MATERIAL TO CONTAIN) WEARING RECOMMENDED PROTECTIVE EQUIPMENT, VE BULK OF LIQUID. ADD DRY MATERIAL TO ABSORB REMAINING LIQUID; PICK UP CONTAINERIZE FOR RECOVERY OR DISPOSAL.
ralizing Agent: NONE
e Disposal Method: THIS PRODUCT, IF DISPOSED AS SHIPPED, IS NOT A

AZARDOUS WASTE AS SPECIFIED IN 40 CFR 261. CONSULT STATE OR LOCAL FFICIALS FOR PROPER DISPOSAL METHOD.

recautions-Handling/Storing: STORE IN A COOL, DRY, WELL-VENTILATED AREA. REVENT WATER OR MOIS AIR FROM ENTERING STORAGE CONTAINERS. KEEP CONTAINERS OSED WHEN NOT IN USE.

her Precautions: WHEN EMPTY, THOROUGHLY RINSE CONTAINER WITH WATER EFORE DISPOSAL, RETURN TO MANUFACTURER, OR ANY OTHER INDUSTRIAL USE. EMPTY ONTAINERS MAY BE HAZARDOUS. THEY MAY CONATIN VAPORS WHICH COULD BE NITED. DO NOT CUT, PUNCTURE OR WELD CONTAINR

Control Measures

spiratory Protection: IF A NIOSH-PEL IS EXCEEDED, A NIOSH-APPROVED ESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE OR SUPPLIED AIR IS REQUIRED.

ntilation: LOCAL EXHAUST PREFERABLE.

otective Gloves: RUBBER OR SYNTHETIC RUBBER.

e Protection: USE CHEMICAL SAFETY GOGGLES.

her Protective Equipment: RUBBER APRON , RUBBER BOOTS, EYE WASH, SAFETY OWER.

rk Hygienic Practices: WASH THOROUGHLY AFTER USE AND BEFORE EATING, OKING OR USING TOILET FACILITIES. DO NOT BREATH VAPORS OR MIST.

ppl. Safety & Health Data: FOR INDUSTRIAL USE ONLY. KEEP OUT OF REACH OF ILDREN. PROTECT EYES, SKIN AND CLOTHING FRPN CONTACT WITH PRODUCT. USE TH ADEQUATE VENTILATION.

TOLUENE

TOL

Common Synonyms

Toluol
Methylbenzene
Methylbenzol

Watery liquid | Colorless | Pleasant odor

Floats on water. Flammable, irritating vapor is produced.

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.

Exposure

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline
May be dangerous if it enters water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** $C_6H_5CH_3$
3.3 **IMO/UN Designation:** 3.2/1294
3.4 **DOT ID No.:** 1294
3.5 **CAS Registry No.:** 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Air-supplied mask; goggles or face shield; plastic gloves.
5.2 **Symptoms Following Exposure:** Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 600 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 **Late Toxicity:** Kidney and liver damage may follow ingestion.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.17 ppm
5.11 **IDLH Value:** 2,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 40°F C.C.; 55°F O.C.
6.2 **Flammable Limits in Air:** 1.27%-7%
6.3 **Fire Extinguishing Agents:** Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 997°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.7 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available

(Continued)

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 Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 1180 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0%, 5 days; 38% (theor), 8 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 92.14
12.3 **Boiling Point at 1 atm:** 231.1°F = 110.6°C = 383.8°K
12.4 **Freezing Point:** —139°F = —95.0°C = 178.2°K
12.5 **Critical Temperature:** 605.4°F = 318.6°C = 591.8°K
12.6 **Critical Pressure:** 596.1 psia = 40.55 atm = 4.108 MN/m^2
12.7 **Specific Gravity:** 0.867 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.069
12.12 **Latent Heat of Vaporization:** 155 Btu/lb = 86.1 cal/g = 3.81×10^5 J/kg
12.13 **Heat of Combustion:** —17,430 Btu/lb = —9686 cal/g = -405.5×10^5 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:** 17.17 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

TOL

TOLUENE

12.17
SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
—30	57.180
—20	56.870
—10	56.550
0	56.240
10	55.930
20	55.620
30	55.310
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500

12.18
LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.396
5	.397
10	.399
15	.400
20	.402
25	.403
30	.404
35	.406
40	.407
45	.409
50	.410
55	.411
60	.413
65	.414
70	.415
75	.417
80	.418
85	.420
90	.421
95	.422
100	.424
105	.425
110	.427
115	.428
120	.429
125	.431

12.19
LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
0	1.026
10	1.015
20	1.005
30	.994
40	.983
50	.972
60	.962
70	.951
80	.940
90	.929
100	.919
110	.908
120	.897
130	.886
140	.876
150	.865
160	.854
170	.843
180	.833
190	.822
200	.811
210	.800

12.20
LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
0	1.024
5	.978
10	.935
15	.894
20	.857
25	.821
30	.788
35	.757
40	.727
45	.700
50	.673
55	.649
60	.625
65	.603
70	.582
75	.562
80	.544
85	.526
90	.509
95	.493
100	.477

12.21
SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.050

12.22
SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
0	.038
10	.057
20	.084
30	.121
40	.172
50	.241
60	.331
70	.449
80	.600
90	.792
100	1.033
110	1.332
120	1.700
130	2.148
140	2.690
150	3.338
160	4.109
170	5.018
180	6.083
190	7.323
200	8.758
210	10.410

12.23
SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	.00070
10	.00103
20	.00150
30	.00212
40	.00296
50	.00405
60	.00547
70	.00727
80	.00954
90	.01237
100	.01584
110	.02007
120	.02518
130	.03127
140	.03850
150	.04700
160	.05691
170	.06840
180	.08162
190	.09675
200	.11400
210	.13340

12.24
IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.228
25	.241
50	.255
75	.268
100	.281
125	.294
150	.306
175	.319
200	.331
225	.343
250	.355
275	.367
300	.378
325	.389
350	.400
375	.411
400	.422
425	.432
450	.443
475	.453
500	.462
525	.472
550	.482
575	.491
600	.500

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Triclene; Algylen Chlorylen Germalgene Trethylene Trichloran; Trilene	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness. 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. 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)

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:** Halogenated hydrocarbon
3.2 **Formula:** $CHCl=CCl_2$
3.3 **IMO/UN Designation:** 9.0/1710
3.4 **DOT ID No.:** 1710
3.5 **CAS Registry No.:** 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Chloroform-like; ethereal

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.
5.2 **Symptoms Following Exposure:** INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
5.3 **Treatment of Exposure:** Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
5.4 **Threshold Limit Value:** 50 ppm
5.5 **Short Term Inhalation Limits:** 200 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 50 ppm
5.11 **IDLH Value:** 1,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 90°F C.C.; practically nonflammable
6.2 **Flammable Limits in Air:** 8.0%-10.5%
6.3 **Fire Extinguishing Agents:** Water fog
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Toxic and irritating gases are produced in fire situations.
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 770°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not pertinent
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 Group:** 36

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 660 mg/l/40 hr/daphnia/kill/fresh water
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:** Technical; dry cleaning; degreasing; extraction
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** ORM-A

11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 131.39
12.3 **Boiling Point at 1 atm:** 189°F = 87°C = 360°K
12.4 **Freezing Point:** —123.5°F = —86.4°C = 186.8°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 1.46 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 34.5 dynes/cm = 0.0345 N/m at 24°C
12.10 **Vapor (Gas) Specific Gravity:** 4.5
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.116
12.12 **Latent Heat of Vaporization:** 103 Btu/lb = 57.2 cal/g = 2.4 X 10^5 J/kg
12.13 **Heat of Combustion:** Not pertinent
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:** 2.5 psia

NOTES

TCL

TRICHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	94.669
5	94.410
10	94.150
15	93.889
20	93.629
25	93.370
30	93.110
35	92.849
40	92.589
45	92.330
50	92.070
55	91.809
60	91.549
65	91.290
70	91.030
75	90.770
80	90.509
85	90.250
90	89.990
95	89.730
100	89.469
105	89.209
110	88.950
115	88.690
120	88.429
125	88.169

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.220
10	.221
20	.223
30	.225
40	.226
50	.228
60	.230
70	.231
80	.233
90	.235
100	.236
110	.238
120	.240
130	.241
140	.243
150	.245
160	.246
170	.248

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.800
20	.775
25	.750
30	.727
35	.705
40	.684
45	.664
50	.645
55	.627
60	.610
65	.593
70	.577
75	.562
80	.548
85	.534
90	.521
95	.508
100	.496
105	.485
110	.474
115	.463
120	.453

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.110

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
40	.508
50	.678
60	.894
70	1.166
80	1.507
90	1.929
100	2.448
110	3.081
120	3.846
130	4.765
140	5.862
150	7.163
160	8.695
170	10.490
180	12.580
190	15.010
200	17.810
210	21.020

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	.01245
50	.01628
60	.02105
70	.02695
80	.03418
90	.04296
100	.05354
110	.06619
120	.08120
130	.09891
140	.11960
150	.14380
160	.17180
170	.20390
180	.24080
190	.28280
200	.33040
210	.38420

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.136
25	.139
50	.143
75	.146
100	.149
125	.152
150	.155
175	.157
200	.160
225	.162
250	.165
275	.167
300	.169
325	.172
350	.174
375	.176
400	.177
425	.179
450	.181
475	.182
500	.184
525	.185
550	.186
575	.187
600	.188

TETRACHLOROETHYLENE

TTE

Common Synonyms

Tetracap
Perclene
Perchloroethylene
Perk

Watery liquid   Colorless   Sweet odor

Sinks in water. Irritating vapor is produced.

Stop discharge if possible.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Poisonous gases are produced when heated.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

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.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
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)

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:** Not listed
- 3.2 **Formula:** $Cl_2C{=}CCl_2$
- 3.3 **IMO/UN Designation:** 9.0/1897
- 3.4 **DOT ID No.:** 1897
- 3.5 **CAS Registry No.:** 127-18-4

4. OBSERVABLE CHARACTERISTICS

- 4.1 **Physical State (as shipped):** Liquid
- 4.2 **Color:** Colorless
- 4.3 **Odor:** Ethereal; like chloroform; mildly sweet

5. HEALTH HAZARDS

- 5.1 **Personal Protective Equipment:** For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves.
- 5.2 **Symptoms Following Exposure:** Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.
- 5.3 **Treatment of Exposure:** INHALATION: if illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention. INGESTION: induce vomiting only on physician's recommendation. EYES AND SKIN: flush with plenty of water and get medical attention if irritation or injury occurs.
- 5.4 **Threshold Limit Value:** 50 ppm
- 5.5 **Short Term Inhalation Limits:** 100 ppm for 60 min.
- 5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg
- 5.7 **Late Toxicity:** None
- 5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary.
- 5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
- 5.10 **Odor Threshold:** 5 ppm
- 5.11 **IDLH Value:** 500 ppm

6. FIRE HAZARDS

- 6.1 **Flash Point:** Not flammable
- 6.2 **Flammable Limits in Air:** Not flammable
- 6.3 **Fire Extinguishing Agents:** Not pertinent
- 6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
- 6.5 **Special Hazards of Combustion Products:** Toxic, irritating gases may be generated in fires.
- 6.6 **Behavior in Fire:** Not pertinent
- 6.7 **Ignition Temperature:** Not flammable
- 6.8 **Electrical Hazard:** Not pertinent
- 6.9 **Burning Rate:** Not flammable
- 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 Group:** Data not available

8. WATER POLLUTION

- 8.1 **Aquatic Toxicity:** Data not available
- 8.2 **Waterfowl Toxicity:** Data not available
- 8.3 **Biological Oxygen Demand (BOD):** None
- 8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

- 9.1 **Grades of Purity:** Dry cleaning and industrial grades: 95+%
- 9.2 **Storage Temperature:** Ambient
- 9.3 **Inert Atmosphere:** No requirement
- 9.4 **Venting:** Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

- 11.1 **Code of Federal Regulations:** ORM-A
- 11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

- 11.3 **NFPA Hazard Classification:** Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

- 12.1 **Physical State at 15°C and 1 atm:** Liquid
- 12.2 **Molecular Weight:** 165.83
- 12.3 **Boiling Point at 1 atm:** 250°F = 121°C = 394°K
- 12.4 **Freezing Point:** —8.3°F = —22.4°C = 250.8°K
- 12.5 **Critical Temperature:** 657°F = 347°C = 620°K
- 12.6 **Critical Pressure:** Not pertinent
- 12.7 **Specific Gravity:** 1.63 at 20°C (liquid)
- 12.8 **Liquid Surface Tension:** 31.3 dynes/cm = 0.0313 N/m at 20°C
- 12.9 **Liquid Water Interfacial Tension:** 44.4 dynes/cm = 0.0444 N/m at 25°C
- 12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
- 12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.116
- 12.12 **Latent Heat of Vaporization:** 90.2 Btu/lb = 50.1 cal/g = 2.10×10^5 J/kg
- 12.13 **Heat of Combustion:** Not pertinent
- 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:** Data not available

NOTES

TTE

TETRACHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
35	103.400
40	103.099
45	102.900
50	102.599
55	102.299
60	102.000
65	101.700
70	101.400
75	101.099
80	100.799
85	100.500
90	100.200
95	99.910
100	99.610
105	99.320
110	99.020
115	98.730
120	98.429
125	98.139
130	97.839
135	97.549
140	97.250
145	96.959
150	96.669
155	96.370
160	96.080

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.198
10	.200
20	.201
30	.202
40	.203
50	.204
60	.205
70	.206
80	.207
90	.208
100	.210
110	.211
120	.212
130	.213
140	.214
150	.215
160	.216
170	.217
180	.218
190	.220
200	.221
210	.222

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
55	.958
60	.929
65	.900
70	.873
75	.848
80	.823
85	.800
90	.777
95	.756
100	.736
105	.716
110	.698
115	.680
120	.663
125	.647
130	.631
135	.616
140	.601
145	.588
150	.574
155	.561
160	.549
165	.537
170	.526
175	.515

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.016

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.236
70	.318
80	.425
90	.561
100	.732
110	.948
120	1.217
130	1.548
140	1.953
150	2.446
160	3.042
170	3.756
180	4.607
190	5.616
200	6.805
210	8.199
220	9.824
230	11.710
240	13.890
250	16.390
260	19.260
270	22.520
280	26.230

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00702
70	.00929
80	.01216
90	.01575
100	.02022
110	.02571
120	.03242
130	.04055
140	.05032
150	.06199
160	.07583
170	.09215
180	.11130
190	.13360
200	.15940
210	.18910
220	.22330
230	.26230
240	.30660
250	.35680
260	.41330
270	.47680
280	.54790

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.108
25	.110
50	.113
75	.116
100	.118
125	.120
150	.122
175	.125
200	.127
225	.129
250	.131
275	.132
300	.134
325	.136
350	.138
375	.139
400	.141
425	.142
450	.143
475	.144
500	.146
525	.147
550	.148
575	.148
600	.149

m-XYLENE

XLM

Common Synonyms
1, 3-Dimethylbenzene
Xylol

Watery liquid Colorless Sweet odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.

Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness

Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness

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.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS
Fouling to shoreline
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-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** m-$C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 g/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 84°F C.C.
6.2 **Flammable Limits in Air:** 1.1%-6.4%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 986°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
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 Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):**
0 lb/lb, 5 days; 0% (theor.), 8 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

NOTES

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:**
Flammable liquid

11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:**
269.4°F = 131.9°C = 405.1°K
12.4 **Freezing Point:**
−54.2°F = −47.9°C = 225.3°K
12.5 **Critical Temperature:**
650.8°F = 343.8°C = 617.0°K
12.6 **Critical Pressure:**
513.6 atm = 34.95 psia = 3.540 MN/m^2
12.7 **Specific Gravity:**
0.864 at 20°C (liquid)
12.8 **Liquid Surface Tension:**
28.6 dynes/cm = 0.0286 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:**
36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:**
147 Btu/lb = 81.9 cal/g = 3.43 X 10^5 J/kg
12.13 **Heat of Combustion:** −17,554 Btu/lb = −9752.4 cal/g = −408.31 X 10^5 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:** 26.01 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.34 psia

m-XYLENE

12.17
SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	55.400
20	55.260
25	55.130
30	54.990
35	54.850
40	54.710
45	54.570
50	54.430
55	54.290
60	54.160
65	54.020
70	53.880
75	53.740
80	53.600
85	53.460
90	53.320
95	53.180
100	53.050

12.18
LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.387
50	.393
60	.398
70	.404
80	.410
90	.415
100	.421
110	.426
120	.432
130	.437
140	.443
150	.448
160	.454
170	.460
180	.465
190	.471
200	.476
210	.482

12.19
LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	.962
40	.953
45	.944
50	.935
55	.926
60	.917
65	.908
70	.899
75	.890
80	.881
85	.873
90	.864
95	.855
100	.846

12.20
LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.938
20	.898
25	.862
30	.827
35	.794
40	.764
45	.735
50	.708
55	.682
60	.658
65	.635
70	.613
75	.592
80	.572
85	.554

12.21
SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I N S O L U B L E

12.22
SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.090
70	.127
80	.177
90	.242
100	.326
110	.434
120	.571
130	.743
140	.956
150	1.219
160	1.538
170	1.924
180	2.388
190	2.939
200	3.590
210	4.355
220	5.247
230	6.282
240	7.476
250	8.846
260	10.410

12.23
SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00172
70	.00238
80	.00324
90	.00435
100	.00577
110	.00754
120	.00975
130	.01247
140	.01577
150	.01977
160	.02455
170	.03023
180	.03691
190	.04473
200	.05382
210	.06431
220	.07635
230	.09009
240	.10570
250	.12330
260	.14310

12.24
IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.247
25	.260
50	.273
75	.286
100	.299
125	.311
150	.324
175	.336
200	.348
225	.360
250	.371
275	.383
300	.394
325	.406
350	.417
375	.427
400	.438
425	.449
450	.459
475	.469
500	.479
525	.489
550	.499
575	.508
600	.517

o-XYLENE

XLO

Common Synonyms

1, 2-Dimethylbenzene
Xylol

Watery liquid — Colorless — Sweet odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
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.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
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-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: o-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 63°F C.C.; 75°F O.C.
6.2 Flammable Limits in Air: 1.1%-7.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 869°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
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 Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: >100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb. 5 days; 2.5% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No reaction
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.6°K
12.4 Freezing Point: —13.3°F = —25.2°C = 248.0°K
12.5 Critical Temperature: 674.6°F = 357.1°C = 630.3°K
12.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m^2
12.7 Specific Gravity: 0.880 at 20°C (liquid)
12.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 Liquid Water Interfacial Tension: 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.068
12.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 3.47×10^5 J/kg
12.13 Heat of Combustion: —17,558 Btu/lb = —9754.7 cal/g = —408.41 X 10^5 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: 30.64 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.28 psia

NOTES

XLO

o-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	56.460
20	56.330
25	56.190
30	56.050
35	55.910
40	55.770
45	55.630
50	55.490
55	55.360
60	55.220
65	55.080
70	54.940
75	54.800
80	54.660
85	54.520
90	54.380
95	54.250
100	54.110

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
35	.389
40	.391
45	.394
50	.396
55	.398
60	.400
65	.402
70	.404
75	.406
80	.408
85	.411
90	.413
95	.415
100	.417

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	1.043
40	1.035
45	1.027
50	1.018
55	1.010
60	1.002
65	.993
70	.985
75	.977
80	.969
85	.960
90	.952
95	.944
100	.935

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	1.328
20	1.263
25	1.202
30	1.145
35	1.092
40	1.042
45	.995
50	.952
55	.911
60	.873
65	.836
70	.802
75	.770
80	.740
85	.712

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.071
70	.101
80	.141
90	.194
100	.263
110	.352
120	.465
130	.609
140	.787
150	1.007
160	1.277
170	1.605
180	1.999
190	2.469
200	3.028
210	3.686
220	4.456
230	5.352
240	6.389
250	7.581
260	8.947

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00135
70	.00188
80	.00258
90	.00349
100	.00464
110	.00611
120	.00794
130	.01021
140	.01298
150	.01634
160	.02038
170	.02520
180	.03090
190	.03759
200	.04539
210	.05443
220	.06484
230	.07674
240	.09030
250	.10560
260	.12290

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.261
25	.274
50	.287
75	.299
100	.311
125	.323
150	.335
175	.347
200	.358
225	.370
250	.381
275	.392
300	.403
325	.414
350	.424
375	.435
400	.445
425	.455
450	.465
475	.475
500	.485
525	.494
550	.504
575	.513
600	.522

p-XYLENE

XLP

Common Synonyms

1, 4-Dimethylbenzene
Xylol

Watery liquid | Colorless | Sweet odor

Floats on water. Flammable, irritating vapor is produced.
Freezing point is 56°F.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
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.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
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-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** p-$C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 106-42-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 pmm

6. FIRE HAZARDS

6.1 **Flash Point:** 81°F C.C.
6.2 **Flammable Limits in Air:** 1.1%-6.6%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 870°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
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 Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb in 5 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.8%; Technical: 99.0%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 280.9°F = 138.3°C = 411.5°K
12.4 **Freezing Point:** 55.9°F = 13.3°C = 286.6°K
12.5 **Critical Temperature:** 649.4°F = 343.0°C = 616.2°K
12.6 **Critical Pressure:** 509.4 atm = 34.65 psia = 3.510 MN/m²
12.7 **Specific Gravity:** 0.861 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.3 dynes/cm = 0.0283 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 37.8 dynes/cm = 0.0378 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 150 Btu/lb = 81 cal/g = 3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —17,559 Btu/lb = —9754.7 cal/g = —408.41 X 10^5 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:** 37.83 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.34 psia

NOTES

LP

p-XYLENE

12.17
ATURATED LIQUID DENSITY

nperature grees F)	Pounds per cubic foot
60	53.970
65	53.830
70	53.690
75	53.550
80	53.410
85	53.270
90	53.140
95	53.000
100	52.860
105	52.720
110	52.580
115	52.440
120	52.300

12.18
LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
60	.412
70	.418
80	.424
90	.429
100	.435
110	.440
120	.446
130	.451
140	.457
150	.462
160	.468
170	.474
180	.479
190	.485
200	.490
210	.496
220	.501
230	.507
240	.512
250	.518
260	.524
270	.529
280	.535

12.19
LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
60	.935
65	.928
70	.921
75	.914
80	.907
85	.900
90	.892
95	.885
100	.878

12.20
LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
60	.678
65	.654
70	.631
75	.610
80	.590
85	.571
90	.552
95	.535
100	.519
105	.503
110	.488
115	.474
120	.460

12.21
LUBILITY IN WATER

erature rees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22
SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.096
70	.135
80	.187
90	.255
100	.343
110	.456
120	.599
130	.777
140	.998
150	1.270
160	1.600
170	1.998
180	2.475
190	3.041
200	3.710
210	4.493
220	5.407
230	6.465
240	7.683
250	9.080
260	10.670

12.23
SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00183
70	.00252
80	.00343
90	.00459
100	.00607
110	.00792
120	.01022
130	.01303
140	.01646
150	.02059
160	.02553
170	.03138
180	.03826
190	.04629
200	.05561
210	.06636
220	.07867
230	.09270
240	.10860
250	.12650
260	.14670

12.24
IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.246
25	.259
50	.272
75	.285
100	.297
125	.309
150	.321
175	.333
200	.345
225	.357
250	.368
275	.380
300	.391
325	.402
350	.413
375	.424
400	.435
425	.445
450	.456
475	.466
500	.476
525	.486
550	.496
575	.505
600	.515

ATTACHMENT III

SAFETY GUIDELINES FOR EXCAVATIONS

EXCAVATION AND TRENCHING GUIDELINES

- Remove all surface encumbrances.
- Locate all underground installations prior to opening excavation.
- Supply means of egress so that no more than 25 feet of lateral travel is required by personnel in the excavation.
- Supply warning vests for personnel exposed to vehicular traffic.
- Utilize barricades, hand signals, or stop logs for equipment operating next to excavations and slope grade away from excavation.
- Check for hazardous atmospheres.
- Protect excavation and personnel form water accumulation.
- Check stability of adjacent structures.
- Protect personnel from loose rock or soil.
- Inspect excavations and record information from the inspection in the field log book.
- Provide for fall protection.
- Describe in detail any protective system used for personnel protection (sloping and benching of sides, support systems, or shield systems).

APPENDIX D

Well Logs for the Existing On-site Monitoring Wells

NMB
NMB (USA) Inc.

Reg

RECEIVED
2/26/96

File
NMB

February 13, 1996

Chittibabu Vasudevan, Ph.D., P.E.
Chief, Remedial Section A
Bureau of Eastern Remedial Action
Division of Hazardous waste Remediation
New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-7010

re: IMC Magnetics (I-30-043A)

Dear Dr. Vasudevan:

Pursuant to your request for additional information regarding ground-water monitoring wells at the 570 Main Street property, I have reviewed my files and am forwarding the following:

- a schematic showing the approximate locations of wells MW-1, MW-2, and MW-3;[1]
- summary geologic logs for each of the wells; and
- a table summarizing the results of sampling of various wells, including MW-1, MW-2, and MW-3; and

I note that all the above were provided to me by Anson Environmental Ltd. ("Anson") in the form I have forwarded them to you. The work was performed by Anson, and pre-dates my involvement in the project. This is, I believe, the entirety of non-privileged documents in my possession relating to these wells.

Please do not hesitate to call if you have any questions or require any additional information.

Sincerely,

Chris M. Rawnsley

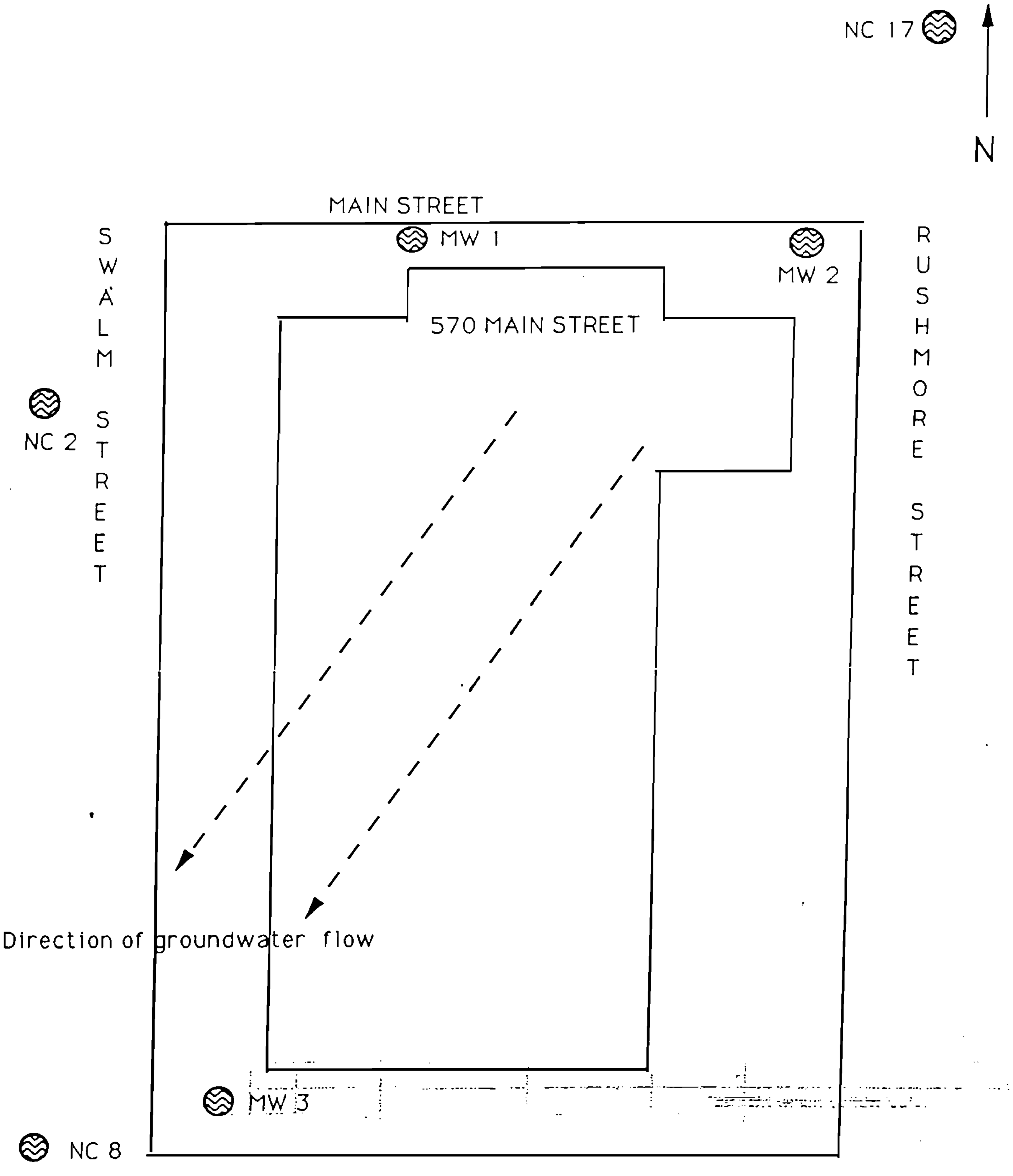
CMR/cmr:enc.imcw017

cc: Marriane Mancino-Theide, Esq., P&M
Craig Kasper, P.E., HAI

---

[1] The precise location should be included on the site survey included with IMC Magnetics' draft work plan.

NMB (USA) Inc. / 9730 Independence Avenue / Chatsworth. CA 91311-4373 / TEL (818) 709-1770 / FAX: (818) 775-1127



NOT TO SCALE

SAMPLING LOCATIONS
ANSON ENVIRONMENTAL LTD.

Sampling Locations

The reported direction of groundwater flow in the site vicinity is to the southwest

ANSON ENVIRONMENTAL LTD.

GEOLOGIC LOG

STUDY		BORING		SAMPLER
Study No.:	92061	Boring No.:	1	Type: Hollow stem auger
Project:	IMC Magnetics	Location:	Westbury	Hammer:
Date:	4/26/94	Depth:	65'	Fall:
Driller:	Miller Env.	G.W. Elev.:	55'	Sample Interval: 5'

No.	Rec.	Sample Interval	Blows/6"	Depth	Sample Description
1				0'	Yellowish brown color.
				-	sub rounded very coarse shape
				-	poorly sorted and very moist
				-	OVM reading = 0.00
				-	
				5'	Yellowish brown color
				-	sub rounded very coarse shape
				-	poorly sorted and very moist
				-	OVM reading = 0.00
				-	
				10'	Brownish yellow color
				-	sub rounded coarse
				-	well sorted some pebbles
				-	OVM reading = 0.00
				-	
				15'	Brownish yellow color
				-	sub rounded very coarse
				-	poorly sorted, some pebbles
				-	OVM reading = 0.00
				-	
				20'	Brownish yellow color
				-	sub rounded coarse shape
				-	poorly sorted, some pebbles
				-	OVM reading not detected
				-	
				25'	Brownish yellow color
				-	sub rounded shape
				-	well sorted, coarse to medium sand
				-	OVM reading not detected
				-	
				30'	Brownish yellow color
				-	sub rounded
				-	well sorted, coarse to medium sand
				-	OVM reading not detected
				-	
				35'	Brownish yellow color

					rounded shape
					well sorted, medium sized sand
					OVM reding not detected
				40'	Brownish yellow color
					rounded
					Poorly sorted, medium sand
					some clay
					OVM reading not detected
				45'	Brownish yellow color
					Round shape
					well sorted, medium sand
					OVM reading not detected
				50'	Brownish yellow color
					round shape
					well sorted, medium sand
					clay very hard, stuck to augers
					OVM reading not detected
				55'	Brownish yellow color
					Round shape
					well sorted, medium sand
					OVM reading not detected
				60'	Brownish yellow color
					Round shape
					well sorted, medium to coarse sand
					OVM reading not detected
				65'	Bottom of well

ANSON ENVIRONMENTAL LTD.

GEOLOGIC LOG

STUDY		BORING		SAMPLER
Study No.:	92061	Boring No.:	2	Type: Hollow stem auger
Project:	IMC Magnetics	Location:	Westbury	Hammer:
Date:	4/26/94	Depth:	65'	Fall:
Driller:	Miller Env.	G.W. Elev.:	55'	Sample Interval: 5'

No.	Rec.	Sample Interval	OVM Reading	Depth	Sample Description
2			0	0'	Light brownish yellow color
				-	poorly sorted
				-	medium sand and pebbles
				-	sub angular shape
				-	not very moist
			ND	5'	yellowish brown color
				-	poorly sorted
				-	very coarse sand
				-	sub angular shape
				-	
			ND	10'	yellowish brown color
				-	well sorted with pebbles
				-	medium to coarse sand
				-	sub angular shape
				-	some moisture
			ND	15'	Yelowish Brown color
				-	poorly sorted with pebbles
				-	very coarse sand
				-	sub angular shape
				-	some soil moisture
			ND	20'	Yellowish brown color
				-	poorly sorted with pebbles
				-	very coarse sand
				-	sub angular shape
				-	some soil moisture
			ND	25'	Brownish yellow color
				-	poorly sorted with pebbles
				-	very coarse to medium sand type
				-	sub rounded shape
				-	soil moisture
			ND	30'	Brownish yellow color
				-	well sorted with pebbles
				-	coarse to very coarse sand
				-	sub rounded shape
				-	soil moisture
			ND	35'	Brownish yellow color

					poorly sorted with pebbles
					very coarse sand
					sub rounded shape
					soil moisture
			ND	40'	Yellow color
					well sorted some pebbles
					medium to coarse sand
					sub rounded shape
					soil moisture
			ND	45'	Yellow color
					well sorted
					medium to fine sand
					sub rounded shape
					soil moisture
			ND	50'	Yellow color
					well sorted
					fine to very fine sand
					sub rounded shape
					soil moisture
			ND	55'	Yellow color
					well sorted
					fine to very fine sand
					sub rounded shape
					soil moisture
			ND	60'	Yellow color
					well sorted
					very fine sand
					sub rounded shape
					soil moisture
			ND	65'	bottom of well

ANSON ENVIRONMENTAL LTD.

GEOLOGIC LOG

STUDY		BORING		SAMPLER
Study No.:	92061	**Boring No.:**	3	**Type: Hollow stem auger**
Project:	IMC Magnetics	**Location:**	Westbury	**Hammer:**
Date:	4/27/94	**Depth:**	65'	**Fall:**
Driller:	Miller Env.	**G.W. Elev.:**	55'	**Sample Interval: 5'**

No.	Rec.	Sample Interval	OVM Reading	Depth	Sample Description
3			0	0'	Coarse sand
				-	Dark brown color
				-	some pebbles
				-	
				-	
			ND	5'	coarse sand
				-	yellow brown color
				-	pebbles, poorly sorted sand
				-	
				-	
			ND	10'	coarse sand, yellow brown color
				-	pebbles
				-	poorly sorted sand
				-	
				-	
			ND	15'	coarse sand
				-	dark yellow to brownish color
				-	some pebbles poorly sorted
				-	
				-	
			ND	20'	coarse sand
				-	yellowish brown color
				-	some pebbles poorly sorted sands
				-	
				-	
			ND	25'	coarse sand
				-	yellowish brown color
				-	some pebbles poorly sorted sands
				-	
				-	
			ND	30'	coarse sand
				-	dark yellow brown
				-	pebbles and poorly sorted
				-	
				-	
			ND	35'	coarse sand

					yellow brown color
					pebbles and poorly sorted
			ND	40'	coarse sand
					yellow brown color
					some pebbles and poorly sorted
			ND	45'	medium sand
					brownish yellow color
					well sorted
			ND	50'	medium sand
					brownish yellow color
					well sorted
			ND	55'	medium sand
					light yellow brown in color
					well sorted
			ND	60'	medium sand
					pale brown
					well sorted
			ND	65'	bottom of well

APPENDIX E

Focused Ground-Water Feasibility Study Work Plan

WORK PLAN
FOR THE
FOCUSED GROUND-WATER FEASIBILITY STUDY
FOR THE
570 MAIN STREET PROPERTY
WESTBURY, NEW YORK
(HAI Document # NMB004C.008)

DISTRIBUTION:

Dr. Chittibabu Vasudevan, P.E., NYSDEC
Joseph Jones, NYSDEC
Jeanna E. Hussey, Esq., NYSDEC
Ray Cowen, NYSDEC
G. Anders Carlson, Ph.D., NY State Department of Health
Chris M. Rawnsley, IMC, c/o New Hampshire Ball Bearings, Inc.
J. Brian Molloy, Esq., Piper & Marbury, L.L.P.
Timothy L. Douthit, LTR
Michael C. Harvell, Esq., Sheehan, Phinney, Bass & Green
Mr. John Lovejoy, Nassau County Department of Health
HAI Internal Copies

TABLE OF CONTENTS

1.0 INTRODUCTION

Hull & Associates, Inc. (HAI) and Land Tech Remedial, Inc. (LTR) have been retained by IMC Eastern Corp. (IMC) to conduct a Focused Ground-Water Feasibility Study for 570 Main Street in Westbury, New York (Site). The Site is within the New Cassel Industrial Area (NCIA), a Class 2 inactive hazardous waste site as designated by the New York State Department of Environmental Conservation (NYSDEC).

2.0 FOCUSED GROUND-WATER FEASIBILITY STUDY

2.1 Objectives

The Focused Ground-Water Feasibility Study will be completed to select the most practicable remedial approach for addressing contaminated ground water beneath the Site. Data obtained from the Focused Ground-Water Investigation will form the primary basis for evaluating various remedial approaches.

2.2 Focused Ground-Water Feasibility Study Report

The Focused Ground-Water Feasibility Study Report will open with a summary of findings from previous investigations, including those from the Focused Ground-Water Investigation, and a description of remedial action objectives. Objectives will be developed through review of applicable or relevant and appropriate requirements (ARARs), completion of a baseline risk assessment (as appropriate), identification and evaluation of cleanup standards and criteria, and determination of remediation goals.

The body of the Focused Ground-Water Feasibility Study Report will describe development and preliminary screening of remedial action alternatives and provide a detailed analysis of remedial action alternatives.

Development and preliminary screening of remedial action alternatives will include:

1. identification and preliminary screening of remedial technologies;
2. development of remedial alternatives; and
3. preliminary evaluation and screening of remedial alternatives.

Remedial alternatives retained following the above screening process will undergo detailed analyses, which will include:

1. a detailed description of each alternative;
2. an assessment of each alternative with respect to evaluation criteria, including:
    - short-term effectiveness;
    - long-term effectiveness;

- reduction of toxicity, mobility or volume
- implementability;
- cost;
- compliance with ARARs;
- overall protection of human health and the environment; and
- community acceptance; and

3. a comparison of alternatives.

3.0 SCHEDULE OF IMPLEMENTATION

The schedule for conducting the Focused Ground-Water Feasibility Study is contingent upon completion of the NYSDEC's review of the revised Focused Ground-Water Investigation Work Plan and implementation of that plan. It is anticipated that a draft Focused Ground-Water Feasibility Study Report can be submitted to the NYSDEC within 120 days of receiving approval of the Focused Ground-Water Investigation Report.

Following approval of the Focused Ground-Water Feasibility Study Report by the NYDEC, a Remedial Action Work Plan and schedule will be prepared and submitted for the NYDEC's review.