

**FOCUSED GROUND-WATER
REMEDATION WORK PLAN
FOR THE
570 MAIN STREET
FACILITY
WESTBURY, NEW YORK
NYSDEC SITE CODE #130043A
(HAI DOCUMENT # NMB007.200.0035)**

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1.0 INTRODUCTION

1.1 General

Hull & Associates, Inc. (HAI) was retained by IMC Eastern Corp. (IMC) to prepare a Focused Ground-Water Remediation Work Plan for the former IMC Magnetics facility at 570 Main Street in Westbury, New York, New York State Department of Environmental Conservation (NYSDEC) Code #130043A (Site). The Site is within the New Cassel Industrial Area (NCIA), a Class 2 inactive hazardous waste site as designated by the NYSDEC.

Preparation of this document and all activities performed at the Site have been, to the maximum extent practicable, in accordance with the provisions of Consent Order Index # 1-W1-0750-00-03 effective April 26, 2001 (the Order).¹ To date, field work and reporting have also been, to the maximum extent practicable, consistent with the April 1998 Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study Work Plan (Addendum 1 – HAI Document # NMB004.300.0074) and supporting documents contained therein.

Activities proposed in this Focused Remediation Work Plan are directed toward completing the preferred alternative of *in-situ* chemical oxidation of ground-water contamination, as identified in the September 1999 Focused Ground-Water Feasibility Study (Revised September 1999 – HAI Document # NMB007.200.0019). The NYSDEC issued a Record of Decision in March 2000 that identified *in-situ* chemical oxidation as the selected remedy for on-Site ground-water contamination.

This report is arranged in four sections. Section 1.0 provides an introduction including the Site description, Site history and operations, a summary of previous investigations and studies, an overview of project objectives, a description of project organization and a review of 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 The Order addresses "Development and Implementation of a Remedial Program for Operable Unit 2 of an Inactive Hazardous Waste Disposal Site, Under Article 27, Title 13, and Article 71, Title 27 of the Environmental Conservation Law of the State of New York."

1.2 Site Description

The Site is located at 570 Main Street in Westbury, New York, and is within the 170-acre NCIA. The NCIA contains approximately 200 industrial or commercial enterprises. 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 owned and occupied by Castle Collision, an entity unrelated to IMC.

1.3 Previous Investigations and Studies

1.3.1 Anson Environmental, Ltd.

Anson Environmental, Ltd. (Anson) performed preliminary investigative activities related to the closure of the IMC manufacturing operation at the Site. Anson reportedly developed a closure 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 (refer to Plate 1). Sediment and soil samples were collected from these locations for laboratory testing of volatile organic compounds (VOCs). Sediment samples were also collected from four floor drains in the building for laboratory VOC 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.

Laboratory analyses revealed the presence of VOCs in soils and floor drain sediment samples. The highest concentrations were detected beneath Area 2.

Based upon findings from the field activities, Anson identified the following three main potential source areas:

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.

Anson installed and sampled three ground-water monitoring wells in 1994. The monitoring wells were apparently screened from above the water table to a depth of approximately ten ft. below the water table. VOCs were detected in all monitoring wells.

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. The investigation consisted of a file review, ground-water sampling and analysis from 56 existing monitoring wells, and ground-water sampling and analysis from direct-push soil boring locations installed during the investigation. The Site was identified as a potential source of ground-water contamination in the VOC plume designated as the "570 Main Street plume;" however, this was never confirmed by investigations conducted by LMS or Anson.

1.3.3 Interim Remedial Measure (Soils), February 1997

HAI and Land Tech Remedial, Inc. (LTR – presently Handex of New York) conducted an Interim Remedial Measure (IRM) Investigation of soils at the Site from May to July 1996. Investigative activities were conducted per an approved Work Plan and included: completion of a detailed file review and source and release identification study; collection of unsaturated soil samples at various depths in eighty-eight direct-push borings; collection of five shallow ground-water samples; and completion of a soil vapor extraction (SVE) pilot test. The Final Investigation Report documents the results of the IRM.

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

The primary contaminants detected in soils were VOCs, with tetrachloroethene (PCE) found at the highest concentrations. The highest concentration of PCE detected at the Site was almost 40,000,000 ug/kg, located at a depth of ten to twelve ft. beneath a former leaching pool in Area 2. Identification

of PCE in excess of 1% of the soil mass provides strong indication of the presence of residual dense nonaqueous phase liquid (DNAPL) beneath Area 2.² With the exception of PCE, no VOCs exceeded 100 µg/kg in soils outside of Area 2. Furthermore, no VOCs other than PCE were detected below a depth of 10 ft. outside Area 2.

Table 1 presents a summary of analytical results for ground-water samples collected from existing monitoring wells MW-1, MW-2 and MW-3 and using direct-push sampling methods at five on-Site locations. All samples were collected from an interval less than ten ft. below the water table.

The highest VOC concentrations at the Site were collected from direct-push boring SB-25 at a depth interval of 60-62 ft. below the ground surface. Concentrations ranged up to 2,680 ug/L for PCE (mobile lab) and TCE (fixed lab), respectively. Combined with the distribution of VOCs in unsaturated soils, the relatively high concentrations of VOCs in SB-25 indicated that Area 2 is a likely source of ground-water contamination.

The IRM Investigation determined that heavy metals in soils did not require remediation based on their concentrations and distribution. Based on pathway completeness evaluations for VOCs, the IRM Investigation determined that active intervention would be required in Area 2. Considering the volatility of VOCs detected in Area 2 and the results of a pilot study, HAI and LTR selected soil vapor extraction (SVE) as the interim remedial measure and prepared a plan to describe operation, monitoring and maintenance of the system.

HAI and LTR installed a SVE system in August 1997 by connecting it to nested vapor extraction wells in Area 2 that were used for the pilot test. The system began continuous operation in October 1997. The SVE system continues to operate in accordance with the approved Soil Vapor Extraction Operation, Monitoring and Maintenance Plan.

² Cohen, Robert M. and J.W. Mercer. 1993. *DNAPL Site Evaluation*. CRC Press, Inc. Boca Raton, FL.

1.3.4 Focused Ground-Water Investigation, September 1998

HAI and LTR conducted a Focused Ground-Water Investigation at the Site. Field investigations were conducted between June 18, 1998 through July 30, 1998. The objective of the work was to gather data for evaluating the fate and vertical and horizontal distribution of selected volatile organic compounds (VOCs) and metals in ground water upgradient and downgradient of Area 2, as described in the revised Work Plan for the Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study (HAI Document # NMB004.300.0074).

Major field activities for the Focused Ground-Water Investigation included: installation of twelve monitoring wells in four three-well clusters; measurement of static water levels in the wells to confirm the direction of ground-water flow; sampling of wells and testing for VOCs and selected heavy metals; and completion of biodegradation studies. A summary of construction information for the monitoring wells is included on Table 2. Findings from the investigation are below.

1.3.4.1 Regional Geology/Hydrogeology

The majority of the ground water underlying NCIA 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 ft.³ Data collected by HAI during investigation of the Site and by the NYSDEC during investigations in the NCIA indicate that the upper Pleistocene deposits in the NCIA are unsaturated; therefore, the water table may locally occur in the underlying Magothy aquifer approximately 55 ft. below grade. Regional ground-water flow direction local to the NCIA, as determined by the USGS and the Nassau County Department of Public Works, is towards the southwest.

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 ft. 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 Westbury Water District (Bowling Green Wells), which are located approximately 3,000 ft. southeast of the Site. A solid brown clay layer was logged during the drilling of well number N-8956 at 95 ft. below grade. This same clay layer was not encountered during the drilling of well number N-8957, which was installed only 140 ft. to the southeast of N-8956.

The Magothy aquifer is approximately 500 ft. thick beneath the NCIA, and is encountered at a depth of approximately 50 ft. 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

³ U.S. Geological Survey, in cooperation with the Nassau County Department of Public Works, *Geology of the Town of North Hempstead, Nassau County, Long Island, New York*. 1979.

Pleistocene deposits is often indistinguishable in Nassau County because the sediments are of similar composition and show no significant lithological difference.

1.3.4.2 Site Geology/Hydrogeology

Unsaturated soils at the Site consist primarily of a heterogeneous mixture of brown to tan fine sands with lesser 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 ft. below grade. Below this silty layer, soil composition remains generally constant with a slight fining-downward trend (progressively less coarse sands and gravels with depth) to approximately 50 ft. below grade. No clay lenses, or other impermeable features were encountered at the unsaturated deposits.

Saturated deposits were encountered at approximately 50 ft. below grade. These deposits consist primarily of brown to tan, fine to medium and fine to coarse sands. In the northwestern portion of the Site, extending to Main Street's north right-of-way, lenses of fine sand, silty fine and silty fine to medium sand, and clayey, silty fine to medium sand were encountered at depths between approximately 57 and 120 ft. below grade. Occasional thin silty clay seams were encountered during drilling of the MW-4 cluster in the north right-of-way for Main Street. These seams appear to pinch out toward the south. Saturated deposits are relatively homogeneous south of the MW-5 well cluster along the western boundary of the Site.

Soil organic carbon content at the Site was tested during the IRM Investigation and found to average approximately 0.2 percent total organic carbon (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.

Water level measurements during the IRM Investigation and the Focused Ground-Water Investigation indicated a ground-water flow at the Site to be toward the southwest, consistent with the regional ground-water flow direction in the NCIA. The average ground-water gradient was determined to be approximately 0.0015 ft/ft. Figure 2 shows the piezometric surface, as measured in water table wells.

Minimal variations in heads were identified in clustered wells during the Focused Ground-Water Investigation. This indicates that ground-water flow within the upper ninety ft. of the aquifer is essentially horizontal.

1.3.4.3 Contaminant Distribution

Analytical results show that chlorinated VOCs are the primary contaminants in most of the wells at the Site. Of the chlorinated VOCs detected during the Interim Remedial Measures and Focused Ground-Water Investigation, PCE was found at the highest concentrations: up to 2,680 µg/L in a direct-push water sample collected directly beneath a leaching pool in Area 2; 660 µg/L in MW-2; and 160 µg/L in MW-5U, located near to and downgradient of Area 2. While no DNAPL was directly observed during the IRM Investigation or the Focused Ground-Water Investigation, detection of PCE at a concentration greater than 1 ppm indicates that DNAPL may exist beneath the water table.⁴

TCE and 1,1,1-TCA were detected at concentrations of up to 34 µg/L and 60 µg/L, respectively, in the MW-5 well cluster. At least one of the typical biodegradation daughter products 1,1-DCE, 1,1-DCA and/or cis 1,2-DCE was detected in all wells except MW-1.

Evaluation of the distribution of VOCs indicates that chlorinated VOCs, primarily PCE, 1,1,1-TCA, and TCE, are entering the Site from one or more upgradient sources and combining with VOCs in Area 2 ground water. A likely source of TCE is Atlas Graphics, located in a general upgradient direction of Area 2, and where TCE was recently detected in ground water at a concentration of 3,900 µg/L by NYSDEC. Analytical results from multi-level sampling at LMS probe location GP-20, installed just south of the corner of Main Street and Swalm Avenue in October 1993 (refer to Plate 1), indicate that TCE is the predominant VOC, supporting an interpretation that VOCs have migrated near to and beneath the Site from Atlas Graphics.

Elevated concentrations of PCE and TCE (660 and 330 µg/L, respectively) were detected in MW-2 during the IRM investigation. As MW-2 was located near the property's northern property line,

⁴ Cohen, Robert M. and J.W. Mercer. 1993. *DNAPL Site Evaluation*. CRC Press, Inc. Boca Raton, FL.

upgradient of known potential source areas at the Site and approximately 80 feet east of Area 2, it is likely that the detected VOCs originated from one or more off-Site source.

VOC concentrations show marked reduction with distance from Area 2. As noted above, likely contribution of VOCs from one or more source upgradient of Area 2 and potential contribution from downgradient sources make it impossible to define the limits of VOCs originating from the Site.

Detection of daughter products in ground water indicates that biodegradation of chlorinated VOCs has occurred. In particular, detection of cis 1,2-DCE shows degradation of PCE and TCE. Taken together with the above observations, ground-water characterization results indicate that conditions in the aquifer system are moderately favorable for anaerobic degradation of PCE and TCE.

Microbial studies conducted during the Focused Ground-Water Investigation showed that at all wells sampled bacterial strains exist that are capable of biodegrading chlorinated VOCs. The strain most adaptable to VOC concentrations found at the Site was identified in ground water collected from MW-5U, providing strong evidence of active biodegradation in the vicinity of Area 2, where nutrient sources are likely to be the most abundant.

1.3.5 Ground-Water Sampling Subsequent to the Focused Ground-Water Investigation

During October 1998, IMC identified two monitoring wells, UN-22 and UN-24 (NYSDEC designations), located west of the Site. These were sampled to more completely define the distribution of VOCs downgradient of Area 2. The locations of UN-22 and UN-24 are shown on Plate 1.

Well soundings indicated that UN-22 and UN-24 are screened at or just below the water table. Table 4 summarizes chemical analysis of samples collected from the wells in November 1998. UN-22 contained TCE and PCE at concentrations of 230 ug/L and 11 ug/L, respectively. UN-24 contained TCE and PCE at concentrations of 68 ug/L and 11 ug/L, respectively. Ratios of TCE to PCE concentrations in these wells were not consistent with ratios observed in samples near Area 2 (e.g. the MW-5 cluster and SB-25), where PCE predominates. This indicates that at least a portion of the contamination found in UN-22 and UN-24 comes from a source other than Area 2.

Results from a July 1999 sampling event that included MW-1, MW-3 and well clusters MW-5 through MW-7 are summarized on Table 4. Changes in VOC concentrations between the July 1998 and July 1999 sampling events were variable. Of note was a reduction in the PCE concentration at MW-5U from 160 ug/L to 42 ug/L while the TCE concentration increased from 34 ug/L to 110 ug/L. PCE in MW-6U increased from 51 ug/L to 140 ug/L.

1.3.6 Focused Ground-Water Feasibility Study, September 1999

The Focused Ground-Water Feasibility Study examined the nature and distribution of contaminants in ground water, as determined by previous studies, and presented a ground-water model that evaluated current impacts to existing ground-water supply wells. The study concluded that contaminants originating at the Site are unlikely to be captured by Bowling Green or Westbury Water District Wells, and that the most realistic exposures to contamination would be ingestion of water from a future water supply well.

The study described probable VOC contamination entering the Site from one or more upgradient sources. The study concluded that continued migration of these VOCs onto the Site would make attainment of State Drinking Water maximum contaminant limits technically impracticable. The study therefore recommended identifying alternative cleanup standards, to be established during Remedial Design. Furthermore, the study evaluated remedial technologies with a focus on removing source material, to the extent possible, and allowing intrinsic remediation to reduce concentrations downgradient of the Site.

As a product of screening of numerous remedial technologies, HAI selected *in-situ* chemical oxidation in conjunction with intrinsic remediation as the preferred alternative for addressing ground-water contamination at the Site. *In-situ* chemical oxidation was determined to be more suited to achieving remedial goals than other technologies as it is capable of destroying source-concentration VOCs without producing toxic by-products. Given the size of the apparent source area and other Site-specific conditions, costs for employment of *in-situ* chemical oxidation were also found to be reasonable relative to other screened technologies.

1.4 Project Description and Objectives

The project will consist of installing additional ground-water monitoring wells upgradient and downgradient of the apparent source area (Area 2). HAI will also install chemical oxidation reagent application wells.

HAI will sample existing monitoring wells, new monitoring wells and new application wells to identify baseline conditions prior to conducting *in-situ* chemical oxidation pilot studies. In-Situ Chemical Oxidative Technologies, Inc. (ISOTEC) will conduct bench testing on selected ground-water and soil samples to identify appropriate quantities of catalyst agents and oxidizing reagent to be applied during a pilot study.

HAI and ISOTEC will complete a chemical oxidation pilot study in Area 2, evaluate data collected from the pilot study and, as appropriate, design a final remedial system. Upon completion of remedial activities, HAI will conduct five years of environmental monitoring to evaluate the permanence of the remedial action.

HAI has designed the project to meet the following primary objectives:

1. confirm the general applicability of *in-situ* chemical oxidation as a means of remediating ground water through baseline environmental sampling and bench testing;
2. evaluate site-specific performance of the *in-situ* chemical oxidation remedial method through pilot testing;
3. adjust the remedial approach as appropriate based on findings from pilot testing; and
4. employ *in-situ* chemical oxidation to significantly and permanently reduce VOC concentrations in ground water resulting from contamination in Area 2.

HAI will prepare a report describing findings from the pilot study. As the pilot study will result in treatment of the entire areal extent of the source area as HAI understands it, the final remedial design may not require additional application wells. However, additional applications of reagent are commonly required. To the extent that *in-situ* chemical oxidation is determined to be ineffective in achieving project objectives, HAI will propose one or more alternative technologies. Whether *in-situ*

chemical oxidation is determined effective or an alternative technology is deemed necessary, the final design will include a long-term environmental monitoring plan.

1.5 Project Organization

The project will be managed from HAI's Mason, Ohio office. During implementation, HAI will assure that the type and quality of work conforms to this Work Plan and supporting documents.

1.5.1 Project Team

The work will be performed, on behalf of IMC, by HAI and several subcontractors, including:

1. ISOTEC, Inc. in West Windsor, New Jersey.
2. Lancaster Laboratories in Lancaster, Pennsylvania (fixed laboratory analyses);
3. Handex of New York, Farmingdale, New York; and
4. Albert Tay PLS, Plainview, New York.

The above list identifies the subcontractors that have been identified by HAI to date. Other subcontractors may be used as necessary.

1.5.2 Project Staff

A brief description of the project staff and their responsibilities is given below. Figure 3 is a graphical representation of the project management structure.

Project Manager

The Project Manager, W. Lance Turley of HAI, 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. Bill Dennis of HAI, will serve as the technical project supervisor. Mr. Dennis will oversee field investigations and environmental monitoring and assist the Project Manager in communications with ISOTEC, Handex of New York and Albert Tay (surveyor).

Health and Safety Coordinator

The Health and Safety Coordinator is Mr. Toby Droughton of HAI. Duties of the Health and Safety Coordinator are described in the Site Specific Health and Safety Plan (HASP), Appendix C.

Site Health and Safety Officer

The Site Health and Safety Officer is Mr. Bill Dennis. Duties and responsibilities of the Health and Safety Officer are included in the HASP, Appendix C.

Quality Assurance Officer

The Quality Assurance Officer is Mr. Kevin Wildman of HAI. 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 Laboratories. The Laboratory Project Manager will communicate with the Quality Assurance Officer, and report to the respective Laboratory Director. 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. Craig A. Kasper, P.E. and Mr. Mark J. Bonifas, P.E. of HAI and Mr. Steve Zervos of ISOTEC will serve as the technical advisors for the project. Messrs. Kasper and Bonifas will assist primarily in evaluating contaminant distribution and fate and transport. Mr. Kasper is a licensed Professional Engineer in the State of New York. Mr. Zervos will assist in evaluation of bench testing and pilot testing results and design and implementation of the final remedial system.

1.6 Organization of Work Plan and Supporting Documents

1.6.1 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 pursuant to this work plan will be used to confirm the applicability of *in-situ* chemical oxidation for significantly and permanently reducing VOC concentrations in ground water resulting from contamination in Area 2. To the extent that bench testing and pilot studies demonstrate the technology to be effective, adjustments may be made to the pilot system to accomplish more extensive contaminant mass reduction.

Brief descriptions of the Work Plan and supporting documents are provided below.

1.6.2 Work Plan

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

1.6.3 Field Sampling and Analysis Plan

The FSAP in Appendix A provides guidelines for field sampling and analysis of ground water. Specifically, the FSAP addresses bench testing and the pilot study and 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.

1.6.4 Quality Assurance Project Plan

The QAPP in Appendix B 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 Laboratories' certification for analysis metals and volatiles pursuant to the New York State Department of Health Environmental Laboratory Approval Program Contract Laboratory Protocol.

1.6.5 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.

2.0 FOCUSED GROUND-WATER REMEDIATION

2.1 General

The Focused Ground-Water Remediation will consist of:

1. Task 1 – ground-water monitoring well and reagent application well installation;
2. Task 2 – baseline ground-water sampling and analysis;
3. Task 3 - bench testing of selected water and soil samples;
4. Task 4 – pilot testing of *in-situ* chemical oxidation;
5. Task 5 – reporting of findings from tasks 1 through 4;
6. Task 6 – Remedial Design; and
7. Task 7 - Remedial Action.

Tasks 1 through 7 are analogous to a Pre-Design, in which a selected remedy is evaluated to determine the most appropriate configuration for a final design. However, given the small area to be remediated, the pilot system may also function as the final remedial system. To the extent that pilot testing and supporting studies indicate that *in-situ* chemical oxidation is an effective means of significantly and permanently reducing VOC concentrations in the apparent source area, the Remedial Design may simply consist of designing a long-term environmental monitoring program and recommending additional applications of reagent or making minor adjustments to the application system. If *in-situ* chemical oxidation is determined not to be effective in significantly reducing VOC concentrations, the Remedial Design will result in alternative proposed technologies, potentially including further pilot testing.

2.2 Task 1 – Ground-Water Monitoring Well and Reagent Application Well Installation

2.2.1 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-3 and the MW-4 through MW-7 well nests to confirm that the current water table elevations are within the range of historic elevations. If the current elevation falls outside

the historic range, proposed screen intervals for new wells, described later in this document, may be adjusted.

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

Proposed locations for the new monitoring wells are shown on Figure 4.⁵ The PMW-8 well nest is located so that it can identify VOCs at various depths potentially entering the Site from upgradient sources. The PMW-9 and PMW-10 well couplets are located near to and in a general downgradient location with respect to leach pits LP-2A and LP-2B. These well couplets will be used to provide baseline ground-water quality data and information on contaminant destruction in the immediate vicinity of the apparent source area.

Exact location of the wells will be determined in the field based upon several factors, which may include, but are 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.

Proposed upper wells PMW-8U, PMW-9U and PMW-10U will each have a 15-ft. long well screen crossing the ground-water table (approximately thirteen ft. of screen below the water table).⁶ Based upon previous static water level measurements collected at the Site, the water table below Area 2 has

⁵ Designations for proposed monitoring wells have a "P" prefix. The "P" will be deleted from the designation after the well has been installed.

⁶ Ground-water monitoring wells in the PMW-8 nest and the PMW-9 and PMW-10 couplets will be constructed using two-inch diameter, Schedule 40, PVC screens and risers. These wells will be constructed in the same manner as the application wells, described in the following section. This construction will allow their use as application wells should pilot studies determine that they are needed.

an approximate elevation 72 ft. above mean sea level (MSL). Therefore, the targeted elevations for the screened interval at all upper well locations are from approximately 77 to 62 ft. above MSL (approximately 45 to 60 ft. below the ground surface).

Proposed monitoring wells PMW-8M and PMW-8L will have screened intervals of 10 ft. Proposed monitoring wells PMW-9L and PMW-10L will have screened intervals of 15 ft. Proposed screen elevations and depths for these and the upper wells will be as summarized below provided that current water table elevation, as measured prior to well installation, is within the historical range:

Proposed Monitoring Well	Construction	Elevation of Center of Screen (ft. above MSL)	Screened Interval (ft. above MSL)	Depth Below Grade¹ (ft.)
PMW-8U	PVC	69.5	62 to 77	45 to 60
PMW-8M	PVC	52	47 to 57	65 to 75
PMW-8L	PVC	37	32 to 42	80 to 90
PMW-9U	PVC	69.5	62 to 77	45 to 60
PMW-9L	PVC	49.5	42 to 57	65 to 80
PMW-10U	PVC	69.5	62 to 77	45 to 60
PMW-10L	PVC	49.5	42 to 57	65 to 80

1. Depth below grade is based on a surface elevation of 122 ft. 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, soil samples will be collected using split spoon samplers at five-ft. intervals from the surface to a depth of approximately 50 ft. below the ground surface. Samples will be collected continuously below a depth of 50 ft. An HAI hydrogeologist will log all soil samples and conduct and record headspace screening for VOCs using a photoionization detector (PID) or flame ionization detector (FID). If the screening results in high values (e.g., > 200 ppm using a PID), the hydrogeologist will use a hydrophobic dye to screen for the presence non-aqueous phase liquids. Soil boring and monitoring well installation procedures are detailed in the FSAP in Appendix A.

2.2.3 Reagent Application Well Locations and Depths

Proposed locations for reagent application well couplets are shown on Figure 4.⁷ Proposed application wells PAW-1U and PAW-1L are situated approximately 12 ft. west-northwest (side gradient) of PAW-2U and PAW-2L, which will be installed through the middle of the former leach pit LP2-B, where the highest concentrations of VOCs at the Site were detected. PAW-3U and PAW-3L will be installed approximately 10 ft. east (side- to upgradient) of the PAW-2 couplet, near the former leach pit LP2-2A. ISOTEC's experience with *in-situ* chemical oxidation at similar sites indicates that the reagent typically extends to treatment zone radius of approximately 15 ft. However, as the reagent migrates further from the application well, its ability to destroy VOCs is reduced. In order to counteract the reduction in effectiveness with distance from the well, ISOTEC recommends several ft. of overlap for radii of influence. Positioning of the proposed application wells is such that the required overlap should be accomplished.

The exact location of the application wells will be determined in the field based upon several factors, which may include, but are 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.

Proposed upper application wells PAW-1U, PAW-2U and PAW-3U will have 15 ft. well screens crossing the ground-water table (approximately 13 ft. of screen below the water table). Proposed lower application wells PAW-1L, PAW-2L and PAW-3L will have screened intervals of 15 ft., with the top of the screen approximately two ft. below the base of the upper well. Proposed screen elevations and depths for the application wells will be as summarized below provided that current water table elevation, as measured prior to well installation, is within the historical range:

⁷ Designations for proposed application wells have a "P" prefix. The "P" will be deleted from the designation after the well has been installed.

Proposed Application Well	Construction	Elevation of Center of Screen (ft. above MSL)	Screened Interval (ft. above MSL)	Depth Below Grade ¹ (ft.)
PAW-1U	PVC	65.5	59 to 74	48 to 63
PAW-1L	PVC	46.5	39 to 54	68 to 83
PAW-2U	PVC	65.5	59 to 74	48 to 63
PAW-2L	PVC	46.5	39 to 54	68 to 83
PAW-3U	PVC	65.5	59 to 74	48 to 63
PAW-3L	PVC	46.5	39 to 54	68 to 83

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

All application 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.

Sampling and field screening for application well installation will be accomplished in the same manner as described for monitoring wells. Soil boring and application well installation procedures are detailed in the FSAP in Appendix A.

During installation of PAW-2U and PAW-2L, a saturated soil sample will be collected from a depth interval between 58 and 64 ft. below the ground surface. One split from the sample will be submitted to Lancaster Laboratories for chemical analysis described in section 2.3. The other split will be shipped to ISOTEC's West Windsor, New Jersey testing facility for bench testing, as described in section 2.4.

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 or FID, the soils will be stockpiled on-site and secured under polyethylene sheeting. If the soils contain VOCs above background concentrations, they 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 - Baseline Ground-Water Sampling and Analytical Procedures

The newly installed monitoring and application wells and existing monitoring wells will be developed and sampled following the procedures described in the FSAP located in Appendix A. Following purging, water from all monitoring wells will be measured for temperature, pH, specific conductance, oxidation-reduction potential and dissolved oxygen using a flow-through cell. One ground-water sample from each well will be submitted to Lancaster Laboratories and analyzed for VOCs in accordance with U.S. EPA SW-846 Method 8021B. Lancaster Laboratories' reporting of analytical results for VOCs will be provided in a NYSDEC ASP Category B deliverables data package.

Ground-water samples collected from the reagent wells and the newly installed monitoring wells will be analyzed by Lancaster Laboratories for: total iron in accordance with U.S. EPA SW-846 Method 7380; sulfate in accordance with Method 375.4; total organic carbon in accordance with U.S. EPA SW-846 Method 9060 and total dissolved solids in accordance with Method 160.1. Two-liter aliquots will also be collected from these wells and submitted to ISOTEC for bench testing, summarized in section 2.4.

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.

HAI will collect one saturated soil sample split during installation of PAW-2U and PAW-2L as described in section 2.2.3. The sample will be submitted to Lancaster Laboratories and analyzed for

VOCs in accordance with U.S. EPA SW-846 Method 8021B, and total organic carbon in accordance with U.S. EPA SW-846 Method 415.1.

Results from baseline VOC analyses will identify the current distribution of contaminants in the apparent source area and across the Site. Baseline data will be compared with VOC concentrations following bench testing, pilot testing and the Remedial Action to determine the degree of mass reduction obtained through employment of the remedial technology.

Field parameters and inorganic analyses, along with VOC concentrations and ISOTEC's experience treating a wide variety of sites, will form a basis for estimating the lateral extent of aquifer material that can be treated per application well.

2.4 Task 3 – Bench Testing

ISOTEC performs bench scale testing to achieve the following objectives:

1. demonstrate proof that the oxidative process is effective under site-specific conditions;
2. demonstrate proof of the effectiveness of the oxidative process in the presence of aquifer solids (i.e. soil);
3. demonstrate proof that the oxidative process is capable of achieving significant contaminant destruction; and
4. determine the optimum mix for subsequent pilot scale testing by performing the bench testing using various catalyst/oxidizer amendments.

2.4.1 Sample Collection

Site soil for bench testing will be collected at a location representative of site contamination and characteristics. Soils may be collected from different locations and composited, if necessary, to obtain a representative sample. A minimum of 6000 grams of soil should be collected. One-liter amber jars with screw top caps may be used to collect soils if they are contaminated. If the soils collected are not contaminated, *Zip Lock* bags may be used for sample collection.

Site ground water for bench testing will be collected from a monitoring well point exhibiting the highest contamination after three well volumes have been purged. Samples from wells containing free product cannot be used during bench scale testing, and will be excluded. A minimum of 5 liters of ground water should be collected and stored in 1-liter amber glass containers with zero headspace (no preservative to be used). In addition, one sample should be submitted unpreserved in a 250-ml amber glass container with zero headspace. Lastly, two samples should be collected in 40-ml vials preserved in HCl to be used during bench testing for control purposes.

2.4.2 Reaction Vessel Preparation

The laboratory experiments will be performed in 120 ml sealed batch reactors. For each vessel, adequate site soil and ground water will be introduced to achieve 1:1(w/w) soil-water slurry, leaving enough headspace for pre-determined reagent volumes to be injected. The vessels will be sealed with caps fitted with Teflon lined septa to facilitate subsequent injections of reagent. Samples of the site soil and ground water will be collected for subsequent analyses to determine the initial concentrations of VOCs in the reaction vessels.

2.4.3 Bench Test Treatments

The bench scale experiments will be performed by injecting a series of catalyst and oxidizer amendments into the reaction vessels. The stoichiometric molar ratio of the reagent combination utilized will be different in each reaction vessel. The merits of stepwise injection will be compared to single aggressive treatment for each reagent combination used. The lab study monitoring will be conducted by setting up parallel monitoring vessels in a similar manner, which will receive the same doses as the corresponding main reaction vessels. Samples will be periodically withdrawn from the monitoring vessels for hydrogen peroxide analysis. Additional treatments to designated reaction vessels will be injected based on residual peroxide concentrations remaining. One of the reaction vessels will initially be isolated for control purposes and will receive equivalent volume of distilled water to compensate for reagent volumes injected into treatment vessels.

Following the last treatment, all reaction vessels will remain undisturbed at room temperature for 24 hours or until such time that the oxidizer is completely consumed. Soil and ground water from each of the reaction vessels will be analyzed for residual VOC concentrations.

2.4.4 Sample Analyses

The results of sample analysis of the 40-ml vials collected in the field will establish ground-water quality in the pilot study area at the Site.

The samples generated from the treatability studies will be submitted to a certified analytical laboratory for VOC analyses by Method 624/8260. The samples will include:

1. the 40 ml vial "field" collected sample;
2. the 4 oz jar "field" collected soil sample;
3. the "initial conditions" soil and ground-water samples collected during preparation of the reactor vessels;
4. the "control" sample from the reactor vessel to which only distilled water was injected; and
5. the treatment samples from the reactor vessels to which varying volumes of catalyst and hydrogen peroxide were injected.

In addition, ISOTEC will submit one, untreated site soil sample to a certified laboratory to be tested for Fe, Mn, and TOC concentrations to evaluate the native conditions. Results of analyses performed on these samples will be evaluated to determine if the objectives of the bench testing stated at the beginning have been achieved.

Bench testing results will be considered in the context of Site-specific geochemical and hydrogeologic conditions to identify an appropriate reagent dosage for each of the application wells.

2.5 Task 4 – Pilot Testing

2.5.1 Reagent Application

An ISOTEC technician will measure ground-water depth, pH, dissolved oxygen, temperature, and air quality parameters at the MW-5 and MW-8 monitoring well nests, PMW-9 and PMW-10 monitoring

well couplets and all application wells. Monitoring will continue at regular intervals in the treatment area monitoring wells during the oxidation reagent (ISOTEC™) application process. A sampling and monitoring schedule is provided in Section 2.2.

Following initial monitoring, ISOTEC will fit each application well with a wellhead seal that includes a riser fitted with two valves. One part of this riser is attached to the aboveground containers of reagents, and the other is used as a reaction vapor off-gassing vent. Catalyst and oxidation reagents will be applied separately to the application wells.

ISOTEC will introduce a patented catalyst formulation which will have been determined in the bench testing phase. The catalyst formulation consists of a chelated iron solution whereby the chelating compound maintains the iron catalyst in a catalytic form without the need to lower the aquifer pH. Although optimal volumes are determined in the bench testing phase, approximately 100 to 200 gallons of catalyst will be added to each application well per well treatment event.

ISOTEC will apply stabilized hydrogen peroxide to all of the application wells at a concentration ranging from 5% to 15%. Using stabilized hydrogen peroxide minimizes the unwanted degradation of the peroxide into oxygen and water and provides more favorable conditions for the catalyzed production of hydroxyl radicals. The estimated volume of hydrogen peroxide to be applied to the site will be finalized following review of bench testing results.

The proper ferrous ion density will cause the peroxide to decompose into a hydroxyl radical in an exothermic reaction. The vertical depth of travel for the reaction is generally based on the screen interval at which the ISOTEC™ reagents are applied, depending on site hydrogeological conditions. The reagents will be applied to the upper saturated zone, approximately 50 feet to 80 feet below ground surface (treatment zone). The application process of catalyst and oxidizer is expected to be completed within four to five days during each of the two field events.

A slight (typically less than 10° C) increase in temperature due to exothermic reaction is expected to be limited to the treatment zone within a few feet of the application wells. However, changes in other ground-water parameters are expected at nearby downgradient treatment area monitoring wells.

The iron effect is limited to the treatment area surrounding the application points and has been observed at other sites to decrease in concentration over several months to background levels. Decreased formation permeability as a result of oxidation treatment has not been observed at other ISOTEC™ project sites.

During the application events, off gassing will occur. ISOTEC will monitor off-gassing vapors in the breathing zone and headspace of monitoring wells at regular intervals during the application events. Air monitoring will also be completed as needed within the nearby equipment compound and shed. Air monitoring parameters to be measured will include volatile compounds (measured with a PID or FID), percent oxygen, percent carbon dioxide, and lower explosive limit. Other observations made during applications include, but are not limited to, pressure checks and temperature readings at the wellheads and fluid short-circuiting to the surface indicating mounding of ground water.

Depending upon results obtained from post-treatment sampling, described below, additional ISOTEC™ applications may be required. If additional treatment is not needed, then post-treatment sampling will be conducted approximately two months after the first application.

2.5.2 Post-Treatment Sampling

HAI will perform post-treatment ground-water sampling approximately one week following completion of each ISOTEC™ treatment, and again at approximately three weeks following the last treatment. Following purging, ground-water samples will be collected from the MW-5 and MW-8 monitoring well nests, PMW-9 and PMW-10 monitoring well couplets and all application wells. Sampling will follow the procedures described in the FSAP located in Appendix A.

Water from the wells will be measured for temperature, pH, specific conductance, oxidation-reduction potential and dissolved oxygen using a flow-through cell. One ground-water sample from each well will be submitted to a Lancaster Laboratories and analyzed for VOCs in accordance with U.S. EPA SW-846 Method 8021B. Lancaster Laboratories' reporting of analytical results for VOCs will be provided in a NYSDEC ASP Category B deliverables data package.

Ground-water samples collected from the reagent wells and the newly installed monitoring wells will be analyzed by Lancaster Laboratories for: total iron in accordance with U.S. EPA SW-846 Method 7380; sulfate in accordance with Method 375.4; total organic carbon (USEPA Method 9060) and total dissolved solids in accordance with Method 160.1.

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.

Analytical results will be compared with baseline data to identify the percentage of VOC reduction achieved in and near Area 2 through *in-situ* chemical oxidation.

2.6 Task 5 - Reporting

Following completion of one or two *in-situ* chemical oxidation applications, HAI will prepare a report that includes::

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 and application well installation;
2. a discussion of field activities performed during well installation and baseline ground-water sampling (Tasks 1 and 2);
3. a scaled base map showing Site structures and existing and newly installed monitoring well and application locations;
4. a water table contour map showing flow direction and gradient;
5. a table presenting baseline ground-water analytical data obtained under Task 2 and, as appropriate, two dimensional isoconcentration maps showing lateral and vertical distribution of VOCs;
6. a discussion of the VOC distribution in Area 2 and Site-wide;
7. boring logs and well construction diagrams for newly constructed monitoring wells and application wells;
8. tables and text describing findings from the bench testing (Task 3)
9. a discussion of field activities performed during pilot testing (Task 4);

10. tables presenting field measurements and observations during Task 4;
11. tables and text describing results of the pilot testing, including estimates of percent contaminant reduction and descriptions of the overall effectiveness of the technology;
12. general recommendations as to treatment system modifications should be addressed during Remedial Design.

If VOC concentrations are reduced significantly as a result of the pilot testing, HAI may recommend long-term monitoring in lieu of a Remedial Design to evaluate the permanence of the reduction.

2.7 Task 6 - Remedial Design

As mentioned previously, the scope of the Remedial Design will be largely dependent upon results of preceding tasks. To the extent that *in-situ* chemical oxidation is determined to be an effective technology, Remedial Design may involve modifications to the pilot system and design of a long-term environmental monitoring program. Failure of the selected technology to attain cleanup goals may require identification, testing and implementation of another remedial technology.

3.0 SCHEDULE OF IMPLEMENTATION

An estimated project schedule follows. The estimated start date of June 4 assumes that the NYSDEC will complete final review of this work plan and supporting documents prior to the end of May.

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.

June 4 through June 13, 2001	Task 1 – Ground-Water Monitoring Well and Reagent Application Well Installation
June 13 through June 29, 2001	Task 2 – Baseline Ground-Water Sampling and Analytical Procedures
June 15 through July 3, 2001	Task 3 - Bench Testing
July 9 through September 14, 2001	Task 4 – Pilot Testing ⁸
September 14, 2000 through December 14, 2001	Task 5 – Reporting

Remedial Design will be initiated upon receipt of NYSDEC's review of the Pilot Study Report. HAI anticipates that the final Remedial Design will be completed within three months, dependent upon NYSDEC's requirement for, and review of, 30% and 90% design submittals. It is probable that the Remedial Action, if required, will begin during the spring or summer of 2002. Environmental monitoring will continue for five years after active portions of the Remedial Action are completed.

⁸The schedule assumes one round of reagent application. If a second round of application is conducted, subsequent tasks will be moved back approximately seven weeks.

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.

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

U.S. Geological Survey, in cooperation with the Nassau County Department of Public Works, *Geology of the Town of North Hempstead, Nassau County, Long Island, New York*. 1979.

Wiedemeier, M.A., et al., *Overview of the Technical Protocol for Natural Attenuation of Chlorinated Aliphatic Hydrocarbons in Ground Water, Under Development for the U.S. Air Force Center for Environmental Excellence*. Proceedings from the Symposium on Natural Attention of Chlorinated Organics in Ground Water, 1996.

TABLES

**Focused Ground-Water Remediation Work Plan
Former IMC Magnetics Facility
Westbury, New York**

Table 1

**Summary of Ground-Water Analytical Results - Detected Analytes
May 1996 Sampling Event**

ANALYTE	ANALYTICAL RESULTS FOR VOCs (ug/L)							
	MW-1	MW-2	MW-3	SB-25	SB-29	SB-54	SB-63	SB-65
1,1,1-TRICHLOROETHANE								
- Mobile Laboratory	<1	7	2	<1	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	2.2	<13	<0.5	<1.3	1.9	<2.5
1,1-DICHLOROETHANE								
- Mobile Laboratory	NT	NT	NT	NT	NT	NT	NT	NT
- Fixed Laboratory	<0.5	<5	1.8	<13	<0.5	<1.3	<0.5	<2.5
1,1-DICHLOROETHENE								
- Mobile Laboratory	<1	<1	1	<1	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	<0.5	<2.5
trans-1,2-DICHLOROETHENE								
- Mobile Laboratory	<1	<1	<1	<1	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	76	<2.5
BENZENE								
- Mobile Laboratory	<1	<1	<1	<1	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	<0.5	<2.5
CHLOROFORM								
- Mobile Laboratory	NT	NT	NT	NT	NT	NT	NT	NT
- Fixed Laboratory	<0.5	<5	1.7	<13	<0.5	<1.3	<0.5	<2.5
ETHYLBENZENE								
- Mobile Laboratory	<1	<1	<1	4	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	<0.5	<2.5
METHYLENE CHLORIDE								
- Mobile Laboratory	NT	NT	NT	NT	NT	NT	NT	NT
- Fixed Laboratory	<0.5	17	1.4	55	<0.5	<1.3	0.9	<2.5
TETRACHLOROETHENE								
- Mobile Laboratory	7	899	64	2,680	<1	55	48	172
- Fixed Laboratory	3.1	660	42	1000	0.8	31	42	160
TOLUENE								
- Mobile Laboratory	<1	<1	<1	33	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	<0.5	<2.5
TRICHLOROETHENE								
- Mobile Laboratory	<1	206	10	<1	<1	102	55	<1
- Fixed Laboratory	0.7	330	15	<13	<0.5	110	44	<2.5
TRICHLOROFLUOROMETHANE								
- Mobile Laboratory	NT	NT	NT	NT	NT	NT	NT	NT
- Fixed Laboratory	<0.5	12	1	<13	<0.5	<1.3	<0.5	<2.5
XYLENES (Total)								
- Mobile Laboratory	<1	<1	<1	9	<1	<1	<1	<1
- Fixed Laboratory	<0.5	<5	<0.5	<13	<0.5	<1.3	<0.5	<2.5
ANALYTICAL DATA FOR METALS (mg/l)								
BARIUM (Total)								
- Fixed Laboratory	0.054	0.079	0.047	0.34	0.3	0.37	0.13	0.18
CADMIUM (Total)								
- Fixed Laboratory	<0.003	<0.003	<0.003	0.032	0.0061	<0.003	<0.003	0.0067
CHROMIUM (Total)								
- Fixed Laboratory	<0.010	<0.010	0.032	5.2	3.2	1	0.71	1.7
MERCURY (Total)								
- Fixed Laboratory	<0.0002	<0.0002	<0.0002	0.0061	0.00031	0.00034	0.00033	0.00088
LEAD (Total)								
- Fixed Laboratory	<0.003	<0.003	<0.003	0.32	0.056	0.051	0.018	0.0066

**Focused Ground-Water Remediation Work Plan
Former IMC Magnetics Facility
Westbury, New York**

Table 2

Summary of Monitoring Well Construction

Monitoring Well ID.	Location Relative to Area 2	Date(s) Installed	Drilling Method	Installed By	Northing (1)	Easting (1)	Ground Elevation (2)	Top of Casing Elevation (2)	Total Drilling Depth (ft.)	Screened Interval (ft.)	Sand Interval (ft.)	Bentonite Seal Interval (ft.)	Native Backfill Interval (ft.)	Concrete Interval (ft.)
MW-1	Side/Upgradient	04/26/94	4 25" ID HSA	Anson (4)	465	49	122.78	122.30	65	7-65 (6)	7 (6)	7 (6)	7 (6)	0-7 (6)
MW-2	Side/Upgradient	04/26/94	4 25" ID HSA	Anson (4)	467	152	—	—	65	7-65 (6)	7 (6)	7 (6)	7 (6)	—
MW-3	Side/Dowgradient	04/27/94	4 25" ID HSA	Anson (4)	55	293	121.52	121.12	65	7-65 (6)	7 (6)	7 (6)	7 (6)	0-7 (6)
MW-4U	Upgradient	6/29/98	8 25" ID HSA	LTR (5)	521	192	122.26	121.90	65	50-65	48-65	47-48/4-6	6-47	0-1
MW-4M	Upgradient	6/29/98	8 25" ID HSA	LTR (5)	521	192	122.26	121.93	114	104-114	102-114	100-101/4-6	6-47	0-1
MW-4L	Upgradient	6/29/98	8 25" ID HSA	LTR (5)	521	192	122.26	121.94	140	130-140	127-140	126-127/4-6	6-47	0-1
MW-5U	Dowgradient	06/20/98	8 25" ID HSA	LTR (5)	422	242	122.26	121.93	60	50-65	45-60	4-6/41-42	6-41	0-1
MW-5M	Dowgradient	06/20/98	8 25" ID HSA	LTR (5)	422	242	122.26	121.93	100	103-113	86-100	4-6/86-87	6-86	0-1
MW-5L	Dowgradient	06/20/98	8 25" ID HSA	LTR (5)	422	242	122.26	121.84	140	50-65	127-140	4-6/126-127	6-126	0-1
MW-6U	Dowgradient	06/23/98	8 25" ID HSA	LTR (5)	244	236	122.22	121.96	65	45-60	48-66	4-6/47-48	6-47	0-1
MW-6M	Dowgradient	06/23/98	8 25" ID HSA	LTR (5)	244	236	122.22	121.68	100	90-100	88-100	4-6/87-88	6-87	0-1
MW-6L	Dowgradient	06/23/98	8 25" ID HSA	LTR (5)	244	236	122.22	121.97	140	130-140	127-140	4-6/126-127	6-126	0-1
MW-7U	Dowgradient	06/25/98	8 25" ID HSA	LTR (5)	75	282	119.85	119.68	60	45-60	41-60	4-6/41-42	6-41	0-1
MW-7M	Dowgradient	06/25/98	8 25" ID HSA	LTR (5)	75	282	119.85	119.64	100	90-100	87-100	4-6/87-88	6-87	0-1
MW-7L	Dowgradient	06/25/98	8 25" ID HSA	LTR (5)	75	282	119.85	119.72	140	130-140	127-140	4-6/126-127	6-126	0-1

Note: (1) Coordinates refer to a site grid, with origin southeast of building
(2) Elevations reference Nassau County Datum.
(3) MW-2 was destroyed at surface through landscaping activities.
(4) Anson Environmental, Ltd., drilled by Miller Environmental.
(5) Land Tech Remedial, Inc.

(5) Construction intervals for MW-1, MW-2 and MW-3 are not known.

Focused Ground-Water Remediation Work Plan
Former IMC Magnetics Facility
Westbury, New York

Table 3
Summary of Ground-Water Analytical Results - Detected Analytes
July 8, 1998 Sampling Event

ANALYTE	ANALYTICAL RESULTS FOR VOCs (ug/L) - SW-846 Method 8010B													
	MW-1	MW-3	MW-4U	MW-4U (DUP)	MW-4M	MW-4L	MW-5U	MW-5M	MW-5L	MW-6U	MW-6M	MW-6L	MW-7U	MW-7M
1,1,1-TRICHLOROETHANE	<1.0	2.9	7.6	7.7	11	1.8	14	60	<1.0	2.4	5.6	1.3	2.3	<1.0
1,1-DICHLOROETHENE	<1.0	<1.0	1.1	1.1	2.3	<1.0	<2.0	18	<1.0	<1.0	1.7	<1.0	<1.0	<1.0
1,1-DICHLOROETHANE	<1.0	3.7	1.2	1.2	1.8	4.5	2.1	12	4.1	1.4	4.2	4.4	3.3	2.1
BROMOFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CIS-1,2-DICHLOROETHENE	<1.0	7.7	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	2.2	<1.0	<1.0	<1.0	<1.0
TETRACHLOROETHENE	2.1	19	2	2.1	<1.0	<1.0	160	21	2.1	51	1.6	<1.0	19	3.5
TOLUENE	<1.0	<1.0	<1.0	<1.0	1.3	1.2	<2.0	<1.0	<1.0	1.9	45	100	3.6	6.1
TRICHLOROETHENE	<1.0	6.8	11	12	<1.0	1.5	34	10	<1.0	20	<1.0	<1.0	3	<1.0
ANALYTICAL RESULTS FOR METALS (mg/L) - SW-846 Method 7000 Series														
BARIIUM (Total)	<0.10	<0.10	0.17	0.21	<0.10	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	0.25	<0.10
CHROMIUM (Total)	<0.030	0.058	0.167	0.223	<0.03	<0.03	0.049	<0.030	<0.03	0.065	<0.030	<0.030	0.155	<0.030
LEAD (Total)	<0.0030	0.0034	0.054	0.054	<0.003	0.0236	0.024	<0.0030	0.0033	0.0218	0.0123	0.01	0.09	<0.0030

**Focused Ground-Water Remediation Work Plan
Former IMC Magnetix Facility
Westbury, New York**

Table 4

**Summary of Ground-Water Analytical Results for Selected
Off-Site Wells - Detected Analytes
November 22, 1998**

ANALYTE	WELL DESIGNATIONS AND ANALYTICAL RESULTS (ug/L)	
	UN-22	UN-24
1,1,1-Trichloroethane	12	2.6
CIS-1,2-Dichloroethene	8.6	37
Tetrachloroethene	11	11
Trichloroethene	230	68

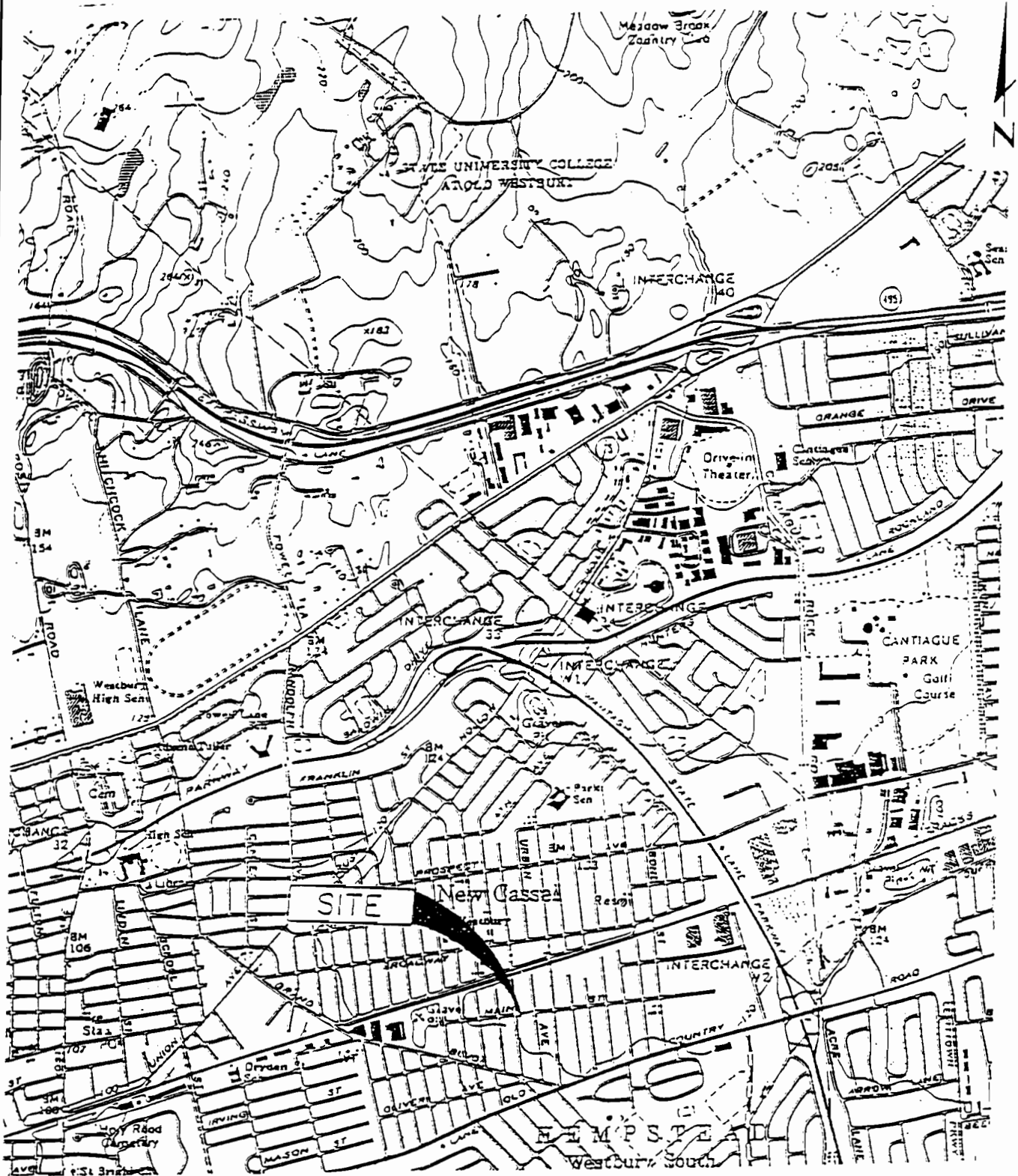
Focused Ground-Water Remediation Work Plan
Former IMC Magnetics Facility
Westbury, New York

Table 5

Summary of Ground-Water Analytical Results from July 1999 Sampling Event - Detected Analytes

ANALYTE	ANALYTICAL RESULTS FOR VOCs (ug/L)													
	MW-1	MW-3	MW-4U	MW-4M	MW-4L	MW-5U	MW-5M	MW-5L	MW-6U	MW-5M	MW-6L	MW-7U	MW-7M	MW-7L
1,1,1-TRICHLOROETHANE	<1.0	1.4	3.7	2.6	<1.0	1.4	25	1.6	<5.0	41	5.1	<1.0	<1.0	22
1,1-DICHLOROETHENE	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	5.4	<1.0	<5.0	11	1.5	<1.0	<1.0	5.9
1,1-DICHLOROETHANE	<1.0	1.4	<1.0	1.1	1.0	<2.0	2.6	1.8	<5.0	<1.0	4.3	<1.0	<1.0	4.4
cis-1,2-DICHLOROETHENE	<1.0	18	4.4	<1.0	<1.0	4.0	<1.0	<1.0	10	<1.0	<1.0	<1.0	<1.0	<1.0
CHLOROFORM	<1.0	1.3	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0
TETRACHLOROETHENE	1.7	48	12	<1.0	<1.0	42	<1.0	<1.0	140	1.3	<1.0	26	3.5	1.4
TRICHLOROETHENE	<1.0	20	26	<1.0	<1.0	110	<1.0	<1.0	22	<1.0	<1.0	2.5	<1.0	1.8
TRICHLOROFLUOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	2.5

FIGURES



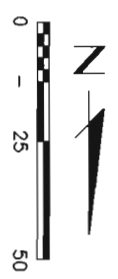
SCALE: 1" = 2000'
 SOURCE: USGS 7.5 MIN. QUADRANGLE
 HICKSVILLE, NEW YORK - 1967
 (PHOTOREVISED - 1979)

0 500 1000 2000
 SCALE IN FEET

FIGURE 1

Hull & Associates, Inc. MASON, OHIO	
570 MAIN STREET PROPERTY FOCUSED GROUND-WATER REMEDIATION WORK PLAN	
SITE LOCATION MAP	
WESTBURY, NEW YORK	
DATE: APRIL 2001	PROJECT: NMB007

NMB007.001.0014
 5/24/00 d
 UNIT 3 Des 1



50

FIGURE 2

Hull & Associates, Inc.
MASON, OHIO

FOCUSED GROUND-WATER REMEDIATION WORK PLAN PIEZOMETRIC CONTOUR MAP UPPER WELLS (7/8/98 MEASUREMENT EVENT) WESTBURY, NEW YORK	DATE: APRIL 2001	PROJECT: NMB007

DATE:	PROJECT:
APRIL 2001	NMB007

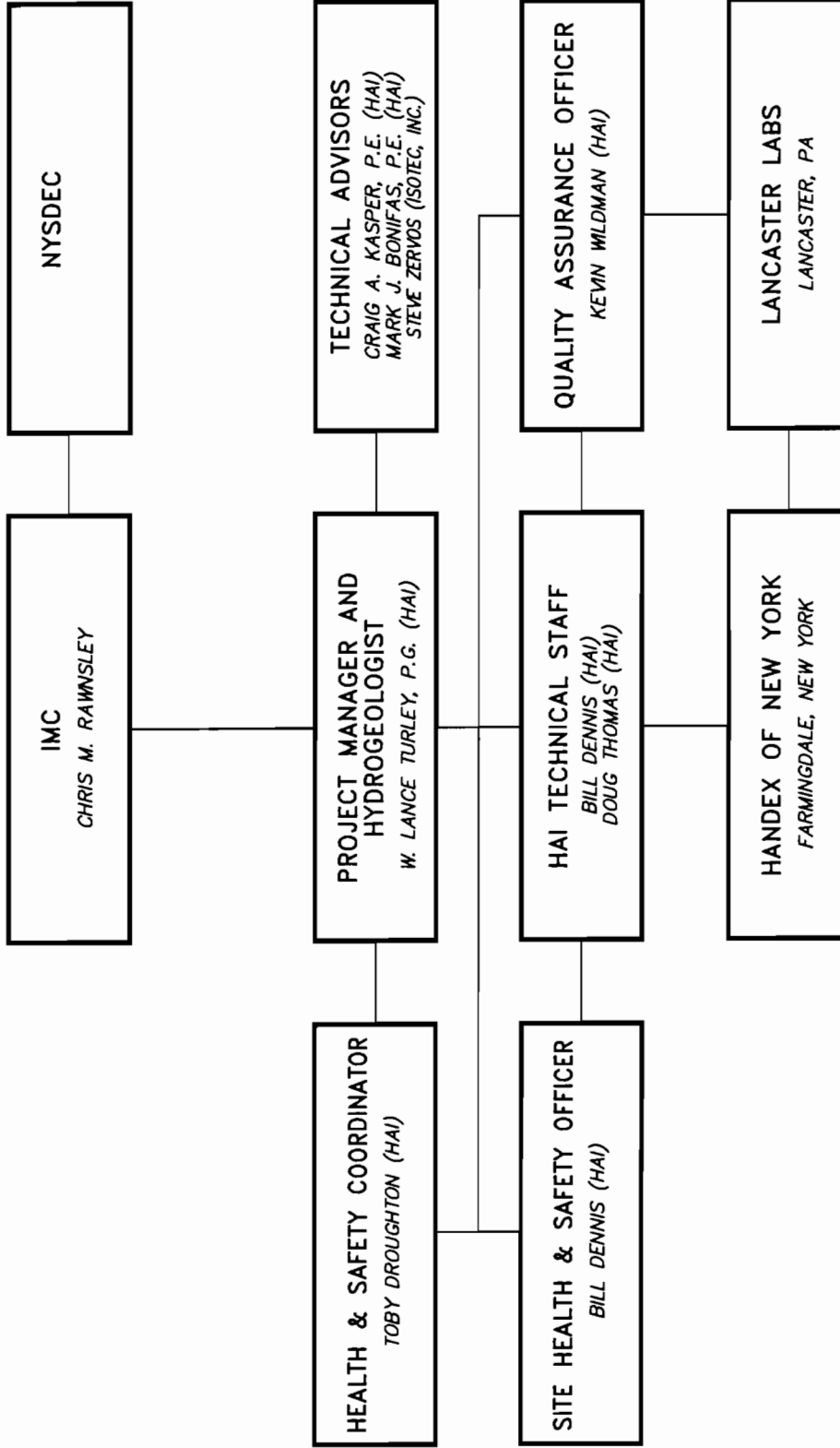
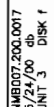


FIGURE 3

Hull & Associates, Inc. MASON, OHIO
570 MAIN STREET PROPERTY FOCUSED GROUND-WATER REMEDIATION WORK PLAN
PROJECT MANAGEMENT CHART
DATE: APRIL 2001
PROJECT: NMB007



PLATE

APPENDIX A

Field Sampling and Analysis Plan (FSAP)

FIELD SAMPLING AND ANALYSIS PLAN

FOR

FOCUSED GROUND-WATER REMEDIATION

FOR THE

**570 MAIN STREET
MANUFACTURING FACILITY
WESTBURY, NEW YORK
NYSDEC SITE CODE #130043A**

APRIL 2001

PREPARED FOR:

IMC EASTERN CORPORATION



PREPARED BY:

**HULL & ASSOCIATES, INC.
4700 DUKE DRIVE, SUITE 172
MASON, OHIO 45040
(513) 459-9677**

**FIELD SAMPLING AND ANALYSIS PLAN
FOR THE
FOCUSED GROUND-WATER INVESTIGATION
AT THE
570 MAIN STREET PROPERTY
WESTBURY, NEW YORK
(HAI Document # NMB007.200.0037)**

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1.0 INTRODUCTION

1.1 General

This Field Sampling and Analysis Plan (FSAP) has been prepared for IMC Eastern Corp. (IMC), Hull and Associates, Inc. (HAI) field personnel and their subcontractors, and other representatives for use during the focused ground-water investigation at 570 Main Street in Westbury, New York, New York State Department of Environmental Conservation (NYSDEC) Code #130043A (Site). The Site is within the New Cassel Industrial Area (NCIA), a class 2 inactive hazardous waste site as designated by the NYSDEC.

The Site location is shown in Figure 1, and a current Site plan is shown in Plate 1. The property is slightly over two acres with one manufacturing building and a paved parking lot covering most of the area. IMC occupied the Site from the early 1950s until 1992. The Site is currently owned and occupied by Castle Collision, an entity unrelated to IMC.

1.2 Purpose and Objectives

The purpose of the FSAP is to describe the standard methods and operating procedures for conducting the various field investigative and sampling activities proposed in the Focused Ground-Water Remediation Work Plan (Work Plan). Where applicable, HAI Standard Operating Procedures (SOPs) are used to describe methods for conducting the various field/sampling tasks (Appendix A). Other standards that may apply are described or referenced in this document.

The identified areas to be investigated are described in HAI's Work Plan and are shown on Plate 1. In general, the Focused Ground-Water Remediation will include the following tasks, which are described in greater detail in the Work Plan:

Task 1 – Ground-Water Monitoring Well and Reagent Application Well Installation

Three new monitoring well nests and three reagent application well nests will be installed to further characterize the Site hydrogeology, apply reagents for in-situ chemical oxidation of organic contaminants, and monitor the effectiveness of the oxidation method. During the soil boring process, soil samples will be collected and screened for volatile organic compounds (VOCs) using a photoionization detector (PID) or flame ionization detector (FID).

Task 2 – Baseline Ground-Water Sampling and Analytical Procedures

The newly installed monitoring and application wells and existing monitoring wells will be developed and sampled for laboratory analysis for VOCs. Ground-water samples collected from the reagent application wells and newly installed monitoring wells will be analyzed for total iron, sulfate, total organic carbon (TOC), and total dissolved solids (TDS). Aliquots of the ground-water samples will also be submitted to In-Situ Oxidative Technologies, Inc. (ISOTEC) for bench testing.

Results from baseline VOC analyses will identify the current distribution of contaminants at the Site. Baseline data will be compared with VOC concentrations following bench testing, pilot testing, and the Remedial Action to determine the degree of mass reduction obtained through employment of the in-situ oxidation remedial technology.

Task 3 – Bench Testing

ISOTEC will perform bench testing on several water samples and a saturated soil sample. Bench testing results will be used to identify appropriate reagent dosages for each application well.

Task 4 – Pilot Testing

ISOTEC will apply in-situ chemical oxidation reagents to each application well. Ground-water depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, temperature, and air quality parameters will be measured prior to reagent application, and monitoring will continue at regular intervals during the application process.

HAI will perform post-treatment ground-water sampling approximately one week following completion of the chemical oxidation treatment. Ground-water samples will be collected from the MW-5 and PMW-8 monitoring well nests, PMW-9 and PMW-10 monitoring well couplets, and all application wells. Water from the wells will be measured for temperature, pH, specific conductance, ORP, and dissolved oxygen using a flow-through cell. One ground-water sample from each will be submitted to the lab and analyzed for VOCs. In addition, ground-water samples for the reagent wells and the newly installed monitoring wells will be analyzed for total iron, sulfate, TOC, and TDS. Analytical results will be compared with baseline data to identify the percentage of VOC reduction achieved through in-situ chemical oxidation.

Depending upon results from post-treatment sampling, another application of oxidation reagents and post-treatment sampling may be conducted approximately two months after the first application.

Task 5 – Reporting

Following completion of one or two in-situ chemical oxidation applications, HAI will prepare a report that includes discussions on Site geology/hydrogeology, field activities, and analytical data. The report will also contain a scaled base map of the area, a water table contour map, tables presenting all analytical data, isoconcentration maps showing distribution of VOCs, boring logs, and well construction diagrams.

Task 6 – Remedial Design

The scope of the remedial design will be largely dependent upon results of the preceding tasks. To the extent that in-situ chemical oxidation is determined to be an effective technology, Remedial Design may involve modifications to the pilot system and design of a long-term environmental monitoring program. Failure of the selected technology to attain cleanup goals may require identification, testing, and implementation of another remedial technology.

1.3 Special Considerations

Field QA/QC must serve to minimize sources of error, minimize potential for cross contamination, and maximize the representativeness of the data collected. Field instrumentation used for this project must have appropriate calibration and maintenance documentation to support QA/QC requirements.

1.4 Project Team

The work will be performed, on behalf of IMC, by HAI and several subcontractors, including:

1. ISOTEC, Inc. in West Windsor, New Jersey;
2. Lancaster Laboratories in Lancaster, Pennsylvania (fixed laboratory analyses);
3. Handex of New York, Farmingdale, New York; and
4. Albert Tay PLS, Plainview, New York.

The above list includes the subcontractors that have been identified by HAI to date. Other subcontractors may be used as necessary.

1.4.1 Project Staff

A brief description of the project staff and their responsibilities is given below.

Project Manager

The project Manager, W. Lance Turley of HAI, 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 time requirements specified in the Work Plan.

Technical Project Supervisor

The Project Hydrogeologist, Mr. Bill Dennis of HAI, will serve as the technical project supervisor. Mr. Dennis will oversee field investigations and environmental monitoring and assist the Project Manager in communications with ISOTEC, Handex of New York, and Albert Tay (surveyor).

Health and Safety Coordinator

The Health and Safety Coordinator is Mr. Toby Droughton of HAI. Duties of the Health and Safety Coordinator are described in the Site Specific Health and Safety Plan (HASP), Appendix C.

Site Health and Safety Officer

The Site Health and Safety Officer is Mr. Bill Dennis of HAI. Duties and responsibilities of the Health and Safety Officer are included in the HASP, Appendix C.

Quality Assurance Officer

The Quality Assurance Officer is Mr. Kevin Wildman of HAI. Duties and responsibilities of the Quality Assurance Officer are discussed in the Quality Assurance Project Plan (QAPP).

Laboratory Project Manager

The Analytical Laboratory Project Manager is Mr. Tim Oostdyk, and employee of Lancaster Laboratories. The Laboratory Project Manager will communicate with the Quality Assurance Officer and report to the respective Laboratory Director. In addition, responsibilities of the Laboratory Project Manager include:

1. communicating between the lab 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. Craig A. Kasper, P.E. and Mr. Mark J. Bonifas, P.E. of HAI and Mr. Steve Zervos, P.E. of ISOTEC will serve as the technical advisors for the project. Messrs. Kasper and Bonifas will assist primarily in evaluating contaminant distribution and fate and transport. Mr. Adams will assist in evaluation of bench testing and pilot testing results and design and implementation of the final remedial system.

2.0 MONITORING AND REAGENT APPLICATION WELL INSTALLATION AND GROUND-WATER SAMPLING

2.1 Monitoring and Application Well Construction and Installation Procedures

2.1.1 Monitoring and Application Well Location and Installation

The proposed monitoring well locations are shown in Figure 2. The PMW-8¹ well nest is located so that it can identify VOCs at various depths potentially entering the Site from upgradient sources. The PMW-9 and PMW-10 well couplets are located near to and in a general downgradient location with respect to leach pits LP-2A and LP-2B. These well couplets will be used to provide baseline ground-water quality data and information on contaminant destruction in the immediate vicinity of the apparent source area. Well depths will be based on HAI's field stratigraphic (i.e., boring log) data.

Proposed locations for reagent application well couplets are shown in Figure 2. Proposed application wells PAW-1U¹ and PAW-1L are situated approximately 12 ft. west-northwest (side gradient) of PAW-2U and PAW-2L, which will be installed through the middle of the former leach pit LP2-B, where the highest concentrations of VOCs at the Site were detected. PAW-3U and PAW-3L will be installed approximately 10 ft. east (side- to upgradient) of the PAW-2 couplet, near former leach pit LP2-2A. This positioning of the proposed application wells enables overlap of the treatment zone radii, which will enhance the effectiveness of the treatment method.

During monitoring well installation, soil samples will be collected at five-ft intervals from the surface to a depth of 50 feet below ground surface (bgs). Samples will be collected continuously below a depth of 50 ft. Descriptions of soil samples will be documented consistent with HAI SOP No. F1006 (1999 rev). To the extent that the field geologist suspects the potential presence of non-aqueous phase liquids in soil samples, he or she may conduct field screening using an ultraviolet fluorescence examination and hydrophobic dye shake test consistent with HAI SOP No. F4010 (1999 rev).

2.1.2 Monitoring and Application Well Designation

New monitoring wells will be numbered sequentially beginning with PMW-8. Monitoring wells MW-1, MW-2, MW-3, and the MW-4 and MW-5 well nests were installed during previous

investigations. Individual wells within a nest or couplet will 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, PMW-8U is screened in the uppermost portion of the aquifer. PMW-8M and PMW-8L are screened in progressively lower portions of the aquifer.

Application wells will be numbered sequentially beginning with PAW-1. Individual wells within a couplet will be suffixed with a “U” for upper or “L” for lower depending on relative vertical positions of their well screens.

2.1.3 Equipment and Procedures

2.1.3.1 Split Spoon Soil Sampling

Split-barrel soil sampling is explained in HAI SOP No. F3000 and will be conducted consistent with ASTM Method D 1586-84. Soil samples will be collected at five-ft intervals from the surface to a depth of 50 feet below ground surface (bgs). Samples will be collected continuously below a depth of 50 ft. In addition, a saturated soil sample will be collected from PAW-2U from a depth interval between 58 and 64 ft bgs. One split from the PAW-2U sample will be submitted to the lab for VOC (U.S. EPA Method 8021 B) and TOC (Method 415.1) analysis. The other split will be used for bench testing. Standard Penetration Test (SPT) data will be documented on the boring logs by the field hydrogeologist.

2.1.3.2 Headspace Analysis of Soil Samples

All soil samples will be field screened utilizing a PID equipped with an 11.7 eV bulb or a FID as described in HAI SOP No. F4008 (1999 rev). Soil samples will be screened as soon as possible following sample collection (preferably within ten minutes). The PID or FID will be calibrated in the field according to the manufacturer's specifications.

2.1.3.3 Hollow Stem Auger Drilling

Monitoring and application wells will be installed utilizing hollow stem augers consistent with HAI SOP No. F2000 (1999 rev).

¹Designations for proposed monitoring and application wells have a “P” prefix. The “P” will be deleted from the designation after the well has been installed

2.1.3.4 Disposal of Cuttings and Unused Soil Samples

Excess soil generated will be properly stored and secured according to HAI SOP No. F2013. Auger cuttings 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 or FID, the soils will be stockpiled on-Site and secured under polyethylene sheeting. Soils containing VOCs above background concentrations will be stored on-Site in NYS DOT-approved 55-gallon steel drums and labeled consistent with SOP No. F2013 pending proper disposal.

2.1.3.5 Monitoring and Application Well Construction Specifications

Monitoring and application wells will be installed consistent with HAI SOP No. F2006. Two ground-water monitoring well couplets and one well nest will be installed within the treatment area. Each couplet will consist of two wells installed in the same borehole and the nest will consist of three wells installed in the same borehole. Proposed locations of monitoring wells are shown in Figure 2.

Proposed upper monitoring wells PMW-8U, PMW-9U, and PMW-10U will each have a 15-ft long well screen crossing the ground-water table, with approximately 13 ft of screen below the water table. Proposed monitoring wells PMW-8M and PMW-8L will have screened intervals of 10 ft. Proposed monitoring wells PMW-9L and PMW-10L will have screened intervals of 15 ft. Proposed screen elevations and depths for all of the proposed monitoring wells are summarized in the Work Plan (Section 2.2.2). Vertical separation between nested monitoring wells will be accomplished by installing a bentonite plug in the well bore between the well screens.

Monitoring wells will be constructed of 2-inch inside diameter PVC casing and 0.010-inch slotted PVC screen. Monitoring well construction diagrams are included in Appendix B.

Three application well couplets will be installed in order to deliver an adequate volume of ISOTEC™ reagents to the Area 2 treatment zone. Proposed locations of the application wells are shown in Figure 2. The upper application wells will have 15 ft screens crossing the ground-water table, with approximately 13 ft of the screen below the water table. Lower

application wells will have screened intervals of 15 ft, with the top of the screen approximately two ft below the base of the upper well. Vertical separation between nested application wells will be accomplished by installing a bentonite plug in the well bore between the well screens.

Application wells will be constructed using 2-inch diameter PVC casings and 0.010-inch slotted PVC screens. A generalized application well construction diagram is provided in Appendix B.

All wellheads will be completed slightly below ground surface within a minimum 16-inch flush mount well protector. The wellheads of application wells will need to be placed approximately 4 inches apart within the well protector to allow space for connection of ISOTEC's wellhead assemblies.

2.1.3.6 Well Development

Monitoring and application wells will be thoroughly developed to increase permeability surrounding the well screen and to reduce fines entering the well. The well development methods that may be used include bailing, surging, or over pumping. The method used for each particular well will be determined by HAI based on field conditions. Development will generally be conducted by bailing or surging using the *Watterra* hand pump/tubing system equipped with a surge block. If necessary, an air-lift or bladder pump will be used in addition to the *Watterra* system. Well development will consist of surging then removing a minimum of three to five well volumes. Notes regarding the relative turbidity (visual) and measurements of temperature, pH, and conductivity will be taken following removal of each well volume by the field technician. Well development will be considered complete when clarity of purged water has ceased to improve and consecutive temperature, pH, and conductivity measurements of the purge water stabilize within ten percent. If a well bails dry prior to removing the three to five well volumes, then an attempt will be made to redevelop the well after ground-water recovery. If the well does not recover within a time period of four to eight hours, then development will be considered completed.

2.1.3.7 Disposal of Well Development Water

Purge water generated during development will be contained in NYS DOT-approved 55-gallon closed-top steel drums consistent with HAI SOP No. F2012. The drums will be temporarily staged on the Site pending proper disposal.

2.1.3.8 Monitoring and Application Well Decommissioning Specifications

Monitoring and application wells that require decommissioning will be decommissioned consistent with HAI SOP No. 2010.

2.2 Monitoring and Application Well Sampling

2.2.1 Sample Locations and Frequency

A summary of sampling events is included in Table 1. Ground-water samples will be collected from all newly installed monitoring and application wells and all existing monitoring wells before and after application of the remedial technology. Aliquots of selected samples from the initial round of sampling will be submitted to ISOTEC for use in bench testing. All samples from both rounds of testing will be sent to Lancaster Laboratories for analysis for VOCs. Samples from the application wells and newly installed monitoring wells will also be analyzed by Lancaster Laboratories for total iron, sulfate, TOC, and TDS. Sampling activities will include air monitoring, water level and immiscible layer measurements, well purging, sampling, and field analysis of various parameters on ground water (i.e., pH, specific conductance, temperature, ORP, and dissolved oxygen). Further details of sampling procedures are included in the following discussions. Additional information is included in the QAPP.

2.2.2 Sample Designation

Sample designation is discussed fully in the QAPP, while the basics are given here. Ground-water samples will be identified using a Sample Identification Number (SIN) with the following format:

Project Number : Well Designation : Type of Sample and Date (mmddyy) : Employee Number

The type of sample will be indicated using a single letter: "G" for ground water or "S" for soil.

An example of a valid SIN for a ground-water sample collected during this project from monitoring well MW-8L on August 15, 2000 is as follows:

NMB007:MW8L:G081500:481

Soil sample identification numbers will have the following format:

Project Number : Well Designation : Type of Sample and Depth Interval (ft) : Employee Number

An example of a valid SIN for a soil sample collected during this project between 58.0 and 64.0 feet below ground surface (bgs) in application well AW-2U is as follows:

NMB007:AW2U:S580640:481

2.2.3 Sampling Equipment and Procedures

The procedures that will be performed at each monitoring and application well prior to collecting ground-water samples include:

1. well headspace analysis;
2. measurement for immiscible layers;
3. measurement of the water level within the well;
4. well evacuation (purging); and
5. headspace analysis of purged water.

These items are discussed below and will be performed in the order presented.

2.2.3.1 Well Headspace Analysis

The well headspace will be screened for VOCs with a PID equipped with an 11.7 eV bulb or a FID consistent with HAI SOP No. F3004. Initially, the ambient air will be checked within three feet of the well headspace. After this reading is recorded, the probe will be inserted into the top of the well riser to obtain a second reading. All readings will be recorded on the field log book or the ground-water monitoring data sheets. The readings that are collected will be compared to action levels discussed in the Health and Safety Plan (HASP, HAI Document NMB007.200.0039) and, if necessary, the appropriate health and safety precautions will be initiated.

2.2.3.2 Detection of Immiscible Layers

Floating (light) and/or sinking (dense) nonaqueous phase liquids, if present, will be measured in all wells using an interface probe. Light nonaqueous phase liquids (LNAPL) will be detected by carefully lowering the interface probe into the well until the approximate static water level is reached (i.e., water/immiscible layer interface). Dense nonaqueous phase liquids (DNAPL) will be detected by carefully lowering the probe to the bottom of the well. HAI SOP No. F3006 provides a detailed description of the procedures that will be utilized to detect immiscible layers. As explained in HAI SOP F1000 (1999 rev), the interface probe will be decontaminated by washing with nonphosphate detergent followed by rinsing with potable and then distilled water.

2.2.3.3 Water Level Measurements

A water level indicator will be used to measure the static water level elevation in each well. Alternatively, an interface probe may also be used to obtain water level measurements. Ground-water measurements will be conducted consistent with HAI SOP No. F3005. Each measurement will be taken to the nearest 0.01 foot using the USGS datum from the designated reference point on each well (e.g., top of the protective casing or the top of the flush mount rim). When measuring the total depth of the well with the interface probe, it is necessary to add the distance from the sensor to the tip of the probe to the tape reading. In addition, the volume of water present in the well will be calculated as discussed in HAI SOP No. F3007. A detailed description of the procedures to be followed when collecting water samples is found in HAI SOP No. F3008 (1999 rev). As explained in HAI SOP No. F1000 (1999 rev), the water level indicator will be decontaminated by washing with a nonphosphate/potable detergent water solution, followed by rinsing with potable water, and then distilled water.

2.2.3.4 Well Evacuation (Purging)

Each well will be purged prior to sampling to help ensure that the ground-water sample is representative of saturated zone conditions. All purging procedures will be performed consistent with HAI SOP No. F3007.

Clean gloves will be worn by all personnel handling purging equipment. Clean plastic sheeting will be placed around the well in order to prevent the purging equipment from contacting the ground.

Wells will be purged using a low-flow technique with a stainless steel submersible pump. During purging, the temperature, pH, specific conductance, dissolved oxygen concentration, and ORP of the purge water will be continuously monitored using a flow-through cell attached to the pump discharge line. A minimum of three well volumes of purge water will be removed from each well; however, purging will continue until the parameters referenced above have stabilized within ten percent. In the event a low-yielding well is purged dry before three well volumes are removed and does not recover within a reasonable time period (15 to 30 minutes), then the well will be sampled after sufficient ground-water recovery.

If necessary, the Project Manager may approve alternative purging methods, including but not limited to manual bailing or using hand pumps. Also, the Project Manager may modify the purge water parameters (temperature, pH, specific conductance, dissolved oxygen, and ORP) to be measured.

Non-disposable purging equipment will be decontaminated consistent with HAI SOP No. 1000 (1999 rev). Decontamination will include washing the equipment with a nonphosphate detergent/ potable water solution followed by rinsing with potable water and distilled water.

2.2.3.5 Disposal of Well Purge Water

Purge water generated during ground-water sampling generally will be contained in NYS DOT-approved 55-gallon closed-top steel drums consistent with HAI SOP No. F2012. Drums will be temporarily staged on the Site pending proper disposal.

2.2.3.6 Headspace Screening of Purged Water

Headspace screening of the purge water for VOCs will be performed consistent with HAI SOP No. F4008 (1999 rev). Measured headspace readings will be recorded in the field log book and on ground-water monitoring data sheets.

2.2.3.7 Sample Withdrawal

After purging activities are completed, monitoring and application wells will be sampled directly from the submersible pump discharge line or by using disposable bailers consistent with HAI SOP No. F3008 (1999 rev). Clean gloves will be worn by each individual handling the sampling equipment, and clean plastic sheeting will be placed around the well to prevent sampling equipment from contacting the ground.

Ground-water samples will be collected with disposable bailers in the following manner:

1. The check valve of each bailer will be tested for proper operation with distilled water to ensure that no problems may cause reduced delivery capability or result in sample aeration.
2. A clean length of polypropylene rope or nylon string will be used to lower the bailer into the well and collect the sample.
3. The bailer will not be allowed to free fall into the well, as this may cause degassing of the water on impact.
4. The bailer contents will be transferred to the proper sample containers in a manner that will minimize agitation and aeration.

All sampling equipment including disposable bailers, strings, gloves or other protective clothing, will be properly disposed of after use. Waste sampling equipment will be temporarily stored in plastic trash bags until transported to dedicated waste receptacles.

2.2.4 Sample Handling and Analysis

All sample containers and preservatives will be provided by the laboratory. Specific information on analytical methods and sample containers is provided in the QAPP.

2.2.4.1 List of Analytical Methods

Ground-water samples from all existing wells and the newly installed monitoring and application wells will be submitted to Lancaster Laboratories and analyzed for VOCs in accordance with U.S. EPA SW-846 Method 8021B. Samples from the newly installed wells will also be analyzed for: total iron in accordance with U.S. EPA SW-846 Method 7380, sulfate in accordance with Method 375.4, TOC in accordance with U.S. EPA SW-846 Method 9060, and TDS in accordance with Method 160.1. A summary of analytical methods is included in Table 1.

2.2.4.2 Sample Preservation

Laboratory supplied containers may be prepreserved. Alternatively, the laboratory may supply applicable preservatives to be added to the sample containers in the field by the sampling personnel. In addition, each sample will be placed on ice in a cooler immediately after collection and proper labeling.

2.2.4.3 Special Handling Considerations

Volatile Organics

Samples that are to be analyzed for VOCs will not be transferred from one container to another, as this action could result in the loss of VOCs from the ground-water sample. Sample containers for VOCs will be completely filled with no headspace to minimize the loss of VOCs from the sample.

Blanks

Trip blanks and equipment blanks will be included with the ground-water samples to evaluate if sample handling and sampling equipment have affected the integrity of the ground-water samples.

Trip blanks are applicable only to ground-water samples submitted for VOC analyses. The laboratory will prepare the trip blank with laboratory prepared reagent-grade 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 that contains samples for

VOC analyses. Trip blanks must accompany sample containers during sample collection and transportation.

Equipment blanks will be used to evaluate the effects of the sampling equipment on the ground-water samples. Equipment blanks will be prepared by the following method:

1. The sampling device (e.g., a disposable bailer or disposable pump discharge hose) will be rinsed with distilled water.
2. The equipment blank sample container will be filled by filling the sampling device with distilled water and then transferring it to the sample container, or by pouring the distilled water through the sampling device into the sample container (the distilled water will contact the inside of the sampling device).

The frequency of equipment blank collection for each analytical method will be at least 10% of the investigative samples analyzed for that method each day, with a minimum of one equipment blank per day per method per sampling team. The sample team leader will be responsible for collecting the appropriate number of blanks each day.

If laboratory analysis indicates that contaminants are present in the trip or equipment blanks, the source of the contamination will, if possible, be identified. Corrective action, such as modifying the procedure and/or re-sampling, will then be initiated.

Duplicates

Field duplicate samples will be collected for each analytical method at the rate of one per every ten investigative samples (10%) with a minimum of one per day per method per sampling team. The sample team leader will be responsible for collecting the appropriate number of duplicate samples.

2.2.4.4 Chain-of-Custody

The chain-of-custody program will provide detailed tracking of handling and possession of ground-water samples from field collection through laboratory analysis. Refer to Section 5.0 of the QAPP for a detailed discussion of chain-of-custody procedures. All chain-of-custody procedures will be performed consistent with HAI SOP No. F3014 (1999 rev).

3.0 BENCH TESTING

3.1 Bench Test Objectives

The overall objective of the bench test is to verify that ISOTEC's process is capable of effecting substantial reductions in organic constituent concentrations in the saturated soil and ground-water samples collected from the Site. The specific objectives for the bench test are as follows:

1. demonstrate proof that the oxidative process is effective under site-specific conditions;
2. demonstrate proof of the effectiveness of the oxidative process in the presence of aquifer solids (i.e. soil);
3. demonstrate proof that the oxidative process is capable of achieving significant contaminant destruction; and
4. determine the optimum mix for subsequent pilot scale testing by performing the bench testing using various catalyst/oxidizer amendments.

3.2 Sample Collection

3.2.1 Soil

HAI will collect a saturated soil sample between 58 and 64 ft bgs from PAW-2U. A minimum of 6000 grams of soil should be collected. If 6000 grams cannot be obtained between 58 and 64 ft bgs, additional soil may be collected from depth intervals immediately above and/or below the target interval and composited to obtain sufficient sample volume. One-liter amber jars with screw top caps may be used to collect soils if they are contaminated. If the soils collected are not contaminated, *Zip Lock* bags may be used for sample collection. A portion of the PAW-2U sample will be placed in a 4-oz jar to be used as a baseline sample.

3.2.2 Ground Water

HAI will collect ground water for bench testing from a monitoring well point exhibiting the greatest contamination after three well volumes have been purged. Samples from wells containing free product cannot be used during bench scale testing and shall be excluded. A minimum of 5 liters of ground water should be collected and stored in 1-liter amber glass containers with zero headspace (no preservative to be used). In addition, one sample will be submitted upreserved in a 250-ml amber

glass container with zero headspace. HAI will also collect two samples in 40-ml vials preserved in HCl to be used to establish baseline conditions. Field parameters including depth to water, pH, specific conductance, ORP, dissolved oxygen, and temperature will be measured and recorded throughout ground-water sample collection activities.

3.3 Reaction Vessel Preparation

The laboratory experiments will be performed in 120 ml sealed batch reactors. For each vessel, adequate site soil and ground water will be introduced to achieve 1:1(w/w) soil-water slurry, leaving enough headspace for pre-determined reagent volumes to be injected. The vessels will be sealed with caps fitted with *Teflon* lined septa to facilitate subsequent injections of reagent. Samples of the site soil and ground water will be collected for subsequent analyses to determine the initial concentrations of VOCs in the reaction vessels.

3.4 Bench Test Treatments

The bench scale experiments will be performed by injecting a series of catalyst and oxidizer amendments into the reaction vessels. The stoichiometric molar ratio of the reagent combination utilized will be different in each reaction vessel. The merits of stepwise injection will be compared to single aggressive treatment for each reagent combination used. The lab study monitoring will be conducted by setting up parallel monitoring vessels in a similar manner, which will receive the same doses as the corresponding main reaction vessels. Samples will be periodically withdrawn from the monitoring vessels for hydrogen peroxide analysis. Additional treatments to designated reaction vessels will be injected based on residual peroxide concentrations remaining. One of the reaction vessels will initially be isolated for control purposes and will receive equivalent volume of distilled water to compensate for reagent volumes injected into treatment vessels.

Following the last treatment, all reaction vessels will remain undisturbed at room temperature for 24 hours or until such time that the oxidizer is completely consumed. Soil and ground water from each of the reaction vessels will be analyzed for residual VOC concentrations.

3.5 Sample Analyses

The results from the baseline ground-water samples will establish existing ground-water quality in the pilot study area. In addition, ISOTEC will submit one untreated soil sample to Lancaster Laboratories to be analyzed for Fe, Mn, and TOC concentrations to evaluate native conditions.

The samples generated during bench testing will be submitted to Lancaster Laboratories for VOC analysis. These samples will include:

1. the 40-mL vial field collected ground-water samples
2. the 4-oz jar field collected soil sample
3. the "initial conditions" soil and ground-water samples collected during preparation of the reactor vessels;
4. "control" sample from the reactor vessel to which only distilled water was injected; and
5. the treatment samples from the reactor vessels to which varying volumes of catalyst and hydrogen peroxide were injected.

Results of analyses performed on these samples will be evaluated to determine if the objectives of the bench testing have been achieved. Bench testing results will be considered in the context of Site-specific geochemical and hydrogeologic conditions to identify an appropriate reagent dosage for each of the application wells.

4.0 PILOT TESTING

4.1 Field Application Objectives

The overall field application objective is to evaluate the ISOTEC™ process under Site conditions as an applicable Site-wide remediation technology and to significantly reduce the mass of contaminants of concern in the upper hydrogeologic zone in the vicinity LP-2B (Figure 2). The applicability of the ISOTEC™ process as a feasible remediation technology for reducing ground-water impacts in the treatment area at Area 2 will be initially determined by evaluating Site data and information and by conducting an ISOTEC™ bench test on representative saturated soil and ground-water samples from the treatment zone. Evaluation of treatment area data collected before the application (baseline data) will facilitate the project objective. Results of baseline ground-water sampling and monitoring, ground-water monitoring during the treatment process, and post-treatment ground-water sampling in the proposed treatment area will provide the measure for the effectiveness of the field application at the Site.

In addition to evaluating the overall effectiveness and contaminant reduction potential of the ISOTEC™ process, other Site-specific elements will be evaluated during the field application. They include (1) Site permeability (observed application well radius of influence), (2) verifying Site-specific ISOTEC™ reagent requirements and optimal flow rates, (3) well treatment volume, and (4) contaminant reduction potential per application.

Verify the permeability of the impacted formation material

This will be accomplished through the measurement of the rate at which ISOTEC™ conditioning agents and oxidizer can be added to the formation through the application well. Permeability is important to the effectiveness of the ISOTEC™ process because it will govern the field time required for application and is a factor in determining the lateral extent of formation material that can be treated from one application well.

Validate Bench Test Assumptions for Reagent Requirements

The quantities of conditioning agents and oxidizer needed for application of ISOTEC™ reagents at the application well are estimated for the field application based on the results of the bench test and

previous experience at similar sites. The amount of conditioning agents and oxidizer needed during each application will be verified during the first reagent application event. This will be accomplished by the periodic measurements of dissolved oxygen, ORP, specific conductance, and pH during the field application.

Estimate Application Well Treatment Volume

The lateral extent of formation material that can be treated from one application well will be determined by the field measurements of dissolved oxygen, ORP, specific conductance, and pH, (and eventually, laboratory measurements of petroleum constituents in ground-water samples) at wells located at varying distances from the application wells.

Estimate Contaminant Reduction Potential Per Application

This will be determined primarily by the concentration of VOCs detected from observation wells as compared to the levels of VOCs prior to the ISOTEC™ process application. Contaminant reduction potential is important because it will determine the number of applications needed to meet Site-wide remediation objectives. ISOTEC expects that the organic contaminant reduction will range from 60% to 80%. The reagent formulation anticipated for the field application may be altered based on the results of the planned bench testing.

4.2 Pilot Study Procedure

Application of ISOTEC™ reagents will be conducted in the upper saturated zone (treatment zone) within Area 2. This section provides descriptions of technical elements necessary to implement the field application and achieve the application objectives.

Following completion of bench testing and review of bench test data, several technical tasks will need to be completed before, during, and following the ISOTEC™ reagent application events at the Site. These tasks include (1) installation of ground-water monitoring wells and ISOTEC™ application wells, (2) baseline monitoring, sampling, and laboratory sample analysis of ground water; (3) application of conditioning and oxidizer reagents, and ground-water monitoring performed during the application, (4) ground-water monitoring, sampling, and laboratory sample analysis following the application, and (5) technical reporting. Technical elements are described within the section text below.

4.2.1 Ground-water Monitoring and Application Well Installation

Ground-water monitoring well installation procedures are described in Section 2 of this document. Proposed locations of monitoring wells are shown on Figure 2.

4.2.2 Baseline Ground-water Monitoring and Sampling

Prior to baseline sampling activities, the soil vapor extraction system currently operating in Area 2 will be shut down for the duration of ISOTEC™ application fieldwork. HAI will perform baseline ground-water parameter monitoring and collect ground-water samples and one saturated soil sample for laboratory analysis prior to ISOTEC's application of the remedial technology. Baseline ground-water samples will be collected from all existing wells and the newly installed wells using the methods outlined in Section 2.2. Measured ground-water parameters will include depth to ground water, pH, specific conductance, dissolved oxygen, temperature, and ORP. The saturated soil sample will be collected between 58 and 64 ft bgs from PAW-2U.

Following sample collection, ground-water samples will be shipped to Lancaster Laboratories and analyzed for VOCs, total iron, TOC, and TDS. The soil sample will be analyzed for VOCs and TOC. Results of initial ground-water monitoring and sample analysis will serve as the baseline conditions for the chemical oxidation field application.

ISOTEC will collect baseline air quality parameters in the upper headspace of all application area wells immediately prior to applying ISOTEC™ reagents. Air parameters to be monitored will include percent carbon dioxide, lower explosion limit (LEL), percent oxygen, and VOCs (through PID or FID screening).

Following installation of the application wells, baseline monitoring, and ground-water sampling and analysis, ISOTEC will review the baseline data and other newly acquired Site data prior to mobilizing to the Site. A full review of all pertinent Site data is needed to evaluate and finalize the application formulation and design.

4.2.3 ISOTEC™ Reagent Application

ISOTEC™ reagents will be added to the application wells to effect mass reductions of constituents of concern in the treatment area. ISOTEC employees will complete fieldwork under their own Site-specific Health and Safety Plan (HASP). Prior to beginning field activities, HAI and ISOTEC will conduct an initial health and safety meeting for all associated field personnel. The meeting will include discussions of general health and safety, issues specific to the Site's constituents of concern and other hazards, and issues specific to the ISOTEC™ process application. A copy of ISOTEC's HASP will be made available to all associated field personnel prior to pilot test field activities.

One cycle of ISOTEC™ treatment will be completed at each application well. A second cycle may be conducted if deemed necessary after reviewing the results obtained from the first cycle. Groundwater depth, pH, ORP, specific conductance, dissolved oxygen, temperature, and air quality parameters will be measured by ISOTEC at monitoring and application wells in the vicinity of the treatment area prior to conditioning and oxidation reagent application. Monitoring will continue at regular intervals in the treatment area monitoring wells during the oxidation reagent application process.

Following initial monitoring, ISOTEC will fit each application well with a wellhead seal that includes a riser fitted with two valves. One part of this riser is attached to the aboveground containers of reagents, and the other is used as a reaction vapor off-gassing vent. Catalyst and oxidation reagents will be applied separately to the application wells.

ISOTEC will introduce a patented catalyst formulation consisting of a chelated iron solution. The chelating compound maintains the iron catalyst in a catalytic form without the need to lower aquifer pH. Approximately 100 to 200 gallons of catalyst will be added to each application well per well treatment event. The exact amount of catalyst to be added will be determined during bench testing.

ISOTEC will apply hydrogen peroxide at a concentration ranging from 10% to 20%. The estimated volume of hydrogen peroxide to be applied to the Site will be finalized following review of bench testing results.

The acidified matrix coupled with the proper ferrous ion density will cause the peroxide to decompose into a hydroxyl radical in an exothermic reaction. The vertical depth of travel for the reaction is generally based on the hydrogeological conditions of the screened interval at which the ISOTEC™ reagents are applied. The reagents will be applied to the upper saturated zone, approximately 50 feet to 70 feet below ground surface (treatment zone). The application process of conditioning reagents is expected to be completed within one to two days. Application of hydrogen peroxide will be completed during the remaining scheduled fieldwork.

An increase in temperature due to exothermic reaction is expected to be limited to the treatment zone within a few feet of the application wells. However, changes in other ground-water parameters are expected at nearby downgradient treatment area monitoring wells. Following treatment, the effects of dilution by ground-water movement work to shift pH toward background levels. Long-term pH effects are avoided by using a dilute acid solution in the conditioning process. The pH effects created within the treatment volume are expected to subside within several days to a month following treatment. The iron effect is limited to the treatment area surrounding the application points and has been observed at other sites to decrease in concentration over several months to background levels. Decreased formation permeability as a result of oxidation treatment has not been observed at other ISOTEC™ project sites.

Off gassing will occur during the application events. ISOTEC will monitor off-gassing vapors in the breathing zone and headspace of monitoring wells at regular intervals during the application events. Air monitoring will also be completed as needed within the nearby equipment compound and shed. Air monitoring parameters to be measured will include VOCs (via PID or FID screening), percent oxygen, percent carbon dioxide, and LEL. Other observations made during applications include, but are not limited to, excessive pressures and temperatures at the wellheads and fluid short-circuiting to the surface indicating mounding of ground water

4.2.4 Post-Treatment Sampling

HAI will perform post-treatment ground-water sampling and analysis approximately one week following completion of the ISOTEC™ treatment, and again at approximately three weeks following treatment. Ground water will be collected from the MW-5 and PMW-8 well nests, PMW-9, and PMW-10 well couplets, and all application wells. Following sample collection, ground-water

samples will be immediately shipped to Lancaster Laboratories and analyzed for VOCs. Samples from the new monitoring and application wells will be analyzed for total iron, sulfate, TOC, and TDS.

5.0 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.

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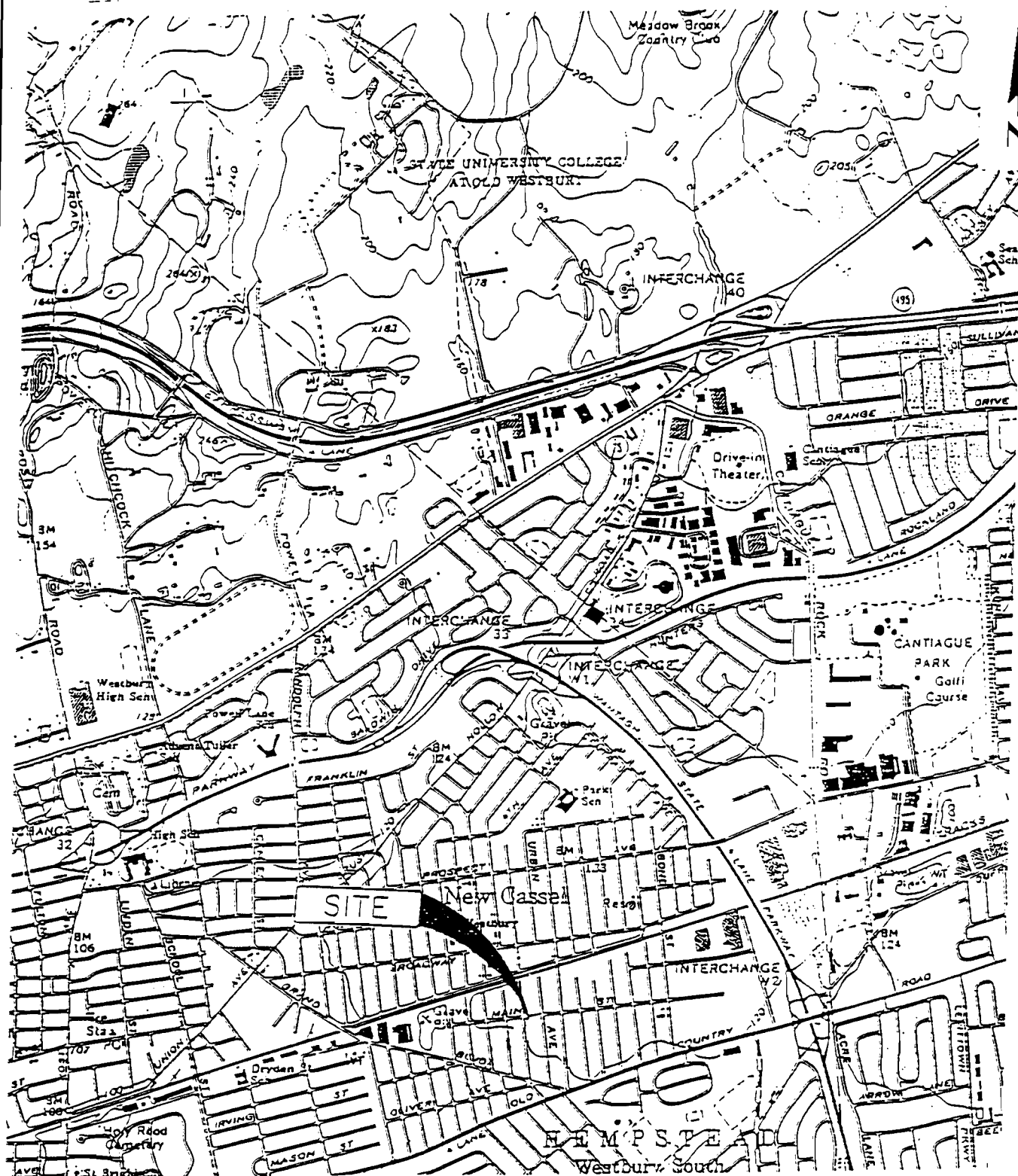
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FIGURES



SCALE: 1" = 2000'
 SOURCE: USGS 7.5 MIN. QUADRANGLE
 HICKSVILLE, NEW YORK - 1967
 (PHOTOREVISED - 1979)

0 500 1000 2000
 SCALE IN FEET

FIGURE 1

Hull & Associates, Inc.
 MASON, OHIO

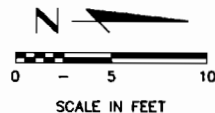
570 MAIN STREET PROPERTY
 FIELD SAMPLING AND ANALYSIS PLAN

SITE LOCATION MAP

WESTBURY, NEW YORK

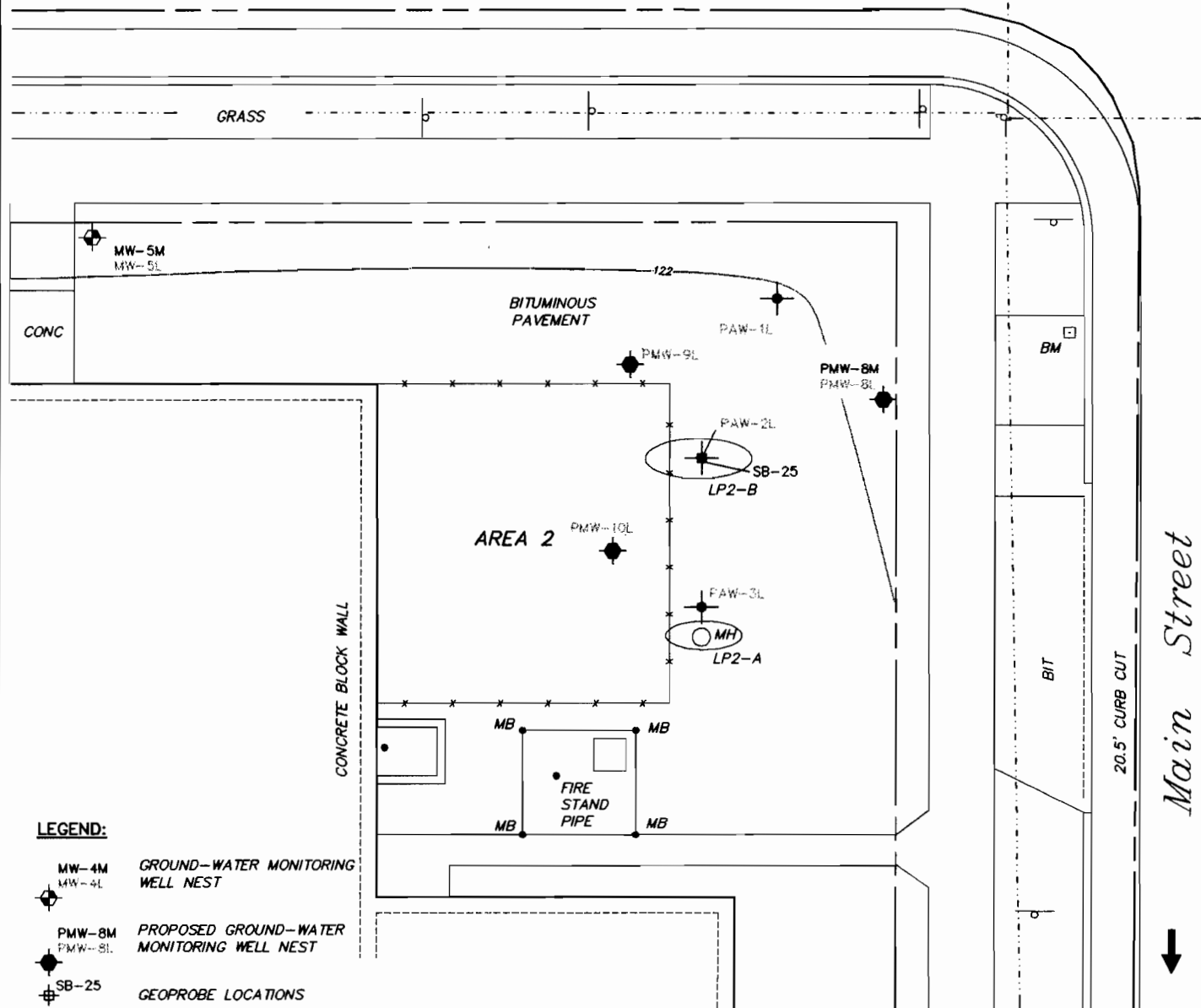
DATE:
 APRIL 2001

PROJECT:
 NMB007



Swalm Avenue

GP-20
(APPROXIMATE
LOCATION)



LEGEND:

- MW-4M**
MW-4L GROUND-WATER MONITORING WELL NEST
- PMW-8M**
PMW-8L PROPOSED GROUND-WATER MONITORING WELL NEST
- SB-25** GEOPROBE LOCATIONS
- PAW-1L** PROPOSED REAGENT APPLICATION WELL COUPLET
- OVERHEAD WIRES
- PROPERTY LINE
- CHAIN LINK FENCE
- TRAFFIC FLOW
- UTILITY POLE WITH GUY WIRE
- MB** METAL BUMPER
- BM** BENCHMARK "B" CUT ON
- CATCH BASIN. ELEVATION = 121.59'
- NASSAU COUNTY DATUM
- MANHOLE

FIGURE 2

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FIELD SAMPLING AND ANALYSIS PLAN

PROPOSED GROUND-WATER MONITORING
WELLS AND REAGENT APPLICATION WELLS

WESTBURY, NEW YORK

DATE:
MAY 2000

PROJECT:
NMB007

NMB007.200.0017
5/24/00 db
UNIT 3 DISK 1

PLATE

TABLE

TABLE 1. SUMMARY OF SAMPLING EVENTS AND ANALYTICAL METHODS

FIELD EVENT	SAMPLING LOCATION	LABORATORY ANALYSIS	FIELD PARAMETERS
Baseline Monitoring, Ground-Water Sampling and Analysis	All monitoring and application wells	VOCs (8021B)	WL, pH, ORP, SC, DO, Temp, Air Monitoring
	PMW-8 nest, PMW-9, -10 couplets, and PAW-1, -2, -3 couplets	Iron (7380), Sulfate (375.4), TOC (9060), TDS (160.1)	
Baseline Soil Sampling and Analysis	PAW-2U; Saturated soil sample between 58 and 64 ft bgs	VOCs (8021B), TOC (415.1)	Soil description, Standard Penetration Test
Reagent Application Monitoring	All monitoring and application wells	Not Applicable	WL, pH, ORP, SC, DO, Temp, Air Monitoring
Post-Treatment Monitoring, Ground-Water Sampling and Analysis	All monitoring and application wells	VOCs (8021B)	WL, pH, ORP, SC, DO, Temp
	PMW-8 nest, PMW-9, -10 couplets, and PAW-1, -2, -3 couplets	Iron (7380), Sulfate (375.4), TOC (9060), TDS (160.1)	

VOCs = volatile organic compounds

TOC = total organic carbon

TDS = total dissolved solids

WL = ground-water level

ORP = oxidation reduction potential

SC = specific conductance

DO = dissolved oxygen

Temp = temperature

Air Monitoring = carbon dioxide, lower explosion limit, oxygen, photo-ionization monitoring

APPENDIX A

Hull & Associates, Inc.
Standard Operating Procedures

List of Standard Operating Procedures

F1000 (1999 rev)	Decontamination of Field Equipment
F1006 (1999 rev)	Field Soil Classification/Description
F2000 (1999 rev)	Overburden/Glacial Drilling - Utilizing Hollow Stem Augers
F2006	Monitoring Well Installation - Overburden Wells
F2010	Overburden/Glacial Monitoring Well/Piezometer - Decommissioning
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
F3004	Well Headspace Analysis
F3005	Ground-water Level Measurement
F3006	Immiscible Layer Detection and Measurement
F3007	Monitoring Well Purging
F3008 (1999 rev)	Ground-water Sample Collection
F3014 (1999 rev)	Chain-of-Custody Procedures
F4008 (2000 rev)	Soil/Water Sample Headspace Screening with a Photoionization Detector or a Flame Ionization Detector
F4010 (1999 rev)	Visual Detection of Non-Aqueous Phase Liquids (NAPL) in Soils and Ground Water

SOP No. F1000 (1999rev)
DECONTAMINATION OF FIELD EQUIPMENT

1.0 Purpose

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

Decontamination will be performed as both a quality assurance measure and as a safety precaution. Specifically, the purpose for these decontamination procedures is to minimize the potential for cross contamination between sampling locations and prevent potentially contaminated materials from being transported off-site.

2.0 Equipment and Materials

Equipment and materials required for decontamination of field equipment may include, but will not necessarily be limited to:

- high-pressure steam cleaner;
- cleaning fluids: non-phosphatic soap and/or detergents, potable water, distilled/deionized water;
- shovels and brushes;
- paper towels;
- disposable gloves;
- waste storage containers: plastic bags, drums, boxes;
- cleaning containers: plastic buckets, etc.;
- plastic sheeting; and
- personal protective equipment.

3.0 General

- A. All decontamination will be performed under the assumption that the equipment is contaminated. At a minimum, clean, unused vinyl or latex gloves will be worn during all decontamination activities. Additional personal protective equipment will be worn as required.
- B. An adequate supply of all decontamination equipment and materials will be available on site.
- C. All equipment will be decontaminated before leaving the site.
- D. Decontamination of vehicles or large equipment will generally be conducted in a designated area. Smaller equipment may be decontaminated at the sampling location.

- E. All decontamination materials that cannot be re-used will be properly packaged for disposal based on the nature of contamination.

4.0 Procedures

The following sections present the minimum procedures that will be used to decontaminate field equipment. 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 coming in contact with potential contamination, both as part of subsurface equipment advancement and aboveground contact with drilling fluids, extracted soils, ground water, drill rig lubricants and fuels, etc., will be decontaminated prior to use. At the discretion of the Project Manager, decontamination of the entire drilling rig may be required due to the adherence of foreign substances as a result of operations, transportation from off-site, or travel between soil boring locations.
- B. A high-pressure steam cleaner will be used to clean the 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 until such time as it can be properly disposed of.
- D. The date, time, and decontamination procedure used will be recorded on the boring log, daily field report or in a field notebook.

4.2 Sampling Equipment (split spoons, trowels, etc.)

Sampling equipment will be decontaminated between sample locations and sample intervals to minimize the potential for cross-contamination.

- A. The sampler will be completely disassembled and any adhered soil will be removed.
- B. The sampler will be placed in a bucket containing a non-phosphatic soap and water (e.g., *Liquinox*™) and scrubbed until visibly clean. The soap and water will be changed as necessary.
- C. The sampler will then be thoroughly rinsed with potable water until all soap solution is removed. All rinse water will be collected and containerized.
- D. The sampler will be reassembled and given a final rinse with distilled/deionized water.

- E. If the sampler is not to be used immediately it must be stored in a location or manner that will prevent it from becoming re-contaminated.

4.3 Ground-water Pumps

This procedure will be employed to decontaminate the non-dedicated pumps that are used during well purging, development, and sampling operations.

- A. Any dedicated tubing that was used with the pump will be removed and properly discarded.
- B. All exterior surfaces will be wiped with clean paper towels and any extraneous materials will be removed using a stiff brush.
- C. The pump and all associated downhole equipment will be placed in a suitably sized container of non-phosphatic soap (e.g., *Liquinox*™) and potable water. If the tubing on the pump is to be re-used, the pump will be turned on to circulate the solution through the pump and tubing.
- D. The pump will then be thoroughly rinsed with potable water. If the tubing on the pump is to be reused then the pump will be turned on until the internal portions of the pump and tubing are free of cleaning solution. The last rinse applied to the pump system will always be distilled water.
- F. The pump and associated downhole equipment will be properly stored to ensure that the system remains clean during transportation to other well heads. The pump will not be allowed to come in contact with the ground at any time during handling and transportation. If this occurs, the pump and associated downhole equipment will be re-cleaned.
- G. All liquids and waste materials produced during this operation will be properly stored and disposed of as determined by the Project Manager.

4.4 Bailers

This section documents the procedures that will be followed to decontaminate non-dedicated bailers used for purging or sampling ground water.

- A. The bailer will be scrubbed with non-phosphatic soap and water solution. The inside of the bailer will be scrubbed with a cylinder brush to ensure that interior walls are thoroughly cleaned.
- B. The bailer will be rinsed with potable water until it is free of the soap solution. A final rinse of distilled water will then be applied.
- C. The bailer will be properly stored if it is not to be immediately used. To properly store the bailer, the entire bailer will be placed in its dedicated storage tube or wrapped in inert material (e.g., *Saran* wrap, aluminum foil, etc.).

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

4.5 Well Casing and Screen Pre-Installation Decontamination Procedures

This section documents the procedures that will be followed to decontaminate well construction materials prior to installation. The following procedures apply to both PVC and Type 304 stainless steel casing and screen materials.

- A. All personnel handling the well materials must wear clean and unused vinyl or latex gloves.
- B. The well casing and screen will be removed from the packaging. The well materials will be placed on clean sawhorses or equivalent support device. The well materials will be washed with a clean stiff brush and a non-phosphatic soap and water solution (e.g., *Liquinox*™).
- C. The well materials will then 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 will remain on the saw horses until well construction commences.

4.6 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

SOP No. F1006 (1999rev)
FIELD CLASSIFICATION AND DESCRIPTION OF SOILS^a

1.0 Purpose

This SOP summarizes specific procedures for characterizing the most critical soil properties, pursuant to appropriate ASTM standards, to be used to visually classify and describe soils in the field. These soil properties include: soil density or consistency (depending on soil type), soil color, textural classification, moisture content, and other selected physical properties.

2.0 Equipment and Materials

- Pocket penetrometer
- ASTM D 2488-93 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- Dropper bottle with diluted (10%) HCl
- Knife or spatula
- Measuring tape or rule (0.10 foot divisions)

3.0 Procedures

In general, soil descriptions shall be written in the following format, using the procedures outlined herein:

- density or consistency classification/color/second major textural 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.*

A. DENSITY OR CONSISTENCY CLASSIFICATION

Density or consistency classification of soils is determined using blow-count (N-value) data, when available, and is a function of cohesiveness or non-cohesiveness as described in Tables A-1 and A-2 below.

^a Unless otherwise noted, all terms used in this SOP are derived from and defined in References 1, 2, and 3 listed in Section 6.0.

Table A-1

Density of Cohesionless Soils		
When N-Values Available ^{ref. 4}		When N-Values Not Available
<u>N-Value Range</u>	<u>Density Adjective</u>	No such classification available in ref. 2
0-10	loose	
11-20	medium dense	
21-30	med. dense to dense	
31-40	dense	
41-50	dense to very dense	
>50	very dense	

Table A-2

Consistency of Cohesive Soils		
When N-Values Available ^{ref. 5}		When N-Values Not Available ^{b,c}
<u>N-Value Range</u>	<u>Consistency Adjective</u>	
<2	very soft	<u>Very soft</u> - thumb will penetrate more than 1 in.
2-4	soft	<u>Soft</u> - thumb will penetrate about 1 in.
5-8	medium stiff	<u>Firm</u> - thumb will indent soil about 1/4 in.
9-15	stiff	
16-30	very stiff	
>30	hard	<u>Hard</u> - thumb will not indent soil but readily indented with thumbnail
		<u>Very Hard</u> - thumbnail will not indent soil

If blow count data are not available, the Visual-Manual procedures shall be used for cohesive soils. Soils are to be described in the field using flow-charts in Figures 1a, 1b and Figure 2 of Reference 2 (ASTM 2488-93). This visual manual procedure does not apply to non-cohesive soils.^{d,e} Additionally, per Note 15 of Reference 2, textural classification may be further defined using percentages (by weight) of gravel, sand, and fines, as follows:

- Trace - particles of a given size range present, but present at < 5%
- Few - 5 to 15%
- Little - 15 to 25%
- Some - 30 to 45%
- Mostly - 50 to 100%

^b Taken from Table 5 of reference 2.

^c If available, a pocket penetrometer may be used in lieu of this table. The penetrometer is to be used in accordance with the manufacturer's suggested methodology

^d A *cohesionless soil* is one that, when unconfined, has little or no strength when air-dried and has little or no cohesion (shear strength) when submerged. A *cohesive soil* is one that, when unconfined, has considerable strength when air-dried and has significant cohesion when submerged.

^e As described in detail in reference 3, N-values are the blowcount representation of the penetration resistance of the soil. Specifically, the N-value - reported in blows per foot - equals the sum of the number of blows required to drive a 2" outside-diameter, 1-3/8" inside-diameter split-barrel sampler over the depth interval of 6 to 18 inches (i.e., the two lowermost 6" intervals for an 18"-length split spoon). As described in Reference 3, the sampler is driven by means of a 140-pound weight falling freely through a vertical distance of 30 inches.

B. SOIL COLOR

Color descriptions are to be made subjectively at the discretion of the field professional. Color can vary depending on moisture content; therefore, it is important to note moisture content when describing color. If the sample contains layers or patches (e.g., mottling) of varying colors, this shall be noted and all representative colors shall be described. Color contrasts are commonly observed in lacustrine deposits where varves are present from seasonal depositional events.

C. TEXTURAL CLASSIFICATION (AND PARTICLE-SIZE RANGES)

Particle size ranges defined by ASTM as follows:

-	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)
-	Fines ^f : Silt	-	0.005mm to 0.074mm
	Clay	-	Less than 0.005mm

Textural composition of fines (particles < 0.074 mm) is determined by the degree to which fines exhibit *plasticity* (putty-like properties), as described Table C-1. If soil is non-plastic or only very slightly plastic, fines are considered to be primarily silt; however, if soil clearly exhibits plastic character, fines are considered to be primarily clay.

Table C-1

Criteria for Describing Plasticity ^g	
Description	Criteria
Non-plastic	A 1/8-in. (3-mm) thread cannot be rolled at any water content).
Low	The thread can barely be rolled and the lump cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit. ^h
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading

^f Particle size ranges for silt- and clay-sized particles are derived from reference 6.

^g Table 11 from Reference 2 (ASTM 2488).

^h Plastic limit is defined as the water content, in percent, of a soil at the boundary between plastic and brittle states. The water content at this boundary is the water content at which soil can no longer be deformed by rolling into a 1/8-in. diameter thread without crumbling (ASTM 4318).

	to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

If required or desired, Tables C-2 through C-5 can be used to describe soil dry strength, dilatancy, toughness and group symbology, respectively.

Table C-2

Criteria for Describing Dry Strengthⁱ	
Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger. Pressure. Specimen will break into pieces between thumb and a hard surface
Very high	The dry specimen cannot be broken between the thumb and a hard surface

Table C-3

Criteria for Describing Dilatancy^j	
Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

ⁱ Table 8 from Reference 2 (ASTM 2488).

^j Table 9 from Reference 2 (ASTM D2488).

Table C-4

Criteria for Describing Toughness ^k	
Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

Table C-5

Identification of Inorganic Fine-Grained Soils from Manual Tests ^l			
Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot be formed
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

In summary, and in terms of textural classification, the major soil constituent (>50% by weight) is the principle noun, i.e. gravel, sand, silt, or clay. The second major constituent is an adjective to the principle noun and lesser constituents, if present, follow the noun. Do not use more than one adjective (i.e., modifier) to the principle noun. For example, if clay content within the fine-sized fraction is sufficient such that clay dominates soil properties (i.e., soil plasticity and other characteristics), clay becomes the principal noun and the other major soil constituent(s) become modifier(s); e.g., silty clay. If present, other minor soil constituents (e.g., sand and gravel) may then be included in the description in accordance with the above particle-size ranges above, e.g., silty CLAY, trace of sand, little gravel. Do not use multiple modifiers as in this example where gravelly in becomes the multiple modifier (e.g., gravelly silty CLAY with a trace of sand).

D. GROUP SYMBOLS

USCS group symbols e.g., CL, ML, SM, GW, etc., will not be used on field logs. However, if samples are analyzed in the laboratory and texturally classified according to the appropriate ASTM standard, then such group symbol(s) may then be entered onto the log for report-presentation purposes.

E. MOISTURE CONTENT

Moisture contents may be written as dry, moist or wet as described below:

- Dry- apparent absence of moisture, dusty, dry to touch
- Moist- damp, but no visible water
- Wet- visible free water, usually soil is below water table

^k Table 10 from Reference 2 (ASTM D2488).

^l Table 12 from Reference 2 (ASTM D2488).

F. OTHER PHYSICAL CHARACTERISTICS

For description of physical soil properties other than density or consistency, color, texture, or moisture, see the following tables in Reference 2 for the following parameters:

- Particle angularity or shape - Tables 1 or 2
- Soil reaction with hydrochloric acid (HCl) - Table 4
- Strength of soil cementation - Table 6
- Structural criteria – Table 7

Other soil characteristics that should be noted and described, if observed, include: fractures, fracture fillings, laminations, varves, organic content, oxidation, mineral fillings, sorting, root holes, worm borrows, and any evidence of potential contamination such as odors or sheens.

G. SAMPLE-TYPE DESIGNATIONS:

Methods by which soil samples are collected for analysis are to be abbreviated as follows:

- AS- Auger Sample - Directly from auger flight.
- BS - Miscellaneous Samples - Bottle or Bag.
- SP - Split Spoon Sample - ASTM D 1586-67.
- LS - Liner Sample (brass liners) liner inserts 3 or 6 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.
- DP- Direct Push Sample- 4 foot Macro Core or 2 foot acetate-lined sampler.

4.0 Documentation

Sample identification will be documented on the soil boring logs.

5.0 Special Notes

It is important to measure the length of recovery when collecting soil samples with a split spoon or similar device, preferably in tenths of a foot. It is assumed that if sample recovery is less than 100%, the portion of the sample that is missing is from the bottom of the sampling interval and NOT the top. For example, if the sampling interval is 6 to 8 feet and 1.5 feet of recovery is measured, it is assumed that the sample represents the interval from 6 to 7.5 feet. The description for the missing portion must be inferred based on the description above and below the missing interval.

6.0 Applicable Standards and References

1. ASTM Standard D 653-96, "Standard Terminology Relating to Soil, Rock, and Contained Fluids," In: *ASTM Standards on Environmental Sampling*, Second Edition, 1997, Philadelphia, PA. Pages 920-954.
2. ASTM Standard D 2488-93, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)," In: *ASTM Standards on*

Environmental Sampling, Second Edition, 1997, Philadelphia, PA. Pages 103-113.

3. ASTM Standard D 1586-84 (Reapproved 1992), "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils," In: *ASTM Standards on Environmental Sampling*, Second Edition, 1997, Philadelphia, PA. Pages 141-145.
4. McCarthy, D.F., 1988, "Essentials of Soil Mechanics and Foundations: Basic Geotechnics," third edition, Prentice-Hall publishers, 614 pages.
5. Naval Facilities Engineering Command, 1986, "Soil Mechanics," Design Manual 7.01, Revalidated by change 1, September 1986.
6. ASTM Standard D 4318, "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils."

SOP No. F2000 (1999rev)
OVERBURDEN/GLACIAL DRILLING USING HOLLOW-STEM AUGERS

1.0 Purpose

This section documents the procedures for advancing hollow-stem augers in unconsolidated materials to collect geotechnical and hydrogeologic data and to install ground-water monitoring wells, piezometers, ground-water extraction wells, sparging wells, and soil vapor probes.

2.0 Equipment and Materials

The driller shall provide a drilling rig with hollow-stem augers appropriate for the tasks requested by the project manager. The inside diameter (I.D.) of the hollow-stem augers will be specified in the work plan or project operation plan. The following equipment will be on-site and provided by the drilling contractor.

- drilling rig with appropriate drilling capacity;
- drill rods, minimum size equivalent to the "A" rod, with an outside diameter (O.D.) of 1-5/8 inches and an I.D. of 1-1/8 inches;
- hollow-stem augers;
- hollow-stem auger center plug;
- drive hammer, 140 pounds (± 5 pounds);
- 18- or 24-inch-long split-spoon barrel samplers or five-foot length continuous samplers;
- thin-walled Shelby tubes;
- tri-cone roller;
- water tank and pump; and
- steam cleaner, 5-gallon buckets, brushes, and nonphosphate detergent.

In addition, the drilling contractor will provide the following equipment if requested or necessary:

- steel bailer;
- auger finger baskets;
- drive hammer, 300 pounds (± 5 pounds); and
- rock coring equipment.

3.0 Procedures

The boring will be installed by rotating the hollow-stem augers to the desired depth to collect soil samples or install a well, piezometer, or probe. While drilling, the hollow-stem auger center plug and drill rods will be inserted in the auger stem to minimize soil cuttings from entering the augers. Waste soil/overburdened material from drilling will be properly disposed of as directed by the project manager.

Soil samples will be collected by drilling to the top of the desired sampling interval and a split spoon or Shelby tube sampler advancing through the lead auger into undisturbed soil/overburden material. Split spoon samples will be collected in accordance with ASTM D1586, and Shelby tube samples will be collected in accordance with ASTM D1587. Alternatively, five-foot continuous samplers can be advanced as the augers are advanced. The sampler will be retrieved following each five-foot auger run.

The driller will be prepared to minimize the effects of heaving sands during drilling operations by using auger finger baskets in place of a center plug to minimize heave into the augers, or by removing heaving sand from the augers with a steel bailer. Potable water will be added to the augers to control heave only if approved by the project manager. The project manager must approve any other methods for controlling heaving sands.

If an obstruction is encountered, the driller will attempt to penetrate the obstruction using the tri-cone roller bit, coring device, or other acceptable equipment as directed by the project manager. If attempts to penetrate the obstruction are unsuccessful, the boring will be decommissioned in accordance with HAI SOP No. F 2022, and reinstalled at an upgradient location.

Hollow-stem augering will be employed **without** the use of drilling fluids unless approved by the project manager. When water is used in the drilling operations, it will not be recirculated into boring unless approved by the project manager. Water produced from this operation will be properly contained and disposed of as directed by the project manager.

If a well, piezometer or probe is not installed, each boring will be decommissioned in accordance with HAI SOP F2022.

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 generally the preferred technique for performing soil investigations and well/piezometer installations. However, certain physical site characteristics may preclude use of this technique. These characteristics include depth to ground water, soil characteristics (e.g., heaving sands) and spatial limitations for drilling equipment. In addition, hollow-stem augering may cause excessive smearing of the boring in some clayey soils. The smearing effect may tend to reduce hydraulic communication between saturated zones and the screened intervals of monitoring wells and piezometers. Consequently, additional well development may be required to remove the smear zone.

6.0 Applicable Standards and References

ASTM D1452, Standard Practice for Soil Investigation and Sampling by Auger Borings

ASTM D5784, Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices

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-ring¹
- Two or four-inch diameter, 0.01-inch continuously slotted Type 304 stainless steel or Schedule 40 PVC well screen², flush-threaded joints with O-ring
- Type 304 stainless steel or PVC bottom cap
- Sodium-bentonite clay pellets or chips
- Clean filter sand³
- 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.
- B. After the sand cushion is in place, the well column will be assembled and installed.

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

²The 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.

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

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

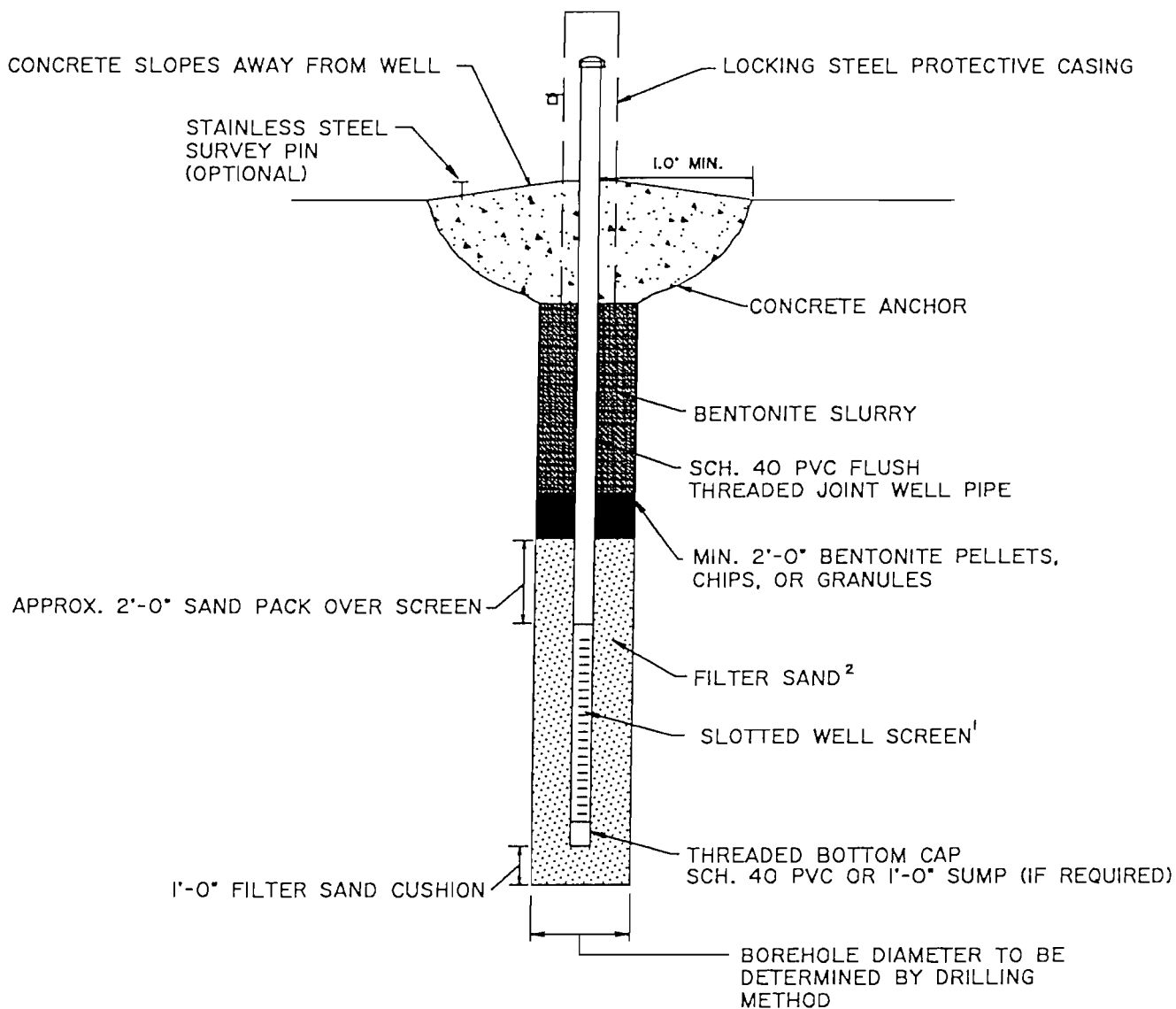
Well installation data will be recorded on the soil boring log or appropriate form. Installation details will include the total depth of the boring, the depth to the top and bottom of the well screen, the type of sand pack, the depth to top and bottom of the sand pack, the type of grout, the depth to 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

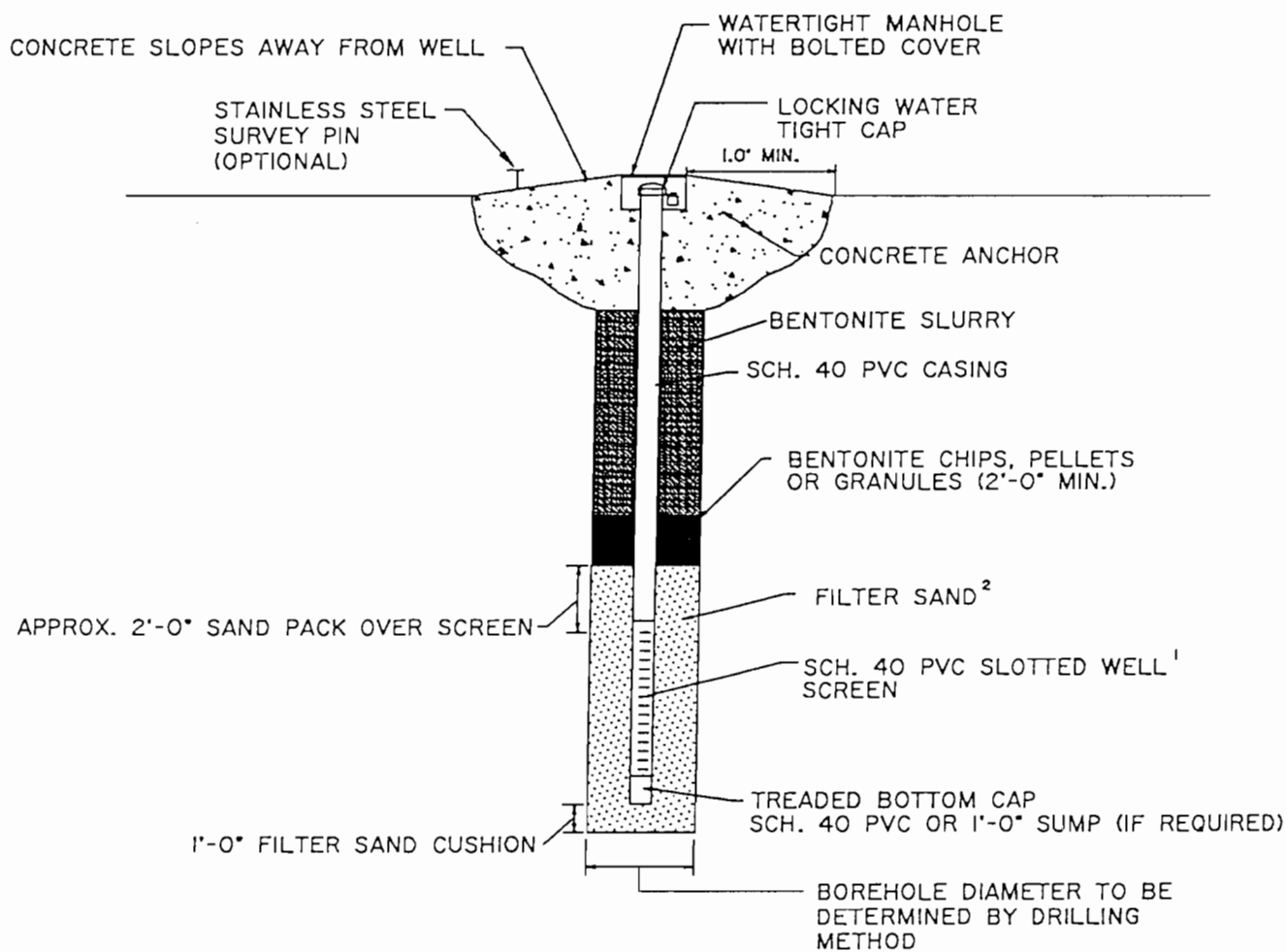
Hull & Associates, Inc.

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

DATE:

AUGUST 1995

STD



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, Inc.

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

DATE:
AUGUST 1995

STD

SOP No. F2010
OVERBURDEN/GLACIAL MONITORING WELL/PIEZOMETER -
DECOMMISSIONING

1.0 Purpose

This section documents the procedures to decommission a monitoring well or piezometer that was installed in unconsolidated geologic materials.

2.0 Equipment and Materials

- Back hoe
- Drilling rig with the appropriate drilling capacity
- Sodium-bentonite slurry
- Concrete

3.0 Procedures

- A. Prior to decommissioning, the total depth of the well/piezometer will be measured and recorded. The hydraulic lift on the drill rig will then be employed to remove the protective casing and concrete pad. A back hoe may also be utilized to remove the surficial well/piezometer construction materials.
- B. Once the protective casing and concrete have been removed, the well/piezometer casing will be overdrilled with either a 4.25 inch or 6.25 inch (ID) hollow stem auger depending on the initial borehole diameter. This procedure will be used to remove extraneous well/piezometer material (e.g., well/piezometer screen, filter sand, etc.). The borehole will be advanced to six inches beyond the reported depth of installation.
- C. A clean side-discharging tremie pipe will then be placed inside the augers for the placement of a thick smooth sodium-bentonite slurry. The slurry will be pumped under pressure until the augers are full. The augers will be withdrawn and additional slurry will be added as needed. The slurry will be placed in the annular space of the borehole to approximately three feet below the ground surface. The slurry will be allowed to settle and stabilize for approximately 24 hours at which time the hole will be re-inspected for subsidence. Additional slurry will be added, if required.

An alternative method will be to pull out the well/piezometer column using the drill rig's hydraulic lift and tremie slurry into the resultant annulus, as described above.

- D. For wells/piezometers that are decommissioned on paved surfaces or in traffic areas, the remaining annular space will be sealed with a three-foot plug of concrete (only after the slurry has reached a static level). In areas which can support vegetative growth, the slurry will be brought to approximately four feet below the ground surface. The remaining four feet will consist of a three-foot plug of concrete and one foot of topsoil.

4.0 Documentation

All pertinent data such as the length of well/piezometer column removed, the total depth of drilling, the amount of slurry used, the mixture of slurry used, the thickness of the slurry column, and the thickness of the concrete plug will be recorded on the soil boring log.

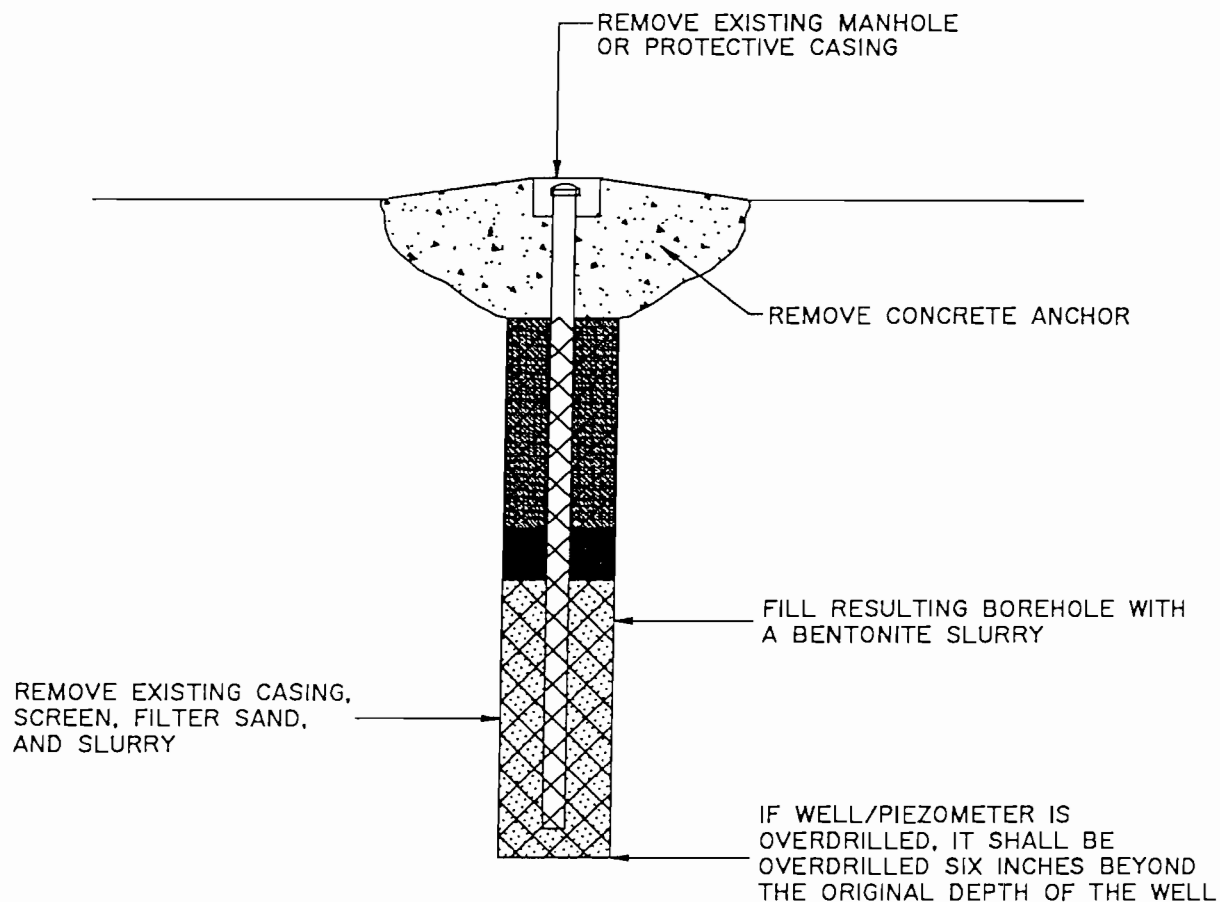
It should be noted that the decommissioning of any monitoring well/piezometer shall be performed under prior approval of the Project Manager.

5.0 Special Notes

If a new monitoring well/piezometer is installed, it will be placed approximately ten feet away and hydraulically upgradient from the previous location to prevent any effect of the sodium-bentonite slurry on the ground-water quality. The attached figure F2010-1 is an example of a decommissioned overburden monitoring well/piezometer.

6.0 Applicable Standards and References

None



NOTE: IF WELL IS PRESENT IN AN UNPAVED AREA A VEGETATIVE LAYER SHALL BE PLACED FROM 0'-0" TO 2'-0".

FIGURE F2010-1

Hull & Associates, Inc.

DECOMMISSIONED WELL/
PIEZOMETER DIAGRAM

DATE:

AUGUST 1995

STD

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

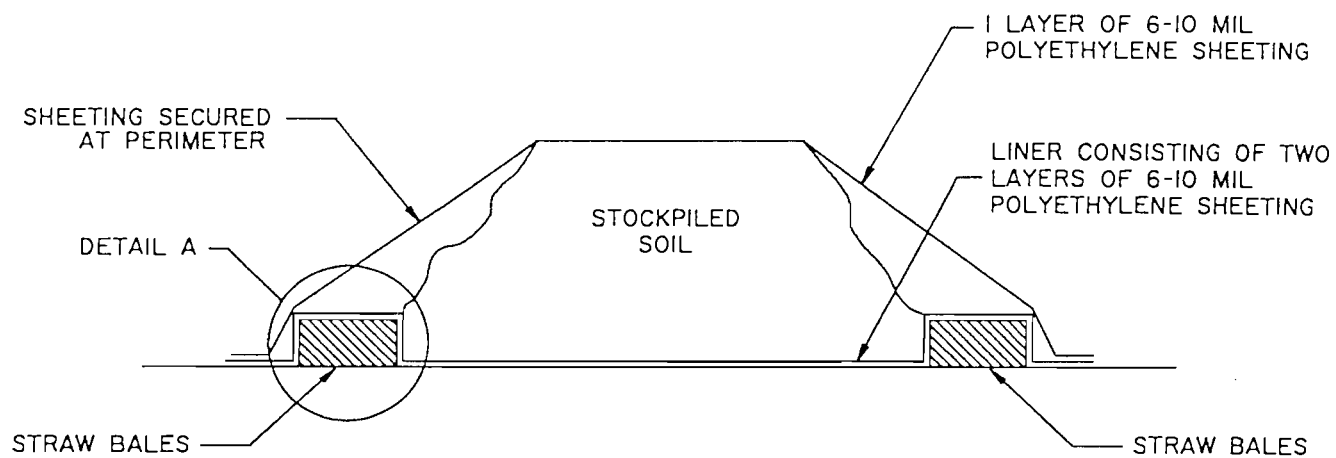
- A. If auger cuttings are placed in drums, the following information will be included on the soil boring log, field notebook, or in the daily field report:
- the number of drums generated
 - labeling procedures
 - the type of drums used
- B. If auger cuttings or excavated soils are stockpiled, this 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

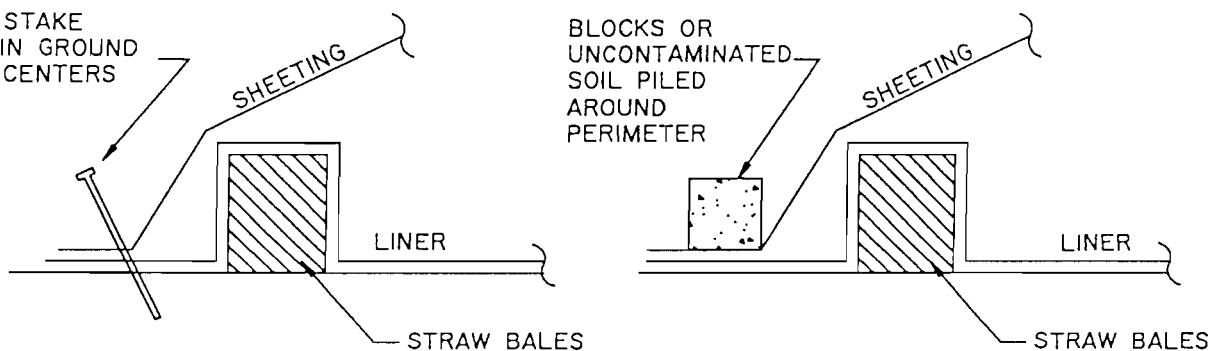
None



SECTION

SCALE: NONE

18 INCH STAKE
DRIVEN IN GROUND
• 6'-0" CENTERS



DETAIL A SHEETING AND LINER ANCHORING DETAILS

SCALE: NONE

FIGURE F2013-1

Hull & Associates, Inc.

STOCKPILED SOIL DETAILS

DATE:
AUGUST 1993

STD

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. F3004
WELL HEADSPACE ANALYSIS

1.0 Purpose

This section documents the procedures for real time (direct reading) ambient air monitoring in the vicinity of, and inside, the monitoring well. These procedures will be performed to determine if toxic, flammable, or oxygen deficient environments exist at the well head prior to initiating the well sampling procedures.

2.0 Equipment and Materials

- A portable photoionization detector (PID)
- Percent oxygen meter
- Explosive gas (% LEL) meter

3.0 Procedures

- A. The ambient air conditions in the vicinity of the well head will be determined prior to its opening. The PID will first be utilized to determine if any significant concentrations of volatile organic compounds (VOCs) are present in the air surrounding the well. After screening for VOCs, the % LEL and % O₂ meters will be employed to determine if explosive or oxygen deficient conditions exist in the vicinity of the well head. These screening measurements will be conducted at specified heights and distances from or in the well head.

If either screening method indicates conditions above action levels, the area will be immediately evacuated until the situation can be reevaluated. In any case, a concerted effort will be maintained by the sampling team to perform all ground-water sampling procedures upwind from the well head.

- B. After the environment in the vicinity of the well head is deemed satisfactory, the well will be opened and the air conditions in the well column determined. The PID probe will be inserted approximately six inches in the well column for accurate determination of VOC concentrations. After completing the VOC assessment, the % LEL and % O₂ meters will be employed to determine if explosive or oxygen deficient conditions exist inside the well.

If either screening method indicates conditions above action levels, the area will be immediately evacuated and appropriate actions taken.

- C. During sampling, ambient air conditions will be monitored periodically with both instruments to ensure that conditions are safe.

4.0 Documentation

During implementation of these procedures, all readings will be recorded on the Ambient Air Monitoring sheet and will also include, at a minimum, both the date and time of the reading.

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 corrugated 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 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/miscible 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 than 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. Detailed operating procedures for the conductivity and pH/temperature meter are included in HAI SOP Nos. F1003 and F1004, respectively.

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

<u>Well Diameter</u>	<u>Cubic Feet</u>	<u>Gallons</u>
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:

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

$$\text{Where: } \pi = 3.1416$$

$$d = \text{Diameter of Well Casing (feet)}$$

$$C = 7.48 \text{ (constant for converting ft}^3 \text{ to gallons)}$$

Then the volume to be purged will be:

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

$$\text{Where: } V = \text{Volume to be purged (gallons)}$$

$$L = \text{Column of standing water in well (feet)}$$

$$n = \text{Number of well volumes to be removed (3 to 5)}$$

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 (1999rev)
GROUNDWATER SAMPLE COLLECTION

1.0 Purpose

This SOP describes the procedures that will be followed during the collection of representative groundwater samples from monitoring wells/piezometers.

2.0 Equipment and Materials (as Required)

- portable Photoionization detector (PID);
- multi-gas meter (i.e., O₂, CH₄, percent LEL, percent gas) or equivalent(s);
- interface probe or water level indicator with a tape graduated to 0.01 ft;
- submersible pump, bladder pump, peristaltic pump, foot-valve lift pump, or positive displacement piston pump;
- power source (e.g., generator), if an electric pump is used;
- dedicated or reusable bailer constructed of Teflon, stainless steel, disposable polyethylene, or other acceptable bailer;
- tubing constructed of polyvinyl chloride, polypropylene, polyethylene, stainless steel or other suitable materials sized appropriate for the pump discharge;
- polypropylene rope/ or other suitable bailer cord;
- pH/temperature meter;
- conductivity meter;
- storage container for purge water;
- calibrated container with a capacity of at least five gallons;
- latex sample gloves.

As an alternative to standard purging and sampling techniques, low-flow sampling may be conducted. Besides equipment and materials listed above (e.g., peristaltic or submersible pump, tubing, etc.), the following additional equipment will be required for low-flow sampling:

- flow-through cell capable of continuously monitoring field indicator parameters during purging and sampling
- turbidity meter (optional); and
- a graduated cylinder.

3.0 Procedures

- A. As the monitoring well/piezometer is approached, a visual inspection of the condition will be completed and documented.. If warranted in the site-specific Health & Safety Plan (HASP), the ambient air conditions in the vicinity of the wellhead will be documented prior to its opening. The PID will be used to determine if any significant concentrations of volatile organic compounds (VOCs) are present in the ambient air near the well. After screening for VOCs, the appropriate meter(s) will be employed to

determine percent LEL and percent O₂ to determine if explosive or oxygen deficient conditions exist in the vicinity of the wellhead. These screening measurements will be conducted at heights and distances from or in the wellhead as directed by the project manager, or as described in the site-specific HASP.

If either screening method indicates conditions above action levels are present, the area will be immediately evacuated until the situation can be reevaluated. In any case, the sampling team will make a concerted effort to perform all groundwater sampling procedures upwind from the wellhead.

- B. After the environment in the vicinity of the wellhead is deemed satisfactory, the well will be opened and the air conditions in the well column determined, if specified in the site-specific HASP. The protective casing of the well/piezometer will be unlocked and the cap will be accessed. After removal of the cap, the air quality in the riser will be screened (as applicable) and the findings will be documented. If warranted, the PID probe will be inserted approximately six inches into the well column for accurate determination of VOC concentrations. After completing an assessment for VOCs, the appropriate meter(s) may be employed to determine percent LEL, percent O₂ or other gases, to determine conditions within the well column.

If either screening method indicates conditions above action levels, the area will be immediately evacuated and appropriate actions taken.

- C. The monitoring well will be allowed to stabilize prior to collecting water level measurements using a water level meter or, if warranted, an interface probe. The interface probe or water level indicator will be decontaminated in accordance with HAI SOP No. F1000 prior to collecting water level measurements.
- D. If warranted (i.e., if there is the potential for the presence of nonaqueous phased liquid {NAPL} in the well), a determination of immiscible layer(s) will be conducted in accordance with the probe manufacturer's instructions. Care will be taken so that the probe and tape do not touch the well casing as they are lowered into the well. Measurements will be recorded in the field notebook or on the appropriate field data sheet. After the immiscible layer procedure is complete, the probe and all measuring tape lowered into the well will be thoroughly decontaminated in accordance with HAI SOP No. F1000.
- E. If a water level probe is used to measure water levels, the probe will be slowly and carefully lowered into the well column until the water level is encountered. The water level indicator will emit an audible signal when it makes contact with water. The tape will be slowly raised and lowered to determine the exact measurement, to within 0.01 feet. After the water level measurement procedure is complete, the probe and all measuring tape lowered into the well will be thoroughly decontaminated in accordance with HAI SOP No. F1000. The measurement will be recorded in the field notebook or on the appropriate field data sheet.

- F. Measurements will be taken from the survey mark indicated on the top of the well casing. If a mark is not already indicated, the north position of the casing should be used as the measurement point. This point should then be marked for future reference.
- G. The monitoring well/piezometer can now be purged. 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. Purging is completed using a variety of bailers and/or pumps, which are described below. The Project Manager will determine the most appropriate purging method. The device selected 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 without producing a deleterious effect on groundwater quality.

The U.S. EPA recommends that three to five well volumes be purged from a well in order to obtain a representative groundwater sample. Typically, indicator field parameters (pH, temperature and conductivity) stabilize within the period that monitoring wells are purged of three well volumes. Occasionally, it is advisable to purge less than three well volumes (e.g., in conditions where excessive purging may cause contaminant migration or if minimal purge volume technology such as low flow sampling is employed). Furthermore, more than three well volumes will be purged in cases where indicator field parameters have not stabilized. Under these conditions, the well will be purged until the temperature, conductivity and pH of the purge water have stabilized, or up to five well volumes (unless the FSAP or project manager specifies that more than five well volumes will be purged. The temperature, pH, and conductivity will be measured initially, as well as after each well volume is purged. The last two values obtained must be within 10 percent of one another. The values will be recorded in the field logbook or on the appropriate field data sheet. The pH meter will be calibrated using a 2-point curve with pH buffer solutions that bracket the suspected groundwater pH. Conductivity will be calibrated using a commercially available standard in accordance with manufacturer's instructions and recommendations. Operation and maintenance of the pH/temperature and conductivity meters will also be in accordance with the manufacturer's instructions and recommendations.

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 sample cannot be obtained after the initial purging, multiple trips to the well with less than 24 hours between trips will be made in accordance with applicable regulations.

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

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

The following formula was used to determine the conversion factors:

$$\text{Gallons/feet of water} = C \times (\pi \times d^2/4 \times 1 \text{ feet})$$

Where: $\pi=3.1416$

d = Diameter of Well Casing (feet)

C = 7.48 (constant for converting feet³ to gallons)

Then the volume to be purged will be:

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

Where: V = Volume to be purged (gallons)

L = Column of standing water in well (feet)

n = Number of well volumes to be removed (typically three to five)

As an alternative to purging based on volume, low-flow water extraction may be conducted as part of sampling. The pump will be carefully lowered in the well to avoid disturbing sediment that may have settled in the bottom of the well. The pump's intake will be situated within the screened interval – by convention, halfway between the top and bottom of the screen; however, site-specific conditions may warrant setting the intake above or below the halfway point. Pumping will then be initiated, with the flow adjusted such that little or no water level drawdown is measured within the well – U.S. EPA generally recommends keeping the flow rate below 200 ml/min. to avoid aeration of the water. Indicator field parameters will be measured and recorded until stabilization occurs. EPA recommends that the basis for stabilization is three consecutive readings, taken within three to five minute intervals, which fall within the following limits:

- turbidity (10% for values greater than 1 NTU);
- DO (10%);
- Specific conductance (3%);
- temperature (3%)
- pH (+/- 0.1 unit); and
- ORP/Eh (+/- 10 millivolts).

H. Bailing

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

When using this purging technique, a new rope will be attached to the bailer when purging each well, unless the rope is dedicated with the dedicated bailer. 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). All water removed during purging will be assumed contaminated unless analytical data have been obtained that indicate otherwise. Purge water will be stored on-site and properly disposed of as directed by the Project Manager.

I. Groundwater 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 pumps will be employed to maximize the efficiency of purging. Any pump used will be properly decontaminated prior to purging, in accordance with HAI SOP No. F1000. The use of any pump to purge a well will be carried out in accordance with the manufacturer's instructions.

1. Submersible Pumps

Submersible pumps provide an effective means of well purging for deep wells. Submersible pumps are particularly useful in situations where the depth to water is greater than 20 feet, or where the depth or diameter of the well requires that a large volume of water be removed.

These pumps will only be used with approval of the Project Manager for purging operations and will generally not be used for the collection of groundwater samples.

2. Foot-Valve Lift Pump (e.g., *Waterra*™)

In some instances, where wells are difficult to access, a foot-valve lift pump (e.g., *Waterra*™) will be used. A foot valve is attached to the end of semi-rigid 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 method 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 used to purge a well at an intermediate rate (up to four gallons per minute (gpm) at a variety of depths). The intermediate flow rates allow for only a minimal introduction of fines into the well column.

4. Low Volume Dedicated Purge Pumps

Dedicated pumps are useful in situations where the excavation of very large volumes of water from wells/piezometers are in equilibrium and representative groundwater samples can be collected prior to purging of three well volumes. Their design allows smaller purge volumes than might be required with conventional pumps. Groundwater samples may also be collected from these types of pumps.

These pumps will only be used with approval of the Project Manager for purging and sampling operations.

- J. In many cases, a disposable polyethylene bailer sized for two-inch inside-diameter wells will be used when sampling each well. Acceptable sampling collection equipment includes a disposable bailer, dedicated bailer, or properly-decontaminated *Teflon*, stainless steel, or other acceptable bailer. A spool of nylon, polypropylene, or other acceptable 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 with 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 lowering into the well.

As an alternative to sampling with a bailer, low-flow purging (as described in G, above) and sampling may be conducted. All reusable down-hole equipment (e.g., tubing, submersible pump, etc.) will be properly decontaminated in accordance with HAI SOP No. F1000 before being lowered into the well.

- K. 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 process. If the bailer cord cannot be prevented from touching the ground, protective plastic sheeting may be

placed around the well area to prevent rope from contacting the ground.

- L. During sample collection, the bailer will be slowly lowered into the well to prevent agitation of the water to minimize the volatilization of any VOCs. The bailer will then be slowly and smoothly raised to the surface in a manner that will not agitate the sample.
- M. The contents will be transferred into the appropriate containers and preserved in accordance with the specified analytical method. Samples will be collected in order of decreasing volatility (i.e., volatiles, semivolatiles, metals, etc.). Sample bottles will be properly labeled in accordance with the relevant plans for the project.

As an alternative to sampling with a bailer, the low-flow technique may be used to collect samples. Samples should be collected from a bypass assembly prior to water entering the flow-through cell or, alternatively, the flow-through cell can be disconnected. To the extent possible, the tubing should remain water-filled while directing water into sample containers. Care will be taken so that minimal turbulence/aeration occurs during transfer of water from the tubing into sample containers.

- O. All sample containers will be placed on ice as soon as possible after collection. Samples should remain at 4°C until analysis.
- P. Finally, all materials used during sample collection will be either properly disposed of, or in the case of reusable equipment, will be properly decontaminated in accordance with HAI SOP No. F1000.

4.0 Documentation

A number of documents may be completed and maintained as part of the groundwater sampling effort. The documents should provide a summary of the sample collection procedures and conditions, shipment method, analyses requested and the custody history. Below is a list of the items and documents that should be completed:

- Field notebook
- Groundwater Monitoring Well Field Data Sheets
- Sample labels
- Chain-of-Custody records
- Daily Field Reports
- Request for analysis sheets

All pertinent data including, but not limited to, the type of purging device, the volume purged, pH, conductivity, temperature, and any other relevant information will be recorded on in the field notebook or on the appropriate data sheet. Any deviation from the above-described procedures will be performed only with prior approval of the Project Manager.

5.0 Special Notes

See manufacturer's instructions for specific notes on various equipment and materials used in the collection of groundwater samples from monitoring wells/piezometers.

SOP No. F3014 (1999rev)
CHAIN-OF-CUSTODY PROCEDURES

1.0 Purpose

This SOP documents the chain-of-custody (COC) procedures that will be employed during all sampling activities.

2.0 Equipment and Materials

- Indelible ink ball-point pens
- Chain-of-custody records
- One-gallon size *Zip-Loc* (or equivalent) storage bags

3.0 General

A completed COC record must accompany every sample from the point of collection to delivery to the laboratory. A single COC record may accompany several samples as long as all the samples are contained in a single unit (e.g., cooler, box, etc.). If a single COC is to be used for multiple samples in multiple coolers then a photocopy of the original COC must be placed in each cooler. All COCs will be kept in one-gallon *Zip-Loc* bags to prevent damage from melting ice, broken samples, and bad weather. A copy of every completed COC record will be retained in the project files.

4.0 Procedures

4.1 Completion of COC Record

- A. The COC record is initiated in the field by the sampler(s) immediately after a sample is collected. Figure F3014-1 illustrates a properly completed COC.
- B. The sample identification number will be recorded on the COC. Each sample number consist of four distinct data fields. A space for each data field is provided on the COC. These data fields include; Project Number, Sample Location, Sample Type, Sampler I.D.
- C. The number of containers that makes a complete sample will be recorded in the box labeled "No. of Containers". A sample may consist of multiple containers depending upon the analytical procedures requested.
- D. If the sample is to be analyzed for metals, the box labeled "Metals" shall be completed to indicate whether the sample fractions for metals have been filtered. A "F" will be used to indicate that the metals were filtered and a "N" will indicate that they were not filtered. Occasionally, some samples may require metal fractions to be filtered and not filtered (e.g., analyses for dissolved and total metals). In this case a "B" will be used to indicate that the sample contains both filtered and non-filtered fractions. If the

sample does not require analyses for metals a single line will be drawn through this box.

- F. The date and time (military) of sample collection will be recorded in the box labeled "Sampling Date/Time". It is very important to note the time each sample was collected even if samples are collected a few minutes apart.
- G. The requested analytical methods will be recorded in the diagonal spaces provided under the box labeled "Analyses". The preservatives added to the containers for each analytical method will be indicated by recording the letter in the box labeled "Preservatives" that corresponds to the preservative added. The preservatives and corresponding letters are listed near the top of the COC record. Finally, a check mark(s) will be made under each fraction for which a particular sample will be analyzed.
- H. Any comments relating to the collected sample(s) can be recorded in the box labeled "Comments". These comments may indicate special handling or analytical instructions for the laboratory (e.g., compositing instructions, confirm MTBE, etc.) or may be used to indicate the location of sample collection.
- I. Additional information required on the COC record includes the person the analytical reports should be sent to, client, site, project description, project number, names of all samplers involved in sample collection, where the samples are to be delivered, method of delivery, and airbill number (if applicable).

4.2 Transfer of Custody

- A. The COC record must document the transfer of custody each time the sample(s) changes hands. The National Enforcement Investigations Center (NEIC) of the EPA defines custody as:
 - 1. the sample is in your physical possession;
 - 2. the sample is within view after being in your physical possession;
 - 3. the sample was in your possession and then you locked it or sealed it to prevent tampering; and/or
 - 4. the sample is placed in a designated secure place with limited access to authorized personnel only.
- B. When transferring custody of samples, the person in custody (e.g., the sampler) must sign the box labeled "Relinquished By" and fill in the date and time (military time) the custody of the samples was relinquished. The person accepting custody of the samples must then sign the box labeled "Received By" and complete the date and time (military time) the custody of the samples was accepted.

- C. The above procedures must be followed until the samples are delivered to the laboratory. Both internal (within the same organization) and external (between different organizations) transfers need to be documented. In cases where a commercial courier (e.g., Federal Express) is used to deliver the samples, the person relinquishing custody to the courier should put the name of the courier in the "Received By" box and seal the COC inside the cooler. Most couriers have a policy against signing for custody of samples.
- D. The pink copy (bottom) of the COC will be retained by the sampler before the samples are shipped and the remaining copies (white and yellow) of the COC are delivered to the laboratory. The pink copy will then be immediately given to the QAO. The white copy will be returned by the laboratory with the final report.

5.0 Documentation

Chain-of-custody record

6.0 Special Notes

If samples are shipped via commercial courier on Friday the air bill needs to be checked for Saturday delivery.

If samples are known to contain flammable or hazardous materials they need to be shipped accordingly. Check with the courier for specific shipping, labeling and packing requirements.

7.0 Applicable Standards and References

U.S. Environmental Protection Agency. NEIC Policies and Procedures. EPA-330/9-78-001-R. May 1978. (Revised February 1983.)

U.S. Environmental Protection Agency. User's Guide to the Contract Laboratory Program. Office of Emergency and Remedial Response. December 1986.

U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. EPA/540/P-87/001, December 1987.



CHAIN OF CUSTODY RECORD

6631 Commerce Parkway
Suite E
Dublin, Ohio 43017
Phone: (614) 793-8777
FAX: (614) 793-9070

REPORT TO: K. Wildman

Client: ABC COMPANY Site: ANYTOWN, OHIO
Project: GW SAMPLING Project #: ABCAL
Samplers: J. Small, T. Large

Samplers: J. Small, T. Large

WHITE -- ORIGINAL
PINK -- LAB USE
YELLOW -- LAB USE (MUST BE RETURNED W/ REPORT)

(Please forward results to address at top left)

FAX: (614) 793-9070

REPORT TO: K. Wildman

Client: ABC COMPANY Site: ANYTOWN, OHIO
Project: QW SAMPLING Project #: ABCAL
Samplers: J. Small, T. Large

SAMPLE IDENTIFICATION	SAMPLE MATRIX	NO. OF CONTAINERS
ABCAL-MW1-001-D153	1	5
ABCAL-MW2-001-D153	1	3
ABCAL-MW3-001-D153	1	1

RELINQUISHED BY: <u>J. Small</u>	DATE: 1-31-93 TIME: -11-32
RELINQUISHED BY: <u>K. COURIER</u>	DATE: 2-1-93 TIME: -12-30
RELINQUISHED BY:	DATE: -- TIME: --
RELINQUISHED BY:	DATE: -- TIME: --

RECEIVED BY: <u>K. COURIER</u>	DATE: 2-1-93 TIME: -9-30
RECEIVED BY: <u>M. LAB</u>	DATE: 2-1-93 TIME: -12-30
RECEIVED BY:	DATE: -- TIME: --
RECEIVED FOR LAB BY:	DATE: -- TIME: --

DATE: 2-1-93

TIME: -9-30

DATE: 2-1-93

TIME: -12-30

DATE: --

TIME: --

DATE: --

TIME: --

Deliver To: SOME LAB, INC.

Method of Delivery: FEDEX

Airbill Number: 1573111770

NOTES: PLEASE CALL ASAP WITH

VERBAL RESULTS.

FIGURE F3014-1

Hull & Associates, Inc.

CHAIN OF CUSTODY RECORD

DATE: AUGUST 1993

Q15

SOP No. F4008 (2000rev)
SOIL/WATER SAMPLE HEADSPACE SCREENING
WITH A PHOTOIONIZATION DETECTOR OR FLAME IONIZATION DETECTOR

1.0 Purpose

This section documents the procedures that will be followed to perform headspace screening on soil and water samples using a photoionization detector (PID) or a flame ionization detector (FID).

2.0 Equipment and Materials

- PID equipped with the appropriate eV bulb, or FID, as determined in the project work plan or as determined by the Project Manager
- adequate supply of calibration gas
- clean glass jars with lids
- 1 qt. *Zip-loc* baggies or equivalent
- aluminum foil

3.0 Procedures

- A. The PID or FID will be calibrated in the field in accordance with the manufacturers' requirements. Calibration should be performed at a minimum interval of once per day, specifically at the beginning of each day. The time, date, and other pertinent calibration information (e.g., span setting, if appropriate) will be recorded in the field notebook and equipment calibration log.
- B. When the sample (e.g., soil or water) is collected, it will be placed into the glass sample jar until the jar is approximately half full. The mouth of the jar will be sealed with clean aluminum foil and the lid placed on the jar so that the foil is sealed against the jar. The sample jar will be agitated for at least fifteen seconds, taking care to avoid piercing the foil seal. The sample will be allowed to develop for five to ten minutes in a warm area. The probe will be inserted through the foil seal and the maximum instrument response (which should occur after two to five seconds) will be recorded.

As an alternative, *Zip-loc* baggies or equivalents may be used to screen soil samples. The sample will be prepared in the same manner as with a glass jar. After the sample has developed, the probe will be inserted through a small opening in the upper portion of the baggie to obtain the maximum headspace reading. The opening should be immediately closed around the probe to minimize any dilution of the headspace vapor. The bag should not be squeezed during headspace measurement.

- C. Special care will be taken to avoid inserting the probe directly into the sample (e.g., soil or water), thus preventing permanent damage to the instrument.

4.0 Documentation

PID or FID readings and calibration data will be recorded in the equipment calibration log, and field notebook, or on an appropriate data sheet.

5.0 Special Notes

Where feasible, use of the PID shall be avoided in atmospheres with high humidity. The meter response is affected by high humidity. In addition, a PID or FID should be acclimated to the atmosphere that will be measured (i.e., the instrument will not be used immediately after taking it from a heated car or building to a cool outdoors). The instrument should be allowed to equilibrate for approximately fifteen to thirty minutes before it is used.

FIDs are sensitive to methane. If methane gas is present or suspected, the sample must be screened with a charcoal filter and without the filter. The difference in results is the concentration of volatile organics present in the sample.

6.0 Applicable Standards and References

Calabrese, E.J and P.T. Kostecki. Petroleum Contaminated Soils, Volume 2. Lewis Publishers, Inc. pp 133-135. 1989.

SOP NO. F4010 (1999rev)
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 Å) 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 or a five-foot continuous 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 by hand to break apart portions of the sample. **Note: protective eyewear must be worn when viewing the sample with UV light.** Most hydrocarbons fluoresce milky white to yellow under the UV light. The observation results will be recorded on the soil boring log as:
 1. present;
 2. suspected; or
 3. no visual evidence.

C. Hydrophobic Dye Soil-Water Shake Test

1. Only 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. [An alternate method consists of using a graduated 50 ml test tube can be used to estimate the volume of NAPL in the sample. Approximately 20 cm³ (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, all appropriate personal protective equipment should be worn while using this dye.** The results of this test will be recorded on the boring log as follows:

1. present (color);
2. suspected (color); or
3. no visual evidence.

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 as follows:

1. present (color);
2. suspected (color); or
3. no visual evidence.

4.0 Documentation

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

5.0 Special Notes

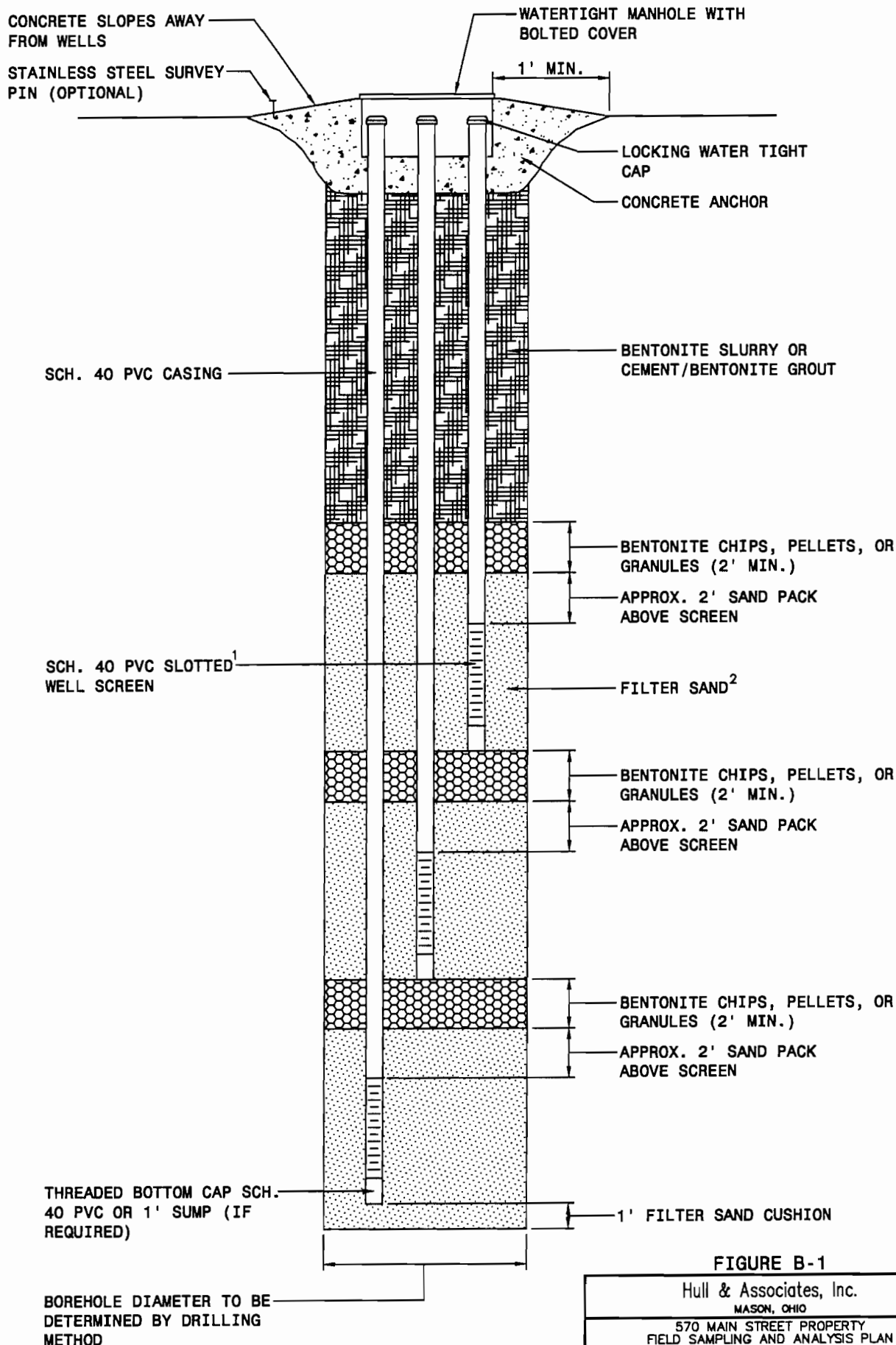
Prior to employing these techniques in the field, personnel will be trained in the use of the equipment. A set of standards will be viewed with the fluoroscope and dye test to familiarize the examiner with typical responses to these tests. Although these techniques can be used at LNAPL sites, it is primarily 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

Monitoring and Application Well Construction Diagrams

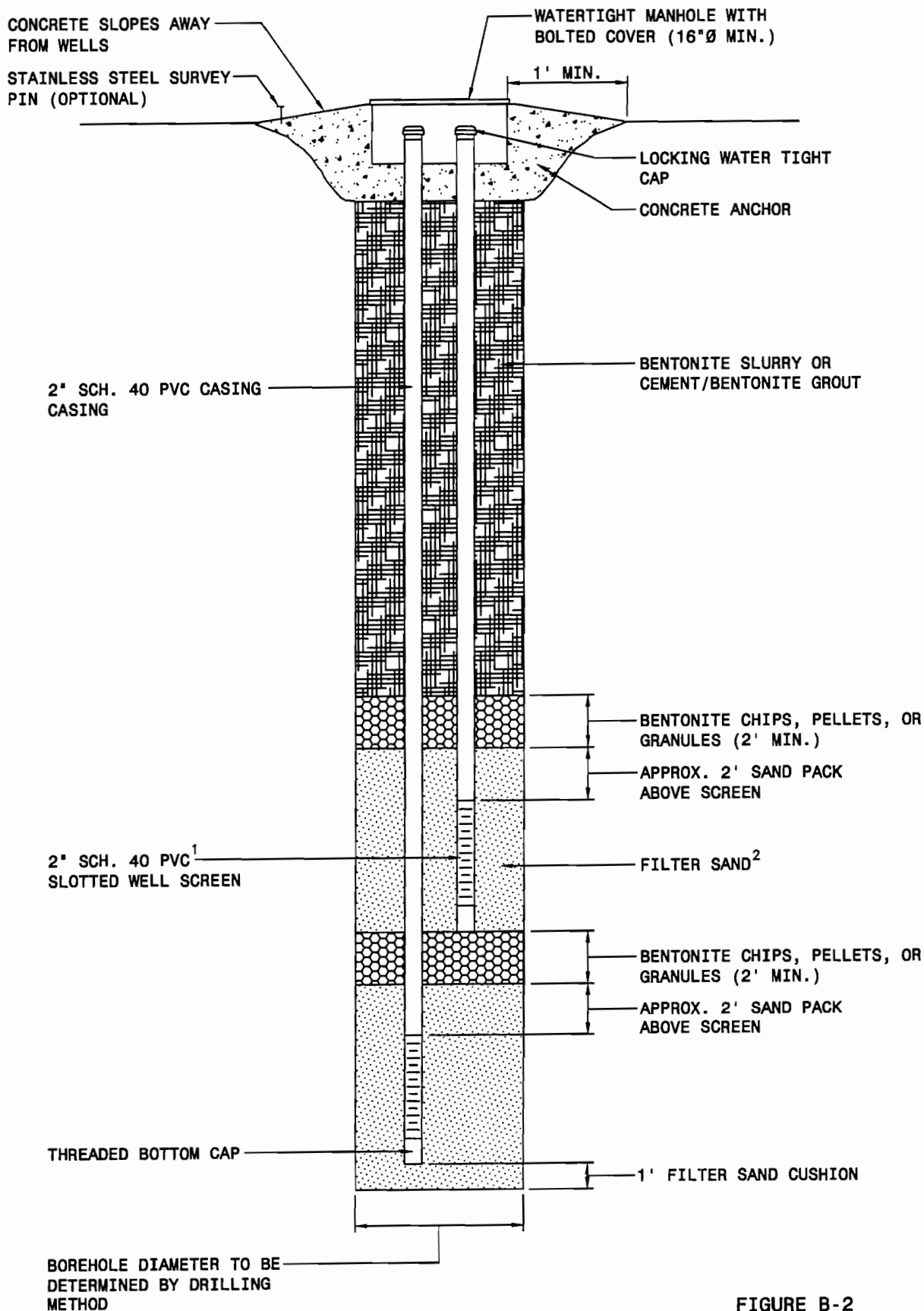


¹ SCREEN SLOT SIZE WILL VARY DEPENDING UPON FORMATION CHARACTERISTICS.

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

FIGURE B-1

Hull & Associates, Inc. MASON, OHIO	
570 MAIN STREET PROPERTY FIELD SAMPLING AND ANALYSIS PLAN	
GROUNDWATER MONITORING WELL NEST CONSTRUCTION DIAGRAM	
WESTBURY, NEW YORK	
DATE: APRIL 2001	PROJECT: NMB007



¹ SCREEN SLOT SIZE WILL VARY DEPENDING UPON FORMATION CHARACTERISTICS.

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

FIGURE B-2

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FIELD SAMPLING AND ANALYSIS PLAN
GROUNDWATER MONITORING/REAGENT
APPLICATION WELL COUPLET CONSTRUCTION
DIAGRAM

WESTBURY, NEW YORK

DATE:
APRIL 2001

PROJECT:
NMB007

APPENDIX B

Quality Assurance Project Plan (QAPP)

QUALITY ASSURANCE PROJECT PLAN

FOR

FOCUSED GROUND-WATER REMEDIATION

FOR THE

**570 MAIN STREET
MANUFACTURING FACILITY
WESTBURY, NEW YORK
NYSDEC SITE CODE #130043A**

APRIL 2001

PREPARED FOR:

IMC EASTERN CORPORATION

PREPARED BY:



**HULL & ASSOCIATES, INC.
4700 DUKE DRIVE, SUITE 172
MASON, OHIO 45040
(513) 459-9677**

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1.0 INTRODUCTION

1.1 General

This Quality Assurance Project Plan (QAPP) has been prepared for IMC Eastern Corp. (IMC), Hull and Associates, Inc. (HAI) field personnel and their subcontractors, and other representatives for use during the focused ground-water investigation at 570 Main Street in Westbury, New York, New York State Department of Environmental Conservation (NYSDEC) Code #130043A (Site). The Site is within the New Cassel Industrial Area (NCIA), a class 2 inactive hazardous waste site as designated by the NYSDEC.

The property is slightly over two acres with one manufacturing building and a paved parking lot covering most of the area. IMC occupied the Site from the early 1950s until 1992. The Site is currently owned and occupied by Castle Collision, an entity unrelated to IMC.

The analytical subcontractor for this project will be Lancaster Laboratories in Lancaster, Pennsylvania. Lancaster's QAP has been included as Appendix A of this document. If an alternate laboratory is required, its QAP will be submitted as an addendum to this plan.

1.2 Objective

The objective of this plan is to document the procedures that will be used to collect sufficient data of known quality for the Focused Ground-Water Remediation Work Plan. The QAPP is intended to be used as supplemental guidance to the Work Plan and Field Sampling and Analysis Plan. The quality assurance measures for the analytical program will be in accordance with the appropriate U.S. EPA methods, good laboratory practices, and the laboratory's quality assurance program (Appendix A).

Table 1 provides the anticipated list of the parameters to be analyzed and their corresponding methods. Reporting limits for all parameters will be in accordance with the provisions of the analytical methods used and good laboratory practices. Reporting limits may vary between samples as they can be affected by sample matrix, dilutions, and other interferences. If additional analytical methods are required, this document will be revised accordingly by addendum.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 General

The work will be performed, on behalf of IMC, by HAI and several subcontractors, including:

1. In-Situ Oxidative Technologies, Inc. (ISOTEC), West Windsor, New Jersey;
2. Lancaster Labs in Lancaster, Pennsylvania (fixed laboratory analyses);
3. Handex of New York, Farmingdale, New York; and
4. Albert Tay PLS, Plainview, New York.

The above list includes the subcontractors that have been identified by HAI to date. Other subcontractors may be used as necessary. The responsibilities of key individuals are outlined below.

2.2 Field Operations Personnel

2.2.1 Project Manager (PM)

The PM for this project will be W. Lance Turley of HAI. Mr. Turley 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 time requirements specified in the Work Plan.

2.2.2 Quality Assurance Officer (QAO)

The Quality Assurance Officer (QAO) is primarily responsible for Quality Assurance (QA) and reports directly to the Project Manager. The QAO for this project will be Kevin Wildman of HAI. Mr. Wildman will be responsible for the adherence to the QAPP. Duties and responsibilities of the QAO will be to:

1. establish QA/QC procedures required for the project;
2. evaluate data quality and maintain QC records;
3. provide a communication link between project personnel and the laboratory;
4. monitor the progress of the field sampling personnel and enforce provisions of this plan; and
5. stop work at any time that the QAPP is not being adhered to, or if the quality of the results are jeopardized by the work in progress; once work is stopped, only the PM can restart activities.

2.2.3 Technical Project Supervisor (TPS)

The Project Hydrogeologist, Mr. Bill Dennis of HAI, will serve as the technical project supervisor. Mr. Dennis will oversee field investigations and environmental monitoring and assist the Project Manager in communications with ISOTEC Environmental Corporation, Handex of New York, and Albert Tay (surveyor).

Health and Safety Coordinator

The Health and Safety Coordinator is Mr. Toby Droughton of HAI. Duties of the Health and Safety Coordinator are described in the Site Specific Health and Safety Plan (HASP), Appendix C.

2.2.4 Site Health and Safety Officer (HSO)

The Site Health and Safety Officer is Mr. Bill Dennis of HAI. Duties and responsibilities of the Health and Safety Officer are included in the HASP, Appendix C.

2.2.5 Technical Advisors

Mr. Craig A. Kasper, P.E. and Mr. Mark J. Bonifas, P.E. of HAI and Mr. Steve Zervos of ISOTEC, Inc. will serve as the technical advisors for the project. Messrs. Kasper and Bonifas will assist primarily in evaluating contaminant distribution and fate and transport. Mr. Adams will assist in evaluation of bench testing and pilot testing results and design and implementation of the final remedial system.

2.3 Laboratory Personnel

The laboratory will have its own project organization with responsibilities similar to that of the field operations personnel. Please refer to Lancaster Laboratories' QAP in Appendix A for an organizational chart.

2.3.1 Laboratory Director

The Laboratory Director will be primarily responsible for the overall operation of the laboratory including all samples analyzed and data reported. The Laboratory Director will also be responsible for initiating corrective action measures when analytical data do not meet the requirements of this plan or the laboratory's QAP.

2.3.2 Laboratory Project Director

The Laboratory Project Director will be the primary communication link between the laboratory and HAI's QAO. The Laboratory Project Director will be responsible for relating any special needs of the field operations personnel to the laboratory. The Laboratory Project Director will also provide the final review of all data packages before reporting results.

2.3.3 Laboratory Quality Assurance Officer

The Laboratory QAO will be primarily responsible for implementing the laboratory's QAP within the laboratory and monitoring compliance with the laboratory's QAP. The Laboratory QAO's duties will also include: conducting audits, reviewing all QC sample recoveries, reporting problems to Laboratory Director for corrective action, and other laboratory-related activities.

3.0 QA OBJECTIVES FOR MEASUREMENT

3.1 General

Data quality objectives for measurement during this project will be addressed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC parameters). The collection of data used in this project will require that the sampling and analysis be performed using standard methods, with properly operated and calibrated equipment, and conducted by trained personnel.

3.2 Precision

Precision is the determination of the reproducibility of measurements under a given set of conditions, or a quantitative measure of the variability of a group of measurements compared to their average value. Precision of analytical results will be based upon laboratory replicate analyses. Precision is reported as Relative Percent Difference (%RPD). Precision goals for the parameters to be analyzed will be in accordance with the provisions of the U.S.EPA methods used for analysis.

3.3 Accuracy

Accuracy is defined as the degree of agreement of a measurement or average of measurements with an accepted reference or true value. Sampling accuracy can be assessed by evaluating the results of field and trip blanks. Analytical accuracy is assessed by percent recovery of analytical spikes and reference standards. Accuracy goals for parameters to be analyzed will be in accordance with the provisions of the U.S.EPA methods used for analysis.

3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, and/or environmental condition. Representativeness is best achieved by insuring that sampling locations are properly selected, and a sufficient number of samples are collected.

Functional data are provisional on meeting the criteria for representativeness. The QA goal will be to have all samples and measurements representative of the media sampled; representative samples are contingent on proper selection of sampling techniques, location, and number of samples collected to

represent the media. Also, the aliquots taken for analysis should be representative of the sample received.

3.5 Completeness

Completeness expresses the measure of confidence with which the data, resulting from a data collection activity, meets the specific objectives of the activity. It is the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal operating conditions. While efforts will be made to ensure that all generated data is valid (complete), some samples may be lost or broken in transit or at the laboratory. In addition, the results may not be acceptable based on laboratory QC requirements. It will be the goal of this project to have 95% of the data generated to be complete data.

3.6 Comparability

Comparability expresses the measure of confidence in which data sets can be considered equivalent with regard to the measurement of a specific parameter and/or groups of parameters. The ability to compare data sets is particularly critical when a set of data for a specific parameter is compared to historical data for determining trends. By using standard sampling techniques, analytical methodologies, and reporting units, the comparability of data will be ensured.

4.0 SAMPLING

4.1 General

The purpose of this section is to detail the general sampling procedures that will be used to collect the required data. The sampling efforts will be uniform and follow specific protocols to be considered relevant to the project. Additional information is included in the Work Plan.

4.2 General Sampling Procedures

4.2.1 Sample Containers and Preservatives

Sample containers will consist of I-Chem 200 series (or equivalent) glass or plastic bottles and will be provided and prepared by the laboratory prior to sampling efforts. The laboratory will also provide any required preservatives. Table 2 lists the containers, preservatives, and holding times for parameters that will be analyzed during this project.

4.2.2 Sample Labeling

All sample containers will be labeled at the time of sampling. Each label will be completed with the required information and then secured to the container with transparent packing tape to prevent accidental loss or damage. Required information on the sample label includes: project number, sample identification number, date, time, analyses, and sampler's initials. Also, any preservatives or special handling instructions will be clearly displayed on the label.

4.2.3 Sample Identification Numbers

All samples collected will be issued a unique Sample Identification Number (SIN) to aid in tracking and record keeping. SINS will be assigned by the QAO and given to the Technical Project Supervisor prior to sampling efforts. Ground-water sample identification numbers will have the following format:

Project Number : Well Designation : Type of Sample and Date (mmddyy) : Employee Number

The type of sample will be indicated using a single letter: "G" for groundwater and "S" for soil.

An example of a valid SIN for a ground-water sample collected during this project from MW-8L on June 15, 2000 is as follows:

NMB007:MW8L:G061500:481

Soil sample identification numbers will have the following format:

Project Number : Well Designation : Type of Sample and Depth Interval (ft) : Employee Number

An example of a valid SIN for a soil sample collected during this project between 58.0 and 64.0 feet below ground surface (bgs) in application well AW-2U is as follows:

NMB007:AW2U:S580640:481

Duplicate ground-water samples will be designated by an "A" added to the end of the date in the SIN. Duplicate soil samples will have an "A" added to the end of the depth interval. Field blanks will be numbered the same way as ground-water samples, except that a "W" will be used to indicate water as the sample type, rather than a "G" as in ground-water samples.

The SIN system described above is very important in the tracking and record keeping of the large number of samples to be collected for this project. For this reason, the SIN system will not be deviated from without authorization of the QAO. Any questions regarding the SIN system will be directed towards the QAO.

4.2.4 Sampling Equipment Preparation and Decontamination

Reusable sampling equipment will be thoroughly decontaminated between sampling locations and at the beginning and end of each day. The equipment it will be washed with a mild nonphosphatic soap solution, rinsed with potable water, and given a final rinse with distilled water. HAI Standard Operating Procedure (SOP) No. F1000 (1999 rev) provides a more detailed description of decontamination procedures (refer to Appendix A of the FSAP). If complete cleaning of any piece of sampling equipment is not possible, then it will be discarded and replaced with a clean article.

4.2.5 Sample Storage and Transportation

Field samples will be placed in portable coolers with ice immediately following sample collection and remain on ice until being delivered to the laboratory. Ice will be double bagged to prevent leakage and possible water damage to samples, sample labels, and documentation. Any samples not placed on ice immediately upon collection will be discarded, and a new sample will be collected.

4.2.6 Field Notes

General field notes will be recorded in waterproof surveyors notebooks using indelible ink. In addition to the field notebooks, certain activities will require the completion of data sheets. A Soil Boring Log (Appendix B) will be completed for each soil boring/monitoring well installed. A Groundwater Monitoring Well Sampling Data Sheet (Appendix B) must be completed for each monitoring well sampled. When weather conditions prohibit the completion of data sheets in the field, data may be recorded in field notebooks and then transferred to data sheets at the end of the day.

In addition, a Daily Field Report (Appendix B) summarizing activities and observations will be completed at the end of the day. Copies of the documentation will be forwarded to HAI's Mason, Ohio office weekly. If copies of previous work are required, then arrangements will be made with the QAO.

Field notebooks, field data sheets, or daily field reports will not be obscured, destroyed, or discarded, even if they contain errors or are illegible. Errors will be corrected by drawing a single line through the error and writing in the correct information. Corrections will be dated and initialed by the person making the correction.

4.2.7 Chain-of-Custody

Chain-of-custody procedures are discussed in Section 5.0 of this plan.

4.2.8 Field Sampling Equipment List

Table 3 is a list of the general field sampling equipment that will be available on-site. The field analysis equipment will be calibrated in accordance with the manufacturer's recommendations and this plan.

4.2.9 Sampling Quality Control

Several sampling quality control measures will be necessary to assess the integrity of samples collected. These measures include the use of field blanks and trip blanks to locate possible sources of sample contamination.

Field (equipment) blanks will be used to evaluate the effects, if any, of sampling equipment on ground-water samples. The number of field blanks analyzed for a class of compounds will be "equal to" ten percent of the total investigative samples analyzed. Field blanks will be collected by running laboratory prepared deionized water through the sample collection equipment and into sample containers. Field blanks will be analyzed for the same parameters as the field samples.

Trip blanks will be used to evaluate the effects, if any, of sample shipping and handling procedures. One trip blank per shipping container (e.g., cooler) will be required. Trip blanks are only necessary for samples requiring volatile organic analyses. Trip blanks will be prepared in the laboratory, prior to sampling efforts, using laboratory-prepared deionized water and preserved using the same procedures as the samples. Trip blanks must accompany sample containers during sample collection and transportation.

Field duplicate samples will be collected for each analytical method at the rate of one per every ten investigative samples (10%). The minimum number of duplicates is one per day per sampling team.

4.3 Site-Specific Sampling Procedures

Site-specific sampling procedures are presented in the Field Sampling and Analysis Plan.

5.0 SAMPLE CUSTODY

5.1 General

The intention of chain-of-custody (COC) procedures is to document, in a legally defensible manner, the transfer of custody of each sample from collection through analysis. Additional information regarding COC procedures is presented in HAI SOP No. F3014 (1999 rev), which is included in Appendix A of the FSAP.

5.2 Chain-of-Custody

The importance of COC cannot be overstated. COC documentation records the history of the samples' custody from acquisition to ultimate disposal. Samples collected may be used as legal evidence. As such, the hand-to-hand custody from the point of collection to delivery at the laboratory must be clearly documented. The National Enforcement Investigations Center (NEIC) of the U.S. EPA defines custody as:

1. the sample is in your physical possession;
2. the sample is within view after being in your physical possession;
3. the sample was in your possession and then you locked or sealed it to prevent tampering; and/or
4. the sample is placed in a designated secure place with limited access to authorized personnel only.

A COC form (Appendix B) must accompany every shipping container. Each COC form will be filled out in triplicate. Information required on the COC form includes:

1. client information;
2. project information;
3. samplers' names;
4. sample identification numbers;
5. date and time of collection;
6. type of sample (grab or composite);

7. matrix or matrices;
8. sample description;
9. number of containers;
10. requested analyses;
11. remarks (preservatives); and
12. signatures of anyone relinquishing or accepting custody.

Field samplers will be responsible for the care and custody of the samples collected until the samples are transferred or dispatched properly. After completing a sampling event, sample custody will be transferred to a designated person who will maintain custody of samples until they are dispatched to the laboratory.

If samples are to be delivered to laboratory via a courier, a COC will be signed over to the courier. The courier will keep COC forms until relinquishing custody to the laboratory. One copy of the COC form will be retained before there is a transfer of custody to the courier. Evidence tape or custody seals will be placed so that when the coolers are opened the seals will be broken. Transparent tape will be used to guarantee that the seals are not accidentally removed or destroyed.

If samples will be delivered to the laboratory via commercial carrier, then the COC forms will be placed in a watertight *Ziploc* bag and taped to the inside lid of the sample cooler. Evidence tape or custody seals will be placed so that when the coolers are opened the seals will be broken. Transparent tape will be used to guarantee that the seals are not accidentally removed or destroyed.

5.3 Laboratory Custody Procedures

Samples will be received in an area designated for sample receipt and storage. Upon receipt, each sample will be assigned a unique laboratory sample identification number. This number, along with the date received and general description, will be recorded in the laboratory's master log. HAI's QAO will be immediately notified if there are any problems with the samples received (e.g., discrepancies between COC and samples submitted, breakage, improper preservation, etc.). Additional information regarding laboratory custody procedures is presented in Appendix A.

5.4 Laboratory Documentation

Workbooks, bench sheets, instrument logbooks, and instrument printouts are used to trace the history of samples through the analytical process and to document and relate important aspects of the work, including the associated quality controls. All logbooks, bench sheets, instrument logs, and instrument printouts are part of the permanent record of the laboratory. Laboratory notebooks will be periodically reviewed by the Laboratory Section Heads for accuracy, completeness, and compliance with the Laboratory Quality Assurance Program Plan. Completed workbooks and instrument logbooks will be submitted to the Laboratory Director for storage.

The laboratory's documentation procedures are presented in Appendix A. In general, good laboratory practices require that the following (or equivalent) procedures be used. Each entry will be dated and initialed by the analyst when the record is made. Errors in entry will be crossed out in indelible ink with a single stroke. The use of white-out, obliterating, or writing directly over the erroneous entry is prohibited. All corrections will be initialed by the individual making the correction.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 General

This section details the calibration frequency and procedures for both the field and laboratory instrumentation that will be used during this project. Materials used for instrument calibration will be obtained through the U.S. EPA Pesticide and Industrial Chemicals Repository, or a suitable commercial source.

6.2 Field Equipment Calibration Procedures

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual and instructions for each instrument to ensure that all maintenance requirements are being observed.

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The calibration of field instruments will be in accordance with the manufacturer's specifications. Frequency of calibration will be dictated by field conditions, instrument response, and the manufacturer's specifications. At a minimum, all instruments will be calibrated at the beginning of each day and after any extended breaks (e.g. lunch).

6.3 Laboratory Instrumentation Calibration Procedures

Calibration of laboratory equipment is described in Lancaster Laboratories' QAP (Appendix A). The laboratory will operate in strict accordance with the requirements of the U.S.EPA methods used. Any proposed deviations from calibration procedures will be submitted by the laboratory for approval in the form of a SOP.

7.0 ANALYTICAL PROCEDURES

The analytical methods that will be employed in this project are summarized in Table 4. All analytical procedures will be conducted in accordance with the specified U.S. EPA methods. In the event that additional procedures are deemed necessary, the appropriate modifications will be made to this QAPP by revision or addendum.

8.0 DATA REDUCTION, REVIEW, REPORTING AND VALIDATION

8.1 Data Reduction

Analytical results will be reduced to the concentration units using the equations specified in the analytical procedure. Appropriate blank corrections will be applied in all cases. Calculations will be checked by senior laboratory staff.

8.2 Data Review

Review of data by the laboratory is described in Lancaster Laboratories' QAP in Appendix A. Audits of final reports by the Laboratory Quality Assurance Officer may be conducted to determine the precision, accuracy, completeness, and representativeness of sample analyses.

8.3 Data Reporting

Lancaster Laboratories' reporting of analytical results for volatile organic compounds (VOCs) will be provided in a NYSDEC ASP Category B deliverables data package. All other data will be reported in accordance with the appropriate U.S.EPA method used for analysis. Specific elements of laboratory reporting are included in Lancaster Laboratories' QAP in Appendix A.

Reports will be issued to HAI's QAO. Any draft reports should be clearly identified as such.

8.4 Data Validation

Analytical data will be reviewed according to Lancaster Laboratories' data validation procedures outlined in Appendix A. After passing internal data validation, the data will be reported to HAI's QAO. Data will be reviewed by HAI's QAO to determine that proper preservation, holding times, and sample analysis procedures have been followed and are clearly documented. Additionally, the analytical results will be reviewed and compared to previous data, if any exist. Any questions regarding the data reports will be brought to the laboratory project manager's attention.

If additional data validation is required, the data will be submitted for validation to an independent third-party data validator. The analytical laboratory is required to address any comments and correct any deficiencies identified in the data validation report.

9.0 INTERNAL QUALITY CONTROL

9.1 General

The purpose of internal quality control measures is to document the validity of analytical data generated by the laboratory. Laboratory internal quality control may include, but is not limited to, the analysis of method blanks, reference standards, analytical spikes, and surrogate spikes. Every analytical series will include some of these controls depending on the analytical methods used. The internal quality controls used by the laboratory will be combined so they are completely representative of the analytical task from sample preparation to sample analysis.

The following sections present a summary of, and suggested frequencies for, various quality control measures that may be used dependent upon the analytical method(s) selected. Lancaster Laboratories' QAP, presents the actual quality control measures and frequencies that will be employed (Appendix A).

9.2 Blank Samples

Blanks are used to assess contamination introduced in transit, storage, or in the laboratory. The types and frequencies of laboratory blank samples are specified by the U.S.EPA methods used for analysis.

9.2.1 Method Blanks

Method blanks identify sources of contamination throughout the analytical process, whether a contribution of specific analytes or a source of interference, which will need to be identified, isolated, and corrected. To accomplish this, the method blank must be initiated at the beginning of the analytical process and include all aspects of the analytical work. This includes all glassware, reagents, and instrumentation, as well as any other possible source of contamination. Minimum method blank analyses will be one method blank per analytical series at a frequency of one per 20 samples.

9.2.2 Container Blank

The same concept for the method blank will apply to the sample bottles furnished from the laboratory. This container blank will be analyzed for each type of sample container as it would be

used for collection. The frequency of analysis will extend to each lot of processed sample containers. At a minimum, the analysis of a container blank should be performed whenever the preparation process, preservation reagent, or the type of container changes.

9.2.3 Holding Blanks

Another type of method blank is a holding blank. Holding blanks are associated with volatile organic analyses and indicate possible cross-contamination among samples while stored at the laboratory. At least one holding blank per each group of samples will be generated and analyzed with the samples.

9.3 Reference Standards

Reference standards are standards of known concentration and independent in origin from the calibration standards. These reference standards are generally available through the U.S.EPA, the National Bureau of Standards, or are specified by analytical methodologies. The purpose of a reference standard is to assess analytical proficiency within an analytical series including the preparation of calibration standards, the validity of calibration, sample preparation, instrument set-up, and the premises inherent in quantitation. Reference standards will be used in every analytical series except GC/MS and specific GC analyses, for which there are no reference standards.

A control chart will be maintained for analytes in which reference standards are used in their analyses. When a reference standard value exceeds the established warning limits, careful scrutiny will be given to the operations system, standards preparation, and procedures that were used in obtaining the result. If the value of the reference standard exceeds the established control limits, then the sample analysis will be stopped and corrective action will be initiated. Samples analyzed since the last passing reference standard will be re-analyzed following instrument re-calibration.

9.4 Analytical Spikes

The purpose of an analytical spike is to assess the efficiency and proficiency of an analytical series. This includes quantitation standards, sample preparation, instrument set-up, and the premises inherent in quantitation. This control reflects the competency of sample analysis within an analytical series, while it is less sensitive in reflecting the conditions that are within the control of the analyst.

The types and frequencies of analytical spikes are specified by the U.S.EPA methods used for analysis.

9.4.1 Matrix Spike

Within an analytical series, a representative sample portion is designated as a separate sample and spiked with known concentrations of the analytes under consideration. Advantages of spikes are that the spiked portion is handled and prepared in exactly the same way as the samples. Sample related interference affecting analysis will be reflected in the results from the spiked sample. Results of spikes exceeding tolerances specified by the methods need to be evaluated thoroughly in conjunction with other measures of control.

9.4.2 Surrogate Spike

Surrogates, which have properties similar to the analytes of interest, are compounds unlikely to be found in nature. The intent of a surrogate spike is to provide broader insight to the proficiency and efficiency of an analytical method on a sample specific basis. This control reflects analytical conditions that may not be attributable to the sample matrix. If results of a surrogate spike analysis exceed method specified tolerances, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. Re-analysis of the sample with additional controls, or different analytical methodologies, will be necessary.

9.5 Replicate Analysis

Replicate analysis is a measure of analytical precision and can be limited in its scope. If used in conjunction with reference standards or analytical spikes, it can measure the reliability of the analytical systems. Replicate analyses can be significant in the interpretation of analytical results for samples with complex matrices.

9.6 Calibration Check Standards

The purpose of a calibration check standard is to assess an instrument's stability. A calibration check standard will be analyzed at the beginning and end of an analytical series or periodically throughout large series of samples. Calibration check standard will be run after every ten samples. In analyses where internal standards are used, a calibration check standard need only be run at the beginning of

an analytical series. If results of the calibration check standard exceed method specified tolerances, then samples analyzed since the last acceptable calibration check standard will be re-analyzed.

9.7 Internal Standards

Internal standards will be monitored when required by the method. The internal standard is present in all acquisitions with the exception of performance standards. The response of each compound within the internal standard is plotted on a control chart. The area of any compound cannot fall below 50% of its value in the preceding check standard, nor can it rise above 100% of its value. If internal standard areas in one or more samples exceed the specified tolerances, then the instrument will be re-calibrated and all affected samples re-analyzed.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 General

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed within the constraints of this plan. Audits can be conducted internally by field or laboratory staff, or externally by state or federal agencies. The laboratory will participate in any performance or system audit conducted or requested by HAI, appropriate state agencies, or the U.S.EPA.

10.2 Performance Audits

Performance audits will be conducted periodically to determine the accuracy of the total measurement system(s) or components. In this program, blind performance evaluation samples, submitted by state and federal agencies, are analyzed and evaluated throughout the year as part of an ongoing participation in their certification programs. Any deficiencies in the results of these analyses are reported to the laboratory and corrective action is initiated.

In addition to blind sample analyses, the laboratory will also participate in any audits from state and federal agencies. If these agencies submit a report noting any deficiencies and/or necessary corrective actions, the laboratory will respond with evidence of compliance within a limited time.

The laboratory will also maintain a schedule of internal audits whereby each section of the laboratory is audited by the Laboratory Quality Assurance Officer. When the audit is completed, a formal report will be issued to the Laboratory Director. This report will note any deficiencies and a follow-up date to confirm corrective action.

10.3 System Audits

A system audit is an evaluation of the various components of the measurement system performed in order to assess their proper selection and use. This includes a careful evaluation of all laboratory quality control measures. System audits will be conducted internally by the laboratory.

10.4 Field Audits

Internal audits of field activities (sampling and measurements) will be conducted by HAI's QAO and/or TPS. These audits will include examination of field sampling records, field instrument operating records, sample collection, shipping and handling, COC, etc. These audits will occur at the onset of the project to verify that the established procedures are followed. Follow-up audits will be conducted to correct deficiencies and to verify the QA/QC procedures are being maintained throughout the project. When an audit is completed, a written report will be submitted to the PM.

HAI personnel will participate in any external audit requested by state and federal agencies. The results and recommendations of any external audit should be reported to HAI's QAO and/or PM in a timely manner so that corrective actions may be initiated.

11.0 PREVENTIVE MAINTENANCE

Field instruments and equipment will be maintained and serviced according to the manufacturer's instruction manual. A maintenance record for each instrument will be maintained. These records will include dates and descriptions of service and preventive maintenance. Major maintenance on any environmental instruments will only be performed by the manufacturer or trained technicians. Field personnel will be responsible for daily maintenance of all equipment in their possession. Critical spare parts (e.g., batteries/chargers, probes, screws, etc.) and tools will be kept with the equipment. Equipment problems will be reported to the QAO or the PM immediately.

Laboratory instruments will be maintained and serviced according to the individual instrument manuals. Lancaster Laboratories' preventative maintenance procedures are documented in Appendix A.

12.0 DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Precision

Precision is a measure of agreement between repetitive measurements under identical conditions. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision. Sampling precision may be determined by analyzing duplicates or replicate field samples and then creating and analyzing laboratory replicates from one or more of the field samples. The analytical results from the field duplicates or replicates provide data on overall measurement precision. Analytical results from the laboratory replicates provide data on analytical precision. Sampling precision can be calculated by subtracting the analytical precision from the overall measurement precision. For organic analyses, precision is reported as the Relative Percent Difference (%RPD) between matrix spike and matrix spike duplicate analyses. For metal analyses, precision is reported as %RPD between two duplicate samples. Acceptable limits for precision are specified by the U.S.EPA method. In the presence of outliers, corrective action will be taken including repairing instruments and/or re-analysis of the affected sample or samples. The following equation will be used in calculating %RPD:

$$\%RPD = \frac{D_1 - D_2}{(D_1 + D_2)/2} \times 100$$

RPD = Relative Percent Difference

D1 = First Sample Value

D2 = Second Sample Value (duplicate)

12.2 Accuracy

Accuracy is the difference between a measured value and the actual value, or the bias in a measurement system. Accuracy is difficult to measure for the entire data collection activity. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Sampling accuracy can be assessed by evaluating the results of field and trip blanks. For the analytical procedures to be used, accuracy is assessed by Matrix Spike Percent Recovery. Acceptable limits for accuracy are specified by the U.S.EPA method. In the

presence of outliers, corrective action will be taken including fixing instruments and/or re-analysis of the affected sample or samples. Matrix spike percent recovery will be calculated by the following equation:

$$\text{MSPR} = \frac{\text{SSR} - \text{SR}}{\text{SA}} \times 100$$

MSPR = Matrix Spike Percent Recovery
SSR = Spike Sample Results
SR = Sample Results
SA = Spike Added (concentration)

12.3 Completeness

Completeness will be reported as the percentage of the measurements judged to be valid. Completeness goals for this project are presented in Section 3.5. Completeness will be calculated by the following equation:

$$\text{Completeness} = 100 \times (\text{valid measurements} / \text{total measurements})$$

13.0 CORRECTIVE ACTION

13.1 General

Corrective actions may be required for either analytical and equipment problems or noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory analysis, and data review. Noncompliance problems are associated with nonconformance to this plan or the U.S.EPA methods being used.

13.2 Laboratory Corrective Action

When deficiencies or "out-of-control" situations exist, the laboratory will provide a means of detecting and correcting these situations. An "out-of-control" situation is defined as data exceeding control limits. Samples analyzed during "out-of-control" situations will be re-analyzed prior to reporting results. Lancaster Laboratories' corrective action procedures are documented in Appendix A. In general, there are several levels of "out-of-control" situations that may occur in the laboratory during analysis.

13.2.1 Bench Level

Corrective action procedures will often be handled at the bench level. If an analyst finds a non-linear response during calibration of an instrument, then the instrument will be re-calibrated before sample analysis. The problem may be corrected by a careful examination of the preparation or extraction procedure, spike and calibration mixes, or instrument sensitivity. If the problem persists, it will be brought to the management level.

13.2.2 Management Level

If resolution at the bench level was not achieved, or a deficiency is detected after the data has left the bench level, then corrective action becomes the responsibility of the Laboratory Manager or Director. Unacceptable matrix or surrogate spike recoveries detected by data review will be reported to the Laboratory Manager. A decision to re-analyze the sample or report results will be made depending on the circumstance.

13.2.3 Receiving Level

If discrepancies exist in either the documentation of a sample or its container, a decision will be made after consulting with the appropriate management personnel. Decisions will be fully documented. Some examples of container discrepancies are broken samples, inappropriate containers, or improper preservation. In these cases, corrective action will involve the Laboratory Project Manager contacting HAI's QAO.

13.3 Field Corrective Action

Corrective actions for field equipment problems will consist of reporting the problem to the PM and/or the QAO so that maintenance can be performed or new equipment can be acquired. Noncompliance problems will be reported immediately to the QAO. The QAO will consult with the PM and corrective actions will be initiated. When warranted, the PM will report the nature of the noncompliance and corrective actions implemented to the appropriate state agencies and/or the U.S. EPA. The nature, extent, and corrective action for all non-compliances will be documented.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 Internal Reporting

Lancaster Laboratories' Quality Assurance Officer will report the status of the laboratory QA/QC program to the laboratory management. Each report will include:

1. periodic assessment of measurement data accuracy, precision, and completeness;
2. results of audits;
3. significant QA/QC problems and recommended solutions; and
4. resolutions of previously stated problems.

The laboratory will determine the content and frequency of these reports in accordance with its QAP and SOPs. The laboratory will report to HAI's QAO when the results of HAI's samples have been affected by internal quality issues.

14.2 Additional Reporting

Laboratory analytical reports will include a summary of the quality assurance activities and quality control data for the project as related to sample analysis. The Laboratory Project Manager will report suspected field QA/QC problems to HAI's QAO.

HAI's QAO will report to HAI's PM when appropriate. These reports may be either oral or written depending upon the nature and complexity of the issues in the report.

15.0 REFERENCES

A variety of technical manuals, administrative documents, and publications were referred to in preparing 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 have not been strictly adhered to unless stated otherwise.

Hull & Associates, Inc., *Focused Ground-water Remediation Work Plan for the 570 Main Street Manufacturing Facility, Westbury, New York*, May 2000.

Hull & Associates, Inc., *Field Sampling and Analysis Plan for Focused Ground-Water Remediation for the 570 Main Street Manufacturing Facility, Westbury, New York*, June 2000.

Hull & Associates, Inc., *Health and Safety Plan for the Focused Ground-Water Remediation for the 570 Main Street Manufacturing Facility, Westbury, New York*, June 2000.

U.S. Environmental Protection Agency, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, EPA/600/4-83-004*, February 1983.

U.S. Environmental Protection Agency, *Data Quality Objectives for Remedial Response Activities: Development Process, EPA/540/6-87/003*, March 1987.

U.S. Environmental Protection Agency, *Data Quality Objectives for Remedial Response Activities: Example Scenario, EPA/540/6-87/004*, March 1987.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001*, December 1987.

U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition*, September 1986.

U.S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes, EPA/600/4-79-020*, March 1983.

U.S. Environmental Protection Agency, *Quality Assurance/ Quality Control Guidance for Removal Activities, EPA/540/G-90/004*, April 1990.

Table 1. Parameter List

U.S. EPA Method	Parameter
8021B	Benzene Bromodichloromethane Bromoform Bromomethane Carbon tetrachloride Chlorobenzene Chlorodibromomethane Chloroethane Chloroform Chloromethane 1,2-Dichlorobenzene (o) 1,3-Dichlorobenzene (m) 1,4-Dichlorobenzene (p) Dichlorodifluoromethane 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethene cis-1,2-Dichloroethene trans-1,2-Dichloroethene 1,2-Dichloropropane cis-1,3-Dichloropropene trans-1,3-Dichloropropene Ethylbenzene Methylene chloride 1,1,2,2-Tetrachloroethane Tetrachloroethene Toluene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene Trichlorofluoromethane Vinyl chloride Xylenes (total)
7380	Iron
375.4	Sulfate
160.1	Total Dissolved Solids
415.1	Total Organic Carbon
9060	Total Organic Carbon

Table 2. Sampling Containers and Preservatives

Parameter (U.S.EPA Method)	Container Size and Material	Preservatives	Max Holding Time
VOCs (8021B)	Soil: 5 grams; En Core™ sampler	Cool 4°C	14 days
	Water: three 40 mL; glass	Cool 4°C; HCl pH <2	14 days
Iron (7380)	Water: one 500 mL; plastic or glass	HNO ₃ pH < 2	6 months
Sulfate (375.4)	Water: one 100 mL; plastic or glass	Cool 4°C	28 days
Total Dissolved Solids (160.1)	Water: one 500 mL; plastic or glass	Cool 4°C	7 days
Total Organic Carbon (415.1 modified)	Soil: 20 grams; glass	Cool 4°C	28 days
Total Organic Carbon (9060)	Water: four 125 mL; glass.	Cool 4°C; H ₂ SO ₄ pH < 2	28 days

Note: All holding times are from time of sample collection. This list represents typical sample containers that may be supplied for this project. The contracted laboratory will provide a detailed sheet describing the types and number of containers sent for each analysis with each sample kit. The actual number of containers may be less as several parameters may be combined into a single container. The laboratory will also provide any required preservatives and instructions for preservation. If pre-preserved bottles are supplied, they will be clearly identified on the sampling container.

Table 3. Field Equipment List

1. *Visqueen*
2. Non-phosphatic soap
3. Distilled water
4. Trash bags
5. Analytical containers
6. Shipping containers/coolers
7. Shipping Labels
8. Ice
9. Indelible ink pens
10. Clear packing tape
11. Health and safety equipment
12. Decon supplies
13. Tools
14. PID or FID
15. Calibration gas
16. *Zip-Loc* bags
17. Flow-through cell
18. Submersible pump or peristaltic pump
19. Tubing
20. Electrical cords
21. Disposable bailers
22. Bailer line
23. Hydrophobic dye
24. Chain-of-Custody forms
25. Well development and Sampling forms
26. Soil boring log forms
27. Camera

Note: This represents a general list of sampling equipment required for this project. Additional equipment required for specific tasks is presented in the FSAP.

Table 4. Summary of Analytical Methods

U.S. EPA Method	Parameters
8021B	Volatile Organic Compounds
7380	Iron
375.4	Sulfate
160.1	Total Dissolved Solids
9060	Total Organic Carbon

APPENDIX A

Lancaster Laboratories - Quality Assurance Plan

LABORATORY QUALITY ASSURANCE PLAN

OCTOBER 9, 1990
REVISED: June 25, 1999

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.



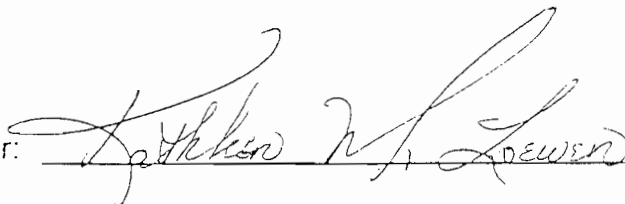
Lancaster Laboratories
A division of Thermo Analytical Inc.

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: _____

 Stephen M. Lewin

<u>Section</u>	<u>Pages</u>	<u>Revision</u>	<u>Date</u>
1. Title Page	1	7	06/25/99
2. Table of Contents	1	7	06/25/99
3. Project Description	1	5	04/27/98
4. Project Organization and Responsibility	4	5	04/27/98
5. QA Objectives for Measurement Data, in terms of precision, accuracy, completeness, representativeness, and comparability	4	4	04/27/98
6. Sampling Procedures	3	4	04/27/98
7. Sample Custody	32	5	04/27/98
8. Calibration Procedures and Frequency	6	5	04/27/98
9. Analytical Procedures	29	5	04/27/98
10. Data Reduction, Validation, and Reporting	10	5	04/27/98
11. Internal Quality Control Checks	28	5	04/27/98
12. Performance and Systems Audits	10	7	06/25/99
13. Preventive Maintenance	3	4	04/27/98
14. Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness	4	5	04/27/98
15. Corrective Action	3	4	04/27/98
16. Quality Assurance Reports to Management	1	3	07/24/95
Appendix A - Example Reporting Forms	80	5	04/27/98

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 III, 1996. 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 III, December 1996.*

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.

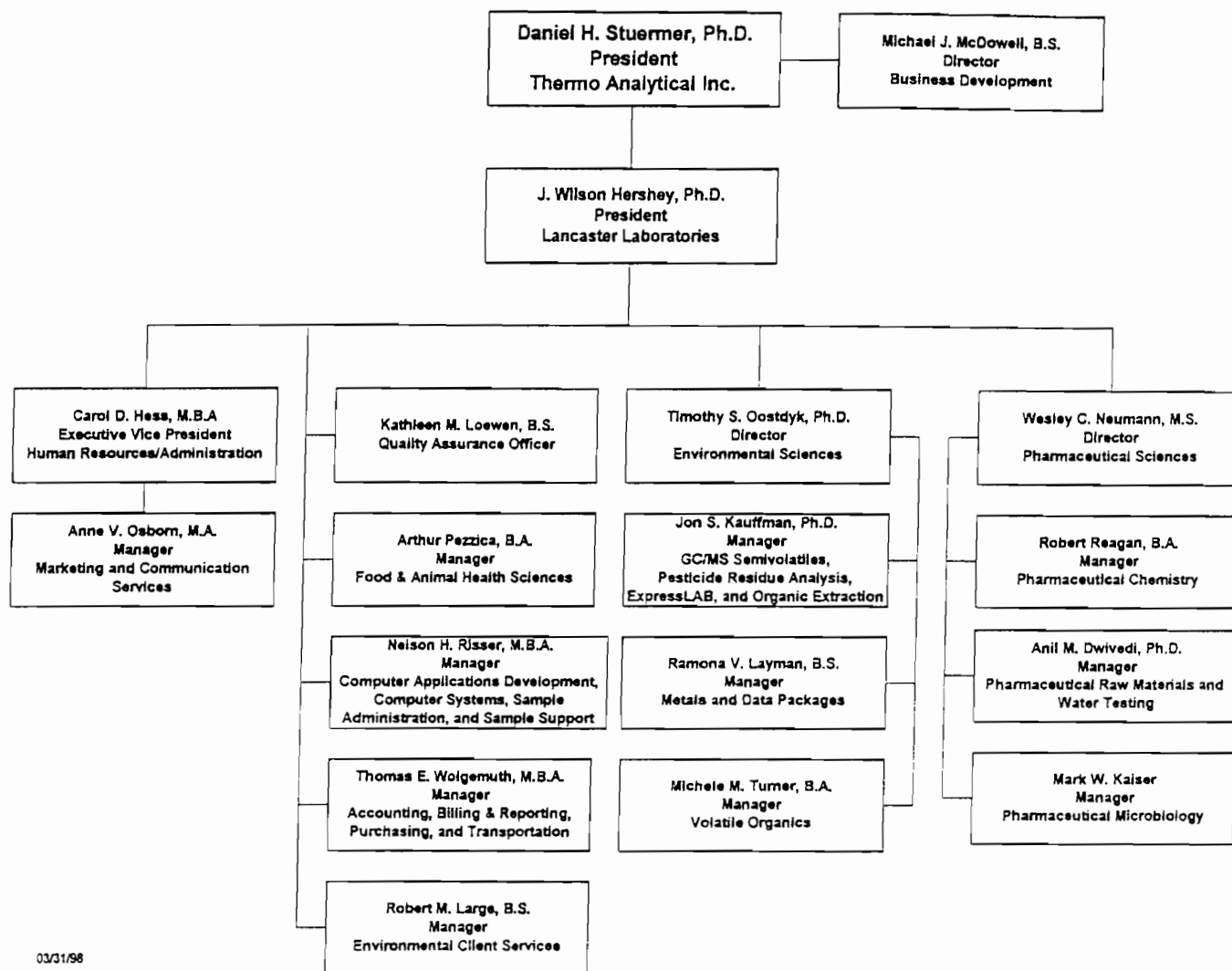
The attached organizational charts show key managerial personnel. Resumes of key individuals may be found in the enclosed *Qualifications Manual*.

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.

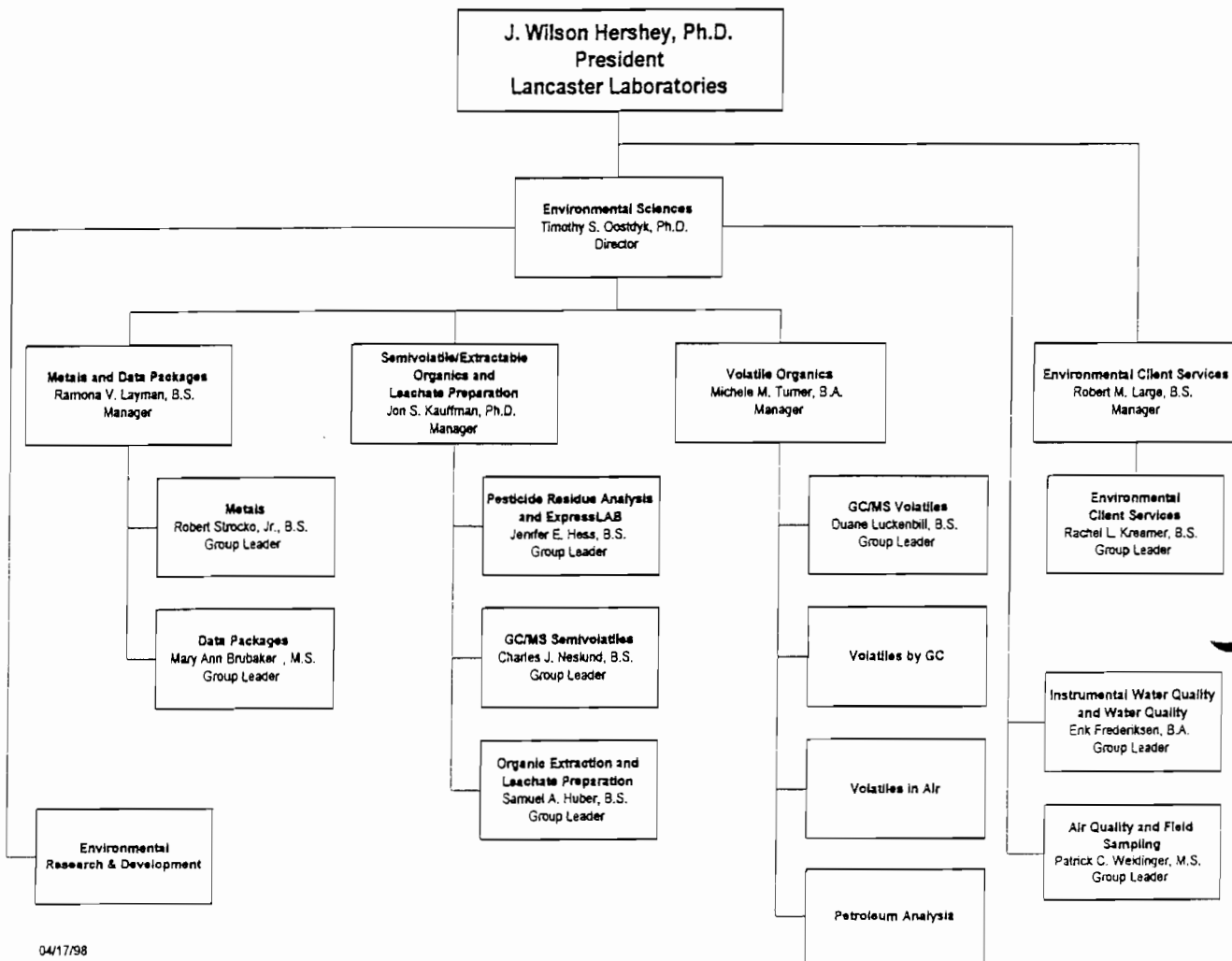
The Quality Assurance Department is responsible for reviewing quality control data, conducting audits in the laboratory and reporting findings to management, maintaining current copies of all analytical methods, maintaining copies of computer code used to calculate and report results, submitting blind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

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



03/31/98

Environmental Sciences



04/17/98

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.

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

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

To ensure attainment of the quality assurance objectives, SOPs are in place detailing the requirements for the correct performance of laboratory procedures. The laboratory SOPs fall under five general categories:

1. Corporate policy
2. Quality assurance
3. Sample administration
4. General laboratory procedures
5. Analytical (i.e., methods, standard preps., instrumentation)

All SOPs are approved by the QA Department prior to implementation. The distribution of current SOPs and archiving of outdated ones are controlled through a master file. Table 5-1 provides an index of QA SOPs in place in support of the Quality Assurance objectives. These requirements are supplemented by the procedures in the laboratory and analytical SOPs.

Table 5-1	
Document #	Document Title
QA-101	Sample Collection
QA-102	Sample Log-in
QA-103	Sample Storage and Discard
QA-104	Internal 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, Logbooks, and Documentation
QA-110	Reagents
QA-111	Instrument and Equipment Calibration
QA-112	Instrument and Equipment Maintenance
QA-113	Data Entry, Verification, and Reporting of Results for the Computerized Sample Management System (CSMS)
QA-114	Data Storage, Security, and Archiving
QA-115	Quality Control Records
QA-116	Investigation and Corrective Action of Unacceptable Quality Control Data
QA-117	Personnel Training Records and Curriculum Vitae
QA-118	Quality Assurance Audits
QA-119	Proficiency Samples
QA-120	Documentation of Programming for the Sample Management System
QA-121	Quality Assurance Guidelines for Computers and Computerized Systems
QA-122	Investigation and Corrective Action Reporting for Laboratory Problems
QA-123	Missed Holding Time Reports
QA-124	External Audits
QA-125	Document Control
QA-126	Qualification and Validation Documentation for Laboratory Instrumentation and Equipment
QA-127	Handling of Client Technical Complaints (Investigations and Response)
QA-128	Compliance with Good Laboratory Practice (GLP) Regulations

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.

Table 6-1					
Sample Containers, Preservatives, and Holding Times for Aqueous and Solid Samples					
Fraction	Vol. Req. (mL) Wt. Req. (g)	Container P=Plastic G=Glass	Preservation ^a	Holding Time ^d From Date of Collection	
				Water	Soil
Volatiles	$\frac{3 \times 40 \text{ mL}}{100 \text{ g}^f$	G	Cool, 4°C ^b pH <2 w/HCl	14 Days	14
Pesticides	$\frac{2 \times 1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C ^b	7 Days to extraction ^e	14
Herbicides	$\frac{2 \times 1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C ^b	7 Days to extraction ^e	14
Halocarbons	$\frac{3 \times 40 \text{ mL}}{100 \text{ g}^f$	G	Cool, 4°C ^b pH <2 w/ HCl ^c	14 Days	14
Aromatics	$\frac{3 \times 40 \text{ mL}}{100 \text{ g}^f$	G	Cool, 4°C ^b pH <2 w/ HCl	14 Days	14
Semivolatiles (Acid/Base Neutrals)	$\frac{3 \times 1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C ^b	7 Days to extraction ^e	14
PAHs (HPLC)	$\frac{2 \times 1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C Na ₂ S ₂ O ₃	7 Days to extraction ^e	14
Metals	$\frac{1000 \text{ mL}}{100 \text{ g}}$	P,G	HNO ₃ to pH <2	6 Months Hg 28 days	6
Cyanide	$\frac{5000 \text{ mL}}{100 \text{ g}}$	P,G	Cool, 4°C NaOH to pH >12 ascorbic acid	14 Days	14
Sulfide	$\frac{500 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C (NaOH, ZnAC Waters Only)	7 Days	7
Phenol	$\frac{1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C H ₂ SO ₄ to pH <2	28 Days	28
TPH	$\frac{2 \times 1000 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C pH <2 w/ HCl	7 Days	14
TPH-GRO	$\frac{3 \times 40 \text{ mL}}{100 \text{ g}}$	G	Cool, 4°C pH <2 w/ HCl	14 Days to extraction ^e	14
TPH-DRO	$\frac{2 \times 1000 \text{ mL}}{200 \text{ g}}$	G	Cool, 4°C <2 with HCl	7 Days	14
TOX	$\frac{4 \times 250 \text{ mL}}{50 \text{ g}}$	G	Cool, 4°C H ₂ SO ₄ to pH <2, Na ₂ SO ₃	28 Days	N/A
TOC	$\frac{125 \text{ mL}}{20 \text{ g}}$	G	Cool, 4°C H ₂ SO ₄ to pH <2	28 Days	28

^apH Adjustment with acid/base is performed on water samples only.

^bSodium thiosulfate needed for chlorinated water samples

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

^dSamples 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.

^eAnalysis 40 days from extraction.

^fThis is for soils not sampled by Method 5035. For Method 5035, see below.

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.**

Method 5035

Containers for sampling soils for volatile organic compounds

Analysis Level	Option #	EnCore™ Sampler	Methanol Preserved 40-mL Vial	Unpreserved Container for Moisture	Travel Blank
Low	A	3 (7*)	—	1	Water
High	B	1 (3*)	—	1	Water
	C	—	1 (3*)	1	Methanol

*Total number of sampled containers needed for background/MS/MSD analyses. Because only one analysis will come from each container, additional samples must be collected for matrix spikes/matrix spike duplicate analyses or other quality control analyses. The number of containers for MS/MSD samples is listed above.

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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.

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Figure 7-1

CLIENT

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

SAMPLE IDENTIFICATION / LOCATION			CL. RES:
COLLECTION INFORMATION			☐ COMPOSITE
DATE	TIME	BY:	☐ GRAB
TESTING REQUIRED			PRESERVATIVE(S) ADDED
 Lancaster Laboratories 2425 New Holland Pike, Lancaster, PA 17601-5994			LLI #

Sample Label (Field)

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)



CUSTODY SEAL

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

DATE: _____

SIGNATURE: _____

Laboratory Custody Seal



Where quality is a science.

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QUALITY ASSURANCE OPERATIONS MANUAL
Sample Log-In

Purpose:

In order to provide accountability of our results, protect client confidentiality, and to prevent sample loss/mix-up, a continuous and unique Lancaster Laboratories (LL) identification number is assigned to each sample upon laboratory receipt.

Scope:

This SOP will cover the procedure used to log client samples into the computerized sample management system (CSMS) after receipt. The Sample Administration Group is responsible for laboratory sample log-in. Sample Administration has procedures to define this sample entry process.

This procedure applies only to samples which are logged into and tracked by the CSMS. There are only a few cases where samples may not be tracked using the CSMS. These include samples which will be stored for a long period of time prior to analysis, (e.g., stability storage) or for special project samples that could be reported in a narrative research and development style report instead of our usual analytical reports. Written procedures for tracking samples not entered into the CSMS need to be developed by the technical department responsible for the project or analysis of those samples.

Personnel Training and Qualifications:

Training in sample log-in is performed in accordance with Sample Administration training procedures.

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Procedure:

1. All samples received for testing shall be delivered to the Sample Administration Department immediately upon arrival at the laboratory.
2. The Sample Administration Department will be responsible for unpacking and organizing the samples.
3. Client correspondence relating to the samples shall also be transferred to the Sample Administration Department. This may include purchase orders, quotations, letters, phone logs, and Incoming Sample Activity Records (ISARs).
4. Personnel of the Sample Administration Group shall log the samples into the CSMS as soon as practical after receipt. Samples awaiting log-in are stored in temporary holding areas, at required temperature, to maintain the sample integrity. At the time of entry the computer will assign a unique Lancaster Laboratories' identification number to each sample. Samples can be received at the laboratory 7 days a week, 24 hours a day, 365 days of the year. Samples should be logged in on the same day as they are received, but there could be 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 evening by third shift Sample Administration personnel.
 - b. Samples submitted by clients which do not identify the type of testing to be performed or with unclear or incomplete paperwork documentation - Every effort will be made to contact the client on the same day of sample receipt. In this situation, the samples will be tracked in a hold database. The group of samples will be assigned a hold number. This database is maintained by the Sample Administration Group.

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If same day sample log-in is not possible, all specified and appropriate storage requirements will be observed (e.g., refrigeration).

5. Upon assignment of a sample number, the CSMS 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 sample label will include the LL sample number, the client name, the storage location, the analyses requested, a bottle code indicating container and preservative type, if applicable, a unique bar code (used for samples stored in Automated Sample Retrieval and Storage System locations [ASRS]), and any applicable notes to laboratory personnel.
6. Preservation, homogenization, and subsampling, if necessary, will be the responsibility of the Sample Support Group, or the testing laboratory. SOPs are in place within the group to define these procedures. A list of preservatives required for routine environmental analyses may be found in the *Environmental Schedule of Services*. A preservation, sulfate, and chlorine check shall be performed immediately after sample log-in for all applicable environmental samples.
7. After all above steps are performed, as required, samples shall be stored in an assigned storage location, taken to the laboratory for testing, or may temporarily be stored in SA until technical center picks up samples.
8. The next working morning, after sample log-in, a copy of an entry acknowledgment will print from the CSMS. The acknowledgment is a hard copy record of the sample entry. It will summarize, the LL sample number, the sample(s) submitted in an entry group, the test(s) to be performed, the client requesting the work, the account to be billed for the work, and the unique sample identifications assigned by the client. This acknowledgment is mailed to the client to confirm sample receipt and entry.

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9. Another copy of the sample acknowledgment will print and be designated as the laboratory copy. This acknowledgment, in addition to client paperwork, will be audited by three levels of personnel after the entry process:
 - a. **Sample Administration** will audit to assure that the entry corresponds to all entry documentation including client supplied paperwork and/or quotations.
 - b. **Client Services** will audit to assure the entry is reflective of client documentation and that additional client/project requirements were communicated and taken into consideration. They will also verify that account and billing information is accurate.
 - c. **Technical centers** will assure appropriate preparation and analysis set-up steps have been added to the entry. They will also verify that project and technical requirements have been taken into consideration from a technical point of view.

Each reviewer will initial the top of the SA file copy of the acknowledgment to document their review. Additional copies of this acknowledgment can be made for laboratory personnel.

10. The LL sample number assigned to each sample shall be used to identify the sample in all laboratory records, including laboratory notebooks, instrument printouts, and laboratory final reports. The sample number will also be used to identify all additional containers of the sample which may be created during sample preparation and analysis. This will include subsamples, extracts, and digests.

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Revision Log:

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00	02/15/96	Previous issue
01	03/14/97	Major changes are as follows: • Expanded upon the scope of the procedure • Added section about printing and auditing of the sample entry acknowledgment • Added Personnel Training and Qualification section • Removed specifics on how to document preservation checks
02	APR 01 1998	Major changes are as follows: • Corrected typo • Wording changes in Procedure section to clarify current operations

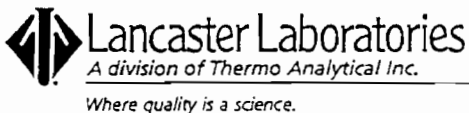
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031198

Prepared by: Kathy D. Wetzal Date: 3/23/98

Approved by: Kathleen J. Loswin Date: 3/23/98

Approved by: Jonathan Hensley Date: 3/24/98

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Supersedes Date: 10/01/96
Effective Date: SEP 02 1997
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QUALITY ASSURANCE OPERATIONS MANUAL

Sample Storage and Discard

Purpose:

Sample integrity can be compromised by improper storage conditions. The objective of this procedure is to prevent sample deterioration and mix-up prior to analysis. The computerized sample management system (CSMS) is used to assign storage locations to assist in the orderly storage of samples. Systems are also in place to ensure organized retrieval of samples for analysis and discard/return to client at an appropriate date.

Scope:

This procedure applies to all Lancaster Laboratories business units (Environmental Sciences, Food and Animal Health Sciences, Pharmaceutical Sciences). The content of this procedure will describe general systems that are in place for sample storage, retrieval, return, and discard. Additional procedures may be in place to describe specific storage operations and requirements within each business unit.

The scope of this procedure does not address the storage and monitoring of samples stored in stability chambers. Separate procedures are in place within the Pharmaceutical area to describe these operations.

The scope of this procedure also does not address the storage and discard of controlled substances. This is defined within SOP-LA-036, "Controlled Substance Handling Procedure."

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Safety Precautions:

Refer to the corporate *Chemical Hygiene Plan* which provides safety information. Contact your supervisor if you have questions or concerns about a sample.

Personnel Training and Qualifications:

Personnel who handle client samples must be familiar with the requirements of this procedure.

Procedure:

A. Sample storage and transfer

1. Sample Administration will gather information into the CSMS at the time of sample entry about the approximate size of samples to be received in a group and the type of storage they require (e.g., refrigerator, freezer, or room temperature).
2. The CSMS will assign the storage location and record the length of time the samples must be retained after the analysis report has been issued.
3. Samples will be stored in the assigned storage location, when not in the laboratory area.
4. In the event that a sample location change is needed, a Sample Storage Custodian or designated analyst will access the appropriate CSMS program and choose a new location. After a successful change in location has occurred, the new location will be written on each Lancaster Laboratories sample label, or a new label will be reprinted and adhered to the sample. The sample will then be transferred to the new storage location.
5. Analysts requiring the use of a sample may determine its location by referring to a departmental sample status sheet, CSMS, or SA entry paperwork.

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

B. Security of storage areas

There are varying degrees of additional security requirements for storage areas, which are in addition to the building security. This additional security may be driven by various regulatory agencies. The following are different levels of security which are in place at the laboratory.

1. Samples may be located in an individual laboratory area which is not locked. No additional security is required, in addition to the existing building security. Samples may only be removed from and returned to these locations by an analyst working in that area. Care shall be exercised in returning the samples to their appropriate location.
2. Locked storage areas are also available in many individual laboratory areas, in addition to the environmental sample support area. Access to these storage areas is limited to analysts who are responsible for testing the samples that are stored there. These areas are locked when the laboratories are unattended; keys or combinations are available only to members of the department where they are located. Again, care shall be exercised in returning the sample to its appropriate location.
3. Controlled access areas are attended by a sample custodian and are large areas used by more than one group. Samples stored in controlled access areas are coordinated by the sample custodian assigned to the area. Only appropriate personnel may access this controlled area. After analysis, samples are returned to this storage center and placed in their designated storage location.

Pharmaceutical and Animal Health samples are stored in a controlled access area. Environmental and some Food samples which are also stored in a

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separate controlled access area are tracked by an automated sample retrieval storage system (ASRS). Samples are barcoded in and out of this system to track retrieval, return, and disposal.

4. 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 chain-of-custody documentation as outlined in SOP-QA-104, "Internal Chain of Custody Documentation." Samples may not be removed from this area without signing a chain-of-custody form. A chain-of-custody record may also be kept for samples, at the request of the client, even if the samples are not for forensic purposes.
5. Security of the controlled substance samples storage area is addressed by SOP-LA-036.

C. Sample discard

1. When the retention time for sample storage has expired, a discard list will be generated from the CSMS. The retention dates are based upon client requirements or defaulted to a given number of days past the date when the final analysis report is generated, if no client requirement is given.
2. These samples will be removed from their assigned storage area by a sample custodian or analyst, and either disposed of or returned to the client.
3. Hazardous samples shall either be returned to clients, decontaminated, or disposed of at the direction of supervisory personnel.

D. Storage conditions

1. The temperature of each sample storage location requiring a temperature control should be checked during each normal working day by an assigned person responsible for the sample storage area. This information shall be recorded.

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2. Temperature documentation can be recorded on logs posted on the outside of the unit or by computerized recording devices or chart recorders.
3. The following temperature ranges need to be maintained within storage units.

	Refrigerator Storage	Freezer Storage
Environmental	2° to 4°C	-10° to -20°C
Foods	2° to 6°C	-10° to -20°C
Pharmaceutical Animal Health	2° to 8°C	-10° to -20°C

NOTE:

Pharmaceutical Room Temperature Sample Storage (for Pharmaceutical, Animal Health, and GLP samples) is maintained at 15° to 30°C.

Foods also has storage conditions available at $-40^{\circ} \pm 10^{\circ}\text{C}$ and $-80^{\circ} \pm 10^{\circ}\text{C}$.

4. If the temperature recorded does not fall within these ranges, corrective action needs to be taken.
5. Temperature monitoring documentation shall be recorded in ink and changes shall be made in accordance with the error correction procedure outlined in SOP-QA-109, "Laboratory Notebooks, Logbooks, and Documentation."
6. Temperature records must be reviewed by a second qualified person and this information must be permanently archived.
7. In the event that additional storage areas are needed as "overflow" storage, systems must be put into place before samples can be stored. These areas must also be monitored for acceptable storage conditions.
8. If a client requests storage conditions which are outside the temperature ranges defined above, arrangements will be made to accommodate the request, if possible.

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00	10/01/96	Previous Issue
01	SEP 02 1997	Major changes are as follows: • Expanded upon Scope, Purpose, and Procedure to include Pharmaceutical Sciences and Animal Health • Added Personnel Training and Qualifications section • Broke Procedure section down into sample storage and transfer, security of storage areas, sample discard, and storage conditions • Incorporated Procedural Amendment #1 • Clarified the scope of this procedure does not apply to the storage of samples in our stability chambers or the storage of controlled substances

SOPQA103.DOC
081597

Prepared by: Kathy D Wetzel Date: 8/15/97

Approved by: Stephen M. Lowen Date: 8/18/97

Approved by: J. Keith Hensley Date: 8/19/97



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QUALITY ASSURANCE OPERATIONS MANUAL

Internal Chain-of-Custody Documentation

Purpose:

In order to demonstrate reliability of data which may be used as evidence in a legal case, required by a regulatory agency, or required by a 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 purpose of a chain of custody is to ensure traceability of samples while they are in the possession of the laboratory.

Scope:

This procedure describes the initiating and maintaining of chain-of-custody (COC) documentation for samples that require this level of traceability. It applies to all business units of Lancaster Laboratories (Environmental Sciences, Food and Animal Health Sciences, Pharmaceutical Sciences) when a client or regulatory agency requests an accurate written record tracing the possession of samples from the time they are received at the laboratory until the last requested analysis is verified. This procedure also applies to samples, especially environmental samples, which may be used as evidence in a legal case.

The first section of this procedure summarizes the COC requirements for food, animal health, and pharmaceutical samples. The second section summarizes the requirements for environmental COC samples.

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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, pharmaceutical samples storage area).

Personnel Training & Qualifications:

Training for this procedure consists of reading SOP-QA-104. Supervisory review of all COC documentation should be done until the trainer is satisfied that proficiency has been achieved. Training of all laboratory personnel is the responsibility of the group leader. Documentation that this training has been completed must be kept in the training records.

Procedure:

A. Food, Animal Health, and Pharmaceutical procedure

1. General overview
 - a. Chain-of-custody documentation shall be kept upon the request of a client or regulatory agency. As with all analytical data, it is extremely important that this documentation be 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

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procedure addressed in SOP-QA-109, "Laboratory Notebooks, Logbooks, and Documentation." It is the responsibility of the person who made an error in documentation to correct the error.

- b. For Food, Animal Health, and Pharmaceutical samples, internal COC documentation will begin when samples are received at the laboratory.
- c. A member of the Sample Administration group will receive and unpack the samples. They will sign the client paperwork that accompanies the samples, if provided. If the samples were picked up by our Transportation department, the driver must also sign applicable paperwork to relinquish the samples to Sample Administration.
- d. The Sample Administration group will track the custody of samples between receipt and entry into the computerized sample management system (CSMS) 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.
- e. Samples will be entered into the CSMS as described in SOP-QA-102, "Sample Log-in."
- f. After entry, samples are released by the Sample Administration group to be stored in other areas of the laboratory (e.g., Foods, Pharmaceutical specific storage areas). 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. Chain-of-custody transfer documentation is recorded on a form which is given as Figure 6 of this procedure.

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2. Documentation of custody changes

- a. An example of how to document changes in sample custody is shown as Figure 6 of this procedure. Each change of sample custody must be accurately documented in a consistent format. Entries documenting change of custody will use the following format:

Signature: 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

- b. When sample(s) are released from storage, they must be signed out by the analyst receiving them. The analyst must note the sample number(s) taken, the date and time received, and a note as to the reason why they were removed from storage (reason for change of custody).
- c. When an analyst returns sample(s) to storage, they must note the sample number(s) being returned in addition to time of return.
- d. If the custody of sample(s) is passed from one analyst to another, the following must be noted: the sample number(s) transferred, the reason for the transfer, in addition to the time and date of transfer. It is the responsibility of the analyst now in possession of the samples to ensure they are returned to the storage area.
- e. Each specific test that an analyst performs, in conjunction with the associated sample number(s), must be accurately documented by the analysts in the Reason for Change of Custody column before the samples are returned to the sample storage area.

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3. Additional COC issues

- a. Chain-of-custody paperwork will remain with and accompany sample containers at all times.
- b. When sample analysis is complete, samples shall be returned to the storage area, in conjunction with the COC form.
- c. Original COC documentation will be maintained at the laboratory and filed in the sample storage area. COC documentation will be overchecked in conjunction with the sample data before a copy is sent to the client. The copy could either accompany the samples as they are returned to the client or it could be included within a client data package.
- d. 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.**

B. Environmental procedure

1. Initiation of COC documentation

- a. 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. It will be the responsibility of the person who made an error in documentation to correct the error.

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- b. 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.
 - c. 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.
 - d. The Sample Administration group will track the custody of samples between receipt and entry into the CSMS 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.
 - e. Samples will be entered into the Sample Management System as described in SOP-QA-102. 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.
2. Creating the internal COC
- a. 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

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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.

- b. 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.
- c. 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.

3. Documentation of custody changes

- a. 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

- (1) 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.

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- (2) 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).

- (3) 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.

- (4) When sample support receives samples from an analyst they must:

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

- b. 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 (3)a. above.
- c. 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.

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- d. 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.
- e. The following changes of custody will be handled in the following manner:
 - (1) 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.
 - (2) 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.
 - (3) 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

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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.

- (4) 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.

4. Additional COC issues

- a. 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.
- b. 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.

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5. When sample analysis is complete
 - a. 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 "All Sample Consumed," "Discard," or "Storage" for the final reason of transfer.
 - b. 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.
 - c. 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.
 - d. 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

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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.

Revision Log:

Initiated Date: 03/87

<u>Ver. #</u>	<u>Effective Date</u>	<u>Change</u>
00	12/01/95	Previous Issue
01	03/14/97	Major changes are as follows: • Training section added. • Examples of SA Receipt Documentation Log and Metals Locked Storage COC updated. • Section E.1., Option to end chain with "All Sample Consumed" added.
02	SEP 02 1997	Major changes are as follows: • Incorporated specific Procedure section for Food, Animal Health, and Pharmaceutical procedures. • Expanded upon the scope of the procedure.

SOPQA104.DOC
081297

Prepared by: Kathy D Wetzol Date: 8/12/97

Approved by: Kathleen W. Lowery Date: 8/14/97

Approved by: Julian Hershey Date: 8/18/97

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Figure 1

Analysis Request/ Environmental Services Chain of Custody

For Lancaster Laboratories use only

Acct. # _____ Sample # _____

Lancaster Laboratories
A Division of Thermo Analytical Inc.

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

1	Client _____	Acct. # _____	For lab use only
2	Project Name/ID# _____	PNVSD # _____	5
3	Project Manager _____	P.O. # _____	6
4	Sampler _____	Quote # _____	7
8	Name of state where samples were collected: _____	8	9
9	Sample Identification # _____	9	10
10	Turnaround Time Requested (TAT) (Leave blank; Rush TAT is subject to Lancaster Laboratories approval and surcharge): _____	10	11
11	Rush results are needed: _____	11	12
12	Phone results requested by (please circle): Phone _____ Fax _____	12	13
13	Phone # _____ Fax # _____	13	14
14	QC Summary	14	15
15	Type I (Tier 0) _____	15	16
16	Type II (Tier 1) _____	16	17
17	Type III (RU Red. Del.) _____	17	18
18	Type IV (CLP) _____	18	19
19	Site-specific QC required? Yes No	19	20
20	Internal Chain of Custody required? Yes No	20	21
21	SDG Complete? Yes No	21	22
22	Retransmitted by: _____	22	23
23	Retransmitted by: _____	23	24
24	Retransmitted by: _____	24	25
25	Retransmitted by: _____	25	26
26	Retransmitted by: _____	26	27
27	Retransmitted by: _____	27	28
28	Retransmitted by: _____	28	29
29	Retransmitted by: _____	29	30
30	Retransmitted by: _____	30	31
31	Retransmitted by: _____	31	32
32	Retransmitted by: _____	32	33
33	Retransmitted by: _____	33	34
34	Retransmitted by: _____	34	35
35	Retransmitted by: _____	35	36
36	Retransmitted by: _____	36	37
37	Retransmitted by: _____	37	38
38	Retransmitted by: _____	38	39
39	Retransmitted by: _____	39	40
40	Retransmitted by: _____	40	41
41	Retransmitted by: _____	41	42
42	Retransmitted by: _____	42	43
43	Retransmitted by: _____	43	44
44	Retransmitted by: _____	44	45
45	Retransmitted by: _____	45	46
46	Retransmitted by: _____	46	47
47	Retransmitted by: _____	47	48
48	Retransmitted by: _____	48	49
49	Retransmitted by: _____	49	50
50	Retransmitted by: _____	50	51
51	Retransmitted by: _____	51	52
52	Retransmitted by: _____	52	53
53	Retransmitted by: _____	53	54
54	Retransmitted by: _____	54	55
55	Retransmitted by: _____	55	56
56	Retransmitted by: _____	56	57
57	Retransmitted by: _____	57	58
58	Retransmitted by: _____	58	59
59	Retransmitted by: _____	59	60
60	Retransmitted by: _____	60	61
61	Retransmitted by: _____	61	62
62	Retransmitted by: _____	62	63
63	Retransmitted by: _____	63	64
64	Retransmitted by: _____	64	65
65	Retransmitted by: _____	65	66
66	Retransmitted by: _____	66	67
67	Retransmitted by: _____	67	68
68	Retransmitted by: _____	68	69
69	Retransmitted by: _____	69	70
70	Retransmitted by: _____	70	71
71	Retransmitted by: _____	71	72
72	Retransmitted by: _____	72	73
73	Retransmitted by: _____	73	74
74	Retransmitted by: _____	74	75
75	Retransmitted by: _____	75	76
76	Retransmitted by: _____	76	77
77	Retransmitted by: _____	77	78
78	Retransmitted by: _____	78	79
79	Retransmitted by: _____	79	80
80	Retransmitted by: _____	80	81
81	Retransmitted by: _____	81	82
82	Retransmitted by: _____	82	83
83	Retransmitted by: _____	83	84
84	Retransmitted by: _____	84	85
85	Retransmitted by: _____	85	86
86	Retransmitted by: _____	86	87
87	Retransmitted by: _____	87	88
88	Retransmitted by: _____	88	89
89	Retransmitted by: _____	89	90
90	Retransmitted by: _____	90	91
91	Retransmitted by: _____	91	92
92	Retransmitted by: _____	92	93
93	Retransmitted by: _____	93	94
94	Retransmitted by: _____	94	95
95	Retransmitted by: _____	95	96
96	Retransmitted by: _____	96	97
97	Retransmitted by: _____	97	98
98	Retransmitted by: _____	98	99
99	Retransmitted by: _____	99	100

2435 New Holland Pk., PO Box 12425, Lancaster, PA 17605-2425 (P) 717 656-2300 (F) 717 656-2300

Copyright: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

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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.

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Figure 2



Sample Administration
Receipt Documentation Log

Client/Project: XYZ Accidental/Well Monitoring Shipping Container Sealed: (Y) / N
Date of Receipt: 6/27/97 COC Seal Present: (Y) / N
Time of Receipt: 1350 COC Seal Intact: (Y) / N
Source Code: 60 Package: (Chilled) / Not Chilled
Unpacker Emp. No.: 210

Temperature of Shipping Containers	
#1	#2
Thermometer ID: <u>123</u>	Thermometer ID: _____
Temp.: <u>N/A</u>	Temp.: _____
Temp. Bottle / Surface Temp.	Temp. Bottle / Surface Temp.
Wet Ice / Dry Ice / Ice Packs	Wet Ice / Dry Ice / Ice Packs
Ice Present? <u>(Y)</u> / N	Ice Present? Y / N
#3	#4
Thermometer ID: _____	Thermometer ID: _____
Temp.: _____	Temp.: _____
Temp. Bottle / Surface Temp.	Temp. Bottle / Surface Temp.
Wet Ice / Dry Ice / Ice Packs	Wet Ice / Dry Ice / Ice Packs
Ice Present? Y / N	Ice Present? Y / N

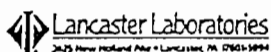
Paperwork Discrepancy/Unpacking Problems: Broken 40ml Vial, Client ID
345-01, Client Called 6/27/97 at 1610.

Sample Administration Chain of Custody			
Name	Date	Time	Reason for Transfer
<u>K. Hutto</u>	<u>6/27/97</u>	<u>1600</u>	Unpacking
<u>A. Hutchinson</u>	<u>6/27/97</u>	<u>1615</u>	<u>(Place in Storage)</u> or Entry
<u>D. Neslund</u>	<u>6/27/97</u>	<u>1800</u>	Remove from Storage / <u>Entry</u>
			Place in Storage or Entry
			Entry

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Figure 3



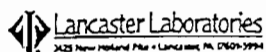
Locked Storage Chain of Custody
Original Sample

Client/Project: XYZ Associated
Preservative: HCl Matrix: Water SDG: XYZ01
Sample # Range of Entry Group: 2420638-39 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 nealund	SS Storage	11/27/95	1600	Entry & Storage	
2420638-39	SS Storage	B. 705 Weaver	11/29/95	700	Remove from SS Storage	
2420638-39	B. 705 Weaver	dept 21 Storage	11/29/95	715	VOA Storage	
2420638-39	dept 21 Storage	K. 396 Witman	11/29/95	1315	VOA Analysis	X
2420638-39	K. Witman 396	A. 513 Taylor	11/29/95	1700	VOA Analyst Shift Change	
2420638-39	A. 513 Taylor	dept 21 Storage	11/29/95	2100	VOA Storage	
2420638-39	dept 21 Storage	C. 266 Quinn	12/3/95	800	Transfer to SS Storage	
2420638-39	C. Quinn 266	A. 630 Kearse	12/3/95	815	Storage	

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Figure 4



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 (#38)	D. Neelund 208	11/27/95
1000 ml Amber Glass (#45)		
1000 ml Plastic (#09)		
1000 ml Amber Glass (#29)		

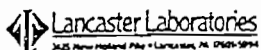
Supplemental Chains		
Bottle Type	Started By	Date Started
77	C. Abner 266	11/27/95
21	C. Abner 266	11/27/95

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

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Figure 5



Locked Storage Chain of Custody Metals

Digest Type (circle one): Hg Métals GF Hydrides Trial No: 2 (If not 1, fill in)

Batch No:

9	5	3	0	5

1	8	4	9

0	0	4

[illegible]

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Figure 6



Food, Pharmaceutical, Animal Health
Locked Storage Chain of Custody
Original Sample

Client/Project: Smith Pharmaceutical
Preservative: N/A Matrix: Tablets
Sample # Range of Entry Group: 2830419-30
Bottle Type: Amber Glass - 100 Tablets/Bottle

Sample Number(s) In Custody	Released By	Received By	Date of Transfer	Time of Transfer	Reason for Change of Custody
2830419-30	⁰⁷⁴ D. Carruthers	m. Coho 589	7/25/97	1300	Entry/Transfer to Pharm. Storage
2830419-30	m. Coho 589	Pharm Storage	7/25/97	1315	Storage
2830419-30	Pharm Storage	E. Ortiz 572	7/27/97	800	PK analysis
2830419-30	E. Ortiz 572	Pharm Storage	7/27/97	1000	Storage
2830419-30	Pharm Storage	D. Wright 330	7/29/97	930	GC assay Amplex
2830419-30	D. Wright 330	Pharm Storage	7/29/97	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 in 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.

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Table 8-1						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GC/MS Volatiles*	After C-cal fails	6	RF for SPCCs >0.300 for chlorobenzene and 1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform and chloromethane 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	6	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	At least 5	%RSD of <20% for individual compounds or for average of all compounds	Every 12 hours, or every 10 samples	1	%Drift $\pm$ 15% for individual compounds or average of all compounds
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% Alternatively, if the average of the %RSDs of all compounds in the calibration standard is $\leq$ 20%, then the AVG RF can be used for all compounds.	Every 10 samples Every 20 samples or 12 hours for Method 8081A, 8082	1	$\leq$ 15% difference from initial response for quantitation C-cal - A CCV is also compliant if the average RPD is $\leq$ 15% for all compounds in the CCV standard. DDT/Endrin breakdown check 15% every 12 hours or 20 injections
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 Alternatively, if the average of the %RSDs of all compounds in the calibration standard is $\leq$ 20%, then the AVG RF can be used for all compounds.	Every 10 samples	1	$\leq$ 15% difference from initial response for quantitation C-cal - A CCV is also compliant if the average RPD is $\leq$ 15% for all compounds in the CCV standard.
GC TPH-GRO	After C-cal fails	At least 5	%RSD of <20% otherwise use calibration curve	Every 12 hours or every 10 samples	1	%Drift $\pm$ 15%
GC TPH-DRO	After C-cal fails	5	% RSD of <20% otherwise use calibration curve	Every 10 samples	1	%Drift $\pm$ 15%
ICP/Trace ICP	Each new run	1	Independent calibration verification within $\pm$ 10%, standards <5%RSD	Every 10 samples	1	Same as initial
CVAA	Each new run	5	Independent calibration verification within $\pm$ 10% Correlation coefficient >0.995	Every 10 samples	1	$\pm$ 20% of true value

Table 8-1						
Instrument	Initial Calibration			Continuing Calibration Verification		
	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria
GFAA	Each new run	5	Independent calibration verification within $\pm 10\%$ Correlation coefficient > 0.995	Every 10 samples	1	$\pm 20\%$ of true value
Flame AA	Each new run	5	Independent calibration verification within $\pm 10\%$ Correlation coefficient > 0.995	Every 10 samples	1	$\pm 20\%$ of true value
Autoanalyzer	Daily	6	Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
Infrared Spectrophotometer (FTIR)	Daily	5	Correlation coefficient > 0.995	Every 10 samples	1	$\pm 10\%$ of true value
TOC Analyzer	Daily	5	$\pm 10\%$ @ STD	Every 10 samples	1	$\pm 10\%$ of true value
TOX Analyzer	Each Batch	4	$\pm 5\%$ @ STD	Every 8 samples	1	$\pm 5\%$ of true value
Balance	Daily	4	Top-loading balance $\pm .5\%$ Analytical balances $\pm .1\%$ for weights $> .1$ g .05 g $\pm .5\%$.02 g $\pm 1.0\%$.01 g $\pm 2.0\%$.005 g $\pm 2.0\%$	N/A	N/A	N/A

*All compounds with %RSD > 15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is $\leq 15\%$, the AVG RF can be used for all compounds.

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

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 III, 1996, 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 8260B/5030B/5035.

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 8270C.

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 5030B/8021B/5035. Non-halogenated organics are analyzed by flame ionization detectors. Method 5030B/8015B, 5035.

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 capillary column, and confirmation on a GC/EC using a second 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 8081A and 8141A. PCBs Method 8082. Herbicides Method 8151A.

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 3550B/3630C/8310.

TPH-GRO - This method determines the concentration of gasoline range organics (2-methylpentane to 1,2,4-trimethylbenzene). 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 8015B/5030B/5035.

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 and 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, Method 8015B.

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 6010B.

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.)

Total Cyanide Analysis - Distillation of the sample releases the cyanide from cyanide complexes as HCN. The liberated HCN and 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 9012A.

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 8 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. (modified).

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 microcoulometrically through the generation of Ag⁺ ions. A Mitsubishi TOX analyzer is used. Method 9020B.

Inorganic Method Numbers				
	ICP	GFAA	Flame AA	Cold Vapor
Aluminum	6010B		7020	
Antimony	6010B	7041		
Arsenic	6010B	7060A		
Barium	6010B		7080A	
Beryllium	6010B	7091		
Cadmium	6010B	7131A	7130	
Calcium	6010B		7140	
Chromium	6010B	7191	7190	
Cobalt	6010B			
Copper	6010B	7211	7210	
Iron	6010B		7380	
Lead	6010B	7421	7420	
Magnesium	6010B		7450	
Manganese	6010B		7460	
Mercury				7470A/7471A
Molybdenum	6010B			
Nickel	6010B	7521	7520	
Potassium	6010B		7610	
Selenium	6010B	7740		
Silver	6010B	7761	7760A	
Sodium	6010B		7710	
Thallium	6010B	7841		
Tin	6010B			
Vanadium	6010B			
Zinc	6010B		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 - 8260B)				
Compounds	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.
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.
<i>trans</i> -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.
<i>trans</i> -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.
<i>cis</i> -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.
<i>cis</i> -1,2-Dichloroethene	5.	2.	5.	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 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 8260B)				
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.
<i>trans</i> -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.
<i>trans</i> -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.

Appendix IX Volatile Compounds (GC/MS 8260B)				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
1,2-Dibromoethane	5.	1.	5.	1.
cis-1,2-Dichloroethene	5.	2.	5.	2.
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 (8260B)				
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.
<i>trans</i> -1,2-Dichloroethene	5.	2.	5.	2.
2,2-Dichloropropane	5.	1.	5.	1.
<i>cis</i> -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.
<i>m+p</i> -Xylene	5.	1.	5.	1.
<i>o</i> -Xylene	5.	1.	5.	1.

GC/MS Volatile Compound List (8260B)				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Styrene	5.	1.	5.	1.
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.
<i>n</i> -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.
<i>tert</i> -Butylbenzene	5.	1.	5.	1.
1,2,4-Trimethylbenzene	5.	1.	5.	1.
<i>sec</i> -Butylbenzene	5.	1.	5.	1.
<i>p</i> -Isopropyltoluene	5.	1.	5.	1.
1,3-Dichlorobenzene	5.	2.	5.	2.
1,4-Dichlorobenzene	5.	2.	5.	2.
<i>n</i> -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.

Semivolatile Priority Pollutant Compound List				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Diethyl phthalate	10.	2.	330.	67.
1,2-Diphenylhydrazine	10.	1.	330.	67.
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.
Benzdine	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				
Compound	Waters		Soils**	
	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.

Appendix IX Semivolatile Compounds				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
2,4-Dichlorophenol	10.	2.	330.	33.
2,6-Dichlorophenol	10.	1.	330.	67.
Diethyl phthalate	10.	2.	330.	67.
Dimethoate	10.	2.	330.	100.
<i>p</i> -(Dimethylamino) azobenzene	10.	1.	330.	133.
7,12-Dimethylbenz(a) anthracene	10.	2.	330.	33.
3,3'-Dimethylbenzidine	20.	2.	670.	100.
<i>a,a</i> -dimethyl-1-phenethylamine	20.	1.	670.	67.
2,4-Dimethylphenol	10.	1.	330.	67.
Dimethyl phthalate	10.	3.	330.	33.
<i>m</i> -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- <i>n</i> -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- <i>cd</i>) 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.

Appendix IX Semivolatile Compounds				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
2-Naphthylamine	10.	2.	330.	33.
2-Nitroaniline	10.	1.	330.	67.
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-Tetrachlorophenol	10.	2.	330.	33.
Tetraethyl dithiopyrophosphate	10.	2.	330.	67.
Thionazin	20.	2.	670.	200.
o-Toluidine	10.	2.	330.	100.

Appendix IX Semivolatile Compounds				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
1,2,4-Trichlorobenzene	10.	1.	330.	33.
2,4,5-Trichlorophenol	10.	1.	330.	67.
2,4,6-Trichlorophenol	10.	1.	330.	67.
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.

¹N-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.	.5	100.	10.
Bromomethane	5.	.5	100.	1.
Dichlorodifluoromethane	2.	.2	40.	8.
Vinyl chloride	1.	.2	20.	4.
Chloroethane	1.	.2	20.	4.
Methylene chloride	1.	.2	20.	4.
Trichlorofluoromethane	1.	.2	20.	4.
1,1-Dichloroethene	1.	.2	20.	4.
1,1-Dichloroethane	1.	.2	20.	4.
<i>cis</i> -1,2-Dichloroethene	1.	.2	20.	4.
<i>trans</i> -1,2-Dichloroethene	1.	.2	20.	4.
Chloroform	1.	.2	20.	4.
1,2-Dichloroethane	1.	.2	20.	4.
1,1,1-Trichloroethane	1.	.2	20.	4.
Carbon tetrachloride	1.	.2	20.	4.
Bromodichloromethane	1.	.2	20.	4.
1,2-Dichloropropane	1.	.2	20.	4.
<i>trans</i> -1,3-Dichloropropene	1.	.2	20.	4.
Trichloroethene	1.	.2	20.	4.
Dibromochloromethane	1.	.2	20.	4.
1,1,2-Trichloroethane	1.	.2	20.	4.
<i>cis</i> -1,3-Dichloropropene	1.	.2	20.	4.
2-Chloroethylvinyl-ether	10.	1.0	200.	20.
Bromoform	1.	.2	20.	4.
1,1,2,2-Tetrachloroethane	1.	.2	20.	4.
Tetrachloroethene	1.	.2	20.	4.
Chlorobenzene	1.	.2	20.	4.
Benzene	1.	.2	20.	4.
Toluene	1.	.2	20.	4.
Ethylbenzene	1.	.2	20.	4.
<i>o</i> -Xylene	1.	.6	60.	12.
<i>m</i> -Xylene	2.	.6	60.	12.
<i>p</i> -Xylene	3.	.6	60.	12.

*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				
Compound	Waters		Soils**	
	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 the 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.

Petroleum Analysis				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Benzene	1.	0.2	5.	2.
Toluene	1.	0.2	5.	2.
Ethylbenzene	1.	0.2	5.	2.
Total Xylene	3.	0.6	15.	5.
Methyl Teritary Butyl Ether	1.	0.3	20.	5.
Napthalene	5.	1.	20.	5.

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

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

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				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
alpha-BHC	0.01	0.002	0.33	.067
beta-BHC	0.01	0.002	0.33	.067
gamma-BHC (Lindane)	0.01	0.002	0.33	.067
delta-BHC	0.01	0.002	0.33	.067
Heptachlor	0.01	0.002	0.33	.067
Aldrin	0.01	0.002	0.33	.067
Heptachlor epoxide	0.01	0.002	0.33	.067
4,4-DDE	0.02	0.004	0.67	.13
4,4-DDD	0.02	0.004	0.67	.13
4,4-DDT	0.02	0.004	0.67	.13
Dieldrin	0.02	0.004	0.67	.13
Endrin	0.02	0.004	0.67	.13
Chlordane	0.5	0.05	17.	3.3
Toxaphene	1.	0.2	33.	6.7
Endosulfan I	0.01	0.002	0.33	.067
Endosulfan II	0.02	0.004	0.67	.13
Endosulfan sulfate	0.02	0.004	0.67	.13
Endrin aldehyde	0.02	0.004	0.67	.13
Methoxychlor	0.1	0.002	3.3	.67
PCB-1016	0.5	0.1	17.	3.3
PCB-1221	0.5	0.1	17.	3.3
PCB-1232	0.5	0.1	17.	3.3
PCB-1242	0.5	0.1	17.	3.3
PCB-1248	0.5	0.1	17.	3.3
PCB-1254	0.5	0.1	17.	3.3
PCB-1260	0.5	0.1	17.	3.3

*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* (µg/kg)	J-Value (µg/kg)
Aldrin	0.01	0.002	0.33	.067
alpha-BHC	0.01	0.002	0.33	.067
beta-BHC	0.01	0.002	0.33	.067
delta-BHC	0.01	0.002	0.33	.067
gamma-BHC (Lindane)	0.01	0.002	0.33	.067
Chlordane	0.5	0.05	17.	3.3
4,4-DDT	0.02	0.004	0.67	.13
4,4-DDE	0.02	0.004	0.67	.13
4,4-DDD	0.02	0.004	0.67	.13
Dieldrin	0.02	0.004	0.67	.13
Endosulfan I	0.01	0.002	0.33	.067
Endosulfan II	0.02	0.004	0.67	.13
Endosulfan sulfate	0.02	0.004	0.67	.13
Endrin	0.02	0.004	0.67	.13
Endrin aldehyde	0.02	0.004	0.67	.13
Heptachlor	0.01	0.002	0.33	.067
Heptachlor epoxide	0.01	0.002	0.33	.067
Kepone	0.1	0.02	3.3	.67
Methoxychlor	0.1	0.002	3.3	.67
PCB-1016	0.5	0.1	17.	3.3
PCB-1221	0.5	0.1	17.	3.3
PCB-1232	0.5	0.1	17.	3.3
PCB-1242	0.5	0.1	17.	3.3
PCB-1248	0.5	0.1	17.	3.3
PCB-1254	0.5	0.1	17.	3.3
PCB-1260	0.5	0.1	17.	3.3
Toxaphene	1.	0.2	33.	6.7

*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.

Appendix IX Herbicide Compounds				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
2,4-D	.5	.1	17.	3.3
Dinoseb	.25	.05	8.3	1.7
2,4,5-TP	.05	.01	1.7	3.3
2,4,5-T	.05	.01	1.7	3.3

*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				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Disulfoton	.4	.2	13.	6.5
Methyl parathion	.4	.2	13.	6.5
Ethyl parathion	.4	.2	13.	6.5
Famphur	.4	.2	13.	6.7
Phorate	.4	.2	13.	6.5

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

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

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				
Compound	Waters		Soils**	
	LOQ* (µg/L)	J-Value (µg/L)	LOQ* (µg/kg)	J-Value (µg/kg)
Naphthalene	8.	.8	270.	27.
Acenaphthylene	8.	.8	270.	27.
Acenaphthene	8.	.8	270.	27.
Fluorene	.8	.17	27.	2.5
Phenanthrene	.3	.046	11.	1.
Anthracene	.2	.031	5.	0.5
Fluoranthene	.2	.02	5.	0.5
Pyrene	.8	.18	27.	2.5
Benzo(a)anthracene	.08	.018	3.	0.25
Chrysene	.3	.059	11.	1.
Benzo(b)fluoranthene	.06	.035	2.	0.2
Benzo(k)fluoranthene	.06	.027	2.	0.2
Benzo(a)pyrene	.08	.022	3.	0.25
Dibenzo(a,h)anthracene	.2	.047	5.	0.5
Benzo(g,h,i)perylene	.5	.099	16.	1.5
Indeno(1,2,3-cd)pyrene	.3	.064	11.	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. 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)				
Analyte	Waters		Soils**	
	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	0.125	0.1

¹Analyzed by Trace ICP

²Analyzed 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.

Inorganic Appendix IX Analyte List				
Analyte	Waters		Soils**	
	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
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	0.125	0.1
Sulfide	2.	0.56	20.	5.46

¹Analysis by Trace ICP

²Analysis 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.

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Parameter	Waters		Soils**	
	LOQ* (mg/L)	J-Value (mg/L)	LOQ* (mg/kg)	J-Value (mg/kg)
Phenols	0.01	0.004	0.7	0.23
TOC	1.0	0.16	50.	12.
TOX	5. µg/L	1.3 µg/L	100.	100.
TPH	0.5	0.16	40.	12.6

*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**:

$$Q = (A_x) (I_s) / (A_{I_s}) (RRF) (V_i)$$

Where:

A_x = Peak area

A_{I_s} = Internal standard peak area

I_s = Amount of internal standard injected (ng)

RRF = Relative response factor

V_i = 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:

$$\text{Concentration} = (Q) (D) (F) (1000) / (I)$$

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 $\mu\text{g/L}$ for water samples and $\mu\text{g/kg}$ 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 and petroleum analysis**, a calibration is performed with a minimum of five levels using either an internal standard calibration or external calibration.

A. Internal standard calibration

$$CF = \frac{(Ax) (Cis)}{(Ais) (Cx)} \text{ or } CF = \frac{(Hx) (Cis)}{(His) (Cx)}$$

Where:

Ax = Peak area of the compound to be measured in that level of the initial calibration

Hx = Height area of the compound to be measured in that level of the initial calibration

Ais = Peak area of the internal standard

His = Height area of the internal standard

Cis = Concentration of the internal standard.

NOTE: On some systems, this is set at 1.

Cx = Concentration of the compound spiked into that level

$$\overline{CF} = \frac{\sum \text{all CF in the initial calibration}}{n}$$

Where:

n = Number of levels in the initial calibration

$$\text{Concentration} = \frac{(Ax)(Cis)}{(Ais)(\overline{CF})} \times DF \quad \text{or} \quad \frac{(Hx)(Cis)}{(His)(\overline{CF})} \times DF$$

Where:

Ax = Peak area of the compound to be measured

Hx = Height area of the compound to be measured

Ais = Peak area of the internal standard

His = Height area of the internal standard

Cis = Concentration of the internal standard.

NOTE: On some systems, this is set at 1.

$\overline{CF}$ = Average calibration factor

DF = Dilution factor or preparation factor

B. External calibration

$$CF = \frac{Ax}{CF} \times DF \quad \text{or} \quad \frac{Hx}{CF} \times DF$$

$$\text{Concentration} = \frac{Ax}{CF} \times DF \quad \text{or} \quad \frac{Hx}{CF} \times DF$$

When all parameters are defined in A above.

Results are reported in $\mu\text{g/L}$ 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 and organophate pesticides**, an internal standard calibration is used. The results are calculated from the curve when the individual analyte %RSD is >20% and the average of the analyte %RSDs is also >20%. Otherwise, the results are calculated using the average response factor.

A. Curve

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

Where:

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

FV = Final volume

IW or IV = Initial weight, initial volume

DF = Dilution Factor

AF = Additional preparation factors

B. Average response factor

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

Where:

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

The results for the **PAHs by HPLC and pesticide/PCBs** analyses are calculated using the following equation:

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

Where:

Pk Ht = Peak height found in sample

ARF = Average response factor (Pk Ht/Concentration of analyte in standard)

FV = Final volume of sample extract (mL)

DF = Dilution factor (where applicable)

IV = Initial volume of sample extracted (mL)

IW = Initial weight of the sample extracted (gm)

AF = Additional factor

If a curve is used, then $\frac{\text{Pk Ht}}{\text{ARF}}$ is replaced by the following in the preceding equation:

$$\frac{Pk\ Ht - y - intercept}{slope}$$

Results are reported as 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. Results are reported on Lancaster Labs Analysis Report Forms shown in Appendix A.

For TPH-GRO and TPH-DRO, an external calibration procedure of at least five levels of standards 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:

$$Concentration = (Ax / Rf) \times (DF)$$

Where:

Ax = Total peak area in region defined as analyte

DF = Dilution factor

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

$$RF = \frac{[(As1 / Qs1) + (As2 / Qs2) + (As3 / Qs3) + (As4 / Qs4) + (As5 / Qs5) + \dots (Asn / Qsn)]}{n}$$

Where:

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

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

n = Number of calibration levels

Results are reported in mg/L for water samples and in mg/kg for solid samples. Soil samples are reported on an as-received and 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:

$$\text{Concentration} = (A) (D) (E) / (F)$$

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 for quality, compliance, and conformance to 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 for quality assurance 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, Data Package Personnel, and 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 III, 1996. 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. An LCS is analyzed with every batch.

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 (8260B)			
Type	Acceptance Limits(%) WATERS SOILS		Frequency
Surrogates:			Each sample, MS, MSD, LCS, and blank
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:	See Table 11.2 for acceptance criteria		Each group (≤ 20) of samples per matrix/level
Spike all compounds of interest			LCS run for compounds outside acceptance limits
Laboratory Control Samples:	See Table 11.2 for acceptance criteria		Each group (≤ 20) of samples per matrix/level
Spike all compounds of interest			Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits
Matrix Spike Duplicates (RPD):	$\leq 30\%$		Each group (≤ 20) of samples per matrix/level
Spike all compounds of interest			Evaluated by analyst in relationship to other QC results
Blanks:	$\leq \text{LOQ}$ for all compounds		Once for each 12-hour time period
			Reanalyze blank and associated samples if blank outside limits
Internal Standards:	-50% to +100% of internal standard area of 12-hour STD		Each sample, MS, MSD, LCS, and blank
Bromochloromethane			
1,4-Difluorobenzene			
Chlorobenzene-d5	RT Change ≤ 30 sec.		Reanalyze samples; if reanalysis confirms original, document on report or case narrative

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

Table 11-2

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

Compound Name	Waters		Soils	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
Dichlorodifluoromethane	44-117	35-130	36-136	31-143
Chloromethane	55-119	54-125	48-130	45-134
Vinyl Chloride	62-122	58-132	60-127	58-133
Bromomethane	46-125	44-138	46-134	43-135
Chloroethane	34-127	37-139	30-142	18-148
Trichlorofluoromethane	33-160	34-173	39-135	21-158
1,1-Dichloroethene	57-153	65-147	69-146	67-153
Methylene Chloride	81-118	79-122	69-126	65-136
<i>trans</i> -1,2-Dichloroethene	78-118	79-122	73-126	74-127
1,1-Dichloroethane	84-123	77-132	81-130	79-134
2,2-Dichloropropane	79-130	75-142	79-132	76-138
<i>cis</i> -1,2-Dichloroethene	84-118	84-121	84-123	80-128
Chloroform	82-122	80-126	82-123	78-129
Bromochloromethane	73-117	48-137	69-134	59-138
1,1,1-Trichloroethane	77-137	77-140	84-132	82-135
Carbon Tetrachloride	69-136	68-138	78-129	68-138
1,1-Dichloropropene	86-121	82-128	82-130	82-128
Benzene	82-123	79-127	77-126	76-128
1,2-Dichloroethane	82-126	79-132	81-123	78-125
Trichloroethene	80-122	78-127	81-123	74-130
1,2-Dichloropropane	82-120	79-125	77-127	76-129
Dibromomethane	89-113	84-120	82-119	79-119
Bromodichloromethane	84-118	82-122	80-121	80-120
Toluene	80-126	78-130	74-128	69-140
1,1,2-Trichloroethane	87-120	84-122	81-124	65-144
Tetrachloroethene	78-140	72-145	83-150	74-157
1,3-Dichloropropane	89-122	86-124	79-128	78-125
Dibromochloromethane	88-114	82-119	80-120	76-125
1,2-Dibromoethane	90-114	84-120	84-118	79-119
Chlorobenzene	84-119	84-120	81-121	81-122
1,1,1,2-Tetrachloroethane	90-117	86-121	87-122	85-126
Ethylbenzene	89-124	86-127	86-129	77-138
<i>m+p</i> -Xylene	88-123	83-129	86-128	83-130
<i>o</i> -Xylene	88-123	86-124	86-127	56-159
Styrene	88-121	86-123	84-127	84-124

Table 11-2				
GC/MS Statistical Acceptance Limits for Volatile Compounds (8260B)				
Compound Name	Waters		Soils	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
Bromoform	80-118	71-124	73-120	68-122
Isopropylbenzene	85-120	77-130	84-127	77-130
1,1,2,2-Tetrachloroethane	73-131	72-132	70-124	59-142
Bromobenzene	86-115	84-119	85-122	78-132
1,2,3-Trichloropropane	84-120	74-131	72-122	66-134
Acetone	64-134	50-142	46-133	29-163
Carbon Disulfide	62-173	74-157	52-165	56-171
<i>n</i> -Propylbenzene	74-127	69-138	76-135	66-145
2-Chlorotoluene	81-124	78-130	78-129	62-151
1,3,5-Trimethylbenzene	72-129	70-136	78-134	67-150
4-Chlorotoluene	82-122	79-129	78-130	75-134
<i>tert</i> -Butylbenzene	84-123	79-129	81-134	73-140
1,2,4-Trimethylbenzene	80-130	79-133	77-138	61-151
<i>sec</i> -Butylbenzene	76-128	71-135	75-136	57-150
<i>p</i> -Isopropyltoluene	78-127	75-133	80-139	71-143
1,3-Dichlorobenzene	83-118	81-121	81-125	82-121
1,4-Dichlorobenzene	82-113	81-116	79-122	78-120
<i>n</i> -Butylbenzene	53-138	54-146	68-147	50-157
1,2-Dichlorobenzene	85-117	84-120	83-125	61-142
1,2-Dibromo-3-chloropropane	63-137	48-152	53-133	46-141
1,2,4-Trichlorobenzene	70-124	58-133	72-130	51-132
Hexachlorobutadiene	35-160	34-166	65-156	24-170
Naphthalene	55-140	43-147	57-126	27-137
1,2,3-Trichlorobenzene	64-130	56-137	66-129	42-132
<i>trans</i> -1,3-Dichloropropene	62-136	84-118	69-131	68-135
4-Methyl-2-pentanone	70-133	58-140	63-123	47-140
<i>cis</i> -1,3-Dichloropropene	86-118	84-119	79-126	79-123
Xylene (Total)	89-123	88-123	88-128	83-135
2-Hexanone	68-139	62-138	60-128	40-154
2-Butanone	47-153	51-148	61-130	47-147

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

Table 11-3
Quality Control
GC/MS Semivolatiles

Type	Acceptance Limits (%) WATERS SOILS	Frequency	Corrective Action
Surrogate: Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d6 2-Fluorophenol 2,4,6-Tribromophenol	47 - 114 31 - 126 51 - 106 45 - 113 37 - 119 37 - 130 7 - 74 39 - 108 25 - 88 35 - 108 34 - 125 23 - 125	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes: Spike all compounds of interest	See Table 11-4 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	See Table 11-4 for acceptance limits	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	$\leq 30\%$	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	$\leq \text{LOQ}$ 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

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

Table 11-4				
Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery				
Compound Name	Water		Soil	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
N-Nitrosodimethylamine	46-81	42-84	47-109	48-113
Phenol	5-83	5-112	49-105	29-112
bis (2-Chloroethyl) ether	66-106	40-128	53-109	12-158
2-Chlorophenol	62-107	56-112	55-107	36-124
1,3-Dichlorobenzene	45-91	44-99	53-103	31-123
1,4-Dichlorobenzene	45-94	34-108	52-103	20-124
1,2-Dichlorobenzene	52-97	32-121	56-107	44-113
bis (2-Chloroisopropyl) ether	43-118	38-118	38-117	36-121
N-Nitroso-di- <i>n</i> -propylamine	62-118	58-120	50-124	38-140
Hexachloroethane	40-84	40-113	52-108	40-113
Nitrobenzene	61-113	43-127	56-110	40-125
Isophorone	66-113	42-134	57-114	46-127
2-Nitrophenol	67-104	64-108	59-107	40-125
2,4-Dimethylphenol	52-99	33-107	39-108	32-119
bis (2-Chloroethoxy) methane	64-103	57-108	56-103	40-121
2,4-Dichlorophenol	65-98	61-101	59-100	39-135
1,2,4-Trichlorobenzene	52-93	50-98	57-104	44-125
Naphthalene	58-99	50-106	60-97	41-115
Hexachlorobutadiene	24-86	24-98	56-115	35-116
4-Chloro-3-methylphenol	60-111	54-115	56-108	22-142
Hexachlorocyclopentadiene	17-80	15-83	27-113	1-127
2,4,6-Trichlorophenol	66-105	43-121	62-106	37-127
2-Chloronaphthalene	61-103	60-106	60-106	60-118
Dimethylphthalate	1-90	11-107	61-104	44-112
Acenaphthylene	64-100	61-103	62-101	42-119
2,6-Dinitrotoluene	64-112	45-128	58-113	39-136
Acenaphthene	61-100	60-101	61-100	47-114
2,4-Dinitrophenol	25-124	6-120	29-117	1-126
4-Nitrophenol	3-83	1-93	44-110	5-132
2,4-Dinitrotoluene	64-112	45-128	58-113	39-136
Diethylphthalate	30-99	46-106	59-104	43-114
4-Chlorophenyl-phenylether	62-104	58-106	52-110	41-115
Fluorene	61-108	59-110	59-109	59-121

Table 11-4

**Semivolatile Matrix Spike/
Matrix Spike Duplicate Sample Recovery**

Compound Name	Water		Soil	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
4,6-Dinitro-2-methylphenol	43-120	38-116	42-107	5-128
N-Nitrosodiphenylamine	64-103	44-124	60-106	28-144
1,2-Diphenylhydrazine	57-123	46-133	52-129	31-149
4-Bromophenyl-phenylether	69-102	63-106	61-110	53-125
Hexachlorobenzene	62-109	48-118	52-123	31-135
Pentachlorophenol	46-114	14-130	42-108	14-131
Phenanthrene	68-102	64-105	62-107	54-120
Anthracene	66-101	62-103	62-105	42-119
Di- <i>n</i> -butylphthalate	61-105	60-110	59-114	35-118
Fluoranthene	66-106	61-109	58-110	26-137
Benzidine	1-116	1-125	1-74	1-70
Pyrene	58-112	55-114	52-115	52-115
Butylbenzylphthalate	48-105	53-110	58-119	45-133
3,3'-Dichlorobenzidine	37-104	37-106	15-94	1-125
Benzo(a)anthracene	69-101	64-103	63-106	33-135
Chrysene	67-101	63-104	60-107	9-153
bis(2-Ethylhexyl)phthalate	64-113	39-131	8-158	8-158
Di- <i>n</i> -octylphthalate	59-118	52-121	54-127	41-146
Benzo(b)fluoranthene	64-101	54-108	59-105	24-148
Benzo(k)fluoranthene	67-105	59-112	63-108	41-126
Benzo(a)pyrene	65-101	60-102	61-107	21-139
Indeno(1,2,3-cd)pyrene	59-111	55-114	55-111	28-127
Dibenz(a,h)anthracene	66-117	57-124	60-117	11-152
Benzo(g,h,i)perylene	52-113	12-133	55-115	49-121
Aniline	53-99	33-113	30-97	1-126
Acetophenone	68-136	64-137	59-134	31-161
Ethyl methanesulfonate	50-123	57-115	65-117	38-142
Methyl methanesulfonate	43-114	54-106	66-122	1-164
N-nitrosodiethylamine	37-135	37-135	37-135	37-135
N-nitrosomethylethylamine	58-140	73-132	78-128	1-187
N-nitrosomorpholine	49-120	50-118	78-109	1-158
N-nitrosopiperidine	52-123	73-108	78-105	1-158
N-nitrosopyrrolidine	1-152	60-121	77-113	1-160

Table 11-4

**Semivolatile Matrix Spike/
Matrix Spike Duplicate Sample Recovery**

Compound Name	Water		Soil	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
2-picoline	26-135	28-127	29-129	1-142
o-Toluidine	60-94	1-145	12-89	1-128
Benzyl Alcohol	59-108	44-117	62-115	9-146
2-chlorophenol	62-107	56-112	55-107	36-124
2-methylphenol	55-96	25-122	57-101	20-130
3- or 4-methylphenol	48-99	15-130	48-116	22-138
Pyridine	38-82	31-85	34-92	21-96
2,6-dichlorophenol	64-107	58-110	62-109	1-156
1,3-dinitrobenzene	62-111	26-142	61-109	1-150
Hexachloropropene	70-130	70-130	70-130	70-130
Isosafrole	9-76	10-76	14-72	1-100
1,4-naphthoquinone	70-130	70-130	70-130	70-130
N-nitrosodi-n-butylamine	48-120	72-101	75-103	1-168
1,4-phenylenediamine	70-130	70-130	70-130	70-130
Safrole	4-122	18-109	30-109	1-136
1,2,4,5-tetrachlorobenzene	67-105	9-160	61-113	30-141
O,O,O-triethylphosphorothioate	46-118	53-119	67-103	52-126
a,a-dimethylphenethylamine	4-100	4-100	4-100	4-100
4-chloroaniline	34-101	9-119	1-102	1-123
2-methylnaphthalene	62-98	57-103	60-102	45-112
2-nitroaniline	58-112	60-111	54-111	8-154
2,4,5-trichlorophenol	67-103	40-122	63-107	18-139
2,3,4,6-tetrachlorophenol	21-137	19-109	62-103	1-134
Dimethoate	1-59	1-83	23-79	1-123
1-naphthylamine	1-179	1-140	1-99	1-147
2-naphthylamine	2-162	1-173	1-100	1-93
5-nitro-o-toluidine	70-130	70-130	70-130	70-130
Pentachlorobenzene	8-162	34-137	69-100	1-148
Phenacetin	7-180	10-177	69-105	1-152
Tetraethyl dithiopyrophosphate	41-125	44-132	62-111	1-193
1,3,5-trinitrobenzene	70-130	70-130	70-130	70-130
Diallate (trans/cis)	48-128	69-113	23-79	1-123
Diphenylamine	64-103	44-124	60-106	28-144

Table 11-4				
Semivolatile Matrix Spike/ Matrix Spike Duplicate Sample Recovery				
Compound Name	Water		Soil	
	LCS/LCSD (%)	MS/MSD (%)	LCS/LCSD (%)	MS/MSD (%)
Thionazin	60-114	61-114	63-110	3-147
Dibenzofuran	67-99	64-100	62-102	38-120
3-nitroaniline	40-108	43-105	9-110	8-114
4-nitroaniline	37-120	1-170	55-116	55-116
2-acetylaminofluorene	70-130	70-130	70-130	70-130
4-aminobiphenyl	1-174	28-130	1-46	1-112
Chlorobenzilate	1-132	24-144	9-223	6-198
<i>p</i> -(dimethylamino) azobenzene	14-184	2-187	1-186	1-247
7,12-dimethylbenz(a) anthracene	87-184	83-184	99-213	1-286
3,3'-dimethylbenzidine	1-149	1-153	1-137	1-110
Isodrin	51-110	52-109	66-117	1-145
3-methylcholanthrene	71-135	66-132	58-169	1-206
4-nitroquinoline-1-oxide	70-130	70-130	70-130	70-130
Pentachloronitrobenzene	68-108	58-112	68-115	10-146
Pronamide	1-138	3-123	1-132	1-153
Methapyrilene	25-151	24-154	35-138	1-142

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

Table 11-5

Quality Control
Pesticides/PCBs

Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Surrogate:				
Organochlorine Pesticides;			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
DCB	60 - 120	50 - 120		
TCMX	60 - 120	50 - 120		
Herbicides;				
DCAA	60 - 120	50 - 120		
Organophosphate Pesticides;				
2NMX	60 - 120	50 - 120		
Matrix Spikes:				
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	See Table 11-6		Each extraction group (≤ 20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Herbicides (all compounds of interest);				
2,4-D	52 - 141	58 - 147		
2,4,5-TP	51-126	44 - 153		
2,4,5-T	59-130	40 - 145		
Dinoseb	4-96	1 - 33		
Organophosphate Pesticides;				
Phorate	63 - 139	42 - 146		
Disulfoton	65 - 125	1 - 119		
Famphur	61 - 155	40 - 174		
Methyl Parathion	51 - 152	1 - 116		
Ethyl Parathion	62 - 120	1 - 140		
PCBs:				
1016	43 - 126	64 - 127		
1260	51 - 126	69 - 123		

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Quality Control Pesticides/PCBs

Quality Control Pesticides/PCBs			
Type	Acceptance Limits (%)		Frequency
	WATERS	SOILS	Corrective Action
Laboratory Control Sample:			Each group (≤ 20) when MS/MSD falls outside established limits
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	See attached Table 11-6		Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits
Herbicides;			
2,4-D	52 - 141	58 - 147	
2,4,5-TP	51-126	44 - 153	
2,4,5-T	59-130	40 - 145	
Dinoseb	4-96	1 - 33	
Organophosphate Pesticides;			
Phorate	63 - 139	42 - 146	
Disulfoton	65 - 125	1 - 119	
Famphur	61 - 155	40 - 174	
Methyl Parathion	51 - 152	1 - 116	
Ethyl Parathion	62 - 120	1 - 140	
Matrix Spike Duplicates (RPD):	Water $\leq 30\%$		Each group (20) of samples per matrix/level
Organochlorine Pesticides; Spike all compounds of interest, except PCBs, chlordane, and toxaphene	Soils $\leq 50\%$		Evaluated by analyst in relationship to other QC results
Herbicides;			
2,4-D			
2,4,5-TP			
2,4,5-T			
Dinoseb			
Organophosphate Pesticides;			
Phorate			
Disulfoton			
Famphur			
Methyl Parathion			
Ethyl Parathion			

Table 11-5

**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 11-6 Quality Control Pesticides/PCBs Organochlorine Pesticides Spike Acceptance Limits		
Compound Name	Matrix Spike and Laboratory Control Sample Limits	
	Waters (%)	Soils (%)
Lindane	62-132	51-142
Heptachlor	46-120	60-137
Aldrin	41-115	49-145
DDT	59-135	60-138
Dieldrin	61-122	59-130
Endrin	68-148	69-152
Methoxychlor	60-164	52-174
Delta-BHC	64-132	44-145
Heptachlor Epoxide	64-126	59-136
Endosulfan I	45-132	46-135
Endrin Aldehyde	52-142	28-166
Alpha-BHC	60-133	48-144
Beta-BHC	64-122	34-145
DDE	55-126	61-135
DDD	60-134	53-141
Endosulfan II	52-130	48-132
Endosulfan Sulfate	67-132	40-150

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

Table 11-7

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; 1-Bromo-4-chlorobenzene (Hall)	70 - 130	70 - 130		
Aromatics; 1-Bromo-4-chlorobenzene (Hall)	70 - 130	70 - 130		
Halocarbons/Aromatics; 1-Bromo-4-chlorobenzene (Hall)	70 - 130	70 - 130		
Non-halogenated; 2-hexanone (FID)	75 - 125	70 - 130		
Matrix Spikes: Spike all compounds of interest except:	See Table 11-8 for acceptance limits		Each group of samples of similar matrix/level (≤ 20) each method	Analyze LCS for compounds outside of acceptance limits
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 11-8 for acceptance limits		Each group (≤ 20) when MS/MSD falls outside established limits	Reanalyze LCS and associated samples for compounds outside of acceptance limits

Table 11-7				
Quality Control Volatiles by GC				
Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Internal Standard: Fluorobenzene	80 - 120	80 - 120	Each sample, MS, MSD, blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative
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:	$\leq$ LOQ for all compounds		Every 12 hours	Reanalyze blank and associated samples if blank is outside limits

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

Table 11-8				
Quality Control Volatiles by GC				
Spike Acceptance Limits				
Compound Name	MS/MSD/LCS (%) Waters	MS/MSD/LSD (%) Soils	Max. % RPD Waters	Max. % RPD Soils
Chloromethane	18-134	40-115	30	30
Bromomethane	54-134	50-115	30	30
Vinyl Chloride	49-145	39-115	30	30
Chloroethane	50-133	49-115	30	30
Methyl Chloride	67-134	66-115	30	30
Trichlorofluoromethane	45-128	35-115	30	30
1,1-Dichloroethene	76-135	53-115	30	30
1,1-Dichloroethane	81-127	82-115	30	30
1,2-Dichloroethene (cis/trans)	81-132	67-115	30	30
Chloroform	82-124	83-115	30	30
1,2-Dichloroethane	82-120	87-115	30	30
1,1,1-Trichloroethane	80-129	74-115	30	30
Carbon Tetrachloride	79-135	71-115	30	30
Bromodichloromethane	74-125	85-115	30	30
1,2-Dichloropropane	82-121	80-115	30	30
Trichloroethene (PID)	77-132	60-118	30	30
Dibromochloromethane	64-127	88-115	30	30
Bromoform	56-139	84-115	30	30
Tetrachloroethene	77-138	78-115	30	30
Chlorobenzene (PID)	83-119	78-108	30	30
Benzene (PID)	77-125	76-105	30	30
Toluene (PID)	69-126	72-109	30	30
Ethylbenzene (PID)	73-125	75-109	30	30
<i>o</i> -Dichlorobenzene (Hall)	72-135	70-130	30	30
<i>m</i> -Dichlorobenzene (Hall)	92-126	84-101	30	30
<i>p</i> -Dichlorobenzene (PID)	81-126	82-113	30	30
<i>o</i> -Xylene	82-122	77-107	30	30
<i>m</i> + <i>p</i> -Xylene	82-123	77-108	30	30
Total Xylenes	82-123	77-108	30	30

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

Table 11-9			
Petroleum Analysis Acceptance Criteria			
Type	Acceptance Limits (%) WATERS SOILS	Frequency	Corrective Action
Surrogate: $\alpha\alpha\alpha$ -Trifluorotoluene	70 - 130 20 - 130	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document a report and/or case narrative
Matrix Spike: Spike all compounds of interest	See Table 11-10	Each group (≤ 20) of samples per matrix/level	Run LCS for compounds outside of acceptance limits
Laboratory Control Sample: Spike all compounds of interest	See Table 11-10	Each group (≤ 20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits
Matrix Spike Duplicates (RPD):	$\leq 30\%$	Each group (≤ 20) of samples per matrix/level	Evaluated by an analyst in relationship to other QC results
Blanks:	$\leq \text{LOQ}$ for all compounds	At least one per 20 samples	Reanalyze blank and associated samples if blank is outside limits
Internal Standards: 1-Chloro-3-fluorobenzene	-50% to +100% if internal standard area	Each sample, MS, MSD, LCS, and blank analyzed on the PID	Reanalyze samples; if reanalysis confirms original, document on report or case narrative

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Table 11-10						
Petroleum Analysis						
Compound Name	MS% Water	MS% Soil	Max. % RPD Water	Max. % RPD Soil	LCS%	
					Water	Soil
Benzene	78-138	70-130	30	30	78-138	70-130
Toluene	78-118	70-130	30	30	78-118	70-130
Ethylbenzene	77-119	70-130	30	30	77-119	70-130
Total Xylenes	76-116	70-130	30	30	76-116	70-130
MTBE	76-144	70-130	30	30	76-144	70-130
Naphthalene	83-112	70-130	30	30	83-112	70-130

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

Table 11-11			
Quality Control PAHs by HPLC (8310)			
Type	Acceptance Limits (%) WATERS SOILS		Frequency
Surrogate: Nitrobenzene or Triphenylene	60 - 120 60 - 120	50 - 120 50 - 120	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase
Matrix Spike: Spike all compounds of interest	See Table 11-12		Each group (≤ 20) of samples per matrix/level
Laboratory Control Sample: Spike all compounds of interest	See Table 11-12		Each group (≤ 20) when MS/MSD falls outside established limits
Matrix Spike Duplicates (RPD): Spike all compounds of interest	$\leq 30\%$	$\leq 50\%$	Each group (≤ 20) of samples per matrix/level
Blanks:	$\leq \text{LOQ}$ 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 11-12		
Quality Control		
PAHs by HPLC Spike Acceptance Limits		
Compound Name	Matrix Spike and Laboratory Control Sample Limits	
	Waters (%)	Soils (%)
Naphthalene	37-120	31-162
Acenaphthylene	41-135	39-166
Acenaphthene	38-135	38-170
Fluorene	41-140	40-175
Phenanthrene	48-152	47-176
Anthracene	42-143	38-164
Fluoranthene	48-155	48-167
Pyrene	51-146	42-162
Benzo(a)anthracene	52-146	51-148
Chrysene	56-145	52-148
Benzo(b)fluoranthene	59-141	55-142
Benzo(k)fluoranthene	60-137	56-139
Benzo(a)pyrene	42-158	33-156
Dibenzo(a,h)anthracene	49-142	47-139
Benzo(g,h,i)perylene	46-148	40-150
Indeno(1,2,3-cd)pyrene	64-134	50-146

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

Table 11-13				
Quality Control TPH-DRO				
Type	Acceptance Limits(%)		Frequency	Corrective Action
	WATERS	SOILS		
Surrogate:				
Chlorobenzene o-Terphenyl	50 - 150 50 - 150	50 - 150 50 - 150	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.
Matrix Spike:				
No. 2 Fuel: 8015B API California	60 - 120	60 - 120	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.
Laboratory Control Sample:				
No. 2 Fuel	60 - 120	60 - 120	Each group ≤ 20	Reinject if surrogates appear low. If still out of spec, repeat batch.
Laboratory Control Duplicates (RPD):				
No. 2 Fuel	$\leq 20\%$ for waters and soils		Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks:	$\leq \text{LOQ}$ 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 11-14

**Quality Control
TPH-GRO**

Type	Acceptance Limits(%) WATERS SOILS		Frequency	Corrective Action
Surrogate:				
1-Chloro-3-fluorobenzene (FID) trifluorotoluene (FID)	70 - 130 70 - 130	70 - 130 70 - 130	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
Matrix Spike:				
Gasoline standard			Each group of samples of similar matrix/level (≤ 20) each method	Analyze LCS
8015B	70 - 130	70 - 130		
Laboratory Control Sample				
Gasoline standard	70 - 130	70 - 130	Each group (≤ 20) when MS/MSD falls outside established limits	Reanalyze LCS and associated samples if MS/MSD fails
Matrix Spike Duplicate (RPD):	Maximum RPD 30%	Maximum RPD 30%	Each group (≤ 20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Same compounds as matrix spikes				
Blanks:	$\leq$ LOQ for analytes		At least one per 20 samples	Reanalyze blank and associated samples if blank is outside limits

Table 11-15

Quality Control
Inorganics

Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Matrix Spikes:	AA: 80% to 120% except where sample conc. exceeds spike conc. by $\geq 4\times$ ICP: 75% to 125% except where sample conc. exceeds spike conc. by $\geq 4\times$		Each group of samples of similar matrix/level (≤ 20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD):	Same as above $\pm 20\%$ 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):	$\pm 20\%$ RPD for sample values $\geq 5\times$ LOQ		Each group of samples of similar matrix/level (≤ 20) each method	Flag the data
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB) Preparation Blank	ICP: $< 3\times$ IDL or blank $< 1/10$ conc. of action level and samples not $\pm 10\%$ of action level AA: $< \text{LOQ}$ $\leq \text{LOQ}$ $> \text{LOQ}$ then lowest conc. in sample must be $20\times$ blk. conc.		Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.) Each SDG or batch (≤ 20 samples)	Correct problem, recalibrate, and rerun Redigest and reanalyze blank and associated samples if sample result $< 20\times$ blank result

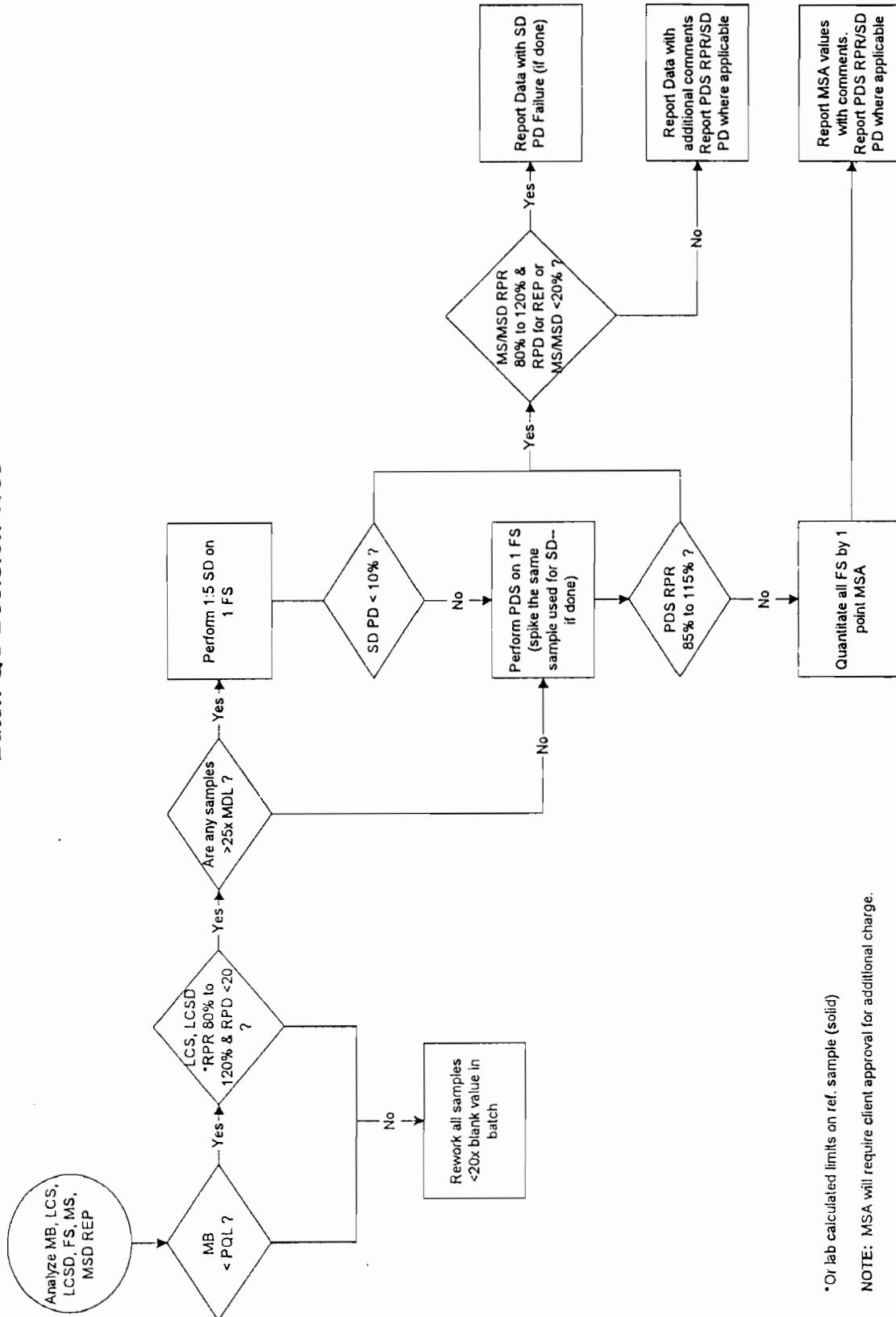
Table 11-15

**Quality Control
Inorganics**

Type	Acceptance Limits (%)		Frequency	Corrective Action
	WATERS	SOILS		
Serial Dilutions (ICP & GFAA only):	Within $\pm 10\%$ of the original determination		Each group of (≤ 20) of similar matrix/level	Flag the data
Interference Check Sample (ICP only):	$\pm 20\%$ of the true value for the analytes		Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2 $\times$ per 8 hour	Recalibrate the instrument
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:	AA: 85% to 115% ICP: 75% to 125%		When matrix spikes are outside 80% to 120% range	Flag the data
Analytical Spike:	85% to 115%		One per 20 field samples	See Table 11-16A

Figure 11-1A

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 11-16



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



Certification

PriorityPollutn™/CLP Inorganic Soils

Quality Control Standards

Catalog No PPS-46

Lot No 232

Parameter	Certified Value	Performance Acceptance Limits™
TRACE METALS PriorityPollutn™ (Catalog No 540)	mg/Kg	mg/Kg
aluminum	4500	2820 - 6190
antimony	38.2	7.41 - 81.3
arsenic	103	73.4 - 133
barium	170	126 - 214
beryllium	120	91.2 - 148
boron	102	68.8 - 135
cadmium	88.8	66.9 - 111
calcium	1990	1440 - 2530
chromium	133	104 - 163
cobalt	72.9	56.3 - 89.5
copper	85.0	68.0 - 102
iron	7580	4270 - 10900
lead	86.4	58.0 - 115
magnesium	1180	810 - 1560
manganese	187	147 - 228
mercury	2.86	1.78 - 3.94
molybdenum	96.1	69.8 - 122
nickel	95.5	72.1 - 119
potassium	2160	1580 - 2740
selenium	129	93.9 - 165
silver	117	84.5 - 150
sodium	392	258 - 526
strontium	95.6	65.1 - 126
thallium	105	55.4 - 155
tin	67.1	44.1 - 90.1
titanium	216	129 - 303
vanadium	73.5	47.0 - 100
zinc	71.8	53.4 - 90.2
CYANIDE PriorityPollutn™ (Catalog No 541)	mg/Kg	mg/Kg
total cyanide	138	70.9 - 204

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 various EPA methods such as Method 3050, 3051, etc. 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™ programs. 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 2.2 mg/Kg and that yttrium is present at 17 mg/Kg.

Table 11-17				
Quality Control Acceptance Criteria				
Parameter	Blank	Spike Recovery (%)	Duplicate RPD (%)	Lab Control Recovery
Phenols	<LOQ	53 - 126	≤20	70 - 116
Total Petroleum Hydrocarbons	<LOQ	61 - 110	≤34	66 - 106%
TOC	<LOQ	75 - 125	≤20	Commercial certified standard advisory range
TOX	<LOQ	75 - 125	≤20	90 - 110
Sulfide	<LOQ	76 - 114	≤20	85 - 110

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

Performance Evaluation Report
USEPA Water Supply Study WS041

Report: PE005
Page: 1
Date: 30SEP98

Participant ID: PA00009 *Lancaster Labs* Type: OTHER Requesting Office: NH

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS PER LITER:					
001-ARSENIC	001	67.6	65.6	58.2- 72.9	Accept.
003-CADMIUM	001	17.7	18.2	14.6- 21.8	Accept.
004-CHROMIUM	001	55.2	55.5	47.2- 63.8	Accept.
007-SELENIUM	001	46.8	46.3	37- 55.6	Accept.
091-COPPER	001	692.	702	632- 772	Accept.
140-ANTIMONY	001	31.8	31.4	22- 40.8	Accept.
141-BERYLLIUM	001	2.44	2.58	2.19- 2.97	Accept.
142-NICKEL	001	348.	352	299- 405	Accept.
143-THALLIUM	001	3.59	3.50	2.45- 4.55	Accept.
226-BORON	002	819.	790	736- 874	Accept.
236-MANGANESE	002	182.	183	167- 196	Accept.
237-MOLYBDENUM	002	78.7	76.7	66.2- 86.4	Accept.
239-ZINC	002	380.	402	359- 441	Accept.
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
009-NITRATE AS N	001	12.4	15.0	13.5- 16.5	Not Accept.
010-FLUORIDE	001	5.61	6.20	5.58- 6.82	Accept.
092-NITRITE AS N	001	1.80	1.70	1.45- 1.96	Accept.
261-ORTHOPHOSPHATE AS P	001	1.26	1.30	1.19- 1.39	Accept.
INSECTICIDES IN MICROGRAMS PER LITER:					
011-ENDRIN	001	0.784	0.789	0.552- 1.03	Accept.
012-LINDANE	001	2.69	2.50	1.38- 3.63	Accept.

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USEPA Water Supply Study WS041

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Date: 30SEP98

Participant ID: PA00009

Type: OTHER

Requesting Office: NH

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
013-METHOXYCHLOR					
	001	26.4	26.8	14.7- 38.9	Accept.
014-TOXAPHENE					
	002	7.29	6.90	3.8- 10	Accept.
093-ALACHLOR					
	004	12.7	12.9	7.1- 18.7	Accept.
094-ATRAZINE					
	004	14.3	14.5	7.98- 21	Accept.
095-HEPTACHLOR					
	001	0.710	0.830	0.457- 1.2	Accept.
096-HEPTACHLOR EPOXIDE					
	001	0.620	0.630	0.347-0.914	Accept.
097-CHLORDANE (TOTAL)					
	003	2.57	2.90	1.6- 4.21	Accept.
112-HEXACHLOROCYCLOPENTADIENE					
	001	1.08	1.93	0.0861- 2.58	Accept.
113-SIMAZINE					
	004	13.1	11.8	3.29- 17.9	Accept.
172-HEXACHLOROBENZENE					
	001	1.00	1.03	0.426- 1.23	Accept.
258-DIELDRIN					
	001	0.928	0.920	0.622- 1.14	Accept.
259-PROPACHLOR					
	001	5.38	5.02	3.14- 6.8	Accept.
CARBAMATES IN MICROGRAMS PER LITER:					
098-ALDICARB					
	001	35.7	35.3	26.6- 45.1	Accept.
099-ALDICARB SULFONE					
	001	14.8	15.3	10.4- 17.5	Accept.
100-ALDICARB SULFOXIDE					
	001	23.0	26.0	16.6- 30	Accept.
101-CARBOFURAN					
	001	43.4	43.7	24- 63.4	Accept.
114-OXAMYL (VYDATE)					
	001	31.8	33.8	23.6- 40.8	Accept.
245-METHOMYL					
	001	217.	238	187- 270	Accept.
HERBICIDES IN MICROGRAMS PER LITER:					
015-2,4-D					
	001	49.7	73.1	36.6- 110	Accept.
016-2,4,5-TP (SILVEX)					
	001	21.9	24.1	12.1- 36.2	Accept.

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USEPA Water Supply Study WS041

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Participant ID: PA00009

Type: OTHER

Requesting Office: NH

Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
102-PENTACHLOROPHENOL				
001	24.9	34.6	17.3- 51.9	Accept.
115-DALAPON				
001	143.	183	D.L. - 258	Accept.
116-DINOSEB				
001	13.9	27.6	0.568- 41.9	Accept.
117-PICLORAM				
001	47.0	62.1	D.L. - 86.9	Accept.
247-DICAMBA				
001	94.4	123	32.1- 167	Accept.
262-ACIFLUORFEN				
001	71.4	72.1	25.4- 101	Accept.
POLYCHLORINATED BIPHENYLS IN MICROGRAMS PER LITER:				
118-DECACHLOROBIPHENYL				
001	1.98	1.80	D.L. - 3.6	Accept.
PAH'S IN MICROGRAMS PER LITER:				
122-BENZO(A)PYRENE				
001	1.28	2.37	0.502- 2.87	Accept.
136-DI (2-ETHYLHEXYL)PHTHAL.				
001	16.0	15.3	6.95- 24.7	Accept.
TRIHALOMETHANES IN MICROGRAMS PER LITER:				
017-CHLOROFORM				
001	13.2	14.4	11.5- 17.3	Accept.
018-BROMOFORM				
001	14.5	16.6	13.3- 19.9	Accept.
019-BROMODICHLOROMETHANE				
001	10.7	12.3	9.84- 14.8	Accept.
020-CHLORODIBROMOMETHANE				
001	16.3	19.4	15.5- 23.3	Accept.
021-TOTAL TRIHALOMETHANE				
001	54.7	62.7	50.2- 75.2	Accept.
VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:				
032-VINYL CHLORIDE				
001	24.1	22.3	13.4- 31.2	Accept.
034-1,1-DICHLOROETHYLENE				
001	6.60	5.25	3.15- 7.35	Accept.
035-1,2-DICHLOROETHANE				
001	15.4	13.7	11- 16.4	Accept.
036-1,1,1-TRICHLOROETHANE				
001	13.7	12.6	10.1- 15.1	Accept.

Performance Evaluation Report
USEPA Water Supply Study WS041

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Participant ID: PA00009

Type: OTHER

Requesting Office: NH

Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
037-CARBON TETRACHLORIDE 001	15.7	14.2	11.4- 17	Accept.
038-TRICHLOROETHYLENE 001	7.33	6.87	4.12- 9.62	Accept.
039-BENZENE 001	19.6	18.7	15- 22.4	Accept.
040-TETRACHLOROETHYLENE 001	10.5	11.5	9.2- 13.8	Accept.
041-1,4-DICHLOROBENZENE 001	15.8	15.8	12.6- 19	Accept.
044-1,2 DICHLOROPROPANE 001	15.8	15.4	12.3- 18.5	Accept.
045-1,2DIBROMO3CHLOROPROPANE 003	0.301	0.451	0.271-0.631	Accept.
046-ETHYLENE DIBROMIDE (EDB) 003	0.267	0.344	0.206-0.482	Accept.
047-TOLUENE 001	19.9	18.7	15- 22.4	Accept.
048-ETHYLBENZENE 001	15.1	14.7	11.8- 17.6	Accept.
049-CHLOROBENZENE 001	19.3	18.6	14.9- 22.3	Accept.
053-STYRENE 001	13.1	12.4	9.92- 14.9	Accept.
054-1,2 DICHLOROBENZENE 001	12.7	11.3	9.04- 13.6	Accept.
055-DICHLOROMETHANE 001	15.6	15.9	12.7- 19.1	Accept.
060-2,2-DICHLOROPROPANE 002	13.2	12.7	9.73- 14.4	Accept.
061-1,1,2-TRICHLOROETHANE 001	12.6	13.3	10.6- 16	Accept.
063-1,1,1,2TETRACHLOROETHANE 002	14.9	15.2	12- 17.5	Accept.
064-1,2,3-TRICHLOROPROPANE 002	15.5	14.8	10.2- 18	Accept.
076-1,2,4-TRICHLOROBENZENE 001	14.6	14.2	11.4- 17	Accept.
077-1,2,3-TRICHLOROBENZENE 002	20.6	18.4	12.7- 21.5	Accept.
081-HEXACHLOROBUTADIENE 002	13.5	11.6	8.53- 14.5	Accept.
090-TOTAL XYLENES 001	34.8	30.8	24.6- 37	Accept.

Performance Evaluation Report
USEPA Water Supply Study WS041

Report: PE005
Page: 5
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Participant ID: PA00009 Type: OTHER Requesting Office: NH

Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
152-C 1,3 DICHLOROPROPENE 002	13.7	15.2	12.1- 17.4	Accept.
153-T 1,3 DICHLOROPROPENE 002	13.0	13.7	10- 15.6	Accept.
MISCELLANEOUS ANALYTES:				
022-RESIDUAL FREE CHLORINE(MILLIGRAMS PER LITER) 001	1.79	1.90	1.55- 2.32	Accept.
023-TURBIDITY(NTU'S) 001	2.89	2.60	2.37- 3.31	Accept.
024-TOTAL FILTERABLE RESIDUE(MILLIGRAMS PER LITER) 001	407.	474	287- 826	Accept.
025-CALCIUM HARDNESS(MG. CAC03/L) 001	261.	248	229- 266	Accept.
026-PH-UNITS 001	9.06	9.13	8.88- 9.28	Accept.
027-ALKALINITY(MG. CAC03/L) 001	51.6	50.6	48- 56.7	Accept.
029-SODIUM(MILLIGRAMS PER LITER) 001	23.7	23.3	21.6- 26.3	Accept.
263-TOC 001	1.70	1.60	1.21- 2.05	Accept.
264-LOW-LEVEL TURBIDITY(BY BENCH-TOP, PORTABLE, OR IR INSTR.) 002		Not Evaluated in this Study		
003		Not Evaluated in this Study		
004		Not Evaluated in this Study		

***** 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.

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LANCASTER LAB. QCL
1400 FRY DOBSON RD
2475 NEW HOLLAND PKWY
LANCASTER PA 17601

Performance Evaluation
USEPA Water Pollution Study WPN040

Report: F2005
Page: 1
Date: 19NOV98

Participant ID: PA00009 Type: OTHER Requesting Office: UT

Sample Number	Reported Value	True Value ²	Acceptance Limits	Warning Limits	Performance Evaluation

TRACE METALS IN MICROGRAMS/LITER

001-ALUMINUM	01	3040.	3105	2740- 3440	2830- 3350	Accept.
002-ARSENIC	01	144.	160	128- 190	136- 183	Accept.
003-BERYLLIUM	02	36.5	36.9	33.1- 42.2	34.2- 41	Accept.
004-CADMIUM	01	162.	170	147- 193	152- 187	Accept.
008-IRON	01	847.	880	824- 931	810- 903	Accept.
009-MERCURY	01	790.	834	744- 936	768- 912	Accept.
010-MANGANESE	01	1.21	1.15	0.813- 1.47	0.895- 1.39	Accept.
011-NICKEL	01	230.	240	216- 259	222- 254	Accept.
012-LEAD	01	2450.	2501	2340- 2860	2400- 2790	Accept.
013-SELENIUM	01	68.4	70.6	61.7- 83.3	64.4- 80.6	Accept.
014-VANADIUM	01	231.	260	189- 297	202- 284	Accept.
015-ZINC	01	4240.	4202	3880- 4640	3980- 4550	Accept.
016-ANTIMONY	02	609.	631	563- 709	581- 690	Accept.
017-SILVER	02	500.	499	381- 590	407- 564	Accept.
018-THALLIUM	02	821.	851	736- 930	760- 908	Accept.
074-MOLYBDENUM	02	830.	841	747- 970	775- 942	Accept.
075-STROMTIUM	02	19.4	18.2	14- 22	15- 21	Accept.
076-TITANIUM	02	302.	301	263- 342	273- 332	Accept.
076-TITANIUM	02	161.	160	142- 177	147- 173	Accept.

MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)
020-SPEC. COND. (ORHOS/CM AT 25 C)

01	490.	525	471- 544	480- 535	Accept.

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Performance Evaluation Report
USEPA Water Pollution Study #P040

Report: #E005
Page: 7
Date: 15NOV98

Participant ID: PA00009			Type: OTHER		Requesting Office: OT		
Sample Number	Reported Value	True Value ^a	Acceptance Limits	Warning Limits	Performance Evaluation		
021-TDS AT 180 C							
01	277.	274	270- 337	243- 323	Accept.		
022-TOTAL HARDNESS (AS CaCO3)							
01	99.2	105	93.3- 119	96.5- 116	Accept.		
023-CALCIUM							
01	28.3	29.0	25.1- 33.2	26.1- 32.2	Accept.		
024-MAGNESIUM							
01	7.50	8.00	7.06- 8.86	7.29- 8.64	Accept.		
028-CHLORIDE							
01	74.3	74.9	68.1- 81.2	70- 81.3	Accept.		
029-FLUORIDE							
01	0.826	0.860	0.718- 1.05	0.777- 1.01	Accept.		
030-SULFATE							
01	67.8	69.0	54.3- 78.4	60.8- 75.9	Accept.		
NUTRIENTS IN MILLIGRAMS/LITER							
031-AMMONIA-NITROGEN							
01	4.85	4.80	3.89- 5.84	4.13- 5.6	Accept.		
032-NITRATE-NITROGEN							
01	11.8	12.0	10.1- 13.9	10.6- 13.4	Accept.		
033-ORTHOPHOSPHATE							
01	0.578	0.580	0.476-0.669	0.516-0.648	Accept.		
034-AMMONIA-NITROGEN							
02	4.37	5.40	4.02- 6.79	4.35- 6.45	Accept.		
035-TOTAL PHOSPHORUS							
02	3.49	4.00	3.3- 4.68	3.47- 4.52	Accept.		
DEMANDS IN MILLIGRAMS/LITER							
036-COD							
01	64.0	60.7	42.5- 73.5	46.5- 69.5	Accept.		
037-TOC							
01	24.8	24.0	20.7- 28.1	21.6- 27.2	Accept.		
038-5-DAY BOD							
01	42.2	37.6	17.7- 57.2	22.6- 52.2	Accept.		
102-CARBONACEOUS BOD							
01	39.0	31.5	14.5- 53.4	19.6- 48.3	Accept.		
PCB'S IN MICROGRAMS/LITER							
042-PCB-AROCLO 1232							
01	3.53	4.73	1.1- 7.18	1.88- 6.41	Accept.		
046-PCB-AROCLO 1260							
02	2.52	3.24	1.29- 4.6	1.71- 4.18	Accept.		

Performance Evaluation Report
USEPA Water Pollution Study WPO90

Report: F8005
Page: 3
Date: 191CT98

Participant ID: PA00009		Type: CTRF		Requesting Office: OT	
Sample Number	Reported Value	True Value ^a	Acceptance Limits	Warning Limits	Performance Evaluation

PCB'S IN OIL IN MILLIGRAMS/MILIGRAM

099-PCB IN OIL- 1016/1242					
02	34.7	38.7	3.96- 57.2	10.8- 50.3	Accept.
100-PCB IN OIL- 1254					
01	22.2	24.0	0.1- 40.2	3.97- 34.9	Accept.

PESTICIDES IN MICROGRAMS/LITER

050-DDT					
01	3.20	3.64	1.74- 5.1	2.16- 4.68	Accept.
051-DDT					
01	6.79	8.42	2.61- 12.7	3.89- 11.5	Accept.
052-HEPTACHLOR					
01	1.60	2.49	0.837- 3.91	1.16- 3.08	Accept.
053-CHLORDANE					
02	3.11	4.81	2.08- 6.8	2.68- 6.2	Accept.
078-HEPTACHLOR EPOXIDE					
01	1.37	1.98	1.13- 2.42	1.29- 2.26	Accept.

VOLATILE HALOCARBONS IN MICROGRAMS/LITER

054-1,2 DICHLOROCETHANE					
01	15.8	14.6	9.85- 18.5	10.9- 17.4	Accept.
055-CHLOROFORM					
01	19.0	18.4	13.7- 21.7	14.7- 20.7	Accept.
056-1,1,1 TRICHLOROETHANE					
01	33.8	32.8	22.2- 41.1	24.6- 38.7	Accept.
057-TRICHLOROCETHENE					
01	23.2	23.4	15.6- 29.8	17.4- 28	Accept.
058-CARBONTETRACHLORIDE					
01	27.0	26.3	16.3- 32.9	18.3- 30.8	Accept.
059-TETRACHLOROETHENE					
01	32.3	32.5	21.6- 39.5	23.8- 37.2	Accept.
060-BROMODICHLOROMETHANE					
01	17.7	16.5	10.9- 19.8	12- 18.7	Accept.
061-DIBROMOCHLOROMETHANE					
01	30.9	32.7	21.4- 40.6	23.8- 38.2	Accept.
062-BROMOFORM					
01	14.6	14.7	9.12- 18.7	9.44- 17.3	Accept.
063-METHYLENE CHLORIDE					
01	45.4	44.1	29.7- 58.8	33.3- 55.1	Accept.
064-CHLOROBENZENE					
01	24.6	24.7	17.6- 29.3	19- 27.8	Accept.

Section No. 12
Revision No. 7
Date: 06/25/99
Page 10 of 10

Performance Evaluation Report
USEPA Water Pollution Study WPO40

Report: P2005
Page: 4
Date: 15NOV98

Participant ID: PA00009 Type: OTHER Requesting Office: GT

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
VOLATILE AROMATICS IN MICROGRAMS/LITER					
065-BENZENE					
01	29.1	25.7	21.7- 33.7	23.4- 32.2	Accept.
066-ETHYLBENZENE					
01	42.3	42.6	29.9- 54	32.9- 50.6	Accept.
067-TOLUENE					
01	33.9	32.3	23.9- 39.8	25.9- 37.8	Accept.

MISCELLANEOUS ANALYTES					
019-PH-UNITS					
01	8.54	8.60	8.31- 8.92	8.38- 8.84	Accept.
071-TOTAL CYANIDE (IN MG/L)					
01	0.122	0.140	0.089-0.184	0.101-0.172	Accept.
072-NON-FILTERABLE RESIDUE (IN MG/L)					
01	54.2	64.0	12.4- 80.7	20.9- 72.1	Accept.
073-OIL AND GREASE (HEXANE EXTRACTABLE) (IN MG/L)					
01	14.3	19.1	5.9- 27.5	8.78- 24.6	Accept.
097-TOTAL PHENOLICS (IN MG/L)					
01	.0405	0.0668	0.0261-0.108	0.0367-0.097	Accept.
098-TOTAL RESIDUAL NICOTINE (IN MG/L)					
01	1.06	0.930	0.811- 1.32	0.878- 1.25	Accept.
104-OIL AND GREASE (HEXANE EXTRACTABLE) (IN MG/L)					
01	18.1	19.1	5.65- 28.7	8.82- 25.6	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.

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 Check fans Check cool flow Clean source Change oil in vacuum pump Change oil in turbo pump	Weekly or AN* Monthly Monthly Bimonthly or AN Semiannually Semiannually
GC Volatiles	Check propanol level Check all flows Conductivity detector maintenance: Clean cell Change reaction tube Change Teflon line Change resin Replace trap Column maintenance Change PID lamp Precalibration instrument settings check	Semiweekly or AN Prior to calib. or AN AN AN AN AN AN AN AN AN Prior to each calibration
GC	Septum change Column maintenance Clean detector Vacuum filters Leak check ECDs	Each run AN AN Semiannually Semiannually
Flame AA and Hydride Generation AA	Rinse burner head, chamber and trap Clean nebulizer Inspect tubing and O-rings Replace lamp	AN: Min. Weekly Weekly Monthly AN
GFAA	Rinse workhead assembly Clean windows Replace probe tubing Check rinse bottle & drain	Weekly Weekly AN Daily
Cold Vapor AA	Change drying tube Replace pump tubing Lubricate pump head Lubricate autosampler Inspect optical cell and windows Clean	Daily AN: Min. weekly Weekly Weekly Monthly AN
ICP	Clean torch Clean nebulizer & spray chamber Replace pump winding Lubricate autosampler Check mirror Checking tubing to torch Check fan filters, clean if needed Check cool flow, clean if needed Check water filter, replace if needed	AN AN Check Daily Check Daily Daily Daily Weekly Weekly Quarterly

Table 13-1		
Preventive Maintenance Schedule		
Instrument	Preventive Maintenance	Frequency
Autoanalyzer	Clean sample probe Clean proportioning pump Inspect pump tubing, replace if worn Clean wash receptacles Inspect condition of distillation head	AN Weekly AN Monthly Monthly
Infrared Spectrometer (FTIR)	Check on-demand diagnostics Check wavenumber with polystyrene film Change dessicant	Quarterly Quarterly Quarterly
HPLC	Pump lubrication Check pump seals Check valves cleaned or rebuilt Detector maintenance: Bulb replacement and adjustment Flow cell cleaning Routine column maintenance Replace Teflon lines Autosampler septa replacement In-line filter sonication/cleaning System pasivation PCRS pump lubrication	Annually Annually AN AN AN AN AN AN AN AN AN
Total Organic Carbon Analyzer	Check IR zero Check for leaks Check acid pump calib. Check persulfate pump calibration Inspect 6-port rotary valve Inspect sample pump head Wash molecular sieve Check sample loop calibration Clean gas permeation tube Inspect digestion vessel O-rings Check activated carbon scrubber Dust back and clean circuit boards Check IR cell	AN AN Bimonthly Bimonthly AN AN AN Monthly AN AN AN AN AN
Total Organic Halogen Analyzer	Polish counter electrode Polish sensor electrode Clean loaders and pistons Replace agar bridge	Daily Biweekly Biweekly 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:

D₁ = First sample value

D₂ = Second sample value (Duplicate)

Duplicates will be run on at least 5% of the samples. Acceptance criteria shall be based on statistical evaluation of past lab data. (See Section No. 11.) All quality control sample results are entered into the computer and compared with acceptance limits. In addition, there is a monthly review of values on the computer QC system. Data obtained from quality control samples is entered onto our computer system which charts the data and calculates a mean and standard deviation on a monthly basis. The Quality Assurance Department then reviews this data for trends which may indicate analytical problems. The control charts are graphical methods for monitoring precision and bias over time.

Accuracy - Accuracy refers to the agreement between the amount of a compound measured by the test method and the amount actually present. Accuracy is usually expressed as a percent recovery (R). Recoveries will be calculated according to the following equations:

$$\text{Surrogate Recovery} = \frac{Q_d}{Q_a} \times 100$$

Where:

Qd = Quantity determined by analysis

Qa = Quantity added to sample

$$\text{Matrix Spike Recovery} = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample results

SR = Sample results

SA = Spike added

$$\text{Laboratory Control Sample Recovery} = \frac{LCS \text{ Found}}{LCS \text{ True}} \times 100$$

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.

$$\text{Completeness} = \frac{\text{Number of valid measurements}}{\text{Total measurements needed}} \times 100$$

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:

$$MDL = t_{(n-1, 1-\alpha = 0.99)} \times S$$

MDL = Method detection limit

s = Standard deviation of the replicate analyses

$t_{(n-1, 1-\alpha = 0.99)}$ = Students' t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

Definitions:

Method detection limit (MDL) - 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.

Limit of quantitation (LOQ) - 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.

Figure 15-1A



No. _____

Investigation and Corrective Action Report (ICAR)

Part I - Description of the Problem (Attach additional page, if needed, in addition to supporting documentation.)

1. Date of issue:
2. LL sample number(s) involved:
3. Nature of the problem (describe in detail):

Initiated by: _____

Part II - The Investigation (Attach additional page, if needed, in addition to supporting documentation.)

1. Steps taken to investigate the problem:
2. Explanation of probable cause(s):
3. Steps taken to prevent future occurrence:
4. Must investigation be complete before reporting further data to clients? Yes No
5. In addition to the samples listed above, would any additional data already reported to clients be affected by this problem? Yes No If yes, please explain

Investigator(s): _____ Date: _____

Investigator(s): _____ Date: _____

Supervisor(s): _____ Date: _____

Supervisor(s): _____ Date: _____

Quality Assurance: _____ Date: _____

Return to QA by: _____



16. Quality Assurance Reports to Management

Reports of quality status from the Quality Assurance Department to management are made frequently and in various forms. All results from internal or external performance evaluation samples are circulated to management. A report of each audit performed is prepared and copied to management. Monthly summaries of data obtained from analysis of quality control check samples are generated via the computerized sample management system. These summaries include mean and standard deviation to aid in assessment of data accuracy and precision. Forms summarizing problems which require investigation and corrective action are completed by group leaders and circulated to management. Through these channels, laboratory management is kept apprised of QA/QC activities.

Any problems or unusual observations that occur during the analysis of samples for a specific project will be listed on the laboratory report and/or in the case narrative delivered with the data package. The items often discussed in this manner include samples with surrogate recovery outside of the acceptance criteria and samples with matrix problems requiring dilution and causing increased detection limits. Where applicable, any corrective action attempted or performed to address the problem will also be presented.

The laboratory will contact the client for direction regarding major problems such as samples listed on the chain of custody but missing 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.

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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

 - Tune¹

 - Surrogate Recovery

 - Method Blank

 - Matrix Spike/Matrix Spike Duplicate

 - Duplicate²

 - Standard Addition²

 - Serial Dilution²

 - Laboratory Control Sample Recovery (if applicable)

 - Interference Check²

 - Internal Standard¹

- Sample Data

 - Sample Result Summary and LOQs

 - Sample Chromatograms

 - Quantitation Reports

 - Mass Spectra¹

 - Library Searches¹ (if applicable)

 - Confirmatory Chromatogram³

 - Confirmatory Quantitation Report³

- 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 Columns³

 - Calibration Curve (When quantitating against init. calib.)

 - ICAP Interference Table²

Raw QC Data

BFB/DFTPP Spectra and Mass Listing¹

Method Blank Chromatograms, Quantitation Reports,
Mass Spectra¹ (GC/MS)

Matrix Spike/Matrix Spike Duplicate Chromatograms and Quant.

Duplicate Data Printouts²

Standard Addition Data²

Serial Dilution Data²

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.



ILLI Sample No. WW 2869067

Collected:

Submitted: 2/ 4/98 Reported: 3/26/98

Discard: 4/10/98

Trace Metals - 1

EPA WP039 Proficiency Samples

Account No: 00649
Lancaster Laboratories
2425 New Holland Pike
Lancaster PA 17601-5994

P.O.
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED		
		RESULTS	LIMIT OF QUANTITATION	UNITS
1743	Aluminum	0.47	0.20	mg/l
1749	Cadmium	0.034	0.010	mg/l
1751	Chromium	0.214	0.030	mg/l
1752	Cobalt	0.083	0.050	mg/l
1753	Copper	0.075	0.025	mg/l
1754	Iron	0.19	0.10	mg/l
1755	Lead	1.90	0.10	mg/l
1758	Manganese	0.527	0.010	mg/l
1761	Nickel	0.734	0.050	mg/l
1771	Vanadium	1.43	0.020	mg/l
1772	Zinc	0.126	0.025	mg/l
7035	Arsenic TR	0.888	0.010	mg/l
7036	Selenium TR	0.768	0.010	mg/l
0243	Aluminum	0.52	0.20	mg/l
0249	Cadmium	0.026	0.010	mg/l
0251	Chromium	0.213	0.030	mg/l
0253	Copper	0.061	0.025	mg/l
0254	Iron	0.21	0.10	mg/l
0255	Lead	1.79	0.10	mg/l
0258	Manganese	0.496	0.010	mg/l
0259	Mercury	0.00058	0.00020	mg/l
0261	Nickel	0.645	0.050	mg/l
0272	Zinc	0.138	0.025	mg/l
1045	Arsenic (furnace method)	0.79	0.20	mg/l
1064	Selenium (furnace method)	0.64	0.25	mg/l

1 COPY TO Lancaster Laboratories, Inc. ATTN: Ms. Sue Shorter

Questions? Contact your Client Services Representative
Kay G. Hower at (717) 656-2300
19:28:31 D 0001 20 601254
609 15.00 00041600 ASR000



Lancaster Laboratories
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax 717-656-2681

Respectfully Submitted
Ramona V. Layman
Manager, Metals/Data Deliv.



LLI Sample No. WW 2869072

Collected:

Submitted: 2/ 4/98 Reported: 3/26/98

Discard: 4/10/98

Demand - 1

EPA WP039 Proficiency Samples

Account No: 00649
Lancaster Laboratories
2425 New Holland Pike
Lancaster PA 17601-5994

P.O.
Rel.

AS RECEIVED

CAT NO.	ANALYSIS NAME	RESULTS	LIMIT OF QUANTITATION	UNITS
0273	Total Organic Carbon	74.2	1.0	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	126.	2.0	mg/l
1364	Carbonaceous BOD	128.	2.0	mg/l
4001	Chemical Oxygen Demand	198.	50.	mg/l

1 COPY TO Lancaster Laboratories, Inc. ATTN: Ms. Sue Shorter

Questions? Contact your Client Services Representative
Kay G. Hower at (717) 656-2300
19:31:04 D 0001 20 601254
609 0.00 00012600 ASR000

Respectfully Submitted
Ramona V. Layman
Manager, Metals/Data Deliv.



Lancaster Laboratories
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425



LLI Sample No. WW 2869077

Collected:

Submitted: 2/ 4/98 Reported: 3/26/98

Discard: 4/10/98

Pesticides - 1

EPA WP039 Proficiency Samples

Account No: 00649
Lancaster Laboratories
2425 New Holland Pike
Lancaster PA 17601-5994

P.O.
Ref.

AS RECEIVED

CAT NO.	ANALYSIS NAME	RESULTS	LIMIT OF QUANTITATION	UNITS
Pesticides/PCB's in Water				
1902	Alpha BHC	< 0.010	0.010	ug/l
1903	Beta BHC	< 0.010	0.010	ug/l
0453	Gamma BHC - Lindane	< 0.010	0.010	ug/l
1904	Delta BHC	< 0.010	0.010	ug/l
0454	Heptachlor	0.61	0.10	ug/l
0455	Aldrin	0.97	0.10	ug/l
1905	Heptachlor Epoxide	0.50	0.10	ug/l
1906	DDE	1.53	0.10	ug/l
1907	DDD	2.01	0.10	ug/l
0478	DDT	2.51	0.10	ug/l
0469	Dieldrin	1.66	0.10	ug/l
0477	Endrin	< 0.010	0.010	ug/l
08	Chlordane	< 0.30	0.30	ug/l
1909	Toxaphene	< 4.0	4.0	ug/l
1910	Endosulfan I	< 0.010	0.010	ug/l
1911	Endosulfan II	< 0.010	0.010	ug/l
1912	Endosulfan Sulfate	< 0.030	0.030	ug/l
0638	Endrin Aldehyde	< 0.10	0.10	ug/l
1913	PCB-1016	< 1.0	1.0	ug/l
1914	PCB-1221	< 1.0	1.0	ug/l
1915	PCB-1232	< 1.0	1.0	ug/l
1916	PCB-1242	< 1.0	1.0	ug/l
1917	PCB-1248	< 1.0	1.0	ug/l
1918	PCB-1254	< 1.0	1.0	ug/l
1919	PCB-1260	< 1.0	1.0	ug/l

Questions? Contact your Client Services Representative
Kay G. Hower at (717) 656-2300

Respectfully Submitted
Jenifer E. Hess, B.S.
Group Leader Pesticides/PCBs



Lancaster Laboratories
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425

2A

Lab Name: LANCASTER LABS

SDG No: MOY01

	EPA SAMPLE NO.	S1 (DBFM) #	S2 (DCA) #	S3 (TOL) #	S4 (BFB) #	OTHER	TOTAL OUT
01	MLCHR	106	98	100	101		
02	MLCHRMS	112	104	104	105		
03	MLCHRMSD	108	102	100	100		
04	MLTBN	108	102	101	103		
05							
06	LAB QC						
07	VBLKJ13	100	102	98	92		
08	VBLKJ17	106	98	100	100		
09	LCSJ13	99	104	98	94		
10							
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				QC LIMITS
S1	(DBFM)	=	Dibromofluoromethane	86 - 118
S2	(DCA)	=	1,2-Dichloroethane-d4	80 - 120
S3	(TOL)	=	Toluene-d8	88 - 110
S4	(BFB)	=	4-Bromofluorobenzene	86 - 115

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

5A
VOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - BROMOFLUOROBENZENE (BFB)

ab Name: LANCASTER LABS

Contract: _____.

Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.

Lab File ID: >JAMT7

BFB Injection Date: 04/22/98

Instrument ID: HP03047

BFB Injection Time: 18:39

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	16.6
75	30.0 - 60.0% of mass 95	44.0
95	Base peak, 100% relative abundance	100.
96	5.0 - 9.0% of mass 95	7.1
173	Less than 2.0% of mass 174	0.0 (0.0) 1
174	Greater than 50.0% of mass 95	50.2
175	5.0 - 9.0% of mass 174	3.6 (7.2) 1
176	Greater than 95.0%, but less than 101.0% of mass 174	48.0 (95.7) 1
177	5.0 - 9.0% of mass 176	3.3 (7.0) 2

1-Value is % mass 174

2-Value is % mass 176

HIS 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	VSTD050	050 PPB IC	>JAMID	04/22/98	20:48
02	VSTD100	100 PPB IC	>JAMIE	04/22/98	21:24
03	VSTD300	300 PPB IC	>JAMIF	04/22/98	21:59
04	VSTD004	004 PPB IC	>JAMIG	04/23/98	01:02
05	VSTD010	010 PPB IC	>JAMIH	04/23/98	02:13
06	VSTD020	020 PPB IC	>JAMII	04/23/98	03:08
07					
08					
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBULKI05

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS

Case No.: _____

SAS No.: _____

SDG No.: _____

Matrix: (soil/water) SOIL

Lab Sample ID: VBULKI05

Sample wt/vol: 10.0 (g/mL) G

Lab File ID: >IAQB1

Level: (low/med) MED

Date Received: _____

% Moisture: not dec. _____

Date Analyzed: 04/26/98

Column: (pack/cap) CAP

Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	MDL UG/KG Q
75-71-8	Dichlorodifluoromethane	250	U
74-87-3	Chloromethane	250	U
75-01-4	Vinyl Chloride	250	U
74-83-9	Bromomethane	380	U
75-00-3	Chloroethane	380	U
75-69-4	Trichlorofluoromethane	250	U
107-02-8	Acrolein	2500	U
75-35-4	1,1-Dichloroethene	250	U
76-13-1	Freon 113	250	U
67-64-1	Acetone	880	U
75-15-0	Carbon Disulfide	380	U
75-09-2	Methylene Chloride	250	U
107-13-1	Acrylonitrile	1200	U
156-60-5	trans-1,2-Dichloroethene	250	U
75-65-0	t-Butyl Alcohol	2500	U
1634-04-4	Methyl t-Butyl Ether	120	U
75-34-3	1,1-Dichloroethane	120	U
594-20-7	2,2-Dichloropropane	120	U
156-59-2	cis-1,2-Dichloroethene	250	U
78-93-3	2-Butanone	880	U
74-97-5	Bromochloromethane	120	U
67-66-3	Chloroform	120	U
71-55-6	1,1,1-Trichloroethane	120	U
56-23-5	Carbon Tetrachloride	120	U
563-58-6	1,1-Dichloropropene	120	U
71-43-2	Benzene	120	U
107-06-2	1,2-Dichloroethane	250	U
79-01-6	Trichloroethene	120	U
78-87-5	1,2-Dichloropropane	380	U
74-95-3	Dibromomethane	120	U
75-27-4	Bromodichloromethane	250	U
110-75-8	2-Chloroethyl Vinyl Ether	250	U
10061-01-5	cis-1,3-Dichloropropene	120	U
108-10-1	4-Methyl-2-Pentanone	380	U
108-88-3	Toluene	120	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLKI05

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) SOIL

Lab Sample ID: VBLKI05

Sample wt/vol: 10.0 (g/mL) G

Lab File ID: >IAQB1

Level: (low/med) MED

Date Received: _____

% Moisture: not dec. _____

Date Analyzed: 04/26/98

Column: (pack/cap) CAP

Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) MDL UG/KG	Q

10061-02-6-----trans-1,3-Dichloropropene	120	U
79-00-5-----1,1,2-Trichloroethane	250	U
127-18-4-----Tetrachloroethene	120	U
142-28-9-----1,3-Dichloropropane	120	U
591-78-6-----2-Hexanone	380	U
124-48-1-----Dibromochloromethane	120	U
106-93-4-----1,2-Dibromoethane	120	U
108-90-7-----Chlorobenzene	120	U
630-20-6-----1,1,1,2-Tetrachloroethane	250	U
100-41-4-----Ethylbenzene	120	U
1330-20-7-----m+p-Xylene	120	U
95-47-6-----o-Xylene	120	U
100-42-5-----Styrene	120	U
75-25-2-----Bromoform	120	U
98-82-8-----Isopropylbenzene	380	U
79-34-5-----1,1,2,2-Tetrachloroethane	120	U
108-86-1-----Bromobenzene	120	U
96-18-4-----1,2,3-Trichloropropane	120	U
103-65-1-----n-Propylbenzene	120	U
95-49-8-----2-Chlorotoluene	120	U
108-67-8-----1,3,5-Trimethylbenzene	120	U
106-43-4-----4-Chlorotoluene	120	U
98-06-6-----tert-Butylbenzene	120	U
95-63-6-----1,2,4-Trimethylbenzene	120	U
135-98-8-----sec-Butylbenzene	120	U
99-87-6-----p-Isopropyltoluene	120	U
541-73-1-----1,3-Dichlorobenzene	250	U
106-46-7-----1,4-Dichlorobenzene	250	U
104-51-8-----n-Butylbenzene	120	U
95-50-1-----1,2-Dichlorobenzene	250	U
96-12-8-----1,2-Dibromo-3-Chloropropane	250	U
120-82-1-----1,2,4-Trichlorobenzene	120	U
87-68-3-----Hexachlorobutadiene	250	U
91-20-3-----Naphthalene	120	U
87-61-6-----1,2,3-Trichlorobenzene	120	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

VBULKI05

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: ____ SAS No.: ____ SDG No.: ____

Matrix: (soil/water) SOIL

Lab Sample ID: VBLKI05

Sample wt/vol: 10.0 (g/mL) G

Lab File ID: >IAQB1

Level: (low/med) MED

Date Received: _____

% Moisture: not dec. _____

Date Analyzed: 04/26/98

Column: (pack/cap) CAP

Dilution Factor: 1.0

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
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25.				

FORM I VOA-TIC

4A
VOLATILE METHOD BLANK SUMMARY

Lab Name: LANCASTER LABS Contract: _____
 Lab Code: LANCAS Case No.: _____. SAS No.: _____. SDG No.: _____.
 Lab File ID: >JAKB1 Lab Sample ID: VBLKJ13
 Date Analyzed: 04/20/98 Time Analyzed: 11:15
 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	LCSJ13	LCSJ13	>JAK06	15:25
02	ESMW4DL	2907187	>JAK07	16:25
03	VP6--DL	2907190	>JAK08	17:03
04	VP6--	2907190	>JAK09	17:39
05	47EW2	2907307	>JAK10	18:38
06	47EW3	2907308	>JAK11	19:15
07				
08				
09				
10				
11				
12				
13				
14				
15				
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25				
26				
27				
28				
29				
30				

COMMENTS: _____

8A
VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS

Case No.: _____

SAS No.: _____

SDG No.: _____

Lab File ID (Standard): >JAKS2

Date Analyzed: 04/20/98

Instrument ID: HP03047

Time Analyzed: 10:13

Matrix: (soil/water) WATER Level: (low/med) LOW Column: (pack/cap) CAP

		IS1 (FBZ) AREA #	RT	IS2 (CBZ) AREA #	RT	IS3 (DCB) AREA #	RT
=====	=====	=====	=====	=====	=====	=====	=====
12 HOUR STD		115936	11.16	82736	15.44	42201	18.79
=====	=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT		231872		165472		84402	
=====	=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT		57968		41368		21101	
=====	=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.							
=====	=====	=====	=====	=====	=====	=====	=====
01	VBLKJ13	127105	11.16	92558	15.45	44749	18.79
02	LCSJ13	131383	11.18	94445	15.49	49279	18.84
03	ESMW4DL	138204	11.16	100360	15.44	49635	18.78
04	VP6--DL	129000	11.16	93165	15.45	44978	18.78
05	VP6--	125872	11.17	90957	15.44	44652	18.80
06	47EW2	137616	11.15	100123	15.44	50220	18.79
07	47EW3	132361	11.16	95398	15.45	47264	18.79
08							
09							
10							
11							
12							
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18							
19							
20							
21							
22							

IS1 (FBZ) = Fluorobenzene
IS2 (CBZ) = Chlorobenzene-d5
IS3 (DCB) = 1,4-Dichlorobenzene-d4

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.

Lancaster Laboratories, Inc.
GC/MS Volatiles Matrix Spike/Spike Duplicate Recoveries

Unspiked: ^JAN02
MLCHR 2910334
Method: 8260 5mL
Instrument: KP03047

Matrix spike: ^JAN04
MLCHRMS 2910334
Matrix/Level: WL
Dilution Factor: 1.0

Spike Duplicate: ^JAN03
MLCHRMSD 2910334
Batch: J981101AD

COMPOUND NAME	SPIKE LEVEL	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RANGE LOWER-UPPER	IN SPEC	RPD %	RPD MAX
Dichlorodifluoromethane	20.00	0.00	17.02	17.60	85	83	44-150	YES	-3	30.00
Chloromethane	20.00	0.00	19.73	17.37	94	87	36-150	YES	8	30.00
Vinyl Chloride	20.00	0.00	20.44	19.96	102	100	55-141	YES	2	30.00
Bromomethane	20.00	0.00	19.33	19.54	93	93	17-149	YES	2	30.00
Chloroethane	20.00	0.00	17.25	17.31	86	86	23-140	YES	-0	30.00
Trichlorofluoromethane	20.00	0.00	21.75	11.97	109	60	42-151	NO	58	30.00
Acrolein	150.00	0.00	176.41	169.18	113	113	55-140	YES	4	30.00
1,1-Dichloroethene	20.00	0.00	23.76	22.17	113	111	43-141	YES	7	30.00
Acetone	150.00	0.00	142.63	132.53	95	88	59-119	YES	7	30.00
Carbon Disulfide	150.00	0.00	215.48	123.90	144	86	36-177	NO	50	30.00
Methylene Chloride	20.00	0.00	21.93	20.44	110	102	52-133	YES	7	30.00
Acrylonitrile	150.00	0.00	174.40	161.66	116	108	69-135	YES	8	30.00
trans-1,2-Dichloroethene	20.00	0.00	23.04	21.25	115	106	46-131	YES	8	30.00
n-Butyl Alcohol	200.00	0.00	246.05	232.52	123	116	30-200	YES	6	30.00
ethyl n-Butyl Ether	20.00	0.00	22.00	20.64	110	103	30-200	YES	6	30.00
1,1-Dichloroethane	20.00	0.00	23.24	21.43	116	107	66-125	YES	8	30.00
1,2-Dichloropropane	20.00	0.00	25.91	23.38	130	119	74-127	NO	8	30.00
cis-1,2-Dichloroethane	20.00	0.00	23.18	21.81	116	109	69-125	YES	6	30.00
2-Butanone	150.00	0.00	173.62	164.86	116	110	62-125	YES	5	30.00
Chloroform	20.00	0.00	21.94	20.60	110	103	79-121	YES	6	30.00
Bromochloromethane	20.00	0.00	21.12	20.62	136	103	72-119	YES	2	30.00
1,1,1-Trichloroethane	20.00	0.00	26.00	24.39	130	122	73-132	YES	6	30.00
Carbon Tetrachloride	20.00	0.00	23.25	21.36	116	107	68-134	YES	8	30.00
1,1-Dichloropropene	20.00	0.00	23.34	21.92	117	110	59-131	YES	6	30.00
Benzene	20.00	0.00	23.33	21.73	117	109	64-127	YES	7	30.00
1,2-Dichloroethane	20.00	0.00	22.36	21.31	112	106	72-124	YES	5	30.00
Trichloroethane	20.00	0.00	23.70	22.23	118	111	69-130	YES	6	30.00
1,2-Dichloropropane	20.00	0.00	22.26	20.70	111	103	71-123	YES	7	30.00
Dibromomethane	20.00	0.00	21.67	20.36	108	102	76-117	YES	6	30.00
Bromodichloromethane	20.00	0.00	22.66	20.48	113	102	65-120	YES	10	30.00
1-Chloroethyl Vinyl Ether	20.00	0.00	7.12	3.96	36	20	30-200	NO	57	30.00
cis-1,3-Dichloropropene	20.00	0.00	22.57	20.93	113	105	71-113	YES	7	30.00
4-Methyl-2-Pentanone	100.00	0.00	122.28	116.96	122	117	64-135	YES	4	30.00
Toluene	20.00	0.00	23.15	21.82	116	109	56-150	YES	6	30.00
trans-1,3-Dichloropropene	20.00	0.00	21.96	20.36	110	102	70-119	YES	8	30.00

N/C = Could not calculate

Lab Chronicle: _____

Ent. by _____

Ver. by _____

* The %RPD for this compound exceeds requirements.

Lancaster Laboratories, Inc.
GC/MS Volatiles Matrix Spike/Spike Duplicate Recoveries

Unspiked: ^JAN02
MLCHR 2910334
Method: 8260 5mL +SPECIALS
Instrument: HP03047

Matrix spike: ^JAN04
MLCHMS 2910334
Matrix/Level: WL
Dilution Factor: 1.0

Spike Duplicate: ^JAN08
MLCHMSD 2910334
Batch: J981101AD

COMPOUND NAME	SPIKE LEVEL	US CONC UG/L	MS CONC UG/L	MSD CONC UG/L	MS REC %	MSD REC %	RANGE LOWER-UPPER	IN SPEC	RPD %	RPD MAX
1,1,2-Trichloroethane	20.00	0.00	21.85	20.69	109	103	74-118	YES	5	30.00
Tetrachloroethene	20.00	0.00	25.21	23.12	126	116	61-148	YES	9	30.00
1,3-Dichloropropane	20.00	0.00	22.13	20.81	111	104	72-123	YES	6	30.00
2-Hexanone	100.00	0.00	123.48	121.10	123	121	60-136	YES	2	30.00
Dibromochloromethane	20.00	0.00	21.21	20.19	106	101	71-119	YES	5	30.00
1,2-Dibromoethane	20.00	0.00	22.27	21.04	111	105	72-116	YES	6	30.00
Chlorobenzene	20.00	0.00	23.72	22.10	119	110	74-120	YES	7	30.00
1,1,1,2-Tetrachloroethane	20.00	0.00	22.67	22.04	113	110	79-120	YES	3	30.00
Ethylbenzene	20.00	0.00	23.02	21.74	115	109	74-130	YES	6	30.00
m-p-Xylene	40.00	0.00	47.66	44.23	119	110	74-131	YES	7	30.00
o-Xylene	20.00	0.00	23.68	22.01	118	110	74-128	YES	7	30.00
Styrene	20.00	0.00	23.40	22.07	117	110	60-134	YES	6	30.00
Bromoform	20.00	0.00	23.85	21.91	119	110	72-115	NO	8	30.00
Isopropylbenzene	20.00	0.00	24.06	22.69	120	113	75-140	YES	6	30.00
1,1,2,2-Tetrachloroethane	20.00	0.00	21.35	20.53	107	103	65-123	YES	4	30.00
Bromobenzene	20.00	0.00	22.65	21.23	113	106	76-120	YES	6	30.00
1,2,3-Trichloropropane	20.00	0.00	21.95	20.31	110	102	70-121	YES	8	30.00
n-Propylbenzene	20.00	0.00	23.26	22.29	116	111	66-144	YES	4	30.00
2-Chlorotoluene	20.00	0.00	22.63	21.40	113	107	70-128	YES	6	30.00
1,3,5-Trimethylbenzene	20.00	0.00	24.05	23.05	120	115	71-132	YES	4	30.00
4-Chlorotoluene	20.00	0.00	22.98	21.74	115	109	67-130	YES	6	30.00
tert-Butylbenzene	20.00	0.00	24.61	23.53	123	118	72-134	YES	4	30.00
1,2,4-Trimethylbenzene	20.00	0.00	23.94	22.75	120	114	66-130	YES	5	30.00
sec-Butylbenzene	20.00	0.00	24.02	22.97	120	115	70-135	YES	4	30.00
p-Isopropyltoluene	20.00	0.00	23.20	22.25	116	111	76-139	YES	4	30.00
1,3-Dichlorobenzene	20.00	0.00	22.73	21.66	114	108	76-119	YES	5	30.00
1,4-Dichlorobenzene	20.00	0.00	22.74	21.76	114	109	75-119	YES	4	30.00
n-Butylbenzene	20.00	0.00	22.68	22.08	113	110	66-144	YES	3	30.00
1,2-Dichlorobenzene	20.00	0.00	23.24	22.05	116	110	73-121	YES	5	30.00
1,2-Dibromo-3-Chloropropane	20.00	0.00	21.80	20.26	109	101	46-127	YES	7	30.00
1,2,4-Trichlorobenzene	20.00	0.00	23.44	22.93	117	115	57-129	YES	2	30.00
Hexachlorobutadiene	20.00	0.00	22.30	19.83	112	99	67-155	YES	12	30.00
Naphthalene	20.00	0.00	25.90	23.81	130	119	22-149	YES	8	30.00
1,2,3-Trichlorobenzene	20.00	0.00	26.51	26.04	132	130	44-134	YES	2	30.00

N/C = Could not calculate

Lab Chronicle: _____ Enc. by _____

Ver. by _____

* The %RPD for this compound exceeds requirements.

Lancaster Laboratories, Inc.
GC/MS Volatiles Laboratory Control Sample Recovery

File: JAX06 Injected: 04/20/98 at 15:25 Method: 8250 SmL +SPEC
Inst: HP03047 Sample: LCSJ13 LCSJ13 Matrix/level: WL
Dilution Factor: 1.0 Batch: J981101AA

COMPOUND NAME	SPIKE LEVEL	LCS CONC UG/L	LCS REC %	RANGE LOWER-UPPER	IN SPEC
Dichlorodifluoromethane	20.00	21.03	105	57- 144	YES
Chloromethane	20.00	20.24	101	58- 155	YES
Vinyl Chloride	20.00	22.05	110	74- 134	YES
Bromomethane	20.00	23.87	119	30- 154	YES
Chloroethane	20.00	22.35	112	38- 142	YES
Trichlorofluoromethane	20.00	32.95	155	73- 130	NO
Acrolein	150.00	132.03	88	22- 169	YES
1,1-Dichloroethane	20.00	22.74	114	38- 153	YES
Acetone	150.00	152.53	108	57- 117	YES
Carbon Disulfide	150.00	158.38	112	41- 186	YES
Methylene Chloride	20.00	20.93	105	57- 132	YES
Acrylonitrile	150.00	161.08	107	65- 132	YES
trans-1,2-Dichloroethene	20.00	21.38	107	34- 148	YES
Methyl t-Butyl Ether	20.00	19.71	98	30- 200	YES
1,1-Dichloroethane	20.00	22.08	110	59- 132	YES
2,2-Dichloropropane	20.00	23.37	117	75- 118	YES
is-1,2-Dichloroethene	20.00	21.58	108	63- 130	YES
Butanone	150.00	174.93	117	63- 120	YES
Chloroform	20.00	22.14	111	73- 126	YES
Bromochloromethane	20.00	15.94	85	68- 115	YES
1,1,1-Trichloroethane	20.00	22.82	114	65- 139	YES
Carbon Tetrachloride	20.00	21.70	108	61- 139	YES
1,1-Dichloropropene	20.00	22.37	112	47- 140	YES
Benzene	20.00	21.27	106	58- 133	YES
1,2-Dichloroethane	20.00	21.40	107	68- 125	YES
Trichloroethene	20.00	21.57	108	67- 130	YES
1,2-Dichloropropane	20.00	21.50	108	70- 123	YES
Dibromomethane	20.00	20.98	105	67- 124	YES
Bromodichloromethane	20.00	21.64	108	64- 123	YES
2-Chloroethyl Vinyl Ether	20.00	19.50	98	30- 200	YES
cis-1,3-Dichloropropene	20.00	22.03	110	66- 124	YES
4-Methyl-2-Pentanone	100.00	105.03	106	73- 125	YES
Toluene	20.00	21.73	109	63- 143	YES
trans-1,3-Dichloropropene	20.00	20.96	105	66- 125	YES
1,1,2-Trichloroethane	20.00	20.94	105	72- 119	YES

Lab Chronicle: _____ Ent. by _____

Ver. by _____

Lancaster Laboratories, Inc.
GC/MS Volatiles Laboratory Control Sample Recovery

File: JAK06 Injected: 04/20/98 at 15:25 Method: 8260 5mL +SPEC
Inst: HP03047 Sample: LCSJ13 LCSJ13 Matrix/level: WL
Dilution Factor: 1.0 Batch: J981101AA

COMPOUND NAME	SPIKE LEVEL	LCS CONC UG/L	LCS REC %	RANGE LOWER-UPPER	IN SPEC
Tetrachloroethene	20.00	23.86	119	62- 150	YES
1,3-Dichloropropane	20.00	21.23	106	67- 123	YES
2-Hexanone	100.00	103.82	104	66- 126	YES
Dibromochloromethane	20.00	20.27	101	69- 115	YES
1,2-Dibromoethane	20.00	20.55	103	66- 122	YES
Chlorobenzene	20.00	21.13	106	74- 120	YES
1,1,1,2-Tetrachloroethane	20.00	21.48	107	77- 122	YES
Ethylbenzene	20.00	22.04	110	70- 132	YES
m+p-Xylene	40.00	42.92	107	68- 135	YES
o-Xylene	20.00	21.67	108	68- 132	YES
Styrene	20.00	21.51	108	74- 127	YES
Bromoform	20.00	19.36	97	70- 114	YES
Isopropylbenzene	20.00	21.34	107	74- 138	YES
1,1,2,2-Tetrachloroethane	20.00	20.65	103	70- 119	YES
Bromobenzene	20.00	20.58	103	74- 113	YES
1,2,3-Trichloropropane	20.00	20.30	102	66- 125	YES
n-Propylbenzene	20.00	22.10	110	69- 145	YES
2-Chlorotoluene	20.00	21.79	109	71- 132	YES
1,3,5-Trimethylbenzene	20.00	21.81	109	66- 135	YES
4-Chlorotoluene	20.00	22.17	111	65- 133	YES
tert-Butylbenzene	20.00	20.78	104	75- 133	YES
1,2,4-Trimethylbenzene	20.00	21.54	108	61- 136	YES
sec-Butylbenzene	20.00	21.50	108	64- 140	YES
p-Isopropyltoluene	20.00	21.44	107	63- 144	YES
1,3-Dichlorobenzene	20.00	20.51	102	42- 150	YES
1,4-Dichlorobenzene	20.00	20.38	102	42- 150	YES
n-Butylbenzene	20.00	21.88	109	63- 148	YES
1,2-Dichlorobenzene	20.00	20.72	104	49- 139	YES
1,2-Dibromo-3-Chloropropane	20.00	24.50	122	51- 120	NO
1,2,4-Trichlorobenzene	20.00	13.73	69	52- 128	YES
Hexachlorobutadiene	20.00	17.43	87	63- 140	YES
Naphthalene	20.00	13.59	68	50- 122	YES
1,2,3-Trichlorobenzene	20.00	10.25	51	52- 131	NO

Lab Chronicle: _____

Enc. by _____

Ver. by _____

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

00448

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) SOIL

Lab Sample ID: 2916270

Sample wt/vol: 11.5 (g/mL) G

Lab File ID: >IY316

Level: (low/med) MED

Date Received: 04/23/98

% Moisture: not dec. 16

Date Analyzed: 05/04/98

Column: (pack/cap) CAP

Dilution Factor: .9

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown alkane	14.57	30000.	J
2.	C9H12 aromatic	17.14	47000.	J
3.	C9H12 aromatic	17.26	44000.	J
4.	C9H12 aromatic	17.56	28000.	J
5.	C9H12 aromatic	17.82	55000.	J
6.	C10H14 aromatic	18.43	37000.	J
7.	C10H14 aromatic	18.75	39000.	J
8.	C10H14 aromatic	18.84	33000.	J
9.	C10H14 aromatic	19.30	21000.	J
10.	C10H14 aromatic	19.41	25000.	J
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

FORM I VOA-TIC

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: _____ SAS No.: _____ SDG No.: _____

Instrument ID: HPO3047 Calibration Date(s): 04/22/98 04/23/98

Calibration Times: 2048 0308

Matrix: (soil/water) WATER Level: (low/med) LOW Column: (pack/cap) CAP

Min RRF for SPCC(*) = 0.300 (0.10 for Bromoform, Chloromethane, and 1,1-Dichloroethane) Max %RSD for CCC(*) = 30.0%

LAB FILE ID:	RRF 4= >JAMIG	RRF 10= >JAMIH	RRF 20= >JAMII	RRF 50= >JAMID	RRF100= >JAMIE	RRF300= >JAMIF	RRF	%	CAL.
COMPOUND	RRF 4	RRF 10	RRF 20	RRF 50	RRF100	RRF300	RRF	RSD	METHOD
Dichlorodifluoromethane	.445	.397	.394	.400	.397	.413	.408	4.8	AVG
Chloromethane	* .274	.278	.273	.252	.245	.249	.252	5.6	AVG *
Vinyl Chloride	* .271	.291	.285	.274	.272	.271	.277	3.1	AVG *
Bromomethane	.250	.273	.267	.250	.249	.242	.257	4.7	AVG
Chloroethane	.131	.205	.200	.175	.136	.155	.194	9.8	AVG
Trichlorofluoromethane	.137	.212	.208	.173	.211	.250	.207	12.8	AVG
Ethyl Ether	.238	.227	.229	.213	.217	.211	.222	4.7	AVG
Acrolein	.029	.030	.031	.028	.029	.030	.030	3.2	AVG
1,1-Dichloroethene	* .242	.248	.243	.252	.249	.244	.245	1.5	AVG *
Acetone	* .079	.059	.054	.043	.044	.042	.053	25.5	AVG *
Methyl Iodide	.539	.538	.523	.548	.545	.551	.541	1.9	AVG
Carbon Disulfide	.733	.716	.685	.411	.540	.611	.616	20.1	2ND DEG
2-Propanol	.009	.012	.012	.011	.011	.011	.011	8.4	AVG
Allyl Chloride	.431	.444	.423	.402	.406	.375	.422	8.8	AVG
Methylene Chloride	.304	.293	.295	.276	.279	.280	.285	3.7	AVG
Acrylonitrile	.063	.060	.063	.057	.060	.060	.061	3.5	AVG
trans-1,2-Dichloroethene	.274	.275	.271	.272	.275	.267	.272	1.2	AVG
t-Butyl Alcohol	.013	.022	.022	.022	.023	.022	.022	7.1	AVG
Methyl t-Butyl Ether	.741	.703	.713	.656	.679	.662	.692	4.7	AVG
n-Hexane	.395	.380	.359	.406	.411	.405	.393	5.1	AVG
1,1-Dichloroethane	* .514	.514	.511	.502	.513	.506	.511	1.1	AVG *
Vinyl Acetate	.660	.621	.641	.600	.620	.595	.623	4.0	AVG
2-Chloro-1,3-Butadiene	.359	.357	.370	.374	.376	.367	.367	2.2	AVG
2,2-Dichloropropane	.312	.320	.308	.315	.317	.305	.313	1.9	AVG
cis-1,2-Dichloroethene	.298	.290	.284	.283	.287	.283	.287	2.1	AVG
2-Butanone	.113	.095	.096	.086	.087	.085	.094	13.1	AVG
Propionitrile	.024	.022	.024	.021	.023	.022	.023	4.1	AVG
Methacrylonitrile	.090	.083	.087	.078	.083	.080	.083	5.5	AVG
Tetrahydrofuran	.055	.062	.064	.058	.059	.055	.059	6.0	AVG
Chloroform	* .553	.526	.510	.514	.516	.508	.521	3.3	AVG *
Bromochloromethane	.169	.179	.174	.166	.169	.169	.171	2.7	AVG
1,1,1-Trichloroethane	.352	.358	.360	.372	.377	.313	.355	6.4	AVG
Cyclohexane	.460	.446	.432	.447	.448	.451	.447	2.0	AVG

*- Average response factor used due to poor curve fit.

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: _____ SAS No. _____ SDG No.: _____

Instrument ID: HP01047 Calibration Date(s): 04/22/99 04/23/99

Calibration Times: 2043 0108

Matrix: (soil/water) WATER Level: (low/med) LOW Column: (pack/cap) CAP

Min RRF for SPCC(%) = 0.100 (0.10 for Bromoform, Chloromethane, and 1,1-Dichloroethane) Max %RSD for CCC(%) = 10.0%

LAB FILE ID:	RRF 4= >JAMIG	RRF 10= >JAMIH	RRF 20= >JAMIE	RRF 50= >JAMID	RRF100= >JAMIE	RRF100= >JAMIF	RRF	RSD	CAL.
COMPOUND	RRF 4	RRF 10	RRF 20	RRF 50	RRF100	RRF100	RRF	RSD	METHOD
Carbon Tetrachloride	.309	.308	.307	.327	.329	.334	.319	3.9	AVG
1,1-Dichloropropene	.399	.384	.332	.387	.390	.385	.383	1.6	AVG
Isobutyl Alcohol	.005	.005	.006	.006	.005	.005	.005	8.1	AVG
Benzene	.864	.851	.820	.814	.821	.808	.830	2.7	AVG
1,2-Dichloroethane	.294	.299	.296	.291	.300	.298	.295	1.5	AVG
n-Heptane	.175	.291	.245	.270	.255	.258	.254	15.5	2NDEEG
n-Butanol	.004	.005	.006	.005	.005	.006	.005	9.3	AVG
Trichloroethene	.325	.314	.309	.322	.322	.312	.317	2.1	AVG
1,2-Dichloropropane	.365	.358	.357	.349	.355	.340	.354	2.4	AVG
Methyl Methacrylate	.223	.222	.220	.200	.210	.196	.209	5.3	AVG
Dibromomethane	.283	.277	.256	.277	.232	.259	.279	2.1	AVG
1,4-Dioxane	.001	.002	.002	.002	.003	.002	.002	23.6	1STDG
n-Propyl Acetate	.157	.147	.153	.140	.146	.136	.145	5.4	AVG
Bromodichloromethane	.457	.493	.494	.493	.433	.489	.434	2.8	AVG
2-Nitropropane	.074	.044	.045	.041	.043	.042	.043	25.5	2NDEEG
2-Chloroethyl Vinyl Ether	.214	.188	.196	.135	.192	.199	.194	5.3	AVG
cis-1,3-Dichloropropene	.477	.482	.484	.479	.492	.478	.482	1.2	AVG
4-Methyl-2-Pentanone	.319	.258	.280	.245	.256	.243	.259	10.5	AVG
Toluene	.795	.747	.748	.753	.752	.730	.754	2.9	AVG
trans-1,3-Dichloropropene	.591	.583	.582	.587	.591	.586	.583	1.2	AVG
Ethyl Methacrylate	.743	.670	.686	.638	.672	.643	.675	5.6	AVG
1,1,2-Trichloroethane	.400	.385	.391	.374	.380	.367	.383	3.1	AVG
Tetrachloroethene	.377	.370	.362	.338	.381	.370	.375	2.5	AVG
1,3-Dichloropropane	.733	.723	.720	.691	.695	.628	.695	5.6	AVG
2-Hexanone	.367	.284	.294	.241	.250	.241	.279	17.3	2NDEEG
Dibromochloromethane	.514	.571	.573	.522	.522	.558	.543	4.9	AVG
1,2-Dibromoethane	.579	.576	.576	.549	.565	.546	.565	2.5	AVG
Chlorobenzene	.881	.883	.859	.870	.875	.844	.869	1.7	AVG
1,1,1,2-Tetrachloroethane	.401	.411	.399	.403	.410	.392	.403	1.3	AVG
Ethylbenzene	1.607	1.567	1.506	1.535	1.520	1.397	1.522	4.7	AVG
m-p-Xylene	.532	.529	.513	.526	.524	.506	.523	1.8	AVG
o-Xylene	.500	.502	.493	.502	.504	.472	.496	2.5	AVG
Styrene	.870	.901	.900	.906	.916	.858	.892	2.5	AVG
Bromoform	.184	.273	.293	.263	.271	.313	.256	16.6	2NDEEG

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS Case No.: _____ SAS No. _____ SDG No.: _____

Instrument ID: HP01047 Calibration Date(s): 04/22/98 04/23/98

Calibration Times: 2043 0108

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(*) = 0.300 (0.10 for Bromoform, Chloromethane, and 1,1-Dichloroethane) Max %RSD for CCC(*) = 10.0%

LAB FILE ID:	RRF 4- >JAMIG	RRF 10- >JAMIH	RRF 20- >JAMII	RRF 50- >JAMID	RRF100- >JAMIE	RRF100- >JAMIF	RRF	%	CAL.
COMPOND	RRF 4	RRF 10	RRF 20	RRF 50	RRF100	RRF100	RRF	RSD	METHOD
Isopropylbenzene	1.433	1.456	1.402	1.452	1.470	1.402	1.437	2.0	AVG
trans-1,4-Dichloro-2-Butene	.137	.129	.132	.122	.123	.108	.125	8.2	AVG
1,1,2,2-Tetrachloroethane	1.377	1.357	1.405	1.250	1.307	1.220	1.321	5.4	AVG
Bromobenzene	.776	.762	.759	.745	.757	.725	.754	2.3	AVG
1,2,3-Trichloropropane	.277	.287	.295	.256	.273	.248	.275	6.0	AVG
n-Propylbenzene	4.059	3.968	3.785	3.851	3.887	3.655	3.867	3.6	AVG
2-Chlorotoluene	2.729	2.631	2.482	2.525	2.493	2.331	2.532	5.4	AVG
1,3,5-Trimethylbenzene	2.493	2.475	2.366	2.419	2.423	2.275	2.407	3.3	AVG
4-Chlorotoluene	3.029	2.989	2.934	2.833	2.854	2.663	2.893	4.6	AVG
tert-Butylbenzene	.506	.555	.530	.529	.531	.493	.524	4.1	AVG
Pentachloroethane	.496	.539	.544	.543	.557	.505	.531	4.5	AVG
1,2,4-Trimethylbenzene	2.566	2.537	2.451	2.430	2.433	2.185	2.434	5.5	AVG
sec-Butylbenzene	3.636	3.483	3.327	3.434	3.411	3.267	3.425	3.8	AVG
p-Isopropyltoluene	2.739	2.655	2.519	2.624	2.602	2.379	2.535	4.8	AVG
1,1-Dichlorobenzene	1.395	1.351	1.274	1.251	1.284	1.225	1.293	4.8	AVG
1,4-Dichlorobenzene	1.507	1.482	1.446	1.435	1.439	1.390	1.450	2.9	AVG
n-Butylbenzene	3.432	3.086	2.853	3.014	2.947	2.746	3.013	7.9	AVG
1,2-Dichlorobenzene	1.281	1.262	1.231	1.197	1.223	1.159	1.225	3.5	AVG
1,2-Dibromo-1-Chloropropane	.189	.185	.210	.161	.157	.155	.180	10.5	AVG
1,2,4-Trichlorobenzene	.574	.534	.523	.447	.470	.458	.501	10.0	AVG
Hexachlorobutadiene	.512	.425	.360	.353	.360	.356	.393	15.9	1STDDEV
Naphthalene	.895	.827	.897	.617	.655	.643	.756	17.0	2NDDEV
1,2,3-Trichlorobenzene	.329	.289	.284	.211	.225	.214	.259	19.8	2NDDEV
Dibromofluoromethane	.393	.434	.436	.445	.454	.433	.433	4.4	AVG
1,2-Dichloroethane-d4	.251	.272	.278	.280	.283	.253	.271	4.4	AVG
Toluene-d8	1.163	1.220	1.223	1.241	1.251	1.298	1.234	3.5	AVG
4-Bromofluorobenzene	.817	.799	.780	.783	.787	.801	.795	1.7	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: 04/20/98 Time: 1013
 Lab File ID: >JAKS2 Init. Calib. Date(s): 04/13/98 04/14/98
 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
Dichlorodifluoromethane	.350	.475	59.45	50.0	-18.9
Chloromethane	# .234	.272	58.18	50.0	-16.4#
Vinyl Chloride	* .249	.280	56.17	50.0	-12.3*
Bromomethane	.249	.287	57.53	50.0	-15.1
Chloroethane	.161	.189	58.52	50.0	-17.0
Trichlorofluoromethane	.240	.407	72.47	50.0	-44.9
Acrolein	.034	.028	409.34	500.0	18.1
1,1-Dichloroethene	* .249	.244	48.87	50.0	2.3*
Acetone	.045	.043	104.57	100.0	-4.6
Carbon Disulfide	.772	.709	45.94	50.0	8.1
Methylene Chloride	.284	.275	48.30	50.0	3.4
Acrylonitrile	.058	.060	520.52	500.0	-4.1
trans-1,2-Dichloroethene	.282	.280	49.64	50.0	.7
Methyl t-Butyl Ether	.663	.668	50.40	50.0	-.8
1,1-Dichloroethane	# .490	.498	50.83	50.0	-1.7#
2,2-Dichloropropane	.345	.372	53.89	50.0	-7.8
cis-1,2-Dichloroethene	.299	.302	50.43	50.0	-.9
2-Butanone	.085	.090	105.54	100.0	-5.5
Chloroform	* .502	.526	52.35	50.0	-4.7*
Bromochloromethane	.174	.169	48.70	50.0	2.6
1,1,1-Trichloroethane	.389	.408	52.40	50.0	-4.8
Carbon Tetrachloride	.352	.366	52.01	50.0	-4.0
1,1-Dichloropropene	.383	.403	52.57	50.0	-5.1
Benzene	.832	.840	50.46	50.0	-.9
1,2-Dichloroethane	.280	.302	53.90	50.0	-7.8
Trichloroethene	.331	.334	50.41	50.0	-.8
1,2-Dichloropropane	* .342	.352	51.39	50.0	-2.8*
Dibromomethane	.272	.287	52.77	50.0	-5.5
Bromodichloromethane	.492	.522	53.10	50.0	-6.2
2-Chloroethyl Vinyl Ether	.206	.200	97.16	100.0	2.8
cis-1,3-Dichloropropene	.463	.486	52.43	50.0	-4.9
4-Methyl-2-Pentanone	.263	.266	101.00	100.0	-1.0
Toluene	* .783	.770	49.16	50.0	1.7*
trans-1,3-Dichloropropene	.548	.567	51.75	50.0	-3.5

Chloromethane, 1,1-Dichloroethane and Bromoform must meet a minimum RRF of .10.

7A
VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: LANCASTER LABS

Contract: _____

Lab Code: LANCAS

Case No.: _____

SAS No.: _____

SDG No.: _____

Instrument ID: HP03047

Calibration Date: 04/20/98

Time: 1013

Lab File ID: >JAKS2

Init. Calib. Date(s): 04/13/98

04/14/98

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
=====	=====	=====	=====	=====	=====
1,1,2-Trichloroethane	.359	.364	50.70	50.0	-1.4
Tetrachloroethene	.448	.436	48.73	50.0	2.5
1,3-Dichloropropane	.635	.655	51.59	50.0	-3.2
2-Hexanone	.244	.252	103.15	100.0	-3.1
Dibromochloromethane	.591	.608	51.42	50.0	-2.8
1,2-Dibromoethane	.551	.563	51.01	50.0	-2.0
Chlorobenzene	# .924	.923	49.96	50.0	.1#
1,1,1,2-Tetrachloroethane	.421	.434	51.53	50.0	-3.1
Ethylbenzene	* 1.509	1.569	51.99	50.0	-4.0*
m+p-Xylene	.550	.563	102.26	100.0	-2.3
o-Xylene	.522	.537	51.46	50.0	-2.9
Styrene	.942	.958	50.84	50.0	-1.7
Bromoform	# .357	.360	50.47	50.0	-.9#
Isopropylbenzene	1.531	1.534	50.12	50.0	-.2
1,1,2,2-Tetrachloroethane	# 1.113	1.192	53.58	50.0	-7.2#
Bromobenzene	.820	.821	50.05	50.0	-.1
1,2,3-Trichloropropane	.253	.267	52.89	50.0	-5.8
n-Propylbenzene	3.714	3.871	52.12	50.0	-4.2
2-Chlorotoluene	2.348	2.410	51.32	50.0	-2.6
1,3,5-Trimethylbenzene	2.391	2.426	50.74	50.0	-1.5
4-Chlorotoluene	2.678	2.793	52.16	50.0	-4.3
tert-Butylbenzene	.581	.563	48.42	50.0	3.2
1,2,4-Trimethylbenzene	2.411	2.464	51.10	50.0	-2.2
sec-Butylbenzene	3.466	3.478	50.17	50.0	-.3
p-Isopropyltoluene	2.692	2.692	50.00	50.0	-.0
1,3-Dichlorobenzene	1.378	1.390	50.42	50.0	-.8
1,4-Dichlorobenzene	1.539	1.528	49.63	50.0	.7
n-Butylbenzene	2.888	2.979	51.57	50.0	-3.1
1,2-Dichlorobenzene	1.250	1.266	50.64	50.0	-1.3
1,2-Dibromo-3-Chloropropane	.091	.124	67.85	50.0	-35.7
1,2,4-Trichlorobenzene	.375	.319	42.49	50.0	15.0
Hexachlorobutadiene	.402	.292	36.29	50.0	27.4
Naphthalene	.396	.379	47.86	50.0	4.3
1,2,3-Trichlorobenzene	.152	.110	36.12	50.0	27.8
=====	=====	=====	=====	=====	=====
Dibromofluoromethane	.455	.454	49.88	50.0	.2
1,2-Dichloroethane-d4	.245	.267	54.39	50.0	-8.8
Toluene-d8	1.193	1.163	48.73	50.0	2.5
4-Bromofluorobenzene	.765	.703	45.96	50.0	8.1

Chloromethane, 1,1-Dichloroethane and Bromoform must meet a minimum RRF of .10.

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

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	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 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	QCREC 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
Benizidine	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	RPO 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
Benizidine	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							
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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.

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)	RT	IS5 (CRY)	RT	IS6 (PRY)	RT
	AREA #		AREA #		AREA #	
=====	=====	=====	=====	=====	=====	=====
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						
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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.

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
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: HPO3189 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
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]anthracene	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%

Compound	Laboratory ID: >V6255 >V6253 >V6254 >V6252 >V6251					$\overline{RRT}$	$\overline{RF}$	% RSD	CORR1	CORR2	CCC SPCC
	RF	RF	RF	RF	RF						
	5.00	50.00	80.00	120.00	160.00						
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	1.76798	1.55918	1.52924	1.48261	1.36499	.912	1.54080	9.537	.996933	.999390	*
Phenol	1.93389	1.70183	1.56847	1.56675	1.48548	.907	1.65128	10.659	.998645	.999650	
Aniline	1.24564	1.06949	1.02811	.94230	.85281	.934	1.02767	14.361	.992803	.999484	
bis(2-Chloroethyl) ether	1.33872	1.26047	1.23940	1.18673	1.07652	.939	1.22037	7.966	.995277	.999092	
2-Chlorophenol	1.62398	1.44936	1.43212	1.33748	1.23856	.982	1.41630	10.127	.995980	.999667	
1,3-Dichlorobenzene	1.62289	1.45768	1.44714	1.33786	1.24186	1.005	1.42148	10.059	.995689	.999672	*
1,4-Dichlorobenzene	.64116	.63989	.64618	.63211	.60274	1.049	.63242	2.742	.998922	.999794	
Benzyl alcohol	1.50654	1.26080	1.20831	1.09342	.96645	1.047	1.20710	16.743	.989268	.998784	
1,2-Dichlorobenzene	1.06906	1.02068	1.03824	1.01341	.96625	1.089	1.02153	3.682	.998915	.999754	
2-Methylphenol	2.84608	2.73835	2.77272	2.69897	2.44925	1.093	2.70107	5.583	.995947	.998684	
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	1.27931	1.03681	.94716	.83044	.73515	1.135	.96577	21.670	.985430	.999485	
4-Methylphenol	1.27931	1.03681	.94716	.83044	.73515	1.135	.96577	21.670	.985430	.999485	
3 or 4-Methylphenol	-	-	-	-	-	-	-	-	-	-	
N-Methylaniline	4.26555	3.45993	3.49401	3.35231	3.06730	1.127	3.52782	12.620	.996392	.999046	
Acetophenone	1.03265	.93870	.91620	.77714	.57599	1.132	.84813	20.925	.940946	.961451	**
N-Nitroso-di-n-propylamine	2.67333	2.16375	1.97112	2.02910	1.77576	1.136	2.12261	15.924	.993679	.996437	
o-Toluidine	.61351	.61966	.62997	.60694	.54893	1.147	.60380	5.271	.995270	.998633	
Hexachloroethane	1.13750	1.15613	1.17156	1.14477	1.08383	.636	1.13876	2.923	.998591	.999696	
2-Fluorophenol	1.50024	1.39209	1.32710	1.28028	1.18458	.908	1.33686	8.869	.996816	.999674	
Phenol-d5	1.50024	1.39209	1.32710	1.28028	1.18458	.908	1.33686	8.869	.996816	.999674	
Phenol-d6	.39301	.41991	.42313	.42316	.39824	.849	.41149	3.562	.998634	.999481	
Nitrobenzene	-	-	-	-	-	-	-	-	-	-	
N,N-Dimethylaniline	-	-	-	-	-	-	-	-	-	-	

RF - Response factor (Subscript is amount in ng/ul)

$\overline{RRT}$ - Average Relative Retention Time (RT Std/RT 1std)

$\overline{RF}$ - Average Response Factor

%RSD - Percent Relative Standard Deviation

CORRn - Coefficient of Correlation (nth degree)

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (**)

DRE 6/29/95

Initial Calibration Data
HSL Compounds

Case No: _____ Instrument ID: HP03189
Contractor: LANCASTER LABS Calibration Date: 06/28/95
Contract No: _____

Minimum RF for SPCC is 0.05 Maximum % RSD for CCC is 30.0%

Compound	Laboratory ID: >V6255 >V6253 >V6254 >V6252 >V6251					RRT	RF	% RSD	CORR1	CORR2	CCC	SPCC
	RF	RF	RF	RF	RF							
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		
bis(2-Chloroethoxy)methane	.43929	.41809	.41920	.42831	.41085	.959	.42315	2.588	.999465	.999608		(Conc=20.
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-Chloronitrobenzene	-	-	-	-	-	-	-	-	-	-		
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		
trobenzene-d5	.35737	.39655	.40945	.41992	.39875	.845	.39641	5.986	.999063	.999292		
Hexachlorocyclopentadiene	.29573	.44824	.50519	.56009	.54839	.858	.47153	22.324	.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)

RRT - Average Relative Retention Time (RT Std/RT Istd)

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 RF for SPCC is 0.05 Maximum % RSD for CCC is 30.0%

Compound	Laboratory ID: >V6255 >V6253 >V6254 >V6252 >V6251					RRT	RF	% RSD	CORR1	CORR2	CCC	SPCC
	RF	RF	RF	RF	RF							
	5.00	50.00	80.00	120.00	160.00							
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-phenyl ether	.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)

RRT - Average Relative Retention Time (RT Std/RT Istd)

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 RF for SPCC is 0.05 Maximum % RSD for CCC is 30.0%

Compound	Laboratory ID: >V6255 >V6253 >V6254 >V6252 >V6251					RRT	RF	% RSD	CORR1	CORR2	CCC	SPCC
	RF	RF	RF	RF	RF							
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	*	-
Benidine	.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)

RRT - Average Relative Retention Time (RT Std/RT Istd)

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]anthracene	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

FORM VII SV-2

1/87 Rev

Benzidine level in the 50 standard is 200 ng/ul.

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

SAMPLE CODE NO.

PBLKU2

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Matrix: (soil/water) SOILLab Sample ID: BLANKASample wt/vol: 30.0 (g/ml) G

Lab File ID:

% Moisture:

Date Received:

Extraction: (SepF/Cont/Sonc) SONCDate Extracted: 03/06/98Concentrated Extract Volume 10000 (uL)Date Analyzed: 03/18/98Injection Volume: 1 (uL)Dilution Factor: 1

GPC Cleanup: (Y/N) N pH:

Sulfur Cleanup: (Y/N) N

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(UG/L or UG/KG) <u>UG/KG</u>	Q
319-84-6	alpha-BHC		0.067 U
58-89-9	gamma-BHC (Lindane)		0.067 U
319-85-7	beta-BHC		0.067 U
319-86-8	delta-BHC		0.067 U
76-44-8	Heptachlor		0.067 U
309-00-2	Aldrin		0.067 U
1024-57-3	Heptachlor epoxide		0.067 U
72-55-9	4,4'-DDE		0.13 U
959-98-3	Endosulfan I		0.067 U
60-57-1	Dieldrin		0.13 U
72-20-8	Endrin		0.13 U
72-54-8	4,4'-DDD		0.13 U
33213-65-9	Endosulfan II		0.13 U
50-29-3	4,4'-DDT		0.13 U
7421-93-4	Endrin aldehyde		0.13 U
72-43-5	Methoxychlor		0.67 U
1031-07-8	Endosulfan sulfate		0.13 U
11104-28-2	Aroclor-1221		3.3 U
12674-11-2	Aroclor-1016		3.3 U
11141-16-5	Aroclor-1232		3.3 U
53469-21-9	Aroclor-1242		3.3 U
12672-29-6	Aroclor-1248		3.3 U
57-74-9	Chlordane (Technical)		3.3 U
11097-69-1	Aroclor-1254		3.3 U
11096-82-5	Aroclor-1260		3.3 U
8001-35-2	Toxaphene		6.7 U

FORM I PEST

ame?

2F SOIL PESTICIDE SURROGATE RECOVERY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01

GC Column(1): RTX-CLP ID: 0.53 (mm)

GC Column(2): RTXCLPB ID: 0.53 (mm)

	SAMPLE	SAMPLE CODE NO.	TCX 1 %REC #	TCX 2 %REC #	DCB 1 %REC #	DCB 2 %REC #	TOT OUT
01	LCSA	LCSOS	97	111	106	108	0
02	BLANKA	PBLKU2	96	110	104	107	0
03	2887307	SB279	100	112	107	110	0
04	2887307 MS	SB279MS	98	110	102	107	0
05	2887307 MSD	SB279MSD	92	104	99	104	0
06	2887310	SB581	96	111	105	107	0
07	2887311	SB681	99	113	108	110	0

ADVISORY
QC LIMITS

NOMINAL
CONCENTRATION

TCX = Tetrachloro-m-xylene

(50-120)

13.4 ug/Kg

DCB = Decachlorobiphenyl

(50-120)

13.4 ug/Kg

Column to be used to flag recovery values

* Values outside of QC limits

D Surrogate diluted out

3F

SOIL PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Matrix Spike - Sample Code No.: SB279

Compound	Spike Added (ug/Kg)	Sample Concen (ug/Kg)	MS Concen (ug/Kg)	MSD Concen (ug/Kg)	MS % REC#	MSD % REC#	MS-MSD % REC Limits	% RPD #	% RPD LIM
alpha-BHC	7.40	0.0939	7.91	7.40	106	99	(48-144)	7	50
gamma-BHC (Lindan	7.39	0	8.74	8.42	118	114	(51-142)	4	50
beta-BHC	7.40	0	7.14	6.66	96	90	(34-145)	7	50
delta-BHC	7.39	0	9.51	8.77	129	119	(44-145)	8	50
Heptachlor	7.39	0	8.29	7.93	112	107	(60-137)	4	50
Aldrin	7.40	0	7.57	7.26	102	98	(49-145)	4	50
Heptachlor epoxid	7.40	0	7.68	7.40	104	100	.0008-1	4	50
4,4'-DDE	7.40	0	8.35	7.94	113	107	(61-135)	5	50
Endosulfan I	7.40	0	6.70	6.43	91	87	(46-135)	4	50
Dieldrin	7.40	0	7.15	6.85	97	93	(59-130)	4	50
Endrin	7.39	0	9.18	8.74	124	118	(69-152)	5	50
4,4'-DDD	7.39	0	9.29	8.76	126	119	(53-141)	6	50
Endosulfan II	7.40	0	7.10	6.55	96	89	(48-132)	8	50
4,4'-DDT	7.40	0	9.37	8.82	127	119	(60-138)	6	50
Endrin aldehyde	7.39	0	4.56	4.19	62	57	(28-166)	8	50
Methoxychlor	7.40	0	11.9	11.0	161	149	(52-174)	8	50
Endosulfan sulfat	7.39	0	8.39	7.24	114	98	(40-150)	15	50

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 17 outside limits

Spike Recovery: 0 out of 34 outside limits

COMMENTS:

Sample No.: 2887307

Batch: 980650001A

3F

SOIL PESTICIDE LAB CONTROL SPIKE/LAB CONTROL SPIKE DUPLICATE

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Lab Control Spike - Sample Code No.: LCSOS

Compound	Spike Added (ug/Kg)	LCS Concen (ug/Kg)	LCSD Concen (ug/Kg)	LCS % REC#	LCSD % REC#	LCS-LCSD % REC Limits	% RPD #	% RPD LIM
alpha-BHC	6.69	6.96		104		(48-144)		50
gamma-BHC (Lindan)	6.69	7.87		118		(51-142)		50
beta-BHC	6.70	6.39		95		(34-145)		50
delta-BHC	6.69	8.37		125		(44-145)		50
Heptachlor	6.69	7.43		111		(60-137)		50
Aldrin	6.69	6.89		103		(49-145)		50
Heptachlor epoxid	6.69	6.9		103		(59-136)		50
4,4'-DDE	6.70	7.41		111		(61-135)		50
Endosulfan I	6.70	6.04		90		(46-135)		50
Dieldrin	6.69	6.51		97		(59-130)		50
Endrin	6.69	8.29		124		(69-152)		50
4,4'-DDD	6.69	8.28		124		(53-141)		50
Endosulfan II	6.70	6.43		96		(48-132)		50
4,4'-DDT	6.69	8.4		126		(60-138)		50
Endrin aldehyde	6.69	4.41		66		(28-166)		50
Methoxychlor	6.69	10.7		160		(52-174)		50
Endosulfan sulfat	6.69	7.52		112		(40-150)		50

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 17 outside limits

Spike Recovery: 0 out of 34 outside limits

COMMENTS:

Sample No.: LCSABatch: 980650001A

4C

PESTICIDE METHOD BLANK SUMMARY

SAMPLE CODE NO.

PBLKU2

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Lab Sample ID: BLANKA

Lab File ID:

Matrix: (soil/water) SOILExtraction: (SepF/Cont/Sonc) SONCSulfur Cleanup: (Y/N) NDate Extracted: 03/06/98Date Analyzed (1): 03/18/98Date Analyzed (2): 03/18/98Time Analyzed (1): 0:12Time Analyzed (2): 0:12Instrument ID (1): H1674AInstrument ID (2): H1674BGC Column (1): RTX-CLP ID: 0.53 (mm)GC Column (2): RTXCLPB ID: 0.53 (mm)

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD

	SAMPLE CODE NO.	LAB SAMPLEID	DATE ANALYZED 1	DATE ANALYZED 2
01	LCSOS	LCSA	03/18/98	03/18/98
02	PBLKU2	BLANKA	03/18/98	03/18/98
03	SB279	2887307	03/18/98	03/18/98
04	SB279MS	2887307	03/18/98	03/18/98
05	SB279MSD	2887307	03/18/98	03/18/98
06	SB581	2887310	03/18/98	03/18/98
07	SB681	2887311	03/18/98	03/18/98

COMMENTS:

6D
PESTICIDE INITIAL CALIBRATION - RETENTION TIME SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01

Instrument: H1674A

Calibration File: 1P6076

GC Column(1): RTX-CLP ID: 0.53 (mm)

Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	RT OF STANDARDS					MIDPOINT RT	RT WINDOW	
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5		FROM	TO
alpha-BHC	3.07	3.07	3.07	3.07	3.07	3.07	3.04	3.10
gamma-BHC (Lindane)	3.42	3.42	3.42	3.42	3.42	3.42	3.39	3.45
beta-BHC	3.51	3.51	3.52	3.52	3.52	3.52	3.49	3.55
delta-BHC	3.72	3.72	3.72	3.72	3.72	3.72	3.69	3.75
Heptachlor	3.99	3.99	3.99	3.99	3.99	3.99	3.96	4.02
Aldrin	4.35	4.35	4.35	4.35	4.35	4.35	4.32	4.38
Heptachlor epoxide	5.05	5.05	5.06	5.06	5.06	5.06	5.03	5.09
4,4'-DDE	5.46	5.46	5.46	5.46	5.46	5.46	5.43	5.49
Endosulfan I	5.52	5.52	5.52	5.52	5.53	5.52	5.49	5.55
Dieldrin	5.81	5.81	5.82	5.82	5.82	5.82	5.79	5.85
Endrin	6.09	6.09	6.09	6.09	6.09	6.09	6.06	6.13
4,4'-DDD	6.17	6.17	6.17	6.17	6.17	6.17	6.14	6.20
Endosulfan II	6.36	6.36	6.36	6.36	6.36	6.36	6.33	6.40
4,4'-DDT	6.51	6.51	6.52	6.52	6.52	6.52	6.48	6.55
Endrin aldehyde	6.85	6.85	6.86	6.86	6.86	6.86	6.83	6.89
Methoxychlor	7.12	7.12	7.13	7.13	7.12	7.13	7.10	7.16
Endosulfan sulfate	7.37	7.37	7.38	7.38	7.38	7.38	7.35	7.41
=====								
Tetrachloro-m-xylene	2.50	2.51	2.51	2.51	2.51	2.51	2.48	2.54
Decachlorobiphenyl	8.99	8.99	8.99	8.99	8.99	8.99	8.96	9.02

6D
PESTICIDE INITIAL CALIBRATION - RETENTION TIME SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01

Instrument: H1674B

Calibration File: 1P6076B

GC Column(1): RTXCLPB ID: 0.53 (mm)

Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	RT OF STANDARDS					MIDPOINT RT	RT WINDOW	
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5		FROM	TO
alpha-BHC	2.99	2.99	2.99	2.99	2.99	2.99	2.96	3.02
gamma-BHC (Lindane)	3.39	3.39	3.39	3.39	3.39	3.39	3.36	3.42
beta-BHC	3.49	3.49	3.49	3.49	3.49	3.49	3.46	3.52
delta-BHC	3.83	3.83	3.83	3.83	3.83	3.83	3.80	3.86
Heptachlor	3.89	3.90	3.90	3.90	3.90	3.90	3.87	3.93
Aldrin	4.27	4.27	4.28	4.28	4.28	4.28	4.25	4.31
Heptachlor epoxide	4.96	4.96	4.96	4.96	4.96	4.96	4.93	4.99
Endosulfan I	5.42	5.43	5.43	5.43	5.43	5.43	5.40	5.46
4,4'-DDE	5.59	5.59	5.59	5.59	5.59	5.59	5.56	5.62
Dieldrin	5.76	5.76	5.76	5.76	5.76	5.76	5.73	5.79
Endrin	6.12	6.12	6.13	6.13	6.13	6.13	6.10	6.16
4,4'-DDD	6.29	6.29	6.30	6.30	6.29	6.30	6.27	6.33
Endosulfan II	6.38	6.39	6.39	6.39	6.39	6.39	6.36	6.42
4,4'-DDT	6.67	6.67	6.67	6.67	6.67	6.67	6.64	6.70
Endrin aldehyde	6.80	6.80	6.80	6.80	6.80	6.80	6.77	6.83
Endosulfan sulfate	7.13	7.14	7.14	7.14	7.14	7.14	7.11	7.17
Methoxychlor	7.53	7.53	7.53	7.53	7.53	7.53	7.50	7.56
=====								
Tetrachloro-m-xylene	2.36	2.36	2.36	2.36	2.36	2.36	2.33	2.39
Decachlorobiphenyl	9.31	9.31	9.32	9.32	9.31	9.32	9.29	9.35

6E

PESTICIDE INITIAL CALIBRATION - CALIBRATION FACTOR SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674ACalibration File: 1P6076GC Column(1): RTX-CLP ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	CALIBRATION FACTORS						% RSD
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	MEAN	
alpha-BHC	1.21E+03	1.20E+03	1.25E+03	1.51E+03	1.33E+03	1.30E+03	10.1
gamma-BHC (Lindane)	1.20E+03	1.18E+03	1.22E+03	1.46E+03	1.27E+03	1.27E+03	9.1
beta-BHC	5.15E+02	5.53E+02	5.80E+02	6.72E+02	5.70E+02	5.78E+02	10.0
delta-BHC	8.09E+02	8.23E+02	8.55E+02	1.07E+03	9.74E+02	9.07E+02	12.5
Heptachlor	1.33E+03	1.29E+03	1.33E+03	1.51E+03	1.29E+03	1.35E+03	7.0
Aldrin	1.22E+03	1.17E+03	1.21E+03	1.41E+03	1.21E+03	1.24E+03	7.6
Heptachlor epoxide	1.30E+03	1.23E+03	1.27E+03	1.43E+03	1.21E+03	1.29E+03	6.7
4,4'-DDE	6.91E+02	6.88E+02	7.21E+02	8.62E+02	7.57E+02	7.44E+02	9.6
Endosulfan I	1.21E+03	1.24E+03	1.27E+03	1.42E+03	1.20E+03	1.27E+03	7.2
Dieldrin	1.03E+03	1.03E+03	1.06E+03	1.25E+03	1.08E+03	1.09E+03	8.5
Endrin	7.90E+02	7.62E+02	7.87E+02	9.21E+02	7.90E+02	8.10E+02	7.8
4,4'-DDD	3.87E+02	3.77E+02	4.00E+02	5.05E+02	4.62E+02	4.26E+02	12.9
Endosulfan II	1.00E+03	9.43E+02	9.66E+02	1.12E+03	9.61E+02	9.99E+02	7.2
4,4'-DDT	4.81E+02	5.00E+02	5.35E+02	6.67E+02	6.05E+02	5.58E+02	13.9
Endrin aldehyde	8.06E+02	7.51E+02	7.60E+02	8.39E+02	7.36E+02	7.78E+02	5.5
Methoxychlor	2.17E+02	2.26E+02	2.46E+02	2.99E+02	2.65E+02	2.50E+02	13.1
Endosulfan sulfate	8.43E+02	8.13E+02	8.35E+02	9.68E+02	8.29E+02	8.58E+02	7.3
=====							
Tetrachloro-m-xylene	1.05E+03	1.03E+03	1.04E+03	1.15E+03	9.44E+02	1.04E+03	7.1
Decachlorobiphenyl	1.27E+03	1.20E+03	1.17E+03	1.21E+03	9.65E+02	1.16E+03	10.0

Average % RSD: 9.1

6E

PESTICIDE INITIAL CALIBRATION - CALIBRATION FACTOR SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BCalibration File: 1P6076BGC Column(1): RTXCLPB ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	CALIBRATION FACTORS						% RSD
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	MEAN	
alpha-BHC	4.89E+02	4.95E+02	5.60E+02	7.54E+02	7.23E+02	6.04E+02	20.9
gamma-BHC (Lindane)	4.96E+02	4.99E+02	5.63E+02	7.43E+02	7.05E+02	6.01E+02	19.3
beta-BHC	2.65E+02	2.52E+02	2.83E+02	3.43E+02	3.03E+02	2.89E+02	12.3
delta-BHC	4.13E+02	3.48E+02	3.80E+02	4.96E+02	4.70E+02	4.22E+02	14.6
Heptachlor	6.31E+02	6.20E+02	6.64E+02	8.02E+02	7.15E+02	6.86E+02	10.8
Aldrin	6.67E+02	6.60E+02	7.33E+02	9.47E+02	8.80E+02	7.77E+02	16.7
Heptachlor epoxide	6.40E+02	6.29E+02	6.95E+02	8.31E+02	7.52E+02	7.09E+02	11.8
Endosulfan I	6.84E+02	6.47E+02	6.97E+02	8.29E+02	7.45E+02	7.20E+02	9.7
4,4'-DDE	2.61E+02	2.54E+02	2.82E+02	3.42E+02	3.18E+02	2.91E+02	12.9
Dieldrin	5.48E+02	5.56E+02	6.21E+02	8.12E+02	7.58E+02	6.59E+02	18.2
Endrin	4.00E+02	4.01E+02	4.45E+02	5.64E+02	5.16E+02	4.65E+02	15.6
4,4'-DDD	1.60E+02	1.57E+02	1.74E+02	2.15E+02	1.97E+02	1.81E+02	13.7
Endosulfan II	5.71E+02	5.68E+02	6.13E+02	7.59E+02	6.83E+02	6.39E+02	12.8
4,4'-DDT	1.89E+02	1.94E+02	2.18E+02	2.67E+02	2.40E+02	2.22E+02	14.7
Endrin aldehyde	4.58E+02	4.55E+02	4.85E+02	5.63E+02	5.21E+02	4.96E+02	9.2
Endosulfan sulfate	5.12E+02	4.95E+02	5.39E+02	6.54E+02	5.82E+02	5.56E+02	11.5
Methoxychlor	9.01E+01	8.82E+01	9.80E+01	1.14E+02	9.88E+01	9.79E+01	10.6
=====							
Tetrachloro-m-xylene	5.30E+02	5.28E+02	5.92E+02	7.41E+02	6.50E+02	6.08E+02	14.8
Decachlorobiphenyl	7.82E+02	7.28E+02	7.10E+02	7.32E+02	5.85E+02	7.07E+02	10.4
						Average % RSD:	13.7

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674ACalibration File: 1P6076GC Column(1): RTX-CLP ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW FROM TO	CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
Aroclor-1260	1	5.82	5.79 5.85	48	1	50.1	2555	8.4
					2	100.2	5053	
					3	200.4	10211	
					4	501	22783	
					5	1002	42154	
	2	6.14	6.11 6.17	49	1	50.1	2563	7.1
					2	100.2	5128	
					3	200.4	10282	
					4	501	23237	
					5	1002	43920	
	3	6.62	6.59 6.65	43	1	50.1	2295	8.2
					2	100.2	4485	
					3	200.4	9044	
					4	501	20342	
					5	1002	37760	
	4	6.93	6.90 6.96	34	1	50.1	1835	6.8
					2	100.2	3517	
					3	200.4	7128	
					4	501	16592	
					5	1002	30783	
	5	7.29	7.26 7.32	101	1	50.1	5297	5.2
					2	100.2	10558	
					3	200.4	20727	
					4	501	48905	
					5	1002	94061	
	6	8.39	8.36 8.42	27	1	50.1	1353	2.3
					2	100.2	2774	
					3	200.4	5405	
					4	501	13120	
					5	1002	26335	
Aroclor-1254	1	4.82	4.79 4.85	41	1	100	4074	
	2	5.12	5.09 5.15	58	1	100	5798	
	3	5.40	5.37 5.43	8	1	100	840	
	4	5.45	5.42 5.48	25	1	100	2522	
	5	5.82	5.79 5.85	22	1	100	2166	
	6	5.93	5.90 5.96	23	1	100	2326	
Aroclor-1221	1	2.68	2.65 2.71	8	1	251.25	2005	
	2	2.83	2.80 2.86	3	1	251.25	715	
	3	2.87	2.84 2.90	20	1	251.25	4943	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674ACalibration File: 1P6076GC Column(1): RTX-CLP ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW		CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
			FROM	TO					
Aroclor-1232	1	2.89	2.86	2.92	19	1	250	4780	
	2	3.25	3.22	3.28	14	1	250	3561	
	3	3.47	3.44	3.50	7	1	250	1825	
	4	3.76	3.73	3.79	14	1	250	3582	
	5	4.14	4.11	4.17	9	1	250	2126	
	6	4.38	4.35	4.41	8	1	250	2046	
Aroclor-1248	1	3.25	3.22	3.28	15	1	100	1463	
	2	3.76	3.73	3.79	15	1	100	1531	
	3	4.14	4.11	4.17	34	1	100	3356	
	4	4.38	4.35	4.41	30	1	100	2997	
	5	4.90	4.87	4.93	26	1	100	2608	
	6	5.12	5.09	5.15	26	1	100	2612	

6F
PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01

Instrument: 11674A

Calibration File: 1P6076

GC Column(1): RTX-CLP ID: 0.53 (mm)

Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW FROM TO	CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
Aroclor-1016	1	2.87	2.84 2.90	15	1	50.12	772	3.5
					2	100.24	1539	
					3	200.48	2981	
					4	501.2000	7336	
					5	1002.400	14167	
	2	3.25	3.22 3.28	35	1	50.12	1879	6.9
					2	100.24	3708	
					3	200.48	7269	
					4	501.2000	17063	
					5	1002.400	31674	
	3	3.76	3.73 3.79	38	1	50.12	1934	2.1
					2	100.24	3873	
					3	200.48	7530	
					4	501.2000	18821	
					5	1002.400	36823	
	4	3.91	3.88 3.94	14	1	50.12	719	1.4
					2	100.24	1430	
					3	200.48	2875	
					4	501.2000	7319	
					5	1002.400	14756	
	5	4.38	4.35 4.41	22	1	50.12	1112	3.1
					2	100.24	2214	
					3	200.48	4325	
					4	501.2000	10689	
					5	1002.400	20560	
	6	4.82	4.79 4.85	14	1	50.12	705	4.3
					2	100.24	1457	
					3	200.48	3016	
					4	501.2000	7032	
					5	1002.400	13425	
Aroclor-124	1	2.90	2.87 2.93	50	1	200.8000	10053	
	2	3.25	3.22 3.28	28	1	200.8000	5674	
	3	3.76	3.73 3.79	28	1	200.8000	5689	
	4	3.91	3.88 3.94	11	1	200.8000	2141	
	5	4.38	4.35 4.41	17	1	200.8000	3460	
	6	4.90	4.87 4.93	14	1	200.8000	2761	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674ACalibration File: 1P6076GC Column(1): RTX-CLP ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW FROM TO	CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
Chlordane (Technical)	1	3.88	3.85 3.91	47	1	200.6000	9462	
	2	3.99	3.96 4.02	57	1	200.6000	11515	
	3	4.49	4.46 4.52	65	1	200.6000	13047	
	4	5.21	5.18 5.24	124	1	200.6000	24806	
	5	5.37	5.34 5.40	191	1	200.6000	38290	
	6	6.15	6.12 6.18	23	1	200.6000	4550	
Toxaphene	1	6.18	6.15 6.21	9	1	501.5	4553	
	2	6.33	6.30 6.36	17	1	501.5	8475	
	3	6.46	6.43 6.49	14	1	501.5	7141	
	4	6.76	6.73 6.79	9	1	501.5	4585	
	5	7.15	7.12 7.18	9	1	501.5	4503	
	6	7.27	7.24 7.30	16	1	501.5	7844	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BCalibration File: 1P6076BGC Column(1): RTXCLPB ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW FROM TO	CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
Aroclor-1260	1	5.99	5.96 6.02	27	1	50.1	1412	5.7
					2	100.2	2746	
					3	200.4	5563	
					4	501	12852	
					5	1002	24686	
	2	6.24	6.21 6.27	23	1	50.1	1207	4.3
					2	100.2	2403	
					3	200.4	4850	
					4	501	11257	
					5	1002	22112	
	3	6.44	6.41 6.47	19	1	50.1	993	6.1
					2	100.2	1944	
					3	200.4	4006	
					4	501	9154	
					5	1002	17322	
	4	6.67	6.64 6.70	24	1	50.1	1214	4.8
					2	100.2	2468	
					3	200.4	4857	
					4	501	11289	
					5	1002	22224	
	5	6.78	6.75 6.81	25	1	50.1	1318	5.7
					2	100.2	2614	
					3	200.4	5356	
					4	501	12212	
					5	1002	23365	
	6	7.44	7.41 7.47	36	1	50.1	1900	4.9
					2	100.2	3793	
					3	200.4	7352	
					4	501	17345	
					5	1002	34194	
Aroclor-1254	1	5.20	5.17 5.23	21	1	100	2149	
	2	5.61	5.58 5.64	13	1	100	1332	
	3	5.75	5.72 5.78	24	1	100	2442	
	4	6.24	6.21 6.27	11	1	100	1095	
	5	6.43	6.40 6.46	12	1	100	1244	
	6	6.67	6.64 6.70	21	1	100	2097	
Aroclor-1221	1	2.64	2.61 2.67	4	1	251.25	1073	
	2	2.73	2.70 2.76	5	1	251.25	1150	
	3	2.85	2.82 2.88	9	1	251.25	2230	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BCalibration File: 1P6076BGC Column(1): RTXCLPB ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW		CALIBRATION	LEVEL	AMOUNT	PEAK	% RSD
			FROM	TO	FACTOR		(ng)	HEIGHT	
Aroclor-1232	1	2.85	2.82	2.88	8	1	250	1972	
	2	3.29	3.26	3.32	7	1	250	1762	
	3	3.79	3.76	3.82	6	1	250	1507	
	4	3.94	3.91	3.97	3	1	250	873	
	5	4.48	4.45	4.51	4	1	250	1074	
	6	4.98	4.95	5.01	3	1	250	644	
Aroclor-1248	1	3.79	3.76	3.82	8	1	100	760	
	2	4.48	4.45	4.51	16	1	100	1582	
	3	4.63	4.60	4.66	12	1	100	1205	
	4	4.93	4.90	4.96	8	1	100	778	
	5	4.98	4.95	5.01	13	1	100	1280	
	6	5.26	5.23	5.29	3	1	100	301	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BCalibration File: 1P6076BGC Column(1): RTXCLPB ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW FROM TO	CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
Aroclor-1016	1	2.85	2.82 2.88	7	1	50.12	340	1.0
					2	100.24	697	
					3	200.48	1384	
					4	501.2000	3474	
					5	1002.400	6979	
	2	3.29	3.26 3.32	18	1	50.12	923	3.5
					2	100.24	1864	
					3	200.48	3626	
					4	501.2000	8849	
					5	1002.400	17058	
	3	3.79	3.76 3.82	16	1	50.12	802	2.7
					2	100.24	1638	
					3	200.48	3224	
					4	501.2000	8357	
					5	1002.400	17122	
	4	3.94	3.91 3.97	10	1	50.12	479	2.8
					2	100.24	977	
					3	200.48	1883	
					4	501.2000	4973	
					5	1002.400	10080	
	5	4.17	4.14 4.20	6	1	50.12	294	2.4
					2	100.24	601	
					3	200.48	1131	
					4	501.2000	2954	
					5	1002.400	5985	
	6	4.63	4.60 4.66	9	1	50.12	444	2.3
					2	100.24	874	
					3	200.48	1704	
					4	501.2000	4405	
					5	1002.400	9073	
Aroclor-1242	1	3.29	3.26 3.32	14	1	200.8000	2818	
	2	3.79	3.76 3.82	12	1	200.8000	2428	
	3	3.94	3.91 3.97	7	1	200.8000	1438	
	4	4.48	4.45 4.51	9	1	200.8000	1835	
	5	4.98	4.95 5.01	7	1	200.8000	1341	
	6	5.26	5.23 5.29	4	1	200.8000	889	

6F

PESTICIDE INITIAL CALIBRATION OF MULTICOMPONENT ANALYTES

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BCalibration File: 1P6076BGC Column(1): RTXCLPB ID: 0.53 (mm)Date(s) Analyzed: 03/17/98 03/17/98

COMPOUND	PEAK	RT	RT WINDOW		CALIBRATION FACTOR	LEVEL	AMOUNT (ng)	PEAK HEIGHT	% RSD
			FROM	TO					
Chlordane (Technical)	1	3.90	3.87	3.93	29	1	200.6000	5732	
	2	4.47	4.44	4.50	39	1	200.6000	7804	
	3	5.19	5.16	5.22	85	1	200.6000	16974	
	4	5.37	5.34	5.40	76	1	200.6000	15157	
	5	6.24	6.21	6.27	15	1	200.6000	2960	
	6	6.44	6.41	6.47	26	1	200.6000	5222	
Toxaphene	1	5.74	5.71	5.77	7	1	501.5	3422	
	2	6.37	6.34	6.40	13	1	501.5	6428	
	3	6.49	6.46	6.52	20	1	501.5	10176	
	4	6.71	6.68	6.74	6	1	501.5	2951	
	5	6.81	6.78	6.84	11	1	501.5	5522	
	6	7.43	7.40	7.46	9	1	501.5	4418	

7D
PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01

Instrument: H1674A

Init. Calib. Date(s): 03/17/98 03/17/98

GC Column(1): RTX-CLP ID: 0.53 (mm)

Date Analyzed: 03/17/98

Lab File ID: 1P6076.05R

Time Analyzed: 14:45

Lab Standard ID: PEMAA

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	3.07	3.04 3.10	9.10	10.00	-9.0
gamma-BHC (Lindane)	3.42	3.39 3.45	9.28	10.00	-7.2
beta-BHC	3.51	3.49 3.55	8.54	10.00	-14.6
4,4'-DDE	5.46	5.43 5.49	0.91		
Endrin	6.09	6.06 6.13	52.33	50.00	4.7
4,4'-DDD	6.17	6.14 6.20	4.41		
4,4'-DDT	6.51	6.48 6.55	101.83	100.00	1.8
Endrin aldehyde	6.85	6.83 6.89	2.38		
Methoxychlor	7.12	7.10 7.16	262.86	250.00	5.1
Endrin ketone	7.72	7.69 7.75	3.27		
Tetrachloro-m-xylene	2.50	2.48 2.54	19.16	20.00	-4.2
Decachlorobiphenyl	8.98	8.96 9.02	18.79	20.00	-6.0

4,4'-DDT % breakdown: 4.3 Endrin % breakdown: 11.6 Combined % breakdown: 15.8

7D

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674AInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTX-CLP ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076.50RTime Analyzed: 4:54Lab Standard ID: PEMCL

COMPOUND	RT	RT WINDOW FROM TO		CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	3.07	3.04	3.10	9.85	10.00	-1.5
gamma-BHC (Lindane)	3.42	3.39	3.45	10.06	10.00	0.6
beta-BHC	3.51	3.49	3.55	9.89	10.00	-1.1
4,4'-DDE	5.46	5.43	5.49	0.85		
Endrin	6.08	6.06	6.13	55.95	50.00	11.9
4,4'-DDD	6.17	6.14	6.20	6.33		
4,4'-DDT	6.51	6.48	6.55	114.45	100.00	14.5
Endrin aldehyde	6.85	6.83	6.89	2.06		
Methoxychlor	7.12	7.10	7.16	306.62	250.00	22.6
Endrin ketone	7.72	7.69	7.75	3.52		
1,2,4,5-tetrachloro-m-xylene	2.50	2.48	2.54	20.77	20.00	3.8
1,2,4,5-tetrachlorobiphenyl	8.98	8.96	9.02	21.29	20.00	6.5

4,4'-DDT % breakdown: 5.0 Endrin % breakdown: 10.9 Combined % breakdown: 15.8

7D

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H16748Init. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTXCLPB ID: 0.53 (mm)Date Analyzed: 03/17/98Lab File ID: 1P6076B.05RTime Analyzed: 14:45Lab Standard ID: PEMAA

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	2.99	2.96 3.02	10.51	10.00	5.1
gamma-BHC (Lindane)	3.39	3.36 3.42	10.91	10.00	9.1
beta-BHC	3.49	3.46 3.52	10.61	10.00	6.1
4,4'-DDE	5.59	5.56 5.62	1.18		
Endrin	6.12	6.10 6.16	62.99	50.00	26.0
4,4'-DDD	6.29	6.27 6.33	9.69		
4,4'-DDT	6.66	6.64 6.70	118.92	100.00	18.9
Endrin aldehyde	6.80	6.77 6.83	3.70		
Methoxychlor	7.52	7.50 7.56	307.75	250.00	23.1
Endrin ketone	7.78	7.76 7.82	3.29		
Tetrachloro-m-xylene	2.35	2.33 2.39	21.06	20.00	5.3
Decachlorobiphenyl	9.31	9.29 9.35	22.01	20.00	10.0

4,4'-DDT % breakdown: 7.2 Endrin % breakdown: 12.0 Combined % breakdown: 19.2

7D

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTXCLPB ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076B.50RTime Analyzed: 4:54Lab Standard ID: PEMCL

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	2.99	2.96 3.02	10.38	10.00	3.8
gamma-BHC (Lindane)	3.39	3.36 3.42	10.81	10.00	8.1
beta-BHC	3.49	3.46 3.52	10.71	10.00	7.1
4,4'-DDE	5.59	5.56 5.62	1.12		
Endrin	6.12	6.10 6.16	61.98	50.00	24.0
4,4'-DDD	6.29	6.27 6.33	11.06		
4,4'-DDT	6.66	6.64 6.70	123.39	100.00	23.4
Endrin aldehyde	6.79	6.77 6.83	2.85		
Methoxychlor	7.52	7.50 7.56	325.80	250.00	30.3
Endrin ketone	7.78	7.76 7.82	3.39		
Tetrachloro-m-xylene	2.35	2.33 2.39	21.52	20.00	7.6
Decachlorobiphenyl	9.31	9.29 9.35	22.05	20.00	10.3

4,4'-DDT % breakdown: 7.8 Endrin % breakdown: 11.3 Combined % breakdown: 19.1

7E

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674AInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTX-CLP ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076.51RTime Analyzed: 5:13Lab Standard ID: MIXA3AT

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	3.07	3.04 3.10	7.99	8.00	-0.1
gamma-BHC (Lindane)	3.42	3.39 3.45	8.06	8.00	0.7
beta-BHC	3.51	3.49 3.55	8.64	8.00	8.0
delta-BHC	3.72	3.69 3.75	8.13	8.00	1.6
Heptachlor	3.99	3.96 4.02	8.15	8.00	1.8
Aldrin	4.35	4.32 4.38	7.91	8.00	-1.1
Heptachlor epoxide	5.05	5.03 5.09	8.14	8.00	1.7
4,4'-DDE	5.46	5.43 5.49	17.25	16.00	7.8
Endosulfan I	5.52	5.49 5.55	8.24	8.00	3.0
Dieldrin	5.81	5.79 5.85	15.92	16.00	-0.5
Endrin	6.08	6.06 6.13	16.04	16.00	0.2
4,4'-DDD	6.17	6.14 6.20	17.44	16.00	9.0
Endosulfan II	6.35	6.33 6.40	16.43	16.00	2.7
4,4'-DDT	6.51	6.48 6.55	16.40	16.00	2.5
Endrin aldehyde	6.85	6.83 6.89	16.91	16.00	5.7
Methoxychlor	7.12	7.10 7.16	88.46	80.00	10.6
Endosulfan sulfate	7.37	7.35 7.41	16.68	16.00	4.3
Tetrachloro-m-xylene	2.50	2.48 2.54	16.59	16.00	3.7
Decachlorobiphenyl	8.98	8.96 9.02	34.21	32.00	6.9

Average of %D: 3.8

7E

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674AInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTX-CLP ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076.52RTime Analyzed: 5:32Lab Standard ID: AR163ES

COMPOUND	RT	RT WINDOW FROM TO		CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
Aroclor-1016	2.87	2.84	2.90	214.46	200.48	7.0
	3.25	3.22	3.28			
	3.75	3.73	3.79			
	3.90	3.88	3.94			
	4.37	4.35	4.41			
	4.82	4.79	4.85			
Aroclor-1260	5.81	5.79	5.85	220.91	200.40	10.2
	6.13	6.11	6.17			
	6.62	6.59	6.65			
	6.92	6.90	6.96			
	7.28	7.26	7.32			
	8.39	8.36	8.42			

Average of %D: 8.6

7E

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTXCLPB ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076B.51RTime Analyzed: 5:13Lab Standard ID: MIXA3AT

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
alpha-BHC	2.99	2.96 3.02	8.31	8.00	3.9
gamma-BHC (Lindane)	3.39	3.36 3.42	8.43	8.00	5.4
beta-BHC	3.49	3.46 3.52	9.31	8.00	16.4
delta-BHC	3.83	3.80 3.86	8.47	8.00	5.8
Heptachlor	3.89	3.87 3.93	8.39	8.00	4.9
Aldrin	4.27	4.25 4.31	7.99	8.00	-0.1
Heptachlor epoxide	4.96	4.93 4.99	8.63	8.00	7.9
Endosulfan I	5.42	5.40 5.46	8.33	8.00	4.1
4,4'-DDE	5.59	5.56 5.62	19.02	16.00	18.9
Dieldrin	5.75	5.73 5.79	16.19	16.00	1.2
Endrin	6.12	6.10 6.16	16.69	16.00	4.3
4,4'-DDD	6.29	6.27 6.33	19.81	16.00	23.8
Endosulfan II	6.38	6.36 6.42	16.92	16.00	5.8
4,4'-DDT	6.66	6.64 6.70	18.56	16.00	16.0
Endrin aldehyde	6.80	6.77 6.83	17.48	16.00	9.2
Endosulfan sulfate	7.13	7.11 7.17	17.18	16.00	7.4
Methoxychlor	7.52	7.50 7.56	97.46	80.00	21.8
Tetrachloro-m-xylene	2.35	2.33 2.39	16.87	16.00	5.4
Decachlorobiphenyl	9.31	9.29 9.35	34.90	32.00	9.1

Average of %D: 9.0

7E

PESTICIDE CALIBRATION VERIFICATION SUMMARY

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01Instrument: H1674BInit. Calib. Date(s): 03/17/98 03/17/98GC Column(1): RTXCLPB ID: 0.53 (mm)Date Analyzed: 03/18/98Lab File ID: 1P6076B.52RTime Analyzed: 5:32Lab Standard ID: AR163ES

COMPOUND	RT	RT WINDOW FROM TO	CALC AMOUNT (ng/ml)	NOM AMOUNT (ng/ml)	%D
Aroclor-1016	2.85	2.82 2.88	222.72	200.48	11.1
	3.28	3.26 3.32			
	3.78	3.76 3.82			
	3.94	3.91 3.97			
	4.17	4.14 4.20			
	4.62	4.60 4.66			
Aroclor-1260	5.98	5.96 6.02	226.79	200.40	13.2
	6.23	6.21 6.27			
	6.44	6.41 6.47			
	6.66	6.64 6.70			
	6.77	6.75 6.81			
	7.44	7.41 7.47			

Average of %D: 12.1

8D

PESTICIDE ANALYTICAL SEQUENCE

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01GC Column: RTX-CLP ID: 0.53 (mm)Init. Calib Date(s): 03/17/98 03/17/98Instrument: H1674ACalibration File: 1P6076

THIS ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

SURROGATE RT FROM INITIAL CALIBRATION

TCX: 2.51 DCB: 8.99

SAMPLE CODE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT	#	DCB RT	#
001	PEMAA	EVALX97C	03/17/98	14:45	2.50	8.98	
002	MIXA1AA	MIXA198A	03/17/98	15:04	2.50	8.99	
003	MIXA2AA	MIXA298A	03/17/98	15:23	2.51	8.99	
004	MIXA3AA	MIXA398B	03/17/98	15:42	2.51	8.99	
005	MIXA4AA	MIXA498A	03/17/98	16:01	2.51	8.99	
006	MIXA5AA	MIXA598A	03/17/98	16:20	2.51	8.99	
007	TOXAXAA	TOXAX97D	03/17/98	18:32	2.51	8.99	
008	AR161AA	AR16197D	03/17/98	19:10	2.51	8.99	
009	AR162AA	AR16297D	03/17/98	19:29	2.51	8.99	
010	AR163AA	AR16397F	03/17/98	19:48	2.51	8.99	
011	AR164AA	AR16497D	03/17/98	20:07	2.51	8.99	
012	AR165AA	AR16597D	03/17/98	20:26	2.51	8.99	
013	AR21XAA	AR21X98A	03/17/98	20:44	2.50	8.99	
014	AR32XAA	AR32X98A	03/17/98	21:03	2.50	8.99	
015	AR42XAA	AR42X97D	03/17/98	21:22	2.50	8.98	
016	AR482AA	AR48297F	03/17/98	21:41	2.51	8.99	
017	AR542AA	AR54297E	03/17/98	22:00	2.51	8.99	
018	ZZZZZ	MDLAX97B	03/17/98	22:19			
019	ZZZZZ	MDLEX97A	03/17/98	22:37			
020	ZZZZZ	MD16X98A	03/17/98	22:56			
021	ZZZZZ	MDTXX98A	03/17/98	23:15			
022	ZZZZZ	MDCHX98A	03/17/98	23:34			
023	ZZZZZ	BLANKC	03/17/98	23:53	2.50	8.98	
024	PBLKU2	BLANKA	03/18/98	0:12	2.50	8.98	
025	LCSOS	LCSA	03/18/98	0:30	2.50	8.98	
026	SB279	2887307	03/18/98	0:49	2.50	8.98	
027	SB279MS	2887307	03/18/98	1:08	2.50	8.98	
028	SB279MSD	2887307	03/18/98	1:27	2.50	8.98	

QC LIMITS

TCX = Tetrachloro-m-xylene

(2.48 -2.54 MINUTES)

DCB = Decachlorobiphenyl

(8.96 -9.02 MINUTES)

Column used to flag retention time values with asterisk.

* Values outside of QC limits.

8D

PESTICIDE ANALYTICAL SEQUENCE

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01GC Column: RTX-CLP ID: 0.53 (mm)Init. Calib Date(s): 03/17/98 03/17/98Instrument: H1674ACalibration File: 1P6076

THIS ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

SURROGATE RT FROM INITIAL CALIBRATION						
TCX: 2.51 DCB: 8.99						
	SAMPLE CODE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT #	DCB RT #
029	SB581	2887310	03/18/98	1:46	2.50	8.98
030	SB681	2887311	03/18/98	2:05	2.50	8.98
031	ZZZZZ	BLANKA	03/18/98	2:24	2.50	8.98
032	ZZZZZ	LCSA	03/18/98	2:42	2.50	8.98
033	ZZZZZ	LCSDA	03/18/98	3:01	2.50	8.98
034	ZZZZZ	2889357	03/18/98	3:20	2.50	8.98
035	ZZZZZ	2889357	03/18/98	3:39	2.50	8.98
036	ZZZZZ	2889357	03/18/98	3:58	2.50	8.98
037	ZZZZZ	2886442	03/18/98	4:17	2.50	8.98
038	ZZZZZ	2888130	03/18/98	4:35	2.50	8.98
039	PEMCL	EVALX97C	03/18/98	4:54	2.50	8.98
040	MIXA3AT	MIXA398A	03/18/98	5:13	2.50	8.98
1	AR163ES	AR16397F	03/18/98	5:32	2.50	8.98

QC LIMITS

TCX = Tetrachloro-m-xylene

(2.48 -2.54 MINUTES)

DCB = Decachlorobiphenyl

(8.96 -9.02 MINUTES)

Column used to flag retention time values with asterisk.

* Values outside of QC limits.

8D

PESTICIDE ANALYTICAL SEQUENCE

Lab Name: Lancaster Laboratories

Contract:

Lab Code:

Case No.:

SAS No.:

SDG No.: LKW01GC Column: RTXCPLB ID: 0.53 (mm)Init. Calib Date(s): 03/17/98 03/17/98Instrument: H1674BCalibration File: 1P6076B

THIS ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

SURROGATE RT FROM INITIAL CALIBRATION						
TCX: 2.36 DCB: 9.32						
SAMPLE CODE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT	#	DCB RT
001	PEMAA	EVALX97C	03/17/98	14:45	2.35	9.31
002	MIXA1AA	MIXA198A	03/17/98	15:04	2.36	9.31
003	MIXA2AA	MIXA298A	03/17/98	15:23	2.36	9.31
004	MIXA3AA	MIXA398B	03/17/98	15:42	2.36	9.32
005	MIXA4AA	MIXA498A	03/17/98	16:01	2.36	9.32
006	MIXA5AA	MIXA598A	03/17/98	16:20	2.36	9.31
007	TOXAXAA	TOXAX97D	03/17/98	18:32	2.36	9.32
008	AR161AA	AR16197D	03/17/98	19:10	2.36	9.32
009	AR162AA	AR16297D	03/17/98	19:29	2.36	9.31
010	AR163AA	AR16397F	03/17/98	19:48	2.36	9.32
011	AR164AA	AR16497D	03/17/98	20:07	2.36	9.31
012	AR165AA	AR16597D	03/17/98	20:26	2.35	9.31
013	AR21XAA	AR21X98A	03/17/98	20:44	2.35	9.31
014	AR32XAA	AR32X98A	03/17/98	21:03	2.35	9.31
015	AR42XAA	AR42X97D	03/17/98	21:22	2.35	9.31
016	AR482AA	AR48297F	03/17/98	21:41	2.35	9.31
017	AR542AA	AR54297E	03/17/98	22:00	2.35	9.32
018	ZZZZZ	MDLAX97B	03/17/98	22:19		
019	ZZZZZ	MDLEX97A	03/17/98	22:37		
020	ZZZZZ	MD16X98A	03/17/98	22:56		
021	ZZZZZ	MDTXX98A	03/17/98	23:15		
022	ZZZZZ	MDCHX98A	03/17/98	23:34		
023	ZZZZZ	BLANKC	03/17/98	23:53	2.35	9.31
024	PBLKU2	BLANKA	03/18/98	0:12	2.35	9.31
025	LCSOS	LCSA	03/18/98	0:30	2.35	9.31
026	SB279	2887307	03/18/98	0:49	2.35	9.31
027	SB279MS	2887307	03/18/98	1:08	2.35	9.31
028	SB279MSD	2887307	03/18/98	1:27	2.35	9.31

QC LIMITS

TCX = Tetrachloro-m-xylene (2.33 -2.39 MINUTES)

DCB = Decachlorobiphenyl (9.29 -9.35 MINUTES)

Column used to flag retention time values with asterisk.

* Values outside of QC limits.

FORM VIII PEST

8D

PESTICIDE ANALYTICAL SEQUENCE

Lab Name: Lancaster Laboratories

Contract:

Lab Code: Case No.:

SAS No.:

SDG No.: LKW01GC Column: RTXCPLB ID: 0.53 (mm)Init. Calib Date(s): 03/17/98 03/17/98Instrument: H1674BCalibration File: 1P6076B

THIS ANALYTICAL SEQUENCE OF BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

SURROGATE RT FROM INITIAL CALIBRATION						
TCX: 2.36 DCB: 9.32						
SAMPLE CODE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT	#	DCB RT
029	SB581	2887310	03/18/98	1:46	2.35	9.31
030	SB681	2887311	03/18/98	2:05	2.35	9.31
031	ZZZZZ	BLANKA	03/18/98	2:24	2.35	9.31
032	ZZZZZ	LCSA	03/18/98	2:42	2.35	9.31
033	ZZZZZ	LCSDA	03/18/98	3:01	2.35	9.31
034	ZZZZZ	2889357	03/18/98	3:20	2.35	9.31
035	ZZZZZ	2889357	03/18/98	3:39	2.35	9.31
036	ZZZZZ	2889357	03/18/98	3:58	2.35	9.31
037	ZZZZZ	2886442	03/18/98	4:17	2.35	9.31
038	ZZZZZ	2888130	03/18/98	4:35	2.35	9.31
039	PEMCL	EVALX97C	03/18/98	4:54	2.35	9.31
040	MIXA3AT	MIXA398A	03/18/98	5:13	2.35	9.31
1	AR163ES	AR16397F	03/18/98	5:32	2.35	9.31

QC LIMITS

TCX = Tetrachloro-m-xylene

(2.33 -2.39 MINUTES)

DCB = Decachlorobiphenyl

(9.29 -9.35 MINUTES)

Column used to flag retention time values with asterisk.

* Values outside of QC limits.



Quality Control Summary

Surrogate Recovery

Volatiles by GC - Water

QC Limits	
LOW	HIGH
70	130
70	130

S1 (1Br4ClBn) = 1-Bromo-4-chlorobenzene (Hall Det)
S2 (1Br4ClBn) = 1-Bromo-4-chlorobenzene (PID Det)

* Values outside QC limits

D Surrogates diluted out



Lancaster Laboratories

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Quality Control Summary

Method Blank
Volatiles by GC

*** BLANK INFORMATION ***

Matrix.....: Water
Batch Number.....: 97365A20
Analysis Date.....: 12/31/97
Analysis Time.....: 12:03
Blank ID Number.....: BLK2016
Instrument.....: 06245
Concentration Units.....: ug/l

Sample Information				Blank Contamination Information					
LL	Sample	Analysis		CAS	Compound	Blank	LOQ	MDL	
Sample #	Designation	Date	Time	Number		Result			
2847740 UNSPK	SS#1-	12/31/97	13:51	74-87-3	Chloromethane	ND	5	1.00	
2847740 MS	SS#1-	12/31/97	14:28	75-01-4	Vinyl Chloride	ND	1	1.00	
2847740 MSD	SS#1-	12/31/97	15:05	74-83-9	Bromomethane	ND	5	0.07	
				75-00-3	Chloroethane	ND	1	0.10	
				75-69-4	Trichlorofluoromethane	ND	1	0.10	
				75-35-4	1,1-Dichloroethene	ND	1	0.05	
				75-09-2	Methylene Chloride	0.37	1	0.20	
				156-60-5	trans-1,2-Dichloroethene	ND	1	0.05	
				75-34-3	1,1-Dichloroethane	ND	1	0.04	
				156-59-2	cis-1,2-Dichloroethene	ND	1	0.04	
				67-66-3	Chloroform	ND	1	0.07	
				107-06-2	1,2-Dichloroethane	ND	1	0.04	
				71-55-6	1,1,1-Trichloroethane	ND	1	0.04	
				56-23-5	Carbon Tetrachloride	ND	1	0.08	
				78-87-5	1,2-Dichloropropane	ND	1	0.05	
				75-27-4	Bromodichloromethane	ND	1	0.05	
				10061-01-5	cis-1,3-Dichloropropene	ND	1	0.07	
				10061-02-6	trans-1,3-Dichloropropene	ND	1	0.03	
				79-00-5	1,1,2-Trichloroethane	ND	1	0.04	
				124-48-1	Dibromochloromethane	ND	1	0.07	
				127-18-4	Tetrachloroethene	ND	1	0.05	
				75-25-2	Bromoform	ND	2	0.10	
				79-34-5	1,1,2,2-Tetrachloroethane	ND	2	0.06	
				79-01-6	Trichloroethene	ND	1	0.05	
				108-90-7	Chlorobenzene	ND	1	0.05	

ABBREVIATION KEY

LOQ = Limit of Quantitation
ND = None Detected
* = above detection limit



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Where quality is a science.

Quality Control Summary

Matrix Spike/Matrix Spike Duplicate
Volatiles by GC

Unspiked Sample Number..... 2847740
Spiked Sample Number..... 2847740 + Spike
Spiked Dup Sample Number..... 2847740 + Spike

Inj. : 06
Inj. : 07
Inj. : 08

Batch Number..... 97365A20
Matrix..... Water
Instrument..... 06245

Date : 12/31/97

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
2848269	Chloromethane	100.5	ND	99.6	96.8	99	96	18 -134	2.8	30
2848270	Vinyl Chloride	100.5	ND	110.4	115.5	110	115	49 -145	4.6	30
2848271	Bromomethane	100.5	ND	99.9	101.3	99	101	54 -134	1.3	30
BLK2016	Chloroethane	100.5	ND	113.2	111.1	113	111	50 -133	1.9	30
BLK2019	Trichlorofluoromethane	100.5	ND	108.4	113.3	108	113	45 -128	4.4	30
	1,1-Dichloroethene	100.5	ND	111.1	108.8	111	108	76 -135	2.1	30
	Methylene Chloride	100.0	ND	111.7	110.6	112	111	67 -134	1.0	30
	trans-1,2-Dichloroethene	100.0	ND	100.3	101.9	100	102	81 -125	1.6	30
	1,1-Dichloroethane	100.5	ND	109.0	109.4	108	109	81 -127	0.4	30
	cis-1,2-Dichloroethene	100.0	ND	116.6	119.1	117	119	87 -132	2.1	30
	Chloroform	100.5	ND	110.2	111.8	110	111	82 -124	1.4	30
	1,2-Dichloroethane	100.5	ND	114.7	114.8	114	114	82 -120	0.1	30
	1,1,1-Trichloroethane	100.5	ND	107.3	108.9	107	108	80 -129	1.5	30
	Carbon Tetrachloride	100.5	ND	107.8	110.3	107	110	79 -135	2.3	30
	1,2-Dichloropropane	100.5	ND	113.1	111.9	113	111	82 -121	1.1	30
	Bromodichloromethane	100.0	ND	109.3	108.8	109	109	74 -125	0.4	30
	cis-1,3-Dichloropropene	101.0	ND	111.3	111.1	110	110	79 -131	0.1	30
	trans-1,3-Dichloropropene	101.0	ND	112.8	109.9	112	109	64 -120	2.7	30
	1,1,2-Trichloroethane	101.0	ND	120.6	117.2	119	116	81 -120	2.9	30
	Dibromochloromethane	100.0	ND	106.7	103.4	107	103	64 -127	3.2	30
	Tetrachloroethene	100.5	ND	111.6	106.6	111	106	77 -138	4.6	30
	Bromoform	100.5	ND	96.0	93.9	96	93	56 -139	2.3	30
	1,1,2,2-Tetrachloroethane	100.5	ND	125.9	124.1	125	123	70 -135	1.4	30
	Trichloroethene	100.5	0.3	93.8	94.4	93	94	77 -132	0.6	30
	Chlorobenzene	100.5	ND	96.6	97.1	96	97	83 -119	0.5	30

ABBREVIATION KEY

MS = Matrix Spike

MSD = Matrix Spike Duplicate

ND = None Detected

RPD = Relative Percent Difference

The RPD limits are advisory and are evaluated in relation to the other QC.



A subsidiary of Thermo TerraTech Inc.

Where quality is a science.

Quality Control Summary

Initial Calibration

Volatiles by GC

Calibration Batch.....: 97358A20

Sample Batch Number.....: 97365A20

Calibration Date.....: 12/24/97

Instrument.....: 06245

Compound	Laboratory Standard ID						AVE RF	VRSD	Fit Type	RT	ID	
	Inj #04	Inj #12	Inj #06	Inj #13	Inj #08	Inj #09					Window	
	Ref STD 1	Ref STD 2	Ref STD 3	Ref STD 4	Ref STD 5	Ref STD 6						
Chloromethane	661.03	580.23	581.51	531.07	485.78	474.05	552.28	12.7	QUAD	4.12	+/- 0.2	mi
Vinyl Chloride	603.72	516.96	495.66	451.49	389.07	387.33	474.04	17.5	QUAD	4.47	+/- 0.2	mi
Bromomethane	314.58	286.34	289.53	276.33	259.97	274.23	283.50	6.5	AVG	5.19	+/- 0.2	mi
Chloroethane	571.57	503.92	496.28	467.38	420.24	446.10	484.25	10.9	QUAD	5.49	+/- 0.2	mi
Trichlorofluoromethane	315.60	288.10	262.89	253.76	201.26	248.65	261.71	14.8	QUAD	6.73	+/- 0.2	mi
1,1-Dichloroethene	936.95	759.74	750.58	700.07	601.33	514.80	710.58	20.5	QUAD	8.09	+/- 0.2	mi
Methylene Chloride	2256.54	1245.97	1115.73	966.07	831.07	731.40	1191.13	46.5	QUAD	8.57	+/- 0.2	mi
trans-1,2-Dichloroethene	1283.17	1097.13	1078.71	1016.25	877.95	740.40	1015.60	18.5	QUAD	10.44	+/- 0.2	mi
1,1-Dichloroethane	1288.14	1086.90	1081.98	1016.92	874.81	739.19	1014.66	18.7	QUAD	11.11	+/- 0.2	mi
cis-1,2-Dichloroethene	1480.72	1252.35	1281.24	1185.88	1033.22	877.05	1185.08	17.7	QUAD	12.70	+/- 0.2	mi
Chloroform	2033.60	1688.06	1660.46	1483.37	1265.88	1066.94	1533.05	22.3	QUAD	13.28	+/- 0.1	mi
1,2-Dichloroethane	1373.51	1194.04	1252.11	1132.39	993.18	850.14	1132.56	16.5	QUAD	14.99	+/- 0.2	mi
1,1,1-Trichloroethane	1538.44	1248.51	1265.83	1119.12	951.04	799.23	1153.70	22.5	QUAD	15.24	+/- 0.2	mi
Carbon Tetrachloride	2264.00	1860.12	1825.87	1620.66	1334.92	1102.08	1667.94	24.7	QUAD	16.08	+/- 0.2	mi
1,2-Dichloropropane	2332.36	1990.53	2003.11	1753.36	1529.27	1309.93	1819.76	20.2	QUAD	17.33	+/- 0.2	mi
Bromodichloromethane	2839.20	2278.95	2195.59	1908.49	1678.40	1502.14	2067.13	23.2	QUAD	17.48	+/- 0.1	mi
cis-1,3-Dichloropropene	2759.41	2384.04	2366.26	2066.97	1766.53	1514.86	2143.01	21.2	QUAD	18.50	+/- 0.2	mi
trans-1,3-Dichloropropene	2584.71	2355.60	2328.99	2078.07	1822.55	1508.09	2113.00	18.7	QUAD	19.09	+/- 0.1	mi
1,1,2-Trichloroethane	3336.88	2846.11	2935.95	2444.60	2066.54	1750.38	2546.74	22.7	QUAD	19.24	+/- 0.1	mi
Dibromochloromethane	2001.74	1874.28	1820.27	1695.51	1543.74	1452.46	1731.33	12.0	QUAD	19.79	+/- 0.2	mi
Tetrachloroethene	4736.60	3904.36	3749.22	3231.04	2614.33	2158.83	3399.06	27.4	QUAD	20.26	+/- 0.2	mi
Bromoform	1171.38	1213.50	1210.05	1182.17	1110.83	1092.10	1163.34	4.4	AVG	21.40	+/- 0.2	mi
1,1,2,2-Tetrachloroethane	2058.86	2270.49	2229.15	2001.40	1650.96	1328.60	1923.24	19.0	QUAD	21.68	+/- 0.1	mi
Trichloroethene	0.041279	0.038472	0.038471	0.037770	0.036335	0.035616	0.037990	5.2	AVG	17.41	+/- 0.2	mi
Chlorobenzene	0.105479	0.104735	0.104864	0.100145	0.096586	0.091207	0.100503	5.7	AVG	20.94	+/- 0.2	mi

For initial calibration 12/24/97, the average response factor was used for all compounds with and RSD less than or equal to 10%.

This initial calibration applies to samples: 2848269 2847740 UNSPK BLK2016
2848270 2847740 MS BLK2019
2848271 2847740 MSD

Check Standard Summary
 Retention Time

Volatiles by GC

Initial Calibration Date..... 12/24/97
 Check Standard Batch..... 97363A20
 Sample Batch..... 97365A20
 Injection Number..... 47
 Injection Date..... 12/31/97
 Instrument..... 06245

Sample Number	Compound	Retention Time	ID Window
2847740 UNSPK	Chloromethane	4.11	+/- 0.1 min.
2847740 MS	Vinyl Chloride	4.45	+/- 0.2 min.
2847740 MSD	Bromomethane	5.13	+/- 0.2 min.
BLK2016	Chloroethane	5.44	+/- 0.2 min.
	Trichlorofluoromethane	6.67	+/- 0.2 min.
	1,1-Dichloroethene	8.06	+/- 0.2 min.
	Methylene Chloride	8.53	+/- 0.2 min.
	trans-1,2-Dichloroethene	10.39	+/- 0.2 min.
	1,1-Dichloroethane	11.06	+/- 0.2 min.
	cis-1,2-Dichloroethene	12.66	+/- 0.2 min.
	Chloroform	13.24	+/- 0.1 min.
	1,2-Dichloroethane	14.96	+/- 0.2 min.
	1,1,1-Trichloroethane	15.19	+/- 0.2 min.
	Carbon Tetrachloride	16.06	+/- 0.2 min.
	1,2-Dichloropropane	17.31	+/- 0.1 min.
	Bromodichloromethane	17.46	+/- 0.1 min.
	cis-1,3-Dichloropropene	18.48	+/- 0.2 min.
	trans-1,3-Dichloropropene	19.07	+/- 0.1 min.
	1,1,2-Trichloroethane	19.23	+/- 0.1 min.
	Dibromochloromethane	19.78	+/- 0.2 min.
	Tetrachloroethene	20.25	+/- 0.2 min.
	Bromoform	21.39	+/- 0.2 min.
	1,1,2,2-Tetrachloroethane	21.68	+/- 0.1 min.
	Trichloroethene	17.40	+/- 0.2 min.
	Chlorobenzene	20.93	+/- 0.2 min.

Initial Calibration Date 12/24/97
 Initial Calibration Batch..... 97358A20
 Sample Batch..... 97365A20
 Instrument..... 06245

SURROGATE RT FROM INITIAL CALIBRATION

1Br4ClBn (Hall): 24.34

1Br4ClBn (PID): 24.34

LL Sample No.	Sample Designation	Date Analyzed	Time Analyzed	RT (1Br4ClBn) Hall Det.	RT (1Br4ClBn) PID Det.
BLK2016	Method Blank	12/31/97	12:03	24.34	24.34
2847740 UNSPK	SS#1-	12/31/97	13:51	24.34	24.34
2847740 MS	SS#1-	12/31/97	14:28	24.34	24.34
2847740 MSD	SS#1-	12/31/97	15:05	24.34	24.34
BLK2019	Method Blank	01/01/98	07:38	24.33	24.33
2848270	FB--1	01/01/98	11:46	24.33	24.33
2848271	TB--1	01/01/98	12:21	24.33	24.33
2848269	GWS-1	01/01/98	12:58	24.33	24.33

Continuing Calibration

Volatiles by GC

Calibration Date.....: 12/24/97

Continuing Calibration Date...: 12/31/97

Concentration Units.....: ug/l

Instrument ID.....: 06245

Check Standard Batch Number: 97363A20

Batch Number.....: 97365A20

Inj #.....: 47

Injection Time.....: 10:23

	Compound	Amount Spiked	Laboratory Control Sample Result	% Recovery	Acceptance Range	Out of Range
2847740 UNSPK	Chloromethane	20.0	21.7	108.7	59.5 % -140.5 %	
2847740 MS	Vinyl Chloride	20.0	21.7	108.5	68.5 % -131.5 %	
2847740 MSD	Bromomethane	20.0	19.5	97.6	58.5 % -141.5 %	
BLK2016	Chloroethane	20.0	22.5	112.7	77.0 % -123.0 %	
	Trichlorofluoromethane	20.0	22.1	110.7	66.5 % -133.5 %	
	1,1-Dichloroethene	20.1	26.6	132.5	63.0 % -137.0 %	
	Methylene Chloride	20.0	21.7	108.4	77.5 % -122.5 %	
	trans-1,2-Dichloroethene	20.0	20.1	100.4	64.0 % -136.0 %	
	1,1-Dichloroethane	20.1	21.7	108.0	84.0 % -116.0 %	
	cis-1,2-Dichloroethene	20.0	23.6	117.8	64.0 % -136.0 %	
	Chloroform	20.1	21.9	109.1	75.0 % -125.0 %	
	1,2-Dichloroethane	20.1	22.7	112.8	71.5 % -128.5 %	
	1,1,1-Trichloroethane	20.1	22.1	110.1	71.0 % -129.0 %	
	Carbon Tetrachloride	20.1	22.6	112.5	68.5 % -131.5 %	
	1,2-Dichloropropane	20.1	22.6	112.6	74.0 % -126.0 %	
	Bromodichloromethane	20.0	21.8	109.1	76.0 % -124.0 %	
	cis-1,3-Dichloropropene	20.2	22.1	109.3	64.0 % -136.0 %	
	trans-1,3-Dichloropropene	20.2	21.5	106.4	64.0 % -136.0 %	
	1,1,2-Trichloroethane	20.2	22.8	113.1	78.5 % -121.5 %	
	Dibromochloromethane	20.0	20.7	103.4	65.5 % -134.5 %	
	Tetrachloroethene	20.1	22.0	109.5	70.0 % -130.0 %	
	Bromoform	20.1	19.0	94.6	73.5 % -126.5 %	
	1,1,2,2-Tetrachloroethane	20.1	23.1	115.1	49.0 % -151.0 %	
	Trichloroethene	20.1	19.6	97.4	77.0 % -123.0 %	
	Chlorobenzene	20.1	20.2	100.3	72.0 % -128.0 %	

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	Q16S2						
	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	--- = Analysis Not Requested
D = Distillation	ND = Not Detected
TOC = Total Organic Carbon	AK = AlpKem
TOX = Total Organic Halogens	LOQ = Limit of Quantitation
* = Out of Specification	NA = Not Applicable

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											
2302109	Q17T2	Organic											
2302110	Q17T3	Carbon	TOC	5/04/95	8KG	33056	4000	SPIKE	17857	51843	mg/kg	105.2	
2302111	Q17T4												
2302112	Q16T2												
2302113	Q16T3												
2302114	Q16T4												
2302115	Q16T5												
2302116	Q16S2												
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	--- = Analysis Not Requested
D = Distillation	ND = Not Detected
TOC = Total Organic Carbon	AK = AlpKem
TOX = Total Organic Halogens	LOQ = Limit of Quantitation
* = Out of Specification	NA = Not Applicable

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	Q16S2												
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	--- = Analysis Not Requested
D = Distillation	ND = Not Detected
TOC = Total Organic Carbon	AK = AlpKem
TOX = Total Organic Halogens	LOQ = Limit of Quantitation
* = Out of Specification	NA = Not Applicable

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	Q16S2									
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	--- = Analysis Not Requested
D = Distillation	ND = Not Detected
TOC = Total Organic Carbon	AK = AlpKem
TOX = Total Organic Halogens	LOQ = Limit of Quantitation
* = Out of Specification	NA = Not Applicable

Std mass: 25.0000 ug
Scaling Factor: 0.04080 Cl mV

Batch Numbers: 95118-201

Blank: 41.1680 mV Standard: 624.385 mV
Blank: 30.9270 mV Standard: 610.960 mV
Blank: 41.3370 mV Standard: 602.709 mV
Average: 37.8107 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	Q16S2								
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



Method Blank
Miscellaneous Wet Chemistry

Comments: The blank is acceptable when the result is less than the limit of quantitation.

TI = Titration	ND = Not Detected
CO = Colorimetric	J = Estimated Value < LOQ
IR = Infrared Spectrophotometry	< = Less Than
OD = Oven Dried	LOQ = Limit of Quantitation
DI = Distillation	NA = Not Applicable
G = Gravimetric	M = Meter
U = Under Method Detection Limit	* = Out of Specification



Comments: Sample values shown may be rounded to be consistent with the limit of quantitation.

TI = Titration	ND = Not Detected
CO = Colorimetric	J = Estimated Value < LOQ
IR = Infrared Spectrophotometry	< = Less Than
OD = Oven Dried	LOQ = Limit of Quantitation
DI = Distillation	NA = Not Applicable
G = Gravimetric	M = Meter
U = Under Method Detection Limit	* = Out of Specification



TI = Titration	ND = Not Detected
CO = Colorimetric	J = Estimated Value < LOQ
IR = Infrared Spectrophotometry	< = Less Than
OD = Oven Dried	LOQ = Limit of Quantitation
DI = Distillation	NA = Not Applicable
G = Gravimetric	M = Meter
U = Under Method Detection Limit	* = Out of Specification



Initial Calibration
Miscellaneous Wet Chemistry
Instrument Identification:

Batch Number:

[illegible]

Batch Number:

[illegible]



Laboratory Control Standard
Laboratory Control Standard Duplicate
Miscellaneous Wet Chemistry

Comments: LCS/LCSD values shown may be rounded to be consistent with the limit of quantitation.

APPENDIX B

Field Data Sheets

HULL & ASSOCIATES, INC. SOIL BORING FIELD LOG

[illegible]



Hull & Associates, Inc.
6130 Wilcox Road
Dublin, Ohio 43016

FIELD DATA SHEET GROUND-WATER SAMPLING

Well I.D. _____

Client: _____ Site Location: _____

Site No.: _____ Project No.: _____

Air Temperature: _____ Weather Conditions: _____

Type of Well Construction _____

Condition of Well circle (Good / Poor) if poor, specify _____

Cap Locked (Yes / No) _____ Lock No.: _____

Depth to Water _____ feet Total Depth _____ feet

NAPL (Yes / No) Depth to LNAPL _____ feet

NAPL Thickness _____ feet

Sample Date _____ Sample No.: _____

PURGE DATA			FIELD TESTING / WELL VOLUME		
TIME	APPROX. VOLUME PURGED GALLONS/WELL VOLUME	NO. OF WELL VOLUMES	TEMP. °C	pH AT 25°C	CONDUCTIVITY Units AT 25°C
	NA	STATIC			
		1			
		2			
		3			
		4			
		5			

One Well Volume Equals: _____ Gallons

Comments: _____

Drum Inventory: Soil _____ Purge Water _____ NAPL _____

Date _____

[illegible]

HULL & ASSOCIATES, INC. WELL DEVELOPMENT FORM

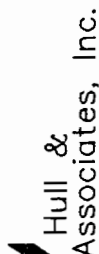
[illegible]

IMHOFF CONE TEST

Start Time: _____
 Volume Water: _____
 End Time: _____
 Volume Sediment: _____

a. Top of casing.
b. NAPL - nonaqueous phase liquid.
c. Depth to water.
d. Cumulative gallons.
e. *C, unless *F noted.
f. Standard units.
g. Visual unless otherwise noted.
h. Specific conductance, $\mu\text{mhos/cm}$ (or $\mu\text{S/cm}$).
i. Visual unless otherwise noted.

PROJECT NO.		HULL & ASSOCIATES, INC.		SHEET	OF
DAILY FIELD REPORT					
PROJECT _____		DATE _____			
LOCATION _____		WEATHER _____			
CONTRACTOR _____		TIME ON-SITE FROM _____ TO _____			
VISITORS ON SITE _____					
DESCRIPTION OF WORK _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____					
	EQUIPMENT USED _____				HOURS
	LABOR _____				
WORK INSPECTED BY _____					
REPORT PREPARED BY _____					



PAGE _____ OF _____

NO. 4182

☐ Warrensville Heights

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Warrensville Heights, Ohio 44128

Phone: (216) 514-7100

FAX: (216) 514-7104

Client:

Site:

Project #: _____ Phase: _____

Samplers:

SAMPLE TYPES	PRESERVATIVES	METALS
A AIR	A - HNO ₃ only, <4° C	F - FILTERED
C ASPHALTOS	B - HNO ₃ pH 2	N - NOT FILTERED
D SEDIMENT	C - H ₂ SO ₄ pH 2	B - BOTH
E GROUNDWATER	D - NaOH pH 12	
G PRODUCT	E - Zn acetate + NaOH, pH > 9	
H SOIL	F - Na ₂ S ₂ O ₃ (0.005%)	
I WATER	G - HCl pH < 2	
J OTHERS		

All samples are kept at 4° C.

[illegible]

RELINQUISHED BY:

DATE: - -

RECEIVED BY:

DATE: _____

3

Deliver To:

RELINQUISHED BY:

DATE: -- --

RECEIVED BY:

DATE: _____

1

Method of Delivery:

RELINQUISHED BY:

TIME: - -
DATE: - -

RECEIVED FOR LAB BY:

TIME: _____
DATE: _____

1	1

Airbill Number:

NOTES:

COOLER TEMPERATURE
AS RECEIVED °C :

;

DISTRIBUTION:
WHITE --LAB USE (MUST BE RETURNED WITH REPORT)
YELLOW --LAB USE

TURN AROUND TIME:

DAYS

APPENDIX C

Health and Safety Plan (HASP)

HEALTH AND SAFETY PLAN

FOR THE

FOCUSED GROUND-WATER REMEDATION

LOCATED AT

**570 MAIN STREET PROPERTY
WESTBURY, NEW YORK**

APRIL 2001

Prepared For:

IMC EASTERN CORPORATION

Prepared By:

**HULL & ASSOCIATES, INC.
4700 DUKE DRIVE, SUITE 172
MASON, OHIO 45040**



recycled paper

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1.0 INTRODUCTION

1.1 General

This Health and Safety Plan (HASP) has been prepared for Hull & Associates, Inc. (HAI) field personnel conducting focused ground-water remediation activities at the former IMC Magnetics facility at 570 Main Street in Westbury, New York, New York State Department of Environmental Conservation (NYSDEC) Code #130043A (Site). The Site is within the New Cassel Industrial Area (NCIA), a Class 2 inactive hazardous waste site as designated by the NYSDEC. This HASP has been prepared with the intention to provide minimum health and safety requirements for activities to be conducted at the Site.

The health and safety guidelines and requirements presented herein are based on a review of available information and an evaluation of potential hazards. Because of the activities and Site conditions that may be encountered, and the uncertainties associated with potential health effects from exposures to various contaminants that may be present, no guarantees can be made regarding the potential health effects associated with field activities on this Site. This HASP outlines the health and safety procedures and equipment required for conducting activities at this Site to minimize the potential for exposure to field personnel.

1.2 Purpose

The specific purpose of this HASP is to detail the applicable engineering, administrative, and protective provisions that shall be followed to help ensure that the health and safety of the surrounding community, Site personnel, and visitors is adequate. It also fulfills the applicable regulations mandated by the Occupational Safety and Health Administration (OSHA), U.S. EPA, and Ohio EPA including, but not limited to:

1. 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response);
2. 29 CFR 1910.1200 (Hazard Communication); and,
3. 40 CFR 264.54 and 1905.08 (d) (4) (I) (EPA Contingency Planning).

1.3 Site Description

The Site is located at 570 Main Street in Westbury, New York, and is within the 170-acre NCIA. The NCIA contains approximately 200 industrial or commercial enterprises. 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 owned and occupied by Castle Collision, an entity unrelated to IMC.

1.4 Project Description

In general, the objectives of this plan are to address the health and safety issues that affect personnel during the anticipated Site activities including, but not limited to:

1. Ground-water monitoring well installation oversight;
2. Well development;
3. Ground-water sampling; and,
4. Soil sampling.

A detailed discussion of individual project tasks is included in the Field Sampling and Analysis Plan and Focused Ground-water Remediation Work Plan. This HASP does not cover any Site activities other than those specifically listed above. Other possible work activities not described may only be conducted after approval of an appropriate addendum to the HASP by the Health and Safety Coordinator (HSC).

1.5 Project Organizational Structure

The following briefly describes the organizational structure and responsibilities of various personnel relative to administration of the health and safety program. A brief description of each individual's project responsibilities is provided below.

1.5.1 Project Manager

W. Lance Turley is the Project Manager for this project. The Project Manager shall be responsible for directing all required Site activities in conjunction with the Scope of Work. The Project Manager shall be readily accessible and present on-Site when possible during Site work to see that activities are performed in a manner consistent with this HASP. This person should also, when possible,

coordinate decisions that potentially affect employee health and safety with the HSC. The Project Manager shall have the authority to stop any phase of the project deemed dangerous to human health and the environment and/or not in substantial compliance with this HASP. The Project Manager or his designee also has the authority to suspend an individual from field activities for infractions of the HASP.

1.5.2 Health and Safety Coordinator (HSC)

Toby Droughton is the Health and Safety Coordinator for this project. The HSC is responsible for coordinating matters of health and safety with the Project Manager. This HASP was developed by the HSC and will be submitted to the Project Manager. The HSC shall work closely with the Project Manager and the Site Health & Safety Officer (SHSO) to ensure that all work is carried out in the safest manner possible. The HSC shall be responsible for ensuring the overall implementation and enforcement of this HASP. The HSC will assist the Project Manager to ensure that proper health and safety equipment is available for the project. This person is also responsible for verifying appropriate air monitoring procedures and personal sampling methods, as needed. The HSC will approve personnel to work on this Site with regard to medical examinations and health and safety training. The HSC shall work with the SHSO and field personnel to minimize occurrences where employees are exposed to contaminant concentrations above the corresponding permissible exposure limits (PELs) or threshold limit values (TLVs), whichever is lower.

The HSC is authorized to suspend work or otherwise limit exposures to personnel if a HASP appears to be unsuitable or inadequate. Personnel will be directed by the HSC to change work practices if they are deemed hazardous to health and safety. The HSC may also remove field personnel from the project if their actions endanger their and/or their coworkers' health and safety.

1.5.3 Site Health and Safety Officer (SHSO)

The Site Health and Safety Officer for this project will be Bill Dennis. The project SHSO shall be responsible for implementing the provisions of this plan during work activities. The SHSO shall report safety-related incidents or accidents to the Project Manager and HSC. He shall also have the authority to temporarily suspend field activities, if health and safety of field personnel are endangered, pending further consideration by the Project Manager and HSC. Only the Project Manager or his designee can order work to begin again. The SHSO has the authority to suspend an individual from field activities for infractions of the HASP, pending further consideration by the

HSC. The SHSO is responsible for the daily enforcement of this HASP. He shall also be responsible for conducting or directing any necessary health and safety equipment maintenance, personal or perimeter air monitoring, accident or incident investigating/reporting, contractor/employee compliance procedures, and any other health and safety-related duties.

1.5.4 Field Personnel

Field personnel will be responsible for following the requirements set forth in this HASP. All persons entering the field should read and fully understand this HASP, and agree to comply with and implement its contents. Any incidents or variation from the plan must be discussed with the HSC, Project Manager, and SHSO.

2.0 HAZARD ASSESSMENT

2.1 Chemical Hazards

The chemical hazard evaluation is based on the history of the Site and investigations completed to date at the Site. The chemical hazard evaluation has been conducted to identify the types of hazards that may be encountered during activities at the Site and to ensure that Site activities, personnel protection, and emergency responses are consistent with the specific contaminants expected to be encountered.

2.1.1 Chlorinated Volatile Organic Compounds (VOCs)

Historical ground-water and soil sampling data indicate that there is a potential for exposure to chlorinated VOCs such as perchloroethylene and trichloroethylene. Inhalation of chlorinated VOC vapors may be irritating to the upper respiratory tract and may cause central nervous system disorders (e.g., headache, nausea, confusion, etc.). Vapors can also be irritating to the eyes causing redness and pain. Skin contact with chlorinated VOCs may cause redness, itching, and pain. Chlorinated VOCs may be absorbed through the skin with possible systemic effects.

2.1.2 Sample Container Preservatives

Sample containers may contain preservatives such as sulfuric acid, hydrochloric acid, and nitric acid. These preservatives are corrosive and can cause redness, pain, and skin burns upon skin contact. Acid vapors are irritating and may cause damage to the eyes. Splashes may cause severe burns and permanent eye damage. Inhalation of vapors may cause coughing, choking, and/or inflammation of the nose, throat, and upper respiratory tract.

2.1.3 Material Safety Data Sheets (MSDS)

MSDSs for compounds that could potentially be encountered at this Site can be found in Appendix A. Additionally, small amounts of other potentially hazardous substances may be present at the Site that have not yet been identified. These chemical hazards involve substances which may exhibit one or more of the following characteristics: toxicity, ignitability, reactivity, or corrosivity. If additional compounds are known to exist, MSDS for those compounds shall be supplied as well.

2.1.4 Occupational Exposure Limits (OELs)

Activities to be completed consistent with the Focused Ground-water Remediation Work Plan shall be performed outside, and will be conducted in a manner to ensure limited exposure to contaminated media. Air monitoring requirements shall be based on knowledge of Site conditions, previous Site data, and current Site data. Air sampling shall be performed before and periodically during all potential exposure situations. If air monitoring action levels are exceeded, further administrative and engineering controls shall be implemented to reduce personnel or off-Site exposure to airborne contaminants. If action levels are still exceeded, appropriate personal protective equipment shall be provided to potentially affected personnel or, in the case of off-Site action level excursions, operations ceased and the situation reassessed.

The general routes of exposure in which personnel may be exposed to the chemicals of concern listed in Table 2-1 include:

1. Inhalation of VOCs, dusts, and other contaminants present in ambient air;
2. Absorption of liquid or vapor through skin (particularly eyes, mucous membranes, and feet);
3. Dermal contact with surface soils, surface water, and sediments;
4. Incidental ingestion of contaminated water and soil through poor personal hygiene and poor use of personal protective equipment (PPE); and,
5. Injection of contaminants through skin (cuts, scrapes, etc.).

OSHA has established permissible exposure limits (PELs) and ACGIH has established threshold limit values (TLVs) for exposure to airborne concentrations of substances. These guidelines represent conditions under which it is expected that nearly all personnel may be repeatedly exposed daily (8-hour time-weighted average) without adverse health effects. Established levels have been listed in Table 2-1 for the compounds, which may present a potential hazard to on-Site personnel. The TLV or PEL representing the lowest contaminant level shall be used as the exposure guideline. When applicable, one-half the TLV or PEL, whichever is lower, shall be used as the action level when monitoring for specific contaminants.

The acute (short-term, immediate) symptoms of exposure to the various anticipated chemical hazards are similar among hazards. In general, acute symptoms of exposure that may occur in certain individuals include the following:

1. Eye, nose, and throat irritation;
2. Headache;
3. Euphoria;
4. Giddiness;
5. Respiratory irritation;
6. Confusion;
7. Weakness;
8. Fatigue;
9. Staggered gait; and,
10. Skin irritation.

TABLE 2-1

SUSPECTED CHEMICALS OF CONCERN

PARAMETER	PEL-TWA	TLV-TWA	STEL	IDLH	LEL
1,1,1-Trichloroethane (Methyl chloroform)	350 ppm	350 ppm	450 ppm	700 ppm	7.5%
1,1-Dichloroethene	-	5 ppm	-	-	6.5%
1,1-Dichloroethane	100 ppm	100 ppm	-	3000 ppm	5.4%
Tetrachloroethene (Perchloroethylene)	100 ppm	25 ppm	100 ppm	150 ppm	-
Toluene	200 ppm	50 ppm	-	500 ppm	1.1%
Trichloroethylene (TCE)	100 ppm	50 ppm	100 ppm	1000 ppm	8.0%
1,2- Dichloroethene	200 ppm	-	-	1000 ppm	5.6%
Trichlorofluoromethane	1000 ppm	-	-	2000 ppm	-

Threshold Limit Value or Permissible Exposure Limits – Time Weighted Average (TLV or PEL – TWA): the time weighted average concentrations for a normal eight hour workday or forty hour work week to which nearly all workers may be repeatedly exposed day after day, without adverse effects. PELs are enforceable OSHA standards. TLVs are recommended guidelines developed by the American Conference of Governmental Industrial Hygienists (ACGIH).

STEL – Short Term Exposure Limit: the maximum concentration to which it is felt the average worker can be exposed for a period of up to fifteen minutes continuously without adverse effects. Exposures above the PEL or TLV up to the STEL should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures.

IDLH – Immediately Dangerous to Life or Health: represents maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape – impairing or irreversible health effects.

(-) No value found or not applicable.

PPM - Parts per million of contaminant by volume.

LEL - Lower Explosive Limit in air.

2.2 Physical Hazards

Physical hazards associated with the project include:

1. lifting heavy objects;
2. operating vehicles on rough, slippery, or unstable terrain;
3. slips, trips, and falls; and,
4. noise.

Field personnel must take extra precautions when walking, working or operating vehicles on unstable, rough, or slippery ground. Field personnel should also note the increased opportunity for cuts, scraps, or the possibility of injection of an object. The specific hazards and their associated safety precautions are identified according to the type of work being conducted in Section 3.0, Hazard Analyses.

2.3 Environment Hazards

2.3.1 Cold Stress

Cold stress can occur during cool or cold weather when personnel are not adequately dressed and/or when they perspire while wearing protective clothing. Personnel shall be encouraged to bring dry clothes and change into them when necessary. Personnel must be aware of the potential for frostbite during cold periods. Proper clothing must be worn and adequate work breaks given to allow personnel to warm up. The SHSO shall determine the required actions to assure personnel safety during cold periods. These actions shall be based on Site-specific conditions (wind, rain, etc.). The following symptoms are indications of overexposure to cold conditions and require immediate attention:

1. Pain or numbness in the extremities are the first early warning of danger to cold stress;
2. Development of severe shivering, which indicates that exposure to cold should be immediately terminated;
3. Decreased manual dexterity, indicating extremity overexposure; and,
4. Feelings of excessive fatigue, drowsiness, irritability, or euphoria, which require an immediate heating shelter.

Cold stress conditions are significantly exacerbated by lowered air temperatures, increased wind velocity, and exposure to wet conditions. The following precautions should be followed:

1. Workers should bring additional dry clothes and change into them immediately when needed. Wet clothing, including both outerwear wet from rain or snow and innerwear wet from sweating, should be removed immediately prior to entering or re-entering cold conditions;
2. Avoid exposed skin and wet clothing that enhances the potential for frostbite;
3. Wear many individual layers of clothing rather than a few bulky layers;
4. Workers must be allowed adequate work breaks to warm body parts;
5. Be aware that wind, snow, and rain may exacerbate cold conditions;
6. Recognize that individual cold tolerances may vary;
7. Protect susceptible areas such as feet, hands, nose, and ears;
8. Workers with circulatory problems may require special precautionary protection against cold injury, such as a reduced exposure period;
9. A heater such as a car heater or heated building must be nearby to warm hands or other body parts. (Remember: Pain in hands and/or feet signifies initial stages of frostbite);
10. Adequately insulated dry clothing must be worn when temperatures are below 40°F;
11. Coffee intake should be limited because of diuretic and circulatory effects. However, adequate liquid intake (e.g., warm, sweet, non-caffeinated drinks and soups) should be maintained;
12. Insulated gloves should be worn when working with metal tools or metal parts in cold weather; and,
13. If clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until weather conditions improve.

For work in cold conditions less than 40°F workers must:

1. Use the buddy system and watch partner for signs of frostbite or hypothermia;
2. Limit work rate to avoid sweating;
3. Minimize sitting still or standing still for long time periods;

4. Avoid work in extremely cold conditions (generally less than 20°F);
5. Protect themselves from drafts in open areas; and,
6. Not be required to work full time in the cold generally during the first week of adjustment to conditions until workers can become accustomed to such working conditions. **Remember that individual reactions to cold working conditions can vary significantly.**

2.3.1.1 Frostbite

- Cause: Exposed skin and extremities (e.g., inadequately insulated parts of the body) have a tendency to freeze in cold temperatures, especially when wet from perspiration, rain, snow or submergence in water.
- Symptoms: The skin turns red or pink and pain is experienced in the early stage of frostbite. As frostbite develops, the skin may become a dull white or grayish yellow and may feel cold and numb. The victim may not feel pain in the later stages. Skin may blister.
- Care: Cover the affected parts with dry insulated materials and immediately transport victim to an indoor heated area. Do not rub affected parts in snow or submerge parts in cold water. Submerge in luke-warm water (approximately 100 degrees Fahrenheit) until skin is pink. Do not use hot water or hold over an open flame or stove to warm exposed parts. Injured parts should be loosely bandaged. Keep affected parts elevated. Immediately consult a physician anytime that frostbite is suspected.

2.3.1.2 Hypothermia

- Cause: Exposure to extreme cold that causes the entire body to chill or freeze. Hypothermia, complete chilling of the body, is often associated with drenching or extensive perspiration in a cold environment.
- Symptoms: Victims may experience shivering, numbness, weakness in the muscles and joints, and a low body temperature. The victims pulse and breathing rates decrease. The victim may seem drowsy and he/she may possibly become unconscious. Eventually, death may occur.
- Care: Transport the victim to a warm environment immediately. Remove all wet and restricting clothing and wrap the victim in dry, warm blankets or garments. **Consult a physician immediately.**

2.3.2 Heat Stress

Heat stress results when the body cannot cope with the increased stress of working in a hot environment. Personnel wearing protective clothing have an increased potential for heat stress because clothing inhibits the body's natural cooling mechanism, the evaporation of perspiration. Dehydration, profuse sweating, and strenuous work conducted under such conditions can lead to heat stress. The following precautions should be taken when working in a potential heat stress environment:

1. Drink plenty of liquids to avoid dehydration;
2. Drink approximately one-pint of water prior to commencing work;
3. At each break, drink tepid water and/or electrolyte fluids;
4. Wear light-colored, cool clothing;
5. Take frequent work breaks;
6. If possible, work during the cooler hours of the day, and avoid strenuous work between 10 am and 2 pm; and,
7. Protect exposed skin from ultraviolet (UV) exposure by frequently applying sunscreen, especially between the hours of 10 am and 2 pm when the most UV damaging rays are present.

Working in hot environments can cause several recognized physical injuries, which in order of increasing severity include: heat rash, heat cramps, heat exhaustion and heat stroke.

2.3.2.1 Heat Rash

Cause: Heat rash is caused by unrelieved exposure to hot humid air. The skin's sweat pores become clogged, thus causing a skin rash to appear. Covered skin is particularly vulnerable, although dried sweat over exposed skin can cause salt crystal buildup and subsequent eye and skin irritation.

Symptoms: Red rash, impaired sweating, mild discomfort, lowered heat tolerance.

Care: Allow victim to rest in cooler environment. Give victim water to drink. Wash skin with cool water.

2.3.2.2 Heat Cramps

- Cause: Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Caused by profuse sweating with inadequate replacement of water and salt.
- Symptoms: Muscle spasms and pain in abdominal muscles and extremities.
- Care: Allow victim to rest in cooler environment. Give victim at least four ounces of water every fifteen minutes for an hour.

2.3.2.3 Heat Exhaustion

- Cause: Heat exhaustion is caused by physical exertion in a hot environment. Profuse sweating without proper evaporation and dehydration can occur. Nervous system control and heart output are inadequate to meet demands of heat and dehydration. Heat exhaustion can lead to heat stroke if not treated properly.
- Symptoms: Pallor, faintness, dizziness, temporary loss of breath, profuse sweating, clammy/cool skin, dilated pupils, headache, nausea and vomiting.
- Care: Allow victim to rest in a cooler environment and remove his/her protective clothing. Give the victim at least four ounces of water every fifteen minutes if he/she is conscious and can tolerate it. Place the victim in the shock position (lying down with feet elevated). Cool victim by fan or applying wet towels, sheets, etc. Monitor closely. Transport victim to medical facility if there are no signs of improvement.

2.3.2.4 Heat Stroke

- Cause: The most serious of heat-induced illnesses is heat stroke because of its potential to be life threatening or to result in irreversible damage. Heat stroke results from excessive physical exertion in a hot environment. **This is a serious problem and can be fatal.** The strain placed on the circulatory system can cause the victim to go into shock.
- Symptoms: Dizziness, nausea, severe headache, constricted pupils, hot dry skin, cessation of sweating, high temperature (usually 100°Fahrenheit and rising), confusion, collapse, delirium, coma, staggering gait, convulsions, and/or loss of consciousness.
- Care: Transport victim immediately to a medical facility. If body is not cooled immediately, irreversible damage to vital organs may develop leading to death. Take victim to a cooler and uncontaminated area and remove protective clothing. **Do not give victim anything to drink.** Cool victim with cold water, cold compresses, and rapid fanning.

2.3.2.5 Additional Heat Stress Considerations

2.3.2.5.1 Thermal Burns

Additional precautions must be considered when working in areas with considerable solar loads. Black or dark non-reflective surfaces can become extremely hot and may cause burns if contacting unprotected skin. In addition, wide open dark surfaces, such as asphalt/blacktop parking lots, can create excessive radiant walking surfaces, which, if ignored, can cause profuse foot perspiration and discomfort as well as increase potential for heat stress-related illnesses. When touching potentially hot surfaces lined or unlined cotton or leather gloves are generally recommended. When working on hot open surfaces, employees may wish to carry additional socks and change them when necessary.

2.3.2.5.2 Ultraviolet Radiation

If unprotected, certain employees not normally acclimated to direct solar radiation are susceptible to severe sunburns. Employees should bring sunscreen (SPF-15) with them if they are particularly prone to burning or if they shall be outside working for a significant amount of time. The hazards of heat stress and thermal/ultraviolet burns can be severe and debilitating. All employees should monitor one another.

2.3.3 Heat Stress Monitoring

Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload, and the individual characteristics of the worker. With the addition of PPE, Site workers are potentially at considerable risk for developing heat stress. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (e.g., evaporation, convection, and radiation) and increases energy expenditure. Therefore, regular monitoring and other preventative precautions will be vital to insuring worker safety. Factors that may predispose workers to heat stress include:

1. Lack of physical fitness;
2. Lack of acclimation;
3. Age;
4. Alcohol and drug use;

5. Disease;
6. Sunburn; and,
7. Diarrhea.

2.3.3.1 Monitoring

Because the occurrence of heat stress depends on a variety of factors, all workers, even those not wearing protective clothing, will be monitored, if weather conditions necessitate. For workers wearing permeable clothing (e.g. standard cotton or synthetic work clothes), the American Conference of Governmental Industrial Hygienists Threshold Limit Values and methods will be implemented. Measurements and values will be calculated using the "Wet Bulb Globe Temperature" (WBGT). Currently the WBGT index is the simplest and most suitable technique to measure environmental factors. WBGT values are calculated by the following equations:

1. Outdoors with solar load:

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

2. Indoors/outdoors with no solar load:

$$WBGT = 0.7NWB + 0.3GT$$

Where:	WBGT	=	Wet Bulb Globe Temperature
	NWB	=	Natural Wet-Bulb Temperature
	DB	=	Dry-Bulb Temperature
	GT	=	Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet bulb thermometer, and a dry-bulb thermometer.

For workers wearing semipermeable or impermeable PPE, the ACGIH standard can not be used. For these situations, workers should be monitored when the temperature in the work zone is above 70°F (21°C). To monitor such workers, the SHSO or their designee will measure each person's heart rate. The radial pulse should be counted during a 30-second period as early as possible once the rest period begins. If the heart rate exceeds 110 beats per

minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

Prior to initiating work, contractors and regular Site personnel should submit the worker's age, weight, and any unordinary physical conditions that he/she may possess. The exceedance of 110 beats per minute may be subjective depending on the individual's physical norms. The SHSO will also monitor the oral temperature of on-Site personnel wearing semi permeable or impermeable PPE. The SHSO will use an approved thermometer or similar device to measure the oral temperature at the end of the work period (before drinking). If the oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. If oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the following work cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 100.6°F.

The SHSO will also monitor the body water loss, if possible. The SHSO will measure body weight on a scale at the beginning and end of each workday to see if enough fluids are being taken to prevent dehydration. Body weight should be measured while the employee is wearing similar clothing or, ideally, when minimal clothing is worn. The body water loss should not exceed 1.5 percent total body weight loss in a workday.

The following table lists the suggested frequency and corresponding temperature for monitoring workers:

TABLE 2-2
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING
FOR FIELD WORKERS

ADJUSTING TEMPERATURE	NORMAL WORK CLOTHING	IMPERMEABLE CLOTHING
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

2.4 Biological Hazards

2.4.1 Insects

Numerous types of pest organisms may be present, including bees, mosquitoes, spiders, and ticks. The presence of flying and biting insects can produce potentially dangerous field conditions because of the distraction they may cause to Site workers. Stings of bees and wasps may cause serious allergic reactions in certain individuals. The SHSO should identify all personnel with known insect allergies or for sensitivities before fieldwork begins. Spider bites can be extremely serious (e.g., those of the black widow). Others are unpleasant or uncomfortable, resulting in rashes, itching, and possible infection. The possibility of allergies greatly increases the danger since people are not usually aware of such allergies until they have been bitten. Therefore, spiders should be regarded as potentially hazardous. Ticks are parasites that feed on the blood of an animal/host and can carry several diseases, at least bringing several days of fever and pain and the worst causing brain damage.

Insect hazards may be reduced by the use of repellents where appropriate. Extreme care should be taken to avoid air, soil, and water contamination with any repellent. If bee or wasp nests are encountered when conducting work in a nesting area, the use of a carbon dioxide extinguisher (if available on-Site) will temporarily incapacitate the insects until the nest can be physically removed using remote mechanical means, such as a long stick or branch. Taping or tying pant legs and shirt sleeves shut minimizes insect bite hazards.

2.4.2 Animals

Rats and other mammals have been known to harbor fleas carrying bubonic plague. Fox, skunk, and raccoons can carry rabies. Poisonous snakes may also be encountered on-Site. Personnel should be alert for snakes before walking through grassy or debris-strewn areas and avoid contact.

2.4.3 Poisonous Plants

Poison ivy, poison oak, and poison sumac may be encountered while conducting field activities. All of these plants secrete oils that can cause an itching rash, which can spread. The best defense against poisonous plants is to learn to identify them and ultimately, not contact them. In summer months when leaves are present, if you cannot identify which three-leafed plants are poisonous, avoid all three-leafed plants. In the fall, spring, and winter when leaves are not present, the stems of these plants can still release oils and cause the associated rashes. Personnel should avoid stepping in areas where such vegetation may exist. Plastic sheeting may be used to reduce contact with vegetation, if work must be conducted in these areas.

3.0 HAZARD ANALYSES

3.1 Hazard: Inhalation, Ingestion, and Absorption of Contaminants During Site Activities

Precautions:

1. Use layered nitrile gloves when handling samples.
2. Avoid unnecessary contact with impacted media.
3. Keep face away from wellhead area to avoid inhalation of contaminants.
4. Do not smell for evidence of contamination.
5. Handle sample media in a cautious manner as to not spill or agitate particulate.
6. Carefully handle sample containers containing preservatives (e.g., sulfuric and nitric acid) as to avoid skin and eye contact and inhalation.
7. Always wear long pants.
8. Wash hands thoroughly prior to eating, drinking, smoking, or applying cosmetics.
9. Wash all exposed areas of skin that may have come in contact with impacted media.
10. Properly dispose of contaminated materials.
11. Remove contaminated clothing as soon as possible.
12. Always treat all handled materials as if they are contaminated.
13. Monitor breathing zone air to determine real-time levels of gases and vapors.

3.2 Hazard: Splashes, Flying Objects, and Overhead Hazards

Precautions:

1. Safety glasses with side shields and hard hats shall be provided and should be worn by all project personnel in areas where the potential for splashes, flying objects, and overhead hazards exist.
2. Safety glasses or goggles are required for ground-water sampling activities.

3.3 Hazard: Inclement Weather

Precautions:

Work shall be ceased during thunderstorms with lightning and/or any other severe weather (e.g., tornado, hail, snow, etc).

3.4 Hazard: Traffic Control

Precautions:

Operate vehicles at safe speeds especially when working in rough terrain.

3.5 Hazard: Inhalation of VOCs and SVOCs

Precautions:

1. Personnel shall stand upwind of product when possible.
2. Personnel shall take breaks away from the contaminated area.
3. If any symptoms of overexposure occur (e.g., headache, nausea, etc.), personnel shall immediately leave the area and contact the SHSO and/or Project Manager.
4. Monitor breathing zone air to determine real-time levels of gases and vapors.

3.6 Hazard: Fire/Explosion

Precautions:

1. Ignition sources shall be removed from any potentially flammable area.
2. Non-intrinsically safe or non-explosion proof electrical devices will **NOT** be used in areas where a potential for fire/explosion exists.
3. Continuously monitor the atmosphere for combustibles.

3.7 Hazard: Noise Exposure

Precautions:

Hearing protection will be provided to all HAI employees and should be worn as needed.

3.8 Hazard: Moving Equipment and Parts

Precautions:

1. Steel-toed boots, hard hats, and safety glasses must be worn while on-Site.
2. Protective gloves (e.g., leather gloves) should be worn when working with tools or equipment, which could potentially cut or pinch fingers or hands.

3.9 Hazard: Slips, Trips, and Falls

Precautions:

1. Clear walkways and work areas of equipment, tools, vegetation, and any other potential trip hazards.
2. Mark, identify, or barricade other obstructions.
3. Use caution or avoid working in areas with unstable terrain to minimize the potential for slips, trips, and falls.

3.10 Hazard: Handling Heavy Objects

Precautions:

1. Implement proper lifting technique.
2. Do not lift over 60 lbs. without assistance.

3.11 Hazard: Heavy Equipment Operation

Precautions:

1. Wear hard hats, steel-toed boots, and safety glasses.
2. Stay a safe distance from equipment and be aware of equipment range of motion.
3. Equipment should be equipped with backing alarms.
4. Maintain eye contact with the operator.
5. All HAI employees should pay particular attention to moving equipment. When working in areas where equipment operator's visibility may be compromised for any reason, the use of spotters and hand signals is required.

3.12 Hazard: Excessive Vegetation

Precautions:

1. Be conscious of hidden trip hazards.
2. Avoid poison ivy, poison sumac, poison oak, mold, and fungi.

3.13 Hazard: Eating, Drinking, Smoking, or Use of Tobacco Products

Precautions:

1. To avoid the unnecessary ingestion of hazardous chemicals, the consumption of the above mentioned items in the designated work zones is prohibited.
2. Prior to consumption of food or tobacco products all personnel shall properly decon with soap and water.

3.14 Hazard: Unanticipated Environmental and/or Health and Safety Considerations

Precautions:

Should any Site personnel anticipate or recognize a potential safety or health hazard they should immediately report their concerns to the SHSO, HSC, and Project Manager.

4.0 HAZARD COMMUNICATION AND TRAINING

Field personnel must be knowledgeable about hazards to which they may be exposed during this project, as required by the OSHA Hazard Communication (HAZCOMM) Standard and the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. Field personnel must sign the form located in Appendix B acknowledging that he/she has read and understood this HASP.

A comprehensive hazard communication and training program requires at least the following elements:

1. Meetings with personnel involved in this project about hazards which may be encountered at the Site (including contractors, subcontractors, and visiting personnel).
2. Proper and adequate employee training in required hazard communication and hazardous waste operations and emergency response topics (OSHA 40 Hour Training Course).
3. Training regarding the understanding of container labeling and required MSDSs.
4. Review of the location of MSDSs and labels for substances found on-Site (MSDSs can be found in Appendix A).
5. Review of the Site-specific HASP and the Hazard Communication program.
6. A Site-specific orientation/safety and health session including:
 - a. Site layout and accessibility;
 - b. Hand signals/communication requirements;
 - c. Safety rules and recognition of potential hazards;
 - d. Personal hygiene;
 - e. Types of hazards;
 - f. Work zones;
 - g. Contingency/emergency planning;
 - h. Air monitoring/sampling;

- i. Decontamination;
- j. Personal protective equipment;
- k. Traffic rules; and,
- l. Confined space entry precautions.

Training programs shall meet all OSHA or other applicable regulations. Also, safety briefings shall be given daily or on an as needed basis by the HSC, the SHSO, or a designee when new or unanticipated activities occur. All on-Site personnel required to wear respirators shall be fit tested and instructed in the proper use, cleaning, storage, and limitations of their respirators. A list documenting the date, time and persons attending each health and safety meeting shall be filed with the HSC.

All personnel shall be required to acknowledge their training via the form in Appendix B. Contractors or other on-Site visitors must have similar programs in effect before entering the Site.

The specific training requirements (for personnel and supervisors/managers at hazardous waste sites) published under 29 CFR 1910.120, Standards for Hazardous Waste Operations and Emergency Response, include:

- 1. 40 hours of initial training (certified course) plus three days of actual field experience under the direct supervision of a trained, experienced supervisor for general Site personnel;
- 2. 24 hours certified training plus one day direct field experience under a trained supervisor for personnel with occasional, limited on-Site tasks who, based on the discretion of the HSC, shall not likely be exposed over a TLV or PEL (e.g., surveyors, equipment operators, etc.); and,
- 3. An additional eight hours of specialized training for manager/supervisors in addition to the 40-hour training.

Documentation of worker training records will be kept on-Site or in a location off-Site proximate to the Site.

5.0 CONTAMINANT MONITORING

The purpose of air monitoring is to identify and quantify airborne contaminants in order to:

1. Determine appropriate PPE;
2. Define areas where PPE is needed;
3. Assess potential health effects of exposure; and,
4. Determine the need for specific medical monitoring.

Air monitoring includes both integrated sampling and real-time monitoring. The air monitoring plan for the Site is discussed in the following sections.

5.1 Site Ambient Air Monitoring

The SHSO or other party designated by the Project Manager shall be responsible for all on-Site air monitoring. This monitoring shall in many cases be real-time in nature due to the constantly changing conditions that may be encountered during field activities. Air monitoring shall be conducted at regular intervals for the following parameters as field activities dictate:

1. Semi-volatile and volatile organic compounds;
2. Oxygen content;
3. Flammable or explosive atmospheres; and
4. Toxic substances (hydrogen sulfide, hydrogen cyanide, etc.).

Air monitoring should be continuous and include real-time measurements for both volatile and semi-volatile vapors. Equipment must be intrinsically safe if there is the potential for flammable atmospheres to exist on-Site. Air temperature, wind speed, wind direction, barometric pressure, and relative humidity should be recorded. A local television station may have this meteorological data. Data will be recorded by the SHSO or his designee on a daily basis and kept on-Site or at an off-Site location proximate to the Site.

5.1.1 Combustible Gas Indicator/Oxygen Meter

A combustible gas indicator (CGI) or equivalent can be used at the Site to detect and measure the concentration of flammable gases and vapors, and oxygen. With regard to flammable or explosive atmospheres, concentrations are measured as "the percent of the lower explosive limit" or percent LEL. The action level when conducting work in potentially explosive atmospheres will be 10 percent LEL.

It should be noted that most organic vapors are quite toxic at the 10 percent LEL level and may represent thousands of parts per million (e.g., 1 percent LEL by volume is equivalent to 10,000 parts per million). A low LEL reading does not indicate a safe condition in terms of potential health effects to exposed, unprotected personnel. If readings exceed that of the LEL, a zero meter reading may be obtained. An extended sampling probe in which a potentially explosive atmosphere can be monitored from a remote, safe area must be used when monitoring possible combustible atmospheres.

Oxygen content will be measured whenever it is reasonable to suspect that a potentially oxygen-deficient atmosphere or a potentially explosive atmosphere exists. Field activities where such atmospheres may exist include, but are not limited to, trenching and excavation, confined space entry, and drum sampling. Oxygen content should be measured as percent oxygen in air, with 20.9 percent being normal. Oxygen levels below 19.5 percent or above 23.5 percent are considered hazardous. It is important to note that when oxygen levels are not within this range, Lower Explosion Limit (LEL) readings will be inaccurate.

5.1.2 Personal Air Samplers

Personal air sampling devices such as badges or personal pumps may be used periodically during critical operations in which there is the potential to be exposed to gross contamination.

5.1.3 Photoionization /Flame Ionization Detector

Exposures to toxic substances in air shall be monitored on a regular basis during the anticipated Site activities. Hand held direct reading monitors, such as a Photovac 2020 or TVA-1000 dual detector (PID/FID) shall be utilized to sample for volatile, toxic organic substances. Exposure to toxic gases shall be kept at a minimum. Action levels for volatile organic compounds using a PID/FID are provided in Table 5-1. These levels are conservative and take into account that many direct reading

detectors, such as the PID/FID, detect total organics and cannot differentiate between compounds. Also, the action level takes into account that a PID/FID meter reading may not reflect the actual concentration of contaminants present in parts per million (ppm). Rather the actual concentration present may be significantly greater than the observed reading. A LEL/O₂ meter should be used to detect flammable atmospheres and to estimate the amount of gas present. The FID should be used to provide direct reading capability for the less volatile compounds.

5.1.4 Detector Tubes and Bellows Pump

Detector tubes will be used at the discretion of the SHSO to detect and measure the concentration of selected contaminants in the air. The detector tubes employed must be sensitive to the concentration 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 bellows pump and detector tubes for perchloroethylene, trichloroethylene, and 1,1,1-trichloroethane may be used during field activities.

5.1.5 Monitor for Aerosol and Dust

The PDM-3 MiniRam Personal Monitor or equivalent will be used at the discretion of the SHSO to detect and quantify the concentration of fugitive dust that may be created during field activities.

5.1.6 Equipment Calibration and Air Monitoring Logs

All air monitoring equipment will be properly calibrated before the start of work and at the conclusion of work. Equipment manuals and calibration instructions will be kept at the Site along with calibration gases and other required apparatus. All measurements and calibration data (time, location, readings, initials, etc.) will be recorded in an air monitoring log or in field equipment notebooks. Personnel operating monitoring equipment will be properly trained to use the equipment.

TABLE 5-1

HAZARD MONITORING METHODS, ACTION LEVELS AND PROTECTIVE MEASURES

HAZARD	MONITORING METHOD	ACTION LEVEL	MONITORING SCHEDULE	PROTECTIVE MEASURES
Organic Vapors/Semi-Volatile Organic Vapors	Photovac 2020 or Foxboro TVA-1000 with a 10.6 eV lamp	<5 ppm above background in the field worker's breathing zone.	Continuing working and monitoring	Level D
		>5 ppm, but <10 ppm above background in the field worker's breathing zone.	Cease work and reassess Site conditions; upgrade PPE.	Level C
		>10 ppm above background in the field worker's breathing zone.	Cease all operations and leave work area; reassess Site conditions; contact HSC or SHSO	Evacuate Area
Explosion	Combustible Gas Indicator	0-10% LEL	Continue investigation.	Level D
		10-20% LEL	Continue monitoring with caution as higher levels are encountered. Revoke Hot Work Permit. Stop all "hot work" in progress.	Evacuate Area
		≥ 20% LEL	Explosion hazard – withdraw from area immediately; contact SHSO, and reassess Site conditions.	
Particulate	MiniRam Monitor	<2.5 mg/m ³ above background in the field worker's breathing zone.	Continue working and monitoring	Level D
		>2.5 mg/m ³ , <10 mg/m ³ above background in the field worker's breathing zone.	Cease work and reassess Site conditions; upgrade PPE.	Level C
		>10 mg/m ³ above background in the field worker's breathing zone.	Cease all operations and leave work area; contact HSC or SHSO.	Evacuate Area
Oxygen Deficiency	Combustible Gas Indicator	<19.5%	Cease all operations and leave work area; contact HSC or SHSO.	Evacuate Area
		19.5%--23.5%	Continue work; deviation from normal level may be due to the presence of other substances.	Continued Monitoring Level of PPE
		>23.5%	Cease all operations and leave work area; contact HSC or SHSO; potential fire hazard may exist.	Evacuate Area

5.2 Frequencies and Locations

Frequencies and locations of monitoring shall be determined using a common sense approach by the SHSO in conjunction with the HSC, on an as needed basis. The SHSO will consider the nature and extent of Site activities, weather conditions, and exposure potential for workers and/or the public. The following frequencies and locations are offered as recommendations:

1. At each sampling location or other work area, a complete walk-around survey and qualitative evaluation will be performed before commencing activities. Ambient air in the work area will be monitored at all times when sampling operations potentially involving hazardous materials. Instrument readings should be measured in both worst case positions (at the source) and in the breathing zone of the person(s) collecting the sample and/or working in the area.
2. Regular scans of the work areas to detect changes in concentrations will be performed. Common sense will prevail in determining the frequencies of this type of monitoring. Workers will be able to modify sampling frequencies according to Site conditions as they become more familiar with the Site and with expected concentrations that are encountered during the project.

5.3 Action Levels

The levels of protection and action levels for personnel safety for organic vapors (volatiles and semivolatiles), combustible gases, hydrogen sulfide, and oxygen deficiency are outlined in Table 5-1. Once initial data regarding specific contaminants are obtained, action levels and/or means of sampling or monitoring may be modified.

5.4 Background Readings

Field personnel may obtain a background reading in the "clean, outside air" due to some ionizable materials present (e.g., trees, grasses, flowers, vehicles, etc.). Background readings will vary with location, humidity, temperatures, and proximity to vehicles or heavy equipment. It is important to be aware of background readings; such readings should never be "zeroed out". Record background readings at the start of Site activities. Keep in mind that changes in humidity and the proximity to and number of vehicles can effect readings.

If a background meter readings seems too high or too low, the instrument can be zeroed with non-contaminated or zero air. After zeroing with non-contaminated air, the ambient air background reading should be reassessed. Any questions or concerns about background readings should be brought to the attention of the SHSO.

5.5 Air Monitoring Program

The primary objectives of conducting air monitoring at this Site are to:

1. Verify that personnel are adequately protected during intrusive activities, which may expose gross contamination to the atmosphere;
2. Protect the health or welfare of the public; and,
3. Provide adequate information to quantitatively document exposure potential to airborne contaminants.

Modifications to the HASP and integrated air monitoring shall be implemented as necessary.

6.0 SAFETY CONSIDERATIONS

6.1 General Safety Guidelines

All personnel will be expected to adhere to the safety practices for their respective tasks. Personnel shall also exercise caution when working in adverse weather, on rough or slippery terrain, when operating on or around machinery, and when vision and mobility are impaired due to use of protective gear. It is also important that the integrity of protective clothing be maintained and personnel realize the increased difficulty in communicating when wearing a respirator (if use is necessary). The following should be noted:

1. In unknown situations, always assume the worst and plan responses accordingly;
2. Use the buddy system; establish and maintain communication by use of hand signals, radios or other means, as necessary;
3. Minimize contact with excavated or other potentially hazardous materials or liquids. Do not place equipment on tanks, drums, or the ground. Never sit or climb on tanks, drums, or other vessels and containers;
4. Use disposable protective items when possible to minimize risks during work;
5. Smoking, eating, or drinking is not allowed after entering the work zone and before personal decontamination. Hands should always be washed prior to smoking, eating, or drinking;
6. Work breaks should be planned to prevent stress-related accidents, fatigue, or heat or cold stress symptoms;
7. Conflicting situations between work requirements and safety procedures must be resolved by the HSC and/or SHSO;
8. Unauthorized breaches of specified safety protocol will not be tolerated. Personnel unwilling to comply with established safety procedures will not be allowed to continue to work at the Site;
9. Be observant of the surroundings and of others. Extra precautions are necessary when using protective gear due to reduced vision and hearing;
10. Wearing a respirator shall require the removal of all facial hair except small mustaches that are within the sealing surface of the respirator;
11. Changes in contingency plans shall be posted to notify all personnel of any modifications to safety protocols related to changing Site conditions;

12. No open flames shall be allowed inside the exclusion zone (e.g., smoking). Intrinsically safe or explosion proof equipment shall be used in potentially explosive atmospheres;
13. When in doubt, withdraw and reassess when encountering any potentially hazardous situation;
14. Be aware that chemical constituents may mimic or enhance symptoms of other illnesses or intoxication;
15. The SHSO shall maintain a log of meetings, facts, incidents, data, etc. relating to the project. Records shall remain at the Site for the duration of the project, if feasible; and,
16. Observance of applicable OSHA, EPA, general health and safety, and specific equipment use practices is mandatory.

6.2 Work Zones

6.2.1 General Work Zones

During project operations, the properties may be divided into three zones: the exclusion zone; contamination reduction zone (CRZ); and support zone. The exclusion zone is the immediate work area where possible exposure to contaminants may occur and where tasks such as sampling, air monitoring etc. are conducted. As necessary, the exclusion zone shall be marked with plastic barrier tape attached to stanchions to prohibit unauthorized, untrained individuals from entering the potentially hazardous area. The CRZ shall consist of an area where personnel from the exclusion zone shall enter to discard their equipment and disposable PPE and where decontamination shall take place prior to entering the support zone. If Level C PPE is warranted and approved, the CRZ shall serve as a PPE doffing area. The support zone shall be located outside the CRZ and the exclusion zone. The support zone is an area where Level D personal protective gear is required and Level C gear is immediately available. In this area there should be no exposure to potential contamination.

6.3 Permit-Required Confined Spaces

The nature of this project and investigative techniques should not require personnel to enter confined spaces such as manholes, sewers, tanks, excavations, etc. Personnel are **prohibited** from entering confined spaces during the course of this project unless specifically authorized by the HSC or SHSO.

If during the project it is apparent that entry into a permit-required confined space (PRCS) is necessary, the HSC shall be informed and the proper PRCS procedures including an entry permit system shall be implemented. Only the HSC or SHSO can determine whether or not a confined space is a PRCS and can authorize entry.

7.0 COMMUNICATIONS

7.1 Off-Site Communications

Communications between on-Site and off-Site personnel may be maintained by the following:

1. Telephone – Working on-Site telephones should be identified and made available for use;
2. Portable Telephone - A cellular telephone shall be located in the project area or in the nearest vehicle; and,
3. Radio - The selected contractor may maintain two-way radio communications with a central dispatcher.

7.2 On-Site Communications

The field personnel performing operations and maintenance activities may maintain communications between on-Site personnel by using portable two-way radios. If no portable radios are used, hand or voice signals shall be used to communicate between personnel on-Site. The following hand signals shall be used when hearing is a problem:

1. <u>Hands on Throat</u>	-	Out of Air.
2. <u>Grip partners wrist or hands on hips</u>	-	Leave area immediately.
3. <u>Thumbs up</u>	-	OK; I'm alright.
4. <u>Thumbs down</u>	-	Negative; there is a problem.

7.3 Emergency Situations

A hand-held air horn, automobile horn, or similar means of communication shall be available on-Site to alert personnel in the event of an emergency situation. Once the emergency signal has been given, the designated evacuation procedures as discussed in Section 10.0 shall be followed.

8.0 PERSONNEL PROTECTIVE SAFETY GEAR

8.1 Level D Protection

If conditions permit, all work on this project shall be conducted in Level D personnel protective safety gear consisting of:

1. Coveralls (disposable coveralls may be desirable);
2. Steel-toed work boots;
3. Safety glasses or goggles (if liquid splash hazard exists);
4. Hard hat;
5. Work gloves (chemical resistant when contact with contamination is anticipated);
6. Ear protection for personnel on/around heavy equipment, etc.; and,
7. Tyvek suits, two layers of nitrile gloves and booties shall be worn when working directly with suspected contaminated media in the exclusion zone.

8.2 Level C Protection

All intrusive activities shall be initiated using Level D personnel protective safety gear. If sustained action levels require Level C protection, equipment shall include:

1. Full-face air purifying respirators equipped with organic vapor and/or acid gas and/or HEPA particulate cartridges or a combination of the above as dependent on the specific hazards to be encountered (See Appendix D for Respiratory Protection Program requirements);
2. Chemical resistant clothing, one piece, long sleeved and hooded;
3. Two layers of nitrile gloves;
4. Rubber outer boots and inner disposable booties;
5. Hard hat;
6. Hearing protection for personnel on/around heavy equipment, etc.; and,
7. Steel-toed work boots;

Boots and gloves should be taped to chemical resistant coveralls.

8.3 Level C Modified Protection

Level C Modified personnel protective safety gear will be used when authorized by the HSC or HSO and will consist of:

1. Half-face air purifying respirators equipped with organic vapor and/or acid gas and/or HEPA particulate cartridges or a combination of the above as dependent on the specific hazards to be encountered (See Appendix D for Respiratory Protection Program requirements);
2. Chemical resistant clothing, one piece, long sleeved and hooded;
8. Two layers of nitrile gloves;
3. Rubber outer boots and inner disposable booties;
4. Hard hat;
5. Hearing protection for personnel on/around heavy equipment, etc.; and,
6. Steel-toed work boots.

Boots and gloves will be taped to chemical resistant coveralls.

8.4 Level B Protection

It is anticipated that all work shall be performed using Level D or Level C personnel protective equipment. All Site activities in the area will be terminated should field conditions warrant the implementation of Level B protection.

9.0 DECONTAMINATION AND CLEANUP PROCEDURES

9.1 Personnel Decontamination

Decontamination shall be carried out by all personnel before leaving the Site. Under no circumstances, except for emergency evacuation or medical emergencies, shall contaminated personnel or equipment be allowed to leave the Site without following proper decontamination procedures.

9.2 Equipment Decontamination

Equipment decontamination shall be conducted in a manner that assures all contaminants remain on Site and potentially contaminated equipment/materials are properly stored (e.g., overpack drums, plastic containers, etc.). Decontamination of large equipment shall occur in a designated area within the contamination reduction zone or the outer most section of the exclusion zone if feasible. Decontamination of sampling equipment or other small equipment shall be conducted in each individual working area.

Monitoring equipment shall be protected from contamination as much as possible. This may be done by storing instruments in a background area, draping with plastic, or covering instruments with plastic bags so as not to hinder operation. After sampling completion, covers shall be disposed of and the instruments internally purged and cleaned with disposable paper towels.

9.3 Property Cleanup

The SHSO and/or Project Manager shall ensure that the Site is left in a clean and orderly condition. All disposable clothing, excess materials, and other debris shall be properly containerized and removed from the Site unless it is contaminated. All contaminated materials shall be properly managed and disposed of accordingly after appropriate characterization.

10.0 EMERGENCY RESPONSE

10.1 General

Some of the potential emergencies associated with this project include areas containing hazardous gases and vapors, physical injury, exposure to temperature extremes, accidents associated with various hand tools or sampling equipment, working around contaminated media, and working where potential for slips and falls exists.

It is anticipated that, unless air monitoring indicates otherwise, all work shall be performed using Level D protection. Work areas shall be restricted as discussed in Section 6.0. If a hazardous level of air contaminants exists or accidentally occurs, personnel shall leave the work area in the upwind direction, if possible.

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:

1. Fires;
2. Chemical exposures; and,
3. Physical injuries.

Decontamination procedures as specified in Section 9.0 will be followed to prevent the spread of contamination off-Site.

10.2 Purpose

The purpose of this emergency response plan is to have a detailed pre-determined strategy for handling emergency incidents and potential problems. This pre-emergency planning will aid in immediate response and abatement of problems and will likely reduce the severity and impact of the situation. The plan is designed to protect Site personnel and the public from potential hazards created by an emergency situation.

10.3 Responsibilities

The Project Manager is responsible for the overall direction and implementation of this emergency response plan, and for overall coordination of any emergency response actions. The Project Manager is responsible for notifying the appropriate outside emergency assistance, as needed. The SHSO shall serve as an assistant and alternate to the Project Manager and shall provide health and safety input during emergencies.

10.4 Recognition

Emergencies can easily be recognized by visual observation, worker complaints or monitoring instruments. A chemical release shall be considered an emergency when it is sufficient to affect unprotected personnel, including Site workers and the public. Action levels listed in Section 5.0 must be followed.

10.5 Response Procedures

10.5.1 Fires

Fires are possible whenever flammable gases or vapors are present in proper concentrations and an ignition source is present. To prevent fires, the equipment specified in Section 5.0 will be used to detect flammable vapors or gases. Ignition sources will be turned off and the area evacuated if vapors or gases reach 10 percent of the LEL. Work will not resume until the SHSO observes readings below 10 percent of the LEL for a minimum of 15 consecutive minutes.

10.5.2 Fire Prevention

Standard fire prevention techniques shall be utilized in addition to those afforded by the local fire department, including:

1. Locating portable fire extinguishers in appropriate vehicles, out-buildings and major Site work areas. In an area where the possibility of a flammable atmosphere exists, a fire extinguisher should be located in the nearest building or vehicle;
2. Designating fire and emergency routes (primary and alternate) for all unique work areas;
3. Instructing personnel on fire and emergency contingencies at pre-construction meetings and other safety training sessions, including the use of fire extinguishers;

4. Implementing communication protocols detailed in Section 7.0 of this HASP; and,
5. Posting emergency numbers and routes at an easily accessible location.

10.6 Chemical Exposures

Work will always be performed in a manner that minimizes exposure to contaminants through skin or eye contact, inhalation or ingestion. Work practices that should be followed to reduce risk of chemical exposure include:

1. PPE, as specified in Section 8.0, for the appropriate work activities and areas as defined by the SHSO, will be used by all field personnel following this HASP. A formal revision to the HASP must be made by the HSC to modify PPE specifications;
2. Keep hands away from face during work activities; and,
3. Minimize all skin and eye contact with contaminants.

Early recognition of 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:

1. Fatigue;
2. Weakness;
3. Eyes, nose, and/or throat irritation;
4. Headache;
5. Dizziness;
6. Nausea;
7. Vomiting;
8. Tremors;
9. Aggressive confusion;
10. Cyanosis (blue color to the skin); and,
11. Muscle spasms.

If a person experiences any of these or other symptoms, or recognizes any of the symptoms in a fellow worker, the person experiencing the symptoms shall immediately stop work and report his/her symptoms to the Project Manager or SHSO. If the symptoms persist or appear to be damaging in any way, the SHSO will seek appropriate medical attention. If symptoms are serious, work activities in the area where the person was exposed will be discontinued until more is known about the incident.

10.6.1 Typical First Aid Procedures for Chemical Exposure

10.6.1.1 Inhalation

1. Remove victim from the toxic atmosphere.
2. Clear airway.
3. Immediately contact supervisor.
4. Seek medical attention.

10.6.1.2 Skin/Eye Contact

1. Remove clothing where chemical has spilled.
2. Skin contact - flush area for 15-30 minutes.
3. Deep skin burns - flush area for 15-30 minutes.
4. Eye splashes - flush area for 15-30 minutes.
5. Cover the burns with a dressing.
6. Immediately contact supervisor.
7. Seek medical attention.

10.6.1.3 Ingestion

1. Immediately contact supervisor.
2. Follow instruction listed on MSDS or label.

In all the above cases, the MSDS or label information should be checked for more specific first aid information. **If exposure is suspected and exposure symptoms exist, prompt medical attention for victim shall be obtained immediately.**

10.7 Physical Injuries

Site personnel will 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; and uneven terrain or unstable surfaces, such as a wall that may cave in or flooring that might give way. Site personnel shall inform the SHSO of any potential hazards observed so that corrective action can be taken.

All personnel injuries, regardless of severity, shall be reported to the HSC and SHSO as soon as possible. If the injury is minor and does not require off-Site treatment, first aid can be administered and the SHSO shall determine if the victim can continue working. If the injury requires medical attention, the individual shall receive immediate care. The HSC will be notified and the proper procedures shall be conducted. The required accident/injury reporting forms shall also be completed. A copy of this form is located in Appendix E.

10.8 Medical Emergency

Medical emergency information is included in Appendix C and consists of written directions to the hospital, a map, and emergency phone numbers. These numbers and the map will be posted at a designated location on-Site such as a vehicle and/or office trailer at the work Site. In the case of a serious injury, an ambulance or emergency medical service shall be summoned via the portable telephone. A company vehicle with appropriate first aid supplies should always be on-Site for less serious injuries.

10.9 Emergency Alerting Procedures

In the event of an accident or chemical release at the Site, the individual(s) involved in the incident should take any reasonable precautions to mitigate immediate harm to themselves, other persons, or the public. The SHSO should, if necessary, immediately alert field personnel when an emergency

occurs by radio or by directly contacting workers. A single blast for 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.

10.10 Emergency Decontamination

Decontamination of an injured or exposed worker 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 PPE.

If a worker has been injured or exposed and decontamination cannot be done:

1. Wrap the victim in blankets or plastic to reduce contamination of other personnel;
2. Alert emergency and off-Site medical personnel to potential contamination; and,
3. Have the SHSO or other personnel familiar with the incident and contaminants at the Site accompany the victim to the hospital.

10.11 Emergency Notifications

The Project Manager and SHSO should use this contingency plan in order to make the proper outside emergency notifications according to the matrix included in this section. Individuals who may be charged with the responsibility of making the proper outside contacts should be familiar with the contingency plan for a particular type of incident.

Upon appropriate notification of the emergency personnel, the SHSO shall notify, in order of priority, the following individuals:

1. Project Manager;
2. HSC; and,
3. SHSO's Immediate Supervisor (if different than the HSC).

The Project Manager or designee will be responsible for dissemination of information to the applicable parties. Prior to initiating investigative activities, a meeting or telephone consultation with the appropriate local emergency response personnel and pertinent local government agencies will be conducted by the Project Manager or his designee and the HSC to brief them on Site hazards and

potential response requirements. The capabilities and response mechanisms of each potential responder shall be identified and documented. The contingency plan will be modified or revised to reflect changes and disseminated to each potential responder. Periodic updates of Site activities, (e.g., when initiating a new or different type of work) will be distributed to potential responders by the Project Manager or his designee.

11.0 MEDICAL MONITORING

11.1 General

Personnel of various contractors may be working on-Site. According to OSHA, employers are responsible for their own employees, regardless of the prime contractors, subcontractors, or Site owners involved in the project. All employers, whose employees may potentially be exposed to waste materials, hazardous materials, or other occupational hazards, shall establish a medical monitoring program for their employees in accordance with the requirements of 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response) and other applicable regulations. Contractors may be asked to verify that their employees are currently under an occupational medical monitoring program.

11.2 HAI Medical Monitoring Program

Hull & Associates, Inc. has developed this medical monitoring program in conjunction the Medical College of Ohio. Medical monitoring will be offered to employees as categorized below:

1. Administrative Personnel (word processing, accounting, receptionists, office administrators, CADD technicians, etc.) – Administrative personnel will not receive any medical monitoring provided they are designated as internal personnel and do not go into the field and are not subject to chemical hazards.
2. Sr. Project Managers, Project Managers, Sr. Hydrogeologists, Project Engineers, etc.- These employees will receive biennial physicals or more frequently as required by individual site conditions or requirements. Personnel in this category rarely go into the field, however, they do conduct site walkovers to assess project schedule and progress. Exceptions to this category (e.g., Project Managers who go into the field three times a week or more) will obtain medical monitoring as recommended in category C below.
3. Environmental scientists, geologists, hydrogeologists, field technicians, design engineers, soils lab technicians, and safety representatives – These employees will receive annual physicals based on the type, duration, and frequency of work performed, and OSHA standards that specify the need for annual physicals (e.g., respiratory protection standard). Personnel in this category regularly perform field work to conduct ground and surface water sampling at hazardous waste sites and landfills, investigations at potentially contaminated sites, asbestos sampling and identification, lead assessments, compaction testing with nuclear gauges, and other typical field activities and investigations.

4. Co-ops, interns, and part-time employees – These employees will be considered the same as administrative personnel, assuming that no field work is performed. Medical monitoring for these employees should be evaluated on a case by case basis.

The recommended medical monitoring guidelines for HAI employees are as follows:

1. Comprehensive Examination by the Physician;
2. Pulmonary Function Test;
3. Health Profile complete with blood work and urinalysis;
4. Chest X-ray (if applicable);
5. Audiogram (if applicable); and,
6. Blood Lead Level (if applicable).

In general, the following guidelines will be used for verifying that new and existing employees meet the medical monitoring requirements of OSHA:

1. Employees who are not required to perform field work and whose functions are primarily internal do not need to receive medical monitoring.
2. All employees who may or are expected to perform field work, even on a periodic basis, should receive a baseline physical. Those employees who frequently perform field work should receive an annual update exam and those who periodically perform field work should receive biennial exams.
3. Employees who conduct lead assessments or anticipate potential exposure to lead should receive blood work, including a check of blood lead levels.
4. Employees who conduct asbestos assessments, sampling, or oversight should receive a chest x-ray during their baseline physical and then every five years through year ten. Beyond year ten, they should receive x-rays biennially.
5. Upon resignation from the company, those individuals who receive annual physicals should receive an exit physical and those who receive biennially physicals should obtain the exam if they are beyond the first year of their biennial exam, or if their supervisor determines that they should have an exit physical for any other reason.
6. "Fit for duty" documentation from the physician will be provided to HAI, but will not be distributed. Employees will receive a letter summarizing some of the results of their physical (e.g., blood pressure and cholesterol level). Employees may acquire additional results of their physicals at no cost or obligation and may have exam results forwarded to their personal physician if there is an issue or concern.

7. If the physician finds an employee unfit to perform his/her duties, this determination will be carefully reviewed by the HSC, the employee's Group Leader, and Office Manager.

12.0 SITE MANAGEMENT

12.1 Control of Contaminated Materials

Contaminated materials that may be generated include, but are not necessarily limited to, decontamination solutions, disposable equipment (e.g., protective clothing), contaminated purge water, etc. Circumstances which may result in these materials being distributed throughout the Site include:

1. Contaminated soils adhering to equipment and personnel;
2. Conveyance via airborne particulate generated from Site activities;
3. Uncontrolled stormwater or wash water spreading contaminated materials and surface water to other areas; and,
4. Spills from containers during transport or transfer.

12.1.1 Personnel Protective Equipment

If personnel are exposed to airborne contaminant levels exceeding sustained background levels as determined with photoionization detectors, etc., or if there is potential for contaminated material to be splashed on personnel, disposable protective clothing shall be designated as contaminated and shall be disposed of properly after use. Contaminated clothing and disposable personnel protective equipment shall be placed in plastic bags. The plastic bags shall be stored in drums and properly staged until disposal arrangements are made.

12.1.2 Equipment Decontamination

Sampling equipment shall be free of any soils, sludge, or other debris before leaving the contamination reduction zone.

12.2 Traffic Control

Personal/company vehicles and other equipment shall follow specific traffic rules. Pedestrians at the properties shall be given the right-of-way. Minimum traffic speeds shall be maintained around the Site to avoid excess generation and to provide safety to pedestrians and equipment operators.

12.3 Site Security

In the event that field personnel observe individuals trespassing on the property and/or suspect trespassers of theft or sabotage:

1. Call the police;
2. Secure Site and verify that no immediate hazards exist for personnel on-Site or the public adjacent to the Site; and,
3. Take any precautions to minimize the risk to the public and personnel.

HAI personnel performing work outside the Site shall obtain the permission from the property owner before commencing activities on that property.

APPENDIX A

Material Safety Data Sheets (MSDS)

CHEM SERVICE -- F13 1,1-DICHLOROETHANE
MATERIAL SAFETY DATA SHEET
NSN: 655000F037545
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: F13 1,1-DICHLOROETHANE

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General Information

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Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 01JUN89
Safety Data Review Date: 30DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJHT

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: 1,1-DICHLOROETHANE (ETHYLIDINE CHLORIDE)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KI0175000
CAS Number: 75-34-3
OSHA PEL: 100 PPM
ACGIH TLV: 200 PPM
Other Recommended Limit: 200 PPM

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.
Boiling Point: 135.14F
Melting Point: -142.6F
Vapor Pressure (MM Hg/70 F): 182
Vapor Density (Air=1): 3.4
Solubility In Water: SLIGHT

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Fire and Explosion Hazard Data

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Flash Point: 23F
Lower Explosive Limit: 6
Upper Explosive Limit: 16
Extinguishing Media: CO2, DRY CHEMICAL POWDER. DON'T USE WATER.
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): SENSITIVE TO HEAT.
Materials To Avoid: STRONG OXIDIZING AGENTS/BASES, CAUSTICS.
Hazardous Decomp Products: TOXIC FUMES.
Hazardous Poly Occur: NO

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Health Hazard Data

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LD50-LC50 Mixture: ORAL LD50 (RAT/MOUSE): 725 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SKIN: RAPIDLY ABSORBED/HARMFUL/IRRITATION/
ALLERGIC REACTION/SENSITIZATION. INHALATION: HARMFUL/RESPIRATORY TRACT
IRRITATION. EXPOSURE CAN CAUSE LIVER/KIDNEY/NERVOUS SYSTEM INJURY, DELAYED
ADVERSE HEALTH AFFECTS. NARCOTIC AT HIGH CONCENTRATIONS.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: IRRITATION, DISORIENTATION.
Emergency/First Aid Proc: EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH
REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET.
INGESTION: DON'T INDUCE VOMITING/GIVE LIQUIDS IF UNCONSCIOUS/ CONVULSIVE.
IF VOMITING, WATCH CLOSELY FOR ANY AIRWAY OBSTRUCTION. OBTAIN MEDICAL
ATTENTION IN ALL CASES.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA
REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR
MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH
CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN
AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED IN A COOL DRY PLACE.
STORE ONLY W/COMPATIBLE CHEMICALS. FOR LABORATORY USE ONLY.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE
VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS
SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

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Control Measures

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Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY
EQUIPMENT.
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection: EYE SHIELDS
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE
REUSE. READILY ABSORBED & RETAINED ON CLOTHING &/SHOES.

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Transportation Data

Disposal Data

Label Data

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Label Required: YES
Label Status: G
Common Name: F13 1,1-DICHLOROETHANE
Special Hazard Precautions: SKIN: RAPIDLY ABSORBED/HARMFUL/IRRITATION/
ALLERGIC REACTION/SENSITIZATION. INHALATION: HARMFUL/RESPIRATORY TRACT
IRRITATION. EXPOSURE CAN CAUSE LIVER/KIDNEY/NERVOUS SYSTEM INJURY, DELAYED
ADVERSE HEALTH AFFECTS. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION,
DISORIENTATION.
Label Name: CHEM SERVICE INC
Label Street: 660 TOWER LN
Label P.O. Box: 3108
Label City: WEST CHESTER
Label State: PA
Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-692-3026/800-452-9994

=====

CHEM SERVICE -- F29 1,1-DICHLOROETHENE
MATERIAL SAFETY DATA SHEET
NSN: 655000F037520
Manufacturer's CAGE: 8Y898
Part No. Indicator: B
Part Number/Trade Name: F29 1,1-DICHLOROETHENE

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General Information

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Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-386-2100/215-692-3026
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 002
Tot Safety Entries This Stk#: 002
Status: FE
Date MSDS Prepared: 26JAN95
Safety Data Review Date: 10APR96
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BZCBT

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: VINYLIDENE CHLORIDE, 1,1-DICHLOROETHENE, 1,1-DICHLOROETHYLENE, VDC
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KV9275000
CAS Number: 75-35-4
ACGIH TLV: 20 MG/CUM
Other Recommended Limit: 5 PPM

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR
Boiling Point: 89.06F
Melting Point: -188.5F
Vapor Pressure (MM Hg/70 F): 500
Solubility In Water: SLIGHT

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Fire and Explosion Hazard Data

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Flash Point: 5F
Lower Explosive Limit: 6.5
Upper Explosive Limit: 15.5
Extinguishing Media: CO2, DRY CHEMICAL POWDER. DON'T USE WATER!
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): HEAT, AIR, PRESSURE.
Materials To Avoid: INCOMPATIBLE MATERIALS
Hazardous Poly Occur: YES
Conditions To Avoid (Poly): MAY POLYMERIZE UPON STANDING.

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Health Hazard Data

LD50-LC50 Mixture: ORAL LD50(RAT/MOUSE): 200 MG/KG

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: NO

Health Haz Acute And Chronic: SKIN: IRRITATION & SENSITIZATION, CAN CAUSE AN ALLERGIC SKIN REACTION. INHALATION: CAN BE IRRITATING TO MUCOUS MEMBRANES. NARCOTIC AT HIGH CONCENTRATIONS, EXPOSURE CAN CAUSE LIVER & KIDNEY DAMAGE, NERVOUS SYSTEM INJURY & CARDIOVASCULAR SYSTEM INJURY. CAN CAUSE DELAYED ADVERSE HEALTH EFFECTS.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NONE

Signs/Symptoms Of Overexp: IRRITATION.

Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS.

SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NO BURNS HAVE OCCURED-USE SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE OXYGEN/MOUTH TO MOUTH IF NEEDED. CONTINUE LIFE SUPPORTING MEASURES UNTIL MEDICAL ASSISTANCE HAS ARRIVED. KEEP WARM & QUIET. INGESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING TO AN UNCONSCIOUS/CONVULSING PERSON. (SEE SUPP)

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Precautions-Handling/Storing: STORE UNDER NITROGEN & REFRIGERATION. STORE ONLY W/COMPATIBLE CHEMICALS. FOR LABORATORY USE ONLY!

Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE VAPORS. KEEP TIGHTLY CLOSED. PERSONS NOT PROPERLY TRAINED SHOULDN'T HANDLE THIS CHEMICAL/ITS CONTAINER. AVOID DIRECT PHYSICAL CONTACT! CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY.

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Control Measures

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Respiratory Protection: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Ventilation: CHEMICAL HOOD.

Eye Protection: GLASS SHIELDS

Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

Suppl. Safety & Health Data: IF PATIENT IS VOMITING-WATCH CLOSELY TO MAKE SURE AIRWAY DOESN'T BECOME OBSTRUCTED BY VOMIT. OBTAIN MEDICAL ATTENTION IN ALL CASES. AN ANTIDOTE IS A SUBSTANCE INTENDED TO COUNTERACT THE EFFECT OF A POISON. IT SHOULD BE GIVEN ONLY BY A PHYSICIAN/TRAINED EMERGENCY PERSONNEL. GET MEDICAL ADVICE FROM POISON CONTROL CENTER.

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Transportation Data

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Disposal Data

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Label Data

=====

Label Required: YES

Label Status: G

Common Name: F29 1,1-DICHLOROETHENE

Special Hazard Precautions: SKIN: IRRITATION & SENSITIZATION, CAN CAUSE AN ALLERGIC SKIN REACTION. INHALATION: CAN BE IRRITATING TO MUCOUS MEMBRANES. NARCOTIC AT HIGH CONCENTRATIONS, EXPOSURE CAN CAUSE LIVER & KIDNEY DAMAGE, NERVOUS SYSTEM INJURY & CARDIOVASCULAR SYSTEM INJURY. CAN CAUSE DELAYED ADVERSE HEALTH EFFECTS. IRRITATION.

Label Name: CHEM SERVICE INC

Label Street: 660 TOWER LN

Label P.O. Box: 3108
Label City: WEST CHESTER
Label State: PA
Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-386-2100/215-692-3026

CHEM SERVICE -- 0-659 CIS 1,2-DICHLOROETHENE - LABORATORY STANDARD
MATERIAL SAFETY DATA SHEET
NSN: 655000F037480
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: 0-659 CIS 1,2-DICHLOROETHENE

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General Information

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Item Name: LABORATORY STANDARD
Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 02JUN92
Safety Data Review Date: 06DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJDT

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Ingredients/Identity Information

=====

Proprietary: NO
Ingredient: DICHLOROETHENE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KV9420000
CAS Number: 156-59-2

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID
Boiling Point: 140F
Melting Point: -112F
Solubility In Water: INSOLUBLE

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Fire and Explosion Hazard Data

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Flash Point: 42.8F
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL
CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION
PRODUCTS ARE CORROSIVE.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION
SOURCES.
Materials To Avoid: STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Hazardous Decomp Products: TOXIC FUMES
Hazardous Poly Occur: NO

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Health Hazard Data

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Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NONE

Signs/Symptoms Of Overexp: IRRITATION, NARCOTIC.

Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS.

SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED & CONTINUE LIFE SUPPORT UNTIL MEDICAL ASSISTANCE ARRIVES. INGESTION: RINSE MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION.

Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

=====

Control Measures

=====

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.

Eye Protection: EYE SHIELDS

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Transportation Data

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Disposal Data

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Label Data

=====

Label Required: YES

Label Status: G

Common Name: 0-659 CIS 1,2-DICHLOROETHENE

Special Hazard Precautions: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION, NARCOTIC.

Label Name: CHEM SERVICE INC

Label Street: 660 TOWER LN

Label P.O. Box: 3108

Label City: WEST CHESTER

Label State: PA

Label Zip Code: 19381-3108

Label Country: US

Label Emergency Number: 215-692-3026/800-452-9994

SUPELCO -- TRICHLOROFLUOROMETHANE, 48541
MATERIAL SAFETY DATA SHEET
NSN: 681000N038387
Manufacturer's CAGE: 54968
Part No. Indicator: A
Part Number/Trade Name: TRICHLOROFLUOROMETHANE, 48541

=====

General Information

=====

Company's Name: SUPELCO INC
Company's Street: SUPELCO PARK
Company's City: BELLEFONTE
Company's State: PA
Company's Country: US
Company's Zip Code: 16823-0048
Company's Emerg Ph #: 814-359-3441
Company's Info Ph #: 814-359-3441
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 06APR90
Safety Data Review Date: 12JAN93
MSDS Serial Number: BRDYV
Hazard Characteristic Code: NK

=====

Ingredients/Identity Information

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Proprietary: NO
Ingredient: METHANE, TRICHLOROFLUORO-; (TRICHLOROFLUOROMETHANE) (SARA III)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: PB6125000
CAS Number: 75-69-4
OSHA PEL: 1000 PPM
ACGIH TLV: C, 1000 PPM; 9293

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Physical/Chemical Characteristics

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Appearance And Odor: CLEAR COLORLESS LIQUID.
Boiling Point: 73.4F, 23C
Melting Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): >1
Specific Gravity: N/A
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NOT APPLICABLE
Percent Volatiles By Volume: 100

=====

Fire and Explosion Hazard Data

=====

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: THIS MATERIAL IS NOT FLAMMABLE. DETERMINED BY
SUPPORTING FIRE.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA
AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE
CHLORIDES, FLUORIDES AND PHOSGENE (FP N). HCL & HF ARE FORMED WHEN MATERIAL
IS HEATED TO DECOMPOSITION.

=====

Reactivity Data

=====

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE
Materials To Avoid: ALKALI METALS
Hazardous Decomp Products: CHLORIDES, FLUORIDES AND PHOSGENE (FP N). HCL,

HF.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT RELEVANT

=====

Health Hazard Data

=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: CHLOROFLUOROCARBON MATERIALS HAVE PRODUCED SENSITIZATION OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS AND COULD HAVE A SIMILAR EFFECT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHRINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY OR CHRONICALLY EXPOSED TO (EFTS OF OVEREXP)

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NOT RELEVANT

Signs/Symptoms Of Overexp: HLTH HAZ:CHLOROFLUOROCARBONS (FP N). VAPOR IS NARCOTIC IN HIGH CONCENTRATIONS. LIVER DAMAGE, KIDNEY DAMAGE. CONTACT WITH LIQUID MAY CAUSE FROSTBITE.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: EYES:FLUSH WITH WATER FOR AT LEAST 15 MINUTES.

SKIN:FLUSH WITH LARGE VOLUMES OF WATER. INHAL:IMMEDIATELY MOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS LABORED. CONTACT A PHYSICIAN. INGEST:NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT.

=====

Precautions for Safe Handling and Use

=====

Steps If Matl Released/Spill: TAKE UP WITH ABSORBENT MATERIAL. VENTILATE AREA.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: COMPLY WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

Precautions-Handling/Storing: REFRIGERATE IN SEALED CONTAINER.

Other Precautions: NO SMOKING IN AREA OF USE. DO NOT USE IN GENERAL VICINITY OF ARC WELDING, OPEN FLAMES OR HOT SURFACES. HEAT AND/OR UV RADIATION MAY CAUSE FORMATION OF CHLORIDES, FLUORIDES AND/OR PHOSGENE (FP N).

=====

Control Measures

=====

Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).

Ventilation: USE ONLY IN WELL VENTILATED AREAS.

Protective Gloves: RUBBER GLOVES.

Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).

Other Protective Equipment: NOT APPLICABLE

Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.

Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

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Transportation Data

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Disposal Data

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Label Data

=====

Label Required: YES

Technical Review Date: 12JAN93

Label Date: 04JAN93

Label Status: G

Common Name: TRICHLOROFLUOROMETHANE, 48541

Chronic Hazard: YES

Signal Word: WARNING!

Acute Health Hazard-Slight: X
Contact Hazard-Moderate: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: REFRIGERATE IN SEALED CONTAINER. ACUTE: VAPOR
IS NARCOTIC IN HIGH CONCENTRATIONS. INHALATION OF VAPOR MAY CONTRIBUTE TO
THE OCCURANCE OF IRREGULAR HEART BEATS (FP N). LIVER DAMAGE, KIDNEY DAMAGE.
CONTACT WITH LIQUID MAY CAUSE FROSTBITE. CHRONIC: NONE LISTED BY
MANUFACTURER
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SUPELCO INC
Label Street: SUPELCO PARK
Label City: BELLEFONTE
Label State: PA
Label Zip Code: 16823-0048
Label Country: US
Label Emergency Number: 814-359-3441

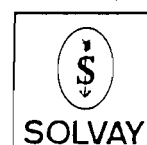
Hydrogen Peroxide

Material Safety Data Sheet

Date Prepared 10/11/93		H-103.5																
Section I																		
Product Hydrogen Peroxide 35%		Name																
Chemical/ Synonyms H ₂ O ₂ /Peroxide		24 Hour Emergency Assistance																
Chemical Family Inorganic Peroxide		SI - (713) 479-2826 Chemtec - 1-800-424-9300																
C.A.S. Number 7722-84-1	UN Number 2014	<table border="1"> <tr> <td colspan="5">Hazard Rating</td> </tr> <tr> <td>Least</td> <td>Slight</td> <td>Moderate</td> <td>High</td> <td>Extreme</td> </tr> <tr> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> </table>		Hazard Rating					Least	Slight	Moderate	High	Extreme	0	1	2	3	4
Hazard Rating																		
Least	Slight	Moderate	High	Extreme														
0	1	2	3	4														
		Health	2															
		Fire	0															
		Reactivity	2															
Section II																		
Ingredients																		
Composition		%	Toxicity Data															
Hydrogen Peroxide		35	30% H ₂ O ₂ Oral TD ₅₀ : 622 gm/kg (mouse)															
Water		65																
Stabilizers		Trace																
Section III																		
Physical Data																		
Boiling Point (°F) 226 @ 760 mm Hg		Melting Point (°F) -26																
Vapor Pressure (mmHg) 23 @ 86°F		Specific Gravity (H ₂ O = 1) 1.131 @ 68°F																
Vapor Density (Air = 1) NA		% Volatile By Volume 100																
Solubility in Water Complete		Evaporation Rate (Butyl Acetate = 1) Less than 1																
Appearance And Odor Clear, colorless liquid. Concentrations over 35% may have sharp odor.																		
Section IV																		
Reactivity																		
Stability ☐ Unstable ☒ Stable		Hazardous Polymerization ☐ May Occur ☒ Will Not Occur																
Conditions And Materials To Avoid Contamination by many substances including heavy metals and their salts, reducing agents, strong oxidizers, alkalis and particulate solids will cause decomposition. The rate of decomposition increases with increasing temperature and may be very vigorous with rapid generation of large volumes of oxygen and steam. Consult Solvay Interox on handling and materials of construction.																		
Hazardous Decomposition Products Oxygen, steam, peroxide vapor and heat.																		
Section V																		
Fire and Explosion Hazards																		
Flash Point and Method Used NA		Flammable Limits (% Volume in Air) Lower Upper Nonflammable																
Extinguishing Media Water																		
Special Fire Fighting Procedures and Precautions Wear protective clothing and self-contained breathing apparatus.																		
Unusual Fire and Explosion Hazards <u>Strong oxidizer</u> : Hydrogen peroxide is not flammable but can initiate spontaneous combustion of paper, wood, cloth, and other organic materials. Ignition may be rapid, but can be delayed for several hours. Rapid oxygen evolution from decomposing hydrogen peroxide may increase the intensity of a fire.																		
Oxygen enrichment of poorly ventilated organic atmospheres increases the potential of vapor phase explosions.																		

To the best of our knowledge the information herein is accurate. However, neither Solvay Interox nor any of its affiliates makes any warranty, expressed or implied, or accepts any liability in connection with this information or its use. This information is for use by technically skilled persons at their own discretion and risk and does not relate to use of the product in combination with any other substance or in any process. This is not a license under any patent. The user alone must finally determine suitability of any information or material for any contemplated use, the manner of use and whether any patents are infringed.

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1-800-INTEROX 713/525-6500 Fax: 713/524-9032



SOLVAY
INTEROX

**TMC CHEMICALS,
INCORPORATED**

P.O. BOX 5430
PARSIPPANY, NJ 07054

PHONE: 973-560-1400
FAX: 973-560-0400

MATERIAL SAFETY DATA SHEET

SECTION 1 - MATERIAL IDENTIFICATION

PRODUCT NAME ISOTECSM Catalyst-4260
Component C

ISOTECSM is a registered servicemark of In-Situ Oxidative Technologies, Inc.

MANUFACTURER TMC Chemicals, Inc.
P.O. Box 5430
Parsippany, NJ 07054

EMERGENCY TELEPHONE NUMBER(S) (973) 560-1400 (Northern NJ)
(609) 275-8500 (Southern NJ)

DATE PREPARED: April 2000 (Revised)
C.A.S. CHEMICAL NAME Mixture
SYNONYMS None
CHEMICAL FAMILY Not Applicable
EMPIRICAL FORMULA NA
INTENDED USE Catalyst

SECTION 2 - INGREDIENTS

CAS Number and Chemical Name	%	OSHA ACGIH PEL/TLV-TWA ppm - mg/M ³	ACGIH STEL-TWA ppm - mg/M ³
Catalyst is a trade secret	100	Not established	Not established

MATERIAL SAFETY DATA SHEET

SECTION 3 - HEALTH HAZARDS

EMERGENCY OVERVIEW

Applicable properties are relevant to certain proprietary ingredients present in the mix at variable concentrations.

ROUTES OF EXPOSURE

Inhalation, Skin Contact, Eye Contact, Ingestion

EXPOSURE STANDARDS

See Section 2 for exposure standards on ingredients

HEALTH HAZARDS

Eye and skin irritant, harmful if inhaled or swallowed

TARGET ORGANS

Skin, Eyes, respiratory tract

SIGNS AND SYMPTOMS OF EXPOSURE (Acute effects)

Irritant to mucous membranes; causes burning in eyes and skin

SIGNS AND SYMPTOMS OF EXPOSURE (Possible Longer Term Effects)

Red and/or burning skin; irritated eyes

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

Not Evaluated

IRRITATION EFFECTS DATA

Not Evaluated

ACUTE TOXICITY EFFECTS DATA

Oral LD50 - Not Evaluated

Dermal LD50 - Not Evaluated

OTHER ACUTE EFFECTS

Not Evaluated

CHRONIC/SUBCHRONIC DATA

Not Evaluated

MATERIAL SAFETY DATA SHEET

SECTION 4 - FIRST AID

EYE CONTACT

Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

SKIN CONTACT

Remove contaminated clothing. Wash affected area immediately with soap and water.

INHALATION

In case of inhalation or suspected inhalation, move patient at once to fresh air and call a physician. If breathing has stopped or is labored, give assisted respiration (e.g., mouth-to-mouth). Supplemental oxygen may be indicated.

INGESTION

If swallowed, call a physician immediately. Do not induce vomiting! Give large quantities of water or milk. Wash mouth with plenty of water. Never give anything by mouth to an unconscious person.

SECTION 5 - FIRE AND EXPLOSION DATA

CHARACTERISTICS:

Flash Point	Not Evaluated
Upper Explosive Limit (UEL)	Not Evaluated
Lower Explosive Limit (LEL)	Not Evaluated
Autoignition Temperature	Not Evaluated
Flash Point Method(s)	Not Specified
Fire Hazard Classification (OSHA/NFPA)	None

EXTINGUISHING MEDIA

This product is not flammable.

SPECIAL FIRE FIGHTING PROCEDURES

Use NIOSH-approved self-contained breathing apparatus and complete protective clothing when fighting chemical fires. Use water spray to cool all affected containers. Avoid skin contact. Contain runoff water in dikes. Prevent stream contamination. Expended liquids from fire fighting should be diverted to an active sanitary sewer line.

UNUSUAL FIRE AND EXPLOSION HAZARDS

May react with some metals to form flammable hydrogen gas. Direct contact with water will cause an exothermic reaction.

MATERIAL SAFETY DATA SHEET

SECTION 6 - REACTIVITY DATA

CHEMICAL STABILITY

Stable

INCOMPATIBILITIES

Contact with organics and concentrated acids may cause violent reactions. Contact with carbohydrates may form carbon monoxide. Also incompatible with some metals, explosives, and organic peroxides.

CONDITIONS TO AVOID

None known.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

Product will react with some metals forming flammable hydrogen gas.

HAZARDOUS POLYMERIZATION

Will not occur

NFPA Reactivity Rating

None

SECTION 7 - SPILL, LEAK AND WASTE DISPOSAL INFORMATION

CONTAINMENT/CLEAN-UP TECHNIQUES

(Small spills) Sweep or shovel spilled material into containers. Neutralize remainder of spill with dilute acid. After removal, flush contaminated area thoroughly with a water spray.

(Large spills) Contain spill with absorbent or chemical boom and ventilate area. Only trained personnel to enter spill area. Collect spill in a waste container or remove with a vacuum truck. Prevent spill from entering natural watercourses. Neutralize remainder of spill with dilute acid and flush area thoroughly with water spray.

OTHER EMERGENCY ADVICE

Avoid eye and skin contact. Wear protective clothing.

WASTE DISPOSAL

Aqueous solutions should be neutralized with a dilute acid or large volume of water and directed to septic drain. Dry material can be disposed of in an appropriate hazardous material container. Check with local sewer authority for compliance with waste discharge.

MATERIAL SAFETY DATA SHEET

ENVIRONMENTAL EFFECTS

Limited information available on environmental fate and effects of this product. Laboratory toxicity data indicate that this chemical is moderately toxic to aquatic and terrestrial organisms. Primary mode of action is due to the corrosive nature of this chemical and its tendency to increase pH in poorly buffered environments. Aquatic organisms become increasingly stressed as pH exceeds 9, with many species being intolerant of pH levels in excess of 10. Increased pH due to the introduction of this chemical may lead to the precipitation of essential micronutrients. Exposed terrestrial species would be subject to skin irritation and burns due to the corrosive nature of this chemical.

SECTION 8 - PERSONAL PROTECTION/EXPOSURE CONTROLS

EYE PROTECTION

Splash-proof chemical safety goggles.

HAND PROTECTION

Impermeable gloves made of neoprene or rubber.

RESPIRATORY PROTECTION

If engineering controls do not maintain airborne concentrations below recommended limits, wear appropriate NIOSH/MSHA-approved respirator.

PROTECTIVE CLOTHING

Long sleeved clothing.

ENGINEERING CONTROLS

Good general ventilation should be used (10 air changes/hour). Avoid drafts that may disperse material beyond the work area.

WORK AND HYGIENE PRACTICES

Provide readily accessible eye wash stations and emergency shower or equivalent. Wash at the end of each work shift and before eating, smoking or using the toilet.

SECTION 9 - STORAGE AND HANDLING

STORAGE

Keep container tightly closed. Keep in a cool, dry place.

HANDLING

Do not inhale. Avoid contact with skin and eyes.

OTHER PRECAUTIONS:

MATERIAL SAFETY DATA SHEET

Carefully read instructions before handling this material. Be sure that all engineering and personal protective equipment is in working order.

SECTION 10 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL FORM	Solid
COLOR	White to off-white
ODOR	None

TYPICAL PHYSICAL DATA

pH	Strongly basic
VAPOR PRESSURE (mm Hg)	42
VAPOR DENSITY (Air = 1)	Not Applicable
BOILING POINT	754° C
FREEZING/MELTING POINT	159° C
SOLUBILITY IN WATER	100% by weight @ 25°C
SPECIFIC GRAVITY (Water = 1)	2.13
EVAPORATION RATE	
(Butylacetate = 1)	Not Applicable
VISCOSITY (CPS)	Not Evaluated

SECTION 11 - TRANSPORTATION INFORMATION

UN No. 1481	
DOT SHIPPING NAME	No Data
IMO SHIPPING NAME	No Data
LATA SHIPPING NAME	No Data

The information set forth above is based upon information which TMC Chemicals, Inc. believes to be accurate. No warranty, express or implied, is intended. The information is provided solely for your information and consideration and TMC Chemical, Inc. assumes no legal responsibility for use or reliance thereon.

TETRACHLOROETHYLENE



Please reduce your browser font size for better viewing and printing.

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtec: 202-483-7516

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.



TETRACHLOROETHYLENE

MSDS Number: T0767 --- Effective Date: 09/08/97



1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride

CAS No.: 127-18-4

Molecular Weight: 165.83

Chemical Formula: Cl₂C=CCl₂

Product Codes:

J.T. Baker: 9218, 9360, 9453, 9465, 9469

Mallinckrodt: 1933, 8058

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

TETRACHLOROETHYLENE

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.

Ingestion:

Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.

Skin Contact:

Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.

Eye Contact:

Causes irritation, redness, and pain.

Chronic Exposure:

May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

TETRACHLOROETHYLENE

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.

Explosion:

Not considered to be an explosion hazard. Containers may explode when involved in a fire.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

TETRACHLOROETHYLENE

-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (ceiling),
300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Ethereal odor.

Solubility:

0.015 g in 100 g of water.

Specific Gravity:

1.62 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

121C (250F)

Melting Point:

-19C (-2F)

Vapor Density (Air=1):

5.7

Vapor Pressure (mm Hg):

18 @ 25C (77F)

Evaporation Rate (BuAc=1):

0.33 (trichloroethylene = 1)

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride

TETRACHLOROETHYLENE

gas and phosgene gas may be formed upon heating. Decomposes with moisture to yield trichloroacetic acid and hydrochloric acid.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.

Conditions to Avoid:

Moisture, light, heat and incompatibles.

11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 34.2 g/m³/8H; investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Tetrachloroethylene (127-18-4)	No	Yes	2A

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals.

Environmental Toxicity:

The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

TETRACHLOROETHYLENE

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
Ingredient TSCA EC Japan Australia

Tetrachloroethylene (127-18-4) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient Korea DSL --Canada-- NDSL Phil.

Tetrachloroethylene (127-18-4) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
Ingredient -SARA 302- -SARA 313-----
RQ TPQ List Chemical Catg.

Tetrachloroethylene (127-18-4) No No Yes No

-----\Federal, State & International Regulations - Part 2\-----
Ingredient CERCLA -RCRA- -TSCA-
261.33 8 (d)

Tetrachloroethylene (127-18-4) 100 U210 No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]

Poison Schedule: No information found.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations

TETRACHLOROETHYLENE

(CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division

Phone Number: (314) 539-1600 (U.S.A.)

1,1,1-TRICHLOROETHANE



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MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-998-6666

Outside U.S. and Canada
Chemtrec: 202-483-7516

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.



1,1,1-TRICHLOROETHANE

MSDS Number: T4914 --- Effective Date: 07/15/99



1. Product Identification

Synonyms: Methyl chloroform; trichloroethane; chloroetene
CAS No.: 71-55-6
Molecular Weight: 133.40
Chemical Formula: CH₃CCl₃
Product Codes: 5381, 9435, 9436, 9437, W509, W510

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl Chloroform	71-55-6	96 - 100%	Yes
Dioxane	123-91-1		

1,1,1-TRICHLOROETHANE

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA (tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 1 - Slight

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Inhalation of vapors will irritate the respiratory tract. Affects the central nervous system. Symptoms include headache, dizziness, weakness, nausea. Higher levels of exposure (> 5000 ppm) can cause irregular heart beat, kidney and liver damage, fall in blood pressure, unconsciousness and even death.

Ingestion:

Harmful if swallowed. Symptoms similar to inhalation will occur along with nausea, vomiting. Aspiration of material into the lungs can cause chemical pneumonitis which can be fatal. If aspirated, may be rapidly absorbed through the lungs and result in injury to other body systems.

1,1,1-TRICHLOROETHANE

Skin Contact:

Causes mild irritation and redness, especially on prolonged contact. Repeated contact may cause drying or flaking of the skin.

Eye Contact:

Liquids and vapors cause irritation. Symptoms include tearing, redness, stinging, swelling.

Chronic Exposure:

Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may affect the kidneys and liver. Dioxane is a suspected human carcinogen based on animal data.

Aggravation of Pre-existing Conditions:

Personnel with CNS, kidney, liver or heart disease may be more susceptible to the effects of this substance. Use of alcoholic beverages may aggravate symptoms.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

1,1,1-TRICHLOROETHANE

5. Fire Fighting Measures

Fire:

Autoignition temperature: 500C (932F)
Flammable limits in air % by volume:
lcl: 7.0; ucl: 16.0
Vapors in containers can explode if subjected to high energy source.
Dioxane has a flash point below 16C (60F).

Explosion:

Can react with strong caustic, such as potash to form a flammable or explosive material. Air/vapor mixtures may explode when heated. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Do not use aluminum, magnesium or zinc metal for storage container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do not use aluminum equipment or

1,1,1-TRICHLOROETHANE

storage containers. Contact with aluminum parts in a pressurized fluid system may cause violent reactions.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
350 ppm (TWA) for trichloroethane
100 ppm (TWA) skin for dioxane
-ACGIH Threshold Limit Value (TLV):
350 ppm (TWA), 450 ppm (STEL) for trichloroethane
20 ppm (TWA) skin, A3 - Animal Carcinogen for dioxane

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. This substance has questionable warning properties.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Viton is a recommended material for personal protective equipment.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Mild chloroform-like odor.

1,1,1-TRICHLOROETHANE

Solubility:

4,400 ppm in water @ 20C (68F)

Specific Gravity:

1.34 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

74C (165F)

Melting Point:

-32C (-26F)

Vapor Density (Air=1):

4.63

Vapor Pressure (mm Hg):

100 @ 20C (68F)

Evaporation Rate (BuAc=1):

12.8

10. Stability and Reactivity

Stability:

Requires inhibitor content to prevent corrosion of metals. Slowly hydrolyzes in water to form hydrochloric and acetic acid.

Hazardous Decomposition Products:

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene

1,1,1-TRICHLOROETHANE

when heated to decomposition. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Hazardous polymerization can occur in contact with aluminum trichloride.

Incompatibilities:

Open flames, welding arcs, nitrogen tetroxide, oxygen, liquid oxygen, sodium, sodium hydroxide, and sodium-potassium alloy, strong alkalis, oxidizers, aluminum and other reactive metals.

Conditions to Avoid:

Insufficient inhibitor, incompatibles, heat, flame and ignition sources

11. Toxicological Information

Oral rat LD50: 9600 mg/kg; inhalation rat LC50: 18000 ppm/4H; investigated as a mutagen, tumorigen, reproductive effector; irritation eye rabbit, Standard Draize, 2mg/24H severe.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Methyl Chloroform (71-55-6)	No	No	3
Dioxane (123-91-1)	No	Yes	2B
1,2-Epoxybutane (106-88-7)	No	No	3

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released to the atmosphere, this material has an average global half-life of 6.0 - 6.9 years. When released into the air, this material may adversely affect the ozone layer.

Environmental Toxicity:

1,1,1-TRICHLOROETHANE

This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations.

Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: 1,1,1-TRICHLOROETHANE

Hazard Class: 6.1

UN/NA: UN2831

Packing Group: III

Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: 1,1,1-TRICHLOROETHANE

Hazard Class: 6.1

UN/NA: UN2831

Packing Group: III

Information reported for product/size: 20L

1,1,1-TRICHLOROETHANE

15. Regulatory Information

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-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC    Japan  Australia
-----
Methyl Chloroform (71-55-6)                  Yes   Yes   Yes    Yes
Dioxane (123-91-1)                          Yes   Yes   Yes    Yes
1,2-Epoxybutane (106-88-7)                  Yes   Yes   Yes    Yes
  
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-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL   Phil.
-----
Methyl Chloroform (71-55-6)                  Yes   Yes    No     Yes
Dioxane (123-91-1)                          Yes   Yes    No     Yes
1,2-Epoxybutane (106-88-7)                  Yes   Yes    No     Yes
  
```

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-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
                                     RQ    TPQ    List  Chemical Catg.
-----
Methyl Chloroform (71-55-6)                  No     No     Yes    No
Dioxane (123-91-1)                          No     No     Yes    No
1,2-Epoxybutane (106-88-7)                  No     No     Yes    No
  
```

```

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
Methyl Chloroform (71-55-6)                  1000    U226    No
Dioxane (123-91-1)                          100     U108    No
1,2-Epoxybutane (106-88-7)                  100     No      No
  
```

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Mixture / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings:
 Health: 2 Flammability: 1 Reactivity: 0

1,1,1-TRICHLOROETHANE

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Avoid breathing vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 8.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division

Phone Number: (314) 539-1600 (U.S.A.)

TRICHLOROETHYLENE



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MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 813-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-562-2537) for assistance.



TRICHLOROETHYLENE

MSDS Number: T4940 --- Effective Date: 03/23/98



1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride
CAS No.: 79-01-6
Molecular Weight: 131.39
Chemical Formula: C₂HCl₃
Product Codes:
J.T. Baker: 5376, 9454, 9458, 9464, 9473, 9474
Mallinckrodt: 8598, 8600, 8633

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

TRICHLOROETHYLENE

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 1 - Slight

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.

Ingestion:

Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.

Skin Contact:

Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.

Eye Contact:

Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.

Chronic Exposure:

Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing

TRICHLOROETHYLENE

contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:

Autoignition temperature: 420C (788F)

Flammable limits in air % by volume:

lcl: 8; ucl: 12.5

Explosion:

A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemical or foam.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

TRICHLOROETHYLENE

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Trichloroethylene:

-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (Ceiling),

300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):

50 ppm (TWA) 100 ppm (STEL);

listed as A5, not suspected as a human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. This substance has poor warning properties.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Chloroform-like odor.

Solubility:

Practically insoluble in water. Readily miscible in organic solvents.

Specific Gravity:

1.47 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

87C (189F)

Melting Point:

-73C (-99F)

Vapor Density (Air=1):

4.5

Vapor Pressure (mm Hg):

57.8 @ 20C (68F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

TRICHLOROETHYLENE

Stability:

Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.

Hazardous Decomposition Products:

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.

Conditions to Avoid:

Heat, flame, ignition sources, light, moisture, incompatibles

11. Toxicological Information

Toxicological Data:

Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

This material has been linked to mutagenic effects in humans.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Trichloroethylene (79-01-6)	No	No	2A

12. Ecological Information

Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

Environmental Toxicity:

The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in

TRICHLOROETHYLENE

accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
Ingredient TSCA EC Japan Australia

Trichloroethylene (79-01-6) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient Korea DSL --Canada-- NDSL Phil.

Trichloroethylene (79-01-6) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
-SARA 302- -SARA 313-----
Ingredient RQ TPQ List Chemical Catg.

Trichloroethylene (79-01-6) No No Yes No

-----\Federal, State & International Regulations - Part 2\-----
Ingredient CERCLA -RCRA- -TSCA-

Trichloroethylene (79-01-6) 100 261.33 8(d)

U228 No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

TRICHLOROETHYLENE

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: No information found.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep away from heat and flame.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 16.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division

Phone Number: (314) 539-1600 (U.S.A.)

TOLUENE



Please reduce your browser font size for better viewing and printing.

MSDS

Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.



TOLUENE

MSDS Number: T3913 --- Effective Date: 11/17/99



1. Product Identification

Synonyms: Methylbenzene; Toluol; Phenylmethane

CAS No.: 108-88-3

Molecular Weight: 92.14

Chemical Formula: C₆H₅-CH₃

Product Codes:

J.T. Baker: 5375, 5584, 5809, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476

Mallinckrodt: 4483, 8091, 8092, 8604, 8605, 8608, 8610, 8611, V560

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Toluene	108-88-3	100%	Yes

TOLUENE

3. Hazards Identification

Emergency Overview

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.

Ingestion:

Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.

Skin Contact:

Causes irritation. May be absorbed through skin.

Eye Contact:

Causes severe eye irritation with redness and pain.

Chronic Exposure:

Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

4. First Aid Measures

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.

Ingestion:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.

Skin Contact:

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while

TOLUENE

removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 7C (45F) CC

Autoignition temperature: 422C (792F)

Flammable limits in air % by volume:

lcl: 3.3; ucl: 19

Flammable liquid and vapor!

Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

TOLUENE

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Toluene:

- OSHA Permissible Exposure Limit (PEL):

200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).

- ACGIH Threshold Limit Value (TLV):

50 ppm (TWA) skin, A4 - Not Classifiable as a Human Carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.

WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Aromatic benzene-like.

Solubility:

0.05 gm/100gm water @ 20C (68F).

Specific Gravity:

0.86 @ 20C / 4 C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

111C (232F)

Melting Point:

-95C (-139F)

Vapor Density (Air=1):

3.14

Vapor Pressure (mm Hg):

22 @ 20C (68F)

Evaporation Rate (BuAc=1):

2.24

TOLUENE

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetroxide; will attack some forms of plastics, rubber, coatings.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49 gm/m3/4H;

Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe. Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Has shown some evidence of reproductive effects in laboratory animals.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Toluene (108-88-3)	No	No	3

12. Ecological Information

Environmental Fate:

When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

TOLUENE

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TOLUENE
Hazard Class: 3
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

International (Water, I.M.O.)

Proper Shipping Name: TOLUENE
Hazard Class: 3.2
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

15. Regulatory Information

```
-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA  EC   Japan  Australia
-----
Toluene (108-88-3)                           Yes  Yes   Yes    Yes
```

```
-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL   Phil.
-----
Toluene (108-88-3)                           Yes   Yes    No     Yes
```

```
-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
                                     RQ   TPQ    List  Chemical Catg.
-----
Toluene (108-88-3)                           No    No     Yes    No
```

```
-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-      -TSCA-
                                     261.33     8(d)
-----
Toluene (108-88-3)                           1000       U220      No
```

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO

TOLUENE

CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3[Y]E

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 3 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Strategic Services Division

Phone Number: (314) 539-1600 (U.S.A.)

APPENDIX B

Personal Acknowledgement to Health and Safety Plan

PERSONNEL ACKNOWLEDGEMENT TO HEALTH AND SAFETY PLAN

I have read and fully understand this health and safety plan and agree to comply with its contents. I understand that employers have the ultimate responsibility for providing a safe and healthy work environment for its employees. By signing this page, I hereby represent that I have read and understand the contents of this plan and agree to perform my work in accordance with it.

Site Name and Number _____

NAME

SIGNATURE

DATE _____

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be from a notebook or a standard ruled sheet of paper. There is no handwriting or other markings on the page.

APPENDIX C

Emergency Telephone Numbers and Map to the Hospital

EMERGENCY TELEPHONE NUMBERS

Site Name: 570 Main Street, Westbury, NY

GENERAL

PHONE

National Response Center

800/424-8802

CHEMTREC (Chemical Information)

800/424-8802

LOCAL

Emergency

911

Fire Department

911

Police Department

911

Nassau County Medical Center

516/572-3000

Poison Control Center

800/962-1253

U.S. EPA National Response Center

800/438-2427

Hull & Associates, Inc.

Project Manager: W. Lance Turley

Office: 513/459-9677

800/795-9677

Mobile: 513/460-8632

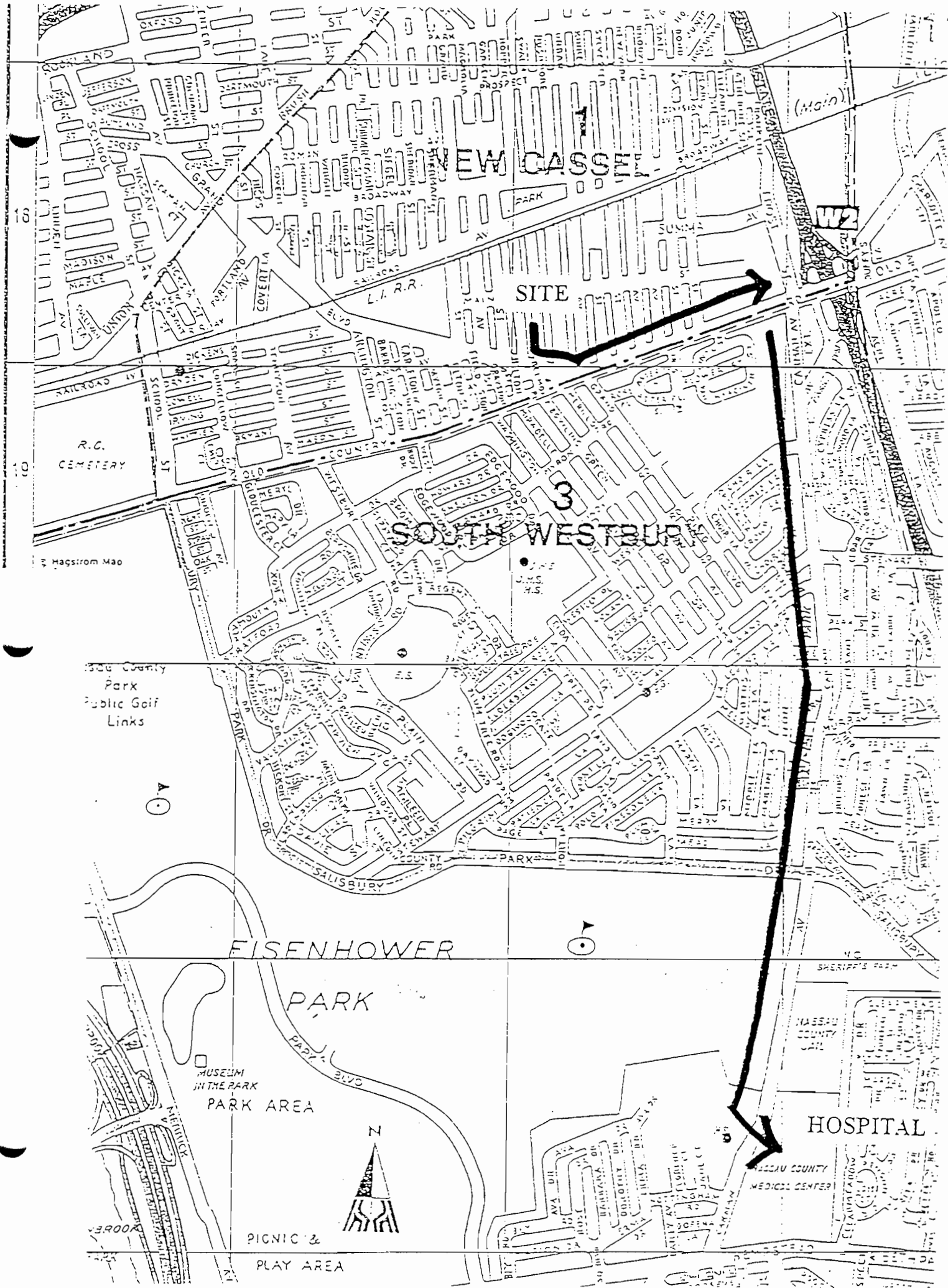
Health and Safety Coordinator: Toby Droughton

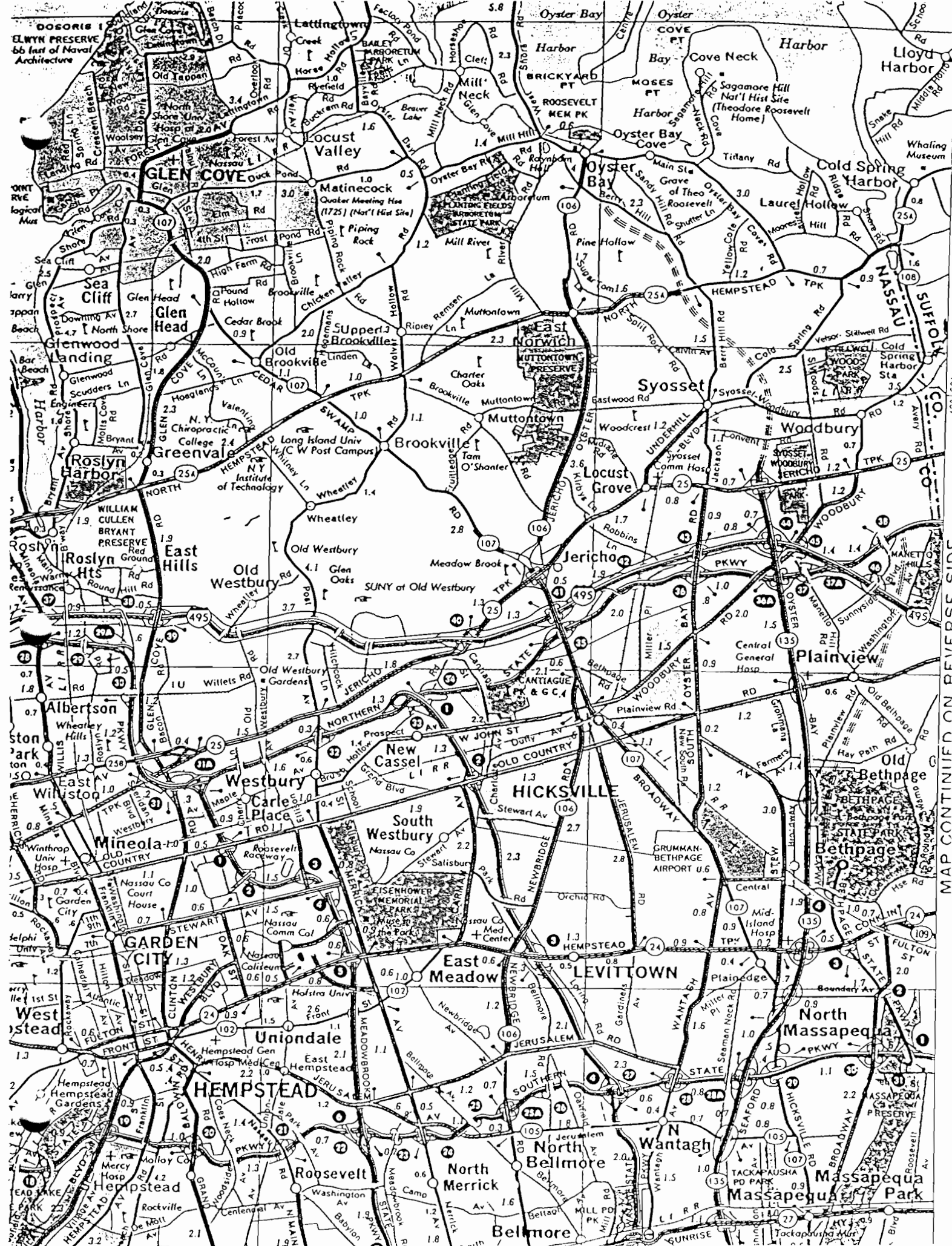
Office: 513/459-9677

Mobile: 513/460-8633

Directions to the Nassau County Medical Center from the Site:

Proceed South from the Site along Swalm or Rushmore to Old Country Road. Proceed East on Old Country Road to Carman Avenue. Proceed South on Carman Avenue to Nassau County Medical Center, which is located on the east side of Carman Avenue, north of Hempstead Turnpike (Route 24).





MAP CONTINUED ON REVERSE SIDE

APPENDIX D

Respiratory Protection Program

5.5 Respiratory Protection Program

Certain employees of Hull & Associates, Inc., during their regular course of duty may be required to enter environments where airborne contaminants, toxins, or sufficants are present; as such, a comprehensive respiratory protection program has been established. The purpose of this document is to establish respiratory protection procedures that meet or exceed regulatory guidelines as they apply to designated employees at various worksites.

5.5.1 Medical Evaluations

The use of respiratory protection may place a physiological burden on an employee that varies with the type of respirator worn, the job and worksite conditions in which the respirator is used, and the current medical status or health of the employee. Therefore, HAI requires those employees who are expected to wear respiratory protection to undergo a thorough medical evaluation performed by a physician or other licensed health care professional to determine whether the employee has any health restrictions before using a respirator. As part of the examination, employees are required to complete a short confidential questionnaire for the physician, relating to past, present, and expected future use of respiratory protection. A copy of this questionnaire is located in Appendix E. The physician must also be provided with information such as the size and model of the respirator to be used, the duration and frequency of respirator use, the expected work effort, additional PPE to be worn, and climatic extremes that may be encountered.

The physician must provide a written recommendation regarding the employee's ability to use a respirator. The recommendation should include any limitations on the employee's respirator use related to the medical condition of the employee, including whether or not the employee is medically able to use the respirator; the need, if any, for follow-up medical evaluations; and a statement that the physician provided the employee with a copy of the written recommendation. A annual follow-up medical evaluation will be required to reassess individual abilities, when an employee reports medical signs and symptoms that are related to his/her ability to use a respirator, or if recommended by the physician when a change in worksite conditions may result in an increased physiological burden on the employee. Employees **will not** be assigned respiratory protection devices unless it has been determined that the employee is physically able to perform the work while wearing the respirator.

5.5.2 Procedures for Selecting Respiratory Protection

HAI shall evaluate potential respiratory hazards at worksites relative to employee exposure and base respirator selection on those factors identified. HAI shall select and provide (at no cost to the employee) an appropriate respirator (certified by NIOSH) based on those potential respiratory or mucous membrane (e.g., eyes) hazards to which an employee is exposed, worksite specific requirements, and user factors that may affect respirator performance and reliability. Every attempt will be made to identify potential airborne contaminants and their associated hazards.

In situations where HAI cannot reasonably estimate the exposure potential, the area will be considered an immediately dangerous to life and health atmosphere (IDLH). HAI employees **are not** permitted to enter IDLH atmospheres. For IDLH or oxygen deficient (<19.5%) conditions, a full-facepiece pressure demand self-contained breathing apparatus (SCBA), certified by NIOSH, for a minimum service life of thirty minutes, or a combination full-facepiece pressure demand supplied-air respirator with auxiliary self-contained air supply must be used.

HAI shall select a respirator appropriate for the chemical and physical state of the contaminant. Respirators shall be selected from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user. Each new situation will be thoroughly evaluated before selecting the respirator adequately designed to protect the health of the employee. Typically, a full-facepiece, air-purifying respirator (APR) equipped with the appropriate cartridge(s) will be used, however, depending on the duration of exposure, environmental conditions, and concentration, an alternate mechanism may be required. When feasible, HAI shall make every attempt to implement engineering controls to abate the hazard(s).

5.5.3 Assigned Protection Factors

The assigned protection factor (APF) of a respirator reflects the level of protection that a properly functioning respirator is expected to provide correctly fitted and trained users. The APF is a unitless number based on the concentration of contaminant that leaks into a respirator facepiece relative to the known concentration outside the facepiece. The following table describes APFs for various types of respirators:

Table of NIOSH/OSHA APFs for Various Types of Respirators

Respirator Class and Type	APF
Air-Purifying	
Filtering Facepiece	10
Half-Mask	10
Full-Facepiece	50
Powered Air-Purifying	
Half-Mask	50
Full-Facepiece	250
Loose Fitting Facepiece	25
Hood or Helmet	25
Supplied-Air	
Half-Mask-Demand	10
Half-Mask-Continuous	50
Half-Mask-Pressure Demand	1000
Full-Facepiece Demand	50
Full-Facepiece Continuous Flow	250
Full-Facepiece Pressure Demand	2000
Loose Fitting Facepiece	25
Hood or Helmet	25
Self Contained Breathing Apparatus (SCBA)	
Demand	50
Pressure Demand	10,000

The APF can be used to estimate the maximum use limit (MUL) of a successfully fitted respirator. The MUL is the highest concentration, **not exceeding the IDLH concentration**, of a specific contaminant in which a respirator can be worn. The occupational exposure limit (OEL) is the recommended exposure limit (REL), threshold limit value (TLV), or permissible exposure limit (PEL) for a given chemical agent.

$$\text{MUL} = \text{APF} \times \text{OEL}$$

For example, if a contaminant has an OEL of 10 ppm, then the MUL for any air purifying half-mask respirator is 100 parts-per-million (ppm); the MUL for a full-facepiece air-purifying respirator or demand SCBA would be 500 ppm.

5.5.4 Fit Testing Procedures

Before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same model and size of respirator that will be used. Employees shall be fit tested before initial use of a respirator, whenever a different facepiece is used, and at least annually thereafter. **Employees who are required to wear a respirator because of exposure to asbestos above the permissible exposure limit must be fit tested every six months.** Additional fit testing will be conducted when changes in an employee's physical condition (e.g., facial scarring, dental changes, cosmetic surgery, obvious change in body weight) could affect respirator fit or when an employee expresses that the fit of the respirator is unacceptable. HAI shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative and/or quantitative fit test. The fit test shall be administered using an OSHA-approved qualitative and/or quantitative fit test.

5.5.4.1 Qualitative Fit Tests

Qualitative fit testing involves the introduction of a harmless, odorous or irritating substance (e.g., isoamyl acetate, Bitrex, irritant smoke, or saccharin) into the breathing zone of the wearer. A proper fit is indicated if the wearer completes several exercises (e.g., breathing deeply, moving the head from side to side, moving the head up and down, and talking) and cannot detect the specified substance. HAI uses either isoamyl acetate or irritant smoke to perform qualitative fit tests.

1. Isoamyl acetate is a chemical with an easily detectable odor. It is used to check the seals of the respirator when organic vapor filters are used. If the user detects any odor, it is an indication that the fit is faulty and adjustment to the respirator seal is required.
2. The irritant smoke test involves exposing the wearer to an irritating aerosol produced by a smoke tube. It is used to check the seals of a respirator equipped with high efficiency particulate air (HEPA) filters. If the user detects any irritant smoke, it is an indication that the fit test is faulty, and adjustment to the respirator seal is required.

Please note that a qualitative fit test will result in an assigned protection factor for the respirator.

5.5.4.2 Quantitative Fit Tests

Quantitative fit testing results in a fit factor specific to the individual and the respirator being used. Quantitative fit testing offers more detailed information on respirator fit. It involves the introduction of an aerosol to the wearer. A tube connected from the respirator to the testing device measures leakage into the respirator. While the wearer performs several exercises that could induce facepiece leakage, the air inside the facepiece is measured for the presence of the aerosol.

5.5.4.3 Field Fit Checks

After a successfully completed fit test, employees should check the fit of his/her respirator immediately before and periodically during respirator use in the field by performing a positive and negative pressure check.

1. To conduct a positive pressure check, cover the exhalation valve with your hand and gently exhale into the facepiece. If a slight positive pressure is built up inside the facepiece without any evidence of leakage, the fit is satisfactory.
2. To perform a negative pressure check, close off the air inlet valves (cartridges) with your hands. Inhale gently to collapse the facepiece slightly, and hold your breath for 10 seconds. If the facepiece remains slightly collapsed and no leakage is detected, the respirator fits properly.

5.5.5 Proper Use of Respirators

Each respirator user must receive fitting instructions that include demonstrations and practice on how the respirator should be worn, how to adjust the respirator, and how to determine if the respirator fits properly. Respirator users shall follow procedures for prohibiting conditions that may result in facepiece seal leakage, preventing removal of respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the workshift, and the use of respirators in IDLH atmospheres.

Although respirators are designed for maximum efficiency, they cannot protect the wearer without a tight seal between the facepiece and wearer. Employees will not be permitted to wear respirators with tight-fitting facepieces if the employee has any facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function. Employees with small mustaches are permitted to wear a respirator as long as the mustache does not interfere with the ability to obtain a tight seal between the facepiece and wearer.

Corrective lenses worn by employees present a problem when fitting respirators. Special mountings to hold corrective lenses inside full-facepieces are available. If corrective lenses are needed, the facepiece and lens must be fitted to provide good vision, comfort, and proper sealing. The corrective lenses will be provided at no cost to the employee. To assure proper protection for a facepiece, it must be checked by the wearer each time the respirator is used.

Full-facepiece and half-mask respirators have different fitting characteristics. Of the several brands of each style marketed, each has a different size and fitting characteristic. Because individual characteristics vary, several models and sizes are necessary to accommodate everyone. Any employee who finds that they cannot obtain a proper fit with their respirator must immediately notify their HSO and/or the Project Manager. Employees will not be permitted to work in any area where respiratory protection is required until the employee is equipped and fit tested with a proper-fitting device. The HSO of each respirator wearer is responsible for ensuring that the appropriate fit test has been conducted and that the result of such testing has indicated a proper fit.

Appropriate surveillance of worksite conditions and degree of employee exposure or stress shall be maintained by the SHSO. When there is a change in worksite conditions or degree of employee exposure or stress that may affect respirator effectiveness, the continued effectiveness of the respirator shall be reevaluated.

HAI EMPLOYEES ARE NOT TO PERFORM WORK IN IDLH ATMOSPHERES.

5.5.6 Respirator Cleaning and Maintenance

5.5.6.1 Cleaning and Disinfecting

Each employee who has finished wearing a disposable respirator (e.g. dust mask) that is to be used only once shall place the respirator in the appropriate waste receptacle or disposal container. The disposable respirator shall not be taken from the worksite for additional use or used a second time under any circumstances.

Respirators that are routinely used shall be regularly cleaned and disinfected by the respirator user. This shall be done as often as necessary to maintain a sanitary condition, but on a daily basis at a minimum when in use. Never use a respirator that has previously been used by another person, unless you have been fit tested on the same model and size of that respirator.

If the respirator is the same model and size, first clean and disinfect the respirator before usage. Respirators maintained for emergency use and for fit testing training shall be cleaned and disinfected after each use. The following describes how to clean and disinfect a respirator correctly:

1. Remove any filters or cartridges. Filters and cartridges should not be washed. Discard any filters that are clogged or cartridges that are spent.
2. Wash the respirator in a solution of warm water and a quarter cup of bleach. Rinse the device with clean warm water.
3. After drying, place the respirator in a sealable plastic bag.

5.5.6.2 Inspection

All respirators used in routine situations shall be inspected before each use and during cleaning. The respirator should also be inspected after taking it off before putting the respirator in storage. Respirators maintained for use in emergencies shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use. Emergency escape-only respirators shall be inspected before being carried to the worksite for use.

Respirator inspections should include the following:

- a check of respirator function, tightness of connections, and the condition of the various parts including, the facepiece, head straps, valves, connecting tube, gaskets, speaking diaphragm, nose piece, and cartridges, canisters, or filters;
- a check of the elastomeric parts for pliability and signs of deterioration; and,
- SCBAs should be inspected monthly. Air and oxygen cylinders should be fully charged and shall be recharged when the pressure falls to 90% of the manufacturer's pressure level.

The inspector of respirators maintained for emergency use shall:

- certify by documenting the date the inspection was performed, the name of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and,

- provide this information on a tag or label that is attached to the storage compartment for the respirator, kept with the respirator or included in inspection reports stored as paper or an electronic file. This information shall be maintained until replaced by a subsequent certification.

An employee should **never** wear an unclean respirator or a respirator that is in any way defective. Employees are required to report any instance of a defective or ineffective respirator to the HSO immediately.

Respirator repairs and part replacement shall only be performed by the HSC or HSO. There shall be no interchanging of parts between different brands of respirators or different model numbers manufactured by the same manufacturer. Replacement parts must be NIOSH-approved for the particular respirator in use. No attempts shall be made to replace components or make adjustments or repairs beyond the manufacturer's recommendations. Reducing valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair. Employees are strictly **prohibited** from altering the respirator in any way that may inhibit the designed functionality of the device.

5.5.6.3 Storage

When not in use, all respirators shall be stored in a sealed container and protected from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals. They shall be packed and stored to prevent deformation of the facepiece and exhalation valve. Gas and vapor cartridges should be kept in a sealed container so they do not passively adsorb gases and vapors from the storage area and thereby reduce the filter life. Particulate filters should also be protected from dusts and dirt.

5.5.7 Identification of Filters, Cartridges, and Canisters

All filters, cartridges, and canisters used at the worksite shall be labeled and color-coded with the NIOSH approved label. No one shall remove the label and the label must remain legible.

There are nine classes of filters (three levels of filter efficiency, each with three categories of resistance to filter efficiency degradation). The levels of filter efficiency are 95%, 99%, and 99.97%. The categories of resistance to filter efficiency degradation are labeled N (Not resistant to oil), R

(Resistant to oil), and P (oil Proof). Selection of filter efficiency depends on how much filter leakage can be accepted. Selection of N-, R-, and P-series filters depends on the presence or absence of oil particles, as follows:

1. If no oil particles are present, use any series (N, R, or P).
2. If oil particles are present, use only R or P series.
3. If oil particles are present and the filter is to be used for more than one work shift, use only P series.

Each respirator must be equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant. The ESLI is a system that warns the user of the approach of the end of adequate respiratory protection (e.g., the sorbent is approaching saturation or is no longer effective). If there is no ESLI appropriate for conditions at the work site, then a change of schedule for canisters and cartridges based on objective information or data must be established to ensure that they are changed before the end of their service life. The information and data relied upon, and basis for the change schedule and reliance on the data must be documented and described.

5.5.8 Limitations of Respirators

1. **Vision**

When a respirator user must wear corrective lenses, a protective spectacle or goggle, a face shield, or other eye and face protective device, the item should be fitted to provide good vision and should be worn in such a manner as not to interfere with the seal of the respirator to the wearer.

Temple bars or straps of a corrective spectacle which pass between the sealing surface of a full-facepiece respirator and the face may prevent a good seal and therefore such a spectacle shall not be worn with a full-facepiece respirator. Special corrective lenses, which are made to be mounted inside a full-facepiece, are available for use by anyone who wears corrective lenses.

Employees who wear full-facepiece respirators will have limited peripheral vision.

2. **Communications**

Speech transmission while wearing a respirator is often necessary to perform specific tasks. Although a respirator facepiece distorts the human voice to some extent, the respirator's exhalation valve usually provides a pathway for some speech transmission over short distances in relatively quiet areas.

3. **Immediately Dangerous to Life or Health (IDLH) Atmospheres**
An IDLH atmosphere is one that is oxygen deficient or contains excessive concentrations of a contaminant, including concentrations of a substance above the lower explosive limits. **HAI EMPLOYEES ARE NOT TO PERFORM WORK IN IDLH ATMOSPHERES.**
4. **Confined Spaces**
Before a person is allowed to enter a confined space, real-time air monitoring shall be carried out to determine the concentration (if any) of known or expected flammable or toxic contaminant present and to determine the concentration of oxygen.
5. **Low-Temperature Environments**
A low-temperature environment may cause fogging of the lens in a respiratory-inlet covering and freezing or improper sealing of the exhalation valve. Coating the inside surface of the lens may prevent fogging at low atmospheric temperatures approaching 32°F, but severe fogging of the lens may occur at temperatures below 0°F. Full-facepieces are available with nose cups that direct the warm and moist air through the exhalation valve without contacting the lens, and these facepieces should provide satisfactory vision at temperatures as low as -25°F. At very low atmospheric temperatures, the exhalation valve of a respirator may freeze open or closed due to the presence of moisture.
6. **High-Temperature Environments**
A person working in a high temperature environment is under stress due to the heat. Wearing a respirator in such an environment applies an added physiological burden and should be minimized by using a respirator having a low weight and a low resistance to breathing. The air-line-type supplied-air respirator is recommended for use in a high-temperature environment.
7. **Poor Warning Properties**
Some contaminants have poor warning properties (e.g. high odor threshold). The respirator wearer will be unable to identify when breakthrough occurs with the cartridges (indicates when cartridges need replaced) and may potentially be exposed to concentrations exceeding the PEL.

5.5.9 Employee Training

HAI shall provide training to employees who are required to use respirators. Training shall include the following elements:

- why a respirator is necessary and how improper fit, usage and maintenance can compromise the protective effect of the respirator;
- what the limitations and capabilities of the respirator are;
- how to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

- how to inspect, don and doff, and use the respirator, and check the seals and elasticity of the respirator;
- what the procedures are for maintenance and storage of the respirator; and,
- how to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.

Training will be conducted before an employee is required to use a respirator at a worksite. Refresher training will be performed annually, and/or when there are changes in the workplace or type of respirator.

Failure to follow all instructions and training on use, care and protection and/or failure to wear respirator during times of exposure will reduce respirator effectiveness and may result in sickness or death. The aerosols, gases, and vapors that can be dangerous to may not be visible with the normal eye. Appropriate discipline will be taken against any employee who fails to observe any portion of the respiratory protection program.

5.5.10 Program Evaluation

Evaluations of the respiratory protection program will be performed periodically to ensure that the program is being properly implemented. Employees will be surveyed to assess their views on the program effectiveness and to provide feedback for future program revisions, to identify any problems (e.g., respirator selection, fit, use, and maintenance), and to ensure that they are using the respirators properly.

5.5.11 Recordkeeping

Records of medical evaluations shall be preserved and maintained for at least the duration of employment plus thirty years. Copies of medical evaluations will be made available to employees upon request.

A record of qualitative and quantitative fit-tests administered shall be established. The record shall include the name of the employee tested, the type of fit test performed; the specific make, model, style, and size of the respirator tested; the date of the test, and the test results. Fit test records shall be retained for respirator users for the duration of employment plus thirty years.

APPENDIX E

Incident Investigation Report

INCIDENT INVESTIGATION REPORT

Employee Name _____ Position _____

Date of Birth _____ Office _____

SSN _____ Incident # _____

Date of Incident _____ Time _____

Accident Location _____

Length of Employment with HAI _____

Length of Time at Job Site _____

Time Shift Started _____

Full description of incident (include task being performed) _____

Type of incident (e.g., inhalation, ingestion, contact, lifting, temp. extremes, motor vehicle, slip, trip, fall, etc.) _____

Nature of incident/part of body (e.g., laceration, burn, fracture, contusion, heat stroke, etc.) _____

What factors led to incident (e.g. failure to wear PPE, lack of/improper training, unsafe speed, inattentive, etc.) _____

Have any near misses occurred similar to this incident _____

What equipment or machinery was involved _____

What PPE was the employee wearing _____

Describe weather conditions and terrain _____

Follow up actions required (e.g., provide PPE, improve/administer training, modify/replace equipment, etc.) _____

Additional concerns _____

Did employee receive professional medical attention (Y / N)

One or more lost work day (Y / N)

If yes, indicate # of days _____

Was employee hospitalized (Y / N)

One or more days of restricted duty (Y / N)

If yes, indicate # of days _____

Name/address of hospital/clinic _____

Name of physician _____ Telephone _____

Was a Health and Safety Plan prepared for this project _____

Was a Health and Safety Briefing form prepared for this project _____

Was an on-site or interoffice Health and Safety briefing held for this project _____

If so, when _____

Who attended _____

Employee Statement _____

By _____ Signature _____ Date _____

Witness Statement _____

By _____ Signature _____ Date _____

Project Manager Statement _____

By _____ Signature _____ Date _____

HSC/HSO Review _____

By _____ Signature _____ Date _____

OSHA Recordable Incident (Y / N)

OSHA forms 101,200 Property logged (Y / N)

APPENDIX D

Well Logs for Existing Monitoring Wells

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'	Yellowish 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



Land Tech Remedial, Inc.

Soil Boring/Well Log No.: PMW-4U, M, L

Client: Hull & Associates

Project No.: 11531

Page: 1/2

Project Name: IMC Magnetites

Permit No.: NA

Project Location: 570 Main Street, Westbury, New York

Date: 6/29/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: Auger
					Hole Diameter: 8 inches
					Depth: 140 feet
					Well Data
					Surface Casing
					Casing Type: NA
					Casing Diameter: NA
					Casing Length: NA
					Casing Interval: NA
					Well Casing
					Casing Type: Sch. 40 PVC
					Casing Diameter: 2-inch
					Casing Length: 10 feet
					Casing Interval: 0-10 feet
					Screen
					Screen Type: Sch. 40 PVC
					Screen Diameter: 2-inch
					Screen Slot: 0.10 inch
					Screen Length: 10 feet
					Screen Interval: 10-15 feet
					Filter Media
					Media Type: NA
					Composition: NA
					Volume Used: NA
					Filter Interval: NA
					Grout Seal
					Bentonite Interval: 0-1 feet
					Cement Interval: NA
					Well Head
					Concrete Pad: Yes
					Size: 24" X 24"
					Road Box: NA
					Size: NA
					Depth to Water
					Date: NA
					Time: NA
					Depth: NA
					Well Development
					Method: NA
					Duration: NA
					Rate: NA
					Date: NA
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack



Land Tech Remedial, Inc.

Soil Boring/Well Log No.: **PMW-4U, M, L**

Client: Hull & Associates
 Project Name: IMC Magnetics
 Project Location: 570 Main Street, Westbury, New York

Project No.: 11531 Page: 2/2
 Permit No.: NA
 Date: 6/29/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: <u>Auger</u>
					Hole Diameter: <u>8 inches</u>
					Depth: <u>140 feet</u>
					Well Data
					Surface Casing
					Casing Type: <u>NA</u>
					Casing Diameter: <u>NA</u>
					Casing Length: <u>NA</u>
					Casing Interval: <u>NA</u>
					Well Casing
					Casing Type: <u>Sch. 40 PVC</u>
					Casing Diameter: <u>2-inch</u>
					Casing Length: <u>10 feet</u>
					Casing Interval: <u>0-10 feet</u>
					Screen
					Screen Type: <u>Sch. 40 PVC</u>
					Screen Diameter: <u>2-inch</u>
					Screen Slot: <u>0.10 inch</u>
					Screen Length: <u>10 feet</u>
					Screen Interval: <u>10-15 feet</u>
					Filter Media
					Media Type: <u>NA</u>
					Composition: <u>NA</u>
					Volume Used: <u>NA</u>
					Filter Interval: <u>NA</u>
					Grout Seal
					Bentonite Interval: <u>0-1 feet</u>
					Cement Interval: <u>NA</u>
					Well Head
					Concrete Pad: <u>Yes</u>
					Size: <u>24" X 24"</u>
					Road Box: <u>NA</u>
					Size: <u>NA</u>
					Depth to Water
					Date: <u>NA</u>
					Time: <u>NA</u>
					Depth: <u>NA</u>
					Well Development
					Method: <u>NA</u>
					Duration: <u>NA</u>
					Rate: <u>NA</u>
					Date: <u>NA</u>
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack

100

110

120

130

140

150

160

170

180

190

200



74.6	103-105	Loose, Tan fine to medium SAND
59.9	108-110	Loose, Tan fine to medium SAND
	113-115	No Recovery
90.9	118-120	Loose, Tan fine to medium SAND
175	123-125	Loose, Tan fine to medium SAND, trace Silty Sand
120	128-130	Loose, Tan fine to medium SAND
136	133-135	Loose, Tan fine to medium SAND
169	138-140	Loose, Tan fine to medium SAND

Land Tech Remedial, Inc.

Soil Boring/Well Log No.: PMW-5U, M, L

Client: Hull & Associates

Project No.: 11531

Page 1/2

Project Name: IMC Magnetics

Permit No.: NA

Project Location: 570 Main Street, Westbury, New York

Date: 6/20/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: Auger
					Hole Diameter: 8 inches
					Depth: 140 feet
					Well Data
					Surface Casing
					Casing Type: NA
					Casing Diameter: NA
					Casing Length: NA
					Casing Interval: NA
					Well Casing
					Casing Type: Sch. 40 PVC
					Casing Diameter: 2-inch
					Casing Length: 10 feet
					Casing Interval: 0-10 feet
					Screen
					Screen Type: Sch. 40 PVC
					Screen Diameter: 2-inch
					Screen Slot: 0.10 inch
					Screen Length: 10 feet
					Screen Interval: 10-15 feet
					Filter Media
					Media Type: NA
					Composition: NA
					Volume Used: NA
					Filter Interval: NA
					Grout Seal
					Bentonite Interval: 0-1 feet
					Cement Interval: NA
					Well Head
					Concrete Pad: Yes
					Size: 24" X 24"
					Rigid Box: NA
					Size: NA
					Depth to Water
					Date: NA
					Time: NA
					Depth: NA
					Well Development
					Method: NA
					Duration: NA
					Rate: NA
					Date: NA
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack

Land Tech Remedial, Inc.

Soil Boring/Well Log No.: PMW-5U, M.L.

Client: Hull & Associates

Project No. 11531

Page 2/2

Project Name: IMC Magnetries

Permit No. NA

Project Location: 570 Main Street, Westbury, New York

Date 6/20/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data	
					Drilling Method	Auger
					Hole Diameter	8 inches
					Depth	140 feet
					Well Data	
					Surface Casing	
					Casing Type	NA
					Casing Diameter	NA
					Casing Length	NA
					Casing Interval	NA
					Well Casing	
					Casing Type	Sch. 40 PVC
					Casing Diameter	2-inch
					Casing Length	10 feet
					Casing Interval	0-10 feet
					Screen	
					Screen Type	Sch. 40 PVC
					Screen Diameter	2-inch
					Screen Slot	0.10 inch
					Screen Length	10 feet
					Screen Interval	10-15 feet
					Filter Media	
					Media Type	NA
					Composition	NA
					Working Level	NA
					Filter Interval	NA
					Grout Seal	
					Bentonite Interval	0-1 feet
					Cement Interval	NA
					Well Head	
					Concrete Pad	Yes
					Size	24" X 24"
					Road Box	NA
					Size	NA
					Depth to Water	
					Date	NA
					Time	
					Depth	NA
					Well Development	
					Method	NA
					Duration	
					Rate	
					Date	
					Legend	
					Concrete Pad	
					Casing Interval	
					Screen Interval	
					Native Fill Material	
					Bentonite Interval	
					Surface Casing	
					Filter Pipes	

**Land Tech Remedial, Inc.****Soil Boring/Well Log No.: PMW-6U, M, L**

Client: Hull & Associates
Project Name: IMC Magnetics
Project Location: 570 Main Street, Westbury, New York

Project No.: 11531 Page: 1/2
Permit No.: NA
Date: 6/23/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: <u>Auger</u>
					Hole Diameter: <u>8 inches</u>
					Depth: <u>140 feet</u>
					Well Data
					Surface Casing
					Casing Type: <u>NA</u>
					Casing Diameter: <u>NA</u>
					Casing Length: <u>NA</u>
					Casing Interval: <u>NA</u>
					Well Casing
					Casing Type: <u>Sch. 40 PVC</u>
					Casing Diameter: <u>2-inch</u>
					Casing Length: <u>10 feet</u>
					Casing Interval: <u>0-10 feet</u>
					Screen
					Screen Type: <u>Sch. 40 PVC</u>
					Screen Diameter: <u>2-inch</u>
					Screen Slot: <u>0.10 inch</u>
					Screen Length: <u>10 feet</u>
					Screen Interval: <u>10-15 feet</u>
					Filter Media
					Media Type: <u>NA</u>
					Composition: <u>NA</u>
					Volume Used: <u>NA</u>
					Filter Interval: <u>NA</u>
					Grout Seal
					Bentonite Interval: <u>0-1 feet</u>
					Cement Interval: <u>NA</u>
					Well Head
					Concrete Pad: <u>Yes</u>
					Size: <u>24" X 24"</u>
					Road Box: <u>NA</u>
					Size: <u>NA</u>
					Depth to Water
					Date: <u>NA</u>
					Time: <u>NA</u>
					Depth: <u>NA</u>
					Well Development
					Method: <u>NA</u>
					Duration: <u>NA</u>
					Rate: <u>NA</u>
					Date: <u>NA</u>
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack
0					
10					
20					
30					
40					
50		01	48-50	Loose, Tan fine to medium SAND, slightly moist.	
60		00	53-55	Loose, Tan fine to coarse SAND, some fine Gravel	
70		01	58-60	Loose, Tan fine to medium SAND, little coarse Sand, moist.	
80		01	63-65	Loose, Tan to brown fine to medium SAND, little coarse Sand.	
90		01	68-70	Loose, Tan to brown fine to medium SAND, trace coarse Sand.	
100		01	73-75	Loose, Tan to brown fine to medium SAND, trace coarse Sand.	
		01	78-80	Loose, Orangish tan, fine to medium SAND	
		01	83-85	Loose Tan to brown, fine to medium SAND.	
		01	88-90	Loose Tan to brown, fine to medium SAND	
		01	93-95	Loose, Light Brown, fine to medium SAND.	
		01	98-100	Loose, Tan fine to medium SAND, little coarse Sand.	

**Land Tech Remedial, Inc.****Soil Boring/Well Log No.:** PMW-6U, M, LClient: Hull & AssociatesProject No.: 11531Page: 2/2Project Name: IMC MagneticsPermit No.: NAProject Location: 570 Main Street, Westbury, New YorkDate: 6/23/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: <u>Auger</u>
					Hole Diameter: <u>8 inches</u>
					Depth: <u>140 feet</u>
					Well Data
					Surface Casing
					Casing Type: <u>NA</u>
					Casing Diameter: <u>NA</u>
					Casing Length: <u>NA</u>
					Casing Interval: <u>NA</u>
					Well Casing
					Casing Type: <u>Sch. 40 PVC</u>
					Casing Diameter: <u>2-inch</u>
					Casing Length: <u>10 feet</u>
					Casing Interval: <u>0-10 feet</u>
					Screen
					Screen Type: <u>Sch. 40 PVC</u>
					Screen Diameter: <u>2-inch</u>
					Screen Slot: <u>0.10 inch</u>
					Screen Length: <u>10 feet</u>
					Screen Interval: <u>10-15 feet</u>
					Filter Media
					Media Type: <u>NA</u>
					Composition: <u>NA</u>
					Volume Used: <u>NA</u>
					Filter Interval: <u>NA</u>
					Grout Seal
					Bentonite Interval: <u>0-1 feet</u>
					Cement Interval: <u>NA</u>
					Well Head
					Concrete Pad: <u>Yes</u>
					Size: <u>24" X 24"</u>
					Road Box: <u>NA</u>
					Size: <u>NA</u>
					Depth to Water
					Date: <u>NA</u>
					Time: <u>NA</u>
					Depth: <u>NA</u>
					Well Development
					Method: <u>NA</u>
					Duration: <u>NA</u>
					Rate: <u>NA</u>
					Date: <u>NA</u>
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack



Land Tech Remedial, Inc.

Soil Boring/Well Log No.: PMW-7U, M, L

Client: Hull & Associates

Project No.: 11531

Page: 1/2

Project Name: IMC Magnetics

Permit No.: NA

Project Location: 570 Main Street, Westbury, New York

Date: 6/25/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: <u>Auger</u>
					Hole Diameter: <u>8 inches</u>
					Depth: <u>140 feet</u>
					Well Data
					Surface Casing
					Casing Type: <u>NA</u>
					Casing Diameter: <u>NA</u>
					Casing Length: <u>NA</u>
					Casing Interval: <u>NA</u>
					Well Casing
					Casing Type: <u>Sch. 40 PVC</u>
					Casing Diameter: <u>2-inch</u>
					Casing Length: <u>10 feet</u>
					Casing Interval: <u>0-10 feet</u>
					Screen
					Screen Type: <u>Sch. 40 PVC</u>
					Screen Diameter: <u>2-inch</u>
					Screen Slot: <u>0.10 inch</u>
					Screen Length: <u>10 feet</u>
					Screen Interval: <u>10-15 feet</u>
					Filter Media
					Media Type: <u>NA</u>
					Composition: <u>NA</u>
					Volume Used: <u>NA</u>
					Filter Interval: <u>NA</u>
					Grout Seal
					Bentonite Interval: <u>0-1 feet</u>
					Cement Interval: <u>NA</u>
					Well Head
					Concrete Pad: <u>Yes</u>
					Size: <u>24" X 24"</u>
					Road Box: <u>NA</u>
					Size: <u>NA</u>
					Depth to Water
					Date: <u>NA</u>
					Time: <u>NA</u>
					Depth: <u>NA</u>
					Well Development
					Method: <u>NA</u>
					Duration: <u>NA</u>
					Rate: <u>NA</u>
					Date: <u>NA</u>
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack



Land Tech Remedial, Inc.

Soil Boring/Well Log No.: PMW-7U, M, L

Client: Hull & Associates
Project Name: IMC Magnetics
Project Location: 570 Main Street, Westbury, New York

Project No.: 11531 Page: 2/2
Permit No.: NA
Date: 6/25/98

Depth Below Surface	Well Diagram	PID Readings (ppm)	Sample Depth (feet)	Field Description of Soil	Bore Hole Data
					Drilling Method: <u>Auger</u>
					Hole Diameter: <u>8 inches</u>
					Depth: <u>140 feet</u>
					Well Data
					Surface Casing
					Casing Type: <u>NA</u>
					Casing Diameter: <u>NA</u>
					Casing Length: <u>NA</u>
					Casing Interval: <u>NA</u>
					Well Casing
					Casing Type: <u>Sch. 40 PVC</u>
					Casing Diameter: <u>2-inch</u>
					Casing Length: <u>10 feet</u>
					Casing Interval: <u>0-10 feet</u>
					Screen
					Screen Type: <u>Sch. 40 PVC</u>
					Screen Diameter: <u>2-inch</u>
					Screen Slot: <u>0.10 inch</u>
					Screen Length: <u>10 feet</u>
					Screen Interval: <u>10-15 feet</u>
					Filter Media
					Media Type: <u>NA</u>
					Composition: <u>NA</u>
					Volume Used: <u>NA</u>
					Filter Interval: <u>NA</u>
					Grout Seal
					Bentonite Interval: <u>0-1 feet</u>
					Cement Interval: <u>NA</u>
					Well Head
					Concrete Pad: <u>Yes</u>
					Size: <u>24" X 24"</u>
					Road Box: <u>NA</u>
					Size: <u>NA</u>
					Depth to Water
					Date: <u>NA</u>
					Time: <u>NA</u>
					Depth: <u>NA</u>
					Well Development
					Method: <u>NA</u>
					Duration: <u>NA</u>
					Rate: <u>NA</u>
					Date: <u>NA</u>
					Legend
					Concrete Pad
					Casing Interval
					Screen Interval
					Native Fill Material
					Bentonite Interval
					Surface Casing
					Filter Pack