June 16, 2026

Mr. Cole Devine
On Scene Coordinator
U.S. Environmental Protection Agency, Region 3
Superfund and Emergency Management Division
Four Penn Center
1600 John F. Kennedy Boulevard
Philadelphia, Pennsylvania 19103

Subject: **Air Monitoring Plan – Revision 1**
Fairmont Brine Removal Support
EPA Contract No. 68HE0320D0003
Technical Direction No. T601-24-12-003
Document Tracking No. 1063

Dear Mr. Devine:

Tetra Tech, Inc. submits the enclosed Air Monitoring Plan (AMP), Revision 1 for your review to support sampling activities at the Fairmont Brine Removal Site in Fairmont, Marion County, West Virginia. This revision captures changes requested for the Spring 2026 remobilization. If you have any questions regarding this plan, please contact me via phone at [redacted] or email at [redacted]

[redacted]

[redacted]
Project Manager

Enclosure (1)

cc: TD file
[redacted], Tetra Tech Program Manager
[redacted] Tetra Tech Administrative Assistant
Tetra Tech Quality Assurance Officer

AIR MONITORING PLAN
FAIRMONT BRINE SITE
FAIRMONT, MARION COUNTY, WEST VIRGINIA

Prepared for:
U.S. ENVIRONMENTAL PROTECTION AGENCY
Superfund and Emergency Management Division
Region 3
Four Penn Center
1600 John F. Kennedy Boulevard
Philadelphia, Pennsylvania 19103

REVISION 1

CONTRACT NO.:	68HE0320D0003	
TECHNICAL DIRECTION NO.:	T601-24-12-003	
EPA ON SCENE COORDINATOR:	Cole Devine	
SITE NAME:	Fairmont Brine Removal Support	
SITE LOCATION:	Fairmont, Marion County, West Virginia	
ACTIVITIES:	Removal Oversight	
DATES:	February 2025 – July 2026	
PREPARER:	Jessie Smith	
SIGNATURE/DATE:	[redacted]	[redacted]
QUALITY ASSURANCE OFFICER:	[redacted]	
SIGNATURE/DATE:	[redacted]	[redacted]
EPA OSC APPROVAL SIGNATURE/DATE:		
DOCUMENT TRACKING NO.:	1063_Revision 1	

CONTENTS

1.0 INTRODUCTION

Under the Superfund Technical Assessment and Response Team (START) Contract No. 68HE0320D0003, Technical Direction (TD) No. T601-24-12-003, U.S. Environmental Protection Agency (EPA) Region 3 tasked Tetra Tech, Inc. (Tetra Tech) to prepare an Air Monitoring Plan (AMP) for the Fairmont Brine Removal Site (the Site) (EPA Identification Number VAN00306050) in Fairmont, Marion County, West Virginia (Appendix A, Figure 1). This AMP details air monitoring actions on the Site.

The objective of the removal action is to remove material from the Site that is contaminated with significant technologically enhanced naturally occurring radioactive material (TENORM). The air monitoring program will proceed throughout work on the Site. This air monitoring will help ensure the safety of all on-site personnel, as well as the public safety of surrounding residents and passersby by monitoring any off-site migration of contamination in the air. Activities described in this AMP are designed to detect dust and radiological particulate matter around the perimeter of the Site and to document potential contamination leaving the Site during the removal action.

This AMP discusses the project scope of work in Section 2.0, outlines the background in Section 3.0, presents field air monitoring activities and procedures in Section 4.0, describes equipment decontamination in Section 5.0, discusses disposal of investigation-derived waste (IDW) in Section 6.0, conveys quality assurance/quality control (QA/QC) procedures in Section 7.0, specifies deliverables in Section 8.0, and lists sources of citations in the text in Section 9.0.

All figures for this AMP are in Appendix A. Tetra Tech standard operating procedures (SOPs) to be implemented during the investigation are in Appendix B.

2.0 SCOPE OF WORK

This section describes air monitoring activities to occur for the duration of removal activities on the Site. Site-specific air monitoring procedures described in this AMP accord with the Tetra Tech Program Quality Assurance Project Plan (QAPP) (Tetra Tech 2024).

The EPA On Scene Coordinator (OSC) tasked START to conduct air monitoring activities for the duration of work on the Site to protect the health and safety of on-site and off-site personnel. The following tasks are to be conducted to achieve this objective:

- Document work zone activities, recording field notes in a logbook in accordance with SOP 024-4 *Recording Notes in Logbooks* (Appendix B).
- Provide air monitoring support, applying a variety of methods as described below.
    - Maintain a network of up to four stations to monitor perimeter dust levels around the work area. Place the four units as follows: upwind, downwind, crosswind left, and crosswind right (when facing downwind). Based on wind direction, position the monitoring stations at various locations around the edge of the upper complex (Appendix A, Figure 3). If only using two stations, they will be placed at an upwind and a downwind location around the upper complex. The number of stations set up will be at the discretion of the OSC on-site.
    - Record station locations using EPA geodatabase and site tablet.
    - Capture radioactive particles for later analysis or screening.

Additional discussion of air monitoring activities is in Section 4.0.

3.0 BACKGROUND

This section specifies the location of the Site and describes it, conveys the history of the Site, and recounts previous investigation activities associated with and performed at the Site.

3.1 SITE LOCATION AND DESCRIPTION

The Site is at 168 AFR Drive, Fairmont, Marion County, West Virginia, at 39.50870 degrees North and 80.12709 degrees West on the northern edge of the town of Fairmont (Appendix A, Figure 1). The Site is bounded north by forest and residential property, east by grassland and forest land, south by forest and residential properties, and west by forest and the Monongahela River (Appendix A, Figure 2).

3.2 SITE HISTORY AND INVESTIGATIONS

Fairmont Brine Processing, LLC (FBP) previously operated and maintained a facility at the Site where it accepted flowback and produced fluids (brine) used in a hydraulic fracturing process to extract natural gas. Produced fluids from fracking operations can contain TENORM. FBP used chemical and carbon filter media, multiple-effect evaporation, and crystallization to treat and process the brine it received. This produced sodium chloride, calcium chloride, and distilled water. Byproducts created from the process include wastewater treatment sludge and filter cake material. The facility has been closed since 2018.

Since closure, the West Virginia Department of Environmental Protection (WVDEP) has issued multiple violations to FBP, including failure to comply with the Site's National Pollution Discharge Elimination System (NPDES) permit and failure to pump water from overflowing retention ponds (WVDEP 2018). During an unscheduled visit to the Site in January 2020, the West Virginia Department of Health (WVDH), formerly known as the West Virginia Department of Health and Human Resources (WVDHHR), and WVDEP assessed the radiation contamination and determined that the facility is a health risk to the community and environment because of detected radiation levels of standing water in buildings and filter cake material. Additionally, overflowing settling impoundments were observed (WVDHHR 2020). On December 29, 2020, the property was sold to Glen Elk Village Development Association, the current owner.

During an inspection on March 16, 2021, WVDEP observed both on-site impoundments overflowing onto the ground surface. Seeps downhill of the impoundments were flowing into a roadside conveyance that ultimately discharges into the Monongahela River (WVDHHR 2021). In May 2023, a consent order was issued by WVDEP to visually monitor the impoundment areas and properly dispose of the fluids (WVDEP 2023).

In May 2023, a fire broke out at the Site, damaging parts of the facility's upper complex. EPA, WVDEP, WVDH, and local first responders responded to the fire. At this response, EPA determined that the Site posed a risk to public health because of its lack of security (for example, no fence and an open gate) and evidence of trespassing throughout the Site (garbage throughout buildings). WVDEP and WVDH requested EPA assistance at the Site.

In September 2023, EPA performed an emergency activation under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to take immediate actions to secure the Site. Intermittent EPA cleanup and removal actions have occurred since then.

The Site encompasses approximately 24 acres and hosts numerous structures and retention impoundments in varying degrees of disrepair. Currently, the Site is secured. The treated fracking brine and process materials are classified as TENORM. Radionuclide-contaminated soils and impoundment water and sediments remain at the Site; the removal process is ongoing. Additional impoundment water and soil investigations are necessary to delineate extents of contamination.

4.0 FIELD AIR MONITORING ACTIVITIES AND PROCEDURES

Tetra Tech will conduct perimeter air monitoring during removal operations at the Site. Air monitoring tasks are discussed below. The EPA Emergency Response and Rapid Services contractor or their subcontractor will also conduct air monitoring within the exclusion zone to ensure safety of personnel.

4.1 EXCLUSION ZONE AND PERIMETER AIR MONITORING

Site perimeter air monitoring will occur during removal activities with the potential to generate dust. Tetra Tech will conduct work-area perimeter air monitoring for particulate matter during removal activities to document and assess the possibility of off-site migration of airborne contaminants. Site perimeter monitoring will use stationary instruments around the outside of the Site. Air monitoring will accord with SOP073-3 *Air Quality Monitoring* (Appendix B).

Tetra Tech will deploy up to four air monitoring stations. The purpose of each monitoring station is to provide coverage of the work area and to collect data about dust and potential radioactive particulates leaving the Site. Proposed air monitoring station locations are planned for one downwind, one upwind, and two crosswinds of the exclusion zone according to daily weather forecasts. Additional allowances may be required for station placement because the terrain is hilly and not level. The planned exclusion zone appears in Figure 3 in Appendix A.

4.2 DUST TRAK AIR MONITORING

Tetra Tech will deploy a DustTrak II 8530 or equivalent with an impactor plate designed to capture particulate matter less than 10 micrometer (μm) in diameter (PM_{10}) at each air monitoring station to assess suspended particulates in real time. Particulate concentrations will be recorded as a 1-minute Time-Weighted Average (TWA). The DustTrak II 8530 will be used to assess PM_{10}

particulates. PM_{10} particulate concentrations will be recorded and reviewed daily. Tetra Tech personnel will download data daily utilizing a site-specific Universal Serial Bus (USB) drive or personnel laptop to be maintained by the Field Team Leader or Project Manager.

Particulate monitors are factory calibrated and therefore do not require field calibration. However, particulate monitors do require zeroing to ambient conditions, which will occur daily before use. Tetra Tech personnel will periodically check the equipment to ensure it is operating properly, the filters are not overloaded, and they are acquiring data. Real-time readings will be recorded on the device for download onto a computer at the end of each workday. Data irregularities and problems will be identified, investigated, addressed, and documented.

Measurements of PM_{10} particulates by the DustTrak will be compared to the Site action level to determine if dust is a hazard to Site personnel or migrating off-site, and if mitigation methods are required. If PM_{10} measurements exceed the action level, work will cease until the implementation of dust suppression measures. The action level for the exclusion zone at the Site will be 2.5 milligrams per cubic meter (mg/m^3). This is a more conservative value than 4.5 mg/m^3, which was calculated based on the maximum observed on-site concentration of radium-226, radium-228, and daughters.

Based on the National Ambient Air Quality Standards for respirable dust, dust action levels are set at 0.150 mg/m^3 on the 24-hour PM_{10} scale for perimeter monitoring. The action level of 0.150 mg/m^3 PM_{10} will be established for the perimeter DustTrak units.

4.3 RADIOLOGICAL MATERIAL AIR MONITORING

Air monitoring for radiological materials will occur during work activities by using a low-volume air sampler to collect daily perimeter air samples at all perimeter air stations. Specialized paper mesh filters will be placed at inlets of the samplers to collect any radioactive particles. These samplers will be placed onto the tripod with the DustTrak units. Perimeter air monitoring systems should collect a minimum of approximately 20,000 liters to achieve a minimum detectable activity (MDA) of the effluent criteria for radium-226.

Counts of alpha and beta activities on air sample filters will occur on a Ludlum 3030 sample counter or equivalent for gross alpha and beta activity. Background and sample count times will be determined to reach an MDA of the effluent criteria associated with radium-226, 9E-13 microCuries per milliliter (µCi/mL), as listed in the Title 10 *Code of Federal Regulations* (10 CFR) Part 20, Appendix B Table 2 "Effluent Concentrations" for the Site. The counts of alpha and beta activities on a filter will occur on a Ludlum 3030 sample counter no less than 96 hours after sample collection to allow for sufficient decay of radon progeny. The final count of alpha activity will be converted to airborne concentration and compared to the appropriate action level. The OSC will be notified of any elevated counts on air filters and will decide if filters should be analyzed by laboratories for isotopic identification.

5.0 EQUIPMENT DECONTAMINATION

Perimeter air monitoring equipment will be set outside of the work zone around the perimeter of the Site. Air monitoring equipment will be scanned for radioactive contamination and will not be released from the Site until achievement of surface radioactivity standards for clearance. These standards and the procedure for scanning equipment for release from the Site will be specified in the site-specific Health and Safety Plan (HASP). Decontamination will follow Tetra Tech SOP No. 002-6 *General Equipment Decontamination* (Appendix B).

6.0 DISPOSAL OF INVESTIGATION-DERIVED WASTE

Disposable PPE generated during field activities will be rendered unusable by tearing (when appropriate), bagged in garbage bags, and disposed of in on-site garbage containers.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

This section describes QA/QC procedures for air monitoring activities at the Site. Monitoring QC procedures, field QC procedures, and data evaluation and management will accord with the EPA Region 3 START VI QAPP (Tetra Tech 2024).

7.1 RESPONSIBILITIES

The Tetra Tech Project Manager will be responsible for ensuring maintenance of data quality and integrity, in accordance with data documentation procedures in the QAPP (Tetra Tech 2024). All QA/QC activities will accord with the Site AMP and the QAPP (Tetra Tech 2024). The field monitoring team will maintain copies of the Site HASP and this AMP on the Site for immediate reference in resolving any QA/QC issues that may arise during field activities.

7.2 AIR MONITORING DATA

Dust Trak data will be downloaded from Dust Trak units onto a computer daily by use of an on-site flash drive or USB computer cable. The data then will be processed from the flash drive or USB computer cable by using TrakPro software. This data will then be processed and saved onto a Tetra Tech server and made available to EPA upon request.

Low-volume air-sampler data results will be recorded in the Site logbook, data spreadsheets, and Survey 123. Any detections above background will be reported, as well as locations of detections (wind direction and cardinal direction). A compiled Excel spreadsheet of these readings will be maintained as well.

8.0 DELIVERABLES

If requested by the OSC, Tetra Tech will prepare a removal after-action report summarizing monitoring activities completed as outlined in the AMP and HASP for removal support at the Site. The report will include maps, sketches, and a data table summarizing analytical and air monitoring results. Tetra Tech will provide EPA with Excel spreadsheets that include air monitoring results and calculations obtained during the removal activities. Tetra Tech will upload DustTrak daily maximums and TWA and air sample results exceeding background counts per minute to an online platform as directed by EPA. Tetra Tech will provide EPA with a final report that incorporates any EPA comments.

9.0 REFERENCES

Tetra Tech, Inc. (Tetra Tech). 2024. *Final Uniform Federal Policy Program Quality Assurance Project Plan*. EPA Region 3 Superfund Technical Assessment and Response Team (START VI Contract). Revision 5. December 12.

West Virginia Department of Environmental Protection (WVDEP). 2018. *Notice of Violation to Fairmont Brine Processing.* Environmental Enforcement. February.

WVDEP. 2023. *Consent Order Issued Under the Water Pollution Control and Groundwater Protection Acts, West Virginia to Fairmont Brine Processing. Code Chapter 22, Articles 11 and 12*. Division of Water and Waste Management. May.

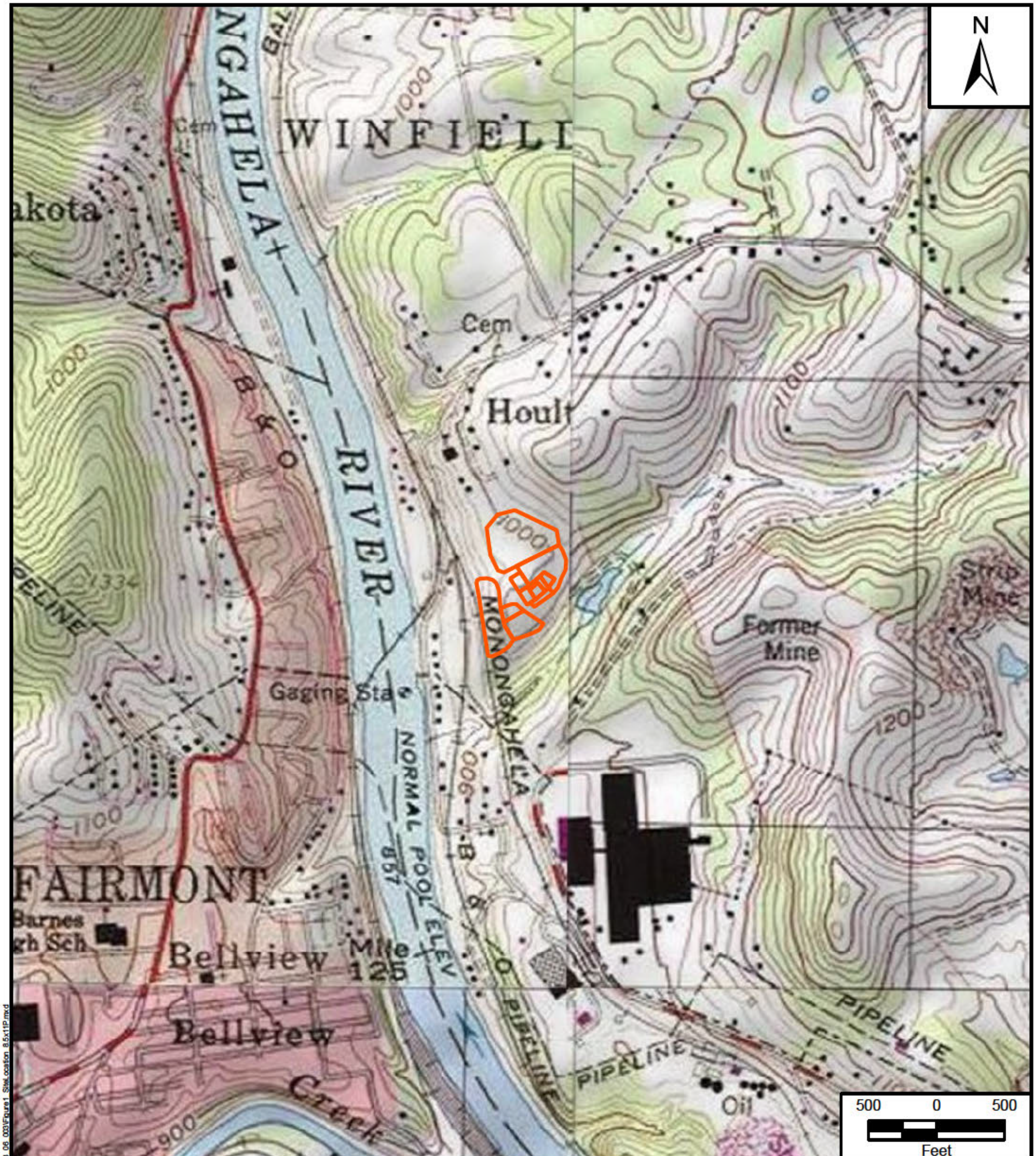
West Virginia Department of Health and Human Resources (WVDHHR). 2020. *Compliance Notice to Fairmont Brine Processing.* Bureau for Public Health, Office of Environmental Health Services. February.

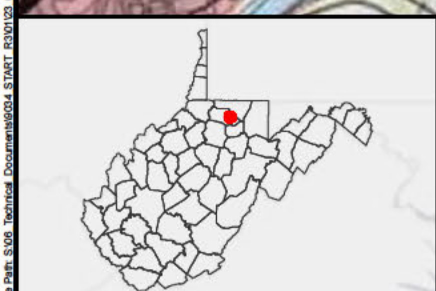
WVDHHR. 2021. *Site Visit Memorandum*. Bureau for Public Health, Office of Environmental Health Services. June.

APPENDIX A

FIGURES

1. Site Location Map
2. Site Layout Map
3. Site Control Zones





Site Areas

Source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Fairmont Brine Radiological Site
Fairmont, Marion County, West Virginia

Figure 1
Site Location

TETRA TECH

Prepared For: EPA R3 START VI | Prepared By: [redacted]

File Path: S:\06_Technical_Documents\9034_START_R3\01\23_06_003\Figure1_SiteLocation_8.5x11P.mxd

Date Saved: 07/07/23 | EPA Contract No: 68-HE-032-D0003 | TD No: T601-23-06-003 | Coordinate System: NAD 1983 2011 StatePlane West Virginia North FIPS [redacted]

Site Areas

Source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Fairmont Brine Air Monitoing Plan
Fairmont, Marion County, West Virginia

Figure 2
Site Layout

TETRA TECH

Prepared For: EPA R3 START VI | Prepared By: [redacted]

File Path: S:\06_Technical_Documents\9034_START_R3\01\23_06_003\Figure2_SiteLayout_8.5x11P.mxd

Date Saved: 07/07/23

EPA Contract No: 68-HE-032-D0003 TD No: T601-23-06-003

Coordinate System: NAD 1983 2011 StatePlane West Virginia North FIPS 4701 FtUS

Source: World Light Gray Canvas Base: Esri, HERE, Garmin, USGS, EPA
World Imagery: Microsoft, Vantor

Fairmont Brine Air Monitoring Plan
Fairmont, Marion County, West Virginia

Figure 3
Site Control Zones

TETRA TECH

Prepared For: EPA R3 START VI [redacted]

File Path: S:\06 Technical Documents\9034 START R301124 12 003\Fairmont\Fairmont.aprx

Date Saved: 05/14/26

EPA Contract No: 68-HE-0320-D0003 TD No: T601-23-06-003

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

APPENDIX B

TETRA TECH STANDARD OPERATING PROCEDURES

1. SOP024-4 *Recording Notes in Logbooks*, 2022
2. SOP073-3 *Air Quality Monitoring*, 2023
3. SOP002-6 *General Equipment Decontamination*, 2023

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING NOTES IN FIELD LOGBOOKS

SOP NO. 024

REVISION NO. 4

Last Reviewed: December 2022

Quality Assurance Approved

December 2022

Date

1.0 BACKGROUND

Complete and accurate field documentation is critical to a successful project and the field logbook is an important tool to support field documentation needs. The field logbook should include detailed records of all field activities, document interviews with people, and record observations of conditions at a site. Entries should be described in a level of detail to allow personnel to reconstruct, after the fact, activities and events that occurred during their field assignments. Furthermore, entries should be limited to facts. Avoid speculation related to field events and do not record hearsay or unfounded information that may be presented by other parties during field activities. For example, do not record theories regarding the presence or absence of contamination when you are collecting field screening data or speculation regarding the reasons for a property owner's refusal to grant access for sampling.

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 but should not contain speculative information that could conflict with information presented in subsequent project deliverables and correspondence. Also be aware that the field logbooks for a site may be a primary source of information for depositions and other legal proceedings that may occur months or years after field work is complete and long after our memories have faded. The accuracy, neatness, and completeness of field logbooks are essential for recreating a meaningful account of events.

Field notes may also be recorded digitally, using a variety of software programs. The requirements and use of digital recording programs is not addressed in this standard operating procedure (SOP) because many items are unique to the selected software system. However, many of the principles discussed in this SOP will apply to the digital recording of field notes.

1.1 PURPOSE

The purpose of this SOP is to provide guidance to ensure that field logbook documentation collected during field activities meets all requirements for its later use. Among other things, field logbooks may be used for:

- Identifying, locating, labeling, and tracking samples
- Recording site activities and the whereabouts of field personnel throughout the day
- Documenting any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel
- Recording arrival and departure times for field personnel each morning and evening and weather conditions each day

- Describing photographs taken during the project.

In addition, the data recorded in the field logbook may later assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining quality control, because it can verify adherence to project scope and requirements.

1.2 SCOPE

This SOP establishes the general requirements and procedures for documenting site activities 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, NY.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Bound (sewn) notebooks
- Ballpoint pens or Sharpies with permanent waterproof ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers, and each page should have preprinted lines or grids and numbered pages. 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 use as a field logbook, although logs and field forms used to record field measurements and data are acceptable as loose-leaf sheets maintained in a three-ring binder with numbered pages, as a supplement to the logbook. If notes are written on loose paper, they must be transcribed as soon as possible into a bound field logbook by the same person who recorded the notes originally.

Ideally, distribution of logbooks should be controlled by a designated person in each office. This person assigns a document control number to each logbook and records the assignment of each logbook distributed (name of person, date distributed, and project number). The purpose of this procedure is to ensure the integrity of the logbook before its use in the field, and to document each logbook assigned to a project. In the event that more than one logbook is assigned to a project, this process will ensure that all logbooks are accounted for at project closeout.

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 (or operable units), designate a separate field logbook for each subsite. Similarly, if multiple activities are occurring simultaneously requiring more than one task leader (for example, well installation, private well sampling, or geophysical survey), each task leader should maintain a separate field logbook to ensure that each activity is documented in sufficient detail.

- At larger sites, a general field log may be kept at the site trailer or designated field office to track site visitors, document daily safety meetings, and record overall site issues or occurrences.

- Data from multiple subsites may be entered into one logbook that contains only one type of information for special tasks, such as periodic well water-level measurements.

- All logbooks must be bound and contain consecutively numbered pages. If the pages are not pre-numbered, the sequential page number should be written at the top of each page.

- No pages can be removed from the logbook for any purpose.

- All information must be entered using permanent, waterproof ink, either a traditional ballpoint pen or a permanent marker. Do not use pens with water-based ink (typically identified as rollerball or gel ink pens) 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.

- Be sure that all entries are legible. Use print rather than cursive writing and keep the logbook pages free of dirt and moisture to the extent possible.

- Set apart critical information such as sample numbers by circling or drawing a box around the critical data.

- 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. Avoid speculation that could conflict with information presented in subsequent project deliverables and correspondence (see Section 1.0 above).

- Use military time, unless otherwise specified by the client. If a logbook entry is not related to a specific event, set it aside with the identification as a “NOTE.”

- Include site sketches, as appropriate.

- Begin a new page for each day’s notes.

- Include the date, project number, and location (if the project has multiple locations) at the top of each page.
- At the end of a day, draw a single diagonal line through any unused lines on the page, and sign at the bottom of the page. Note and implement any client-specific requirements (for example, some clients require each logbook page to be signed).
- Write notes on every line of the logbook. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.
- If a line is left blank for some reason, cross it out (with a single line) and initial to prevent unauthorized entries.
- Cross out (with a single line) and initial any edits to the logbook entries. Note and implement any client-specific requirements (for example, some clients also require that edits be dated). Edits should only be made if the initial entry is illegible or erroneous. Do not make corrections for grammar or style.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent and generally follow the format guidelines presented below. Some clients or contracts may have specific formatting guidelines that differ somewhat from this SOP; review client requirements at the start of the project to help ensure any client-specific guidelines are integrated.

2.2.1 Logbook Cover

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Logbook document control number (assigned by issuer)
- "Book # of #" (determined by the project manager if there is more than one logbook for the project)
- Contract and task order numbers
- Name of the site and site location (city and state)
- Name of subsite (or operable unit), if applicable
- Type of activity, if the logbook is for a specific activity, such as well installation or indoor air sampling
- Beginning and ending dates of activities entered into the logbook (that is, dates of the activities performed or overseen on site)

2.2.2 Inside Cover or First Page

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Tetra Tech project manager and site manager names and telephone numbers
- Tetra Tech office address
- Client contact and telephone number
- Site safety officer and telephone number
- Emergency contact telephone number (911, if applicable, or nearest hospital)
- Subcontractor contacts and telephone numbers
- Site property owner or property manager contact information

Note—some clients prohibit the inclusion of personally identifiable information such as personal mobile telephone numbers on official project records.

2.3 ENTERING INFORMATION IN THE LOGBOOK

The following lists provide guidance on the types of information to be included in a typical field logbook. This guidance is general and is not intended to be all-inclusive. Certain projects or clients may specify logbook requirements that are beyond the elements presented in this SOP; as appropriate, any client- or program-specific guidance regarding logbook notation requirements can be referenced in the logbook.

2.3.1 General Daily Entries

- Document what time field personnel depart the Tetra Tech office and arrive at the hotel or site. If permitted by the client to charge travel time for site work, document what time personnel leave and arrive at the hotel each day. (This information may be needed at remote sites where hotel accommodations are not near the site.)
- Indicate when all subcontractors arrive and depart the site.
- Note weather conditions at the time of arrival on site and any changes to the weather that might affect completion of project tasks during the day.
- Include the date and project number at the top of each page.
- Document that a site safety meeting was held and include the basic contents of the meeting.

- List the level of personal protection to be used for health and safety.
- Summarize the day's planned activities.
- Summarize which activities each field team member will be doing.

2.3.2 Field Activity Entries

- Refer to field data collection forms for details about field data collection activities (for example time, date, depth of samples, and field measurements). If separate field sampling sheets are not used, see Section 2.3.3 regarding logbook entries for sampling activities.
- Refer to well purge forms, well construction logs, and other activity-specific forms as applicable rather than including this type of information in the field logbook. These other forms allow the information to be more accessible at a later date.
- List any air monitoring instrumentation used, with readings and locations.
- Refer to instrument field logs for equipment calibration information.
- Summarize pertinent conversations with site visitors (agency representatives, property owners, client contacts, and local citizens).
- Summarize any problems or deviations from the quality assurance project plan (QAPP) or field sampling plan.
- Document the activities and whereabouts of each team member. (As indicated in Section 2.1, multiple logbooks may be required to ensure sufficient detail for contemporaneous activities).
- Indicate when utility clearances are completed, including which companies participated and specific ticket numbers issued by the utility locate vendor.
- Indicate when verbal access to a property is obtained.
- Include names, addresses, and telephone numbers of any pertinent site contacts, property owners, and any other relevant personnel.
- Document when lunch breaks or other work stoppages occur.
- Include approximate scale for all diagrams. If a scale is not available, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections, and label features on each diagram.

2.3.3 Sampling Activity Entries

The following information should typically be on a sample collection log and referenced in the logbook. If the project does not use sample sheets as a result of project-specific requirements, this information should be included in the logbook.

- Location description

- Names of samplers
- Collection time
- Designation of sample as a grab or composite sample
- Identification of blind duplicates or split samples
- Type of sample (water, sediment, soil gas, or other medium)
- Sample number
- On-site measurement data (such as pH, temperature, and specific conductivity)
- Field observations (odors, colors, weather)
- Preliminary sample description
- Type of preservative used
- Instrument readings, if applicable

2.3.4 Closing Daily Entries

- Describe decontamination procedures (personnel and equipment).
- Describe handling and disposition of any investigation-derived wastes.
- Summarize which planned activities were completed and which ones were not.
- Note the times that personnel depart the site for the day.
- Summarize any activities conducted after departing the site (paperwork, sample packaging, etc.). This may be required to document billable time incurred after field activities were completed for the day.

2.3.5 Photographic Log Entries

- Before using a digital camera, ensure that the system date and time are correct. Verify whether the timestamp is being recorded on the image, if required.
- Indicate in the text that photographs were taken and the location where the photographs can be found (for example, in the project file) and identify the photographer.
- Begin a new photolog page for each new field day.
- Record the time of photograph so that the image can be generally identified when reviewing the digital files.
- Note the direction in which the photograph was taken, along with any relevant details that might not be understood when looking at the photograph.
- In the event that a film camera is used, the sequential number of the image should also be recorded, and the time from the logbook will be the recorded time for the photograph.

2.4 LOGBOOK STORAGE

Custody of logbooks must be maintained at all times. During field activities, field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. When the field work is over, the logbook should be included in the project file, which should be in a secured file cabinet; in addition, if directed by the project manager, scan logbook pages for electronic file management upon returning to the office. The logbook may be referenced in preparing subsequent reports and scanned logbook pages may be included as an appendix to a report. However, it is advisable to obtain direction directly from the client before including the logbook as a report appendix, because its inclusion may not be appropriate in all cases.

2.5 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of, and follow, the health and safety practices that result from the Activity Hazard Analyses (AHA) for a project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific health and safety plan. If health and safety conditions warrant a change to sampling approaches or locations, this should be documented in the field logbook.

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

AIR QUALITY MONITORING

SOP NO. 073

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1.0 BACKGROUND

Air quality monitoring is performed to evaluate concentrations of airborne chemicals or other materials. Particulate matter, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), and other gases and vapors in the air can present potential health risks to workers and other receptors. Reliable measurements of airborne contaminants are necessary for selecting or upgrading personal protective equipment (PPE), delineating areas where protection is needed, assessing the potential health effects of exposure, evaluating site conditions, and evaluating the need for specific medical monitoring. Air monitoring is frequently used in emergency responses, where immediate information is needed about a release or threatened release of hazardous substances that present an imminent danger to public health, welfare, or the environment. 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 laboratory analysis.

Various types of air monitoring instruments are available to monitor each type of airborne contaminant. Common air monitoring instruments used by Tetra Tech include photoionization detectors (PIDs), flame ionization detectors (FIDs), oxygen meters, combustible gas indicators, multigas meters that combine organic and toxic sensors for inorganics, single point monitors, colorimetric instruments, compound-specific instruments, and particulate matter monitors. 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, field sampling plan, or health and safety plan, and should be selected on a site-specific basis depending on the data collection needs, the airborne contaminants to be monitored, and the sampling procedures to be used.

1.1 PURPOSE

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

1.2 SCOPE

This SOP provides only a broad overview of recommendations for monitoring air quality and applies to general procedures for calibrating and operating air monitoring equipment in the field. The project work plan or field sampling plan should identify types of instruments to be used and the actual project-specific field parameters to be measured. The project-specific healthy 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.

This SOP is to be used in conjunction with Tetra Tech EMI SOP No. 003, "Organic Vapor Air Monitoring," U.S. Environmental Protection Agency (EPA) Environmental Response Team (ERT) SOPs, and instrument manuals and quick start guides developed by manufacturers or by qualified users of the monitoring equipment.

1.3 DEFINITIONS

Breathing Zone: The area where field workers would be inhaling potentially impacted air, generally from about 3 to 5 feet above 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.

Direct Reading Instrument: Instrumentation operating on various detection principles such as photoionization, photometry, or spectroscopy to provide real time readings of ambient contaminants in air.

1.4 REFERENCES

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EPA. 2020c. "Operation of the DustTrak Aerosol Monitors; Desktop DRX Model 8533EP and Handheld DRX Model 8534." Environmental Response Team. EPA-PROC-2078-20. June.

EPA. 2020d. "Operation of the SPM Flex Gas Detector." Environmental Response Team. EPA-PROC-2071-20. May.

EPA. 2020e. "Operation of the Jerome J505 Mercury Analyzer." Environmental Response Team. EPA-PROC-2080-20. June.

1.5 REQUIREMENTS AND RESOURCES

Depending on the type of air quality monitoring to be conducted, some or all of the following equipment will be required:

- Particulate monitoring meter, such as the TSI, Inc. DustTrak II Aerosol Monitor Model 8530 or DustTrak DRX Model 8533/8534 or similar
- Organic Vapor Air Monitoring Meter, such as the RAE Systems AreaRAE Pro, MultiRAE Pro, or UltraRAE 3000
- Compound-specific or compound-class-specific air monitoring meters, such as the Honeywell Single Point Monitor or SPM Flex, Lumex RA-915M mercury vapor analyzer, Jerome mercury vapor analyzers, or RAE Systems MultiRAE Benzene
- Manufacturer-supplied calibration kits, including tubing, regulators, and zeroing equipment
- Manufacturer-supplied calibration gas
- Telemetry hardware, such as RAE Systems RAELink 3 modems, Safe Environment Engineering VIPER Lincs and Gateways, or Field Data Solutions radio modems
- Logbook or field data sheets (may be in electronic form)
- Laptop equipped with telemetry software and wireless internet

2.0 APPLICATIONS, DETECTION METHODS, AND LIMITATIONS

All direct-reading instruments have inherent constraints in their ability to detect gaseous organic or inorganic compounds and particulates. They usually detect or measure only specific classes of chemicals or particulates. Generally, many direct-reading instruments that have been designed to detect one particular substance also respond to other substances, causing interferences and possibly resulting in false readings. Applications, detection methods, and limitations of organic air monitoring instruments can be found in Tetra Tech SOP No. 003. The following subsections discuss general applications, detection methods, and limitations when using air monitoring equipment.

2.1 APPLICATIONS

Air monitoring is used to help establish criteria for worker safety, document potential exposures, evaluate site conditions, and determine protective measures for site personnel and surrounding public. Air monitoring instruments can be used alone or as a network integrated using wireless telemetry to monitor for multiple contaminants at numerous locations.

Multigas meters such as the RAE Systems MultiRAE Pro and AreaRAE Pro have slots for electrochemical, carbon dioxide, oxygen, or combustible sensors in addition to the PID. Electrochemical sensors are available for a wide range of toxic gases. A list of available MultiRAE Pro and AreaRAE Pro sensors is available on the manufacturer's website and in the instrument user guides. When operated in datalog mode, the instrument records sensor readings to internal memory for download after the monitoring event. Refer to EPA ERT SOP No. ERT-PROC-2139-20, "Operation of the MultiRAE Pro Wireless Portable Detector" and EPA ERT SOP No. ERT-PROC-2066-20, "Operation of the AreaRAE Wireless Multi-Gas Monitor" for comprehensive standard operating procedures for the MultiRAE Pro and AreaRAE Pro (EPA 2020a; EPA 2020b).

TSI DustTrak DRX monitors or similar particulate monitors can be used to obtain real-time readings of size-segregated mass fractions of particulates with aerodynamic diameters of 1 micron (PM_1), 2.5 micron ($PM_{2.5}$), 4 micron or respirable particles (PM_4), 10 micron or thoracic particles (PM_{10}), and total suspended particulates (TSP). DustTrak II monitors can provide real-time readings of $PM_{2.5}$ or any other mass fraction if the impactor for the specified particle size is installed in the monitor. Both the DustTrak DRX and DustTrak II electronically record particulate data as specified in the "RunMode" menu on the instrument screen. Refer to EPA ERT SOP No. EPA-PROC-2078-20, "Operation of the DustTrak Aerosol Monitors; Desktop DRX Model 8533EP and Handheld DRX Model 8534" for comprehensive standard operating procedures for the DustTrak DRX (EPA 2020c).

Single Point Monitors (SPM) such as the SPM Flex can detect specific chemicals or classes of chemicals, depending on the Chemcassette cartridge installed. A wide range of Chemcassettes are available for toxic gases; a full list is available on the manufacturer's website. The SPM Flex can provide real-time readings of concentrations of the specified gas or gas family and electronically logs the data for download after the monitoring event. Refer to EPA ERT SOP No. EPA-PROC-2071-20, "Operation of the SPM Flex Gas Detector" for comprehensive standard operating procedures for the SPM Flex (EPA 2020d).

Mercury Vapor Analyzers (MVAs) such as the Lumex RA-915+ Mercury Analyzer, RA-915M Mercury Analyzer, and the Jerome J505 Mercury Vapor Analyzer are capable of detecting mercury vapor in ambient air at concentrations from 2 to 200,000 nanograms per cubic meter (ng/m^3) (Lumex RA-915M) and 0.05 to 500 micrograms per cubic meter ($\mu g/m^3$) (Jerome J505 MVA). Both the Lumex RA915-M and Jerome J505 MVA provide real-time readings of mercury vapor concentrations and have the ability to electronically log the data for download after the monitoring event. When operated in "Monitoring" mode, the Lumex RA915-M is capable of running for a designated amount of time with periodical zero checks and datalogging. Refer to EPA Scientific, Engineering, Response and Analytical Services (SERAS) SOP No. 1729, "Operation of the Lumex RA-915+ Analyzer for Measuring Mercury Vapor Concentrations in Air" and EPA ERT SOP No. EPA-PROC-2080-20, "Operations of the Jerome J505 Mercury Analyzer" for comprehensive standard operating procedures for the Lumex RA-915+, Lumex RA-915M, and Jerome J505 MVA (EPA 2016; EPA 2020e)

2.2 DETECTION METHODS

The MultiRAE Pro and AreaRAE Pro electrochemical sensors measure the concentration of the toxic gas within an external circuit using oxidation and reduction reactions. Electrochemical sensors for oxygen (O_2) are available as well. The toxic sensor must be calibrated to the specific toxic gas the sensor is designed to measure, or a member of the group of compounds the sensor is designed to measure. While some sensors are toxic compound specific, all sensors may respond negatively or positively to other compounds in the environment. Some electrochemical sensors such as nitric oxide (NO) and ammonia (NH_3) require a bias voltage to detect the gas and require an equilibrium (or warm-up) time of at least 6 hours after installation. Unbiased sensors require at least 10 minutes to stabilize.

There are two types of combustible sensors available for detecting LEL and methane, protected catalytic bead sensors and non-dispersive infrared (NDIR) sensors. Protected catalytic bead sensors contain a catalyzer that allows for oxidation of the combustion gas at temperatures well below their normal flash point. NDIR sensors utilize light and measure IR absorption at specified wavelengths to estimate concentrations of a gas. While catalytic bead sensors are not sensitive to only one chemical, NDIR sensors rely on chemical-specific IR absorbance to detect a single combustible gas.

TSI DustTrak monitors utilize light-scattering laser photometers to determine mass-based measurements of particulates. Both the DustTrak II and the DustTrak DRX draw aerosols into a sensing chamber using a diaphragm pump, and a sample flow is illuminated by a laser light. While the DustTrak II utilizes the voltage across the photodetector to determine particulate concentration, the DustTrak DRX utilizes the individual pulses from the photometer to make single particle measurements, allowing the monitor to simultaneously measure both the aerodynamic diameter of an individual particle, as well as its mass.

The Honeywell SPM Flex draws a gas sample to the Chemcassette tape-based optical gas detection system. The SPM Flex uses an optical scanning system to detect the presence of a gas based on a color change on the installed Chemcassette. Chemcassettes are available for a wide range of both specific toxic gases and classes of toxic gases; a list of available cassettes can be found in the SPM Flex User's Manual. It is important to note that when using a Chemcassette designed to monitor for a class of toxic gases, such as a mineral acid Chemcassette, the monitor is configured to report the concentration of one specific member of the target compound class. However, a color-change will be induced in the Chemcassette by any member of the target compound class. The specific configuration of the SPM Flex monitor, limit of detection, and instrument response time can vary widely by both Chemcassette and the specific target compound.

The Lumex RA-915+ and RA-915M utilize differential Zeeman atomic absorption spectrometry using high frequency modulation of light polarization (ZAAS-HFM). A mercury lamp, which is a radiation source, is placed into a permanent magnetic field. Two beams are propagated from the lamp to a photodetector, one passes through an analytical cell and one does not. When mercury vapor from a sample is introduced into the analytical cell, the difference between the intensities of the beams increases proportionately to mercury vapor concentration. The Jerome J505 MVA uses atomic fluorescence spectroscopy (AFS), which uses a light source with a wavelength of 254nm. Any mercury present in the sample will absorb and re-emit the light, which is then measured by a photo multiplier tube (PMT).

2.3 LIMITATIONS

Toxic sensors in the MultiRAE Pro and AreaRAE Pro have the following limitations:

- Cannot be exposed to precipitation or operate in temperatures outside of the 14 to 113-degree Fahrenheit (ºF) range.
- Cannot be used when liquid may be inadvertently drawn into the probe.
- Electrochemical sensors can respond to chemicals other than those they are designed to detect. Some sensors, such as formaldehyde (HCHO) and HCN, have extremely high cross-sensitivities. Sensor-specific RAE Systems Technical Notes should be consulted prior to use. RAE Systems Technical notes are available on the manufacturer's website.
- When used in the field, it is recommended that the instrument's accuracy be checked on a daily basis. Silicones, phosphates and phosphorus containing compounds, acidic or basic atmospheres, and overexposure (especially for oxygen [O_2] and VOC sensors) can damage sensors or the PID lamp.
- Most RAE System toxic sensors have a life span of two years.

Combustible sensors in the MultiRAE Pro and AreaRAE Pro have the following limitations:

- Protected catalytic bead sensors must be used in an environment with sufficient oxygen (greater than 10%) in order to operate.
- Protected catalytic bead sensors do not distinguish between combustible gases. If concentrations of a specific combustible gas are desired, use an NDIR sensor for the desired gas.
- Combustible sensors have a shorter life span (about 1 year) than electrochemical sensors. Ensure that the sensor is not expired prior to use.
- Combustible sensors are susceptible to sensor poisoning, in which the presence of certain compounds (typically silicones and phosphorous-containing compounds) can degrade the performance of the sensor over time, resulting in under-reporting of combustible atmospheres.

Photometric particulate monitors such as the DustTrak DRX have the following limitations:

- High humidity or fog may cause elevated particulate readings. The use of the Heated Inlet Sample Conditioning module may mitigate these issues by maintaining a stable relative humidity level.
- Measurement accuracy is dependent on a wide particle size distribution and by the optical characteristics of the particles, such as density, size, shape, and composition.

Single Point Monitors such as the SPM Flex have the following limitations:

- Chemcassette tapes are highly sensitive to rain, fog, humidity, and condensation.
- Cannot be used in temperatures outside of the 32 to 104 ºF range.
- Operation is calibrated for use at altitudes below 3,000 feet. Work at elevations above 3,000 ft may require manufacturer calibration.
- Not all Chemcassette reactions are chemical specific. A colorimetric indicator may react with several similar chemicals, but the concentration determined by the monitor will be for a specific compound, based on a compound-specific conversion factor.
- Chemcassettes have a short life span and often need to be refrigerated or stored in freezers. Additionally, there is a relatively long lead-time to obtain new Chemcassettes.

The Lumex RA-915+, Lumex RA-915M, and Jerome J505 MVA have the following limitations:

- MVAs should never be exposed to metallic mercury.
- The Lumex RA-915+ and Lumex RA-915M should not be used for long durations in environments with high concentrations of mercury vapor (greater than 10,000 ng/m^3). If mercury vapors are present at high concentrations, operate the Lumex instruments in "High Concentrations" measuring mode or use a Jerome J505 MVA.
- Some interference with high levels of VOCs has been observed and noted. If operating any MVA in an environment with VOCs present, consider collecting air samples for laboratory analysis via National Institute for Occupational Safety and Health (NIOSH) Method 6009, *Mercury*.
- MVAs are sensitive to environmental conditions. If operating an MVA in an environment with variable environmental conditions, re-zero the instrument frequently. The MVA should never be exposed to water or dust.

3.0 PROCEDURES

3.1 TESTING AND CALIBRATION PROCEDURES

Each air monitoring instrument should be calibrated according to the 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 monitoring at each site.
- Equipment should be calibrated and tested using manufacturer-provided calibration gas and calibration connector kits.
- Batteries should be charged before the 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 monitoring instrument used, the application, and environmental conditions such as the temperature. Some instruments are equipped with an adapter that will allow the unit to be plugged into a car charger or charge from a car battery. It is recommended that extra batteries be kept on hand when conducting field work.
- Calibration and testing of field equipment should be documented every time it is performed. Calibration and testing information should be recorded in field logbooks, field data sheets, or electronic data capture forms.
- If testing and calibration measurements are out of tolerance, the instrument must be serviced or repaired.
- The manufacturer-recommended factory calibration schedule should be followed. If an instrument is due for factory calibration it should not be used in the field.

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 monitoring to be conducted. Many instruments are affected by moisture, humidity, and dust. Additionally, many instruments include a datalogging option. Even if wireless telemetry is utilized, the datalogging option should be selected to prevent losing air monitoring data. General procedural summaries and processes for air monitoring associated with initial surveys and offsite or perimeter monitoring are presented below.

3.2.1 Initial Surveys

Initial surveys are conducted upon first entry to an area with a potentially hazardous atmosphere. Initial surveys are performed relatively rapidly and are a screening process for collecting preliminary data to use for determining levels of PPE, establishing work zones, and establishing contaminated areas for further monitoring or sampling.

In most cases, project teams will have prior knowledge of the site and site contaminants, allowing air monitoring instrumentation to be selected based on the site-specific contaminants of concerns. When entering unknown environments, utilize the EPA Emergency Response Technical Group "Hazard Evaluation Flow Chart for Unknown" (EPA 2005). Intrinsically safe instrumentation should be used when there is a threat of atmospheres that may be explosive or conducive to ignition.

General procedures for conducting initial surveys are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment. Multiple instruments may be necessary depending on the nature of the site.
- Record calibration information, site name, date and time, and pertinent weather information in a field logbook or on field data sheets.
- Approach the entrance to the site from the upwind direction, if possible. At the entry of the site, record the readings from each instrument in the breathing zone. Negative or non-detect results should also be recorded to demonstrate that the measurement was taken.
- Enter the site and record a measurement in each area of interest (ex: spill areas, frequently utilized spaces, current or historical chemical storage areas).
- Determine if measurements indicate sustained concentrations of contaminants in the breathing zone which are above action levels specified in the site-specific health and safety plan, or which otherwise do not meet healthy and safety criteria. Upgrade the level of PPE, implement engineering controls, and/or stop work if necessary.
- Once the initial survey is complete, download all instrument data and save in the project folder for site records or for future analysis.

Information obtained during initial surveys may lead to further monitoring. A more comprehensive survey and analysis for specific compounds may be warranted.

3.2.2 Off-Site and Perimeter Monitoring

Off-site and perimeter monitoring is typically conducted with the same instrumentation that is used for onsite monitoring. Since air is dynamic by nature, physical boundaries do not necessarily delineate the extent of contamination or the boundary of an area affected by a release. Monitoring at the perimeter of the site, or at locations off site provides information about pollutant migration. General procedures for conducting off-site and perimeter monitoring are as follows:

- Following the instrument manual, calibrate and test air monitoring equipment. Multiple instruments may be necessary depending on the nature of the site.
- Record calibration information, site name, date and time, and pertinent weather information in a field logbook or on field data sheets.
- Identify perimeter or offsite locations for monitoring. Generally, cardinal directions are acceptable for perimeter monitoring. Monitors may be adjusted or added based on wind direction and wind speed, or the presence of priority populations for monitoring, such as sensitive receptors.
- Once monitoring locations have been determined, place instruments in the breathing zone and record monitoring start times and readings. Ensure instruments are not in the way of traffic, work, or other activities that could damage or disturb them.
- If the monitoring period is prolonged, check on the instrument periodically to ensure proper function and accuracy. If sensor drift is suspected or observed, recalibrate the instrument and restart monitoring.
- At the end of the monitoring period, record the monitoring stop time and readings.
- Download all instrument data and save in the project folder for site records or for future analysis.

Lack of detections or negative results should not be interpreted as complete absence of airborne contaminants. It is possible that the compound class the instrument detects is not present or that the concentrations of the compounds are below the instrument's detection limits. The instrument detection limits should be presented with all site data.

3.3 AIR MONITORING TELEMETRY

Many air monitoring instruments are capable of generating a real-time data stream that can be incorporated into telemetry systems for remote monitoring. Telemetry systems make use of wireless data transmission technologies to convey monitoring results to a central location for viewing and storage. Common telemetry systems used for transmitting air monitoring data include EPA ERT's VIPER system and Honeywell's ProRAE Guardian system. The VIPER system can be operated using either wireless local area networks (WLAN)/cellular system or 900 MHz radio modems. Numerous air monitoring instruments can be incorporated in the VIPER system, including DustTrak DRX monitors, SPM Flex monitors, and RAE Systems equipment (for a full list of supported monitoring equipment, see www.response.epa.gov/VIPER). The ProRAE Guardian system utilizes 900 MHz radio modems or

WLAN to transmit data. The ProRAE Guardian system supports most RAE Systems instruments, including AreaRAE Pro and MultiRAE Pro monitors.

When monitoring instruments are configured as part of a telemetry network, monitoring data are compiled and visualized in a telemetry software. Most telemetry software applications provide tools for visualizing trends in monitoring results, configuring alarms when results exceed action levels, and store monitoring data in a database application. Data transmitted to the telemetry software can be viewed in near real-time from a remote location, including simultaneous viewing of multiple types of instruments, positioned at multiple locations.

3.4 ACCURATE RECORDING AND INTERPRETATION

Air monitoring 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 any readings of zero as nondetectable (ND) rather than as "clean." Quantities of chemicals may be present but at concentrations that are not detected by the instrument.

3.5 VARIABLES AFFECTING AIR MONITORING

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

- **Temperature:** An increase in temperature increases the vapor pressure of most chemicals. Generally, worst-case emission of VOCs and SVOCs occur on the hottest day of site activities.

- **Wind speed and direction:** An increase in wind speed can affect airborne contaminant concentrations near free-standing contamination or a release. Wind speed and direction impacts the extent and paths of plumes of airborne contamination.

- **Rainfall:** Water from rainfall can cap vapors, gases, or dust from a site, reducing concentrations of airborne contaminants.

- **Moisture:** Particulates, including finely divided hazardous solids, are highly moisture-sensitive. Moisture can vary significantly with respect to location and time and can impact the accuracy of monitoring results across all instruments.

- **Background emissions:** Background emissions from other activities in the proximity of a site can affect instrument readings. Operations such as vehicle maintenance, fueling facilities, and road or landscape work can affect readings associated with perimeter monitoring. Any potential outside sources of emissions should be recorded in the logbook or on field data sheets.

- **Work activities:** Work activities often require the mechanical disturbance of contaminated materials, which may change the concentration and composition of airborne contaminants at a site. Monitoring should be conducted at all phases of a project to ensure no work activities create hazardous work environments that require upgraded PPE, engineering controls, or stop work.

Consult the manufacturer's manual to determine the instrument-specific impacts of environmental conditions.

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

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1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. All sampling equipment must be thoroughly cleaned before each use to prevent contamination of samples.

1.3 DEFINITIONS

Alconox: Phosphate-containing soap, obtained in powder form and dissolved in water

Deionized (DI) Water: DI water is water that has been treated to remove all ions – typically, that means all of the dissolved mineral salts and metal ions.

Liquinox: Phosphate-free soap, obtained in liquid form for mixing with water

Luminox: Specialized detergent with the capability of removing oils and organic contamination, also phosphate-free and liquid

1.4 REFERENCES

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EPA. 2020. "Field Equipment Cleaning and Decontamination." LSASDPROC-205-R4. June 22. https://www.epa.gov/sites/production/files/2016-01/documents/field_equipment_cleaning_and_decontamination205_af.r3.pdf

EPA. 2020. "Sampling Equipment Decontamination." EPA-PROC-2006-20. November.

1.5 REQUIREMENTS AND RESOURCES

The equipment and supplies to conduct decontamination may include the following:

- Scrub brushes
- Large wash tubs or buckets

- Squirt or spray bottles
- Alconox or Liquinox (Note: Alconox contains phosphates, and phosphates have been banned in many household cleaning products based on their adverse effect on the environment.)
- Tap water
- Distilled water
- DI water
- Plastic sheeting
- Aluminum foil
- Isopropanol (laboratory grade) or Luminox

2.0 PROCEDURES

This section describes procedures for decontamination of personal protective equipment (PPE) as well as equipment for drilling and monitoring well installation, borehole soil sampling, general sampling, water level measurement, and groundwater sampling. PPE (as outlined in the site-specific health and safety plan) should be used during decontamination procedures. Special handling of used PPE and wastewater generated from decontamination procedures may be required if the type of contamination is considered hazardous according to the Resource Conservation and Recovery Act (RCRA).

Any special handling should also be outlined in the site-specific health and safety plan or the sampling and analysis plan. At a minimum, no eating, drinking, smoking, or any other hand-to-mouth contact should be allowed during decontamination activities.

Some clients may have additional requirements for decontamination procedures. For example, phosphate-free detergent may be a requirement and, therefore, it would not be appropriate to use Alconox.

Source water for decontamination should be selected based on site-specific conditions and contaminants. In general, laboratory DI water is preferred for decontamination of instruments and sampling devices. Standard distilled water, readily available at grocery stores, may be appropriate at other times. However, distilled water may still contain unacceptable levels of inorganic ions. Decontamination of heavy equipment such as drill rigs will typically use tap water or similar source water, often used in combination with a steam or hot-water cleaning unit. During procurement, Tetra Tech personnel should specify the source of decontamination water to be used by the subcontractors and ensure that it is consistent with investigation goals. Refer to the site-specific sampling and analysis plan for details concerning source water.

In general, conduct field activities to move from cleaner to more contaminated locations to minimize the potential for cross contamination between locations.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off site or to clean areas. Refer to the site-specific health and safety plan as the first resource for types of PPE; not all types of PPE nor methods for decontamination discussed below will be appropriate for every site. All used disposable protective clothing, such as Tyvek, coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums or similar sealable containers (refer to Section 3.0).

Personnel decontamination procedures will be as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.
3. Remove outer gloves and place into plastic bag for disposal.
4. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for laundry before reuse.
5. Remove air purifying respirator (APR), if used, and place the spent filters in a plastic bag for disposal. Filters should be changed daily or sooner, depending on use and application. Place the respirator into a separate plastic bag after it has been cleaned and disinfected according to the instructions for the respirator.
6. Remove disposable gloves and place them in plastic bag for disposal.
7. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on site before drilling operations begin, between borings, and at completion of the project. Decontamination may be conducted on a temporary decontamination pad constructed at a satellite location within the site. The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Decontamination pads may be constructed of concrete, wood, or plastic sheeting, depending on the site-specific needs and plans. Wash waters and contaminated soil generated during decontamination should be considered investigation-derived waste (IDW) and, thus, should be collected and containerized for proper disposal.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they may be steam cleaned and placed on polyethylene sheeting on site before they are used downhole, if required by the site-specific work plan. The drilling subcontractor will typically furnish the steam cleaner and water.

The drilling auger, bits, drill pipe, any portion of drill rig that is over the borehole, temporary casing, surface casing, and other equipment used in or near the borehole should be decontaminated by the drilling subcontractor as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Remove loose soil using shovels, scrapers, wire brushes, and any related material.
3. Steam clean or pressure wash to remove all visible dirt. Use appropriate PPE (for example, a face shield and Tyvek/coveralls) as necessary.
4. If equipment has directly or indirectly contacted contaminated media and is known or suspected of being contaminated with oil, grease, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), or other hard-to-remove organic materials, rinse equipment with laboratory-grade isopropanol or Luminox solution.
5. To the extent possible, allow components to air dry; drying helps limit the spread of contamination through contact. Equipment should be dried and stored upwind of contaminated areas to minimize potential cross-contamination.
6. All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING DOWNHOLE EQUIPMENT DECONTAMINATION AND GENERAL SOIL SAMPLING EQUIPMENT DECONTAMINATION

All soil sampling equipment should be decontaminated before use and after each sample as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Scrub the split-barrel sampler and sampling tools in a wash bucket or tub using a stiff, long-bristle brush with a solution of tap water with Liquinox or Alconox.
3. Rinse equipment thoroughly with tap water or distilled water.
4. Perform a final rinse with DI or distilled water. Refer to the site-specific sampling and analysis plan for requirements for DI or distilled water.
5. Place cleaned equipment in a clean area on plastic sheeting or aluminum foil and allow to air-dry. Clean, dry equipment should be stored in clean equipment cases to minimize potential cross-contamination. If the equipment does not have a case, it should be stored on a clean surface upwind of contaminated areas to minimize potential cross-contamination.
6. Containerize all water and rinsate; also, containerize disposable, single-use sampling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the water-level indicator or interface probe before inserting and after removing it from each well. The following decontamination procedures should be used:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Wipe the tape and probe with a disposable Alconox- or Liquinox-impregnated cloth or paper towel. Spray the probe with Alconox or Liquinox solution to ensure that all ports on the probe are cleaned.
3. If immiscible layers are encountered, the interface probe may require steam cleaning or washing with laboratory-grade isopropanol or Luminox solution.
4. Rinse with distilled or deionized water, including spraying the probe with rinse water.
5. Store clean, dry equipment in clean equipment cases to minimize potential cross-contamination. If the equipment does not have a case, it should be stored on a clean surface upwind of contaminated areas to minimize potential cross-contamination.
6. Containerize all water and rinsate for proper disposal.

2.5 GROUNDWATER SAMPLING EQUIPMENT

The following procedures are to be employed to decontaminate equipment used for groundwater sampling. Decontamination is not necessary when using disposable (single-use) or dedicated (reused but only at a single sample point) pump tubing or bailers. Decontamination procedures for reused equipment are described below.

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Remove and containerize any purge water in the pump and tubing and dispose of tubing.
3. Dismantle the pump as much as possible and scrub components in a wash bucket or tub using a stiff brushes of appropriate size with a solution of tap water with Liquinox or Alconox.
4. Rinse pump components thoroughly with tap water or distilled water.
5. If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard-to-remove organic materials, rinse the pump and tubing with laboratory-grade isopropanol or Luminox solution.
6. Perform a final rinse with DI or distilled water.
7. Allow components to air dry.
8. Wrap pump in aluminum foil or a clean plastic bag for storage.
9. Containerize the used tubing and decontamination wash waters for proper disposal.

3.0 INVESTIGATION-DERIVED WASTE

IDW can include disposable, single-use PPE and sampling equipment, soil cuttings, purge water, and decontamination wash waters and sediments. Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage will be provided in project-specific documents, or separate direction will be provided by the project manager. Make sure to consult with a qualified professional before making any waste characterization decisions. The following guidelines are provided for general use:

1. Assume that all IDW generated from decontamination contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.
2. Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.
3. Label IDW storage containers with the facility name and address, date, contents, company generating the waste, and an emergency contact name and phone number.
4. Temporarily store the IDW in a protected area that provides access to the containers and allows for spill/leak monitoring, sampling of containers, and removal after the disposal method has been identified.