FINAL INDOOR AMBIENT AIR MONITORING AND ASSESSMENT PLAN FOR THE LOWER DARBY CREEK AREA –CLEARVIEW LANDFILL SITE DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

Prepared for

U.S. Environmental Protection Agency Region 3
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Submitted by

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Approved by

for

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CONTENTS

TABLE

Appendix

Attachment

1.0 INTRODUCTON

Under Eastern Area Superfund Technical Assessment and Response Team (START) Contract No. EP-S3-05-02, Technical Direction Document (TDD) No. E43-028-10-01-001, U.S. Environmental Protection Agency (EPA) Region 3 tasked Tetra Tech EM Inc. (Tetra Tech) to conduct a screening assessment for landfill gas in multiple residences located in the vicinity of the Clearview Landfill, an operable unit of the Lower Darby Creek Area site, located in Delaware and Philadelphia Counties, Pennsylvania.

The purpose of this assessment is to determine whether levels of methane, oxygen, carbon dioxide, and volatile organic compounds (VOC) are present in the indoor air of residences in the vicinity of the former Clearview Landfill at levels that indicate the potential occurrence of vapor intrusion or that pose an imminent threat. If data collected during the screening assessment indicate a potential for vapor intrusion but do not indicate an emergency situation, Tetra Tech will conduct an expanded vapor intrusion evaluation to determine whether any site-related contaminants are or have the potential to eventually migrate into homes at levels that present an unacceptable risk (Tier 1 action). If data collected during the screening assessment indicate an imminent threat or emergency situation, Tetra Tech will recommend that EPA immediately advise the affected residents to evacuate the premises and/or ventilate the building, as well as advise EPA to initiate a response to mitigate the situation (Tier 2 action). The parameters to be measured as part of the first step of this vapor intrusion evaluation are methane, oxygen, carbon dioxide, VOCs, and the flammable or explosive limits of combustible gases in air.

This plan outlines the indoor ambient air monitoring and assessment activities to be conducted in multiple residences located in the vicinity of the Clearview Landfill. Specifically, this plan discusses the site background information in Section 2.0; describes project objectives and data use in Section 3.0; presents the proposed field investigations, project personnel, and sampling activities in Section 4.0; describes quality assurance and quality control (QA/QC) procedures in Section 5.0; presents project deliverables in Section 6.0; and outlines the project schedule in Section 7.0. References cited throughout the plan are listed after the text. Copies of Tetra Tech Standard Operating Procedures (SOP) to be used during the assessment are included as Appendix A and B.

2.0 SITE BACKGROUND

This section describes the site location, presents a site description, and summarizes previous site investigations.

2.1 SITE LOCATION

The Lower Darby Creek Area site is located in Darby Township and the City of Philadelphia, Pennsylvania on the border between Philadelphia and Delaware Counties. The geographic coordinates of the approximate center of the site are 39.90277° north latitude and -75.25277° west longitude (U.S. Geological Survey [USGS] 1967a/b).

The Clearview Landfill portion of the Lower Darby Creek Area site is located along the eastern bank of the Darby Creek straddling the border between Philadelphia and Delaware Counties. The area of investigation is situated entirely in Philadelphia County and includes the residences and building(s) located between the southeastern border of the site and Buist Avenue to the southeast, South 78th Street to the north, and South 83rd Street to the south. The Site Location Map and layout of the site are provided in Appendix C as Figures 1 and 2, respectively (USGS 1967 a/b; DigitalGlobe 2009)

2.2 SITE DESCRIPTION

The Lower Darby Creek Area site consists of two landfills: the previously mentioned Clearview Landfill and the Folcroft Landfill, which is located along Darby Creek in Philadelphia and Delaware Counties. The Clearview Landfill is on the east side of Darby Creek near the intersection of 84th and Lindbergh Boulevard. The Folcroft Landfill is 2 miles downstream, located on the west side of Darby Creek. The Folcroft Landfill is part of the John Heinz National Wildlife Refuge and is managed by the U.S. Fish and Wildlife Service (FWS). The two landfills operated from the 1950s to the 1970s and were eventually closed in the mid-1970s. During operation the operators of the landfill disposed of a variety of waste including municipal, demolition, and hospital waste.

The Clearview Landfill was privately owned and operated from the 1950s to the 1970s. In 1973, after failing to comply with landfill requirements, the Clearview Landfill was closed. However, the property had been used for other waste disposal operations since its closure. In 1976, the Philadelphia Redevelopment Authority (PRA) covered and seeded a portion of the Clearview Landfill and later constructed hundreds of residences around its eastern and southern borders. Residences that will be assessed as part of the indoor air monitoring study are located along Buist Avenue, Angelo Place, Mars Place, Venus Place, and Saturn Place, between South 78th Street and South 83rd Street.

2.3 PREVIOUS SITE INVESTIGATIONS

EPA is currently conducting a remedial investigation/feasibility study (RI/FS) at the Clearview Landfill. The RI/FS includes comprehensive environmental sampling of the soil, groundwater, surface water, stream sediments, and landfill seeps to determine the extent and nature of contamination. EPA collected samples from the Clearview Landfill, the City Park, and Darby and Cobbs Creeks. In 2005, EPA collected stream samples from Darby Creek and soil samples from the City Park as part of the ecological investigation. After a lengthy legal process, EPA received federally court-ordered access to evaluate the Clearview Landfill in October 2005. In 2006, EPA began collecting soil, air, and groundwater samples from the Clearview Landfill and installed groundwater monitoring wells on the landfill property. As part of the RI, EPA is conducting a human health and ecological risk assessment. Landfill gases (methane and carbon dioxide) detected in soil gas by hand-held field instruments used during the soil gas evaluation conducted as part of the EPA RI/FS are presented in Appendix C as Figure 3. Total VOCs and benzene detected in soil gas during the RI by the hand-held field instruments are provided in Appendix C as Figures 4 and 5, respectively.

3.0 PROJECT OBJECTIVES AND DATA USE

The objective of this assessment is to determine whether levels of methane, carbon dioxide, oxygen, combustible gas, and VOCs are present in the indoor air of residences at levels that indicate the potential occurrence of vapor intrusion or that pose an imminent threat from the Lower Darby Creek Area – Clearview Landfill site. If data collected during the screening assessment indicate a potential for vapor intrusion but do not indicate an emergency situation, Tetra Tech will conduct an expanded vapor intrusion evaluation to determine what (if any) site-related contaminants are or have the potential to migrate to residential indoor air at levels that present an unacceptable risk (Tier 1 action). One or more action levels that will trigger a more extensive vapor intrusion evaluation are presented below:

- Methane: Sustained concentrations of 3 parts per million (ppm). The average background concentration of methane is about 1.8 ppm. Sources of methane cannot be determined (e.g. cat litter box).

- Carbon Dioxide: 1,200 ppm (600 ppm is typical of indoor air.)

- Oxygen: 19.6% to 20.6% and > 21% (normal is 20.8%.)

- Total VOCs: 10 times background (outdoor ambient air levels). (Note – some homeowner activities such as smoking in the home may generate high indoor air concentrations.) Sources of VOCs cannot be determined (e.g. paint cans, smoking).

- Combustible gas: > 1% of combustible gas (detected as methane, % LEL equivalents)

If data collected during the screening assessment indicate an imminent threat or emergency situation, Tetra Tech will recommend that EPA immediately alert residents of the unsafe condition and instruct them to vacate the premises, as well as advise EPA to initiate a response to mitigate the situation (Tier 2 action). Action levels that will trigger immediate emergency response activities (including calling the Fire Department, notifying EPA Region 3 Emergency Response Program, ventilating residences, advising evacuation, and/or installing vapor mitigation system) are presented below:

- Methane: >1.25% by volume in air (12,500 ppm). The LEL for methane is 5%, and 25% of the LEL is 1.25%.

- Carbon Dioxide: >2% by volume in air (20,000 ppm). Carbon dioxide is toxic at concentrations greater than 5%. At concentrations greater than 2% for several hours, headaches and dyspnea occur upon mild exertion.

- Oxygen: <19.7% (19.5% is an oxygen deficient atmosphere) and >23.3% (23.5% is an oxygen enriched atmosphere.)

- Total VOCs: 100 times background (outdoor ambient air levels). Sources of VOCs cannot be determined (e.g. paint cans).

- Combustible gas: > 4% of combustible gas in air (in methane % LEL equivalents)

The parameters to be measured as part of the first step of this vapor intrusion evaluation are methane, oxygen, carbon dioxide, VOCs, and the flammable or explosive limits of combustible gases in air.

In the event that screening levels mentioned above do not exceed their respective action levels, the EPA will conduct another round of sampling approximately six months following this event. The purpose of the second round of sampling is to account for any seasonal variability which maybe present.

4.0 PROPOSED FIELD INVESTIGATION

This section describes the scope of work, presents key Tetra Tech personnel responsible for performing the tasks discussed in this plan, and discusses proposed monitoring activities to be conducted during the assessment.

4.1 SCOPE OF WORK

As part of this field investigation, Tetra Tech will perform the following tasks:

- Assist EPA with obtaining signed access agreements from residents in order to conduct the indoor ambient air quality assessments.

- Conduct photographic and written logbook documentation activities in accordance with Tetra Tech SOP No. 024, “Recording of Notes in Field Logbook” (Tetra Tech 2008, attached in Appendix A), and Tetra Tech’s “Quality Assurance Project Plan [QAPP] for START” (Tetra Tech 2006).

- Collect weather data prior to and during the monitoring activities, inclusive of temperature, barometric pressure, precipitation, and predominant wind direction and average wind speed.

- Prior to any air monitoring assessment, remove any possible lifestyle source that may contain target compounds of interest. Hand-held, direct-reading instruments will be used to perform indoor air monitoring in real-time for the target compounds of interest.

- Conduct outdoor ambient air monitoring with direct reading instruments to determine background methane, oxygen, carbon dioxide, and total VOC concentrations flammable (explosive) limits of combustible gas in outdoor air prior to conducting the indoor air quality monitoring assessment. Outdoor ambient air monitoring will be conducted at a frequency of approximately once per every 8 to 10 residences. Outdoor ambient air measurements will be collected in relative close proximity to the homes being evaluated and not further than 300 feet away from any one home. Outdoor ambient air monitoring will be conducted for approximately 30 seconds at each background monitoring location.

- Perform monitoring in accordance with direct reading instrument manufacturers specifications and Tetra Tech SOP No. 003, "Organic Vapor Air Monitoring" (Tetra Tech 2009, attached in Appendix B). Real-time preliminary results will be available at time of monitoring. Based on the results, the EPA Work Assignment Manager (WAM) can determine indoor sampling locations.

- Conduct monitoring with direct reading instruments to determine the concentrations of landfill gases in the permanent dry vapor monitoring wells (VM-01 throughVM-06) in City Park.

- Conduct indoor air quality monitoring to determine methane, oxygen, carbon dioxide, and total VOC concentrations and flammable (explosive) limits of combustible gas inside residences in the vicinity of the Clearview Landfill using a direct-reading instrument. Indoor air quality monitoring will be conducted in the homes of residents. The measurements will focus on areas within the house that have potential of gas accumulation and/or preferential pathways of gas, i.e., in confined areas of basement, in cracks of foundation, under sinks, and in cabinets. If concentrations measured during the initial indoor air monitoring assessment indicate that vapor intrusion is occurring inside a home, a more extensive vapor intrusion evaluation will be conducted and Tetra Tech will prepare a sampling and analysis plan for this evaluation to be submitted as a separate deliverable.

- Assign identifiers for all monitoring locations according to the following naming convention: LCD-AAA-BB-##, where LCD = Site ID (i.e. Lower Darby Creek), AAA = matrix, indoor or outdoor ambient air (i.e. OAA for outdoor ambient air [background] and IAA for indoor ambient air), BB = Street Name initials (i.e. SP for Saturn Place, VP for Venus Place, MP for Mars Place, etc.), and ## = station location (i.e. 01, 02, 03, etc.) All monitoring data will be recorded on air monitoring log sheets or in field logbooks. All monitoring data will be peer reviewed and verified for the appropriate quality assurance objectives.

- Document all activities, including data and field measurements, in field logbook and on field data sheets.

Proposed ambient air monitoring locations are shown on Figures 6 through 12 (Appendix C).

Tetra Tech plans to use the following hand-held, direct-reading instruments to perform the assessment:

- Photovac MicroFID (flame ionization detector) for methane screening

- Landtec GEM™ 2000 Plus (landfill gas analyzer) for carbon dioxide (instrument also measures methane, % LEL, and carbon dioxide.)

- Rae Systems MultiRAE Plus (multiple gas meter with photoionization detector) for measuring total VOCs, oxygen, and % LEL (instrument also measures hydrogen sulfide and carbon monoxide.)

The specifications of these three instruments are provided in Table 1

TABLE 1
SPECIFICATIONS FOR PROPOSED DIRECT-READING INSTRUMENTS

Photovac MicroFID				
Detector	**Response Time**	**Operating Concentration Range**	**Minimum Detection Limit**	**Accuracy**
Flame Ionization	Less than 3 seconds	0.5 ppm to 2,000 ppm methane equivalent (Low range)	0.5 ppm methane	Methane (after calibration with zero air and 500 ppm methane gas): within ± 0.5 ppm or ± 10% of actual methane concentration (0.5 ppm to 2,000 ppm range).
		10 ppm to 50,000 ppm methane equivalent (high range)		

Rae Systems MultiRAE Plus		
Sensor	**Range**	**Resolution**
Oxygen	0-30%	0.1%
Combustible Gas	0-100% LEL	1% LEL
VOCs	0-200 ppm	0.1 ppm
	200 – 2000 ppm	1 ppm

Landtec GEM 2000 Plus					
Gas Measured	**Technology**	**Range**	**Accuracy**		
			0-5%	**5-15%**	**>15%**
Methane	Dual-wavelength infrared cell	0-100%	± 0.3%	±1.0%	±3.0%
Carbon Dioxide		0-100%	± 0.3%	±1.0%	±3.0%

Notes:
LEL = Lower explosive limit
ppm = Parts per million
VOC = Volatile organic compound

Tetra Tech will document monitoring activities, including deviations from this plan, in the field logbook and on the appropriate field data sheets. All instruments will be calibrated according to manufacturer specifications on a daily basis prior to use and operated in accordance with the user manual or operation guide for each instrument. All instrument calibration and/or performance check procedures and methods will be summarized and documented in the field, personal, or instrument log notebooks.

4.2 MONITORING APPROACH AND RATIONALE

EPA Region 3 personnel will determine the specific residential properties to be assessed based on historical site data and individual access agreements.

4.3 KEY PROJECT PERSONNEL

The Tetra Tech START project manager for the TDD is Mr. Kevin Scott. As the project manager, Mr. Scott is responsible and accountable for all aspects of the project scope of work, including achieving the technical, financial, and scheduling objectives for the project. Mr. Scott will communicate directly with the EPA Remedial Program Manager (RPM) for this project, Mr. Josh Barber. Table 2 lists the Tetra Tech START personnel proposed for this project and their roles and responsibilities. The technical or field personnel supporting the project may vary depending on project-specific needs, site conditions, and staff availability.

TABLE 2
KEY PROJECT PERSONNEL

Role	Name	Responsibility
Project Manager	Kevin Scott	The project manager is responsible for implementing all activities identified in the TDD; responsible for developing and implementing the site health and safety plan; has authority to commit resources necessary to complete the work; prepares all deliverables required by the TDD; communicates directly with the EPA RPM, the project team, and any other personnel needed to complete the project.
Field Support Personnel	TBD	The field personnel perform necessary sampling or monitoring activities, as well as other tasks defined in the TDD or assigned by the EPA RPM or the Tetra Tech project manager; communicates directly with the Tetra Tech project manager and, when appropriate, EPA RPM.
Health and Safety Officer	Chris Draper	The health and safety officer oversees and supports development of the site health and safety plan; communicates directly with the Tetra Tech project manager to ensure that all corporate health and safety protocols applicable to the site are being followed.
Chemist	Joshua Cope	The chemist coordinates with the Tetra Tech project manager regarding the analytical requirements for the project; solicits and procures necessary laboratory services; reviews sample data and validates data, if necessary; communicates directly with the Tetra Tech project manager, field support personnel, EPA RPM, and START program manager as necessary.
Graphics and Mapping Specialist	Dan Call	The graphics and mapping specialist generates maps and other figures for project deliverables or presentations; assists the Tetra Tech project manager or other personnel when global positioning system activities are required.
Financial Manager	Bob Rynkar	The financial manager works with the Tetra Tech project manager in planning related to the TDD budget and completion date; enters project financial information into the Tetra Tech management information system; and prepares regular and special reports to assist the Tetra Tech project manager in managing the project.
Point of Contact	Sara Legard	The point of contact assists the Tetra Tech project manager as necessary to implement the project; commits or helps obtain all necessary company resources to meet the objectives of the TDD; provides document quality control reviews; and addresses and helps resolve project management issues with the Tetra Tech project managers.

Notes:
EPA = U.S. Environmental Protection Agency
RPM = Remedial Project Manager
START = Superfund Technical Assessment and Response Team
TBD = To be determined
TDD = Technical Direction Document
Tetra Tech = Tetra Tech EM Inc.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

This section describes the QA/QC procedures for the assessment activities at the Lower Darby Creek Area – Clearview Landfill site. Specifically, this section addresses responsibilities, field QC procedures, and data evaluation and management.

5.1 RESPONSIBILITIES

Tetra Tech project manager, Mr. Kevin Scott, is responsible for ensuring that all monitoring and assessment activities are conducted in accordance with Tetra Tech's "QAPP for START" (Tetra Tech 2006). The EPA-approved START QAPP is not in the format specified in the UFP QAPP Manual; therefore, Appendix D has been included in this SAP to provide a cross-reference indicating where each specified UFP QAPP element can be found in the START QAPP or this SAP (Intergovernmental Data Quality Task Force 2005).

5.2 FIELD QUALITY CONTROL

Field QC measures will consist of proper equipment calibration, adherence to instrument manufacturer user manuals, and Tetra Tech SOPs for air monitoring and documenting monitoring activities in the site logbook as described in the Tetra Tech "QAPP for START" (Tetra Tech 2006) and Tetra Tech SOP No. 024, "Recording of Notes in Field Logbook" (Tetra Tech 2008). All direct-reading instruments will be calibrated daily before use and according to manufacturer instructions. Tables 3 and 4 below describe the equipment QC measures and specifications related to equipment calibration, respectively.

TABLE 3
EQUIPMENT QUALITY CONTROL

Quality Control Measure	Effect
Instrument calibration precision check	Ensure precision and accuracy, respectively, of instrument response to standard.
Instrument calibration	

TABLE 4
EQUIPMENT CALIBRATION

Instrument	Parameters to measured	Frequency of calibration	Calibration gas/conc.
Rae Systems MultiRAE Plus	Oxygen, %LEL, Total VOCs	Daily	Four-gas mix (methane 95 ppm, 20.9% oxygen, 25 ppm hydrogen sulfide, 50 ppm carbon monoxide) Isobutylene: 100 ppm Zero air
PhotoVac MicroFID	Methane (0.5 ppm)	Daily	Methane: 500 ppm Zero air
Landtec - GEM 2000 Plus	Methane, CO2, %LEL	Daily	Multigas mix, methane (50%), carbon dioxide (35%), oxygen (4%)

Notes:
ppm = parts per million
LEL = Lower explosive limit
NA = Not applicable

5.3 DATA EVALUATION AND MANAGEMENT

Where possible, Tetra Tech will utilize direct-reading instruments with data logging capability. As an alternative, Tetra Tech will record field measurements on field data sheets and/or the field logbook. A copy of field data sheets to be used during the assessment is provided as an attachment to this plan. Tetra Tech will use the data collected during the monitoring assessment to base recommendations about further vapor intrusion evaluations or emergency action, and to prepare a trip report for the project. All electronic data will be stored in a Microsoft Excel or Access database for future retrieval and reference based on the RPM's requirements. Each hard copy data package will be kept in the project file in the Tetra Tech office in Boothwyn, Pennsylvania, until the data package is officially transferred to EPA.

6.0 DELIVERABLES

Information obtained during the assessment activities will be compiled in a site trip report. The trip report will include data collection methods, monitoring locations, data summary tables, and applicable maps. All project deliverables will receive an internal QC review prior to release, per guidelines established in the Tetra Tech START QAPP.

7.0 PROJECT SCHEDULE

All site activities are expected to require approximately 4 to 5 days to be completed, depending on access to residences and the number of homes to be assessed. Tetra Tech estimates that each assessment will take approximately 30 minutes per home and projects monitoring approximately 90 homes. Tetra Tech will provide EPA with a draft trip report within 10 days after all site activities are completed. Table 5 presents the required tasks and the anticipated timeframe for completing each task.

TABLE 5
PROJECT SCHEDULE

Task	Completion Timeframe
Receive and accept TDD	January 12, 2010
Attend kick-off/scoping meeting with EPA	February 2, 2010
Conduct site visit with EPA	TBD
Develop site health and safety plan	February 5, 2010
Submit draft Ambient Air Monitoring Plan to EPA for review	February 5, 2010
Finalize Ambient Air Monitoring Plan based on EPA review and comments	April 21, 2010
Mobilize to site	TBD
Conduct field work	1-5 days
Review/evaluate monitoring data	
Make recommendations regarding Tier 1 or Tier 2 action.	
Develop Tier 1 SAP (if necessary)	TBD
Remobilize for Tier 1 work (if necessary)	TBD
Conduct Tier 1 field work,(if necessary)	
Receive validated analytical data from Tier 1 work	28 days after laboratory receives samples
Evaluate validated data from Tier 1 work	5 days after data are received
Develop and submit trip report for Tier 1 work	30 days after validated data received
Write AOC and close out TDD	30 days after all work is completed

Notes:
AOC = Acknowledgement of completion
EPA = U.S. Environmental Protection Agency
RPM = Remedial Project Manager
SAP = Sampling and analysis plan
TBD = To be determined
TDD = Technical Direction Document

REFERENCES

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Tetra Tech EM Inc. (Tetra Tech). 2006. "Quality Assurance Project Plan [QAPP] for START." November.

Tetra Tech. 2008. "Recording of Notes in Field Logbook." Standard Operating Procedure (SOP) No. 024. Revision No. 1. December. Created on May 18, 1993.

Tetra Tech. 2009. "Organic Vapor Air Monitoring." SOP No. 003. Revision No. 3. July.

U.S. Geological Survey (USGS). 1967a. 7.5-Minute Series Topographic Map of Landsdowne, Pennsylvania, Quadrangle. Photorevised 1994.

USGS. 1967b. 7.5-Minute Series Topographic Map of Philadelphia, Pennsylvania–New Jersey Quadrangle. Photorevised 1994.

APPENDIX A

Tetra Tech SOP No. 024, “Recording of Notes in Field Logbook”

SOP APPROVAL FORM

TETRA TECH EM INC.

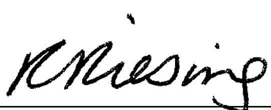
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING OF NOTES IN FIELD LOGBOOK

SOP NO. 024

REVISION NO. 1
May 18, 1993

Last Reviewed: December 2008



Quality Assurance Approved

December 5, 2008

Date

1.0 BACKGROUND

The field logbook should contain detailed records of all the field activities, interviews of people, and observations of conditions at a site. Entries should be described in as much detail as possible so that personnel can accurately reconstruct, after the fact, activities and events during their performance of field assignments. Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed; and they must reflect the importance of the field events.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that logbook documentation for any field activity is correct, complete, and adequate. Logbooks are used for identifying, locating, labeling, and tracking samples. A logbook should document any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel. They also serve as documentation of any photographs taken during the course of the project. In addition, the data recorded in the logbook may assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining good quality control. Quality control is enhanced by proper documentation of all observations, activities, and decisions.

1.2 SCOPE

This SOP establishes the general requirements and procedures for recording notes in the field logbook.

1.3 DEFINITIONS

None

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, N.Y.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Field logbooks
- Ballpoint pens with permanent ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers; they should have preprinted lines and wide columns. They should be approximately 7 1/2 by 4 1/2 inches or 8 1/2 by 11 inches in size. Loose-leaf sheets are not acceptable for field notes. If notes are written on loose paper, they must be transcribed as soon as possible into a regular field logbook by the same person who recorded the notes.

Logbooks can be obtained from an individual's office supply room or directly from outside suppliers. Logbooks must meet the requirements specified in this SOP and should include preprinted pages that are consecutively numbered. If the numbers must be written by hand, the numbers should be circled so that they are not confused with data.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites, designate a separate logbook for each subsite. For special tasks, such as periodic well water-level measurements, data from multiple subsites may be entered into one logbook that contains only one type of information.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.

- All field activities, meetings, photographs, and names of personnel must be recorded in the site logbook.
- Each logbook pertaining to a site or subsite should be assigned a serial number based on the date the logbook is issued to the project manager. The first issued logbook should be assigned number 1, the next issued logbook assigned number 2, and so on. The project manager is to maintain a record of all logbooks issued under the project.
- All information must be entered with a ballpoint pen with waterproof ink. Do not use pens with "wet ink," because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.
- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective.
- Begin a new page for each day's notes.
- Write notes on every line of the logbook. If a subject changes and an additional blank space is necessary to make the new subject title stand out, skip one line before beginning the new subject. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.
- Draw a diagonal line on any blank spaces of four lines or more to prevent unauthorized entries.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent with other field logbooks. Guidelines for the cover, spine, and internal pagination are discussed below.

2.2.1 FORMAT OF FIELD LOGBOOK COVER AND SPINE

Write the following information in clear capital letters on the front cover of each logbook using a Sharpie® or similar type permanent ink marker:

- Logbook identification number
- The serial number of the logbook (assigned by the project manager)
- Name of the site, city, and state
- Name of subsite if applicable
- Type of activity

- Beginning and ending dates of activities entered into the logbook
- “Tetra Tech EM Inc.” City and State
- “REWARD IF FOUND”

Some of the information listed above, such as the list of activities and ending dates, should be entered after the entire logbook has been filled or after decision that the remaining blank pages in the logbook will not be filled.

The spine of the logbook should contain an abbreviated version of the information on the cover: for example, “1, Col. Ave., Hastings, 5/88 - 8/88.”

2.2.2 First Page of the Field Logbook

Spaces are usually provided on the inside front cover (or the opening page in some logbooks), for the company name (“Tetra Tech EM Inc.”), address, contact name, and telephone number. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page.

2.3 ENTERING INFORMATION IN THE LOGBOOK

Enter the following information at the beginning of each day or whenever warranted during the course of a day:

- Date
- Starting time
- Specific location
- General weather conditions and approximate temperature
- Names of personnel present at the site. Note the affiliation(s) and designation(s) of all personnel
- Equipment calibration and equipment models used.
- Changes in instructions or activities at the site
- Levels of personal protective clothing and equipment

- A general title of the first task undertaken (for example, well installation at MW-11, decon at borehole BH-11, groundwater sampling at MW-11)
- Approximate scale for all diagrams. If this can't be done, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections. Label features on each diagram.
- Corrections, if necessary, necessarily including a single line through the entry being corrected. Initial and date any corrections made in the logbook.
- After last entry on each page, initials of the person recording notes. No information is to be entered in the area following these initials.
- At the end of the day, signature of the person recording notes and date at the bottom of the last page. Indicate the end of the work day by writing "Left site at (time)." A diagonal line must be drawn across any remaining blank space at the bottom of this last page.

The following information should be recorded in the logbook after taking a photograph:

- Time, date, location, direction, and, if appropriate, weather conditions
- Description of the subject photographed and the reason for taking the picture
- Sequential number of the photograph and the film roll number or disposable camera used (if applicable)
- Name of the photographer.

The following information should be entered into the logbook when collecting samples:

- Location description
- Name(s) of sampler(s)
- Collection time
- Designation of sample as a grab or composite sample
- Type of sample (water, sediment, soil gas, etc.)
- On-site measurement data (pH, temperature, specific conductivity)
- Field observations (odors, colors, weather, etc.)
- Preliminary sample description
- Type of preservative used
- Instrument readings.

If pre-printed field data forms are available (forms such as the micropurge field data collection form), data should be entered on these pre-printed forms rather than into field logbooks. Note in the logbook that the field data are recorded on separate forms.

2.4 PRECAUTIONS

Custody of field logbooks must be maintained at all times. Field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. Logbooks are official project documents and must be treated as such.

APPENDIX B

Tetra Tech SOP No. 003, “Organic Vapor Air Monitoring”

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

ORGANIC VAPOR AIR MONITORING

SOP NO. 003

REVISION NO. 3

Last Reviewed: July 2009

	July 28, 2009
Quality Assurance Approved	Date

1.0 BACKGROUND

Exposure to airborne organic contaminants can present a significant threat to worker health and safety. Identifying and quantifying these contaminants through air monitoring is essential for reconnaissance activities. Reliable measurements of airborne organic contaminants are necessary for selecting or upgrading personal protective equipment (PPE), delineating areas where protection is needed, assessing the potential health effects of exposure, and determining the need for specific medical monitoring. Organic vapor air monitoring is also commonly used as a screening tool to identify relatively impacted environmental media and to provide a real-time basis for selecting samples for chemical analysis.

Various types of air monitoring instruments are available for measuring organic vapors. Common organic vapor monitoring instruments used by Tetra Tech include HNu® or Photovac 2020ComboPRO® photoionization detectors (PID), Foxboro® organic vapor analyzer (OVA) flame ionization detectors (FID), Photovac MicroFID, and MiniRae 2000 or 3000 PIDs. It should be noted that this standard operating procedure (SOP) discusses only some of the air monitoring instruments available to field personnel. The particular type of meter or monitoring system to be used should be identified in the project work plan or field sampling plan and selected on a site-specific basis depending on the data collection needs, the types of organic vapors to be monitored, and the sampling procedures to be used.

1.1 PURPOSE

This SOP establishes the general requirements and procedures for using various instruments to conduct organic vapor air monitoring in the field. It also discusses general factors to consider when conducting organic vapor air monitoring.

1.2 SCOPE

This SOP applies to general procedures for calibrating and operating organic vapor air monitoring instruments in the field. The project work plan or field sampling plan should identify the types of instruments to be used and the actual project-specific field parameters to be measured. The project-specific health and safety plan should identify chemical-specific action levels for health and safety purposes. For each type of air monitoring instrument, the manufacturer's manual should be consulted for specific operating instructions.

1.3 DEFINITIONS

Flame ionization: A process by which a sample gas is ionized with a flame, allowing a count of carbon atoms to determine organic vapor concentration.

Flame ionization detector (FID): A portable instrument used to detect, measure, and provide a direct reading of organic vapor concentrations in a gas sample that is ionized with a flame.

Ionization potential: The amount of energy needed to strip an electron from the orbit of its resident molecule, expressed in electron volts.

Organic vapor: Airborne compounds composed of carbon, hydrogen, and other elements with chain or ring structures.

Organic vapor analyzer (OVA): A portable instrument used to detect, measure, and provide a direct reading of the concentration of a variety of trace organic gases in the atmosphere through flame ionization.

Photoionization: A process involving the absorption of ultraviolet light by a gaseous molecule, leading to ionization.

Photoionization detector (PID): A portable instrument used to detect, measure, and provide a direct reading of the concentrations of a variety of trace organic gases in the atmosphere through photoionization.

Breathing zone: The area where field workers would be inhaling potentially impacted air, generally from about 3 to 5 feet above the ground surface. The breathing zone will vary depending on the types of work activities being performed. Air monitoring is conducted in this zone to ensure that it is representative of the air being breathed by field team members.

Head space: The vapor mixture trapped above a solid or liquid in a sealed vessel.

1.4 REFERENCES

National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard, and U.S. Environmental Protection Agency (EPA). 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." U.S. Government Printing Office. Washington, DC.

1.5 REQUIREMENTS AND RESOURCES

The following items are typically required to monitor organic vapors in air using this SOP:

- Organic vapor air monitoring meter
- Manufacturer-supplied calibration gas
- Manufacturer-supplied calibration kits including tubing and regulators
- Resealable plastic bags for conducting soil head space measurements (if applicable)
- Sample jars for conducting water head space measurements (if applicable)
- Sharpie or similar type of permanent marker
- Container to collect soil or water used for head space measurements (if applicable)
- Logbook or field data sheets

2.0 APPLICATIONS, DETECTION METHODS, AND LIMITATIONS

All direct-reading instruments have inherent constraints in their ability to detect gaseous organic compounds. They usually detect and/or measure only specific classes of chemicals. Generally, they are not designed to measure and/or detect airborne concentrations below 1 part per million (ppm). Finally, many direct-reading instruments that have been designed to detect one particular substance also detect other substances, causing interference and possibly resulting in false readings. The following subsections discuss general application, detection methods, and limitations when using a PID and an OVA FID.

2.1 APPLICATION

The PID can be used to detect total concentrations of many organic and some inorganic gases and vapors. It can also be used in conjunction with other detection devices such as colorimetric indicator detector tubes to identify specific compounds (see SOP No. 065, Colorimetric Indicator Detectors [Dräeger Tubes]).

When set in the survey mode, the OVA FID can detect the total concentration of many organic gases and vapors. In the gas chromatography (GC) mode, the OVA FID can identify and measure the concentrations of specific compounds. In the survey mode, all organic compounds are ionized and detected at the same time. In the GC mode, volatile species are ionized and detected separately.

Each type of unit (PID or FID) has some limitations as to the detection of various categories of compounds or for specific organic compounds. Examples are described below in Section 2.2. The user manual for the specific instrument should be used to confirm its applicability for measurements of the organic vapors of concern at the site.

2.2 DETECTION METHODS

The PID ionizes molecules using ultraviolet (UV) radiation and can be used with a variety of electron voltage lamps best matched to the compound of concern at a site. The UV radiation strips electrons from the molecules, producing ions that produce a current proportional to the number of ions generated. The PID is more sensitive to aromatic and unsaturated compounds than the OVA FID. The PID is nonspecific for gas and vapor detection for organic and some inorganic compounds. The PID is also sensitive to 0.1 ppm of benzene. Sensitivity is related to the ionization potential of the compound being monitored. PIDs will only detect compounds that have ionization energies similar to the energy of the photons the detector uses. Gases with ionization potential values below the electron volt (eV) output of the lamp will be detected. The most common PID lamp used is the 10.6 eV lamp because it detects most volatile organic compounds; however, 9.5 eV and 11.7 eV lamps are also commonly available. It is recommended that the ionization potential of the chemicals of concern be known in order to select the most appropriate lamp for a specific project. Ionization potential information can be obtained from the vendor, in the manufacturer's manual, or on line (for example, at http://www.detectorsbyaic.com/ion_potential.html).

Organic gases and vapors are flame-ionized in the OVA FID. The ions produce a current that is proportional to the number of carbon atoms present. The current is interpreted by a deflection on the instrument's meter. In the survey mode, the OVA FID functions as a nonspecific total hydrocarbon analyzer. In the GC mode, the OVA FID can provide a tentative qualitative and quantitative identification of gases and vapors. The OVA FID is most sensitive to saturated hydrocarbons (alkanes), unsaturated hydrocarbons (alkenes), and aromatic hydrocarbons. The OVA FID is not suitable for inorganic gases such as chlorine, hydrogen cyanide, and ammonia. The OVA FID is also less sensitive to aromatics and unsaturated compounds than the PID. However, the OVA FID is less sensitive to high humidity than the PID. Gases and vapors that contain substituted function groups such as hydroxide (OH-) reduce the detector's sensitivity. Finally, if the operator monitors for a specific gas or vapor, the operator should use a calibration standard and GC column specific to that particular gas or vapor.

2.3 LIMITATIONS

The PID cannot be used to:

- Detect methane
- Detect a compound that has a higher energy level than the ionization potential of the PID light source
- Respond accurately to a mixture of gases or vapors
- Respond accurately in high humidity or very cold weather
- Respond accurately when interference from other sources is present

The OVA FID cannot be used to:

- Detect organic vapors at temperatures below 40 °F (4 °C)
- Identify specific organic vapors when operated in the survey mode; results must be reported relative to the calibration standard used (for example, as methane equivalents).
- Detect inorganic gases and vapors; the instrument also gives a lower response to oxygen-containing organic compounds (such as alcohols, ethers, and aldehydes) and nitrogen-containing organic compounds (such as amines, amides, and nitriles).

Detect high organic contaminant concentrations or detect contaminants in oxygen-deficient atmospheres; operation in these conditions requires system modification.

3.0 PROCEDURES

The procedures outlined in this SOP are general and typically apply to various types of monitoring instruments used to measure organic vapors in air. General procedures for testing and calibrating the instruments are presented first, followed by procedures for using the instruments and making field measurements, guidelines for recording information accurately, and a discussion of variables that may affect outdoor air monitoring. The particular monitoring instrument should be identified in the project work plan or field sampling plan and should be operated in accordance with the manufacturer's instruction manual.

3.1 TESTING AND CALIBRATION PROCEDURES

Each air monitoring instrument should be calibrated according to manufacturer's specifications. General procedures applicable to most equipment are as follows:

- Equipment should be thoroughly cleaned, and then calibrated and tested before the startup of sampling at each site.
- Equipment should be calibrated and tested using manufacturer-provided calibration gas and calibration connector kits.
- Batteries should be charged prior to startup of field work, and the battery charge level should be checked at the start of each day. The battery charge life will vary depending on the particular monitoring instrument to be used and the application.
- It is recommended that extra batteries be kept on hand when conducting field work.
- The PID can typically run continuously on a fully charged battery for at least 8 hours. The PID battery should be recharged for 14 hours.
- The OVA FID can typically run continuously on a fully charged battery for 8 hours alone or for 3 hours with a strip chart recorder. The OVA FID battery must be recharged every 8 hours or replaced, as needed.
- Calibration and testing of field equipment should be documented every time it is performed. Calibration and testing information should be recorded in field logbooks (or field data sheets, if applicable).
- If testing and calibration measurements are out of tolerance, the instrument must be serviced or repaired.

3.2 FIELD MEASUREMENT PROCEDURES

Each air monitoring instrument should be operated according to manufacturer's specifications. The actual field procedures will vary depending on the type of air monitoring to be conducted. Almost all PIDs and OVA FIDs have a recommended warm-up period (see the manufacturer's operations manual for the specific type of meter to be used). Similarly, many instruments are affected by moisture, humidity, and dust. The use of an external filter on the probe tip is recommended in these situations. Finally, many instruments include a data logging option that can be used, if desired. A general procedural summary for air monitoring associated with health and safety and field screening applications is presented below.

3.2.1 Health and Safety Monitoring

The site-specific health and safety plan will specify the types of contaminants of concern, health and safety related action levels, and the types of PPE necessary. The goal of air monitoring for health and safety purposes is to ensure that field work is conducted in accordance with the health and safety plan and to identify conditions where upgrading the level of PPE may be necessary. General procedures for conducting health and safety air monitoring for organic vapors are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment.
- Approach the sampling location from the upwind direction.
- Monitor organic vapors in the breathing zone (multiple levels of monitoring may be required depending on the work being performed).
- Monitor down-hole vapor concentrations, if drilling.
- Take readings at a frequency appropriate for the types of tasks being conducted, the types of organic vapors expected, and the levels of organic vapors being detected (monitor at a more frequent rate if organic vapors are detected and they are near the site-specific action levels specified in the health and safety plan).
- Record information in a field log book, on field data sheets, or on an air monitoring log sheet (record site name, date and time, sampling location, PID or FID readings, and pertinent weather information).
- Upgrade the level of PPE, implement engineering controls, or stop work if organic vapors are sustained in the breathing zone above action levels specified in the site-specific health and safety plan.

3.2.2 Field Screening

The site-specific work plan or field sampling plan will specify the media to be sampled, the sampling methods and procedures to be used, and field screening requirements. Typically, the goals of air monitoring for field screening purposes are to identify relatively higher organic vapor concentrations in soil, groundwater, or other media to select subsequent sampling locations, or to select environmental samples to send to a laboratory for chemical analysis. General procedures for conducting field screening air monitoring for organic vapors are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment.
- Work from the upwind direction, when possible.
- Directly screen soil cores or drill cuttings by running the tip of the meter along the soil surface while taking care not to get soil into the probe.
- Depending on sampling protocol, dig into or freshly "break" the soil and measure vapors at the newly exposed surface.
- When collecting soil samples for head space measurements, place soil in a resealable plastic bag, record the sampling location and depth on the bag with a Sharpie or other type of permanent marker, wait at least 5 minutes for vapors to accumulate (the bag may be placed in direct sunlight or in a warm area while waiting), shake the bag vigorously, and then insert the probe into the bag without placing the tip directly in the soil (while taking care not to let vapors escape).
- Directly screen purged well water (or surface water) by running the tip of the meter along the water surface while taking care not to get water into the probe.
- When collecting water samples for head space measurements, place water in a jar and tightly close the lid, record the sampling location and depth on the jar with a Sharpie or other type of permanent marker, wait at least 5 minutes for vapors to accumulate (the jar may be placed in direct sunlight or in a warm area while waiting), shake the jar vigorously, and then slightly open the lid and insert the probe into the jar without placing the tip directly in the water (while taking care not to let vapors escape).
- Record information in a field log book, on field data sheets, or on an air monitoring log sheet (record site name, date and time, sampling location, PID or FID readings, and pertinent weather information).

3.3 ACCURATE RECORDING AND INTERPRETATION

Direct-reading instruments must be operated and the data interpreted by individuals who understand the operating principles and limitations of the instruments. At hazardous waste sites, where unknown and multiple contaminants are frequently encountered, instrument readings should be interpreted conservatively.

The following guidelines promote accurate recording and interpretation:

- Calibrate instruments in accordance with the manufacturer's instructions before and after every use.
- Conduct additional monitoring at any location where a positive response occurs.
- Report a reading of zero as nondetectable (ND) rather than as "clean." Quantities of chemicals may be present but at concentrations that are not detectable by the instrument.
- Repeat the air monitoring survey using other detection devices.

3.4 VARIABLES AFFECTING OUTDOOR AIR MONITORING

Complex environments containing many substances, such as those associated with hazardous waste sites, pose significant challenges to accurately and safely assess airborne contaminants. Several independent and uncontrollable variables (most notably temperature and weather conditions) can affect airborne concentrations. These factors must be considered when conducting air monitoring and interpreting data. The following environmental variables must be considered:

- **Temperature:** An increase in temperature increases the vapor pressure of most chemicals.
- **Wind speed:** An increase in wind speed can affect vapor concentration near a free-standing liquid surface. Dust and particulate-bound contaminants are also affected.
- **Rainfall:** Water from rainfall can essentially cap or plug vapor emission routes from open or closed containers, saturated soil, or lagoons, thereby reducing airborne emissions of certain substances.
- **Moisture:** Dusts, including finely divided hazardous solids, are highly sensitive to moisture. Moisture can vary significantly with respect to location and time and can also affect the accuracy of many sampling results.

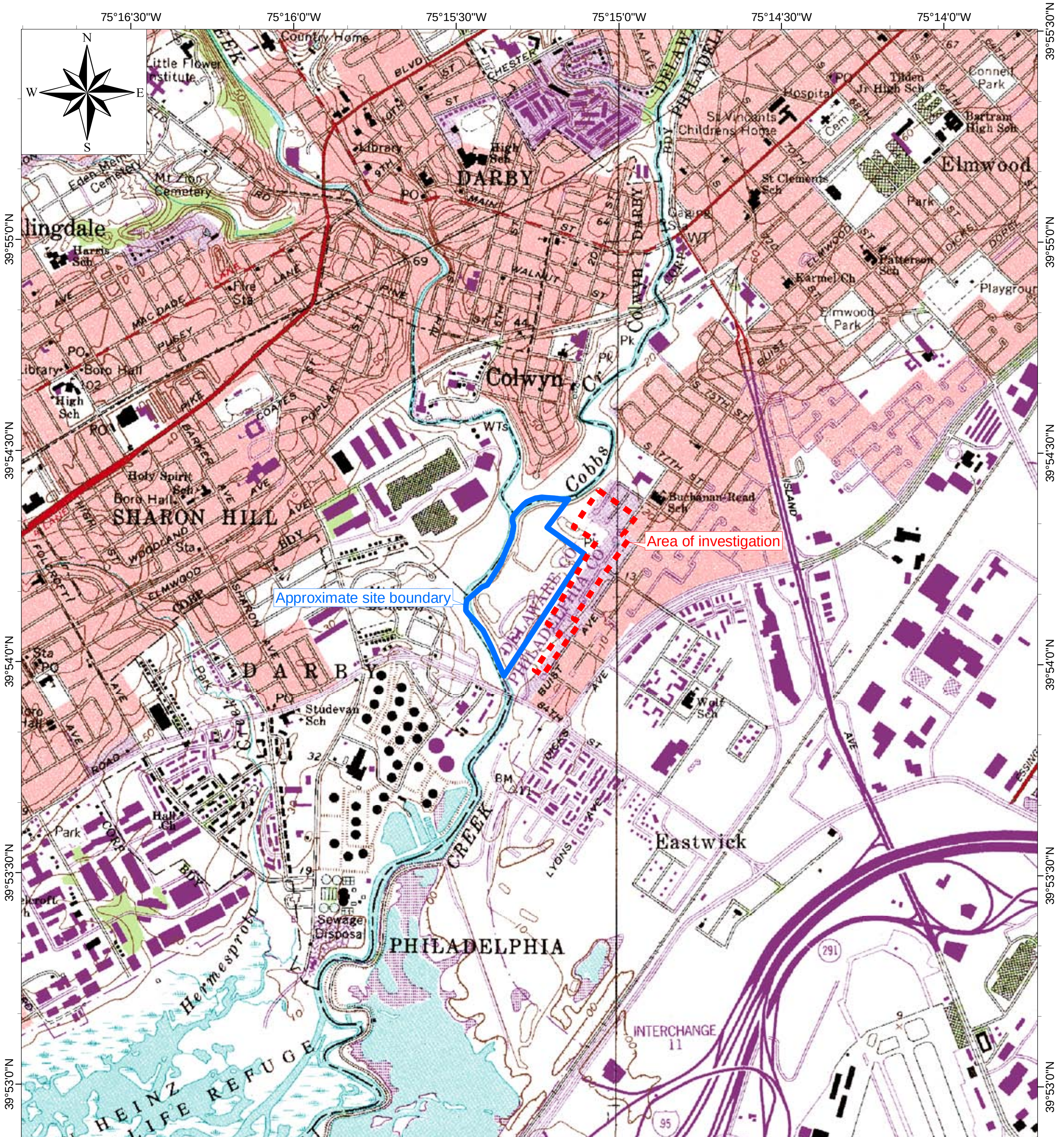
- **Background vapor emissions:** Vapor emission from other activities in the area of the field investigations can also impact readings. Operations such as vehicle maintenance or fueling facilities can affect readings associated with perimeter monitoring.

- **Work activities:** Work activities often require the mechanical disturbance of contaminated materials, which may change the concentration and composition of airborne contaminants and contribute to airborne emissions. Organic air emissions at a work site can also occur from operation of gasoline or diesel engines.

These conditions should be reported with organic vapor readings to provide a more accurate interpretation of monitoring results.

APPENDIX C

FIGURES



Source: Modified from USGS 7.5-Minute Topographic Series Quadrangles: Lansdowne, Pennsylvania, 1967, Photorevised 1994; Philadelphia, Pennsylvania-New Jersey, 1967, Photorevised 1994

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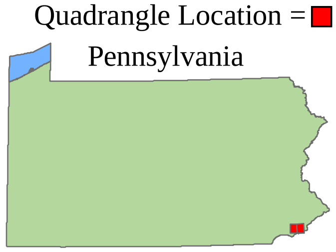
Quadrangle Location = ■



Lower Darby Creek Area - Clearview Landfill Site
Delaware and Philadelphia Counties, Pennsylvania

Figure 1
Site Location Map

TDD No. E43-028-10-01-001
EPA Contract No. EP-S3-05-02

Map created on January 29, 2010
by D. Call, Tetra Tech EM Inc.

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APPENDIX D

START QAPP and UFP QAPP Manual Cross-Reference Table

Appendix D
Quality Assurance Cross-Reference Table
Lower Darby Creek Area – Clearview Landfill Indoor Ambient Air Monitoring Plan

Required QAPP Element(s) and Corresponding QAPP Section(s) in UFP QAPP Manual	Required Information	Cross-Reference Section(s)	
		START QAPP	LDCA - Clearview Landfill IAMP
Project Management and Objectives			
2.1 Title and Approval Page	Title and Approval Page	Page i Contents	Page i Contents
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	Table of Contents QAPP Identifying Information	Page i Contents	Page i Contents
2.3 Distribution List and Project Personnel Sign Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign Off Sheet	Distribution List Project Personnel Sign Off Sheet	Not Applicable	Not Applicable
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	Project Organizational Chart Communication Pathways Personnel Responsibilities and Qualifications Special Training Requirements Table	1.1 Project and Task Organization 1.5 Special Training and Certification	Section 5.1 Responsibilities
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	Project Planning Session Documentation Project Scoping Session Documentation Problem Definition, Site History and Background Site Maps	1.2 Problem Definition and Background 1.3 Project and Task Description	Section 2.0 Background
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives 2.6.2 Measurement Performance Criteria	Site Specific Project Quality Objectives Measurement Performance Criteria	1.4 Quality Objectives and Criteria for Measurement Data	Not Applicable
2.7 Secondary Data Evaluation	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Not Applicable	Not Applicable
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	Summary of Project Tasks Project Schedule/Timeline Table	Not Applicable	Section 7.0 Project Schedule

Appendix D Quality Assurance Cross-Reference Table Lower Darby Creek Area – Clearview Landfill Indoor Ambient Air Monitoring Plan (continued)			
Required QAPP Element(s) and Corresponding QAPP Section(s) in UFP QAPP Manual	**Required Information**	**Cross-Reference Section(s)**	
		START QAPP	**LDCA - Clearview Landfill IAMP**
Measurement/Data Acquisition			
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume and Preservation 3.1.2.3 Equipment/Sample Containers 3.1.2.4 Field Equipment Calibration, Maintenance, Testing and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	Sampling Process Design and Rationale Sample Location Map Sample Locations Methods/SOP Field Quality Control Analytical Methods/SOP Field Quality Control Sample Summary Table Field Equipment Calibration, Maintenance, Testing and Inspection Procedures Project Sampling SOP	2.1 Sampling Process Design 2.2 Sampling Methods 2.6 Instrument and Equipment Testing, Inspection and Maint.	Section 4.0 Proposed Field Investigation
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Calibration Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	Analytical SOPs & References Table Analytical Instrument Calibration Table Analytical Instrument and Equipment Calibration, Maintenance, Testing, and Inspection Table	2.4 Analytical Methods 2.6 Instrument and Equipment Testing, Inspection and Maintenance 2.7 Instrument and Equipment Calibration and Frequency 2.8 Inspection and Acceptance of Supplies and Consumables	Not Applicable
3.3 Sample Containers Documentation, Handling, Tracking and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	Sample Collection & Handling SOPs Sample Container Identification Chain of Custody Forms & Procedures	2.3 Sample Handling and Custody	Not Applicable
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	QC Samples List or Table Screening/Confirmatory Analysis	2.5 Quality Control	Not Applicable

Appendix D Quality Assurance Cross-Reference Table Lower Darby Creek Area – Clearview Landfill Indoor Ambient Air Monitoring Plan (continued)			
Required QAPP Element(s) and Corresponding QAPP Section(s) in UFP QAPP Manual	**Required Information**	**Cross-Reference Section(s)**	
		START QAPP	**LDCA - Clearview Landfill IAMP**
Measurement/Data Acquisition (continued)			
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	Project Documents and Records Analytical Services Data Management SOPs	1.6 Documentation and Records 2.9 Non-Direct Measurement 2.10 Data Management	Section 5.3 Data Evaluation and Management
Assessment/Oversight			
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	Assessments and Response Actions Planned Project Assessments Table Audit Checklists Assessment Findings and Corrective Action Reponses Table	3.1 Assessment and Response Actions	Not Applicable
4.2 QA Management Reports	QA Management Reports Table	3.2 Reports to Management	Not Applicable
4.3 Final Project Report		Not Applicable	Section 6.0 Deliverables
Data Review			
5.1 Overview			
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa: Validation Activities 5.2.2.2 Step IIb: Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitation and Actions from Usability Assessment 5.2.3.2 Activities	Verification (Step I) Process Table Validation (Steps IIa and IIb) Process Table Validation (Steps IIa and IIb) Summary Table Usability Assessment	4.1 Data Review and Reduction Requirements 4.2 Validation and Verification Methods 4.3 Reconciliation and User Requirements	Not Applicable
5.3 Streamlining Data Review 5.3.1 Data Review Steps to be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		Not Applicable	Section 6.0 Deliverables

Notes: START = Superfund Technical Assessment and Response Team
QAPP = Quality Assurance Project Plan
UFP = Uniform Federal Policy
SAP = Sampling and Analysis Plan
SOP = Standard Operating Procedure

ATTACHMENT

TETRA TECH FIELD DATA SHEETS

Indoor Air Quality Assessment Data Sheet
Lower Darby Creek Area

Investigation Zones	Monitoring Date	Monitoring Time	Station Location	Methane Concentration (ppmv)	Tier 1 Action Level Exceeded - Further VI Assessment Sustained concentrations of 3 parts per million (ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>1.25% by volume in air (12,500 ppm])	Carbon Dioxide Concentration (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1200 ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>2% by volume in air [20,000 ppm])	Oxygen (%)	Tier 1 Action Level Exceeded - Further VI Assessment (< 19.6% to 20.6%, > 21%)	Tier 2 Action Level Exceeded - ER Action Needed <19.7% and >23.3%	Combustible Gas (%LEL)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1%)	Tier 2 Action Level Exceeded - ER Action Needed (> 4% of combustible gas in air)	Total volatile organic compounds (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (10 x background)	Tier 2 Action Level Exceeded - ER Action Needed (100 x background)
SATURN PLACE			LD-OAA-SP-1															
			LD-OAA-SP-2															
			LD-OAA-SP-3															
			LD-IAA-SP-1															
			LD-IAA-SP-2															
			LD-IAA-SP-3															
			LD-IAA-SP-4															
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			LD-IAA-SP-27															
			LD-IAA-SP-28															
			LD-IAA-SP-29															
VENUS PLACE			LD-OAA-VP-1															
			LD-IAA-VP-1															
			LD-IAA-VP-2															
			LD-IAA-VP-3															
			LD-IAA-VP-4															
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			LD-IAA-VP-21															
			LD-IAA-VP-22															

Indoor Air Quality Assessment Data Sheet
Lower Darby Creek Area

Investigation Zones	**Monitoring Date**	**Monitoring Time**	**Station Location**	Methane Concentration (ppmv)	Tier 1 Action Level Exceeded - Further VI Assessment Sustained concentrations of 3 parts per million (ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>1.25% by volume in air (12,500 ppm])	Carbon Dioxide Concentration (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1200 ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>2% by volume in air [20,000 ppm])	Oxygen (%)	Tier 1 Action Level Exceeded - Further VI Assessment (< 19.6% to 20.6%, > 21%)	Tier 2 Action Level Exceeded - ER Action Needed <19.7% and >23.3%	Combustible Gas (%LEL)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1%)	Tier 2 Action Level Exceeded - ER Action Needed (> 4% of combustible gas in air)	Total volatile organic compounds (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (10 x background)	Tier 2 Action Level Exceeded - ER Action Needed (100 x background)
MARS PLACE NORTH			LD-OAA-MP-1															
			LD-OAA-MP-2															
			LD-IAA-MP-1															
			LD-IAA-MP-2															
			LD-IAA-MP-3															
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			LD-IAA-MP-14															
			LD-IAA-MP-15															
			LD-IAA-MP-16															
MARS PLACE SOUTH			LD-OAA-MP-3															
			LD-OAA-MP-4															
			LD-OAA-MP-5															
			LD-IAA-MP-17															
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			LD-IAA-MP-33															
			LD-IAA-MP-34															
			LD-IAA-MP-35															
			LD-IAA-MP-36															
			LD-IAA-MP-37															
			LD-IAA-MP-38															
			LD-IAA-MP-39															
			LD-IAA-MP-40															
			LD-IAA-MP-41															
			LD-IAA-MP-42															
			LD-IAA-MP-43															
			LD-IAA-MP-44															
			LD-IAA-MP-45															
			LD-IAA-MP-46															
			LD-IAA-MP-47															

Indoor Air Quality Assessment Data Sheet
Lower Darby Creek Area

Investigation Zones	Monitoring Date	Monitoring Time	Station Location	Methane Concentration (ppmv)	Tier 1 Action Level Exceeded - Further VI Assessment Sustained concentrations of 3 parts per million (ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>1.25% by volume in air (12,500 ppm])	Carbon Dioxide Concentration (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1200 ppm)	Tier 2 Action Level Exceeded - ER Action Needed (>2% by volume in air [20,000 ppm])	Oxygen (%)	Tier 1 Action Level Exceeded - Further VI Assessment (< 19.6% to 20.6%, > 21%)	Tier 2 Action Level Exceeded - ER Action Needed <19.7% and >23.3%	Combustible Gas (%LEL)	Tier 1 Action Level Exceeded - Further VI Assessment (> 1%)	Tier 2 Action Level Exceeded - ER Action Needed (> 4% of combustible gas in air)	Total volatile organic compounds (ppm)	Tier 1 Action Level Exceeded - Further VI Assessment (10 x background)	Tier 2 Action Level Exceeded - ER Action Needed (100 x background)
ANGELO PLACE			LD-OAA-AP-1															
			LD-OAA-AP-2															
			LD-IAA-AP-1															
			LD-IAA-AP-2															
			LD-IAA-AP-3															
			LD-IAA-AP-4															
			LD-IAA-AP-5															
			LD-IAA-AP-6															
			LD-IAA-AP-7															
			LD-IAA-AP-8															
			LD-IAA-AP-9															
			LD-IAA-AP-10															
			LD-IAA-AP-11															
			LD-IAA-AP-12															
			LD-IAA-AP-13															
			LD-IAA-AP-14															
BUIST AVE			LD-OAA-BA-1															
			LD-IAA-BA-1															
			LD-IAA-BA-2															
			LD-IAA-BA-3															
			LD-IAA-BA-4															
			LD-IAA-BA-5															
			LD-IAA-BA-6															
			LD-IAA-BA-7															
			LD-IAA-BA-8															
E. PARK			LD-IAA-EP-1															

Methane Analyzer (Photovac MicroFID)
Landtec GEM2000+
RAE Systems MultiRAE Plus