Work Plan for Removal Action Preconstruction Work

West Lake Landfill Superfund Site

Prepared for

The United States Environmental Protection Agency Region VII

Prepared on behalf of

Bridgeton Landfill, LLC and
Rock Road Industries, Inc.

Prepared by

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May 16, 2014

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1. INTRODUCTION

This Work Plan has been prepared to address the requirements of Paragraph 31a of the Administrative Settlement Agreement and Order on Consent (ASAOC) for Removal Action – Preconstruction Work in the matter of the West Lake Landfill Superfund Site, Bridgeton, St. Louis County, Missouri (EPA Docket No. CERCLA-07-2014-0002) between the United States Environmental Protection Agency (EPA) Region VII and Bridgeton Landfill, LLC and Rock Road Industries, Inc. which was signed on April 16, 2014. This Work Plan has been prepared by Engineering Management Support, Inc. (EMSI) in cooperation with Feezor Engineering, Inc. (FEI), Auxier & Associates (A&A) and Civil & Environmental Consultants, Inc. (CEC) on behalf of Bridgeton Landfill, LLC and Rock Road Industries, Inc.

1.1 Scope

This Work Plan addresses preconstruction activities associated with the proposed installation of an isolation barrier between the municipal solid waste (MSW) and construction and demolition (C&D) debris in Radiological Area 1 (Area 1) of Operable Unit 1 (OU-1) at the West Lake Landfill and MSW located within the adjacent and overlapping permitted North Quarry Landfill cell of the Bridgeton Landfill. The proposed location/alignment and construction methodology for the isolation barrier is still under development; however, several preconstruction activities were identified in the ASAOC that could be initiated prior to finalization of the barrier alignment and construction method.

This Work Plan addresses the Work to be Performed as set forth in Paragraph 30 of the ASAOC. Specifically, this Work Plan addresses the following items:

1. Identification of potential areas proposed to be used for the staging, management and relocation of excavated wastes;

2. Clearing of vegetation and surface obstacles that may be impediments to the installation of the isolation barrier or utilization of the proposed waste staging/relocation areas;

3. Development of a bird hazard mitigation and monitoring plan for ongoing landfill work;

4. Development of an air monitoring, sampling, and QA/QC plan; and

5. Installation of a litter control barrier along the east (St. Charles Rock Road) side of the anticipated waste excavation, staging and relocation areas associated with construction of the isolation barrier.

1.2 Work Plan Contents

This Work Plan contains the following items:

1. Introduction;
2. Description of Work to be Performed;
3. Schedule for the Work;
4. Project Team Organization;
5. Health and Safety Plan;
6. Reporting and Deliverables; and
7. References.

The following items are also included as appendices to this Work Plan:

A. Bird Monitoring and Mitigation Plan;
B. Air Monitoring, Sampling and QA/QC Plan;
C. Health and Safety Plan; and
D. Radiation Safety Plan.

2. DESCRIPTION OF WORK TO BE PERFORMED

This section provides a description of the work to be performed for each of the five preconstruction activities identified in the ASAOC.

2.1 Identification of Waste Staging, Management and Relocation Area

It is anticipated that in order to construct the isolation barrier, a shallow excavation will need to be made into the existing MSW in the North Quarry Landfill in order to provide a level working surface for construction of the barrier and to promote drainage of surface water away from the work areas. This shallow excavation will aid in minimizing the overall depth of the vertical barrier wall. In order to maximize the structural stability of the barrier wall relative to potential settlement of the adjacent MSW in the unlikely event that a subsurface smoldering event (SSE) were to occur in the North Quarry Landfill adjacent to the barrier, the alignment of the barrier must be set back from the quarry edge.

At this point, it is envisioned that this shallow excavation will be approximately 20 feet in depth, 45 feet across at the base and will have slopes of 3 horizontal to 1 vertical (3:1). The waste material removed from this excavation will be relocated onsite and placed into one of the existing landfill areas at the site. Based upon the currently proposed design, is estimated that the volume of waste to be removed to prepare the working platform for construction of the isolation barrier will be approximately from 40,000 to 75,000 bank cubic yards (bcy), depending on the selected alignment.

It is currently anticipated that the isolation barrier will be constructed using a clam shell or other device to excavate an approximately four foot wide trench down through the waste material into an appropriate subsurface unit. This appropriate subsurface unit will be investigated and determined during the barrier design work. Depending upon the barrier alignment, the volume of waste to be removed to allow for construction of the isolation barrier is estimated to be between 10,000 and 20,000 bcy.

Based on the preliminary estimates described above, it is expected that between 50,000 and 95,000 bcy of MSW will need to be relocated in conjunction with construction of the isolation barrier. Due to the shorter haul distances, an overall design preference is to place all, or as much of the excavated waste as possible within the southeastern portion of Area 1 outside of the extent of actual occurrences of Radiologically-Impacted Materials (RIM) within Area 1. Shorter haul distances minimize handling and hauling time which is important in order to expedite the construction schedule. Shorter haul distances also allow for a smaller area of waste management which is important for odor control, prevention of bird attractant conditions and monitoring and mitigation of any potential bird risks.

Portions of Area 1 were overlain by MSW placed during final waste placement of the North Quarry Landfill, which can be demonstrated by comparing current topographic features to historical topographic mapping generated from aerial photogrammetric methods from an April 6, 1975 flight. The majority of the waste to be relocated from the shallow excavation will consist of North Quarry Landfill MSW materials. These waste materials were placed after April 6, 1975 and therefore do not contain or have potential to contain RIM.

Depending upon the final volume of waste material removed during construction of the working platform (the shallow excavation) and the isolation barrier excavation trench, it may not be possible to place all of the material within the southeast portion of Area 1. Therefore, potential additional areas for placement of excavated waste will need to be identified in the event that all of the excavated waste cannot be placed in Area 1. Any excavated material that will be generated below the April 6, 1975 surface will be given preference for relocation to the southeast corner of Area 1. Possible additional areas for waste placement include areas within the North Quarry Landfill footprint, including fill needed to adjust the final waste contours of the North Quarry Landfill in order to promote drainage and complete construction of the final landfill cover over the North Quarry Landfill. This is the most proximate area, which reduces handling and haul time, preventing unnecessary delay in the construction schedule. These proximate locations also minimize the total area of active waste management which would need to be controlled to prevent odor release and bird hazard. If additional areas had to be utilized outside of these areas that would result in a longer construction schedule due to the additional hauling and handling and it may result in the need for two separate areas managed for odor control and bird hazard control.

One of the goals of the design of the isolation barrier is to locate the barrier outside the extent of the contiguous mass of RIM present within Area 1. However, it is possible that some RIM may be encountered during excavation of waste materials located below the April 6, 1975 surface during the barrier wall excavation. All excavations below the April 6, 1975 surface will be

radiologically scanned, in accordance with plans and specifications developed for the removal work plans. If RIM is encountered, this waste will be disposed in an approved manner, and not disposed in the relocation areas.

Paragraph 30(a) of the ASAOC directs that Respondents: "Identify all potential areas on Site proposed to be used for the staging, management and relocation of excavated wastes." This task will entail updating the evaluation of the volumes of waste materials to be relocated and identification of the specific areas, areal extents, and potential waste volume capacities associated with each of the potential areas for waste relocation identified above. In addition, a map will be prepared identifying the potential areas for waste relocation, the size of each area, and the preliminary estimate of the expected in-place volume of waste material that can be relocated to each area. Final determination of the areal extent that could be used for waste relocation and the volumetric capacity of each area will be made in conjunction with the design of the isolation barrier.

2.2 Vegetation and Surface Obstacle Clearing

Once the barrier alignment has been selected, and a volume of waste relocation has been determined, the areas will be cleared of vegetation and other surface and near surface infrastructure (such as landfill gas, leachate, and air supply systems) will be relocated. However, due to timing considerations, only clearing and relocation work necessary for the litter control barrier work (see discussion below) and for the installation of the air monitoring and sampling stations and associated access pathways (see discussion below) will be performed as part of the preconstruction activities. The clearing and the relocation work for the barrier and waste relocation areas will be conducted as part of the barrier project. Clearing and relocation of infrastructure would not be prudent until the exact locations are determined after the final designs have been approved. Premature clearing could render the subsurface soil vulnerable to erosion, while prolonged temporary abandonment of the North Quarry Landfill leachate and landfill gas infrastructure could create environmental or nuisance odor issues.

For areas outside of OU- 1, clearing of vegetation will primarily involve the grading and removing of grassy areas without woody overgrowth. This clearing will primarily involve grading the topsoil and grassed areas into an area which will be taken to a stockpile on the North Quarry Landfill crown area. The perimeter of the stockpile area will be protected with erosion control silt fencing. Once the barrier pre-excavation surface has been finalized, this stockpiled topsoil will be reused as a soil cover over any waste that is exposed during barrier construction, or alternatively may be used as cover on the waste relocation area(s).

For areas within the OU-1, the barrier excavation and waste relocation areas will require the clearing of woody overgrowth and trees. Again, any clearing of vegetation from these areas will be performed in conjunction with isolation barrier construction activities.

Clearing of vegetation in both Areas 1 and 2 of OU-1 may be required to allow for the installation of the air monitoring and sampling stations and creation of access pathways to the

stations. The process for clearing and vegetation management will follow the previously approved processes utilized for the 2013 fence construction and 2013 GCPT Investigation. Woody vegetation will be chipped in place and placed in the OU-1 area as surface mulch. For non-woody vegetation, or for thicket type vegetation, a brush hog or similar surface-level cutting tool will be used. Moisture may be added to the vegetation during brush hog and chipping operations if the natural moisture in the vegetation is insufficient to suppress dust.

Prior to any clearing activities in OU-1, a health physicist will conduct an overland gamma scan of the area. A Ludlum 2221 ratemeter/scaler mated to a Ludlum 44-20 3x3" NaI detector will be used to survey selected portions of ground surface within and around Area 1. This instrument will be coupled to a Trimble GPS and operated in the ratemeter mode. This mode will allow the gamma count rate from the instrument to be collected at one-second intervals and assigned to its specific measurement location (latitude and longitude).

The operator will hold the detector approximately 30 cm above the ground surface and advance across the areas of interest in a series of straight lines at a rate of approximately one meter per second. The separation distance between the lines will be approximately 1.5 meters. After the survey, the field data will be processed using a combination of industry-standard commercial computer applications. Because all data points will be tied to a spatial coordinate, a map of the data will identify areas of surface soil containing RIM. These areas can then be located in the field and avoided or covered with a layer of rock, if necessary.

If the overland gamma scan indicates a radiation level above background, the health physicist will notify the clearing crew that they could be in an area that has surface RIM, and to proceed in a manner that avoids ground disturbance. The path will be cleared of vegetation 10-20 feet in the general direction required, then the cleared path and the path to be cleared (as much as practicable) will be gamma scanned. This process will be repeated until either the entire length that needs to be cleared has been cleared or the activities move outside of the extent of RIM or areas of elevated gamma readings. Once an area has been cleared for gamma, or potential gamma occurrences have been addressed (e.g., through placement of a layer of rock) the work discussed in other areas of this Work Plan (e.g., installation of air monitoring equipment) will proceed.

2.3 Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work

A Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work has been prepared by CEC for the Bridgeton Landfill and is included as Appendix A to this Work Plan. The Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work describes the steps that will be taken to ensure compliance with 10 CSR § 80-3.010(4)(B)1 and 40 CFR § 258.10, and the terms of the Negative Easement and Declaration of Restrictive Covenants Agreement entered into by and between Bridgeton Landfill LLC, Rock Road Industries, Inc., Bridgeton Transfer Station, LLC, and the City of St. Louis, Missouri, dated April 6, 2005, and recorded on April 11, 2005, with the Recorder of Deeds for St. Louis County, Missouri as Document Number 245 (Negative Easement). The Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill

Work has been prepared to incorporate items, concerns and suggestions identified by the City of St. Louis Lambert-St. Louis Airport (Airport) during ongoing discussions between Bridgeton Landfill, LLC and the Airport regarding bird mitigation requirements and practices at the landfill.

As required by the ASAOC, the Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work describes the relevant bird hazard monitoring and mitigation measures that are or will be undertaken as part of construction plans for ongoing work requiring the disturbance of putrescible waste. Specifically, this plan describes the following activities to be taken to monitor and as necessary mitigate potential bird hazards that may originate from site activities:

- Coordination with the Airport;
- Monitoring and mitigation measures for limited excavation activities; and
- Monitoring and mitigation measures for new detention basin construction and operation.

Additional information can be found in the plan which is included in Appendix A.

The Bird Hazard Monitoring and Mitigation Plan for Ongoing Work included in Appendix A will serve as a base document for a Bird Hazard Monitoring and Mitigation Plan to be developed in conjunction with, and to support the design and construction of the isolation barrier following completion of design studies and evaluations.

2.4 Air Monitoring, Sampling and QA/QC Plan

A proposed air monitoring plan has been developed and is presented in Appendix B of this Work Plan. Specifically, Appendix B contains the Air Monitoring, Sampling and QA/QC Plan at the West Lake Landfill Superfund Site, Operable Unit 1. This plan has been prepared in accordance with EPA's "Quality Assurance/Quality Control Guidance for Removal Activities (EPA, 1990) as required by Paragraph 33a of the ASAOC. This plan has also been prepared based on the Air Monitoring and Direct Gamma Radiation Monitoring implemented at the St. Louis Downtown Site (USACE, 2012).

The ASAOC only requires an air monitoring plan to obtain background data and assess potential exposures in the community and demonstration of the effectiveness of any implemented control technologies in conjunction with construction of the isolation barrier between Area 1 and the North Quarry Landfill. However, the West Lake Landfill OU-1 Respondents, which includes Bridgeton Landfill LLC and Rock Road Industries, have determined that it would be more useful to implement an overall air monitoring network for both Areas 1 and 2 in order to begin collection of baseline data in anticipation of implementation of a remedial action for OU-1 in the future. Therefore, the scope of the proposed air monitoring network includes not only Area 1 and portions of the adjacent North Quarry Landfill, as directed by EPA to support the ASAOC and planned isolation barrier construction, but also Area 2. The scope of the air monitoring program does not include any offsite, upwind (background) or downwind sampling locations

based upon direction from EPA that EPA is currently in the process of constructing and implementing an off-site air monitoring program (EPA, 2014).

The currently proposed air monitoring station locations are provided on Figure 3. A total of thirteen (13) air monitoring stations are currently anticipated to be constructed and operated under the air monitoring program. The actual locations may be adjusted as necessary based on physical access constraints, availability of, or restrictions on delivery of electric power to each location, current or anticipated future construction activities that could require relocation of the proposed air monitoring stations, or other factors.

Procurement, installation and operation of an onsite meteorological monitoring station is also included as part of the air monitoring program. At a minimum, the meteorological monitoring station will obtain wind direction, wind speed and temperature data. It is currently anticipated that the meteorological station will be installed on top of the landfill office building; however, this is subject to an inspection of the area around the building and the condition of the roof of the building. It is anticipated that the meteorological station will be connected to the existing site Supervisory Control and Data Acquisition (SCADA) system.

The proposed air monitoring equipment and sample collection frequency is provided on Table 1. All thirteen stations will be monitored and sampled for particulates that will be submitted for gross alpha and gross beta analyses, alpha track detectors for radon gas monitoring and thermo luminescent detectors (TLDs) for radiation dosimetry. In addition, four of the stations will also be monitored for the presence of volatile organic compounds (VOCs) in air.

Additional details regarding the air monitoring program are contained in the Air Monitoring, Sampling and QA/QC Plan at the West Lake Landfill Superfund Site, Operable Unit 1 included as Appendix B to this Work Plan.

2.5 Litter Control Barriers

Litter control during waste excavation will occur using three separate techniques. The first technique involves establishing a temporary litter fence along St. Charles Rock Road (Figure 4). The temporary litter fence will consist of a strong, cable reinforced, litter fence that will be placed on support masts stationed every 50 feet along the litter fence alignment. The 10ft high by 50ft long sections of fencing can be connected to each other to construct a litter fence of any length needed. The support masts are secured to the ground using steel stakes. A spring plate for the base of the support mast allows the mast to lean back without stressing it and the spring plates keep the mast supports from sinking in when saturated ground conditions are present. The temporary litter control fence has a rope tensioner system built into the top and middle cables that can be tightened to keep the fence from sagging when the ground is uneven or rough. Approximately 900 feet of temporary litter control fencing will installed and maintained during the barrier operation. Once all activities are completed, this fencing will be disassembled and used at other facilities.

The second technique of litter control involves the use of dozer - movable litter control units placed very close to each day's waste excavation activities. These dozer – moveable units are constructed of a steel frame approximately 15 feet in height by 20 feet in length that is lined with litter control netting. Four (4) such units will be stationed within 50 feet of the active excavation area. They will be placed downwind of the active excavation, which will be determined each operating day. The dozer – moveable litter control units will have side-nets and canopies which stop litter from escaping off the edges or over the top. These units keep litter trapped on the ground for easy cleanup with the steel frame and windscreens on three sides. In addition, outriggers provide extra overturning resistance for extremely high wind conditions. Once all activities are completed, these dozer - movable litter control units will be removed and either used elsewhere on site or possibly provided to other facilities.

The third and final technique of litter control involves the daily manual policing and removing litter from the litter control fencing and accessible litter that has blown off site (which should be minimal with the deployment of the two litter fencing systems). Any collected litter will be bagged, or vacuumed into a portable collection unit, and deposited in the on-site waste relocation disposal site.

These techniques will minimize blowing litter during the waste relocation efforts. Once an alignment for the isolation barrier has been selected, the design documents for the barrier will also include a waste relocation plan, which will discuss the need for the application of daily cover or alternative daily covers during non working periods, which will also minimize blowing litter.

3. SCHEDULE FOR THE WORK

Table 2 presents the proposed schedule for the preconstruction activities. The schedule for several of the tasks is based on calendar days from EPA approval of the Work Plan and authorization to proceed. The schedules for the Bird Hazard Monitoring and Mitigation Plan and the Air Monitoring, Sampling and QA/QC Plan are based on calendar days from EPA approval of the Work Plan and/or receipt of EPA comments on the draft versions of these plans that are included with this Work Plan. The schedule for clearing of vegetation and surface obstacles from the isolation barrier alignment and the proposed waste staging, management and relocation areas is based on when the final alignment for the isolation barrier is determined and approved by EPA.

4. PROJECT TEAM ORGANIZATION

The work to be performed pursuant to this Work Plan will be conducted by several consultants/contractors including the following:

- Engineering Management Support, Inc.
- Feezor Engineering, Inc.

- Auxier & Associates
- Civil and Environmental Consultants, Inc.
- KayBee Electric
- Weaver Boos

The specific roles and responsibilities of each of these contractors are described below. Figure 5 displays the overall project management structure for the preconstruction work.

Engineering Management Support, Inc. (EMSI)

EMSI will provide overall coordination of the work and will be responsible for preparation and submission of the monthly progress reports required by the ASAOC. EMSI will also provide technical consulting relative to any investigations/evaluations of radionuclide occurrences and air monitoring and sampling. EMSI will also review technical submittals for completeness and conformance with the requirements of the ASAOC and this Work Plan.

Feezor Engineering, Inc. (FEI)

FEI will be responsible for identification and evaluation of potential areas to be used for staging, management and relocation of excavated waste materials. FEI will also supervise any vegetation clearing that may be performed. FEI, in conjunction with Bridgeton Landfill, LLC personnel will identify proposed litter control mechanisms, and to the extent that such work cannot be performed by Bridgeton Landfill LLC personnel, supervise installation of litter fencing to control litter release along that portion of the work area located adjacent to St. Charles Rock Road. Subject to receipt of appropriate training from Auxier & Associates, FEI personnel may also assist with installation and operation of air monitoring equipment and collection of samples for air quality testing.

Auxier &Associates (A&A)

A&A, with assistance from EMSI and possibly other members of the project team, will be responsible for development and implementation of the air monitoring and sampling plan. A&A will also be responsible for development and implementation of the radiation safety plan and provide necessary training, monitoring and supervision for any activities that entail entry into areas where RIM may be present.

Civil & Environmental Consultants, Inc. (CEC)

CEC will be responsible for development of the Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work. Due to the presence of qualified air quality personnel and technicians in their St. Louis office, CEC personnel may also be requested to provide assistance with installation and operation of the air monitoring equipment and implementation of the air monitoring plan and sample collection activities as necessary and appropriate to insure continued operation of the monitoring network.

KayBee Electric (Kay Bee)

KayBee will be responsible for installation of electrical services necessary to support the air monitoring equipment and if appropriate connection of the air monitoring or meteorological equipment to the onsite Supervisory Control and Data Acquisition (SCADA) system.

Weaver Boos

Weaver Boos will provide surveying services as necessary and appropriate to assist in identification of potential areas for staging, management and relocation of excavated waste, to document the locations of the air monitoring stations, and to document the locations of any fixed-position litter control measures that may be installed as part of the preconstruction work.

5. HEALTH AND SAFETY PLAN

All on-site work performed by Bridgeton Landfill employees pursuant to this Work Plan will be conducted in accordance with the Bridgeton Landfill Health and Safety Plan prepared by Bridgeton Landfill, LLC, a copy of which is included in Appendix C. Contractors engaged for work under the ASAOC must develop health and safety plans meeting or exceeding the requirements of the Bridgeton Landfill Health and Safety Plan as appropriate for the specific tasks. Any work that entails entry into the fenced-in portion of Area 1, any portion of Area 2, or potential contact with RIM will also be conducted in accordance with the Radiation Safety Plan prepared by Auxier & Associates, Inc., a copy of which is included in Appendix D.

6. REPORTING AND DELIVERABLES

Performance of the preconstruction activities will be documented through submittal of technical documents and monthly progress reports.

6.1 Technical Deliverables

The following technical deliverables are anticipated to be prepared and submitted to EPA in conjunction with performance of the preconstruction activities:

- Plan view drawing of proposed locations for staging, management and re-location of excavated wastes and preliminary calculations regarding the anticipated volumes of re-located waste that could be placed in each area;
- Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work;
- Air Monitoring, Sampling and QA/QC Plan;
- Documentation of installation and operation of air quality monitoring equipment including
    - Plan view drawing of installed air monitoring and sampling equipment locations;

- Schematic drawing of typical air monitoring equipment station;
- Site power plan, electrical one-line diagram, and electrical service panel details for electrical power service to air monitoring stations;
- Schematic drawing of meteorological station equipment; and
- Operation and maintenance manuals for the air monitoring and sampling equipment and the meteorological equipment.

- Litter control plan including plan view drawing of locations and typical details of litter control fencing.

The above items will be assembled and submitted to complete the Final Report for the pre-construction activities. Subject to approval by EPA's Project Coordinator, the above items may be submitted as electronic deliverables, paper copies, or a combination of the two.

Sample collection documentation and laboratory analytical results obtained as part of the air monitoring program will be provided as part of the monthly progress report submittals described below.

6.2 Monthly Progress Reports

Reports documenting progress made toward completion of the preconstruction activities will be prepared and submitted to EPA's Project Coordinator by the 10th day of each month (unless the 10th day of the month falls on a weekend or a holiday in which case the report will be submitted by the end of the next business day). These monthly reports will include descriptions of the following information:

- Work performed during the prior month (reporting period);
- Significant developments during the reporting period;
- Problems encountered during the reporting period and any resolutions implemented or planned;
- Analytical data received during the reporting period;
- Description of and schedule for activities planned for the next reporting period; and
- Anticipated problems and planned resolutions.

Subject to approval of the EPA Project Coordinator, and consistent with the approach used for submission of monthly progress reports for OU-1 and OU-2, monthly progress reports for the preconstruction activities will be submitted electronically.

7. REFERENCES

United States Army Corp of Engineers (USACE), 2012, Environmental Monitoring Implementation Plan for the St. Louis Downtown Site for CY13, December 27.

United States Environmental Protection Agency (EPA), 2014, Administrative Settlement Agreement and Order on Consent for Removal Action – Preconstruction Work in the matter of: West Lake Landfill Superfund Site, Bridgeton, St. Louis County, Missouri (MOD079900932), EPA Docket No. CERCLA-07-2014-0002, signed April 16, 2014.

U.S. EPA, 1990, Quality Assurance/Quality Control Guidance for Removal Activities – Sampling QA/QC Plan and Data Validation Procedures, Interim Final, EPA/540/G-90/004, April.

Tables

Table 1: Preliminary List of Samplers for Perimeter and On-Site Air Monitoring and Sampling

Perimeter Monitor Inventory per Location	Sampling Mode and Collection Frequency	Parameters Measured
Proposed list of samplers at A01, 07, A09, and A12		
Metered air pump with dual chamber sampler for particulate fiber filter and polyurethane foam (PUF) plug	Continuous / Every 2 Weeks	Total alpha and beta activity and total particulate mass
Alpha Track Detector for radon gas	Continuous / Semi-Annually	Radon-222 and radon daughters
Radiello 130 diffusion sampler	Continuous / Every 28 days	VOC's
Radiation dosimeter (TLD)	Continuous / Quarterly	Gamma radiation levels
Proposed list of samplers at remaining on-site and perimeter locations (10 remaining stations)		
Metered air pump with filter to collect particulates	Continuous / Monthly	Total alpha and beta activity
Alpha Track Detector for radon gas	Continuous / Semi-Annually	Radon-222 and radon daughters
Radiation dosimeter (TLD)	Continuous / Quarterly	Gamma radiation levels
Supplemental measurements inside adjacent buildings		
Commercial Radon Test kits	3-5 Day grab/ Quarterly	Indoor radon levels.

Table 2: Proposed Schedule for Preconstruction Activities

Task	Schedule
Identification of waste staging, management and relocation areas	To be completed within 30 days of EPA approval of Work Plan/authorization to proceed
Clearing of vegetation and surface obstacles from barrier alignment and waste relocation areas	To be performed in conjunction with isolation barrier construction activities
Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work	Finalize plan within 30 days of EPA approval of the Work Plan and/or receipt of EPA comments on the draft Plan included in the Work Plan
Air Monitoring and Sampling Plan	Finalize plan within 30 days of EPA approval of the Work Plan and/or receipt of EPA comments on the draft Plan included in the Work Plan
Litter fence installation	Start procurement and installation within 14 days of EPA approval of the Work Plan and/or EPA approval of the fence design and finish within 42 days of EPA approvals

Figures

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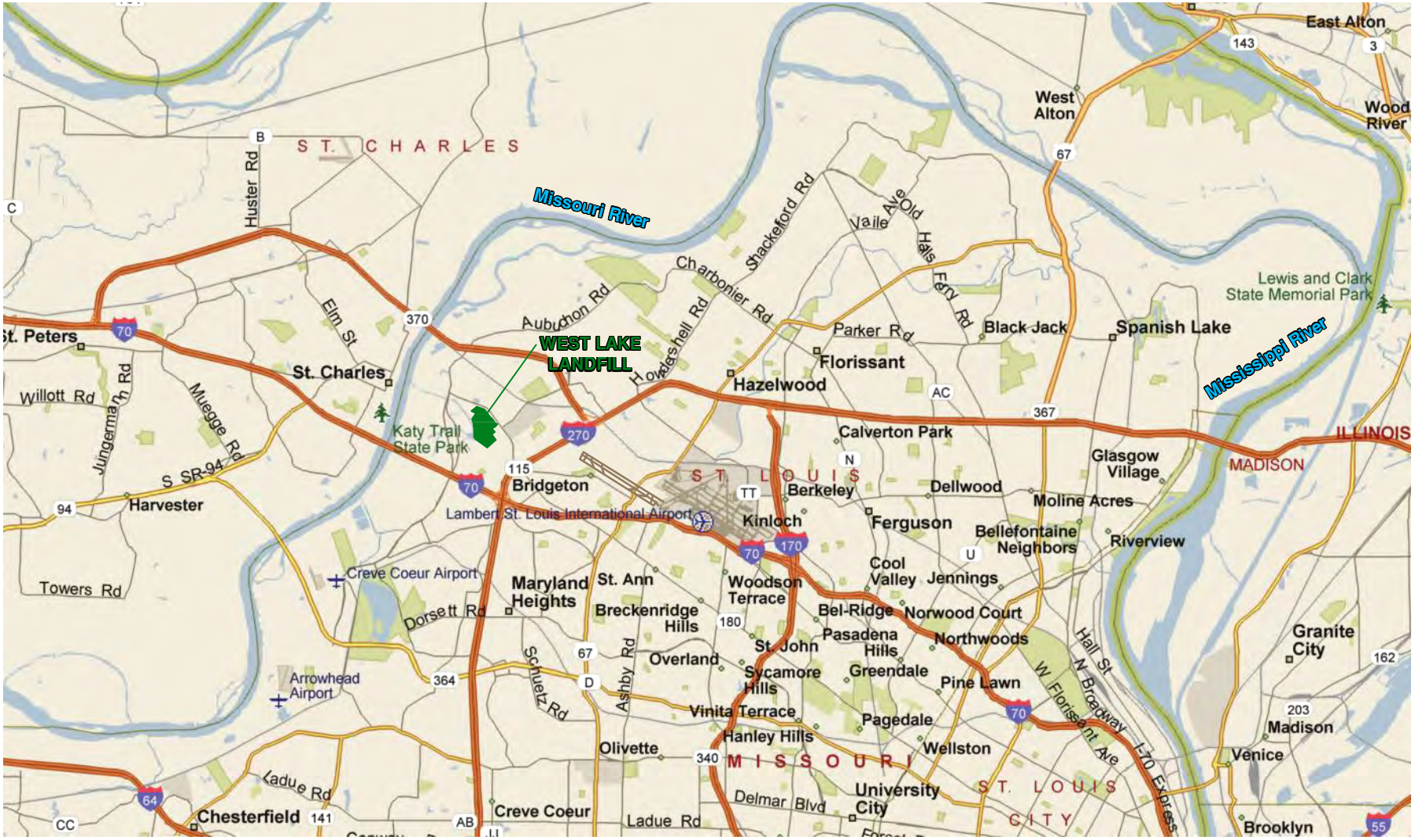

Figure 1

General Location Map

West Lake Landfill OU-1 Supplemental Feasibility Study

EMSI Engineering Management Support, Inc.

Source: Google earth 11/12/2013

0 1000

SCALE IN FEET

N

Figure 2

Site and Surrounding Properties

West Lake Landfill OU-1 Supplemental Feasibility Study

EMSI Engineering Management Support, Inc.

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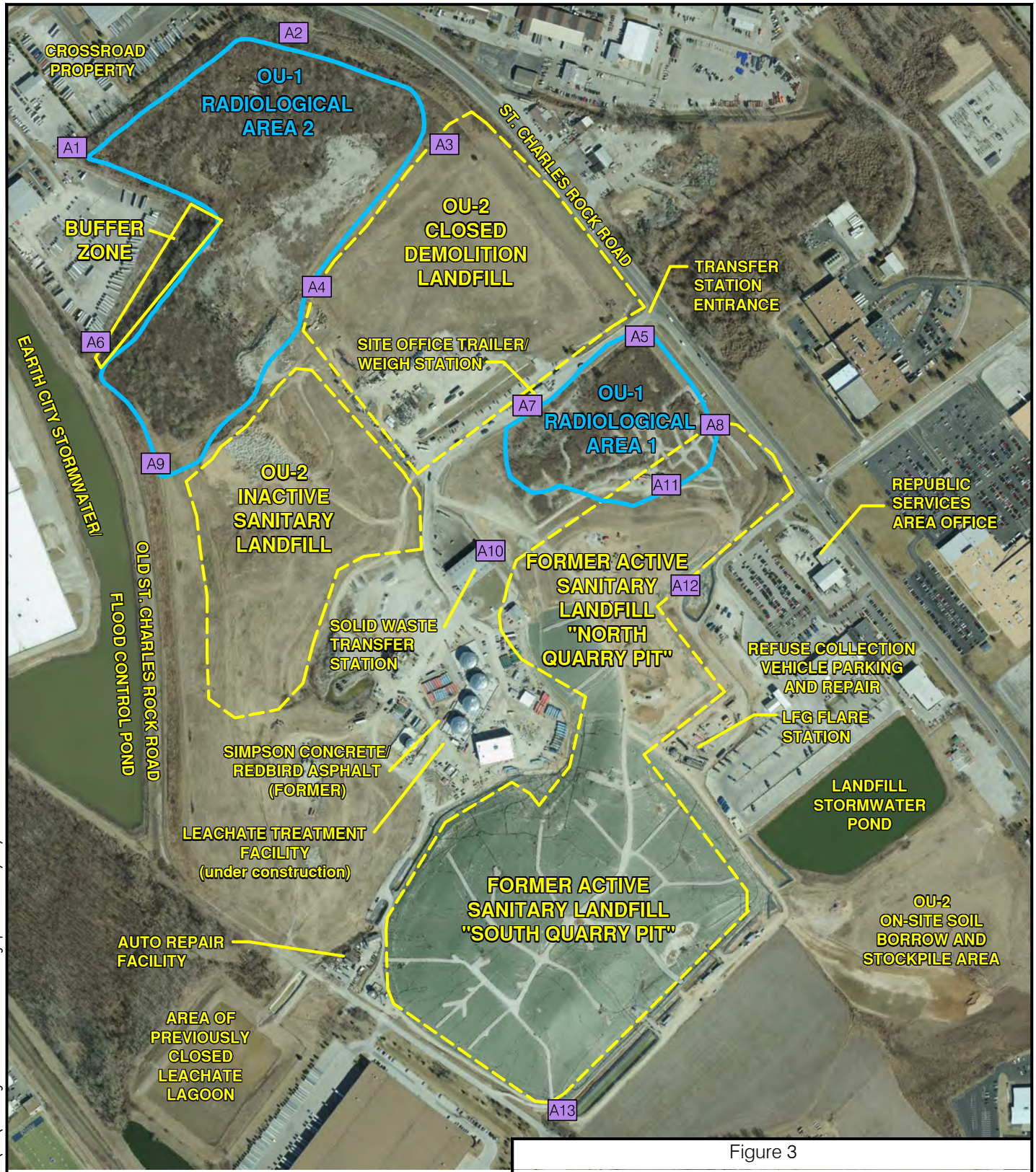

Source: Cooper Aerial Surveys Company (2014)

Legend

A1 Environmental Monitoring Station

Note: All locations are subject to relocation based on physical access and electrical service constaints.

0 600

SCALE IN FEET

N

Figure 3

Proposed Locations of Environmental Monitoring Stations for Baseline Monitoring

West Lake Landfill OU-1

EMSI Engineering Management Support, Inc.

M:\clients\EMSI\westlake\2014\04\WL-Fig-3 Baseline Mon.dwg plotted: 05/15/2014

0 200 400 Feet

EXISTING FENCE

TEMPORARY LITTER FENCE (TLF)
APPROXIMATE LENGTH: 900'

NOTES:
1. TEMPORARY LITTER FENCE LOCATION IS APPROXIMATE
2. AERIAL IMAGERY WAS PROVIDED BY COOPER AERIAL SURVEYS CO. AND IS DATED MARCH 20, 2014

WEST LAKE LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044

WEST LAKE LANDFILL OU-1

TEMPORARY LITTER FENCE PROPOSED LOCATION

PROJECT NUMBER: BT-026

FILE PATH: C:\Users\Paul\Dropbox\Bridgeton\BT-026 (fence And Stockpile)\Figure 4 - TLF Location.dwg

Engineering for a Better World
FEEZOR ENGINEERING, INC.

APRIL 2014
DESIGNED BY: PML
APPROVED BY: DRF

REVISION DATE

FIGURE
4

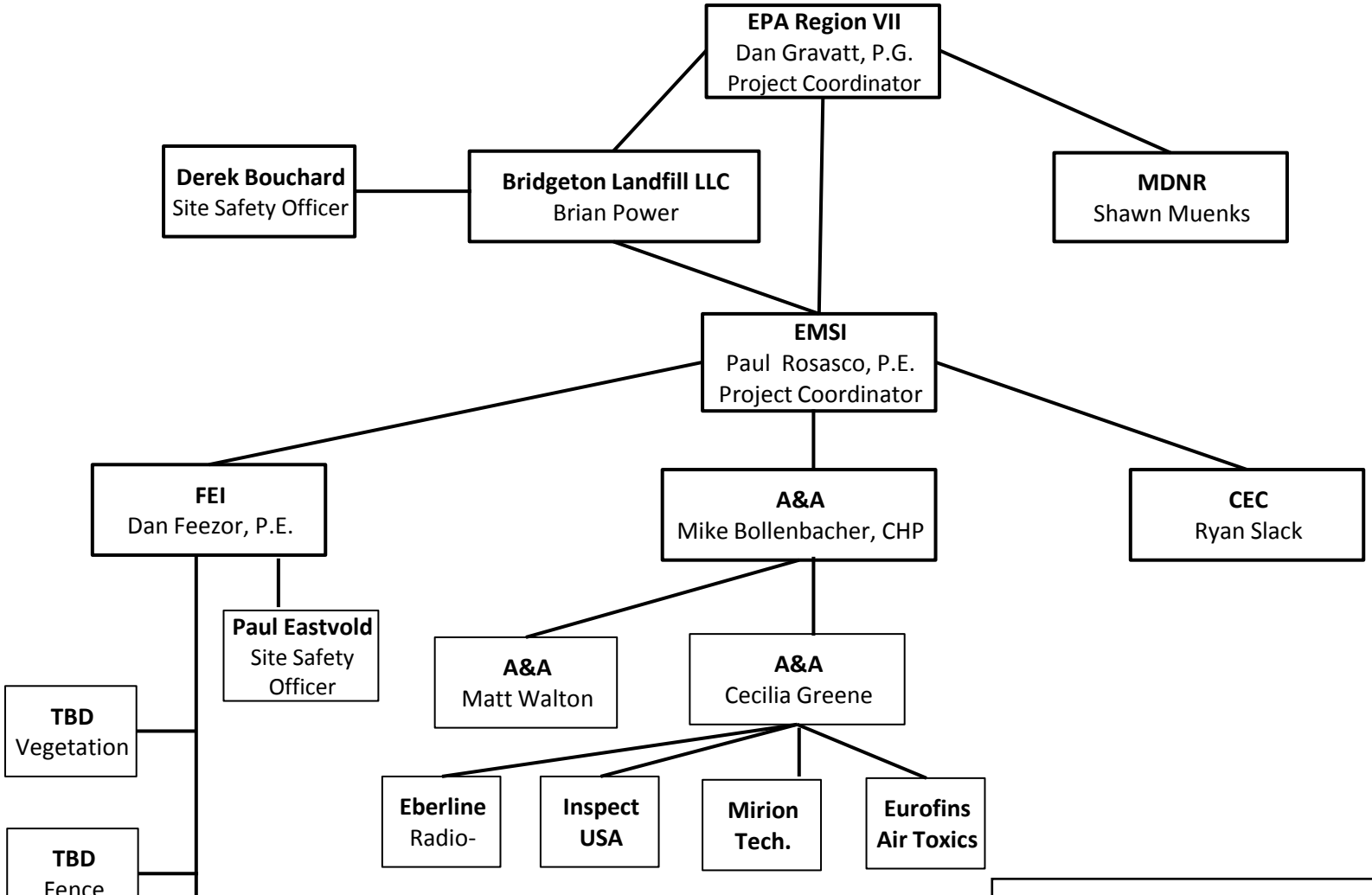

Figure 5

Project Team Organization
Isolation Barrier
Preconstruction Activities

West Lake Landfill Superfund Site

EMSI Engineering Management Support, Inc.

Appendix A:

Bird Hazard Monitoring and Mitigation Plan for Ongoing Landfill Work

Bridgeton Landfill, LLC

BIRD HAZARD MONITORING AND MITIGATION PLAN

Plan for Ongoing Landfill Work

July 26, 2013
REVISED: October 7, 2013
REVISED: May 15, 2014

Prepared by:
Civil and Environmental Consultants, Inc.
Indianapolis, Indiana

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation Plan

This Bird Hazard Monitoring and Mitigation Plan (Plan) has been prepared as required by an Administrative Settlement Agreement and Order on Consent for Removal Action – Preconstruction Work (the Preconstruction ASAOC) concerning the West Lake Landfill Site in Bridgeton, Missouri (Site). The bird hazard monitoring and mitigation measures described in this Plan will be implemented during any day-to-day work at the Site which requires the disturbance of putrescible waste or as otherwise provided for in this Plan. This Plan summarizes the steps that Bridgeton Landfill LLC will take to ensure compliance with 10 CSR § 80-3.010(4)(B)1 and 40 CFR § 258.10, the Negative Easement and Declaration of Restrictive Covenants Agreement which restricts land use activities at the property, and consistent with discussions with The City of St. Louis, the owner and operator of Lambert-St. Louis International Airport® (Airport).

This Plan updates a 2013 Bird Hazard Monitoring and Mitigation Plan and presents measures applicable to any ongoing landfill work that requires limited waste disturbance or removal. Such tasks could include, for example, temperature monitoring probe (TMP) installation and repair, well installation and repair, sump installation, well and subsurface piping abandonment, settlement mitigation, cap repair, and similar ongoing landfill activities. No work requiring more than limited, short-term waste disturbance is expected to be covered under this Plan. Should more extensive waste disturbance be necessary at the Site, Bridgeton Landfill will develop and submit to the Airport an appropriate bird hazard monitoring and mitigation plain for its review and comments prior to conducting the more extensive waste disturbance at the Site.

During 2013, Bridgeton Landfill conducted extensive work in the South Quarry and the North Quarry portions of the Site, including concurrent installation of multiple wells, excavation and installation of toe drains, and the abandonment of non-functioning infrastructure such as underground piping. Construction methods used for that work included waste handling protocols to minimize odor and bird attractant risks implemented using the 2013 version of this Plan. The US Department of Agriculture – Wildlife Services (USDA) observed the South Quarry work on several occasions, and USDA's observation logs indicated that exhumed waste was largely unattractive to birds, as compared to the surrounding off-site foraging environment during that timeframe. Additionally, trained wildlife biologists from Civil and Environmental Consultants, Inc. (CEC) observed the 2013 work in the North Quarry throughout its duration, and confirmed that the North Quarry work also did not present a bird attractant risk. No bird exclusion or wildlife mitigation measures were needed during the 2013 activities at either the North Quarry or the South Quarry.

The majority of the ongoing landfill work covered by this Plan will be more limited in scope than the 2013 activities performed in the South Quarry and the North Quarry, and none is expected to exceed the scope of the 2013 activities. Bridgeton Landfill is prepared to implement bird deterrent measures as necessary for ongoing landfill work, and understands that such measures may vary depending on the invasiveness of the activities, the type of waste uncovered, and the timeframes for waste removal and transport. Therefore, this Plan incorporates the same materials management measures as those used during the 2013 South Quarry and North Quarry work, along with additional contingency measures to actively identify, mitigate, and report any

potential bird hazards. These actions, coupled with continued cooperation with the Airport, are intended to ensure that the ongoing landfill work will continue to be performed in a manner that does not present bird hazard conditions.

An additional response action being evaluated by Bridgeton Landfill and the United States Environmental Protection Agency (EPA) is the installation of an isolation barrier between the North Quarry and the radiological materials in West Lake OU-1, Area 1. Such an action would involve significant excavation of waste material and would require that appropriate bird hazard monitoring and mitigation measures be evaluated in advance of and during such activities. Because appropriate measures for that additional response action are dependent upon the construction details specific to the isolation barrier, including depth and volume of excavation, and the schedule for construction, another bird hazard monitoring and mitigation plan will be prepared separately to address isolation barrier construction activities.

Coordination with Airport

Bridgeton Landfill met with the Airport prior to developing this Plan, and will continue to meet with the Airport as necessary to keep Airport personnel apprised of ongoing landfill work that may impact current site conditions regarding bird attractants and changes in bird populations. Bridgeton Landfill has and will continue to provide the Airport with applicable work plans prior to initiation of new phases of landfill activities at the Site, including any isolation barrier construction work, so that the Airport can assess the sufficiency of any proposed bird monitoring and mitigation measures.

Given the extent of ongoing work to mitigate impacts of the subsurface smoldering event, Bridgeton Landfill currently provides weekly reports to the Missouri Department of Natural Resources (MDNR) regarding completed and planned landfill work. As part of this Plan, Bridgeton Landfill will provide those reports to the Airport contemporaneously with MDNR in order to keep the Airport advised of ongoing and planned work. In addition, if bird hazards are identified, Bridgeton Landfill will provide the Airport with immediate daily reports regarding such hazards until such time as they are resolved, and such hazards and mitigation activities will be addressed in the weekly reports. Additional details regarding reporting are presented below.

Monitoring and Mitigation Measures for Limited Excavation Activities

This Plan addresses measures applicable to activities that require limited waste removal. To ensure these activities do not pose a risk of bird attractant, the following steps will be employed.

Waste Management Control Measures during Handling and Transportation of Excavated Wastes

1. If a borehole is required, drilling activities will be done as quickly as possible to minimize the amount of time the borehole is exposed. To minimize the amount of time trash is exposed, no borehole will be started that cannot be completed without breaks (either end of the day or a lunch break).

2. Solid waste excavated during repair activities will be placed in a roll-off container or dump truck to transport to the Bridgeton transfer station located on-site. The container or

dump truck will be tarped following placement of waste for transport to the on-site transfer station.

3. Where appropriate, waste will be covered with an odor control product in the container used for transport. If wastes require mixing, the product will be applied following mixing if odors persist from the waste materials. The product must be applied to completely cover the mixed wastes with a thin coating.

It is expected that solid wastes removed during limited excavation activities will be handled as follows:

Monday through Friday until 6:00 PM, spoils will be transported from the work area to the on-site transfer station as they are excavated. Bridgeton Landfill will not excavate after 6:00 PM Monday through Friday, unless required for emergency repairs. This spoil-handling procedure will also occur on Saturday until 1:00 PM. After 1:00 PM on Saturday, and all day on Sunday (if work is being performed for emergency repairs) or if emergency repairs are required Monday through Friday after 6:00 PM, excavation spoils will be placed in a lined roll-off box. Once the container is full, it will be covered to prevent access by birds or bird attractants and minimize any odors from escaping the box. The roll-off box will be stored on-site until: a) Monday morning if the repair work is being conducted after 1:00 PM Saturday or on Sunday, or b) the next morning if the repair work is being conducted after 6:00 PM Monday through Friday, when it will be direct hauled to the nearby Roxana Landfill or other approved disposal facilities.

The transfer station, located on-site, is an active, state-permitted facility with a covered roof and large garage doors open only during working hours and closed when not in use. The current heavy use by transfer station truck traffic unloading and loading waste and the covered roof have served and will continue to serve as bird deterrents. Because of the transfer station's proximity to the Airport, USDA and Airport personnel periodically visit the transfer station to assess the absence of birds and bird attractants. Additional use by a periodic truck unloading waste from ongoing landfill activities should not create new bird hazards at the transfer station.

The process described above was used for the 2013 activities at the North Quarry and the South Quarry with the approval of St. Louis County, and the process described above also is subject to approval by St. Louis County. If St. Louis County does not approve use of the on-site transfer station for weekday and Saturday spoils-handling, roll-off boxes will be staged to receive the waste, and each day's roll-off boxes will then be transported to Roxana Landfill or other approved disposal facilities the following day. This process would still include the same materials handling methods as noted above (spray on product, cover with tarps, etc.), and the only change will be storage of the material in lined roll-off boxes instead of use of the on-site transfer station. Bridgeton Landfill will monitor this activity to ensure that this storage of materials does not create a bird hazard at the Site.

<u>Monitoring and Reporting</u>

1. Ongoing landfill work which requires exposure of or excavation into putrescible waste material will be monitored by a Bridgeton Landfill employee or contractor who has

received appropriate training necessary to implement the Plan relevant to monitoring and identifying bird activity and hazards and the dispersal of bird hazards. This representative will be properly trained in wildlife control, including the recognition and dispersal of bird hazards, by a wildlife biologist qualified and experienced in monitoring and controlling bird hazards and wildlife. The wildlife biologist qualified to assess bird hazards will have training and experience consistent with FAA Advisory Circular 150/5200-36A as may be amended, or alternative training and experience reasonably approved by the Airport. At a minimum, the wildlife biologist must have training on wildlife control including the recognition and dispersal of bird hazards, as well as wildlife monitoring and assessment. At present Robert C. Alexander, Wildlife Biologist, with the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Services (APHIS) - Wildlife Services (WS), or his delegate will be conducting the training of Bridgeton Landfills employees or contractors.

2. Any identified bird hazard will be mitigated using the control measures outlined below.

3. Changes in daily bird population levels, any identified bird hazards, and any utilized control activities will be documented using the Bird Control Log in Attachment 1. At a minimum, bird population levels will be monitored and logged at least twice per work day.

4. Bridgeton Landfill currently provides weekly reports to the Missouri Department of Natural Resources (MDNR) regarding ongoing landfill work. The Airport will be added to the weekly report distribution list. Any changes in bird population identified by monitoring, any identified bird hazards, and any necessary control information will be added to the weekly report as applicable.

5. Similarly, the Airport will be added to the distribution of monthly status reports prepared by Bridgeton Landfill under the Agreed Order with MDNR and the Missouri Attorney General's Office. These reports will summarize work completed during the prior month and outline any new plans for activities at the Site that may disturb putrescible waste. Where necessary, the reports will summarize any identified changes of the bird population during the reporting period and will include any bird hazard control measures implemented during the prior month.

6. If the trained on-site personnel identify an increase in bird populations or a bird hazard, Bridgeton Landfill will immediately notify the Airport of this finding and implement the bird hazard control procedures described in the next section of this Plan. Following such notification, daily reports identifying control measures taken will be sent to the Airport until the bird hazard is eliminated. This information also will be summarized in the weekly and monthly reports.

7. Bird hazard notifications and bird monitoring reports will be directed to Dana Ryan, Airport Planning Manager, at dlryan@flystl.com, or such other representative as the Airport designates in writing.

Bird Hazard Control Measures during Limited Excavation, Handling, and Transportation of Excavated Wastes

1. Active control measures, if needed, require knowledge of the proper equipment to be used, understanding of the species of birds being dispersed, and an understanding of the concept of escalating tactics without overuse. Airport representatives will be notified immediately of any observed bird hazard or if bird populations are increasing or a potential bird hazard is identified. Bridgeton Landfill will immediately contact its qualified wildlife biologist (presently USDA-APHIS-WS, Robert C. Alexander or his designee), to provide on-site wildlife biologists to direct the bird hazard control measures. If the Airport believes that Bridgeton Landfill's bird hazard control measures require assistance from Airport personnel or contractors, or if the Airport otherwise uses its personnel or contractors to provide bird hazard control measures at the Site, such assistance will be funded in accordance with the Reimbursement Agreement between Bridgeton Landfill and the Airport.

2. If a bird hazard is identified, various escalating measures will be implemented by Bridgeton Landfill's qualified wildlife biologist, to control and mitigate the hazard, including but not limited to pyrotechnics launched from a hand-held device. These rounds produce either a scream or secondary report that will disperse most species of birds. A .15 mm caliber pistol that can launch both bangers and screamers will be used to reduce habituation (a condition where birds get used to a particular dispersal effort and simply quit responding). In addition, propane cannons will be available, and where necessary, trapping and lethal control will be used to ensure birds do not congregate on-site. Additional mitigation or dispersal methods may be identified by the trained wildlife biologist and, if appropriate, will be implemented at the Site. All of these measures will be available for use by Bridgeton Landfill's qualified wildlife biologist or his designee, and to Airport personnel if they are called upon to provide assistance.

3. The qualified wildlife biologist will control the bird repellant program outlined above and perform on-site training of landfill personnel required to implement this Plan. Such training will include how to recognize and disperse bird hazards, and be tailored to bird species identified during monitoring.

Monitoring and Mitigation Measures for Onsite Drainage and Storm Water Features

The installation of an impermeable cap over the South Quarry and part of the North Quarry required the installation of additional drainage features at the Site in order to ensure proper drainage of storm water from the Site. These consist of detention structures which slow and properly manage the flow of water from the impermeable surfaces and which must meet the surface water control requirements of MDNR.

Some detention structures will drain into an approximately 6-acre storm water retention pond that, according to aerial imagery, has been in existence at the Site for approximately 20 years. This retention pond reportedly was designed as storm water retention for a hauling company located adjacent to the landfill. It is anticipated that the water contribution to the existing retention basin from the new detention area will be negligible. A similarly-sized storm water

retention area for two large existing warehouses exists off-site west of the landfill and is established with vegetation and shallow water, and it presents potentially a much more habitable area for birds to forage and nest than the new synthetically lined detention structures recently installed at the Site.

The operation of the detention basins and overall condition of the on-site drainage structures were observed by trained wildlife biologists with Civil and Environmental Consultants, Inc. during observation of the North Quarry work. The observations, reported in the Summary Report prepared for the Airport and included as Appendix A, confirmed that the on-site drainage structures were operating in a manner which did not pose a bird attractant risk.

The bird hazard threat posed by the new detention structures is negligible by itself and when compared to existing conditions. However, in order to further minimize any potential bird hazards, to the extent possible while still meeting MDNR requirements for storm water management, the new detention basins will be maintained to drain within 24 hours of a rainfall event to the extent possible. If applicable requirements mandate longer detention time than 24 hours, the new structures will be maintained to drain as quickly as the applicable water requirements allow. If detention times longer than 24 hours are needed, Bridgeton Landfill shall conduct appropriate monitoring or studies as recommended by its qualified wildlife biologist to determine whether the longer detention times pose a potential wildlife hazard. If it is determined that the longer detention times pose a wildlife hazard or potential wildlife hazard, then Bridgeton Landfill will immediately notify the Airport and promptly submit to the Airport for its review and comments its plans to monitor and mitigate the identified wild life hazard.

Bird Control Log

Date	Time	Location	Species	Number	Control Method	Comments	Initials

Appendix A

Summary Report of North Quarry Bird Monitoring and Mitigation

March 18, 2014

Mr. Brian Power
Bridgeton Landfill, LLC
13570 St. Charles Rock Road
Bridgeton, Missouri 63044

Dear Mr. Power:

Subject: Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
Phase I Final Report
CEC Project 132-778

This letter report is a summary of Bird Hazard Monitoring and Mitigation activities conducted by Civil & Environmental Consultants, Inc. (CEC) during Phase I of the Bridgeton Landfill, LLC North Quarry Action Plan. This summary covers results of monitoring of bird activity during installation and construction of temperature monitoring probes, gas extraction wells, perimeter sumps, and toe drains. These were the activities conducted during Phase I North Quarry Action Plan that involved excavation of trash that could be considered a bird attractant within the 10,000-foot buffer of the Airport runway. This summary also includes results of bird hazard monitoring at newly constructed detention basins within the 10,000-foot buffer. Because no bird hazards were observed, no mitigation activities were necessitated or occurred during these projects.

1.0 MONITORING REQUIREMENTS

The monitoring was conducted in accordance with the "Bird Hazard Monitoring and Mitigation Plans" (Plan) revised October 7, 2013, in response to comments received from the Lambert St. Louis International Airport (Airport). Construction activities commenced November 1, 2013. After construction began, we received two letters from the Airport's counsel at Husch Blackwell—one dated November 8, 2013, and addressed to the U.S. EPA and the other dated November 25, 2013, addressed to Lathrop & Gage. Since the Husch Blackwell letters were received after construction commenced, we were unable to incorporate the concepts and comments that they contained into the ongoing monitoring program. Therefore, this letter-report of monitoring activities follows the protocol and procedures of the October 7, 2013 version of the "Bird Hazard Monitoring and Mitigation Plans.

2.0 MONITORING PROCEDURES

A CEC biologist was onsite at all times while trash was being exhumed during the Phase I activities from November 1 to December 4, 2013. Resumes of the on-site biologists are attached (Attachment A). We observed and logged activities at a total of 24 gas extraction wells, 12

perimeter sumps, and toe drain around the North Quarry that were installed during this timeframe. Six full or partial rain days were experienced which allowed for a total of 20 observations of on-site detention basins and exposed waste during the North Quarry Phase 1 work. Weather conditions were logged with each field observation so that a weather-related pattern could possibly be observed if birds were to become a hazard to help predict which mitigation efforts might need to be accelerated.

Contractors utilized a number of techniques to minimize potential for bird activity including but not limited to:

- Waste material was promptly placed in roll off containers which were covered with a tarp,
- Waste was hauled and dumped at the enclosed transfer station, in which heavy machinery movement discouraged bird activity, and
- Waste which was not removed from the excavations or boreholes was promptly backfilled with controlled non-putrescible fill material.

The biologists observed bird behavior on or near the Phase I operations to evaluate if the operations were causing a bird hazard. If a bird hazard were to be observed, the on-site biologists were equipped with bird-excluding materials including a hand-held air horn and "Bird Banger" and "Bird Screamer" pyrotechnics designed to disperse flocks of birds. Biologists planned to use past experience and training to escalate the use of the bird-excluding materials by progressing through the three different types starting with the air horn. To avoid habituation, the banger and screamer excluders would be used to escalate the level of bird control, if needed. Movement by the on-site biologist throughout the area with differing escalating techniques were planned and deemed as sufficient measures to disperse birds during trash excavation activities. Bird Control Log Sheets (Attachment B) were completed by the biologists during and after each Phase I action was completed. A log of representative photographs of all Phase I activities is also attached (Attachment C).

As can be seen in the attached Photo Log and Bird Control Log sheets, CEC recorded observations at the start, during, and end of every pertinent action and collected representative photographs for each installation that occurred that involved unearthing waste during Phase I (Attachment C). During rain events, the new detention basins were monitored for bird activities during the excavation activities (Attachments B and C).

3.0 MONITORING RESULTS

As expected, based upon similar conditions observed during similar work in the South Quarry, no incidents of bird hazards were observed by CEC during the North Quarry Phase I operations or at the on-site detention basins. Similar to observations that the USDA logged from similar South Quarry operations, CEC observed that the exhumed waste was largely unattractive to birds relative to the surrounding foraging environment during that timeframe. As noted in the logs, at times, several birds (up to 17) were observed in close proximity; however these seemed to be

random transitory movements which were not attributable to the construction activities or the detention basins (Attachment B).

Monitoring of detention basins was completed during and after rain events while the biologists were on-site during excavation activities. As expected during rain events, water quickly passed through and drained from the detention basins as the design intended and therefore they do not serve as a bird attractant and no birds were attracted to these plastic-lined areas.

4.0 FUTURE MONITORING

CEC believes that the procedures identified in the October 7, 2013 Plan are adequate for the proposed Phase II construction to be performed in the Spring and Summer 2014. All activities during Phase II will be similar in nature and will involve short-duration, small, quickly-backfilled excavations.

However, the procedures in the Plan should be expanded to address the concepts and comments in the November 8 and November 25, 2013 Husch Blackwell letters prior to undertaking construction of an Isolation Barrier. This would include submission of monthly reports of bird activity to Dana Ryan, Airport Planning Manager.

5.0 CLOSING

Please call Mr. Slack at 877-746-0749 or email at rslack@cecinc.com if you have any questions or comments regarding this report.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Ryan Slack
Project Manager

Michael R. Beaudoin, P.E.
Principal

Attachments:
A - CEC Resumes
B - Bird Control Log Sheets
C - Photograph Log

ATTACHMENT A

RESUMES

Ryan Slack

Mr. Slack has a Bachelor's degree in natural resources. As a biologist with 20 years experience, Mr. Slack has worked on or managed several projects involving bird management and surveys, including a large project involving solid waste and bird/aviation conflicts. At CEC, Mr. Slack is also responsible for researching, developing, and implementing cost-effective field investigations on wetland delineations, threatened and endangered species surveys, stream habitat assessments, and Clean Water Act permitting. His daily responsibilities include writing and editing project reports, designing study plans using the most current scientific methods, and qualitative/quantitative interpretation of project data. Prior to joining CEC, Mr. Slack spent 16 years with other firms in the private environmental consulting arena, supervising field investigations for large and small research projects.

For the past three years, Mr. Slack has been managing all facets of a project in Allen County, Indiana at the active National Serv-All Landfill located within 10,000 feet of the Fort Wayne International Airport. As mandated by the City and Airport, Mr. Slack visits the landfill during each season (i.e. four times per year) to help on-site managers with bird exclusion by providing hands-on ways to better control birds at the active face and to monitor bird activity at the landfill compared to bird activity in between the two facilities and at the airport. Mr. Slack produces an annual report of his findings. Results of this multi-year effort have been positive and no issues have arisen despite the landfill being located near the airport and several city parks and state nature preserves.

Mr. Slack has participated in bird surveys relating to the federal Migratory Bird Treaty Act for several pipelines in several Midwestern and northern states and bat mist net/acoustic monitoring surveys for various clients throughout the eastern United States.

Mr. Slack provided specialized training on bird exclusion techniques to the other two on-site CEC biologists.

Greg Gerke

Mr. Gerke has a Bachelor's and Master's Degree in Natural Resources. As a biologist with 25 years experience, Mr. Gerke has worked on or managed several projects involving some level of bird management, including solid waste projects and bird/aviation conflicts. Mr. Gerke has worked in several Midwestern states performing wildlife surveys including Missouri, Kansas, Illinois, Indiana, Michigan, Tennessee, Pennsylvania and Ohio. In addition, Mr. Gerke has spent countless hours performing wildlife surveys, wetland delineations and related ecological projects on numerous solid waste sites throughout the Midwest.

Projects Mr. Gerke has been associated with include bird/aviation conflicts at Oak Ridge Landfill in Logansport, Indiana, bird surveys relating to the federal Migratory Bird Treaty Act for Southern Star Gas in Iola, Kansas, bat surveys and acoustic monitoring for various clients in Illinois, Indiana, Ohio and Pennsylvania, endangered butterfly surveys in Indiana and Pennsylvania, Gopher Tortoise surveys in Georgia and amphibian surveys in Ohio. Mr. Gerke has performed ecological surveys on solid waste sites as close as Roxana Landfill near St. Louis and as far away as Colonial Landfill in New Orleans.

Mr. Gerke received specialized training on bird exclusion techniques from Ryan, Slack, a biologist experienced in bird/aviation conflict resolution on solid waste sites in the Midwest.

Craig Rockey

Mr. Rockey has a Bachelor's and Master's Degree in Natural Resources. As a biologist with seven years experience, Mr. Rockey has contributed on projects involving some bird management, including solid waste projects and bird/aviation conflicts. Mr. Rockey has worked in several states across the Midwest and Northeast performing wildlife surveys including Indiana, Kentucky, Michigan, Missouri, Pennsylvania, Ohio, West Virginia, New York, and New Jersey.

Projects Mr. Rockey has been associated with include bird surveys relating to wind power development in Tuscola and Sanilac Counties, Michigan, various bird surveys in Jackson and Washtenaw Counties, Michigan, bat surveys and acoustic monitoring for various clients in Kentucky, Michigan, New Jersey, New York, Ohio, Pennsylvania, and West Virginia, and wetland and waterbody surveys, including amphibian and macroinvertebrate sampling in Ohio and Pennsylvania.

Mr. Rockey received specialized training on bird exclusion techniques from Ryan Slack, a biologist experienced in bird/aviation conflict resolution on solid waste sites in the Midwest.

ATTACHMENT B

BIRD CONTROL LOG SHEETS

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/1/13	1250	North Quarry Well #207	None	0	None	62	10-15 mph W	clear	Start drilling	RAS
11/1/13	1625	North Quarry Well #207	None	0	None	59	10-15 mph W	clear	end drilling	RAS
11/1/13	1658	North Quarry Well #207	None	0	None	59	10-15 mph W	clear	Dumpsters being hauled to Landfill in Illinois	RAS
11/1/13	1801	North Quarry Well #207	None	0	None	54	10 mph W	clear	Sunset - hole filled with gravel	RAS
11/2/13	0710	North Quarry Well #204	None	0	None	45	5-10 mph W	clear	Start drilling	RAS
11/2/13	1340	North Quarry Well #204	None	0	None	55	15 mph W	Partly Cloudy	end drilling	RAS
11/2/13	1454	North Quarry Well #204	None	0	None	55	10-15 mph W	cloudy	Start drilling	RAS
11/2/13	1500	North Quarry Well #204	None	0	None	55	10-15 mph W	cloudy	Last dumpster covered + left until 11/4	RAS
11/2/13	1506	North Quarry Well #211	None	0	None	55	10-15 mph W	cloudy	Unfinished hole sealed and covered	RAS
11/2/13	1510	North Quarry Well #211	None	0	None	55	10-15 mph W	cloudy	Last dumpster covered + left until 11/4	RAS
11/2/13	1645	North Quarry Well #211	None	0	None	53	10-15 mph NW	Cloudy	End drilling for the day	RAS
11/4/13	0630	North Quarry Well #211	None	0	None	48	10 mph S	cloudy	dumpsters undisturbed ~~Start drilling~~	RAS
11/4/13	0705	North Quarry Well #211	None	0	None	48	10 mph S	cloudy	Start drilling	RAS
11/4/13	0805	North Quarry Well #211	None	0	None	49	15 mph S	cloudy	End drilling	RAS

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/4/13	0903	North Quarry Well #203	None	6	None	52	10-15mph S	cloudy	Start drilling	RAS
11/4/13	1120	North Quarry Well #211	None	0	None	58	10-15mph S	cloudy	Dumpster boxes hauled to transfer station	RAS
11/4/13	1230	North Quarry Well #203	None	0	None	58	10-15mph S	Cloudy	Trash being loaded into dump trucks for haul to Trans Sta.	RAS
11/4/13	1404	North Quarry Well #203	None	0	None	60	10-15mph S	Partly cloudy	Trash being covered and hauled to Trans Sta	RAS
11/4/13	1418 + 1550	North Quarry Well #203	None	0	None	60	10-15 mph S	Sunny	truck dumps @ trans Sta (1418) drilling ends (1550)	RAS
11/4/13	1632	North Quarry Well #203	None	0	None	56	10-15mph S	Partly cloudy	Last dump truck to Transfer Station	RAS
11/5/13	1233	North Quarry Well #214	None	0	None	57	10-15mph S	Cloudy	Start drilling after rain delay	RAS
11/5/13	1436	North Quarry Well #214	None	0	None	60	10 mph S	cloudy	End drilling	RAS
11/5/13	1454	North Quarry Well #214	Gulls	3	None	58	10 mph S	cloudy	Gulls circled area for a period of 2 minutes checking	RAS
11/5/13	1545	North Quarry Well #214	None	0	None	56	10 mph S	Cloudy	Last dump truck to Transfer station	RAS
11/6/13	1257	North Quarry Well #208	None	0	None	45	15mph NW	Cloudy	Start drilling	RAS
11/6/13	1545	North Quarry Well #208	None	0	None	44	10-15mph NW	Cloudy	End drilling - refusal at 66 feet	RAS
11/6/13	1635	North Quarry Well #208	None	0	None	44	10-15mph NW	Cloudy	Hole filled and drill rig moved 10 ft.	RAS
11/6/13	1642	North Quarry Well #208	None	0	None	44	10-15mph NW	Cloudy	Last dump truck to Trans Sta.	RAS

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/7/13	0724	North Quarry Well #208	None	0	None	35	5mphSW	sunny	Start drilling	RD
11/7/13	1410	North Quarry Well #208	None	0	None	56	10-15mphW	sunny	End drilling	RD
11/7/13	1430	North Quarry Well #209	None	0	None	56	10-15mphW	sunny	Last truck to Trans Sta	RD
11/8/13	0625	North Quarry Well #206	None	0	None	33	calm	sunny	Start drilling	RD

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/8/13	1410	NORTH QUARRY WELL #206	NONE	0	NONE	57° F	10MPH S	PT. CLOUDY	END DRILLING	GJG
11/9/13	0600	NORTH QUARRY WELL # 205	NONE	0	NONE	50° F	10 MPH SW	CLEAR	BEGIN DRILLING	GJG
11/9/13	0730	NORTH QUARRY WELL #205	NONE	0	NONE	50° F	10MPH SW	CLEAR	FIRST TRASH BEING HAULED TO TRANSFER STATION	GJG
11/9/13	1243	NORTH QUARRY WELL # 205	NONE	0	NONE	65° F	15MPH W	CLEAR	ENDED EXCAVATION	GJG
11/9/13	1423	NORTH QUARRY WELL # 201	NONE	0	NONE	65° F	13MPH SW	CLEAR	BEGIN EXCAVATION	GJG
11/9/13	1448	NORTH QUARRY WELL # 201	NONE	0	NONE	69° F	13 MPH SW	CLEAR	TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/9/13	1550	NORTH QUARRY WELL #201	NONE	0	NONE	66° F	11 MPH SW	CLEAR	ENDED EXCAVATION	GJG
11/11/13	0655	NORTH QUARRY WELL #41R2	NONE	0	NONE	44° F	0 MPH	OVERCAST SPRINKLES	BEGIN EXCAVATION	GJG
11/11/13	0715	NORTH QUARRY WELL #41R2	NONE	0	NONE	44° F	0 MPH	OVERCAST SPRINKLES	FIRST TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/11/13	1220	NORTH QUARRY WELL #201	NONE	0	NONE	65° F	10 MPH SW	PT. CLOUDY	ROLL OFF TAKEN TO TRANSFER STATION	GJG
11/11/13	1540	NORTH QUARRY WELL #41R2	NONE	0	NONE	61° F	10 MPH W	OVERCAST	ENDED EXCAVATION	GJG
11/11/13	1730	NORTH QUARRY WELL #41R2	NONE	0	NONE	46° F	16 MPH NW	OVERCAST SPRINKLES	LAST TRASH TRUCK TAKEN TO TRANSFER STATION	GJG
11/12/13	0625	NORTH QUARRY WELL # 200	NONE	0	NONE	26° F	10 MPH W	CLEAR	BEGIN EXCAVATION	GJG
11/12/13	0648	NORTH QUARRY WELL #200	NONE	0	NONE	26° F	10 MPH W	CLEAR	TRASH BEING TAKEN TO TRANSFER STATION	GJG

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/12/13	0940	NORTH QUARRY WELL #200	0	0	NONE	26° F	13 MPH W	CLEAR	ENDED EXCAVATION	GJG
11/12/13	0951	NORTH QUARRY WELL #200	0	0	NONE	26° F	13 MPH W	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/12/13	1131	NORTH QUARRY WELL #42R	0	0	NONE	32°F	12 MPH N	CLEAR	BEGIN EXCAVATION	GJG
11/12/13	1144	NORTH QUARRY WELL #42R	0	0	NONE	32°F	12 MPH N	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/13/13	0500	NORTH QUARRY WELL #42R	0	0	NONE	22°F	0 MPH	CLEAR	RESTART EXCAVATION	GJG
11/13/13	0620	NORTH QUARRY WELL #42R	0	0	NONE	22°F	0 MPH	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/13/13	1010	NORTH QUARRY WELL #42R	0	0	NONE	30° F	12 MPH SW	CLEAR	ENDED EXCAVATION	GJG
11/13/13	1215	NORTH QUARRY WELL #40R	0	0	NONE	43°F	9 MPH SW	CLEAR	BEGIN EXCAVATION	GJG
11/13/13	1230	NORTH QUARRY WELL #40R	0	0	NONE	43°F	10 MPH SW	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/13/13	1535	NORTH QUARRY WELL #40R	0	0	NONE	54°F	10 MPH N	CLEAR	ENDED EXCAVATION HOLE PERMANENTLY CAPPED	GJG
11/14/13	0530	NORTH QUARRY WELL #40R	0	0	NONE	29° F	5 MPH S	CLEAR	BEGIN EXCAVATION ON NEW HOLE	GJG
11/14/13	0630	NORTH QUARRY WELL #40R	0	0	NONE	32° F	5 MPH S	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/14/13	1110	NORTH QUARRY WELL #40R	0	0	NONE	37°F	6 MPH S	CLEAR	ENDED EXCAVATION	GJG
11/14/13	1230	NORTH QUARRY WELL #54R	0	0	NONE	37° F	6 MPH S	CLEAR	BEGIN EXCAVATION	GJG

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/14/13	1341	NORTH QUARRY WELL #54R	0	0	NONE	37°F	6 MPH S	PT CLOUDY	TRASH TAKEN TO TRANSFER STATION	GJG
11/14/13	1641	NORTH QUARRY WELL #54R	0	0	NONE	50°F	10 MPH S	CLOUDY	END EXCAVATION FOR DAY HOLE TEMPORARILY COVERED RESUME IN MORNING	GJG
11/15/13	0530	NORTH QUARRY WELL #54R	0	0	NONE	48°F	8 MPH S	OVERCAST SPRINKLES	RESUME EXCAVATION	GJG
11/15/13	0600	NORTH QUARRY WELL #54R	0	0	NONE	48°F	8 MPH S	OVERCAST SPRINKLES	TRASH TAKEN TO TRANSFER STATION	GJG
11/15/13	0836	NORTH QUARRY WELL #54R	0	0	NONE	48°F	6MPH S	OVERCAST	ENDED EXCAVATION	GJG
11/15/13	0928	NORTH QUARRY WELL #43R2	0	0	NONE	48°F	6 MPH S	OVERCAST	BEGIN EXCAVATION	GJG
11/15/13	1005	NORTH QUARRY WELL #43R2	0	0	NONE	50°F	8 MPH SW	OVERCAST	TRASH TAKEN TO TRANSFER STATION	GJG
11/15/13	1611	NORTH QUARRY WELL #43R2	0	0	NONE	57°F	13 MPH S	PT. CLOUDY	ENDED EXCAVATION	GJG
11/15/13	1648	NORTH QUARRY WELL #43R2	0	0	NONE	55°F	13 MPH S	PT. CLOUDY	LAST TRASH TRUCK TAKEN TO TRANSFER STATION	GJG
11/16/13	0530	NORTH QUARRY WELL #53R	0	0	NONE	52°F	13 MPH SE	OVERCAST	BEGIN EXCAVATION	GJG
11/16/13	0748	NORTH QUARRY WELL #53R	0	0	NONE	55°F	13 MPH SE	OVERCAST	TRASH TAKEN TO TRANSFER STATION	GJG
11/16/13	1241	NORTH QUARRY WELL #53R	0	0	NONE	63°F	15 MPH S	OVERCAST	ENDED EXCAVATION	GJG
11/16/13	1255	NORTH QUARRY WELL #53R	0	0	NONE	63°F	15 MPH S	OVERCAST	LAST TRASH TRUCK TAKEN TO TRANSFER STATION	GJG

11/18/13
CDR

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/18/13	0630	N.Q. GEW-202	Ø	Ø	Ø	41° F	W @ 8mph	Clear	On site- Drilling underway	CDR
11/18/13	0710	" "	2	Ø	Ø	41° F	"	"	Trash covered, taken to transfer	CDR
11/18/13	0751	N.Q. GEW-202	Larus Spp.	9	Ø	44° F	WSW 8mph	Clear	9 gulls flew over, No stops or circling	CDR
	0840	" "	None	Ø	Ø	47° F	W @ 8mph	Clear	Trash covered and moved to trans. station	CDR
	0850	N.Q. GEW-55R	None	Ø	Ø	48° F	WNW @ 8mph	Clear	Initial excavation. No trash exposed	CDR
	1031	N.Q. GEW-202	None	Ø	Ø	51° F	NW @ 14 mph	Clear	Trash covered. Taken to trans. station	CDR
	1232	" "	None	Ø	Ø	55° F	WNW @ 7 mph	Clear	Trash Covered, taken to trans station. End Drilling	CDR
	1355	N.Q. GEW-55R	None	Ø	Ø	55° F	WNW @ 16 mph	Clear	Drilling begin. Trash exposed	CDR
	1433	N.Q. GEW-202	None	Ø	Ø	56° F	WNW @ 14 mph	Clear	Top soil plug in place.	CDR
	1451	N.Q. GEW-55R	None	Ø	Ø	56° F	WNW @ 14 mph	Clear	Trash covered. Taken to trans. station	CDR
	1526	N.Q. GEW-209	None	Ø	Ø	56° F	NW @ 13 mph	Clear	Initial excavation. No trash exposed	CDR
	1624	N.Q. GEW-55R	None	Ø	Ø	54° F	NW @ 12 mph	Clear	Trash covered and taken to transfer station.	CDR
	1642	" "	None	Ø	Ø	54° F	NW @ 12 mph	Clear	Drilling ended for day	CDR
↓		" "	None	Ø	Ø	54° F	NW @ 12 mph	Clear	Trash covered and taken to trans. station.	CDR

11/19/13

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/19	0500	N.Q. GEW-55R	None	0	0	[illegible] F	E @ 1 mph	Mostly Cloudy	Begin Drilling	CDR
	0710	" "	None	0	0	35° F	E @ 3 mph	Mostly Cloudy	Trash covered; taken to trans. station	CDR
	0908	" "	None	0	0	39° F	ENE @ 4 mph	Mostly Cloudy	Trash covered; taken to trans. station	CDR
	0914	" "	None	0	0	39° F	ENE @ 4 mph	Mostly Cloudy	End Drilling	CDR
	1030	N.Q. GEW-209	None	0	0	41° F	ESE @ 3 mph	Mostly Cloudy	Begin Drilling. Trash exposed.	CDR
	1116	N.Q. GEW-55R	None	0	0	42° F	SE @ 2 mph	Mostly Cloudy	Top soil plug in place.	CDR
	1119	N.Q. GEW-209	None	0	0	42° F	SE @ 2 mph	Mostly Cloudy	Trash covered; Taken to trans. station	CDR
	1144	N.Q. GEW-55R	None	0	0	44° F	Calm	Mostly Cloudy	Remaining trash cleared from around drill site.	CDR
	1224	N.Q. GEW-209	None	0	0	45° F	E @ 1 mph	Mostly Cloudy	Trash covered; Taken to trans. station	CDR
	1349	" "	None	0	0	47° F	E @ 4 mph	Mostly Cloudy	Trash covered; Taken to trans. station	CDR
	1635	" "	None	0	0	47° F	ESE @ 9 mph	Partly Cloudy	Trash covered, taken to trans. station. Hole back filled. End drilling	CDR

11/20/13 CDR

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/20	0515	N.Q. GEW-209	None	0	0	35° F	SE @ 10 mph	Partly Cloudy	Begin drilling	CDR
	0615	" "	Canada Geese	4	0	35° F	SE @ 10 mph	Partly Cloudy	Flew over, 1 goose made a turn towards [illegible] but then continued West w/ others.	CDR
	—	—								—
	0820	" "	None	0	0	36° F	SE @ 10 mph	Mostly Cloudy	End drilling	CDR
	0913	" "	None	0	0	38° F	SE @ 10 mph	Mostly Cloudy	Top soil plug in place.	CDR
	0919	N.Q. GEW-8R	None	0	0	39° F	SE @ 12 mph	Mostly Cloudy	Begin drilling. Trash exposed	CDR
	0957	" "	Gull	1	0	40° F	SE @ 13 mph	Mostly Cloudy	Flew over work retention site towards pond.	CDR
	1016	" "	Gulls	2	0	41° F	SSE @ 11 mph	Mostly Cloudy	Flew over work site towards retention pond.	CDR
	1040	" "	None	0	0	42° F	SSE @ 10 mph	Mostly Cloudy	Trash covered, taken to trans. station	CDR
	1116	" "	Canada Geese	5	0	43° F	SSE @ 9 mph	Mostly Cloudy	Fly-over headed south. made no stop/circle	CDR
	1116	" "	None	0	0	43° F	SSE @ 9 mph	Mostly Cloudy	Trash covered, taken to trans. station.	CDR
	1234	" "	None	0	0	44° F	S @ 4 mph	Cloudy Raining	End drilling	CDR
	1234	" "	None	0	0	44° F	S @ 4 mph	Cloudy Raining	Trash covered, taken to trans. station.	CDR
	1437	" "	None	0	0	42° F	E @ 7 mph	Clearing	Soil plug in place	CDR

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/20/13	1507	N.O. GEW-216	None	0	0	43° F	ESE @ 7 mph	Cloudy	Begin drilling. Trash scanned.	CDR
	1539	" "	None	0	0	44° F	ESE @ 5 mph	Cloudy	End drilling.	CDR
	1645	" "	None	0	0	44° F	ESE @ 5 mph	Mostly Cloudy	Top soil plug in place.	CDR
	1710	" "	None	0	0	44° F	SE @ 5 mph	Mostly Cloudy	Trash covered, taken to trans. station	CDR

Gas Extraction Well Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
12/2/13	0809	NQ well #216	0	0	N/A	39°F	NO WIND	OVERCAST	BEGIN EXCAVATION	CJG
12/2/13	0851	NQ well #216	0	0	N/A	39°F	NO WIND	OVERCAST	TRASH TAKEN TO TRANSFER STATION	CJG
12/2/13	0919	NQ well #216	0	0	N/A	39°F	NO WIND	OVERCAST	END EXCAVATION	CJG
12/2/13	1048	NQ well #212	0	0	N/A	46°F	NO WIND	PT. CLOUDY	BEGIN EXCAVATION	CJG
12/2/13	1252	NQ well #212	0	0	N/A	52°F	2 MPH SE	PT. CLOUDY	TRASH TAKEN TO TRANSFER STATION	CJG
12/2/13	1401	NQ well #212	0	0	N/A	57°F	5 MPH SSE	CLEAR	END EXCAVATION	CJG
12/3/13	0825	NQ well #212	0	0	N/A	55°F	5 MPH SSE	CLEAR	TRASH PILED & COVERED IN HOLE TRASH	CJG
12/3/13	0915	NQ well #212	0	0	N/A	50°F	5 MPH SW	OVERCAST	TRASH TAKEN TO TRANSFER STATION	CJG

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/7/13	0825	North Quarry PS #30	None	0	None	35°F	5mph S	Clear	Started Earthwork	RAJ
11/7/13	0904	North Quarry PS #30	"	0	"	36°F	5mph S	Clear	Trash exposed and loaded into dump trucks and taken to transfer Sta	RAJ
11/7/13	1110	North Quarry PS #30	"	0	"	42°F	5-10mph S	Clear	Ended Excavation	RAJ
11/7/13	1326	North Quarry PS #29	"	0	"	48°F	5-10mph SW	Clear	Started Earthwork	RAJ
11/7/13	1340	"	"	0	"	52°F	10mph W	Clear	Trash Exposed. Earthwork stopped	RAJ
11/7/13	1439	"	"	0	"	56°F	10-15mph W	Clear	Trash being loaded on dump trucks & taken to Trans. Sta.	RAJ
11/7/13	1549	North Quarry PS #30	"	0	"	52°F	5-10mph W	Clear	Sump installed and hole back-filled	RAJ
11/7/13	1644	North Quarry PS #29	"	0	"	51°F	5mph W	Clear	Last dump truck to Transfer Sta.	RAJ
11/7/13	1651	"	"	0	"	50°F	5mph W	Clear	Unfinished hole backfilled for night	RAJ
11/8/13	0715	"	None	0	None	33°F	Calm	Clear	earthwork begin	RAJ
11/8/13	0950	"	None	0	None	48°F	8mph SE	Partly Cloudy	Trash exposed Trash excavation finished	RAJ
11/8/13	1036	North Quarry PS #28	None	0	None	52°F	10mph SE	Partly cloudy	start earth work	RAJ
11/8/13	1130	"	None	0	None	54°F	10mph S	Partly cloudy	Trash exposed	RAJ
11/8/13	1325	North Quarry PS #29	None	0	None	56°F	10mph S	Partly cloudy	Sump installed hole filled	RAJ

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/9/13	0700	NORTH QUARRY PS # 32	NONE	0	NONE	50°F	10 MPH S	CLEAR	BEGIN EXCAVATION	GJG
11/9/13	0728	NORTH QUARRY PS # 32	NONE	0	NONE	50°F	10 MPH S	CLEAR	FIRST TRASH EXCAVATED AND TAKEN TO TRANSFER STA.	GJG
11/9/13	1003	NORTH QUARRY PS # 32	NONE	0	NONE	56°F	11 MPH S	CLEAR	ENDED EXCAVATION	GJG
11/9/13	1018	NORTH QUARRY PS # 32	NONE	0	NONE	56°F	11 MPH S	CLEAR	ALL TRASH TAKEN TO TRANSFER STATION	GJG
11/9/13	1400	NORTH QUARRY PS # 27	NONE	0	NONE	65°F	15 MPH W	CLEAR	BEGIN EXCAVATION	GJG
11/9/13	1600	NORTH QUARRY PS #27	NONE	0	NONE	66°F	14 MPH W	CLEAR	EXCAVATION COVERED W/ DIRT-NO TRASH EXCAVATED	GJG
11/9/13	1745	NORTH QUARRY PS #27	NONE	0	NONE	65°F	10 MPH S	CLEAR	ROLL OFF BOX COVERED	GJG
11/11/13	0705	NORTH QUARRY PS #27	NONE	0	NONE	44°F	5 MPH SW	OVERCAST SPRINKLES	BEGIN EXCAVATION	GJG
11/11/13	0715	NORTH QUARRY PS #27	NONE	0	NONE	44°F	5 MPH SW	OVERCAST SPRINKLES	FIRST TRASH TAKEN TO TRANSFER STATION	GJG
11/11/13	0820	NORTH QUARRY PS # 26	NONE	0	NONE	44°F	13 MPH SW	OVERCAST SPRINKLES	BEGIN EXCAVATION	GJG
11/11/13	0825	NORTH QUARRY PS # 26	NONE	0	NONE	44°F	13 MPH SW	OVERCAST SPRINKLES	FIRST TRASH TAKEN TO TRANSFER STATION	GJG
11/11/13	0944	NORTH QUARRY PS #27	NONE	0	NONE	55°F	12 MPH SW	OVERCAST	ENDED EXCAVATION	GJG
11/11/13	1355	NORTH QUARRY PS # 26	NONE	0	NONE	60°F	10 MPH W	OVERCAST	ENDED EXCAVATION	GJG
11/11/13	1400	NORTH QUARRY PS # 35	NONE	0	NONE	59°F	10 MPH W	OVERCAST	BEGIN EXCAVATION	GJG
11/11/13	1450	NORTH QUARRY PS # 35	NONE	0	NONE	59°F	10 MPH W	OVERCAST	EXCAVATION COVERED	GJG

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/12/13	0645	NORTH QUARRY PS # 35	0	0	NONE	27°F	12 MPH W	CLEAR	BEGIN EXCAVATION	GJG
11/12/13	0740	NORTH QUARRY TOE DRAIN	0	0	NONE	27°F	12 MPH W	CLEAR	BEGIN EXCAVATION	GJG
11/12/13	0740	NORTH QUARRY PS # 35	0	0	NONE	27°F	12 MPH W	CLEAR	TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/12/13	1015	NORTH QUARRY PS # 35	0	0	NONE	26°F	13 MPH W	CLEAR	ENDED EXCAVATION	GJG
11/12/13	1020	NORTH QUARRY TOE DRAIN	0	0	NONE	26°F	13 MPH W	CLEAR	TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/12/13	1402	NORTH QUARRY PS # 31	0	0	NONE	35°F	12 MPH N	CLEAR	BEGIN EXCAVATION	GJG
11/12/13	1429	NORTH QUARRY PS # 31	0	0	NONE	35°F	12 MPH N	CLEAR	TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/12/13	1432	NORTH QUARRY TOE DRAIN	0	0	NONE	35°F	12 MPH N	CLEAR	END EXCAVATION	GJG
11/12/13	1452	NORTH QUARRY PS #31	0	0	NONE	35°F	11 MPH N	CLEAR	EXCAVATION TEMPORARILY FILLED	GJG
11/13/13	0630	NORTH QUARRY PS #31	0	0	NONE	23°F	0 MPH	CLEAR	RESTART EXCAVATION	GJG
11/13/13	0703	NORTH QUARRY TOE DRAIN	0	0	NONE	23°F	0 MPH	CLEAR	BEGIN EXCAVATION	GJG
11/13/13	0730	NORTH QUARRY PS #31	0	0	NONE	24°F	0 MPH	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/13/13	0930	NORTH QUARRY TOE DRAIN	0	0	NONE	25°F	0 MPH	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/13/13	1331	NORTH QUARRY PS # 31	0	0	NONE	43°F	9 MPH SW	CLEAR	ENDED EXCAVATION	GJG

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/13/13	1530	NORTH QUARRY TOE DRAIN	0	0	NONE	57° F	10 MPH N	CLEAR	ENDED EXCAVATION	GJG
11/14/13	0645	NORTH QUARRY PS # 33	0	0	NONE	32°F	5MPH S	CLEAR	BEGIN EXCAVATION	GJG
11/14/13	0710	NORTH QUARRY PS # 33	0	0	NONE	32°F	5 MPH S	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/14/13	0905	NORTH QUARRY PS # 33	0	0	NONE	37°F	6 MPH S	CLEAR	ENDED EXCAVATION	GJG
11/14/13	0900	NORTH QUARRY TOE DRAIN	0	0	NONE	37°F	6 MPH S	CLEAR	BEGIN EXCAVATION	GJG
11/14/13	0730	NORTH QUARRY TOE DRAIN	0	0	NONE	38°F	6 MPH S	CLEAR	TRASH TAKEN TO TRANSFER STATION	GJG
11/14/13	1205	NORTH QUARRY PS # 34	0	0	NONE	37°F	6 MPH S	CLEAR	BEGIN EXCAVATION	GJG
11/14/13	1300	NORTH QUARRY TOE DRAIN	0	0	NONE	45° F	10 MPH S	PT. CLOUDY	END EXCAVATION	GJG
11/14/13	1400	NORTH QUARRY PS #34	0	0	NONE	49°F	10MPH S	PT. CLOUDY	EXCAVATION RE-COVERED WITH NO TRASH EXPOSED	GJG
11/15/13	0630	NORTH QUARRY WELL #34	0	0	NONE	48°F	8 MPH S	OVERCAST SPRINKLES	RESTART EXCAVATION	GJG
11/15/13	0805	NORTH QUARRY WELL #34	0	0	NONE	48° F	8 MPH S	OVERCAST	ENDED EXCAVATION	GJG
11/16/13	0700	NORTH QUARRY WELL # 36	0	0	NONE	53°F	13 MPH SE	OVERCAST	BEGIN EXCAVATION	GJG
11/16/13	0829	NORTH QUARRY WELL # 36	0	0	NONE	57°	13 MPH SE	OVERCAST	END EXCAVATION - NO TRASH ENCOUNTERED	GJG
11/16/13	0900	NORTH QUARRY TOE DRAIN	0	0	NONE	57°	15 MPH SE	OVERCAST	BEGIN EXCAVATION	GJG

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/16/13	1006	NORTH QUARRY TOE DRAIN	0	0	NONE	60°F	17MPH S	OVERCAST	TRASH BEING TAKEN TO TRANSFER STATION	GJG
11/16/13	1035	NORTH QUARRY TOE DRAIN	0	0	NONE	60°F	17MPH S	OVERCAST	ENDED EXCAVATION	GJG

11/18/13
CDR

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/18/13	0730	N.O. T.D. 26-27	None	0	0	41° F	N @ 8 mph	Clear	TD excavation begin. Trash exposed, being covered. Photos of Ex. taken	CDR
	0813	" "	None	0	0	45° F	WNW @ 8 mph	Clear	Trash covered and taken to trans. station	CDR
	0907	" "	None	0	0	48° F	WNW @ 8 mph	Clear	Trash covered and taken to trans. station	CDR
	0954	" "	None	0	0	49° F	WNW @ 10 mph	Clear	Trash covered and taken to trans. station.	CDR
	1051	" "	None	0	0	52° F	NW @ 15 mph	Clear	Trash covered and taken to trans. station.	CDR
	1318	" "	None	0	0	55° F	WNW @ 17 mph	Clear	Trash covered, taken to trans. station. Excavation complete	CDR
↓	1631	" "	None	0	0	54° F	NW @ 12 mph	Clear	Back fill complete. EVOH installed.	CDR

11/19/13

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
	0720	N.Q. PS-27	None	0	0	35° F	E @ 3 mph	Mostly Cloudy	Horizontal collection pipe installed. No trash exposed.	CDR
	0823	N.Q. TD26-27	None	0	0	37° F	ESE @ 1 mph	Mostly Cloudy	Trench dug for install of EVOH, No trash exposed.	CDR
	1055	N.Q. TD 26-27	None	0	0	42° F	SE @ 2 mph	Mostly Cloudy	Backfill of trench & EVOH installed.	CDR
	1448	N.Q. PS-30	None	0	0	49° F	E @ 5 mph	Mostly Cloudy	Exposing base of ~~Sump~~ for install of ~~Toe Drain~~ tomorrow. NO TRASH EXPOSED	CDR

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/20/13	0729	N.Q. TD 30-36	None	0	0	35° F	SSE @ 6 mph	Partly Cloudy	Excavation begin. Trash exposed.	CDR
	0903	" "	None	0	0	38° F	SE @ 10 mph	Mostly Cloudy	Trash covered. Taken to transf. station	CDR
	1343	" "	None	0	0	42° F	SE @ 6 mph	Cloudy Rain	Backfill complete. No trash exposed	CDR
	1439	" "	None	0	0	42° F	E @ 7 mph	Cloudy	Installing horizontal tubes. No trash exposed.	CDR
	1532	" "	None	0	0	43° F	ESE @ 8 mph	Cloudy	EVOH installed.	CDR
11/22/13	0737	N.Q. TD 36-	None	0	0	39° F	NW @ 13 mph	Cloudy	Begin excavation. No trash exposed.	CDR
	1024	" "	None	0	0	39° F	NNW @ 13 mph	Cloudy	Excavation complete. No trash exposed.	CDR
	1130	" "	Gull	1	0	39° F	NW @ 16 mph	Cloudy	Fly over. No approach or circling of work area.	CDR
	1313	" "	Gull	1	0	40° F	NNW @ 13 mph	Cloudy	Fly over. No approach or circling of work area	CDR
	1402	" "	None	0	0	40° F	N @ 13 mph	Cloudy	Excavation for horizontal drains. No trash exposed.	CDR
	1431	" "	Hawk	1	0	40° F	NNW @ 11 mph	Cloudy	Fly over. No approach or circling of work area	CDR
	1434	" "	None	0	0	40° F	NNW @ 11 mph	Cloudy	Back fill of toe drains complete.	CDR
	1603	" "	None	0	0	38° F	NE @ 13 mph	Cloudy	Digging trench for anchor of EVOH. No trash exposed.	CDR
	1639	" "	None	0	0	38° F	NNW @ 15 mph	Cloudy	EVOH installed. Backfill complete.	CDR

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/23/19	0729	N.O. TD 26-31	None	0	0	31° F	NNW @ 11 mph	Mostly Cloudy	Earthwork underway. Trash exposed.	CDR
↓	0951	" "	None	0	0	32° F	NNW @ 11 mph	Mostly Cloudy	Trash covered, taken to transfer station.	CDR
	1015	" "	Turkey Vulture	1	0	32° F	NW @ 14 mph	Mostly Cloudy	Flying very high. Made no move toward work area.	CDR
	1143	" "	Canada Geese	7	0	32° F	N @ 17 mph	Mostly Cloudy	Fly over. No stop or circle of work area.	CDR
	1222	" "	Canada Geese	1	0	33° F	NNW @ 18 mph	Partly Cloudy	Fly over. No stop or circle of work area.	CDR
	1349	" "	Gull	1	0	34° F	NNW @ 18 mph	Few Clouds	Flying over leachate tanks to NW of work area	CDR
	1418	" "	None	0	0	34° F	NNW @ 15 mph	Few Clouds	Backfill complete. EVOH install begin.	CDR
	1512	" "	Gull	1	0	35° F	N @ 15 mph	Few Clouds	Fly over. No stop or circle of work area.	CDR
	1516	" "	Gull	17	0	35° F	N @ 15 mph	Few Clouds	Flew from S to N over South quarry	CDR
↓	1634	" "	None	0	0	31° F	N @ 20 mph	Few Clouds	EVOH installed.	CDR
11/25/19	0707	N.O. TD 26-31	None	0	0	30° F	S @ 8 mph	Mostly Cloudy	Earthwork underway.	CDR
	0750	" "	None	0	0	30° F	SSE @ 8 mph	Mostly Cloudy	Trash exposed.	CDR
	0900	" "	Canada Geese	17	0	31° F	S @ 9 mph	Mostly Cloudy	Fly over to retention pond. No circle/stop over area.	CDR
	0941	" "	None	0	0	32° F.	S @ 8 mph	Mostly Cloudy	Trash covered, taken to trans. station.	CDR

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/25/13	1017	NIQ. TD26-31	None	0	0	32° F	S @ 9 mph	Mostly Cloudy	Excavation complete.	CDR
↓	1037	" "	Canada Geese	11	0	34° F	SSW @ 8 mph	Mostly Cloudy	Fly over to retention pond. No circle/stop @ work area.	CDR
	1338	" "	None	0	0	36° F	SW @ 7 mph	Mostly Cloudy	Backfill complete.	CDR
	1402	" "	Gulls	14	0	36° F	WSW @ 8 mph	Mostly Cloudy	Fly over. A couple circled to check out area.	CDR
	1557	" "	Gull	1	0	36° F	SW @ 7 mph	Mostly Cloudy	Fly over. No circle or stop @ work area.	CDR
↓	1632	" "	None	0	0	36° F	S @ 4 mph	Mostly Cloudy	EVOH installed.	CDR

Perimeter Sump (PS) and Toe Drain Installation Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
12/2/13	0805	TOE DRAIN	0	0	N/A	39°F	NO WIND	OVERCAST	BEGIN EXCAVATION	GTG
12/2/13	1215	TOE DRAIN	0	0	N/A	52°F	3 MPH SE	PT. CLOUDY	TRASH TAKEN TO TRANSFER STATION	GTG
12/2/13	1430	TOE DRAIN	0	0	N/A	54°F	5 MPH SE	PT. CLOUDY	END EXCAVATION	GTG
12/3/13	0850	TOE DRAIN	0	0	N/A	50°F	8 MPH SW	OVERCAST	BEGIN EXCAVATION	GTG
12/3/13	1145	TOE DRAIN	0	0	N/A	55°F	15 MPH SW	OVERCAST	TRASH TAKEN TO TRANSFER STATION	GTG
12/3/13	1300	TOE DRAIN	0	0	N/A	55°F	15 MPH SW	PT. CLOUDY	END EXCAVATION	GTG
12/4/13	0700	TOE DRAIN	0	0	N/A	52°F	8 MPH SE	OVERCAST IN PART	BEGIN EXCAVATION	GTG
12/4/13	0930	TOE DRAIN	0	0	N/A	53°F	8 MPH SE	OVERCAST	TRASH TAKEN TO TRANSFER STATION	GTG
12/4/13	1045	TOE DRAIN	0	0	N/A	53°F	10 MPH SE	OVERCAST	END EXCAVATION	GTG
12/4/13	1510	TOE DRAIN	0	0	N/A	55°F	12 MPH SE	PT. CLOUDY	LAST TRUCK TAKEN TO TRANSFER STATION	GTG

Retention and Detention Basin Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/5/13	0730	Detention Basins	None	0	None	—	—	Cloudy	Checked during rain event	RAS
11/5/13	1130	Detention Basins	None	0	None	—	—	Cloudy	Checked after rain event	RAS
11/6/13	0730	Detention Basins	None	0	None	—	—	Cloudy	Checked during rain event	RAS
11/6/13	1130	Detention Basins	None	0	None	—	—	Cloudy	Checked after rain event	RAS

Retention and Detention Basin Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/12/13	0720	DETENTION POND BY SILOS	MOURNING DOVE	3	NONE	27° F	10 MPH W	CLEAR	PRECIPITATION W/I LAST 12 HOURS	GJG
11/12/13	0723	DETENTION PONDS EAST OF LF	NONE	0	NONE	27° F	10 MPH W	CLEAR	PRECIPITATION W/I LAST 12 HOURS	GJG

11/19/13
CDR

Retention and Detention Basin Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/19/13	0700	N. Q. Detention Basin	None	0	0	35° F	E @ 3 mph	Mostly Cloudy	Excavation begin. No trash exposed	CDR
↓	1242	" "	None	0	0	45° F	ENE @ 1 mph	Mostly Cloudy	Excavation still underway. No trash	CDR
↓	1447	" "	None	0	0	49° F	E @ 5 mph	Mostly Cloudy	Excavation still underway. No trash	CDR
↓	1551	Retention Basin on East side of property		~50	0	48° F	SE @ 6 mph	Partly Cloudy	Circling basin. Made no move towards work area. Will check on in AM of 11/20/13	CDR

Retention and Detention Basin Bird Control Log

Date	Time	Location	Species	Number	Control Method	Temperature	Wind Speed and Direction	Sky	Comments	Initials
11/20/13	0630	N. Detention Pond	None	0	0	35° F	SE @ 10 mph	Partly Cloudy	Excavation basin. No trash exposed.	CDR
	0932	Retention Pond	Gulls	~35	0	40° F	SE @ 13 mph	Mostly Cloudy	Circling + landing on detention pond.	CDR
	0955	" "	Gulls	~10	0	40°F	SE @ 13 mph	Mostly Cloudy	most gulls flew off to South. A few remain on the pond.	CDR
	1149	Detention Basins	None	0	0	44° F	S @ 8 mph	Cloudy Rain	Light rain. No significant water collection.	CDR
	1227	" "	None	0	0	43° F	SE 4 mph	Cloudy Rain	Continuing to rain. No water collecting	CDR
	1341	" "	None	0	0	42° F	SE @ 6 mph	Cloudy Rain	Photos taken. Continuing to rain. ≤1" water in basin	CDR
↓	1422	" "	None	0	0	42° F	E @ 7 mph	Cloudy	Rain has stopped. Some small pooling ≤ 2" Photo taken	CDR
11/22/13	0630	Detention Basin	None	0	0	40° F	NW @ 13 mph	Cloudy	Basin has ≤ 1" water from yesterday's rain.	CDR
↓	1045	" "	Gulls	~30	0	39° F	NNW @ 13 mph	Cloudy	Gulls circling and landing on pond.	CDR
↓	1103	" "	Gulls	~30	0	39° F	NNW @ 17 mph	Cloudy	Gulls flew off to South	CDR

ATTACHMENT C

PHOTOGRAPH LOG

Photo 1: On-site Bird Exclusion Products.

Photo 2: View of Gas Extraction Well Drill Rig.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 3: View of Trash from Drill Bit during Gas Extraction Well Installation.

Photo 4: View of Trash Removal during Gas Extraction Well Installation.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 5: View of Trash being Hauled to Dumpster Box.

Photo 6: View of Trash in Dumpster Box.

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Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 7: View of Trash Being Covered.

Photo 8: View of Covered Trash before Hauling to Transfer Station.

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Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 9: View of Trash being hauled to Transfer Station.

Photo 10: View of Partially Finished Gas Extraction Well Hole being Covered at End of Work Day.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 11: View of Covered Dumpster Box at End of Work Day.

Photo 12: View of Covered Dumpster Box at Beginning of Work Day.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo: 13: View of Dumpster Box after Dumped at Transfer Station.

Photo 14: View of Trash being placed in Dump Truck for Hauling to Transfer Station.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 15: View of Trash being covered before Hauling to Transfer Station.

Photo 16: View of Trash being dumped at Transfer Station.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 17: View of Trash being Loaded into Dump truck during Perimeter Sump Installation.

Photo 18: View of Gas Extraction Well and Perimeter Sump Installation.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Photo 19: View of Perimeter Sump and Toe Drain Installed.

Photo 20: View of Detention Basin Immediately after a Rain Event.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

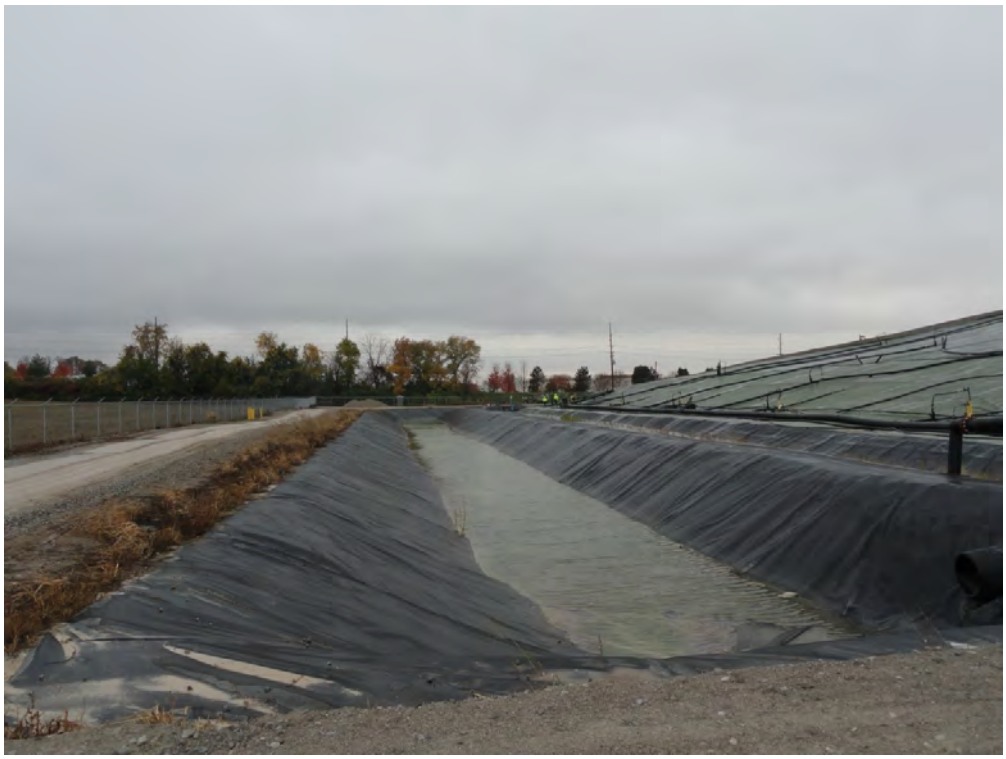

Photo 21: View of Detention Basin Immediately after a Rain Event.

Photo 22: View of Detention Basin Immediately after a Rain Event.

Bridgeton Landfill, LLC
Bird Hazard Monitoring and Mitigation
St. Louis County, Missouri
CEC Project 132-778
Photographs Taken November 1 to December 4, 2013

Appendix B:

Air Monitoring, Sampling and QA/QC Plan West Lake Landfill Superfund Site, Operable Unit 1

Auxier & Associates, Inc.
Radiological Health, Safety and Environmental Services
A USA Environment, L.P. Company

AIR MONITORING, SAMPLING, AND QA/QC PLAN

WEST LAKE SUPERFUND SITE OPERABLE UNIT 1

May 2014

PREPARED BY:

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AIR MONITORING, SAMPLING, AND QA/QC PLAN

SIGNATURES:

Prepared by Mike Bollenbacher, C.H.P. Auxier& Associates, Project RSO

_____ _____,

Signature **Date**

Approved by Paul Rosasco, Project Coordinator EMSI

_____ _____,

Signature **Date**

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FIGURES

TABLES

APPENDICIES

1. INTRODUCTION

This Air Monitoring, Sampling, and Quality Assurance/Quality Control (QA/QC) Plan ("Plan") describes the environmental air sampling and monitoring activities which will be performed at the West Lake Landfill Superfund Site in Bridgeton, Missouri, as required by Paragraph 30d of the April 14, 2014 Administrative Settlement Agreement and Order on Consent for Removal Action – Preconstruction Work (Preconstruction ASAOC) entered into between the U.S. Environmental Protection Agency (EPA) and Respondents Bridgeton Landfill, LLC and Rock Road Industries, Inc. The activities implemented under this Plan are intended to obtain baseline air monitoring data prior to implementation of future remedial actions at West Lake Landfill Operable Unit 1 (OU-1), and to support construction activities associated with the near-term installation of an isolation barrier between the Bridgeton Sanitary Landfill's North Quarry landfill unit and Area 1 of West Lake Landfill OU-1. This Plan also includes provisions to satisfy Paragraph 33a of the Preconstruction ASAOC regarding compliance with EPA's "Quality Assurance/Quality Control Guidance for Removal Activities" (EPA, 1990).

Respondents will install and commence operation of a permanent perimeter air monitoring system before any construction activities begin for the isolation barrier, and will operate the air monitoring system during construction of the isolation barrier. The system will continue to operate after installation of the isolation barrier is completed in order to collect additional data prior to implementation of any other remedial actions for West Lake Landfill OU-1. The air monitoring activities will include sampling for airborne radioactive particulates, radon gas, volatile organic compounds (VOCs), and will measure gamma radiation at each sampling location. Sampling will be performed continuously at the perimeter of OU-1 Areas 1 and 2, and at multiple on-site locations. Data collected from the monitoring activities will be used to assess and document the air quality along the boundaries of OU-1, and to evaluate the potential exposure of occupational workers to airborne contaminants during construction.

1.1 SITE DESCRIPTION

The West Lake Landfill Superfund Site is located at 13570 St. Charles Rock Road in Bridgeton, St. Louis County, Missouri, approximately one mile north of the intersection of Interstate 70 and Interstate 270. The site is divided into two Operable Units. Operable Unit-1 (OU-1) is comprised of the two disposal areas (Area 1 and Area 2) where radionuclides are mixed within landfilled soil and solid waste materials. Operable Unit-2 (OU-2) consists of the remainder of the site and includes several inactive landfilled areas containing sanitary waste or demolition debris, a solid waste transfer station, a concrete plant, an asphalt batch plant, and a permitted sanitary landfill (the Bridgeton Sanitary Landfill), which stopped receiving waste on Dec. 31, 2004. The Bridgeton Sanitary Landfill is a quarry-fill landfill containing municipal waste, and consists of the North Quarry and South Quarry landfill units. The southern border of OU-1 Area 1 is contiguous with the North Quarry cell of the Bridgeton Sanitary Landfill. OU-1's Area 2 is located along the northern portion of the overall site, approximately 1,000 feet (at the closest) from the outer boundary of the North Quarry landfill unit, and is separated from it by a road and by the closed demolition landfill (Figure 1-1).

Land use surrounding the site is primarily commercial and industrial, with residential uses to the south of the site (the Spanish Village subdivision) and to the east (the Terrisan Reste mobile home park).

1.2 BACKGROUND

According to the Nuclear Regulatory Commission (NRC), in 1973, approximately 8,700 tons of leached barium sulfate residues (a remnant from the Manhattan Engineer District/Atomic Energy Commission project) were reportedly mixed with approximately 39,000 tons of soil from the 9200 Latty Avenue Superfund site in Hazelwood, Missouri, transported to the West Lake Landfill, and used as daily or intermediate cover material. (NRC 1988, RMC 1982 and 1981).

EPA added the West Lake Landfill Superfund Site to its National Priorities List in 1990. In May 2008, EPA signed a Record of Decision (ROD) for OU-1, which selected a remedial action for the radiologically contaminated landfill areas and the area formerly described as the Ford Property, now called the Buffer Zone/Crossroad property. The 2008 ROD requires installation of a modified solid waste landfill cover over OU-1 Areas 1 and 2.

Since late 2010, the Bridgeton Sanitary Landfill South Quarry unit has experienced a subsurface smoldering event (SSE). In 2013, Respondents committed to construct a subsurface isolation barrier between the Bridgeton Sanitary Landfill's waste mass and radiologically-impacted material located in OU-1's Area 1.

1.3 CONSTITUENTS OF CONCERN

West Lake Landfill contains both municipal solid waste and construction and demolition wastes. In a March 7, 2014 meeting, representatives from the EPA met with representatives from EMSI and requested that air monitoring be performed for airborne radiological contaminants and volatile organic compounds (VOCs). A Baseline Risk Assessment (BRA) was published in 2000 and identified the radionuclides of concern at the West Lake Landfill. These compounds, plus EPA's requested VOC sampling, will be the constituents of concern (COCs) to be monitored and sampled under this Plan.

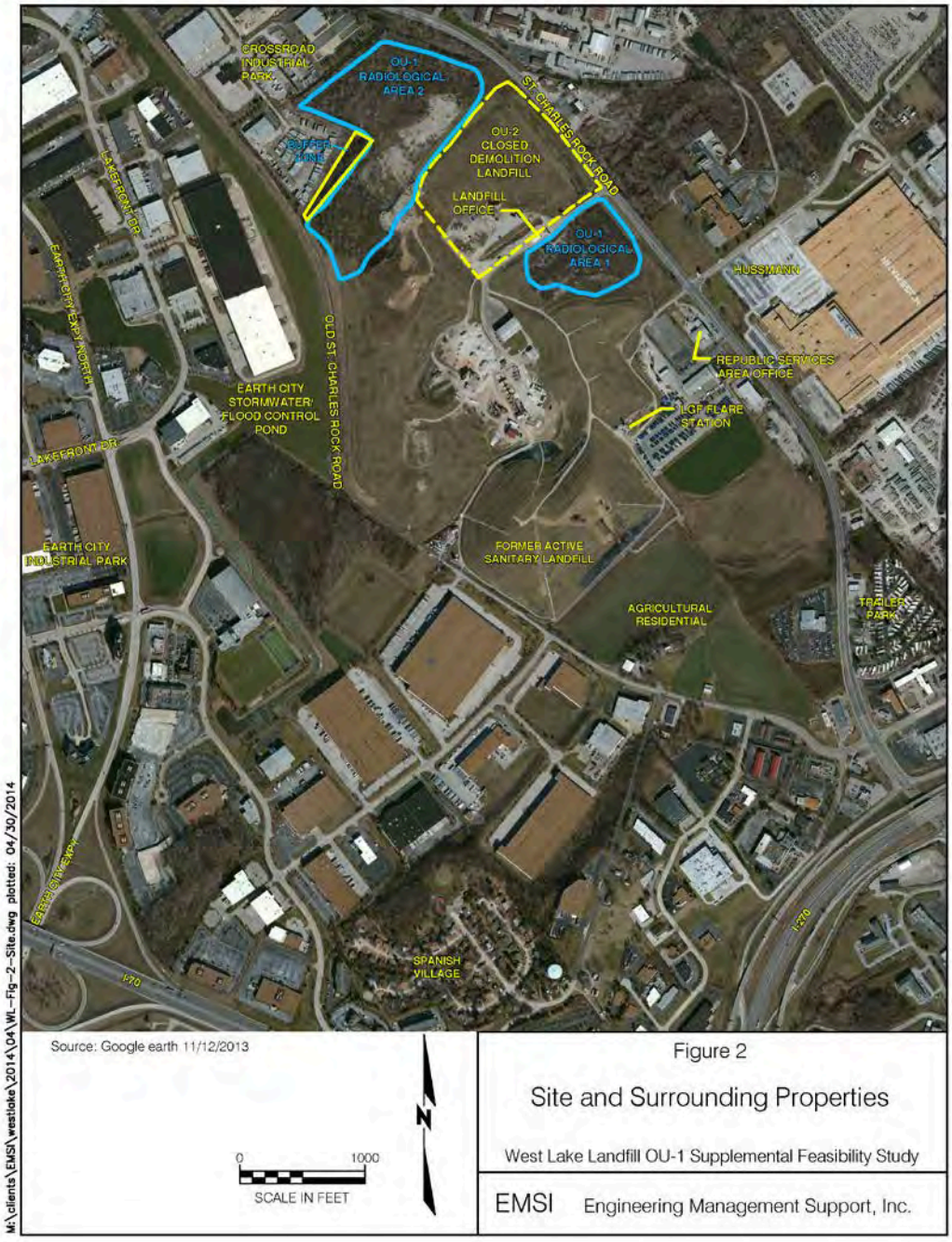


Figure 1-1 West Lake Landfill Superfund Site

2. DATA USE OBJECTIVES

This Plan provides for air quality monitoring in and around OU-1 before, during and after planned construction activities near or in OU-1.

2.1 INTENDED USE OF DATA

Air sampling and direct gamma radiation monitoring data collected by the air monitoring system will:

1) characterize the baseline conditions at the site;
2) monitor exposure pathways by sampling and analysis during construction activities;
3) assess the potential for releases of radioactive materials or chemical contaminants from the site; and
4) characterize trends, if any, in environmental radiation measurements, especially as they are affected by the site's construction events.

This data will be the basis for informed decisions regarding the health and safety of workers and the public, and will document compliance with regulatory standards. It will also provide a basis for qualitative dose reconstructions, if necessary.

2.2 DECISIONS TO BE MADE

Information gathered by the air monitoring and sampling activities will be used to decide if air quality at the perimeter of the site complies with the numerical limits identified in Section 4 of this Plan. If review of the data identifies a condition of non-compliance, the data will be used to determine the cause of the non-conformity, and to aid decision-makers in selecting a course of corrective action. The air monitoring and sampling system then will continue collecting data to document any corrective action's impact and provide quantitative metrics to decision-makers evaluating the effectiveness of a corrective action.

2.3 QUESTIONS TO BE ADDRESSED

Questions to be addressed include:

- What are the pre-construction, baseline airborne levels of COCs?
- What will be the level of exposure to potential receptors as measured by the air monitoring and sampling system, and do those levels exceed numerical limits which reflect dose-based or risk-based standards?
- What are the post-construction airborne levels of COCs, and do they exceed numerical limits?
- What level of air monitoring is required long-term, and will an absence of COCs (in general or at specific locations) support the reduction or elimination of sampling at some future date?

3. QUALITY ASSURANCE OBJECTIVES

The quality assurance objectives for this monitoring and sampling program are designed to assess the quality of the data gathered at the perimeter of OU-1, and at other on-site locations during pre-construction and construction activities. Target analytes for sampling include airborne radioactive particulates (including alpha and beta emitters), radon gas, and VOCs. Gamma radiation will be measured at the sampling locations as well. Quality assurance objectives for data are defined in compliance with EPA's "Quality Assurance/Quality Control Guidance for Removal Activities" (EPA 1990).

Samples collected for airborne radioactive particulates will be analyzed for gross alpha and gross beta activity. The analytical results will be compared to the appropriate work area or perimeter investigative levels as specified in Table 4-3 for baseline and construction activities. These "investigative levels" are administrative limits that are set below the NRC's "Standards for Protection Against Radiation" found at 10 CFR part 20, Appendix B, for occupational limits and effluent concentrations in air. Samples with results that exceed these investigative levels will undergo isotopic analysis to identify and quantify the specific radioisotopes present in the sampled material. All samples submitted for gross alpha/beta and isotopic analysis will be analyzed using EPA approved methods (see Section 4.4, below).

Gamma doses will be measured at the monitoring and sampling stations using thermoluminescent dosimeters. Alpha track etch detectors will be used to measure the levels of radon gas and radon daughters at the sampling locations as well. The results of these measurements, along with the airborne radioactive particulate results, will be incorporated into exposure calculations and compared to relevant criteria, and will determine baseline conditions for comparison during construction activities.

Even though the BRA did not identify VOCs as chemicals of concern at the site, EPA has requested that VOCs also be monitored. Monitoring of VOCs will be performed using Radiello Code 130 chemical adsorbing cartridge diffusion samplers to obtain integrated measurements of VOC concentrations in air for 28 day periods.

All of the analyses described above are characterized as QA3 (definitive quantification and identification), and are subject to the quality requirements detailed in Section 5 of this Plan.

4. AIR MONITORING APPROACH AND SAMPLING METHODS

Auxier and Associates, Inc. (A&A) personnel will be responsible for implementing this Plan, including: air sample collection; analysis and summary of laboratory data; and preparation and submittal of reports to Engineering Management Support, Inc. (EMSI). As Project Coordinator for the Respondents under the Preconstruction ASAOC, EMSI will, in turn, submit the information to EPA. Subcontractors will assist A&A in the analysis of samples and installation of a meteorological station to document wind speeds and directions. Environmental monitoring stations will be maintained by a qualified technician during the baseline monitoring phase of the work, and by the on-site radiological protection group (health physics personnel) during the construction phase of the isolation barrier project. Buried or overhead electrical power service will be provided to all environmental monitoring station locations.

Monitoring activities will measure gamma activity using direct-reading instruments and will filter ambient air to collect samples of dust and vapors. Air sampling activities will use the equipment and methods described in this Plan, while analysis of those samples will be performed by accredited laboratories. The monitoring and sampling frequency is discussed later in this Plan. Occupational health and safety monitoring during construction will be described in a separate Site-Specific Health and Safety and Radiation Safety Plan.

Monitoring and sampling activities will be divided into four phases: pre-construction baseline monitoring; monitoring during isolation barrier construction activities: post barrier construction monitoring; and long-term monitoring. The system of monitoring stations and equipment described in this Plan is intended to service the first three phases of work with only minimal changes over time. Long-term monitoring activities may be modified, depending on the results of the post-construction monitoring. The sampling approach for each monitoring phase is presented in the following subsections.

4.1 PRE-CONSTRUCTION BASELINE MONITORING

An integrated system of 13 static environmental monitoring stations will be established around the perimeters of OU-1 Areas 1 and 2, with two located close to the nearest on-site buildings. These locations were selected to ensure that the sampling campaign encompassed Areas 1 and 2, including the entry road and the road through the center of the site.

An on-site meteorological station will be installed to measure wind speed and wind direction. The station will be mounted on top of the landfill office building (13570 St. Charles Rock Road). RM Young Company's Model 05305 Wind Monitor-AQ (see Appendix D), or an equivalent model will measure wind speed and direction at a minimum, and be installed on the landfill office building in such a way as to minimize or negate building-wake effects. The equipment will meet the requirements of EPA's "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)" (May, 1987).

As evidenced by the Illinois State Climatologist Office and University of Missouri wind rose graphs included as Figure 4-1 and 4-2, predominant wind directions are from the south-east and north-west as measured at Lambert-St. Louis International Airport, which is located just north and west of the site.

The air monitoring and sampling locations are arranged in a broad line running roughly south-east to north-west, with stations strategically located in the non-predominant south-west and north-east wind directions as well. The resulting placements, shown in Figure 4-3, are sufficient to provide a representative sampling of Areas 1 and 2 in all wind direction conditions. While these locations will likely need to be adjusted for access to electrical service, topographical considerations, and in response to current or anticipated construction activities, the integrity of the monitoring design will be maintained.

These samplers will have access to 110-120v line power, be secured from tampering, and be weatherproof. Commercial radon kits may be used for supplemental measurements inside adjacent buildings to the extent needed. It is our understanding that EPA is in the process of installing five off-site air monitoring stations. Monitoring data obtained from these locations will be incorporated into the database and used to provide upwind/background data to the extent available.

Table 4-1 lists the types and quantities of environmental monitoring equipment for the different monitoring stations depicted in Figure 4-3. The table also lists the COCs measured by the equipment housed at each station. This inventory of equipment or COCs may change if new information becomes available during design or implementation of the isolation barrier or other response actions at the site.

The sampling and sensor equipment in each standard monitoring station enclosure will operate continuously. The equipment in these stations will consist of a high volume air sampler for airborne particulates, a continuous radon monitor (alpha track etch), and an environmental radiation detector called a thermoluminescent dosimeter (TLD). Alpha track etch monitors will provide a cumulative measure of radon gas present and will allow determination of average radon levels for the sampling period. TLDs will measure ambient gamma radiation levels.

Particulates gathered on air sample filters will be collected on a monthly basis and analyzed for alpha and beta emitters. Radiation dosimeters and alpha track etch detectors will be exchanged and sent for analysis every calendar quarter.

Five of the monitoring stations will house continuous passive samplers to monitor for VOCs. Monitoring of VOCs will be performed using the Radiello Code 130 chemical adsorbing cartridge diffusion samplers that will be left in place for periods of 28 days. The Radiello Code 130 cartridges consist of a stainless steel net cylinder with 100 mesh grid opening and 5.8 mm diameter, packed with approximately 530 milligrams of activated charcoal. VOCs are trapped by adsorption and recovered by carbon disulfide displacement.

VOC analysis is performed by gas chromatography/mass spectrometry. Passive/diffusive samplers rely on unassisted molecular diffusion of the gaseous agent to migrate from the air onto the sorbent material. The advantages of the Radiello technology include: continuous sampling for up to a 30 day period; higher capacity and sampling rates; greater selectivity and sensitivity; and consistent sampling rates (Sigma Aldrich 2014). A description of the Radiello equipment is presented in Appendix D.

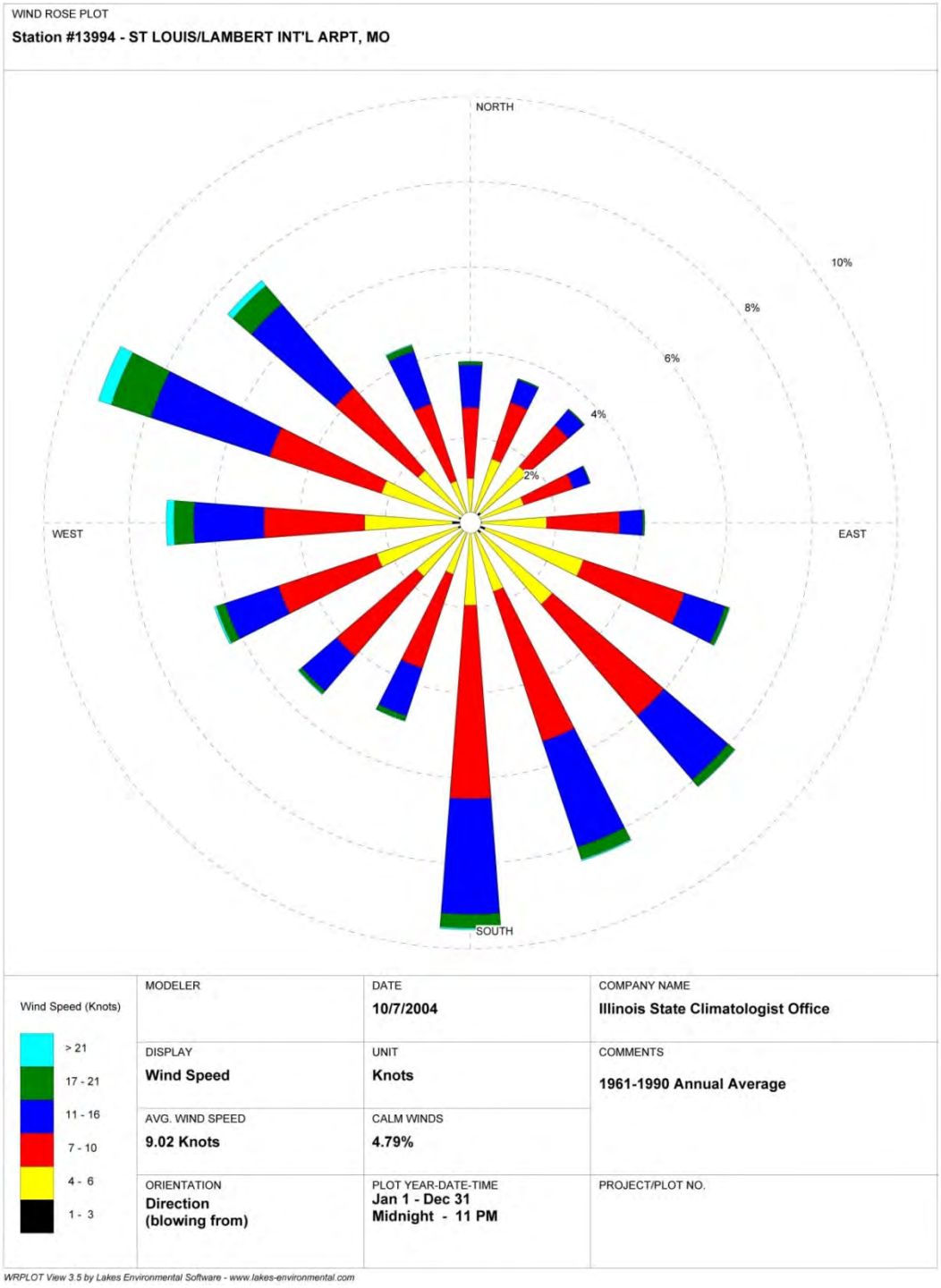


Figure 4-1 Predominant Wind Directions

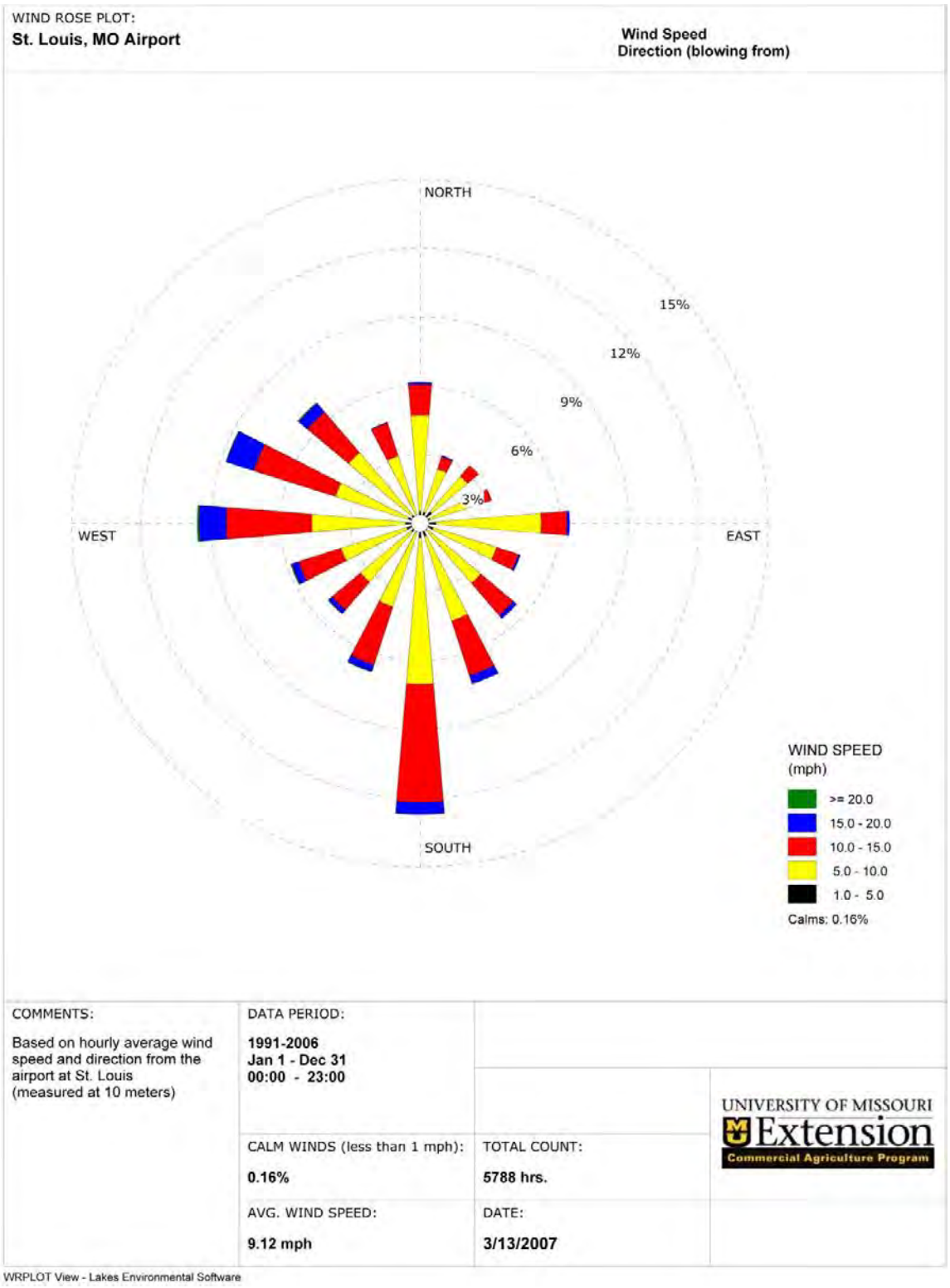


Figure 4-2 Predominant Wind Directions

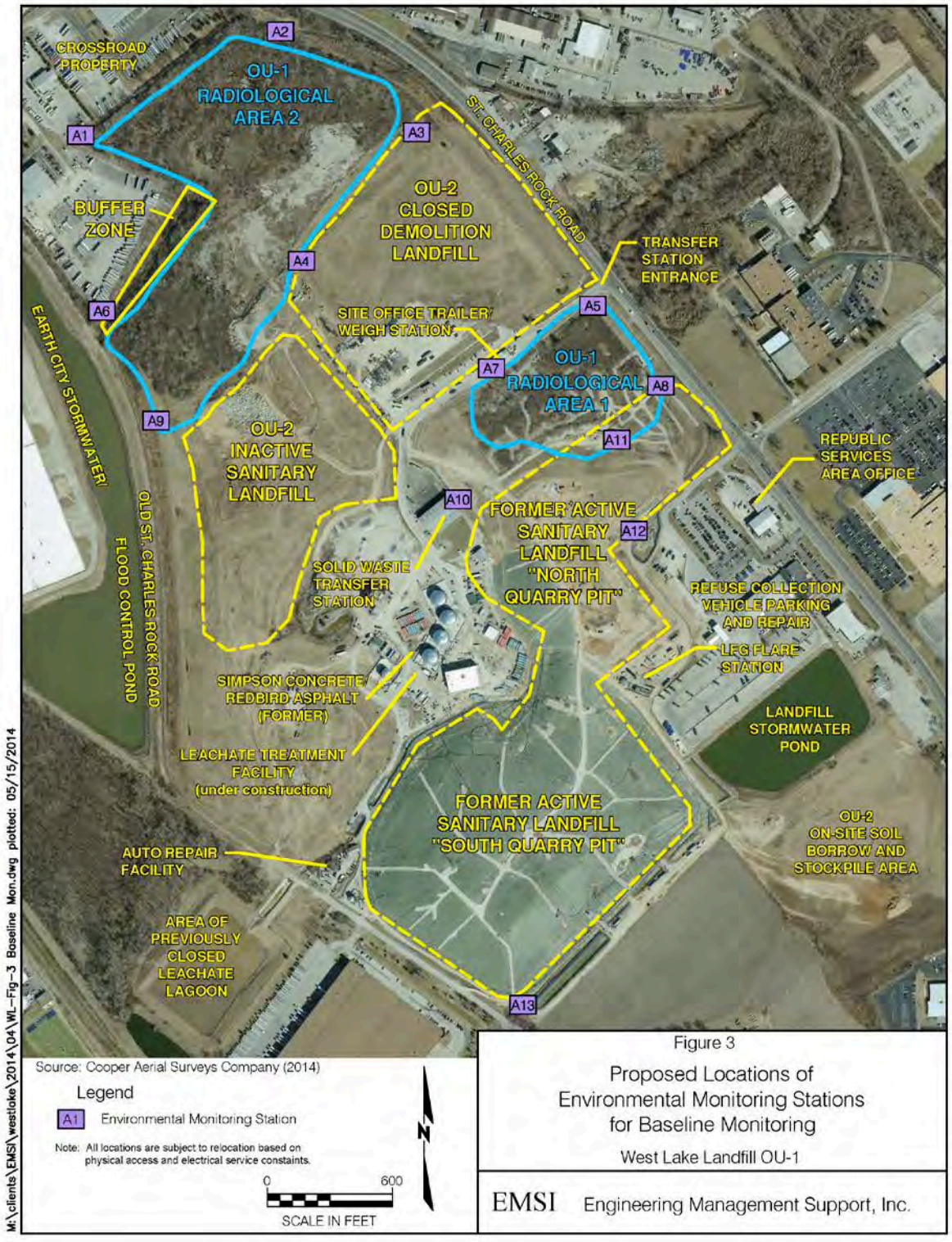


Figure 4-3 Air Monitoring Station Locations

Table 4-1 List of Samplers for Perimeter Monitoring

Perimeter Monitor Inventory per Location	Sampling Mode and Collection Frequency	Contaminants Measured
Proposed list of samplers at A05, A01, A08, A10, A12		
Metered air pump with dual chamber sampler for particulate fiber filter	Continuous / Monthly	Total alpha and beta activity
Alpha Track Etch Detector for radon gas	Continuous / Quarterly	Radon-222 and radon daughters
Radiello RAD130 Canister	Continuous / Every 28 days	Volatile Organic Compounds
Radiation dosimeter (TLD)	Continuous / Quarterly	Gamma radiation levels
Proposed list of samplers at remaining on-site and perimeter locations (x8)		
Metered air pump with filter to collect particulates	Continuous / Monthly	Total alpha and beta activity
Alpha Track Etch Detector for radon gas	Continuous / Quarterly	Radon-222 and radon daughters
Radiation dosimeter (TLD)	Continuous / Quarterly	Gamma radiation levels
Supplemental measurements inside on-site buildings adjacent to Areas 1 and 2		
Commercial Radon Test kits	3-5 Day grab/ Quarterly	Indoor radon levels
Meteorological monitoring station		
High resolution wind sensor	Continuous	Wind speed and direction

4.2 CONSTRUCTION MONITORING

It is expected that the equipment and methods proposed for the OU-1 perimeter monitoring and sampling program during the pre-construction phase will not change during the construction phase. The information collected about airborne levels of radionuclides at the OU-1 perimeter will be augmented during construction by data collected on-site through an occupational health and safety program.

The OU-1 perimeter monitoring and occupational air monitoring will be combined during construction to create an integrated program. As such, the same staff and analytical laboratories may be used to conduct both occupational and perimeter monitoring.

4.2.1 OU-1 Perimeter Monitoring During Construction

OU-1 perimeter monitoring will be performed using the same physical system as used in the pre-construction phase, with the same collection frequencies and analytical requirements presented in Table 4-1.

4.2.2 Health and Safety Monitoring During Construction

Occupational monitoring methods and equipment will depend on the actions taken during the construction phases. These will be detailed in separate Health and Safety and Radiation Safety Plans for those activities.

4.2.3 Compliance Evaluation

Table 4-2 lists airborne activity limits that will be used to evaluate operations that involve the potential exposure of workers or the public to radioactive materials during construction. Because multiple radionuclides are involved, site-specific limits were calculated based on the mixture of radionuclides identified in Area 1, as established in the BRA. Administrative limits (called "investigative levels") are set below their calculated allowable limits. These investigative levels are expressed as the gross alpha and gross beta air concentrations, and are shown in the last two columns of Table 4-2. Samples with analytical results that exceed the investigative levels will undergo isotopic analysis to identify and quantify the specific radioisotopes present in the sampled material. All samples for gross alpha/beta and isotopic analysis will be analyzed using EPA approved methods (see Section 4.4, below)

Table 4-2 Numerical Air Monitoring Limits for Alpha and Beta Emitters

Activity	Maximum Allowable Time-weighted Air Concentration (μCi/mL)	Gross Alpha Investigative Levels		Gross Beta Investigative Levels	
		μCi/mL	dpm/m^3	μCi/mL	dpm/m^3
Inside Work Area	7.7×10^{-12} [a]	1.62E-12[b]	3.6[b]	3.15E-13[c]	0.7[c]
Work Area Boundary	3.5×10^{-14} [d]	2.93E-14[e]	0.065[e]	5.86E-15[f]	0.013[f]
Fence line/Perimeter	7.0×10^{-15} [g]	5.86E-15[h]	0.013[h]	1.35E-15[i]	0.003[i]

[a] Calculated from 10 CFR part 20, Appendix B, Table 1 Derived Air Concentrations (DACs), and the expected mixture of isotopes (Auxier, 2014).
[b] Airborne activity of alpha emitters in the mixture that are present at 25% of the DAC.
[c] Airborne activity of beta emitters in the mixture that are present at 25% of the DAC.
[d] Calculated from 10 CFR part 20, Appendix B, Table 2 Effluent Concentrations (Air) and expected mixture of isotopes.
[e] Airborne activity of alpha emitters in the mixture that are present at the effluent limit of 50 mrem/y assuming 8760 hours of discharge a year.
[f] Airborne activity of beta emitters in the mixture that are present at the effluent limit of 50 mrem/y assuming 8760 hours of discharge a year.
[g] Calculated using 20% of the 10 CFR part 20, Appendix B, Table 2 Effluent Concentrations (Air) and expected mixture of isotopes.
[h] Airborne activity of alpha emitters in the mixture that are present at the NESHAPS limit of 10 mrem/y assuming 8760 hours of discharge a year.
[i] Airborne activity of beta emitters in the mixture that are present at the NESHAPS limit of 10 mrem/y assuming 8760 hours of discharge a year.

4.3 POST CONSTRUCTION MONITORING/LONG-TERM MONITORING

Post-construction monitoring will be performed to determine if there is any change in airborne levels of contaminants from the baseline established in the pre-construction phase. The same physical system, collection frequencies and analytical requirement will be used as presented in Table 4-1. If the data shows that the post-construction levels are comparable or lower than the pre-construction levels, and that the levels comply with numerical limits, Respondents may ask EPA to reduce air monitoring and sampling activities until the start of remedial action for OU-1.

VOC results obtained from ambient upwind and downwind monitoring stations will be compared against permissible exposure limits (PELs) and other applicable criteria, for example, risk screening limits (RSLs).

4.4 SAMPLE ANALYSES

All samples collected will be analyzed by EPA approved methods/procedures. Accredited laboratories with quality systems in place such as those identified in Section 4.4.1 will perform the analyses required to implement this Plan. Table 4-3 details the analytical methods required for each contaminant of concern.

Table 4-3 Sample Analyses and Methods

Analyte (COC)	Collection Method	Test	Sensitivity Level	Test Facility	Facility Location
Thorium Uranium Radium-226	Particulate Air Sample (4 in)	EPA Method 900.0 Gross Alpha/ Beta (GAGB)	1 dpm/sample	Eberline Analytical	Oak Ridge, TN
Rn-222	Track Etch	Alpha Track Etch	0.5 pCi/L	Inspect USA	Marshall, NC
Radiation Dose	TLD	TLD	<1 mRem	Mirion Tech	Irvine, CA
VOC	Radiello Code 130 Passive sorbent diffusion sampler	carbon disulfide desorption followed GC/MS analysis	See Appendix E	Eurofins Air Toxics	Folsom, CA

4.4.1 Accredited Laboratories and Contacts

Eberline Analytical
Mike McDougall
601 Scarboro Road
Oak Ridge, TN 37830
Tel 865.481.0683

Eurofins Air Toxics
Kelly Buettner
180 Blue Ravine Road, Suite B
Folsom, CA 95630

Inspect USA
100 S Main Street, Ste 609
Marshall, NC 28753

Mirion Technologies, Inc
17192 Murphy Avenue
Irvine, CA 92614
800-251-3331

4.4.2 Data Management

The laboratories will supply Level IV data reports with all analytical results to A&A and EMSI. The laboratories will also supply analytical results in electronic spreadsheet format to the A&A Project Manager and EMSI.

4.4.3 Data Verification, Validation, Quality Assessment, and Delivery

The primary goal of data verification and validation (V&V) is to ensure that decisions are supported by data of the type and quality needed and expected for the intended use. Data verification is the process of evaluating the completeness, correctness, and consistency of a laboratory package or final data to assure that laboratory conditions and operations are compliant with project plan documents (see Section 5). Data validation addresses the reliability of the data. Results are evaluated to determine the presence or absence of an analyte and the uncertainty of the measurement process for contaminants of concern (see Section 6). Finally, scientific and statistical evaluation of the data may be required to determine if the quality of the data can support its intended use (MARLAP 2004). V&V and summary reports will be generated and submitted to EMSI. The A&A Project Manager will coordinate with EMSI to determine the formats and schedules desired for transmittal of the laboratory results, validation and summary reports.

4.5 SCHEDULE OF WORK

Work is tentatively scheduled to begin in June 2014. The pre-, post-, and construction sampling program will run for at least a full year with samples collected as indicated in Table 4-4.

4.6 PROJECT ORGANIZATION AND RESPONSIBILITIES

A&A personnel will be responsible for the air monitoring and sampling plan, air sample collection, analysis and summary of laboratory data, and preparation and submittal of reports to EMSI. Michael Bollenbacher will function as the A&A Project Manager and the Certified Health Physicist for this project. Cecilia Greene and Lyn Brill will perform data validation. Environmental monitoring stations will be maintained by a qualified technician during the baseline monitoring phase and by the on-site radiological protection group (health physics personnel) during the construction phase. Subcontractors such as the laboratories listed below and EMSI and Bridgeton Landfill LLC personnel will assist A&A in the analysis of samples and the operation of the monitoring stations.

Eberline Analytical
Mike McDougall
601 Scarboro Road
Oak Ridge, TN 37830
Tel 865.481.0683

Eurofins Air Toxics
Kelly Buettner
180 Blue Ravine Road, Suite B
Folsom, CA 95630

Inspect USA
100 S Main Street, Ste 609
Marshall, NC 28753

Mirion Technologies, Inc
17192 Murphy Avenue
Irvine, CA 92614
800-251-3331

Table 4-4 Field Sampling Summary

Analytical Parameter	Level of Sensitivity	Matrix	Sample Frequency	Container Type	Preservatives & Holding Times	Subtotal Target Field Samples	Field QC Extras			Total Field Samples
							Rinsate Blanks & Matrix Spikes	Filter Blanks	Field Duplicates	
Gross Alpha/Beta	1 dpm/ sample	Air Filter	14 x Continuous Air Samplers /Monthly	Glassine Envelope	NA	156	NA	12	12	180
Radon	0.5 pCi/l	Track Etch Detector	14 x Continuous Samplers /Quarter	Track Etch Detector	NA	56	NA	NA	NA	56
Gamma Dose	1 mrem	TLD	14 x Stations/ Quarter	TLD	NA	56	NA	NA	NA	56
VOC	See Appendix B for MDL and RL	Radiello Canister	5 Continuous Every 28 Days	Radiello Canister	NA	65	NA	NA	1 Every 28 Days	78

5. QUALITY ASSURANCE REQUIREMENTS

The A&A Project Manager (PM) will manage quality assurance for the sample collection and field activities associated with this project. All field activities will be performed by trained personnel according to established A&A procedures. Field records will be reviewed and approved by the A&A Project Manager or his/her representative.

Only laboratories with established QA/QC systems will be retained for analytical services. The laboratory will perform QA/QC procedures to ensure routine laboratory accuracy and precision objectives in accordance with their standard operating procedures and the requirements of the specific methods used for testing. Laboratory QC samples include laboratory control standards, blanks, duplicates and other performance samples, the results of which are included in each data package.

Level IV data packages will be supplied by the laboratories to support analytical findings. Electronic data deliverables are submitted by the laboratory to assist A&A in verifying and validating the data. Records will be reviewed for completeness and maintained in the project files.

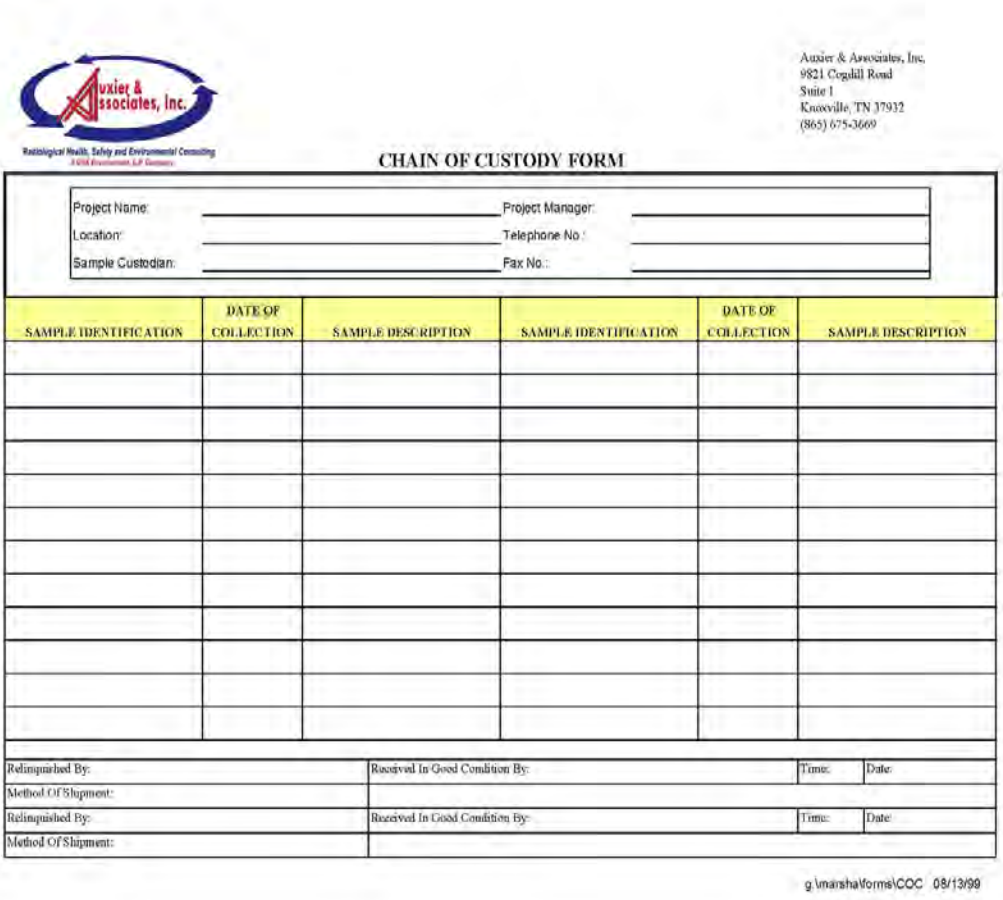
The quality of the air sampling and monitoring campaign is assessed in all phases of the program including:

1. Sample identification, handling and storage;
2. The function of air sampling and monitoring equipment;
3. The accuracy and reliability of analytical procedures; and
4. Recordkeeping.

5.1 SAMPLING IDENTIFICATION, HANDLING, AND STORAGE

Samples will be identified according to approved A&A procedures. All samples will be uniquely identified. Sample designators will be placed on all collection envelopes or containers. Sample information at a minimum shall include: the sample date, sampler's name, time period when the sample was collected, the sample flow rates at start and end of the sample, sample location, and any other information required by the respective analytical laboratories. Sample labels will be filled out using indelible ink and affixed to appropriate containers immediately prior to sample collection.

Samples will be handled carefully to prevent cross-contamination and will be placed in appropriately labeled containers. Chains of Custody forms (Figures 5-1 & 5-2) will be filled out by sampling personnel at the time the sample is obtained. It is the responsibility of the PM to arrange sample collection and delivery to the analytical laboratories. The Chain of Custody accompanies the sample through all transportation functions until the sample is received at the laboratory. The Chain of Custody is signed by the receiving laboratory. The Chain of Custody includes the following information: site name, sample identification number (assigned by the sampler in the field), sample date, sample location (using the established Site Coordinate System), and type of analysis required. Whenever the sample is transferred from one party to another, both parties sign the Chain of Custody and record the date and time of the transfer.



Auxier & Associates, Inc.
9821 Cogdill Road
Suite 1
Knoxville, TN 37932
(865) 675-3669

Radiological Health, Safety and Environmental Consulting

CHAIN OF CUSTODY FORM

Project Name: _____ Project Manager: _____
Location: _____ Telephone No.: _____
Sample Custodian: _____ Fax No.: _____

SAMPLE IDENTIFICATION	DATE OF COLLECTION	SAMPLE DESCRIPTION	SAMPLE IDENTIFICATION	DATE OF COLLECTION	SAMPLE DESCRIPTION

Relinquished By:	Received In Good Condition By:	Time:	Date:
Method Of Shipment:			
Relinquished By:	Received In Good Condition By:	Time:	Date:
Method Of Shipment:			

g:\marsha\forms\COC 08/13/99

Figure 5-1 Sample Chain of Custody Form 1

PASSIVE SAMPLE COLLECTION

Air Toxics LTD.
CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922.

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630
(916) 985-1000 FAX (916) 985-1020

Page ____ of____

Project Manager ____
Collected by: (Print and Sign) ____
Company____ Email____
Address____ City____ State____ Zip____
Phone ____ Fax ____

Project Info:
P.O. #____
Project #____
Project Name____

Turn Around Time:
☐ Normal
☐ Rush
____ specify

Reporting Units:
☐ ppmv
☐ ppbv
☐ μg/m3
☐ mg/m3

Lab I.D.	Field Sample I.D. (Location)	Sampler #	Date of Deployment (mm/dd/yy)	Time of Deployment (hr : min)	Date of Retrieval (mm/dd/yy)	Time of Retrieval (hr : min)	Analysis Requested	Indoor Air	Outdoor Air	Workplace Monitoring	Other (
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐
								☐	☐	☐	☐

Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time	**Sample Site Air Temperature:**
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time	Notes:
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time	

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
					Yes No None	

Figure 5-2 Sample Chain of Custody Form 2

Samples will be stored in a designated location prior to counting and between counts if multiple counts are required. All samples will be held under internal Chain of Custody at the laboratory using the appropriate storage technique. The analytical laboratory project manager assigned by each laboratory to this project will be responsible for tracking the status of the samples throughout the laboratory.

5.2 AIR SAMPLING AND MONITORING EQUIPMENT

Air sampling equipment will be calibrated, and the functionality of the equipment checked according to manufacturer specifications and A&A procedures. The minimum requirements necessary to ensure accurate measurements are described in this section.

Air flow meters, differential pressure indicators, and other devices used to determine volumetric flow rates of air samplers will be calibrated annually. Copies of the calibration records will be maintained on-site as well as in A&A's corporate offices.

The operability of air sampling equipment will be verified at the time of sample collection to include positive air flow indication and adequate supply of strip chart paper.

5.3 LABORATORY PROCEDURES

The quality of the laboratory data is assessed by precision, accuracy, representativeness, completeness, and comparability (the "PARCC" parameters), and detection limits. Definitions of these parameters and the applicable quality control procedures are described below.

5.3.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability (precision) of two or more measurements compared to their average values. Precision is calculated from results of duplicate sample analyses. The duplicate samples will consist of one or more of the following: co-located samples, field replicates, analytical laboratory replicate, and/or laboratory instrument replicate. Laboratory replicate samples will be analyzed at a minimum frequency of one per twenty samples (five percent) per matrix analyzed. Laboratory replicate precision for radionuclides is quantitatively expressed as the absolute or relative percent difference (RPD). These measures are then compared to control limits based on the required or relative method uncertainties.

The variability in the sampling technique will be evaluated by analyzing 1 field duplicate for each monthly sampling event. The laboratory will be instructed to analyze two 47 mm samples from each of the identified filters, for a total of 12 duplicate samples.

Since no standards have been set for VOCs in non-industrial settings, replicates and duplicates as described in OSWER Section 2.8 for compliance with QA3 objectives will not be collected. One field duplicate will be collected per sampling event for a total of 12 duplicate samples.

5.3.2 Accuracy

Accuracy is a measure of the closeness (bias) of the measured value to the true value. The accuracy of laboratory test results can be assessed by analyzing a reference material, third party performance evaluation samples, or "spiking" samples in the laboratory with known standards (surrogates or matrix spikes) and determining the percent recovery.

Laboratory control samples (spikes) for both chemical and radiological analyses will be carried out in accordance with SW846 requirements for organic analyses (EPA, 1986) at a minimum frequency of one in 20 samples (five percent) per matrix analyzed. A surrogate spike will be added to each sample for VOC analysis to evaluate analytical efficiency by measuring recovery.

The accuracy of sample results can also be affected by sample contamination. Sample contamination can occur because of improperly cleaned sampling equipment, or because of high radiation levels in the laboratory. To ascertain that the samples are not contaminated by laboratory activities, blank samples will be analyzed at a minimum frequency of one in 20 samples (five percent) per matrix analyzed.

In the special case of glass fiber air filters, the filters naturally contain 1-2 pCi/g of alpha emitting radionuclides. One clean, unused filter from each lot will be submitted for gross alpha/gross beta analysis. The level of activity measured on the field blank may be considered when evaluating the analytical results of the remaining samples.

5.3.3 Representativeness

Representativeness is a qualitative measure of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sampling collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to assure the results obtained are representative of on-site conditions.

5.3.4 Completeness

Completeness is defined as the percentage of measurements judged to be valid. Results will be considered valid if they are not rejected during data validation. The target completeness goal for this work will be 90 percent.

5.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard methods and procedures for both sample collection and laboratory analysis ensure comparability of data.

5.3.6 Detection Limits

Each laboratory will be requested to provide full documentation of the analysis performed which will include detection limits for the procedure followed. These documents will be reviewed for completeness and maintained in the project files.

5.4 RECORD KEEPING

Each sample is tracked from the time of collection by extensive paper work which is completed during sampling and includes the following, as appropriate: 1) field documentation, 2) sampling field data sheet, 3) chain of custody, and 4) sample labels.

5.4.1 Field Documentation

The field data recorded at the time of sample collection provides an unambiguous identification of each sample. These field data include the following, as appropriate:

- Date of entry;
- Purpose of sampling;
- Description of sample;
- Number and size of sample taken;
- Description of sampling point;
- Date and time of collection of sample;
- Field sample identification number(s);
- References, such as maps or photographs, of the sampling site;
- Field observations;
- All field measurements, sample #, calibration dates, operators and techniques;
- Coordinate location of each sample using the Site x, y, z coordinate system, if applicable; and
- Any other information required by the respective analytical laboratories.

Because sampling situations vary widely, field notes will be as descriptive and inclusive as possible; anyone reading the entries should be able to reconstruct the sampling situation from the recorded information. Language within field notes will be objective, factual, and free of inappropriate or ambiguous terminology. All field personnel are required to date and sign any data entries. All field documentation will be retained.

5.4.1.1 Sampling Field Data Sheets

Sampling field data sheets include information on specific activities related to collection of a single sample. The sampling personnel will complete the sampling field data sheets in the field at the time of the sample collection.

5.4.1.2 Chain of Custody and Sample Labels

See Section 5.1.

6. DELIVERABLES

6.1 REPORTS

Laboratory certification and accreditation is achieved through successful completion of independent performance evaluations and external audits and is available for review in the laboratory's quality assurance plan (see Attachment B). State certification provides initial confidence in the laboratory's ability to successfully apply the requested analytical methods. Quality assurance reports from the laboratory to Michael Bollenbacher, the Project PM/CHP, are made in conjunction with audits by external entities. These reports may include the results of data validation, performance audits, an assessment of the precision, accuracy and completeness of the data, and a summary of quality assurance problems and proposed solutions.

A&A will prepare a validation report after all data packages are received from the laboratories for a particular sampling event and data validation has been completed. The data validation report will summarize the overall quality of the analytical results, identify any corrective measures, and will identify qualifiers applied to the results. The data validation reports will be included in the quarterly status reports or as appropriate.

6.2 DATA VERIFICATION, VALIDATION AND REPORTS

Data validators for A&A and EMSI, Cecilia Greene and Lynn Brill, will review all radiological and chemical data for completeness and accuracy and to determine if the project QA/QC goals have been achieved. Field operations will be fully documented, reviewed, and audited. The quality of field and laboratory data will be evaluated based on precision, accuracy, representativeness, completeness, and comparability of the data generated by each type of analysis.

The validators will review all laboratory submittals to verify that the data package is complete, including checks to verify:

- Sample numbers and analyses match the Chain of Custody;
- All analyses requested were performed;
- Package contains Chain of Custody;
- Laboratory applied data qualifiers (if applicable);
- Case narrative identifies problems (if applicable), including explanation of data qualifiers;
- Sample hold times are met;
- Instrument performance checks performed and acceptable;
- QA/QC samples present at proper frequency; and
- Reports for QA/QC samples

The completeness, correctness, and conformance/compliance of the data will be verified and validated against the method, procedural, and contractual requirements. Guidance for data verification/validation is provided in the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) for radiological constituents, and guidance contained in Quality Assurance/Quality Control Guidance for Removal Activities (EPA, 1990) for chemical constituents. Qualifiers will be applied to the analytical data according to the guidance contained in these documents. One hundred percent of the laboratory data will be verified and validated.

Reports must be reviewed and approved by the Project CHP prior to transmission to a regulatory agency or inclusion in draft reports.

6.3 CORRECTIVE ACTIONS

Corrective actions are developed on a case-by-case basis and are initiated whenever control limits are exceeded, or when results of other system audits or inter-laboratory results indicate an analysis is outside of control limits. Corrective action is taken to determine the cause, and a decision is made on the acceptability of the data collected for that lot of samples.

Situations that may result in corrective action in the analytical laboratory or the field laboratory when include:

- Hold times are exceeded;
- A blank has exceeded the limit of quantitation;
- An instrument has failed a calibration check;
- A performance or check sample result is outside control limits; and
- A laboratory control sample result has exceeded the control limits.

6.4 COMPLETION OF REVIEW

Once all data within the data set are determined to be acceptable, the Project CHP will approve the data set. If not, the Project CHP will determine what further action is necessary. Further action could include re-sampling, reanalyzing archived samples, or eliminating the questionable data from consideration.

7. REFERENCES

EPA 2014 "Administrative Settlement Agreement and Order on Consent for Removal Action – Preconstruction Work, in the matter of West Lake Landfill Superfund Site," United States Environmental Protection Agency (EPA), EPA Docket No. CERCLA-07-2014-0002, 2014.

EPA 1990 "Quality Assurance/Quality Control Guidance for Removal Activities – Sampling QA/QC Plan and Data Validation Procedures," EPA, Interim Final, EPA/540/G-90/004, April 1990.

NRC 1988 "Radioactive Material in the West Lake Landfill – Summary Report," U.S. Nuclear Regulatory Commission (NRC), NUREG 1308 – Rev. 1, June 1988

RMC 1982 "Radiological Survey of the West Lake Landfill, St. Louis County, Missouri," Radiation Management Corporation (RMC), NUREG/CR-2722, May 1982.

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MARLAP 2004 "Multi-Agency Radiological Laboratory Analytical Protocols Manual" (MARLAP), Part I, July 2004.

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Appendix A
Excerpts from Auxier & Associates
Survey and Sampling Procedure Manual

PROCEDURE 2.8
PREPARING SAMPLES FOR TRANSPORTATION

1.0 PURPOSE

1.1 To provide guidance for preparing samples for transportation to assure regulatory compliance.

2.0 RESPONSIBILITIES

2.1 The Site Survey Manager is responsible for assuring this procedure is implemented.

2.2 Survey team members are responsible for following this procedure.

2.3 The Health and Safety Committee will assist in preparing appropriate criteria for potential shipments, including specific radiation action levels at appropriate distances from the container's surface.

3.0 PROCEDURE

3.1 Overview of regulations: Regulations for transportation of samples containing small quantities of radioactivity are set forth in 49 CFR 173, Subpart I. The regulations take a graded approach, and shipments containing greater radioactivity will generally be required to follow more stringent shipping requirements

For transportation purposes, radioactive material is defined in 49 CFR 173.403 as "… any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the table in §173.436 or values derived according to the instructions in §173.433." These activities are reproduced in Table 2.8-1 for a subset of radionuclides.

It is important to note that 49 CFR 173.401(b)(4) states that Subpart I does not apply to "…(n)atural material and ores containing naturally occurring radionuclides which are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the values specified in §173.436."

3.2 Applicability and Additional Considerations: For the purpose of shipping, most samples collected from environmental media, are expected to be either excepted, or classified as non-radioactive for shipping purposes. If the sample shipment

exceeds the limits specified in Table 2.8-1, this procedure does not apply, and special handling will be required.

In addition to requirements imposed by transportation regulations, the analytical laboratory or other receiver of the shipped samples may have further restrictions or requirements which must be considered in preparation of the shipment.

The Health and Safety Committee will assist in preparing appropriate criteria for potential shipments, including specific radiation action levels at the container surface, at 30 cm from the surface, and at 1 m from the surface. Special packaging and labeling instructions will also be developed. This information will be incorporated into the Survey Work Plan.

3.3 The following is the process for preparing samples for transportation:

3.3.1 Select an appropriate outer container for the samples. The container must be strong and capable of retaining contents during conditions normally incident to transportation. A typical container used by A&A is a 48 quart plastic cooler.

3.3.2 Place a plastic liner inside the container. A plastic garbage bag works well.

3.3.3 Place the samples into the lined container. Do not exceed a net sample weight (including the individual sample containers) of 29 kg.

3.3.4 Scan the outside of the loaded container with a gamma detector (Procedure 2.2) to determine the location of the maximum radiation level.

3.3.5 Measure the radiation level (see Procedure 2.4) at a distance of 30 cm from the location on the container identified in Step 3.3. Record the results on the sample chain of custody form.

3.3.6 Compare the measurement obtained with the exposure rate action levels provided in the Survey Work Plan. If the radiation levels satisfy the criteria, the shipment is excepted from all manifesting and labeling requirements.[2] Contact the HSC Chairperson or the project manager if the package still does not meet the specified action levels.

3.3.7 Mark the outside of the inner lining with the UN identification number UN2910. This can be hand written using a black marker.

3.3.8 Fill spaces in the container liner with packing material to restrict sample movement during transport. If the container includes any freestanding

[2] For certain radionuclides, this concentration limit can be demonstrated by measurement of the direct radiation level associated with the package. For example, if the contaminant is oil-field NORM, calculations and experience have shown that the activity concentration limit will be satisfied if the direct radiation level at 30 cm from the package exterior (assuming a typical 48 quart cooler, used by A&A for sample shipping) is less than 20µR/h (or 20 µrem/h), above background. For other radionuclides, the relationship between concentration and direct radiation level may differ from that of Ra-226, and appropriate decision levels must therefore be established for each project.

liquids, include twice the sufficient absorbent material to absorb the liquid contents, in case of leakage.

3.3.9 Seal the inner plastic liner in a manner that leaves the UN number clearly visible.

3.3.10 Place the Chain-of-Custody form and other paperwork on top of the inner liner.

3.3.11 Close and seal the outer container.

3.3.12 Complete shipping papers. If the package is "Exempt", shipping papers are the same as if the shipment did not contain radioactive material.

3.3.13 Attach the shipping papers and initiate the shipment.

Table 2.8-1 Table of Exempt Material Activity Concentrations and Exempt Consignment Activity Limits Found in 49 CFR 173

Symbol of radionuclide [2]	Activity concentration for exempt material (pCi/g)	Parent radionuclide's average activity concentration in exempt package (pCi/g) [3,4]	Activity limit for exempt consignment (pCi)	Activity limit of parent radionuclide for exempt consignment (pCi) [3,4]
Am-241	27	27	2.7E+5	2.7E+5
C-14	2.7E+5	270000	2.7E+8	2.7E+8
Co-60	270	270	2.7E+6	2.7E+6
Cs-137 (b)	270	135	2.7E+5	1.4E+5
K-40	2700	2700 (27000)	2.7E+7	3E+7 (3E+8)
Pb-210 (b)	270	90 (900)	2.7E+5	9E+4 (9E+5)
NORM scale	270	30 (300)	2.7E+5	2E+4 (2E+5)
Ra-224 (b)	270	45 (450)	2.7E+6	5E+5 (5E+6)
Ra-226 (b)	270	30 (300)	2.7E+5	3E+4 (3E+5)
Ra-228 (b)	270	135 (1350)	2.7E+6	1E+6 (1E+7)
Rb(nat)	2.7E+5	3E+5 (3E+6)	2.7E+8	3E+8 (3E+9)
Sr-90 (b)	2700	1350	2.7E+5	1.4E+5
Th-228 (b)	27	4 (39)	2.7E+5	4E+4 (4E+5)
Th-230	27	27 (270)	2.7E+5	3E+5 (3E+6)
Th-232	270	135 (1350)	2.7E+5	1E+5 (1E+6)
Th (nat) (b)	27	3 (27)	2.7E+4	3E+3 (3E+4)
U (nat) (b)	27	2 (19)	2.7E+4	2E+3 (2E+4)
U (enriched to 20% or less)(g)	27	27	2.7E+4	2.7E+4
U (dep)	27	27	2.7E+4	2.7E+4

1 69 FR 3685, Jan 26, 2004

2 +D indicates the sum of the activities of the parent and specified daughters should be compared to exempt values

3 Derived values account for presence of daughters and incorporate 10x modifier for natural origin, if applicable.

PROCEDURE 3.8
SAMPLE CHAIN-OF-CUSTODY

1.0 PURPOSE

To provide a method for sample chain-of-custody.

2.0 RESPONSIBILITIES

2.1 The Site Survey Manager is responsible for assuring that this procedure is implemented.

2.2 Survey team members are responsible for following this procedure.

3.0 PROCEDURE

Chain-of-custody is initiated upon collection (or receipt) of samples and continues until samples are transferred to another organization or are disposed. An acceptable chain-of-custody is maintained when the sample is under direct surveillance by the assigned individual; the sample is maintained in a tamper-free container; or the sample is within a controlled-access facility. The chain-of-custody is recorded on a standardized A&A form (see Appendix A) or a form provided by another organization, such as an analytical laboratory or another sampling agency.

3.1 Field Procedures

3.1.1 An individual present during sample collection is designated as the sample custodian and is responsible for maintaining surveillance of the sample until the custody of that sample is transferred to another party. Samples must, at all times, be in the possession and under the direct surveillance of the sample custodian, or secured in a locked vehicle, building, or container. The sample custodian initiates a chain-of-custody form, daily, for all samples collected or received on that day.

3.1.2 Samples may be listed on the form as an individual entry or group of samples having common characteristics and originating from the same site may be recorded as a single entry, provided information describing each sample in the group (e.g. a completed field data form) is attached to or referenced on the custody form.

3.1.3 If sample custody is to be transferred (relinquished), the container and its contents are inspected by the individual accepting custody to assure that tampering has not occurred and custody has therefore been maintained. If evidence of tampering is observed or if any deviations or problems are noted, a notation must be provided on the form by the individual accepting custody. The sample collector must sign the first "Relinquished by" block and the receiver must complete the first "Received by" block.

3.1.4 If sample custody will not be assured under one of the conditions in item 3.0 above, a security seal is placed on the container of the samples. A security seal is a wire, tape, or other such item, which is uniquely identified (numbered), and can be affixed to a package in a manner as to require damaging the seal if the package is opened. Damage to the seal thereby alerts the recipient of a package to the possibility of tampering with the contents. The number of the seal is entered onto the Chain-of-Custody form. Samples, which are under security seals, do not have to be maintained in a secure area; however, precautions should be taken to restrict sample access to authorized individuals.

3.1.5 The original of the chain-of-custody form must contain all signatures and other pertinent records regarding custody. Therefore the original is retained in the possession of the individual who has custody.

3.1.6 As long as samples remain in custody of the sampler, both copies of the chain-of-custody form are to accompany the samples. If custody is transferred to another individual and the control requirements in item 3.0 above are not satisfied, the duplicate copy of the form is packaged with the samples and the original remains with the individual having custody.

3.1.7 Samples collected by other organizations and provided to A&A personnel will have chain-of-custody initiated for them by the individual receiving the samples. When the organization has an established chain-of-custody in place, a copy of the form will be attached to the A&A form.

3.2 Sample Transport

3.2.1 Samples must comply with regulations of the Department of Transportation, if they are to be transported over or through publicly accessible transport routes. The Health and Safety Plan describes the procedure for assuring compliance with this requirement.

3.2.2 Unsealed samples may be transported by a vehicle controlled by the person having custody of the samples, or in that person's hand carried baggage.

3.2.3 Transport by mail, checked baggage, common carrier, or other mode not controlled by the sample custodian of record, requires that security seals be used.

3.2.3 The method of transport is to be identified on the original chain-of-custody record. If inner containers are sealed, additional seals on outer packaging are not required.

3.3 Samples sent to other organizations

3.3.1 The custodian will sign the "Relinquished by" space and the original form will be packed with the samples.

3.3.2 Receiving organizations will be requested to check the container and its contents for signs of tampering and note any deficiencies in the "Comments" portion of the form.

3.3.3 When samples will not be returned to A&A, the receiving organization will be asked to return the original of the form. The form will be provided to the Project Manager, for inclusion with the project records.

3.3.4 If samples will be returned to A& A, the receiving organization will be asked to sign the "Relinquished by" space and pack the form with the samples for return shipment. Upon receipt, the samples and form will be provided to the Project Manager, who will sign the "Received" space and place a copy in the project file.

Appendix B
Eberline Analytical Oak Ridge Laboratory Quality Assurance Program Manual

Eberline Analytical
Oak Ridge Laboratory
Quality Assurance Program Manual

AUTHORIZATION AND APPROVAL STATEMENT

This **Eberline Analytical** - Oak Ridge Laboratory,
ñQuality Assurance Program Manualò
is authorized and approved in its entirety by:

Saba Arnold Seaver
Quality Assurance Manager

Date: August 1, 2013

Michael R. McDougall
Laboratory Manager

Date: August 1, 2013

Eberline Services – Oak Ridge Laboratory
601 Scarboro Road
Oak Ridge, TN 37830
Phone: (865) 481 - 0683, Fax: (865) 83 - 4621

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MISSION STATEMENT

Our mission is to ensure that all of The Eberline Services, Oak Ridge Laboratory's systems, services, processes, and deliverables are of a quality that meets or exceeds client requirements; and to foster a Laboratory culture in which there is a commitment to a rising standard of quality. This culture demands that the quality of those systems, services, processes, and deliverables and the methods used to achieve that quality be continuously improved.

Quality Assurance is a spirit that pervades all aspects of an organization. It is the quality attitude developed by a quality culture in an organization. It is the spirit in which any organization, procedure or activity is documented, implemented and performed. This spirit produces empowerment and motivation in all employees to achieve the highest level of quality. The result of this attitude is **"Quality Assurance."**

The policy guidelines are presented in this Oak Ridge Laboratory Quality Assurance Program Manual, and are based on the philosophy and premises that:

- People are our greatest asset and are ultimately responsible for the quality of the items and services we provide. Therefore, each person is treated with the greatest possible respect and consideration.
- Employees are inherently proud and want to produce top quality and on time services and deliverables. In order to do this they must be made aware of the quality requirements that are expected and must be provided appropriate facilities, equipment, and proper training.
- A culture of quality embodied within the entire Oak Ridge Laboratory organization is the most effective way to provide support for the employee's commitment to quality.
- Management support is paramount, and organizational responsibilities must ensure integration of quality requirements in the day-to-day operations.
- All systems, services, processes, and deliverables can be planned, performed, assessed, and improved.
- Improvements allow operations to become more efficient and result in contractual requirements performed "on time" and done "right the first time."
- Quality improvements lead to reduced costs and allow the ultimate objective of providing the highest quality items and services to be a viable goal.

Quality is our clientôs perception of us. Our actions must assure our clients that the Oak Ridge Laboratory organization provides for quality systems, services, processes, and deliverables that will meet or exceed their requirements. To this end, each employee must understand and exercise the highest standards of ethics in the performance of their duties and ensure the integrity of the data they report.

STATEMENT OF COMPLIANCE AND MATRIX COMPARISON

This Quality Assurance Program Manual addresses the basic requirements outlined in several regulatory manuals, standards, regulations, and national laboratory programs. Matrix comparison to some of these documents is included in the following pages. Additional regulatory requirements are listed in Section 1.0.

NQA-Quality Assurance Requirements for Nuclear Facility Application
National Environmental Laboratory Accreditation Conference (NELAC), USEPA; 2003, the NELAC Institute (TNI), 2009
USEPA Requirements for the Certification of Laboratories Analyzing Drinking Water; 2005
ISO/IEC 17025 for the General Requirements for the Competence of Calibration and Testing
DOE Quality Systems for Analytical Services (QSAS) Document
DoD Quality Systems Manual for Environmental Laboratories (DoD QSM)
PJLA Accreditation Compliance Requirements

This manual is organized as follows:
ó
Name, Title, Authorization and Approval
Table of Contents
Mission Statement
Statement of Compliance and Matrix Comparison
Introduction and Description
Organization and Responsibility
Quality Assurance Objectives
Personnel Qualification and Training
Instructions and Procedures
Procurement Document Control
Material Receipt and Control
Material Storage and Control
Control of Process
Preventative Maintenance
Control of Measurement and Test Equipment
Data Reduction, Verification, and Reporting
Document Control
Internal Quality Control
Audits
Quality Assurance and Inspection Records
Corrective Action
Quality Assurance Reports to Management

MATRIX COMPARISON

NQA-1, Cross Reference to - Oak Ridge Laboratory Q.A. Program Manual

NQA-1- Quality Assurance Requirements for Nuclear Facility Applications (*Basic Requirements*)		**Oak Ridge, TN laboratory Quality Assurance Program Manual**	
BASIC RQMT	TITLE	QAM SECT	TITLE
1.	Organization	2.0	Organization and Responsibility
2.	Quality Assurance Program	3.0 4.0	Quality Assurance Objectives Personnel Indoctrination and Training
3.	Design Control	N/A	Does not apply
4.	Procurement Document Control	6.0	Procurement Document Control
5.	Instructions, Procedures, and Drawings	5.0	Instructions and Procedures
6.	Document Control	13.0	Document Control
7.	Control of Purchased Items and Services	7.0	Material Receipt and Control
8.	Identification and Control of Items	8.0	Material Storage and Control
9.	Control of Process	9.0	Control of Process
10.	Inspection	14.0	Internal Quality Control
11.	Test Control	14.0	Internal Quality Control
12.	Control of Measurement and Test Equipment	11.0	Control of Measurement and Test Equipment
13.	Handling, Storage, and Shipping	8.0	Material Storage and Control
14.	Inspection, Test, and Operating Status	14.0	Internal Quality Control
15.	Control of Nonconforming Items	8.0	Material Storage and Control
16.	Corrective Actions	17.0	Corrective Actions
17.	Quality Assurance Records	16.0	Quality Assurance and Inspection Records
18.	Audits	15.0	Audits
	N/A	N/A	Title Page
	N/A	N/A	Authorization and Approval Statement
	N/A	1.0	Introduction and Description
	N/A	10.0	Preventive Maintenance
	N/A	12.0	Data Reduction, Verification, and Reporting
	N/A	18.0	Quality Assurance Reports to Management

MATRIX COMPARISON

10 CFR Part 50, Appendix B Cross Reference to Oak Ridge Laboratory Q.A. Program Manual

NRC 10 CFR Part 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."		**Oak Ridge, TN Laboratory Quality Assurance Program Manual**	
Criterion No.	TITLE	QAM SECT	TITLE
I	Organization	2.0	Organization and Responsibility
II	Quality Assurance Program	3.0	Quality Assurance Objectives
III	Design Control	N/A	Does not apply
IV	Procurement Document Control	6.0	Procurement Document Control
V	Instructions Procedures, and Drawings	5.0	Instructions and Procedures
VI	Document Control	13.0	Document Control
VII	Control of Purchased Material, Equipment, and Deliverables	7.0	Material Receipt and Control
VIII	Identification and Control of Materials, Parts, and Components	8.0	Material Storage and Control
IX	Control of Special Process	9.0	Control of Process
X	Inspections	14.0	Internal Quality Control
XI	Test Control	14.0	Internal Quality Control
XII	Control of Measuring and Test Equipment	11.0	Control of Measurement and Test Equipment
XIII	Handling, Storage, and Shipping	8.0	Material Storage and Control
XIV	Inspection, Tests, and Operating Status	14,0	Internal Quality Control
XV	Nonconforming Materials, Parts or Components	7.0	Material Receipt and Control
XVI	Corrective Actions	17.0	Corrective Actions
XVII	Quality Assurance Records	16.0	Quality Assurance Inspection Records
XVIII	Audits	15.0	Audits
		N/A	Title Page
		1.0	Introduction and Description
		10.0	Preventative Maintenance
		12.0	Data Reduction, Verification, and Reporting
		18.0	Quality Assurance Reports to Management

MATRIX COMPARISON

DOE Order 414.1**C** Cross Reference to Oak Ridge Laboratory Q.A. Program Manual

DOE Order 414.1 C "Quality Assurance"			**Oak Ridge, TN Laboratory Quality Assurance Program Manual**
Criterion No.	TITLE	QAM SECT	TITLE
1.	Program	1.0 2.0 3.0 12.0 13.0	Introduction Organization and Responsibility Quality Assurance Objectives Data Reduction, Verification, and Reporting Document Control
2.	Personnel Training and Qualification	4.0	Personnel Indoctrination and Training
3.	Quality Improvement	17.0	Corrective Actions
4.	Documents and Records	16.0 18.0	Quality Assurance Records Quality Assurance Reports to Management
5.	Work Process	5.0 9.0 10.0 14.0	Instructions and Procedures Control of Process Preventive Maintenance Internal Quality Control
6.	Design	N/A	Does not apply
7.	Procurement	6.0 7.0 8.0	Procurement Document Control Material Receipt and Control Material Storage and Control
8.	Inspection and Acceptance Testing	11.0 14.0 15.0	Control of Measurement and Test Equipment Internal Quality Control Audits
9.	Management Assessment	2.0	Organization and Responsibility
10.	Independent Assessment	15.0	Audits
N/A		N/A	Title Page
N/A		N/A	Authorization and Approval Statement

MATRIX COMPARISON

DOE Quality Systems (QSAS). And DoD Quality Systems (QSM) Cross Reference to Oak Ridge Laboratory QA Program Manual.

This cross reference applies also to NELAC Chapter 5.4.2.3

NELAC Chapter 5 "Quality Systemsċ		**Oak Ridge, TN Laboratory Quality Assurance Program Manual**	
4.2.6 RQMT	TITLE	QAM SECT	TITLE
	Title Page		Title Page
(a)	Policy statement, objectives, commitment by top management	1.0 3.0	Introduction and Description Quality Assurance Objectives
(b)	Organization and Management structure, Org Charts	2.0	Organization and Responsibility
(c)	Relationship between management, technical operations, support services and the quality system	2.0	Organization and Responsibility
(d)	Document control and records retention	16.0	Quality Assurance & Inspection Records
(e)	Job Descriptions	4.0	Personnel Indoctrination and Training
(f)	Approval signatories, signed concurrences	A&A	Authorization and Approval Statement
(g)	Traceability of measurements	14.0	Internal Quality Control
(h)	List of test methods	9.0	Control of Process
(i)	Review for facility and resource availability	9.0	Control of Process
(j)	Calibration or verification test procedures	5.0	Instructions and Procedures
(k)	Procedures for handling submitted samples	9.0	Control of Process
(l)	Major equipment and measurement standards	9.0 11.0	Control of Process Control of Measurement & Test Equipment
(m)	Calibration, verification, & maintenance	11.0	Control of Measurement & Test Equipment
(n)	Inter laboratory comparison, proficiency testing, reference material, internal Q.C.	14.0	Internal Quality Control
(o)	Corrective actions	17.0	Corrective Actions
(p)	Departures from policy/procedures	5.0	Instructions and Procedures
(q)	Complaints	1.0	Introduction and Description
(r)	Confidentiality and Proprietary rights	1.0	Introduction and Description
(s)	Audits and Data reviews	12.0 15.0	Data Reduction, Verification, and Reporting Audits
(t)	Personnel experience and training	4.0	Personnel Indoctrination and Training
(u)	Ethical and legal responsibilities	1.0	Introduction and Description
(v)	Analytical results reporting	12.0	Data Reduction, Verification, and Reporting
(w)	Table of Contents	TOC	Table of Contents

MATRIX COMPARISON

10 CFR Part 830.122 Cross Reference to Oak Ridge Laboratory Q.A. Program Manual

10CFR 830.122 "Quality Assurance Criteria"			**Oak Ridge, TN Laboratory Quality Assurance Program Manual**
Criterion No.	TITLE	QAM SECT	TITLE
830.122 (a)	Management/Program	1.0 2.0	Introduction Organization and Responsibility
(b)	Management/Personnel Training and Qualification	4.0	Personnel Indoctrination and Training
(c)	Management/Quality Improvement	3.0 14.0 17.0	Quality Assurance Objectives Internal Quality Control Corrective Actions
(d)	Management/Documents and Records	5.0 9.0 12.0 13.0 16.0 18.0	Instructions and Procedures Control of Process Data Reduction, Verification, and Reporting Document Control Quality Assurance Records Quality Assurance Reports to Management
(e)	Performance/Work Process	7.0 8.0 10.0 14.0	Material Receipt and Control Material Storage and Control Preventive Maintenance Internal Quality Control
(f)	Performance/Design	N/A	Does not apply
(g)	Performance/Procurement	6.0	Procurement Document Control
(h)	Performance/Inspection and Acceptance Testing	11.0 14.0 15.0	Control of Measurement and Test Equipment Internal Quality Control Audits
(i)	Assessment/Management Assessment	2.0	Organization and Responsibility
(j)	Assessment/Independent Assessment	2.0 15.0	Organization and Responsibility Audits
N/A		N/A	Title Page
N/A		N/A	Authorization and Approval Statement

MATRIX COMPARISON

EPA SW-846 Cross Reference to - Oak Ridge Laboratory Q.A. Program Manual

EPA SW-846 (Essential Elements)		**Oak Ridge, TN Laboratory Quality Assurance Program Manual**	
BASIC RQMT	TITLE	QAM SECT	TITLE
1.	Title Page	N/A	Title Page
2.	Table of Contents	N/A	Table of Contents
3.	Project Description	1.0	Introduction and Description
4.	Project Organization and Responsibility	2.0	Organization and Responsibility
5.	Q.A. Objectives	3.0	Quality Assurance Objectives
6.	Sampling Procedures	N/A	Does not apply to laboratory
7.	Sample Custody	9.0	Control of Process
8.	Calibration Procedures and Frequency	11.0	Control of Measurement and Test Equipment
9.	Analytical Procedures	5.0 9.0	Instructions and Procedures Control of Process
10.	Data Reduction, Validation, and Reporting	12.0	Data Reduction, Verification, and Reporting
11.	Internal Quality Control Checks	14.0	Internal Quality Control
12.	Performance and System Audits	15.0	Audits
13.	Preventive Maintenance	10.0	Preventive Maintenance
14.	Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completion	14.0	Internal Quality Control
15.	Corrective Action	17.0	Corrective Actions
16.	Quality Assurance Reports to Management	18.0	Quality Assurance Reports to Management
N/A		N/A	Authorization and Approval Statement
N/A		4.0	Personnel Indoctrination and Training
N/A		6.0	Procurement Document Control
N/A		7.0	Material Receipt and Control
N/A		8.0	Material Storage and Control
N/A		13.0	Document Control
N/A		16.0	Quality Assurance and Inspection Records

MATRIX COMPARISON

EPA QA/R-5 ñEPA Requirements for Quality Assurance Project Plansò

EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans"		Oak Ridge, TN Laboratory Quality Assurance Program Manual	
RQMT	**TITLE**	**SECT**	**TITLE**
A	**Project Management**		
A1	Title and Approval Sheet		Title Page Authorization and Approval (A&A) Statement
A2	Table of Contents		Table of Contents Page Headers (document control)
A3	Distribution List		Title Page
A4	Project/Task Organization	1.4 2.1 2.2 2.5	Introduction Organizational Structure Responsibility Organization Charts
A5	Problem Definition/Background	3.0 9.0 14.0	Quality Assurance Objectives Control of Process Internal Quality Control
A6	Project/Task Description	9.0	Control of Process
A7	Quality Objectives and Criteria	3.0	Quality Assurance Objectives
A8	Special Training/Certification	4.0	Personnel Indoctrination and Training
A9	Documents and Records	5.0 9.2 13.0 16.0	Instructions and Procedures Documented Procedures Document Control Quality Assurance and Inspection Records
B	**Data Generation and Acquisition**		
B1	Sampling Process Design (Experimental Design)	N/A	
B2	Sampling Methods	N/A	
B3	Sample Handling and Custody	14.4	Sample Custody
B4	Analytical Methods	5.0 9.0	Instructions and Procedures Control of Process
B5	Quality Control	14.0	Internal Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	10.0 11.0	Preventive Maintenance Control of Measurement and Test Equipment
B7	Instrument/Equipment Calibration and Frequency	11.0	Control of Measurement and Test Equipment
B8	Inspection/Acceptance of Supplies and Consumables	7.0 8.0	Material Receipt and Control Material Storage and Control
B9	Non-direct Measurements	10.0	Data Reduction, Verification, and Reporting
B10	Data Management	10.0	Data Reduction, Verification, and Reporting
C	**Assessment and Oversight**		
C1	Assessments and Response Actions	15.0 17.0	Audits Corrective Action
C2	Reports to Management	18.0	Quality Assurance Reports to Management
D	**Data Validation and Usability**		
	Data Review, Verification, and Validation	12.0	Data Reduction, Verification, and Reporting

EPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans"		Oak Ridge, TN Laboratory Quality Assurance Program Manual	
RQMT	**TITLE**	**SECT**	**TITLE**
D1		14.3	Data Verification
D2	Verification and Validation Methods	12.0	Data Reduction, Verification, and Reporting
D3	Reconciliation with User Requirements	12.0	Data Reduction, Verification, and Reporting

1.0 INTRODUCTION AND DESCRIPTION

1.1 PREFACE

Eberline Services ï Oak Ridge Laboratory is a radiochemistry laboratory that specializes in providing services for radiological assays to the environmental industry. Radionuclides are quantified within materials such as surface water, ground water, drinking water, wastewater, soil, sediment, sludge, vegetation, and hazardous waste. Bioassay (urine) analysis is performed for total uranium. The objective of the laboratory is to produce the highest quality data that are accurate, precise, legally defensible, and meet our clients data needs and requirements in a timely and cost effective manner.

The management of Eberline Services, Oak Ridge Laboratory is committed to a rigorous Quality Assurance (Q.A.) Program. While this commitment is necessary for the normal conduct of business, our basic policies dictate the highest standards of ethics and integrity in the conduct of our affairs. This philosophy and the specific procedures to attain policy objectives fromthe framework of our Q.A. Program. We will provide only those services that are within our qualifications and with confidence that our Q.A. Program and all related operating procedures dictate reliable performance of those services.

1.2 PURPOSE

This manual outlines management's Q.A. policy and establishes a requirement that procedures be promulgated and implemented to accomplish all of the quality assurance elements necessary to fulfill our responsibility to meet or exceed client or regulatory specifications. It also provides a means for creating mutual understanding regarding our Q.A. program and reliability techniques with our subcontractors, suppliers, and clients. This Eberline Services-Oak Ridge Laboratory Quality Assurance Program provides the structure, policies and responsibilities for the execution of quality control and quality assessment operations to assure that the laboratory meets defined standards of quality.

1.3 SCOPE

This Quality Assurance Program Manual provides guidance to meet operational Q.A. requirements.

In addition to the documents identified in the Cross Reference Section, this Manual complies with applicable requirements of the following the latest revisions of regulations below:

1.3.1 NRC 10 CFR Part 21, "Reporting of Defects and Non-compliance."

1.3.2 ANSI/ANS-10.3-, "Documentation of Computer Software.

1.3.3 NRC Regulatory Guide 4.15, Rev. 1, "Quality Assurance for Radiological Monitoring Programs - Effluent Streams and the Environment."

1.3.4 U.S. EPA QA/R-5, "EPA Requirements for Quality Assurance Program Plans."

1.3.5 DOE Order 414.1C ñQuality Assurance.ò

1.3.6 ISO/IEC 17025, "General Requirements for the Competence of Calibration and Testing Laboratories."

1.3.7 USEPA Directive 2185, ñGood Automated Laboratory Practicesò(GALP).

1.3.8 DOE Quality Systems for Analytical Services (QSAS)

1.3.9 DoD Quality Systems Manual for Environmental Laboratories (DoD QSM)

1.3.10 A National Environmental Laboratory Accreditation Conference (NELAC) Chapter 5 ñQuality Systemsò, July 2003.

1.3.11 USEPA Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-R-004, January 2005.

1.4 INTRODUCTION

Quality assurance, as outlined herein, is a tool that allows management to utilize the expertise and experience of all personnel on the job. It requires each worker to be aware of his/her work environment and to continually evaluate methods and processes to ensure that the best and correct operation is being performed. It requests each employee to identify and suggest any improvement to the processes while performing an operation. Improvements or changes shall be coordinated with management who will validate improvement and disseminate the information to all affected personnel. Management shall also, as needed, change procedures and provide additional training. This program also requires that all personnel be qualified, and trained on a continuing basis to maintain that qualification and be assimilated into the Oak Ridge Laboratory quality culture.

Management will provide resources, tools, equipment, scheduling, and training to ensure personnel can perform their duties effectively.

1.4.1 Management will also ensure that internal assessments are performed annually to evaluate management and processes with feedback for review with a goal of improving all areas of operations.

1.4.2 It is only by having a quality assurance culture, with all personnel involved, that a system, service, or product can be provided with full assurance that the best possible work, the best possible product, or the best possible service has been provided.

1.4.3 In order to ensure that this manual is an effective management tool, subjects that are not normally considered quality assurance, i.e. safety, security, etc., are addressed in other management documents.

1.4.4 The following titled designations of positions are used within the Oak Ridge, TN Laboratory:

Laboratory Manager: Refers to the General Manager of the Oak Ridge Laboratory.

Radiation Safety Officer (RSO): Refers to the RSO of the Oak Ridge Laboratory.

Emergency Coordinator: Refers to the individual who is responsible for overseeing and directing activities and protocols associated with emergencies and disasters..

Project Manager: Refers to an individual who is responsible for client service activities and is the single point of contact with a client for the laboratory.

Supervisor: Refers to individuals within the laboratory who are responsible for the operational functions of a group of personnel.

Q.A. Manager: Refers to the individual who is responsible for the Laboratoryôs Q.A.

Program.

1.5 DESCRIPTION

This document outlines the organization of the Q.A. functions within the laboratory. It depicts the lines of authority, and lists the duties and responsibilities within the organization. It provides direction for the preparation of Procedures Manuals, which provide the detailed methods of processes and analyses that accomplish the goal of quality data in terms of precision, accuracy and reproducibility.

1.6 CONFIDENTIAL AND PROPRIETARY INFORMATION

Oak Ridge Laboratory employees are exposed to confidential and/or proprietary information pertaining to the company and its clients. Information concerning the report of analysis, radiation dosimetry records, audit reports, calibration reports, and other documents relating to a project are considered confidential. This information is to be released only to the client or to the client's authorized representative. Each employee will sign an agreement with the Oak Ridge, TN Laboratory concerning the security of proprietary and confidential information. A copy of the agreement will be retained in the employee's personnel file (at the corporate office in Albuquerque, NM).

1.7 TECHNICAL COMPLAINTS

Technical complaints will be addressed by the Laboratory Manager, Project Manager, Quality Assurance Manager, or staff member with expertise in the area of complaint. If the complaint is not valid, every attempt will be made to satisfy the client. If the complaint is determined to be valid, the cause of the complaint shall be identified and corrected as soon as feasible. Verification that the cause for a valid complaint has been corrected is the responsibility of the individual addressing the complaint. Details of all technical complaints shall be recorded and maintained in the customer's project file. Clients are also encouraged to provide feedback on the Eberline Analytical website via a statement on each client report.

1.8 ETHICAL AND LEGAL RESPONSIBILITIES

Eberline Services-Oak Ridge Laboratory utilizes a clearly stated ethics policy that is discussed with all new employees during orientation. Each employee is required to understand the high standards of ethics and integrity required in order to perform their duties and to ensure the integrity of the data reported in connection with their employment at the Oak Ridge Laboratory. Each employee will understand that intentionally reporting data that are not the actual values obtained, intentionally reporting dates and/or times or data analyses that are not the actual dates and/or times of analyses, intentionally representing another individuals work as their own; or any other action that may affect the integrity of the data reported by the laboratory; will be the cause for dismissal.

1.9 ACCREDITATIONS

Through applications, pre-qualification, performance testing, and external auditing programs; the laboratory has been granted certification by different agencies, organizations, and states. The Laboratory maintains proficiency as required by the clients and regulatory certifying agency. The Quality Assurance Manager maintains credentials and lists of certifying agencies. The list of certifications maintained by the Oak Ridge Laboratory includes:

State of Tennessee, Department of Health ï Laboratory Division
State of California, Department of Public Health ï ELAP Branch
State of South Carolina, Dept of Health & Environmental Control, Environmental Lab Certification Program

State of Utah, Department of Health Bureau of Laboratory Improvement
State of New Jersey, Department of Environmental Protection, Office of Quality Assurance
State of New York, Department of Health, Environmental Lab Approval Program
State of North Dakota, Dept. of Health Environ. Lab. Certification Program - Chemistry Division
State of Nevada, Dept. of Conservation Bureau of water Quality Environmental Lab Services
State of Louisiana, Department of Environmental Quality
State of Texas, Texas Commission of Environmental Quality
State of Alabama, Department of Environmental Management
Commonwealth of Virginia, Dept. of General Services Division of Consolidated Lab Services
State of Washington, Department of Ecology**Perry Johnson Laboratory Accreditation, Inc.**
Department of Energy (DOE)
Department of Defense (DoD)

2.0 ORGANIZATION AND RESPONSIBILITY

2.1 ORGANIZATIONAL STRUCTURE

The Laboratory Manager has overall responsibility for this Quality Assurance Program (hereafter referred to as the Program). In this capacity, he has delegated the responsibility for formulation, implementation, and execution of the Program to the Laboratory Q.A. Manager.

Current organizational charts, identifying key individuals and the structure of the laboratory, are included in the "Statement of Qualifications." Additional organizational structure, functional responsibilities, levels of authority, and lines of communication for management, direction, and execution of the Program are documented below.

2.2 RESPONSIBILITY

Laboratory Management will periodically assess the integrated quality assurance program, its performance, and its effectiveness. Problems that hinder the organization from achieving its objectives will be identified and corrected.

Management will provide training and qualification to ensure quality products and services. Every employee is responsible for supporting the QA program policies, procedures, and guidance with each employee being responsible for their work. Professional qualifications and experience of all individuals and positions are maintained. Position descriptions and resumes are kept on file in the QA office. The specific duties of selected personnel are described below. Other job descriptions are located within an employeeôs training file in the QA office.

2.2.1 Laboratory Manager

The Laboratory Manager, under the authority of the President of Eberline Analytical Corporation, is responsible for the overall laboratory productivity and optimization of the efforts of the analytical staff and those who directly support the analytical effort. Staff interacts with the Lab Manager throughout the day. The Laboratory Manager is responsible for the implementation of regulatory standards, and national program requirements (NELAP, TNI, DOE, and DoD). The Laboratory Manager is responsible for the all safety aspects of the laboratory operations.

The duties of the Laboratory Manager include the following.

- Overall direction and general administration.
- Daily operation of the laboratory.
- Review of analytical procedures and practices.
- Recruitment, hiring, assignment, evaluation and termination of personnel.
- Training and professional development of staff.
- Review of proposals, bids, pricing and quotations.
- Perform an annual assessment of the laboratory operation.

2.2.2 Quality Assurance Manager

The Quality Assurance Manager operates independently from line management while reporting to the Laboratory Manager. The QA Manager has sufficient authority and organizational freedom to identify quality problems, to initiate, recommend or provide solutions; to verify implementation of solutions, and if necessary, to stop work until the problem is resolved. The QA Manager has independence from cost scheduling, and production considerations. In his capacity, he has the authority to control processing, delivery, installation, or use of items or services until proper disposition of an identified non-conformance, deficiency, or condition adverse to quality. The QA

Manager has a direct line of communication to the President of Eberline Analytical Corporation for matters of quality.

The duties and responsibilities of the QA Manager are as follows.

- Develop QA procedures, instructions and plans.
- Maintain surveillance over all applications of the QA Program; make recommendations for resolution of problems, or further evaluation by management.
- Monitor external audits, write responses, and ensure corrective actions.
- Issue non-conformances and formal corrective action(s).
- Issue stop-work orders for work that is not in compliance with requirements.
- Direct, and maintain records of analytical performance evaluation programs to ensure full and prompt participation and evaluation of results and derivation of all benefits relating there from.
- Direct, and maintain records of laboratory certification programs.
- Authorized to sign and designate other personnel to sign client related Certificates of conformance and/or non-conformance.
- Ensures compliance with Regulatory Standards and National Program requirements (e.g. NELAP, TNI, DOE, DoD, . . .)

2.2.3 Health and Safety Manager

The Health and Safety Manager reports directly to the Laboratory Manager and oversees the daily implementation of the laboratoryÕs health and safety program. The program includes an integrated chemical hygiene plan, safety orientation and training, radiation safety plans and training, sample disposal and shipment, and safety checks and audits.

- The duties and responsibilities of the Health and Safety Manager are as follows.
- Administer chemical hygiene, safety, fire extinguisher, etc. training.
- Management of sample disposal in conformance with the waste disposal policy.
- Packaging and shipment of samples, or designation thereof, following DOT regulations.
- Maintain Material Safety Data Sheet (MSDS) documentation.
- Direct spill response.
- Direct safety checks and audits.
- Ensures compliance with regulatory standards and national program requirements (NELAP, TNI, DoD, DOE, . . .)

2.2.4 Technical Director

The Technical Director reports directly to the Laboratory Manager and provides technical direction or advice for the laboratory operations and/or special programs, projects, or activities.

- The duties and responsibilities of the Technical Director are as follows.
- Perform technical analysis for specific projects.
- Make recommendations for research and development.
- Write technical manuals.
- Design systems, procedures, and documentation as necessary.
- Assist chemistry supervisors and technicians in technical interpretation of program requirements.
- Consult with clients, make recommendations regarding analytical schemes.

2.2.5 Data Review Department Staff

The Data Review Department has been structured to handle the specific project requirements of

our clients. The Department is responsible for producing quality control (QC) reports, for ensuring proper assembly of data packages and production of electronic data deliverables (EDDs) that meet the requests of the clients. Data Review personnel, in concert with the QA Manager, will assess the requirements of the various programs and client specific requirements, then interact with the appropriate laboratory personnel to ensure compliance with the clientôs statement of work. These efforts improve the accuracy and efficiency with which QC reports and data packages are prepared and forwarded to the client. Data deliverables are those items associated with the analyses of samples that are provided to the client.

Data Review staff responsibilities include the following.

- Assuring that analytical data have been correctly entered in the final report.
- Assuring that data are not released without reviews.
- Assuring that all data are released to the correct contact person.
- Producing QC reports.
- Assembling Data Packages.
- Ensuring that submitted EDD are complete, verified and in appropriate format.

2.3 ASSESSMENT

2.3.1 The Laboratory Manager will perform routine and continuous assessment of the management system to identify, correct, and prevent management problems that hinder achievement of the organizationôs objective. The assessment will focus on broad categories of management issues to determine the effectiveness of the integrated management system.

2.3.2 Laboratory Managerôs assessments will not be conducted to verify conformance to regulations, product standards, or established procedures, but will evaluate customer and employee perceptions relative to the following key issues.

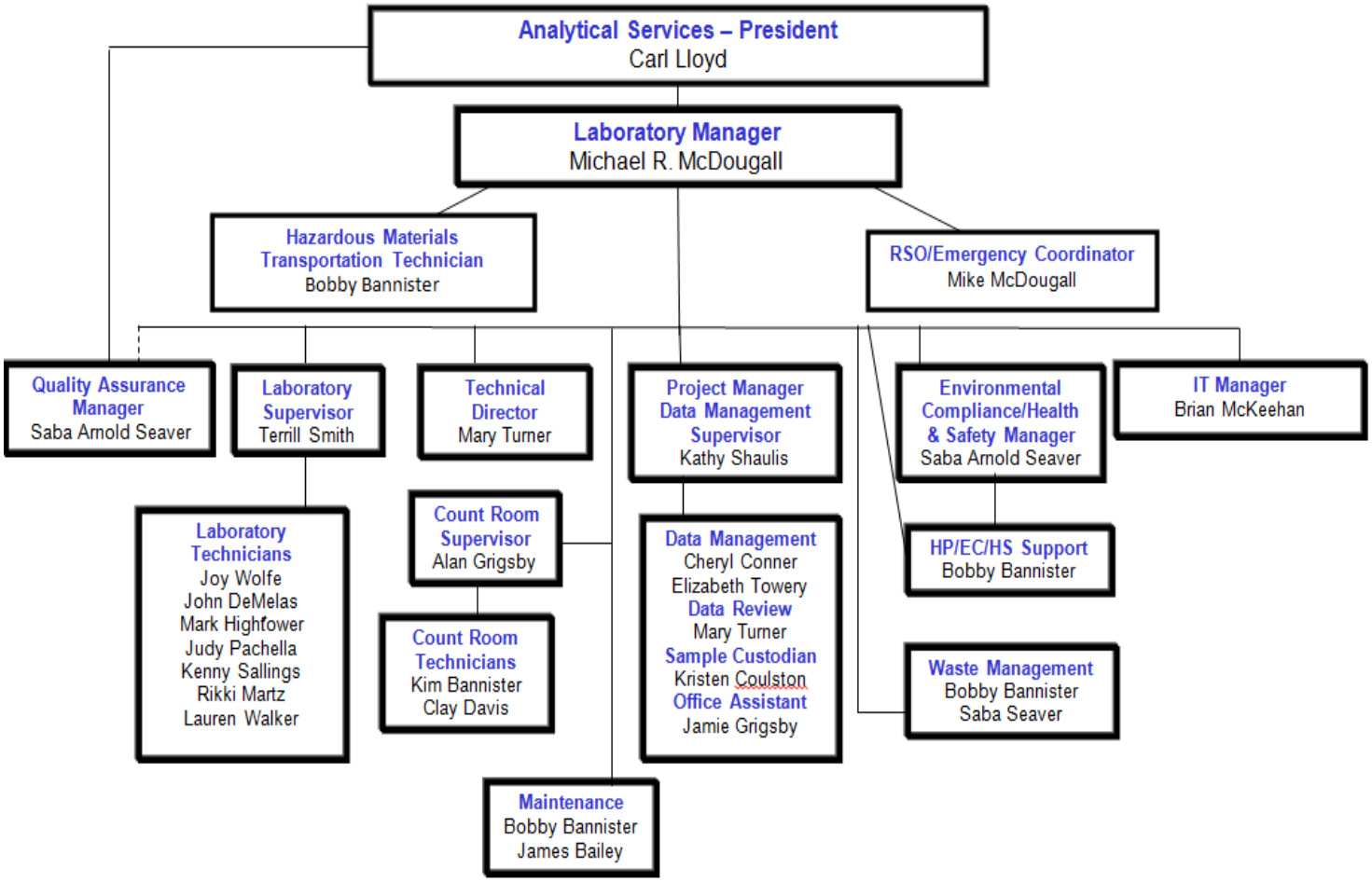
- Mission and strategic objectives of the organization.
- Employeesôrole in the organization.
- Customersôexpectations and degree to which expectations are being met.
- Opportunities for improving quality and cost effectiveness.
- Recognizing and enhancing human resource capabilities.

2.3.3 Results of the Laboratory Managerôs management assessment and recommendations will be documented annually. Decisions and related actions resulting from the recommendations will be properly followed up and evaluated for their effectiveness. Moreover, the opportunity for customer feedback is afforded by means of an on-line customer feedback/satisfaction survey on the laboratory website.

2.4 ORGANIZATION CHARTS

2.4.1 The Oak Ridge Laboratory Organization is illustrated in Figure 2.1

Figure 2.1
Oak Ridge, TN Laboratory Organization



3.0 QUALITY ASSURANCE OBJECTIVES

3.1 OBJECTIVES

The Oak Ridge Laboratory Q.A. Program is organized to meet the following objectives.

3.1.1 To ensure performance of those actions that provide confidence that quality is achieved.

3.1.2 To provide an effective control for the verification of characteristics of all systems, services, and processes that produce data of the required quality.

3.1.3 To ensure that systems, services, processes, and deliverables meet the rigid quality and reliability standards of the Oak Ridge Laboratory. Also, to ensure that individual client criteria pursuant to these standards are met.

3.1.4 To provide a continuing monitoring service for review of operating procedures, and for overall effectiveness and evaluation of the Q.A. Program. Also, to provide observations and recommendations for improvement in all areas of laboratory operations where quality may be affected.

3.1.5 To ensure the program provides valid records of the control measures applied to all factors bearing on the result of investigations.

3.1.6 To ensure the assessment of results provides feedback to improve the process.

3.1.7 To foster a culture of commitment to achieve a rising standard of quality that demands that the methods utilized to achieve the quality systems, services, processes, and deliverables be continuously monitored and improved.

3.2 QUALITY IMPROVEMENT

Operational processes will be reviewed continually by management and employees to detect and prevent problems and to ensure quality improvement. Any item or process that does not meet established requirements will be identified, controlled, and corrected. The cause of problems will be identified with corrections made to prevent recurrence. Item reliability, process implementation, and quality-related information will be reviewed and the data analyzed to identify items and processes needing improvement.

3.3 RESPONSIBILITIES

Employees are an integral part of the organization and are responsible to be aware of their work environment, to review operational processes and materials utilized, to identify any problems, and to make suggestions and recommendations for improvement. Employees are empowered to make and/or recommend corrections to improve operations and to prevent recurrence of the problems. Employees are also empowered, through their supervisor, to stop work where detrimental ethical, contractual, quality, safety, or health conditions exist. Management will immediately be made aware of any situations requiring work stoppage.

All employees are responsible for supporting the Program in principle and in detail and shall retain responsibility for the quality of their work.

Management is responsible to be actively involved in the quality improvement process to ensure

proper focus is maintained and for resolution of difficult issues. Management will maintain a ño faultòattitude to encourage employees to identify problems that compromise safety and reliability. Management will consider all recommendations for quality improvement and will recognize employee contributions.

3.4 CORRECTIONS

Items and processes that do not meet established requirements must be identified, documented, analyzed, and resolved. Corrective actions will be implemented and followed up to ensure effectiveness.

No laboratory analytical data will be revised or corrected after reporting to clients without full documentation of the process. The documentation must show: a) what necessitated the change; b) details of the change in terms of re-run records or recalculation; c) approval process for the change; d) formal client notification.

4.0 PERSONNEL QUALIFICATION AND TRAINING

4.1 QUALIFIED PERSONNEL

4.1.1 The Oak Ridge Laboratory personnel who perform activities that affect quality will have education, experience and training to ensure that suitable proficiency is achieved and maintained. A job description, identifying position qualification and duty requirements, will be included in each individual's training records.

4.1.2 All personnel will have training outlining their ethical and legal responsibilities, including the potential punishment and penalties for improper, unethical, or illegal actions.

4.1.3 Personnel performing technical functions or processes will have known and documented related work experience and minimum qualifications of education.

4.2 RESPONSIBILITY

4.2.1 Supervisors are responsible for initial evaluation of capabilities and qualifications of assigned personnel and will assign those personnel to perform functions based on the individual's qualifications and abilities.

4.2.2 Supervisors and managers are responsible for the day-to-day monitoring of assigned personnel for evidence of unethical, improper, or illegal activities.

4.2.3 Appropriate training is the responsibility of the supervisors with support from management. Training will address specific needs and will vary according to each job's requirements and previous experience of the employee, and will ensure:

4.2.3.1 Understanding of the fundamentals of the work and its context,

4.2.3.2 Understanding of the processes and tools being used, the extent and sources of variability in those processes and tools, and the degree to which control over the variability is maintained,

4.2.3.3 Emphasis on correct performance of the work, understanding why quality requirements exist, and potential consequences of improper work, and

4.2.3.4 Emphasis on "doing it right the first time.ò A particular emphasis is placed on employee safety.

4.2.4 Management will provide ALL employees the resources, tools, equipment, scheduling, and structured training to ensure personnel can perform their duties effectively. New employees will receive detailed information concerning the general corporate policies and the specific laboratory safety practices, and security policies. Training shall be conducted on an individual basis to achieve and maintain suitable proficiencies. The training will include, but will not be limited to:

- Ethical and Legal responsibilities
- Health and Safety
- Radiation Protection
- Waste Management
- Quality Assurance
- Laboratory Procedures
- LIMS Operation

4.2.5 Access to all laboratory documents and procedures will be available at all times to all employees who will be expected to familiarize themselves with these documents.

4.2.6 Milestone achievements or unique training will be noted by the supervisors via entry in the training records. Available certificates of training, education, or awards will also be maintained with the individual's training records.

4.2.7 Supervisors will monitor individual work habits to ensure proficiency is maintained, to note progressive improvement, and to identify any needed supportive training. Additional training requirements will be developed by the individual's supervisor.

4.2.8 As needed, employees will be informed of the requirements of special clients/programs necessary to achieve their duties and responsibilities. Familiarization will be made a matter of record.

4.2.9 All personnel training records will be maintained in the QA office. The details for maintenance of training requirements and records are outlined in the Oak Ridge Laboratory Management Procedure, MP-042 ñPersonnel Training."

5.0 INSTRUCTIONS AND PROCEDURES

5.1 POLICY

The Oak Ridge Laboratory policy uses written and approved procedures for routine activities and for analytical and operational processes. Applicable Laboratory procedures are available to all personnel. The most current revision of the appropriate procedure will be maintained and documented on the laboratory computer server. Departures from routine procedures due to non-standard situations or specific requests from clients will be approved by management and fully documented.

In addition to analytical procedures (AP) the laboratory maintains Management Procedures (MP) that describe the policy and approach for performing quality functions. Separate procedures for Health and Safety, Radiation Protection and Waste Management, are also maintained.

5.1.1 ANALYTICAL PROCEDURES

Analytical procedures are descriptions of particular protocols for testing or operations. Analytical procedures will be developed based on published reference procedures for each test or process, and authorized for use by the Laboratory Manager.

5.1.2 Qualification requirements for personnel performing operations and criteria used to determine the proficiency of the operator will be documented.

5.1.3 Each technical procedure will include a list of Personal Protective Equipment (PPE) required for the operation being performed. Training for the identification, operation, use, limitations, and disposal of the PPE will be conducted.

5.1.4 Each technical procedure will identify any chemicals/reagents required for completion of the operation. Material Safety Data Sheets (MSDSs) for those chemicals/reagents will be readily available, and training applicable to the MSDSs will be conducted.

5.1.5 Training will be conducted to the procedures used for processing wastes generated within the appropriate chemistry laboratory.

5.2 PROCEDURE MANUALS

Procedure manuals consist of the individual analytical procedures for a laboratory area or for an operation combined into one document. The procedures within the manual define all parameters of the operations being performed to include required accuracy and completeness of specific measurement parameters involved. Procedures will be incorporated into procedure manuals. Signature on the Authorization and Approval page applies to all procedures in the manual.

5.3 FORMAT AND DISTRIBUTION

5.3.1 Procedures will comply with the format prescribed in the laboratory management procedure (MP-021, Preparation of Technical and Project QA Documents) and will be approved by the QA Manager and the Laboratory Manager.

5.3.2 Employee access to the most current revision of procedures and manuals will be through the Laboratory computer server. Any distribution of controlled copies of any Laboratory procedure will be in accordance with the laboratoryôs document control protocol.

5.3.3 The Laboratory Manager is responsible for the maintenance and security of the original electronic version of all laboratory procedures and manuals and for ensuring that the most current revision of the procedures and manuals are promptly posted and accessible to all employees.

5.4 REVIEW

Laboratory technical procedure, manuals and Quality Assurance Plan will be reviewed annually and whenever program or procedural changes occur with updates as appropriate. Such reviews will be documented. All effected laboratory personnel and document holders will be made aware of any changes. Training of laboratory personnel on new changes will be conducted as necessary.

5.5 REVISION

5.5.1 The appropriate supervisor, or designated representative, is responsible for revisions or changes to the applicable procedure manuals.

5.5.2 Revisions are reviewed and approved by the organization(s) and personnel responsible for the original document. When possible, revisions or changes will be accomplished on a page replacement basis.

5.5.3 The Q.A. Manager will be advised of any changes in procedures required to satisfy specifications of the client.

5.5.4 The final revision shall be reviewed, approved, and authorized by the laboratory manager and QA manager. The electronic copy is placed on the laboratory server for access.

5.5.5 The Q.A. Manager will be responsible for the electronic retention of past revised and superseded procedures. The Q.A. Manager will also be responsible for maintaining the server location where current revisions are stored for employee reference.

6.0 PROCUREMENT DOCUMENT CONTROL

6.1 PURCHASING

Procurement of material, components, supplies, reagents, equipment, and services necessary to carry on the business interests of the Oak Ridge Laboratory is initiated by purchase requisition and controlled by the use of an authorized purchase order number. To the extent necessary, purchase orders will require suppliers to have a Q.A. program consistent with the requirements of this document. Detailed information on procurement is outlined in the laboratoryôs Purchasing Procedure.

6.2 PURCHASE REQUISITION REVIEW

Purchase requisitions or change orders are reviewed by purchasing department personnel to ensure conformance to the procurement requirements. As applicable, quality related requisitions are reviewed by Q.A. personnel prior to being processed. Change orders undergo the same review process.

6.3 CERTIFICATION/CERTIFICATE OF CONFORMANCE

All materials and processes requiring certification and certificates of conformance are identified on the face of the purchase requisition. Adequate information is provided to ensure supplier compliance to the required specifications. The Q.A. Manager is responsible for the retention, filing, and recall of material certification or certificates of conformance.

6.4 SUBCONTRACTS

When subcontracting analytical work, Oak Ridge Laboratory Management will ensure that the subcontractor can meet all the technical specification, maintain the appropriate certification (NELAP, DOE, DoD, State, . .) and that the prospective subcontractor has a QA program consistent with the requirements of this document. The Oak Ridge Management will secure the client approval for subcontracting their analytical work prior to commencement of the subcontract. The Q.A. Manager is responsible for evaluation and acceptance of the subcontractor's Q.A. program.

6.5 VENDORS

6.5.1 For procurement of quality-related items or services, the Q.A. Manager is responsible for vendor evaluation and approval. Analytical service vendor evaluation and qualification will be through accreditation as a secondary standard calibration laboratory (NVLAP, NIST); an audit by Oak Ridge Laboratory personnel or an acceptable audit agency; or facility inspection, test reports, or receipt inspections, when the quality of the materials or service can be verified by these methods. Documentary evidence that products and services conform to procurement requirements will be provided and retained. A list of approved vendors will be maintained by the Procurement Office.

6.5.2 The effectiveness of the control of quality by contractors and subcontractors will be assessed at intervals consistent with the importance, complexity, and quantity of the product or services.

6.5.3 The purchasing department is responsible for maintaining a record of quality related materials received from vendors including any reports for non-conforming material.

6.6 QUALITY RELATED SERVICES

Q.A. personnel will review the purchase requisitions for quality related services. Those services that are determined to be quality related will include, as applicable, a statement, or wording, in the body of the purchase order or by attachment identifying the applicable requirement.

7.0 MATERIAL RECEIPT AND CONTROL

7.1 POLICY

Only material components, supplies, reagents or standards with acceptable quality characteristics and from qualified vendors will be allowed into the laboratory.

7.2 RESPONSIBILITY

Receipt and initial verification of all materials and equipment received by the Oak Ridge Laboratory, either purchased or contract (client) supplied, is the responsibility of the receiving or designated individual. Technical verification for materials and equipment will be performed by the requisitioner or Q.A. Manager, whichever is applicable. Quality related purchase order items will be receipt inspected by Q.A. personnel.

7.3 MATERIAL CONTROL

Purchased material is controlled by the Laboratory Supervisor or designated individual.

7.3.1 The receiving and stock control clerk, or designated individual, is responsible for the expedient and correct routing of all initially accepted received materials to stock, or to the requisitioner.

7.3.2 Purchasing department personnel are responsible for maintaining a record of materials received from vendors, including Rejected Material Report or equivalent form, for any non-conforming material.

7.4 NON-CONFORMING MATERIAL

When received material, affecting quality, has been determined to be non-conforming, the requisitioner will work with the purchasing agent and will be responsible for proper processing.

7.5 RECORDS

Records of receipt of services and supplies that affect the quality of laboratory operation will be identified with date of receipt, expiration date, source, lot or serial identifier, and calibration or certification records as appropriate.

8.0 MATERIAL STORAGE AND CONTROL

8.1 POLICY

All materials and supplies in storage will have the necessary protection to preclude deterioration, corrosion, or damage during storage life and will carry identification sufficiently clear to ensure that only those materials specified by process instructions will be withdrawn from material storage and issued for processing.

Only analytical grade chemicals and reagents, bearing such grade identification will be utilized by the Laboratory. Each container will be assigned a unique identification number upon receipt. The date of receipt will be posted on each container. The use and the retention (shelf life) of such chemical will be monitored by the Laboratory Supervisor.

All standards used by the Laboratory must be NIST certified. Each standard must be accompanied with a certificate showing the name, composition, concentration, reference number and NIST Certification. The use and distribution of these standards will be monitored by the LIMS. The certificate and certification documents of standards will be controlled by the QA department.

8.2 RESPONSIBILITY

Only authorized personnel will have access to, and the responsibility for, control and issue of materials or supplies. Materials and supplies will be stored to allow for ready identification. Care will be taken to preclude mixing of rejected material and supplies with those that are qualified for issue.

9.0 CONTROL OF PROCESS

9.1 STANDARD PRACTICES

Standard practices applicable to services provided by the Oak Ridge Laboratory are contained in documented procedures and this Q.A. Program Manual. Every effort is made to implement and fulfill the requirements of Federal and local laws, rules, guidance(s), and directives as may be applicable to the operational practices within the Oak Ridge Laboratory. These may include but are not limited to:

9.1.1 Federal and State rules and regulations.

9.1.2 Consensus standards related to the services performed (e.g., American National Standards Institute).

9.1.3 Regulatory Guides published by the Nuclear Regulatory Commission, Department of Energy, the Environmental Protection Agency, and the Department of Defense.

9.1.4 Specific contractual agreements with clients.

9.1.5 Where conflicts may occur among any of the above items, the client will be notified and requested to specify the practice to be followed.

9.2 DOCUMENTED PROCEDURES

Routine analytical operating procedures are documented. Each laboratory procedure includes quality control criteria that are applicable to that process. The laboratory management will develop, promulgate, and implement procedures that document the operations performed in the laboratory. Additionally, the following general procedures or documents, as applicable, will be developed:

9.2.1 Quality Assurance Procedures

9.2.2 Radiation Safety Manual and Procedures

9.2.3 Sample Control Procedures

9.2.4 Purchasing Policies and Procedures

9.2.5 Data Review Procedures

9.2.6 Environmental Compliance Procedures

9.2.7 Safety Procedures

9.2.8 Chemical Hygiene Plan

9.2.9 Hazard Communications Program

9.2.10 LIMS Procedures

9.2.11 Management Procedures

9.2.12 Analytical Procedures

9.3 RESPONSIBILITY

The Laboratory Manager, or designated representative, determines which instructions or procedures require quantitative or qualitative acceptance criteria and specify the appropriate criteria on special contracts or projects.

9.4 WORK POLICY

All work to be performed by the Oak Ridge Laboratory on client samples is authorized by the client and controlled through a Laboratory Information Management System (LIMS) work order document which incorporates the client's requirements. (Or by some other document deemed necessary by the Laboratory Manager or Project Manager as directed by the customer)

9.4.1 The work order specifies those analyses necessary to assure compliance with contractual obligations.

9.4.2 The Project Manager or designated personnel ï under the authority of the Laboratory Manager, are responsible for notifying the Q.A. Manager and performing laboratory departments, through the appropriate supervisor, of all contract requirements including reporting format and quality control criteria. This may be done by reference to other documents (e.g., Purchase Order, statement of work, technical specifications, etc.) that delineates the contract requirements.

9.4.3 The Project Manager or designee ï under the authority of the Laboratory Manager-, will ensure planning, scheduling, and resources are considered when contracting for or accepting work.

9.4.4 When subcontracting analytical services, the Project Manager or designated individual under the authority of the Laboratory manager-, will assure that:

- The client is notified in writing of the intention to subcontract any portion of the testing to another party.
- If the work is covered under NELAP, the work will be placed with a laboratory accredited under NELAP for the tests to be performed.
- Records, demonstrating that the above requirements have been met, are retained in the project folder.

10.0 PREVENTIVE MAINTENANCE

10.1 POLICY

Preventive maintenance is performed as required on instrumentation and equipment to prevent down time and to ensure reliable performance. The laboratories maintain instrument redundancy that precludes the requirement for a repair and maintenance capability for instrumentation. Maintenance and/or repair of equipment are performed by the equipment manufacturer or authorized representative under contract or purchase order.

10.2 MAINTENANCE

Preventive maintenance procedures will be developed for use where instructions are not provided in the manufacturer supplied operator's manual. As applicable, each department will maintain a major equipment and measurement standards list. A record of instrument maintenance, calibration, and repair, if applicable, will also be maintained. The supervisors and operating personnel are responsible for complying with the department maintenance schedule.

10.3 SPARE PARTS

Supervisors will ensure that an adequate inventory of spare parts and consumables is requisitioned and maintained for instrumentation in their area in order to prevent down time or compromise operating conditions.

11.0 CONTROL OF MEASUREMENT AND TEST EQUIPMENT

11.1 MEASUREMENT AND TEST EQUIPMENT CALIBRATION POLICY

This section establishes the controls and calibration requirements for all analytical and nuclear measurement equipment. An equipment list will be maintained indicating calibration status.

11.1.1 All equipment whose operation and function directly affect the quality of service will be inspected/calibrated at established intervals. As applicable, equipment will be suitably identified to reflect calibration status. If an instrument is determined to be out-of-tolerance, it will be segregated, or otherwise clearly identified as inoperable. Records of each calibration will be kept in appropriate logbooks or files. Instruments whose calibrations are performed during method operations are calibrated and controlled in accordance with the method requirements. Run logs will be maintained for this category of instrumentation.

11.1.2 The equipment used to determine the quality characteristics and accuracy of instruments will be checked and verified either internally (dependent upon capability), or by qualified calibration services.

11.1.3 Frequency of inspection/calibration will be based on use of the equipment or instrument, environmental conditions in which it is used, its inherent stability, manufacturer's recommendation, and the wear or deterioration resulting from its use.

11.1.4 Certified standards are used for all primary calibrations. National Institute of Standards and Technology (NIST) or NIST traceable, Environmental Protection Agency (EPA), New Brunswick Laboratory (NBL), or Department of Energy (DOE) standards are used, when available, for the primary calibrations or verification of primary calibrations.

11.1.5 All preparations of standard solutions are recorded in a standards preparation logbook or file. Identities of standards are such that a secondary standard or dilution can be traced, through subsequent actions, back to the initial certification. Records of these reference standards are organized in a secure location in the QA office.

11.1.6 Quality control check standards are used to record instrument sensitivity and linearity and to verify proper response. Methods and calibration entries are dated, initialed, and documented by the analyst.

11.1.7 Measuring and test equipment are tagged as to calibration or operating status for periodic processes performed on a scheduled interval of greater than one month. For processes performed more frequently, separate documentation will be available for verification of operational status. Instruments that are too small to be tagged or are subject to a wide variety of calibrations shall have separate documentation of status available.

11.2 RESPONSIBILITY

Testing and/or calibration of equipment and instruments will be performed under the direction of the supervisor, the department manager, or the operations manager and performed under suitable environmental conditions.

11.3 PROCEDURES

All tests and calibrations will be performed in accordance with written procedures that contain provisions for ensuring that all prerequisites for the given test have been met, including appropriate equipment to be used.

11.4 CERTIFICATION AND CERTIFICATES OF CALIBRATION

11.4.1 To the extent possible, calibration will be traceable to NIST. Records of traceability will be maintained along with records of routine calibrations of each instrument or measurement system. Where no NIST traceability exists, the basis used for calibration will be documented.

11.4.2 Equipment records will be maintained to indicate past and current status, and to provide reproducibility and traceability of results.

11.5 RADIOACTIVE SOURCE CALIBRATION

Radioactive sources used as calibration standards will be periodically calibrated and controlled. Current calibration certificates will be kept on file.

11.6 CALIBRATION RECORDS

Supervisors will ensure that calibration data for instruments and radioactive sources is recorded in the instrument logbook, on data work sheets, on computer files and/or control charts. When required, new calibration charts will be prepared when there is measurable change in calibration effect on instruments that have been calibrated. If an instrument is determined to be out of tolerance, it will be segregated or otherwise clearly tagged as inoperable and not used until repaired.

11.7 REPORTS GENERATED FROM USE OF A DEFICIENT INSTRUMENT

If a major deficiency in an instrument or device is detected during periodic calibration procedures, the technician will immediately notify the supervisor, the operations manager, and the Q.A. Manager. A conference will immediately be scheduled to investigate and decide what corrective action is to be taken on past data and reports resulting from the use of the deficient instrument or device. A record of corrective actions will be maintained.

11.8 PERFORMANCE CHECKS OF RADIATION SCREENING INSTRUMENTS

Performance checks will be made to ensure the continuing capability of radiation screening instruments. Procedures will include efficiency checks and background determinations. The procedure and frequency of each check is optimized for each detector system to provide assurance of the detector's performance. Documentation of the checks and the results are kept for all operations.

12.0 DATA REDUCTION, VERIFICATION, AND REPORTING

12.1 USE OF COMPUTER HARDWARE AND SOFTWARE

Computer programs used in the production or support of client data are either purchased, or developed using approved development methodology. Such programs are independently validated, verified, and documented. Changes are controlled to assess the potential impact of the change on the performance of the program.

12.2 DATA REDUCTION AND VERIFICATION

Sample receipt and distribution through the laboratory is documented by the sample receiving technician. Sample handling, subsampling, and preparation for counting measurement are documented by the laboratory technicians.

12.2.1 The successful completion of an analysis is monitored by the Counting Room staff. The Laboratory Manager, or designated individual, performs the final review and approves the data.

12.2.2 Calculation methods, transcriptions, and data flow, plus times and locations of the various tiers of review are detailed in the specific procedure.

12.3 REPORTING

The Project Manager or designated individual is responsible for providing the client with the required analytical results. Reports to clients will be reviewed for accuracy and completeness and, where required, analytical methods and minimum/method detection limits (MDL) will be reported. Laboratory reports of analyses will be signed by an authorized individual who, along with the person who signed the data sheets, can attest to the fact that the data was generated in accordance with established procedures.

13.0 DOCUMENT CONTROL

13.1 POLICY

The primary formal communication methods within the Oak Ridge Laboratory departments are documents that inform or direct activities affecting purchasing, sample analyses and reporting, instrument calibration and/or testing, radiation controls, proper handling of wastes, radiation safety, and Health and Safety. These documents are controlled by the Q.A. Program Manual, Operating Procedure Manuals, other documented procedures, or by interoffice memoranda. Drawings and specifications are not controlled as separate documents but are included in controlled procedures where applicable. The QA Office controls logbooks used to document the analysis of samples (see MP-023, Documentation of Analytical Laboratory Notebooks).

13.2 RESPONSIBILITY

13.2.1 The Q.A. Manager is primarily responsible for maintaining files of all controlled documents and will:

- Review the Quality Assurance Program Manual and provide recommendations for updating.
- Ensure that all holders of controlled documents receive updates to the documents.
- Maintain files of controlled document distribution indicating document title, number, revision number, assigned date, and the name of the individual to whom the document is assigned.
- Forward revisions of controlled documents to assigned individuals. An acknowledgment form will accompany each document revision for verification of receipt and to provide disposition instructions for the superseded pages
- Maintain a Master List of current procedures which includes procedure number, procedure title, current revision number, and date on which the current revision became effective. The list will be continually updated to reflect all new revisions or new procedures issued. An electronic copy of this list shall be available for employee reference at all times.

13.2.2 Uncontrolled copies of controlled documents will be distributed only if marked "Uncontrolled."

13.2.3 Superseded and/or obsolete documents are isolated from use or destroyed. Upon training to new revisions, employees sign to verify the destruction of all uncontrolled copies of obsolete revisions.

13.2.4 Each employee is responsible for requesting revisions or changes to operating procedures for their area of responsibility.

13.2.5 The Q.A. Manager will be advised of any changes in procedures required to satisfy client specific requirements.

13.2.6 Client information and records such as contract requirements, project descriptions, analytical data and results submitted to the client; and all laboratory records associated with such submittal will be maintained by the laboratory for a minimum of 5 (Five) years. Clients will be contacted and queried for disposition instructions for their related documentation.

13.2.7 If or when the laboratory may transfer ownership, is decommissioned, or goes out of business, ALL clients will be notified and asked to provide specific direction regarding the transfer or disposition of documents and records related to their project(s).

14.0 INTERNAL QUALITY CONTROL

14.1 LABORATORY ANALYTICAL SERVICES

Precautions are taken in the chemistry laboratories to avoid cross-contamination of samples and to ensure the reporting of accurate results. Quality control samples are analyzed along with routine samples to indicate when results may be in error due to improper operation or calibration of equipment, inadequate training of personnel, a deficiency in the procedure, or cross-contamination from other samples.

14.1.1 Laboratory Precision - Laboratory management personnel are responsible to ensure that analytical results are reproduced internally within acceptable limits.

14.1.2 Precision and Accuracy - Replicate standards and/or samples are used to estimate the precision of each analytical test procedure for a known matrix. Data control limits are established to satisfy the requirements of specific measurements based on prior knowledge of the measurement system and method validation studies. Certified standards and/or spiked samples are used to estimate chemical recovery and accuracy for these procedures for known matrices.

14.1.3 Calibration and Performance Checks of Nuclear Measurement Systems - Reference standards are used for calibrating nuclear measurement systems. In addition to calibration of all instrumentation, routine monitoring is performed to ensure the continuing integrity of the instrument performance. The monitoring parameters performed include efficiency checks, background determinations, and energy calibrations. The procedure and frequency of each check is optimized for each detector system to provide assurance of the detector's performance. Documentation of the checks and the results are kept for all systems. The supervisor is responsible for these calibration and performance checks.

14.1.4 Duplicate Analysis - Duplicate aliquots of randomly selected samples will be processed on a routine basis. The analyst will always process samples in accordance within approved operating procedures. The evaluation of the duplicate analysis will be based on examination of the difference between the duplicates. A statistical analysis of the data may be performed when a cursory evaluation indicates problems with the results. If the two results agree within the three standard deviation limits, a more detailed evaluation will generally not be necessary. Results of duplicate analyses will be included in the monthly Q.C./Q.A. report.

14.1.5 Detection and Elimination of Bias - Where possible, calibration will be with standards that are traceable to NIST. However, traceability to NIST is not always possible and reliance on other suppliers may be necessary (e.g., International Atomic Energy Agency, U.S. Department of Energy, U.S. Environmental Protection Agency, or commercial supplier such as Analytics, Amersham Biosciences, AEA Technology, etc.). Standards in the appropriate geometry or form will be used to determine efficiency of instruments on a periodic basis. In the calibration process, the ideal standard will be a known quantity of the radionuclide to be measured, prepared in exactly the same geometry as the samples and counted under the same conditions. In this way, factors such as self-absorption, backscatter, sample geometry, and detector efficiency will be accounted for empirically.

14.1.6 Spiked Samples - A known quantity of calibrated radioactive standard solution will be added to an aliquot of the sample or to a "blank" sample for replicate analysis. When the entire analytical system is operating properly, the laboratory record will demonstrate the accuracy and precision of the data. Divergent data from the spiked sample will point out

problem areas. If the data is consistently higher or lower than the known value, bias in the analytical procedure is indicated. This may require a search for personnel errors, re-standardization of carriers or tracers, and/or recalibration of counting equipment. .

14.1.7 Background Determination - The type of equipment and environmental factors contribute to variation in the counting rate of instrument background. The background of each system instrument will be determined and recorded with sufficient frequency to provide a firm statistical basis for that measurement and to ensure response to potential instrument problems or other artifacts such as controlled contamination.

14.1.8 These background determinations will include use of the items that most closely duplicate the analytical configuration in type, geometry, and with any associated fixtures. In some cases, true blanks are not available, but the closest practicable analog is used.

14.1.9 Some systems are sufficiently stable to require no change in backgrounds used for data reduction (e.g., uranium daughter gamma-rays found in gamma spectra due to adjacent building materials and earth). In this case, backgrounds will be compared to historical data to insure sufficient stability. Other systems experience enough variability to require computed backgrounds based upon running averages.

14.1.10 Background data will be recorded in the logbook or computer file for that specific instrument along with calibration data and instrument maintenance records.

14.1.11 Blanks - Blank samples are routinely analyzed to verify control of contamination and process. Results of processed blanks will be included in the monthly Q.C./Q.A. report.

14.1.12 Collaborative Testing - The Oak Ridge Laboratory participates in collaborative testing or inter-laboratory comparison programs. Natural or synthetic samples prepared to contain known concentrations of certain radionuclides are sent to participating laboratories by an independent referee group such as the DOE Radiological and Environmental Sciences Laboratory DOE, Idaho Falls, Idaho (MAPEP); by a NELAC approved provider such as the Environmental Resources Agency (ERA), Environmental Measurements Laboratory (EML), or by customer(s).

These programs enable Oak Ridge Laboratory personnel to document the precision and accuracy of radioactivity measurements, identify instrumental and procedural problems, and compare performance with other laboratories.

14.2 QUALITY CONTROL AND DATA REPORTS

14.2.1 Quality Control Reports

Quality control results will be summarized, and include with every sample/group of samples.

14.2.2 Data Reports

Routine performance requires documentation of all pertinent information with the basic documents dated and initialed or signed. Required documentation will be the initial work order, Chain-of-Custody (CoC), or document that records all pertinent information such as the identity of the sample and analyses to be performed. The data report will include technical analysis notes, logbooks, work sheets all raw data and other information used in performing the analysis. The report of analysis will be the final report of the data to the client and is issued in accordance with the laboratory's procedure for review and processing, as well as any client specific requirements.

14.3 DATA VERIFICATION

Routine performance requires inclusion of all pertinent information with basic documents dated and initialed or signed. The work order has recorded such information as the identity of the samples and analyses to be performed. All raw data and other information used in performing the

analyses are documented.

14.3.1 Electronic Deliverables Verification - Project managers, or designated individuals, are responsible for ensuring that electronic deliverables are complete and accurate.

14.4 Sample Custody

Samples are assigned a unique laboratory identification number, marked on a label that is applied directly to the container and which identifies the work order and laboratory fraction. Sample control personnel are designated sample custodians for strict (legally defensible) CoC samples. Locked buildings, refrigerators, freezers, and cabinets are available for CoC samples. Sample custody forms or technician analysis notes are used for tracking all samples through the analytical process. Details for radiological survey of samples, sample security, sample disposal, etc. are outlined in approved Sample Control Procedures. Sample chemistry and nuclear counting requirements are assigned by the laboratory manager, or designated individuals.

15.0 AUDITS

15.1 POLICY

The Oak Ridge Laboratory has established a comprehensive system of planned and documented audits to verify compliance with all aspects of the Q.A. Program. An audit is defined as a documented activity performed in accordance with written procedures or checklists to verify, by examination and evaluation of objective evidence, that applicable elements of the Q.A. Program have been developed and effectively implemented in accordance with specific requirements. Audits will be performed by persons not having direct responsibility for those areas being audited.

15.1.1 Customer Access to the Oak Ridge Laboratory Facilities and Personnel - The client is frequently responsible for auditing the Oak Ridge Laboratory's performance relative to contractual requirements. The exact nature of this responsibility is relative to the nature of the regulatory or licensing requirements, the significance of the services, and the technical expertise available or inherent within the client's organization. The need for, and frequency of, client audits is dependent upon the above factors. A client may authorize an independent agency to perform an audit on its behalf. When possible, the facilities, equipment, and records (proprietary information excluded) of the Oak Ridge Laboratory will be made available for client inspection along with the necessary personnel to permit verification of quality characteristics.

15.1.2 The Q.A. Manager will coordinate and participate in audits conducted by the client or the client's representative.

15.1.3 Internal Audits - The Q.A. Manager will audit the laboratory operations to verify compliance with established procedures and requirements set forth in the Q.A. Program Manual. Use of a checklist will insure items in compliance are noted as well as any requirements for improvement.

15.1.4 External Audits - External audits of organizations providing services to the Analytical Services Group are scheduled at a frequency commensurate with the status and importance of the activity.

15.2 RESPONSIBILITY

Audits will be directed by the Q.A. Manager with assistance from designated personnel.

15.2.1 The Q.A. Manager will be responsible for an independent quality assurance audit of each department.

15.2.2 The Q.A. Manager will be responsible for assuring that audits are performed by knowledgeable professionals.

15.2.3 An independent qualified auditor will audit areas of responsibility assigned to the Q.A. Manager.

15.3 DOCUMENTATION

Audit results will be documented by the Q.A. Manager.

15.3.1 The Laboratory Manager shall be provided a copy of the audit report.

15.3.2 The QA Manager will determine if there are any corrective actions required and the individual responsible for implementing the corrective action

15.4 DEFICIENT AREAS

15.4.1 The responsible Manager will ensure correction of the identified deficiencies.

15.4.2 The Q.A. Manager will verify that action is taken to correct any deficiency and will take follow-up action to ensure that corrections have been completed.

15.4.3 The Q.A. Manager will ensure close out, with documentation, of the audit after corrective actions have been completed.

15.4.4 For uncorrected or unresolved deficiencies, after due diligence, the Q.A. Manager will petition the Laboratory Manager to bring to bear his authority for resolution of the deficiencies.

15.5 FREQUENCY OF AUDITS

The Q.A. Manager will ensure internal audits are conducted on an annual basis. Additional selective audits will be conducted when one or more of the following conditions exist:

15.5.1 When significant changes are made in functional areas of the Q.A. Program, including significant reorganization or procedure revisions.

15.5.2 When assessment of the Program's effectiveness is considered necessary.

16.0 QUALITY ASSURANCE AND INSPECTION RECORDS

16.1 POLICY

Records that provide objective evidence of the quality of work are generated and maintained. These records include controlled logbooks, customer instructions, sample analyses data sheets, and results of reviews, inspections, tests, audits, corrective actions, reports, and training records. Also included are related data such as personnel qualifications, procedures, and equipment records.

16.2 RESPONSIBILITY

The responsibility for initiation, completeness, and reliability of Q.A. records is vested in the appropriate supervisor, with periodic verification checks by the Q.A. Manager. All Oak Ridge Laboratory personnel performing processes or services associated with the work being performed will assist in the efforts.

16.3 RECORDS

16.3.1 Inspection and test records will, at a minimum, identify the inspector or data recorder, the type of observation, the results, the action taken in connection with any deficiencies noted, and the date of the inspection or test.

16.3.2 All required records will be legible and of a quality that can be copied. Records shall be completed using reproducible ink. Errors or incorrect entries will be lined through with a single line, dated, and initialed by the recorder.

16.3.3 Correspondence from clients may be made available for inspection at the discretion of client representatives and authorization from the originating organization.

16.3.4 Q.A. records will be identified and controlled by customer number and/or client identification as applicable.

16.4 STORAGE OF RECORDS

16.4.1 Quality assurance records will be firmly attached in binders, placed in folders or

envelopes, and, if applicable, cross referenced by client identification and stored in a secure area.

16.4.2 Q.A. records will be properly stored and made available to the client upon request.

16.4.3 Records will be maintained in a secured and protective storage area.

16.4.4 Records will be identified and be retrievable.

16.4.5 CoC records are included with the sample set records.

16.4.6 Longer retention or duplication of records is available at the specific direction from the client.

16.4.7 Laboratory management will be responsible for governing access to, and controlling the records.

16.4.8 Analytical reports and source calibration data will be retained for a minimum of five years after results are reported to the client.

16.4.9 Procurement records will be retained for a minimum of five years or as required by the contract.

16.4.10 All records and analyses performed pertaining to (NELAC) accreditation will be kept for a minimum of 5 years and would be available for inspection by the accrediting authorities during this period even without prior notification to the laboratory.

17.0 CORRECTIVE ACTION

17.1 POLICY

The Oak Ridge Laboratory policy is to ensure continuous acceptable quality levels for services provided. Conditions adverse to quality will be identified and corrected as soon as practical.

17.2 CORRECTIONS

17.2.1 CORRECTIVE ACTION REPORT (CAR)

In the case of a significant condition adverse to quality, the cause of the condition shall be determined and corrective action taken to preclude recurrence. The identification, cause, and corrective action shall be documented and reported to appropriate levels of management. Follow-up action shall be taken to verify implementation of this corrective action and documented via a Corrective Action Follow-Up form. The Corrective Action Report (CAR) Form shall be used to document this condition. Typically, the Q.A. Manager will initiate investigation and corrective action by issuing a Corrective Action Report (CAR) in any of the following situations:

- When an audit reveals circumstances that will adversely affect quality (Audit Finding) as determined by the Q.A. Manager.
- When any results of an inter-comparison study are out of control, or for non-participation.
- When procedural or technical problems arise and the Q.A. Manager determines that they will significantly affect quality.

17.3 NON-CONFORMANCE REPORT (NCR)

A non-conformance is a deficiency in a characteristic, procedure, or documentation that renders the quality of an item unacceptable, however, is not considered a significant condition that would require an investigation by use of a CAR. In the laboratory, non-conformances can include physical defects, incorrect or inadequate documentation, and deviations from an established protocol, plan, or documented technical requirement. This condition is documented using a Non-Conformance Report (NCR) Form.

17.4 RESPONSIBILITY

All laboratory personnel are responsible to communicate any evidence of unacceptable quality performance to their supervisor, the responsible manager, and/or the Q.A. Manager.

17.4.1 The responsible manager will ensure investigation of a condition adverse to quality, determine assignable cause, and provide recommendation(s) for corrective action.

17.4.2 The responsible manager will ensure action is initiated to correct the assignable cause of the adverse condition and to determine and initiate the specific corrective action(s) necessary to preclude recurrence.

17.4.3 The Q.A. Manager will review CARs, NCRs, and routine Q.C. reports for evidence of unacceptable quality.

17.4.4 Copies of the completed CARs and NCRs will be kept on file by the Q.A. Manager.

17.5 CLIENT NOTIFICATION

The client will be notified when any Corrective Action is initiated due to evidence of unacceptable quality that is related to their contract.

18.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

18.1 POLICY

The Oak Ridge Laboratory policy is to keep management apprised of all quality assurance problems, actions taken to correct them, and any actions taken to prevent recurrence.

18.2 QUALITY ASSURANCE REPORTS

18.2.1 Quality Assurance Reports are prepared quarterly by the QA Manager and submitted to upper management. The reports shall include discussion of inter-comparison studies, status of corrective actions, and quarterly QA objectives.

18.2.2 The Q.A. Manager will report all general or system audit results, problems, corrective actions, and replies.

Document Revision History

Revision	Effective Date	Changes From Previous Revision
7	8/1/13	• Document Revision History table implemented • Added Emergency Coordinator to title designations of positions in Section 1.4.4 • Updated list of accreditations in section 1.9 to reflect all current certifications • Updated Laboratory Organization Chart • Removed requirement for employees to maintain hard copies of procedures in work area.

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Eberline Ananlytical – Oak Ridge Laboratory

601 Scarboro Road, Oak Ridge, TN 37830-7371

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 4.2 10/26/2010 and is accredited is accordance with the:

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Initial Accreditation Date:	*Issue Date:*	*Accreditation No.:*	*Certificate No.:*
December 18, 2012	December 18, 2012	70747	L12-194

Tracy Szerszen
President/Operations Manager

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Eberline Analytical – Oak Ridge Laboratory

601 Scarboro Road, Oak Ridge, TN 37830-7371
Michael McDougall Phone: 865-481-0683

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air/Aqueous	Eberline SOP EiChroM AM-01	Alpha Spectroscopy	Isotopic Curium
Air/Aqueous/Solid	AP-016	Beta GPC	Chlorine-36
Air/Aqueous/Solid	AP-026	Beta LSC	Carbon-14
Air/Aqueous/Solid	ASTM D-5174	KPA	Total Uranium
Air/Aqueous/Solid	Eberline SOP EiChroM Ni-01	Beta LSC	Nickel-63
Air/Aqueous/Solid	Eberline SOP EML Pu-01	Alpha Spectroscopy	Isotopic Plutonium
Air/Aqueous/Solid	Eberline SOP EML Th-01	Alpha Spectroscopy	Isotopic Thorium
Air/Aqueous/Solid	Eberline SOP EPA 903.0	Alpha Spectroscopy	Radium-226
Air/Aqueous/Solid	EiChroM Np-01	Alpha Spectroscopy	Neptunium-237
Air/Aqueous/Solid	EiChroM Sr-01	Beta GPC	Strontium-90
Air/Aqueous/Solid	EiChroM Sr-01	Beta GPC	Total Strontium
Air/Aqueous/Solid	EiChroM Tc-01	Beta LSC	Technetium-99
Air/Solid	Eberline SOP EiChroM AM-01	Alpha Spectroscopy	Americium-241
Air/Solid	Eberline SOP EML Pb-01	Beta GPC	Lead-210
Air/Solid	Eberline SOP EML Po-01	Alpha Spectroscopy	Polonium-210
Air/Solid	Eberline SOP EML U-02	Alpha Spectroscopy	Isotopic Uranium
Air/Solid	Eberline SOP EPA 903.0	Alpha GPC	Total Radium
Air/Solid	Eberline SOP EPA 904.0	Beta GPC	Radium-228
Air/Solid	LANL ER-130	Gamma Spectroscopy	Gamma Emitting Radionuclides
Aqueous	EPA 900.0	Alpha Beta GPC	Gross Alpha & Beta
Aqueous	EPA 901.1	Gamma Spectroscopy	Gamma Emitting Radionuclides
Aqueous	EPA 903.0	Alpha GPC	Total Radium
Aqueous	EPA 904.0	Beta GPC	Radium-228
Aqueous	EPA 906.0	Beta LSC	Tritium
Aqueous	EPA 908.0	Alpha Spectroscopy	Isotopic Uranium
Aqueous/Solid	EiChromM Am-01	Alpha Spectroscopy	Americium-241
Solid	EiChromM Am-01	Alpha Spectroscopy	Isotopic Curium

Perry Johnson Laboratory Accreditation, Inc.

October 1, 2012

Mr. Michael McDougall
Eberline Analytical – Oak Ridge Laboratory
601 Scarboro Road
Oak Ridge, TN 37830-7371

Dear Mr. McDougall:

This letter is to confirm that you have successfully completed your accreditation assessment. A certificate has now been granted and posted on our website. As you are aware, PJLA will no longer be issuing expiration dates on our certificates. Your certificate # **L12-194** will remain valid as long as you continue to maintain your annual assessments and reaccreditation assessments as stated in your customer agreement with PJLA. At this time, we have confirmed that your annual assessments will be conducted during the month of **June** each calendar year. This will include an interim surveillance assessment and a full system reassessment to be completed by **June 2014**. Once your reassessment is conducted and approved by our accreditation committee a revised status letter will be provided to you. Please allow PJLA at least 120 days from your assessment due date to issue this letter.

Please feel free to release this letter to any interested parties as confirmation of your certificate validity. Also, please remind them that your certificate is posted on our website at all times. Any changes in regards to your accreditation status will be reflected on our website.

We would like to thank you for your patronage and we look forward to continuously serving your accreditation needs in the future. If we can assist you any further, please feel free to contact us at any time.

Sincerely,

Tracy Szerszen
President/Operations Manager

755 W. Big Beaver Rd. · Suite 1325 · Troy, MI 48084 · Phone: 1-877-369-LABS or 248-519-2603 · Fax: 248-213-0737

State of New Jersey
Department of Environmental Protection

Certifies That

Eberline Services - Oak Ridge

Laboratory Certification ID # TN004

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing The Certification Of Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the 2009 TNI Standard approved by the

The NELAC Institute

Expiration Date June 30, 2014

Joseph F. Aiello, Manager
Office of Quality Assurance

NJDEP is a NELAP Recognized Accreditation Body

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public. Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

New Jersey Department of Environmental Protection
Environmental Laboratory Certification Program

LABORATORY PERSONNEL LIST

Effective as of: 07/01/2013

Laboratory Name: EBERLINE SERVICES - OAK RIDGE Laboratory Number: TN004 Activity ID: NLC130001
601 SCARBORO RD
OAK RIDGE, TN 37830

Position: Lead Tech. Director

Employee	Category/Instrument	Start Date	End Date	Documentation Status	Complete Date	Comments
AHMED HALOUMA		7/1/2005	7/31/2012	Complete/Qualified		
MIKE McDOUGALL		7/31/2012		Complete/Qualified		

Position: QA Officer

Employee	Category/Instrument	Start Date	End Date	Documentation Status	Complete Date	Comments
SABA ARNOLD		7/31/2012		Complete/Qualified		
AHMED HALOUMA		4/16/2002	7/31/2012	Complete/Qualified		

Position: Supervisor/Tech Dir

Employee	Category/Instrument	Start Date	End Date	Documentation Status	Complete Date	Comments
AHMED HALOUMA	SDW07, 08, WPP09 or 10	7/1/2005	7/31/2012	Complete/Qualified		
MARY TURNER	SDW07, 08, WPP09 or 10	7/31/2012		Complete/Qualified		

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2013 until 06/30/2014

Laboratory Name: EBERLINE SERVICES - OAK RIDGE Laboratory Number: TN004 Activity ID: NLC130001
601 SCARBORO RD
OAK RIDGE, TN 37830

Category: SDW07 -- Radiochem.: Radioactivity / Radionuclide

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	UT	SDW07.01000	DW	Proportional or Scintillation	[EPA 900.0]	Gross - alpha-beta
Certified	Yes	UT	SDW07.03100	DW	Gamma Spectrometry	[EPA 901.1]	Gamma emitters
Certified	Yes	UT	SDW07.03900	DW	Radiochemical	[EPA 903.0]	Radium - 226
Certified	Yes	UT	SDW07.04100	DW	Precipitation	[EPA 904.0]	Radium - 228
Certified	Yes	UT	SDW07.05000	DW	Precipitation	[EPA 903.0]	Radium - total
Certified	Yes	UT	SDW07.06000	DW	Total Sr & Strontium 90	[EPA 905.0]	Strontium - 89, 90
Certified	Yes	UT	SDW07.06010	DW	Strontium 90	[EPA 905.0]	Strontium - 90
Certified	Yes	UT	SDW07.07000	DW	Distillation/Liquid Scintillation	[EPA 906.0]	Tritium
Certified	Yes	UT	SDW07.08100	DW	Co-Precipition	[EPA 908.0]	Uranium
Certified	Yes	UT	SDW07.08400	DW	Radiochemical / Alpha Counting	[EPA 907.0]	Uranium
Certified	Yes	UT	SDW07.09000	DW	Radiochemical / Alpha Counting	[EPA 907.0]	Plutonium

Category: WPP09 -- Radiochem.: Radioactivity / Radionuclide

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	UT	WPP09.01000	NPW	Proportional or Scintillation	[EPA 900.0]	Gross - alpha
Certified	Yes	UT	WPP09.03000	NPW	Proportional Counter	[EPA 900.0]	Gross - beta
Certified	Yes	UT	WPP09.05000	NPW	Precipitation	[EPA 903.0]	Radium - total
Certified	Yes	UT	WPP09.05010	NPW	Proportional	[EPA 903.0]	Radium - 226
Certified	Yes	UT	WPP09.06020	NPW	Co-Precipitation / Beta Counting	[EPA 904.0]	Radium - 228
Certified	Yes	UT	WPP09.07000	NPW	Gamma Spectrometry	[EPA 901.1]	Photon Emitters
Certified	Yes	UT	WPP09.08000	NPW	Precipitation / Beta Counting	[EPA 905.0]	Strontium - 89, 90
Certified	Yes	UT	WPP09.08100	NPW	Precipitation / Beta Counting	[EPA 905.0]	Strontium - 90

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	UT	SHW09.60000	NPW, SCM	Proportional Counter	[SW-846 9310]	Gross - alpha-beta
Certified	Yes	UT	SHW09.60100	NPW, SCM	Precipitation	[SW-846 9315]	Alpha Emitting Radium Isotopes

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

Office of Quality Assurance
401 East State Street
P.O. Box 420, Mail Code 401-02D
Trenton, New Jersey 08625-0420
Telephone: (609) 292-3950
Facsimile: (609) 777-1774

BOB MARTIN
Commissioner

Dear Laboratory Manager:

A Certificate and an Annual Certified Parameter List (ACPL) that reflects the current status of your facility are enclosed. If there are any discrepancies, please contact your Laboratory Certification Officer to verify information and make arrangements for a new ACPL. Effective with the receipt of this letter, your facility's certification status is valid through June 30, 2014. Both the ACPL and Certificate should be conspicuously displayed at your facility in a location on the premises that is visible to the public.

As always, we are available to discuss any comments or questions. Please do not hesitate to contact your Laboratory Certification Officer or me.

Sincerely,

Joseph F. Aiello, Manager

Enclosure(s)

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 07/01/2013 until 06/30/2014

Laboratory Name: EBERLINE SERVICES - OAK RIDGE Laboratory Number: TN004 Activity ID: NLC130001
601 SCARBORO RD
OAK RIDGE, TN 37830

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	UT	SHW09.60110	NPW, SCM	Precipitation	[SW-846 9320]	Radium - 228

Joseph F. Aiello, Manager

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

D H E C

PROMOTE PROTECT PROSPER

Catherine B. Templeton, Director

Promoting and protecting the health of the public and the environment

September 19, 2012

MICHAEL MCDOUGALL
EBERLINE SERVICES OAK RIDGE LAB
601 SCARBORO RD
OAK RIDGE, TENNESSEE 37830

Laboratory I. D. 84013

Dear Michael Mcdougall:

Your amended certificate and associated parameter list(s) are enclosed. These documents now represent the certificate of record for your laboratory. Any certificate(s) and associated parameter list(s) received prior to your receipt of these documents are now null and void and should be destroyed. Please be reminded that all environmental data submitted to the Department is reviewed to ensure that the reporting laboratory possesses the necessary certification. Data reported by laboratories without the proper certification will be addressed by the affected enforcement programs.

If you have any questions, or problems are detected concerning your certificate, please contact this office within ten (10) working days.

Sincerely,

Carol F. Smith, Director
Office of Environmental Laboratory Certification
Bureau of Environmental Services

Enclosures

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61-81, entitled "State Environmental Laboratory Certification Regulations"

EBERLINE SERVICES OAK RIDGE LAB
601 SCARBORO RD
OAK RIDGE, TENNESSEE 37830

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: MICHAEL MCDOUGALL
Certifying Authority: TN
Date of Issue: September 19, 2012
Date of Expiration: December 15, 2014
Certificate Number: 84013001

Director
Office of Environmental Laboratory Certification

CR-010021 2/11

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EBERLINE SERVICES OAK RIDGE LAB (Laboratory ID 84013)
Laboratory Director: MICHAEL MCDOUGALL
Certifying Authority: TN
Certificate Number: 84013001

Date of Issue: September 19, 2012
Expiration Date: December 15, 2014

SAFE DRINKING WATER ACT

INORGANIC - RADIOLOGICAL

GROSS ALPHA	EPA 900.0 (1980)
GROSS BETA	EPA 900.0 (1980)
RADIUM 226	EPA 903.0 (1980)
RADIUM 228	EPA 904.0 (1980)
STRONTIUM 90	EPA 905.0 (1980)
TRITIUM	EPA 906.0 (1980)

State of Tennessee

Department of Environment & Conservation

Division of Water Supply

Certifies That

Eberline Services Laboratory

Having Met the Requirements of the Regulations for the Certification of Laboratories Analyzing Drinking Water is hereby Approved as a

State Certified Laboratory in Radiochemistry

To perform the Analyses as Indicated on the Certified Parameter List For the Public Water Systems of Tennessee

Laboratory ID Number TN02042 - Effective through December 15, 2014

A. Craig LaFever

A. Craig LaFever

Laboratory Certification Manager

Division of Water Supply

This certification is subject to performance on E.P.A. Performance Evaluation Samples, laboratory inspections and payment of annual fees

Certified Parameters - 2011

TENNESSEE

Eberline Services TN02042 EPA # TN01067 12/16/2011

Attn: Ahmed Halouma
601 Scarboro Road
Oak Ridge, TN 37830-7371

Parameter	EPA Parameter #	Approved Method	Study Type	Date Complete	PT Provider / WS #
Radiological					
Cesium-134 (Radioactive)	4270	EPA - 901.1	Proficiency Test	5/19/2011	ERA / RAD-85
Cesium-137 (Radioactive)	4276	EPA - 901.1	Proficiency Test	5/19/2011	ERA / RAD-85
Cobalt-60 (Radioactive)	4142	EPA - 901.1	Proficiency Test	5/19/2011	ERA / RAD-85
Gross Alpha	4000	EPA - 900.0	Proficiency Test	5/19/2011	ERA / RAD-85
Gross Beta	4100	EPA - 900.0	Proficiency Test	5/19/2011	ERA / RAD-85
Radium-226	4020	EPA - 903.0	Proficiency Test	5/19/2011	ERA / RAD-85
Radium-228	4030	EPA - 904.0	Proficiency Test	5/19/2011	ERA / RAD-85
Strontium 89 (Radioactive)	4172	EPA - 905.0	Proficiency Test	5/19/2011	ERA / RAD-85
Strontium 90 (Radioactive)	4174	EPA - 905.0	Proficiency Test	5/19/2011	ERA / RAD-85
Tritium (Radioactive)	4102	EPA - 906.0	Proficiency Test	5/19/2011	ERA / RAD-85
Uranium (Natural)	4006	EPA - 908.0	Proficiency Test	5/19/2011	ERA / RAD-85
Uranium (Radioactive)	4400	ASTM - D 5174-02	Proficiency Test	5/19/2011	ERA / RAD-85

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER SUPPLY
6th Floor, L & C TOWER, 401 Church Street
Nashville, Tennessee 37243-1549

December 27, 2011

Mr. Ahmed Halouma, QA Mgr
Eberline Analytical Corporation
601 Scarboro Road
Oak Ridge, TN 37830-7371

Re: Audit Report
Lab # TN02042

Dear Mr. Halouma:

Division of Water Supply personnel visited your laboratory and performed an audit on December 12 and December 13, 2011. We would like to thank you and your staff for your courtesy during the audit.

I. Certification Status

The certification for Radiochemistry analyses shall be valid until December 15, 2015. Continued compliance with the State of Tennessee certification criteria is subject to the USEPA laboratory certification criteria and procedures for quality assurance (*Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition, 2005).*

Eberline Analytical Corporation Laboratory (TN02042) is granted Certification for the Radiochemistry methods and parameters listed on the enclosed Certified parameter list.

II. List of Deviations

No Deviations noted.

III. Remarks

We appreciate the willingness to share detailed explanations of the methodology and quality control. As discussed, please forward us the completed SOPs for Uranium 234 and 238 analysis by alpha spectrometry and the SOPs for Strontium-89 and Strontium-90.

IV. Personnel

Name	Specialty
Michael R. McDougall	Laboratory Manager
Ahmed Halouma	Quality Assurance Manager

If you have any questions please do not hesitate to contact the Laboratory Certification Officers Craig LaFever (615-532-0181) Craig.LaFever@.tn.gov or Prasad Subbanna (865-594-5557) Prasad.Subbanna@tn.gov.

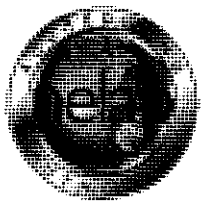
Sincerely,

A. Craig LaFever

A. Craig LaFever
Laboratory Certification Officer
Tennessee Division of Water Supply

cc: file

Enclosure



NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Eberline Analytical Corporation (EPA# TN01067)

601 Scarboro Road

Oak Ridge, TN 37830

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **08261CA**

Expiration Date: **7/31/2014**

Effective Date: **8/1/2013**

Richmond, California
subject to forfeiture or revocation

Fred Chorke for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Eberline Analytical Corporation (EPA# TN01067)

601 Scarboro Road
Oak Ridge, TN 37830
Phone: (865) 481-0683

Primary AA: UT TN010672012-2

Certificate No. 08261CA
Renew Date: 7/31/2014

106 - Radiochemistry of Drinking Water			
106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.030	003	EPA 901.1	Gamma Emitters
106.050	001	EPA 903.0	Total Alpha Radium
106.050	002	EPA 903.0	Radium-226
106.060	001	EPA 904.0	Radium-228
106.070	001	EPA 905.0	Strontium-89, 90
106.070	002	EPA 905.0	Strontium-89
106.070	003	EPA 905.0	Strontium-90
106.080	001	EPA 906.0	Tritium
106.090	001	EPA 908.0	Uranium
106.480	001	ASTM D5174-97	Uranium
112 - Radiochemistry of Wastewater			
112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta
112.140	002	EPA 901.1	Gamma
112.160	001	EPA 904.0	Radium-228
112.180	001	EPA 906.0	Tritium
112.190	001	EPA 908.0	Uranium
118 - Radiochemistry of Hazardous Waste			
118.010	001	EPA 9310	Gross Alpha
118.010	002	EPA 9310	Gross Beta
118.020	001	EPA 9315	Radium, Total
118.030	001	EPA 9320	Radium-228

As of 7/9/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

BOBBY JINDAL
GOVERNOR

PEGGY M. HATCH
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

July 1, 2013

LELAP Lab ID # 05005
AI No. 168684
Accreditation Year FY2014
Renewal due FY 2016

Ms. Saba Arnold Seaver
Eberline Services - Oak Ridge Lab
601 Scarboro Rd
Oak Ridge, Tennessee 37830-7371

Re: Scope of Accreditation

Dear Ms. Arnold Seaver:

The Louisiana Department of Environmental Quality's laboratory accreditation program, in accordance with Louisiana Administrative Code, Title 33, Part I, Subpart 3, Laboratory Accreditation, accredits this laboratory for Fiscal Year 2014. This accreditation does not constitute an endorsement of the suitability of the listed methods for any specific purpose. The laboratory is accredited for the method as identified on the application for accreditation; if the method is partially identified on the application for accreditation, the laboratory is accredited for the versions listed on the current application or referenced in the laboratory standard operating procedure.

National Environmental Laboratory Accreditation Program (NELAP) accreditation is granted **only** for those methods/analytes for which "NELAP" is indicated as the type of accreditation. "STATE" is indicated as the type of accreditation for those methods/analytes for which accreditation by the Louisiana Environmental Laboratory Accreditation Program (LELAP) is granted. Accreditation is dependent on the laboratory's successful ongoing compliance with regulations as outlined in the Louisiana Administrative Code, Title 33, Part I, Subpart 3, Laboratory Accreditation, and with the standards adopted by the NELAP Accreditation Council.

The accreditation certificate is the property of the State of Louisiana. Should your accreditation be suspended or revoked, your laboratory must return the certificate of accreditation to the department and delete any electronic copies until your accreditation status is restored.

LAC 33:I.5313.A and/or NELAC 5.5.10.1 require that the laboratory report include all relevant information. Therefore, the certificate number shall be placed in the upper right corner of all laboratory reports. If the test report includes results of any test for which the laboratory is not accredited, the unaccredited results must be clearly identified as such.

We request that you examine the scope of accreditation attachment for accuracy and completeness. If you find that an analyte for which you expected to be accredited is not listed, please examine your records to ensure that:

1. You have met the requirements for successful participation in proficiency test studies as outlined in LAC 33:I.4711 and in the NELAC Standard 2.7.2.

2. In the case of accreditation by recognition, the requested analyte must be listed for the requested method and matrix on both the certificate issued by the Primary Accreditation Body ***and*** on the Louisiana application form.

If after reviewing this information, the scope and/or certificate are inaccurate, please notify us immediately.

If you have any questions, please contact your assigned assessor Dr. Alicia B. Ryan, Environmental Scientist at (225) 219-1352.

Sincerely,

Lourdes Iturralde
Administrator
Notifications and Accreditations Section
OES, Public Participation & Permit Support Services Division

LI:PB:abr

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Is hereby granting a Louisiana Environmental Laboratory Accreditation to

Eberline Services - Oak Ridge Lab
601 Scarboro Rd
Oak Ridge, Tennessee 37830-7371

Agency Interest No. 168684

According to the Louisiana Administrative Code, Title 33, Part I, Subpart 3, LABORATORY ACCREDITATION, the State of Louisiana formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed in the attachment.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part I, Subpart 3 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part I. Please contact the Department of Environmental Quality, Louisiana Environmental Laboratory Accreditation Program (LELAP) to verify the laboratory's scope of accreditation and accreditation status.

Accreditation by the State of Louisiana is not an endorsement or a guarantee of validity of the data generated by the laboratory. To be accredited initially and maintain accreditation, the laboratory agrees to participate in two single-blind, single-concentration PT studies, where available, per year for each field of testing for which it seeks accreditation or maintains accreditation as required in LAC 33:I.4711.

Lourdes Iturralde, Administrator
Notifications and Accreditations Section
Public Participation & Permit Support Services Division

Certificate Number: 05005

Expiration Date: June 30, 2014
Issued On: July 1, 2013

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
Issue Date: July 1, 2013

Eberline Services - Oak Ridge Lab
AI Number: 168684
Expiration Date: June 30, 2014

601 Scarboro Rd, Oak Ridge, Tennessee 37830-7371

Certificate Number: 05005

Air Emissions

Analyte	Method Name	Method Code	Type	AB
NONE	NONE	NONE	NONE	NONE

Non Potable Water

Analyte	Method Name	Method Code	Type	AB
2830 - Gross-alpha	EPA 900	10112400	NELAP	UT
2840 - Gross-beta	EPA 900	10112400	NELAP	UT
2826 - Gamma Emitters	EPA 901.1	10112808	NELAP	UT
1128 - Radium-223	EPA 903	10113209	NELAP	UT
2960 - Radium-224	EPA 903	10113209	NELAP	UT
2965 - Radium-226	EPA 903	10113209	NELAP	UT
2750 - Total alpha radium	EPA 903	10113209	NELAP	UT
2970 - Radium-228	EPA 904	10113607	NELAP	UT
2995 - Strontium-89	EPA 905	10113801	NELAP	UT
3010 - Strontium-89, 90	EPA 905	10113801	NELAP	UT
3005 - Strontium-90	EPA 905	10113801	NELAP	UT
3030 - Tritium	EPA 906	10114008	NELAP	UT
3035 - Uranium	EPA 908	10114202	NELAP	UT
2830 - Gross-alpha	EPA 9310	10208205	NELAP	UT
2840 - Gross-beta	EPA 9310	10208205	NELAP	UT
100210 - Alpha Emitting Radium Isotopes	EPA 9315	10208409	NELAP	UT
2970 - Radium-228	EPA 9320	10208603	NELAP	UT

Solid Chemical Materials

Analyte	Method Name	Method Code	Type	AB
2830 - Gross-alpha	EPA 9310	10208205	NELAP	UT
2840 - Gross-beta	EPA 9310	10208205	NELAP	UT
100210 - Alpha Emitting Radium Isotopes	EPA 9315	10208409	NELAP	UT
2970 - Radium-228	EPA 9320	10208603	NELAP	UT

Biological Tissue

Analyte	Method Name	Method Code	Type	AB
NONE	NONE	NONE	NONE	NONE

Clients and Customers are urged to verify the laboratory's current certification status with the Louisiana Environmental Laboratory Accreditation Program.

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

LAB ID: 11798

April 01, 2013

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

Certificate Expiration Date:
April 01, 2014

Dear Ms. Turner,

Enclosed are Certificate(s) of Approval issued to your environmental laboratory for the current permit year. The Certificate(s) supersede(s) any previously issued one(s) and is(are) in effect through the expiration date listed. Please carefully examine the Certificate(s) to insure that the categories, subcategories, analytes, and methods for which your laboratory is approved are correct. In addition, verify that your laboratory's name, address, lead technical director, and identification number are accurate.

Pursuant to NYCRR Subpart 55-2.2, original certificates must be posted conspicuously in the laboratory and copies shall be made available to any client of the laboratory upon request.

Pursuant to NYCRR Subpart 55-2.6, any misrepresentation of the Fields of Accreditation (Matrix - Method - Analyte) for which your laboratory is approved may result in denial, suspension, or revocation of your certification. Any use of the Environmental Laboratory Approval Program (ELAP) or National Environmental Laboratory Accreditation Program (NELAP) name, reference to the laboratory's approval status, and/or using the NELAP logo in any catalogs, advertising, business solicitations, proposals, quotations, laboratory analytical reports, or other materials must include the laboratory's ELAP identification number and distinguish between testing for which the laboratory is approved and testing for which the laboratory is not approved.

If you have any questions, please contact ELAP at the New York State Department of Health (NYS DOH), Wadsworth Center, PO Box 509, Albany NY, 12201-0509; by phone at (518) 485-5570; by facsimile at (518) 485-5568; and by email at elap@health.state.ny.us.

Sincerely,

Stephanie E. Ostrowski

STEPHANIE OSTROWSKI, PH.D.
Program Director
Environmental Laboratory Approval Program

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

NY Lab Id No: 11798

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Drinking Water Metals III	
Uranium (Mass)	ASTM D5174-97 02 07
Radiological Analytes	
Gross Alpha	EPA 900.0
Gross Beta	EPA 900.0
Photon Emitters	EPA 901.1
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Strontium-89	EPA 905.0
Strontium-90	EPA 905.0
Tritium	EPA 906.0
Uranium (Activity)	EPA 908.0

Serial No.: 48873

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2014
Issued April 01, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

NY Lab Id No: 11798

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Radiological Analytes

Gross Alpha	EPA 900.0
Gross Beta	EPA 900.0
Photon Emitters	EPA 901.1
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Strontium-89	EPA 905.0
Strontium-90	EPA 905.0
Tritium	EPA 906.0
Uranium (Activity)	EPA 908.0

Serial No.: 48874

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

Texas Commission on Environmental Quality

NELAP-Recognized Laboratory Accreditation is hereby awarded to

Eberline Services - Oak Ridge Laboratory

601 Scarboro Road
Oak Ridge, TN 37830-7371

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

Certificate Number: T104704443-13-5
Effective Date: 10/1/2013
Expiration Date: 9/30/2014

Executive Director Texas Commission on Environmental Quality

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	**T104704443-13-5**
Expiration Date:	**9/30/2014**
Issue Date:	**10/1/2013**

Eberline Services - Oak Ridge Laboratory

601 Scarboro Road
Oak Ridge, TN 37830-7371

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Drinking Water***

Method EPA 900.0

Analyte	AB	Analyte ID	Method ID
Gross-alpha	UT	2830	10112400
Gross-beta	UT	2840	10112400

Method EPA 901.1

Analyte	AB	Analyte ID	Method ID
Gross gamma	UT	2855	10112808
Radioactive cesium	UT	2955	10112808

Method EPA 903.0

Analyte	AB	Analyte ID	Method ID
Radium-226	UT	2965	10113209

Method EPA 904.0

Analyte	AB	Analyte ID	Method ID
Radium-228	UT	2970	10113607

Method EPA 905.0

Analyte	AB	Analyte ID	Method ID
Strontium-89	UT	2995	10113801
Strontium-90	UT	3005	10113801

Method EPA 906.0

Analyte	AB	Analyte ID	Method ID
Tritium	UT	3030	10114008

Method EPA 908.0

Analyte	AB	Analyte ID	Method ID
Uranium	UT	3035	10114202

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704443-13-5
Expiration Date: 9/30/2014
Issue Date: 10/1/2013

Eberline Services - Oak Ridge Laboratory

601 Scarboro Road
Oak Ridge, TN 37830-7371

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 900.0

Analyte	AB	Analyte ID	Method ID
Gross-alpha	UT	2830	10112400
Gross-beta	UT	2840	10112400

Method EPA 903.0

Analyte	AB	Analyte ID	Method ID
Total radium	UT	2975	10113209

Method EPA 908.0

Analyte	AB	Analyte ID	Method ID
Uranium	UT	3035	10114202

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704443-13-5
Expiration Date: 9/30/2014
Issue Date: 10/1/2013

Eberline Services - Oak Ridge Laboratory

601 Scarboro Road
Oak Ridge, TN 37830-7371

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Method EPA 9310

Analyte	AB	Analyte ID	Method ID
Gross-alpha	UT	2830	10208205
Gross-beta	UT	2840	10208205

State of Utah

Department of Health

Environmental Laboratory Certification Program

Certification is hereby granted to

Eberline Services - Oak Ridge Laboratory

601 Scarboro Road
Oak Ridge, TN 37830

Has conformed with the
2009 TNI Standard
Scope of accreditiation is limited to the
State of Utah Accredited Fields of Accreditiation
Which accompanies this Certificate

EPA Number: TN01067
Expiration Date: 9/30/2014
Certificate Number: TN010672013-3

Robyn M. Atkinson, Ph.D, HCLD
Director, Utah Public Health Laboratory

Continued accredited status depends on successful ongoing particitpation in the program.

UTAH DEPARTMENT OF HEALTH

State of Utah
Gary R Herbert
Governor
Gregory S Bell
Lieutenant Governor

Utah Department of Health
W. David Patton Ph.D
Executive Director

Division of Disease Control and Prevention
Robyn M. Atkinson, Ph.D, HCLD
Director, Utah Public Health Laboratory

EPA Number: *TN01067* **Attachment to Certificate Number: TN010672013-3**

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Method EPA 900			
Gross-alpha	10/1/2013	9/30/2014	UT
Gross-beta	10/1/2013	9/30/2014	UT
Method EPA 901.1			
Cesium-134	10/1/2013	9/30/2014	UT
Cesium-137	10/1/2013	9/30/2014	UT
Gamma Emitters	10/1/2013	9/30/2014	UT
Method EPA 903			
Radium-223	10/1/2013	9/30/2014	UT
Radium-224	10/1/2013	9/30/2014	UT
Radium-226	10/1/2013	9/30/2014	UT
Method EPA 904			
Radium-228	10/1/2013	9/30/2014	UT
Method EPA 905			
Strontium-89	10/1/2013	9/30/2014	UT
Strontium-89, 90	10/1/2013	9/30/2014	UT
Strontium-90	10/1/2013	9/30/2014	UT
Method EPA 906.0			
Tritium	10/1/2013	9/30/2014	UT
Method EPA 908			
Uranium	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Non Potable Water)***			
Method EPA 9310			
Gross alpha-beta	10/1/2013	9/30/2014	UT
Method EPA 9315			
Total alpha radium	10/1/2013	9/30/2014	UT
Method EPA 9320			
Radium-228	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***			
Method EPA 9310			
Gross alpha-beta	10/1/2013	9/30/2014	UT
Method EPA 9315			
Total alpha radium	10/1/2013	9/30/2014	UT
Method EPA 9320			
Radium-228	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***SDWA (Potable Water)***			
Method ASTM D5174-02			
Uranium	10/1/2013	9/30/2014	UT
Method EPA 00- 02			
Gross-alpha	10/1/2013	9/30/2014	UT
Method EPA 900.0			
Gross-alpha	10/1/2013	9/30/2014	UT
Gross-beta	10/1/2013	9/30/2014	UT
Method EPA 901.1			
Cesium-134	10/1/2013	9/30/2014	UT
Gamma Emitters	10/1/2013	9/30/2014	UT
Iodine-131	10/1/2013	9/30/2014	UT
Method EPA 903			
Radium-223	10/1/2013	9/30/2014	UT
Radium-224	10/1/2013	9/30/2014	UT
Radium-226	10/1/2013	9/30/2014	UT
Total radium	10/1/2013	9/30/2014	UT
Method EPA 904			
Radium-228	10/1/2013	9/30/2014	UT
Method EPA 905			
Strontium	10/1/2013	9/30/2014	UT
Strontium-89	10/1/2013	9/30/2014	UT
Strontium-90	10/1/2013	9/30/2014	UT
Method EPA 906			
Tritium	10/1/2013	9/30/2014	UT
Method EPA 907.0			
Americium-241	10/1/2013	9/30/2014	UT
Curium-242	10/1/2013	9/30/2014	UT
Curium-243	10/1/2013	9/30/2014	UT
Curium-244	10/1/2013	9/30/2014	UT
Neptunium-237	10/1/2013	9/30/2014	UT
Plutonium-238	10/1/2013	9/30/2014	UT
Plutonium-239	10/1/2013	9/30/2014	UT
Plutonium-240	10/1/2013	9/30/2014	UT
Thorium	10/1/2013	9/30/2014	UT
Uranium	10/1/2013	9/30/2014	UT
Method EPA 908			
Uranium	10/1/2013	9/30/2014	UT

The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.

State of Utah
Gary R Herbert
Governor
Gregory S Bell
Lieutenant Governor

Utah Department of Health
W. David Patton Ph.D
Executive Director

Division of Disease Control and Prevention
Robyn M. Atkinson, Ph.D, HCLD
Director, Utah Public Health Laboratory

EPA Number: ***TN01067*** **Attachment to Certificate Number: TN010672013-3**

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***CWA (Non Potable Water)***			
Method EPA 900			
Gross-alpha	10/1/2013	9/30/2014	UT
Gross-beta	10/1/2013	9/30/2014	UT
Method EPA 901.1			
Cesium-134	10/1/2013	9/30/2014	UT
Cesium-137	10/1/2013	9/30/2014	UT
Gamma Emitters	10/1/2013	9/30/2014	UT
Method EPA 903			
Radium-223	10/1/2013	9/30/2014	UT
Radium-224	10/1/2013	9/30/2014	UT
Radium-226	10/1/2013	9/30/2014	UT
Method EPA 904			
Radium-228	10/1/2013	9/30/2014	UT
Method EPA 905			
Strontium-89	10/1/2013	9/30/2014	UT
Strontium-89, 90	10/1/2013	9/30/2014	UT
Strontium-90	10/1/2013	9/30/2014	UT
Method EPA 906.0			
Tritium	10/1/2013	9/30/2014	UT
Method EPA 908			
Uranium	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Non Potable Water)***			
Method EPA 9310			
Gross alpha-beta	10/1/2013	9/30/2014	UT
Method EPA 9315			
Total alpha radium	10/1/2013	9/30/2014	UT
Method EPA 9320			
Radium-228	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***			
Method EPA 9310			
Gross alpha-beta	10/1/2013	9/30/2014	UT
Method EPA 9315			
Total alpha radium	10/1/2013	9/30/2014	UT
Method EPA 9320			
Radium-228	10/1/2013	9/30/2014	UT

Eberline Services - Oak Ridge Laboratory

	Start Date	Expires	AB
Program/Matrix: ***SDWA (Potable Water)***			
Method ASTM D5174-02			
Uranium	10/1/2013	9/30/2014	UT
Method EPA 00- 02			
Gross-alpha	10/1/2013	9/30/2014	UT
Method EPA 900.0			
Gross-alpha	10/1/2013	9/30/2014	UT
Gross-beta	10/1/2013	9/30/2014	UT
Method EPA 901.1			
Cesium-134	10/1/2013	9/30/2014	UT
Gamma Emitters	10/1/2013	9/30/2014	UT
Iodine-131	10/1/2013	9/30/2014	UT
Method EPA 903			
Radium-223	10/1/2013	9/30/2014	UT
Radium-224	10/1/2013	9/30/2014	UT
Radium-226	10/1/2013	9/30/2014	UT
Total radium	10/1/2013	9/30/2014	UT
Method EPA 904			
Radium-228	10/1/2013	9/30/2014	UT
Method EPA 905			
Strontium	10/1/2013	9/30/2014	UT
Strontium-89	10/1/2013	9/30/2014	UT
Strontium-90	10/1/2013	9/30/2014	UT
Method EPA 906			
Tritium	10/1/2013	9/30/2014	UT
Method EPA 907.0			
Americium-241	10/1/2013	9/30/2014	UT
Curium-242	10/1/2013	9/30/2014	UT
Curium-243	10/1/2013	9/30/2014	UT
Curium-244	10/1/2013	9/30/2014	UT
Neptunium-237	10/1/2013	9/30/2014	UT
Plutonium-238	10/1/2013	9/30/2014	UT
Plutonium-239	10/1/2013	9/30/2014	UT
Plutonium-240	10/1/2013	9/30/2014	UT
Thorium	10/1/2013	9/30/2014	UT
Uranium	10/1/2013	9/30/2014	UT
Method EPA 908			
Uranium	10/1/2013	9/30/2014	UT

The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method.

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COMMONWEALTH of VIRGINIA

Department of General Services

Division of Consolidated Laboratory Services

600 North 5th Street
Richmond, Virginia 23219-3691
(804) 648-4480
FAX (804) 692-0416

12/10/2013

Michael R Mcdougall
EBERLINE SERVICES OAK RIDGE LABORATORY
601 Scarboro Road
Oak Ridge TN 37830

VELAP ID: 460218

Dear Michael R Mcdougall:

EBERLINE SERVICES OAK RIDGE LABORATORY has been granted secondary accreditation pursuant to the provisions of 1VAC30-46 and the National Environmental Laboratory Accreditation Program (NELAP) by the Division of Consolidated Laboratory Services (DCLS). Enclosed please find Certificate 2544 and the corresponding Scope of Accreditation which are valid until 12/14/2014. The certificate must be conspicuously displayed in the laboratory along with the associated Scope of Accreditation.

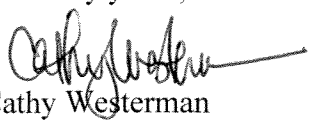
Your laboratory is required to notify the DCLS Virginia Environmental Laboratory Accreditation Program (VELAP) in writing of any changes in key accreditation criteria within 30 calendar days of the change per 1VAC30-46-90 A. This requirement includes changes in ownership, location, key personnel, and major instrumentation.

If your laboratory wishes to change its scope of accreditation an application must be submitted in accordance with the provisions of 1VAC30-46-90 B. These changes are subject to fees as outlined in 1VAC30-46-150 F 1.

Additionally, a laboratory holding secondary accreditation with DCLS is responsible for assuring that DCLS has current information regarding the laboratory's primary accreditation. Upon any change in the status of any field of accreditation, a secondary laboratory must notify DCLS of the exact nature of the change and provide a copy of the laboratory's new primary certificate.

If you have any questions, please contact the VELAP program office at (804)648-4480.

Sincerely yours,



Cathy Westerman
Manager, Virginia Environmental Laboratory Accreditation Program

Enclosures

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF GENERAL SERVICES
DIVISION OF CONSOLIDATED LABORATORY SERVICES

Certifies that

VA Laboratory ID#: 460218
EBERLINE SERVICES OAK RIDGE LABORATORY

601 SCARBORO ROAD
OAK RIDGE, TN 37830

Owner: GLENROSE INSTRUMENT INC, DR. SHELTON CLARK - PRESIDENT
Operator: EBERLINE SERVICES - OAK RIDGE LABORATORY
Responsible Official: MICHAEL R MCDOUGALL

Having met the requirements of 1 VAC 30-46
and the National Environmental Laboratory Accreditation Conference 2003 Standard

is hereby approved as an

Accredited Laboratory

As more fully described in the attached Scope of Accreditation

Effective Date: **December 15, 2013**
Expiration Date: **December 14, 2014**
Certificate # 2544

Thomas L. York, Ph.D., HCLD
DGS Deputy Director for Laboratories

Continued accreditation status depends on successful ongoing participation in the program.
Certificate to be conspicuously displayed at the laboratory.
Not valid unless accompanied by a valid Virginia Environmental Laboratory Accreditation Program (VELAP) Scope of Accreditation.
Customers are urged to verify the laboratory's current accreditation status.

Certificate Not Transferable

Surrender Upon Revocation

Commonwealth of Virginia

Department of General Services
Division of Consolidated Laboratory Services

Scope of Accreditation

VELAP Certificate No.: 2544

EBERLINE SERVICES OAK RIDGE LABORATORY
601 SCARBORO ROAD
OAK RIDGE, TN 37830

Virginia Laboratory ID: 460218
Effective Date: December 15, 2013
Expiration Date: December 14, 2014

DRINKING WATER

METHOD	ANALYTE	PRIMARY
EPA 900.0 1980	GROSS ALPHA	UT
EPA 901.1	CESIUM-134	UT
EPA 903.0	RADIUM-226	UT
EPA 904.0	RADIUM-228	UT
EPA 905.0 1980	STRONTIUM-90	UT
EPA 908.0	URANIUM	UT

METHOD	ANALYTE	PRIMARY
EPA 900.0 1980	GROSS BETA	UT
EPA 901.1	GAMMA EMITTERS	UT
EPA 903.0	TOTAL ALPHA RADIUM	UT
EPA 905.0 1980	STRONTIUM-89	UT
EPA 906.0	TRITIUM	UT

NON-POTABLE WATER

METHOD	ANALYTE	PRIMARY
EPA 900.0 1980	GROSS ALPHA	UT
EPA 901.1	GAMMA EMITTERS	UT
EPA 904.0	RADIUM-228	UT
EPA 905.0 1980	STRONTIUM-90	UT
EPA 908.0	URANIUM	UT
EPA 9310 (9/86)	GROSS BETA	UT
EPA 9320 (9/86)	RADIUM-228	UT

METHOD	ANALYTE	PRIMARY
EPA 900.0 1980	GROSS BETA	UT
EPA 903.0	RADIUM-226	UT
EPA 905.0 1980	STRONTIUM-89	UT
EPA 906.0	TRITIUM	UT
EPA 9310 (9/86)	GROSS ALPHA	UT
EPA 9315 (9/86)	TOTAL ALPHA RADIUM	UT

This Scope of Accreditation must accompany the Certificate issued by Virginia DCLS with the same Certificate Number indicated above.

The State of Washington Department of Ecology

Eberline Services - Oak Ridge Lab
Oak Ridge, TN

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective June 15, 2013 and shall expire June 14, 2014.

Witnessed under my hand on June 20, 2013

Alan D. Rue
Lab Accreditation Unit Supervisor

Laboratory ID
C887

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Eberline Services - Oak Ridge Lab

Oak Ridge, TN

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. Accreditation for U.S. Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846) is for the latest version of the method. SM refers to EPA approved editions of “Standard Methods for the Examination of Water and Wastewater.” ASTM is the American Society for Testing and Materials. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Gross Alpha	EPA 900.0-80	1
Gross Beta	EPA 900.0-80	1
Gamma Emitters	EPA 901.1-80	1
Radium-226	EPA 903.0-80	1
Radium-228	EPA 904.0-80	1
Strontium-90	EPA 905.0-80	1
Tritium	EPA 906.0-80	1
Total Uranium	EPA 908.0-80	1
Non-Potable Water		
Gross Alpha	EPA 900.0-80	1
Gross Beta	EPA 900.0-80	1
Gamma Emitters	EPA 901.1-80	1
Radium-226	EPA 903.0-80	1
Radium-228	EPA 904.0-80	1
Strontium-90	EPA 905.0-80	1
Tritium	EPA 906.0-80	1
Total Uranium	EPA 908.0-80	1
Solid and Chemical Materials		
Gross Alpha	EPA 9310_(9/86)	1
Gross Beta	EPA 9310_(9/86)	1
Radium-226	EPA 9315_(9/86)	1

Matrix/Analyte	Method	Notes
Radium-228	EPA 9320_(9/86)	1

Accredited Parameter Note Detail

(1) Accreditation based in part on recognition of Utah NELAP accreditation.

06/20/2013

Authentication Signature
Alan D. Rue, Lab Accreditation Unit Supervisor

Date

The Alabama Department of Environmental Management

certifies that

Eberline Services Laboratory

Having met Department laboratory certification criteria, is approved to conduct Drinking Water analyses for the following:

Radionuclides

Effective January 1, 2014 through December 31, 2014

Dennis A. Harrison

Alabama Department of Environmental Management

Laboratory Number **41620**

QA/QC RECEIVED
DATE 1/21/14 INITIALS MST

Eberline Services Laboratory
Expires December 31, 2014

Analyte	Method
Gross Alpha	900.0
Gross Beta	900.0
Radium-226	903.0
Radium-228	904.0
Strontium-89	905.0
Strontium-90	905.0
Tritium	906.0
Uranium	908.0
Uranium	ASTM-D 5174-02

NEW YORK
state department of
HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

LAB ID: 11798

April 01, 2014

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

Certificate Expiration Date:
April 01, 2015

Dear Ms. Turner,

Enclosed are Certificate(s) of Approval issued to your environmental laboratory for the current permit year. The Certificate(s) supersede(s) any previously issued one(s) and is(are) in effect through the expiration date listed. Please carefully examine the Certificate(s) to insure that the categories, subcategories, analytes, and methods for which your laboratory is approved are correct. In addition, verify that your laboratory's name, address, lead technical director, and identification number are accurate.

Pursuant to NYCRR Subpart 55-2.2, original certificates must be posted conspicuously in the laboratory and copies shall be made available to any client of the laboratory upon request.

Pursuant to NYCRR Subpart 55-2.6, any misrepresentation of the Fields of Accreditation (Matrix - Method - Analyte) for which your laboratory is approved may result in denial, suspension, or revocation of your certification. Any use of the Environmental Laboratory Approval Program (ELAP) or National Environmental Laboratory Accreditation Program (NELAP) name, reference to the laboratory's approval status, and/or using the NELAP logo in any catalogs, advertising, business solicitations, proposals, quotations, laboratory analytical reports, or other materials must include the laboratory's ELAP identification number and distinguish between testing for which the laboratory is approved and testing for which the laboratory is not approved.

If you have any questions, please contact ELAP at the New York State Department of Health (NYS DOH), Wadsworth Center, PO Box 509, Albany NY, 12201-0509; by phone at (518) 485-5570; by facsimile at (518) 485-5568; and by email at elap@health.state.ny.us.

Sincerely,

Stephanie E. Ostrowski

STEPHANIE OSTROWSKI, PH.D.
Program Director
Environmental Laboratory Approval Program

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2015
Issued April 01, 2014

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

NY Lab Id No: 11798

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Radiological Analytes	
Gross Alpha	EPA 900.0
Gross Beta	EPA 900.0
Photon Emitters	EPA 901.1
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Strontium-89	EPA 905.0
Strontium-90	EPA 905.0
Tritium	EPA 906.0
Uranium (Activity)	EPA 908.0

Serial No.: 50856

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2015
Issued April 01, 2014

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MS. MARY L. TURNER
EBERLINE SERVICES-OAK RIDGE LAB
601 SCARBORO ROAD
OAK RIDGE, TN 37830

NY Lab Id No: 11798

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Drinking Water Metals III	
Uranium (Mass)	ASTM D5174-97 02.07
Radiological Analytes	
Gross Alpha	EPA 900.0
Gross Beta	EPA 900.0
Photon Emitters	EPA 901.1
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Strontium-89	EPA 905.0
Strontium-90	EPA 905.0
Tritium	EPA 906.0
Uranium (Activity)	EPA 908.0

Serial No.: 50855

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

Appendix C
Eurofins Air Toxics, Inc.
Laboratory Quality Assurance Program Manual

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Rev. 26

March 5, 2014

Quality Assurance Manager: Bahar Amiri

The Laboratory Quality Assurance Manual is effective as of the date of the signature of the Quality Assurance Manager

EUROFINS AIR TOXICS, INC.
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LABORATORY QUALITY ASSURANCE MANUAL

Approvals

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REVISION LOG

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Cover page; Appendices Table of Contents; Section 1.3; Section 2.1; Section 2.6.2; table added to Section 6.3; Appendices numbering arrangement	NELAP Concordance, Quality Systems Internal Audit, and minor transcription errors	Added address, phone number to cover page, and appendices to Table of Contents. Statements added to the sections cited to be in compliance with NELAP requirements.
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Section 1.1; Section 2.1 Organizational Chart; Section 2.6 Qualifications and Responsibilities; Section 5.5 Sample Return/Disposal; Section 6.3 Equipment and Instrumentation; Section 8.1 Scope of Testing; Appendices A,D, and F	ISO 17025 Concordance and product testing methods – Chambers addition.	Updates made throughout document regarding product testing and Chambers information. Specified sections include the required information.
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Cover page; Appendices including Method Manuals, Organizational Chart, terms and definitions, and references.	Appendices were updated to correspond to the most current SOPs, methods, DoD, and TNI definitions.	General formatting and spelling errors corrected throughout the entire document.

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1. INTRODUCTION

The purpose of the Laboratory Quality Assurance Manual is to provide a framework to outline the quality systems at Eurofins Air Toxics, Inc.

1.1 Our Unique Promise of Value

Eurofins Air Toxics is the global leader in the The NELAC Institute (TNI) National Environmental Laboratory Accreditation Program (NELAP) for accredited vapor-phase environmental analytical laboratory services, and is also ISO/IEC 17025:2005 accredited for environmental chamber chemical emissions testing and associated analytical laboratory services.

Eurofins Air Toxics supports public and private sectors, including engineering and consulting firms, manufacturers, industry, government, retailers and others by offering a wide variety of certified air methods as well as emissions testing of consumer and building products and materials. Eurofins Air Toxics provides unmatched quality, capacity, and technical expertise to deliver an outstanding service experience to clients worldwide.

1.2 Mission Statement

Eurofins Air Toxics, Inc. is an analytical and environmental laboratory specializing in the analysis of vapor-phase contaminants and air quality parameters. Our business is guided by four key principles:

1) Providing unmatched data integrity
2) Establishing long-term relationships
3) Delivering quality client service
4) Exceeding client expectations

1.3 Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. This group supports the laboratory's commitment to quality as defined by NELAP and ISO 17025.

The Quality Policy Statement gives employees clear requirements for producing analytical data that is scientifically valid, legally defensible, accurate, impartial, and of known and documented quality, through strict adherence to the Quality Policy Statement. The Quality Assurance Officer wrote the Quality Policy Statement with final approval from the Technical Director. The policy cannot be

revised without the Technical Director and Quality Assurance Officer's approvals. Employees are trained on the components of the Quality Policy Statement during their orientation. All employees sign the statement as agreement to implement the policy in all aspects of their work. The statement is as follows:

We strive to provide the highest quality data achievable by:

- Describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries; and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/ qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process and commitment to continuous improvement that provides accuracy; strict compliance with agency regulations and client requirements, giving the highest degree of confidence; and understanding that meeting the requirements of the next employee in the work-flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications but is still of use to the client, and understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems with investigation and applicable corrective action; and documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expressions of concern to management regarding quality issues.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test

procedures or data, or inaccurate documentation, will not be tolerated. Intentional misrepresentation of activities performed is considered fraud and is grounds for termination.

1.4 Statement of Values

At Eurofins Air Toxics, we strive to be the BEST in everything that we do. Our very existence is based on our continued ability to provide innovative, dependable, and cost-effective environmental services to our clients. We CARE about our clients as well as our co-workers and manage our daily activities to build relationships based on mutual TRUST, HONESTY, and RESPECT. We are LEADERS in our field and accept the risks associated with building new frontiers in our professional lives. Our strength comes from our TEAMS for through them we can achieve our goals.

1.5 Certifications, Accreditations, and Registration

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in areas relevant to our technical expertise. We strive to ensure that the facility, equipment, procedures, records, and methods used by Eurofins Air Toxics laboratory in the testing of environmental samples are in compliance with the requirements of these standards.

Appendix C lists accreditations held by Eurofins Air Toxics, Inc. in support of environmental and product testing work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

2. ORGANIZATION AND PERSONNEL

2.1 Organizational Structure

Eurofins Air Toxics' management organization includes six core areas: Operations, Information Technology (IT), Client Services, Research, Sales and Marketing, and Finance and Administration. The management staff includes executives, directors, managers, and group leaders. Each operating area is lead by a manager and/or a group leader. In the absence of a member of the laboratory and operational management team, deputies are appointed as follows:

Position	Deputy
President	Technical Director or appointee
Technical Director	Quality Assurance Manager or appointee
Quality Assurance Manager	Technical Director or appointee
Laboratory Director	Technical Director or appointee
Vice President of VOC Materials Testing	Technical Director or appointee
Managers/Group Leaders	Laboratory Director

Eurofins Air Toxics' senior executives and managers are committed to following and assuring compliance with the TNI Standard as defined in this Laboratory Quality Assurance Manual (LQAM). Each manager is responsible for implementing and maintaining systems as they affect their teams and for participating in their respective role in the management systems as outlined in the LQAM.

An Organizational Chart is presented in Appendix D of this manual. This organizational structure is created in a way to avoid any potential for conflicts of interest or undue pressure that might influence the technical judgment of analytical personnel.

2.2 Management Responsibilities

Management and/or supervisor is defined as group leaders, managers, and directors, and positions above those. The following is a list of management responsibilities:

- Personnel hiring and training
- Supervision of personnel
- Ensuring quality of data produced
- Resources allocation
- Directing daily work operations, including scheduling of work
- Maintaining awareness of technical development and regulatory requirements
- Assessing laboratory capacity and workload
- Contributing to the continuous improvement of the laboratory operation
- Providing resources to ensure a safe work environment

- Providing resources to ensure a work environment free of undue pressures
- Communicating problems and concerns to senior and executive management to enlist a higher level of support for corrections and continuous improvement, ensuring compliance with the requirements of NELAP and ISO 17025
- Ensuring that corrective actions are carried out in an appropriate and agreed upon time frame

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, and understood and implemented by all personnel concerned.

2.3 Overview of the Quality Assurance Program

The Quality Assurance (QA) Department is responsible for developing planned activities the purpose of which is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP and ISO 17025. Although Eurofins Air Toxics is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and quality systems described in this manual are specific to Eurofins Air Toxics.

2.3.1 Quality Assurance Manager

The Quality Assurance Manager ensures that the quality system is followed at all times. The QA Manager reports directly to the Technical Director in order to maintain independence from business operating units and facilitate communications regarding quality-related issues. The QA Manager has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Manager has the final authority to stop work that compromises the laboratory's integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Manager will authorize the resumption of work. The specific duties of the QA Manager are communicated in job description format.

2.4 Quality Assurance Responsibilities

The Quality Assurance team is responsible for implementing and maintaining Quality Assurance procedures throughout the laboratory. This is accomplished

via coordination and dissemination of internal and external assessment information, review of Standard Operating Procedures (SOPs) to document variances taken to published methods, monitoring of the Quality Assurance Manual to ensure consistency with actual practices, maintenance of an ongoing Corrective Action Program with quarterly reports to the senior management team, a leadership role in employee training, data review, and other quality control-related programs.

The QA team is free from any commercial, financial, or production pressures when making assessments or decisions regarding the quality of work produced or effectiveness of the quality systems.

2.5 Communication of Quality Issues to Management

Communication between the Quality Assurance (QA) team and other management teams occurs on a regular basis (typically via bi-weekly status meetings). Information regarding outstanding corrective action items, upcoming assessments, assessment results, and/or general observations are discussed and documented via a database of agenda notes. The QA databases along with the Laboratory Information Management System (LIMS) database are used to compile a Quarterly Quality Assurance Status Report, which is distributed to the senior management team for review.

2.6 Personnel Qualifications and Responsibilities

Full resumes and specific position descriptions for all personnel are located in Human Resources (HR) Department files. In addition, department managers have copies of position descriptions for their staff.

2.6.1 Executive Team

President: Provides leadership that ensures the founding mission and core values of the company are put into practice. The President leads programs relating to the development of long-range strategy, quality systems, financial infrastructure and sales. The President also provides day-to-day leadership and management of programs for overseeing the processes and resources necessary for establishing long-range service objectives, plans, and policies in cooperation with the Board of Directors. The President is responsible for the measurement and effectiveness of both internal and external processes by providing accurate and timely feedback on the operating condition of the company. In addition, the President directs the definition and operation of the laboratory production

by fostering a success-oriented and accountable environment within the company.

Technical Director: Provides oversight for the quality systems and technical performance of the laboratory, and manages technical support, the project management team, and the QA Manager. The Technical Director is responsible for developing products and solutions to meet client and industry needs, and also oversees the validation process of current and new products to ensure quality objectives are met and documented as defined.

Laboratory Director: Responsible for managing the operations of the laboratory, profit/loss relating to operations, laboratory efficiency improvement in software and instrument automation, and serves as the primary interface between finance, HR, IT, and sales/marketing. The Laboratory Director has the overall responsibility of ensuring customer satisfaction goals are met while elevating the skill and training of key technical staff as well as assuring that state-of-the-art instrumentation and capital assets are in place to meet global customer needs.

Vice President of VOC Materials Testing: Responsible for the promotion and demonstration of expertise in chamber testing, product emissions, and indoor air quality (IAQ), providing scientific leadership in these areas. Represents Eurofins Air Toxics on technical committees and at technical conferences and trade shows as they relate to the promotion and demonstration of expertise in chamber emissions testing and IAQ. Has the overall responsibility for establishing and maintaining a strategy and business plan for the emissions and product testing markets in the U.S.

2.6.2 Management Team:

Laboratory management and personnel are free from any commercial, financial, or production pressures when making technical judgments or decisions regarding the quality of work produced.

Information Technology Manager: Oversees all aspects of software engineering and development, database administration, and network administration. The IT manager is instrumental in designing and implementing model work-flow processes, defining user requirements, and proposing software design and implementation to satisfy long-term company business goals. This role provides established policies and

procedures to ensure continuous database and server environment integrity and reliability.

Quality Assurance Manager: Responsible for overseeing the quality systems in the laboratory. Key to the Quality Assurance role is a focus on continuous improvement through effective monitoring of systems and evaluation of non-compliance and corrective actions. To support the quality systems, the Quality Assurance Manager leads the internal and external audit programs, negotiates audit resolution, and oversees the effectiveness of the Corrective Action Report (CAR) program. The QA Manager is tasked with providing timely feedback to front-line managers and bench staff regarding quality programs and also a big-picture assessment to senior management. Additionally, the QA Manager ensures required documentation and certifications are current and accurate, including regulatory accreditations, the LQAM, and SOPs.

Managers/Group Leaders: Responsible for day-to-day operations of the laboratory or specific departments. The Group Leaders oversee technical operations, sample analysis, data entry, report generation, provision of resources, and other related areas. In addition, they are responsible for employee management and review. Group Leaders report directly to the Laboratory Director. Managerial decisions are made by the Laboratory Director in their absence.

2.6.3 Laboratory Staff and Responsibilities

It is the primary responsibility of laboratory staff to produce quality data within the framework of each individual method and within the parameters of the laboratory's quality control guidelines. It is also the responsibility of staff to identify existing problems or inefficiencies, and to improve the processes of the laboratory whenever possible. Duties for these personnel typically include:

- Sample preparations
- Performance of analytical tests
- Calibrations, operation, and maintenance of instruments
- Standard and reagent preparation
- Sample storage
- Data entry
- Data package preparation

2.7 Training

The experience and training received by personnel is of great importance to Eurofins Air Toxics' clients and regulatory agencies. Accurate training documentation is the responsibility of both employees and their supervisors. On a routine basis, the supervisor reviews and signs training documentation to verify that it is complete and current.

Each laboratory analyst being trained to perform a new analysis is required to perform an initial Demonstration of Capability (DOC) and meet the requirements for accuracy and precision before working independently on the test methods. Typically this is accomplished by the successful analysis of at least four aliquots of a laboratory quality control sample. However, there are certain tests that are not required by the mandated test method or regulation to perform the above procedure (e.g., PM10). In this case, the analyst's proficiency demonstration is satisfied by documentation of having read, understood, and agreed to follow the SOP, specific department or method forms and procedures, and observation by scientist or senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the-job training and/or internal and external training courses so that an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed.

2.7.1 New Hire Training

New employees learn about personnel and safety policies as well as business strategies through a formal process administered by our Human Resources Department and the Safety Committee. All new employees are also required to attend the Quality Assurance Orientation course. Completion of this course is documented in the employee's Training Record. The course outline includes:

- Introduction to QA
- Definitions of SOPs and LQAM
- How to use CARS
- Logbook protocol
- Chain-of-custody procedures

- Training Documentation
- Overview of Eurofins Air Toxics classes including Ethics and Integrity courses
- Overall Training Record organization and upkeep

New employee training continues with review and signing of the Eurofins Air Toxics Ethics Policy (Form F1.56), a review of the Quality Assurance Manual, and signing of the Quality Policy. Upon completion of those, employees move on to analytical method training if required for their position. Other non-testing training materials may be required by the departments.

In general, the laboratory staff reviews the department's SOPs and/or the regulatory method as well as the instrument manual. The employee will then observe while an experienced analyst prepares samples and operates the instrument. Training includes sample handling and preparation, documentation protocols, calibration procedures, QC requirements, data management, data reporting and troubleshooting.

2.7.2 Ongoing Training

After successful completion of the initial Demonstration of Capability, all laboratory staff must demonstrate continued proficiency. Whenever there is a change in test method, instrument method type, and/or personnel a new DOC must be performed. At least once per year, each analyst must demonstrate continued proficiency on assigned technical methods. The QA Department notifies personnel via e-mail whenever a new SOP is generated or a current SOP is updated. Employees responsible for that method or procedure must read the new or updated SOP within 30 days and document the review in the LIMS SOP Tracker module. In addition, the Laboratory Quality Assurance Manual and the Chemical Hygiene Plan must be annually reviewed by all employees.

Employees are re-trained if an issue or investigation warrants that it is a necessary corrective action. Management provides direction as to when employee re-training is required, and to the extent of the re-training.

2.8 Employee Safety

Laboratory staff may, on occasion, be exposed to handling of solvents, compressed gases, calibration standards, or other hazards. Eurofins Air Toxics designates an assigned Safety Officer and several staff members who comprise

the Safety Committee. Some members are 40-hour OSHA-trained and respirator-fitted.

Employee education in the safe handling and disposal of these materials is accomplished as follows:

- Each new employee is given a safety tour of the facility within the first two days of employment. Documentation of this orientation appears in the employee's Training Record.
- The Safety Committee meets frequently to discuss safety concerns and ways of improving safety in the work place.
- The Safety Committee schedules ongoing safety training throughout the year.
- If special precautions must be taken to perform a method, a safety section is included in the method SOP or in a stand-alone SOP which discusses protocols and other measures for risk reduction through exposure prevention.
- Safety Data Sheets (SDSs), formerly Material Safety Data Sheets (MSDS), are maintained for each chemical used on-site. The SDSs are accessible to personnel in the library area immediately outside the standards room and/or electronically through the chemical inventory database (CISpro) at all times. SDSs are also accessible on the Internet from product vendors.
- The Safety Committee members are assigned to duties that include hazardous waste disposal, incident or spill management, scheduling staff training, safety site assessments, Chemical Hygiene Plan review, and the overall leadership of the Safety Program.

2.9 Client Services/Project Management Responsibilities

The Project Management group is responsible for organizing and managing client projects. Clients are assigned a Project Manager who serves as their primary contact. It is the Project Manager's responsibility to act as client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal and electronic communications are documented by the project managers in the LIMS Contacts module. In addition to information management, project management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff, including review of project-specific documents and negotiations of variance requests

- Documentation of project requirements
- Coordinating and communicating turnaround-time (TAT) requirements
- Scheduling sample submissions, sample containers, and sample pickup via Eurofins Air Toxics courier service
- Informing clients of deviation from their contract

2.10 Confidentiality

Strict confidentiality is maintained in all of Eurofins Air Toxics dealings with clients. All employees are required to protect company data, including client names and/or test results from disclosure to any third party. This policy is presented to employees in SOP #99 and during their orientation period.

Clients are promptly notified if their data is subpoenaed or requested by a regulatory or legal body.

In order to ensure the confidentiality of our systems and procedures within the laboratory, it is Eurofins Air Toxics' policy to restrict the distribution of our internal procedures to clients. Clients are, however, permitted to review the laboratory's procedures while on-site as part of an audit or visit. Based on this policy, the laboratory requests that any document viewed is not shared or made available to any third parties without the permission of Eurofins Air Toxics.

2.11 Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that Eurofins Air Toxics' mission is to perform all work with the highest level of integrity. Shortcuts or generating results to suit a client's purpose, rather than adhering to good scientific practices, is not considered acceptable under any circumstances. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination. Examples of violations of data integrity are listed below:

- Knowingly recording inaccurate data
- Fabrication of data without performing the work needed to generate the information; this includes creating any type of fictitious data or documentation
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time

- Manipulation of data for the express purpose of passing systems suitability or quality control criteria
- Selective use of data generated, or not using data that was legitimately generated to impact the outcome of a test
- Executing significant deviations from approved test methods and procedures without prior approval from Eurofins Air Toxics management and/or the client

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained the less likely an action is considered fraudulent if further scrutinized. All documentation of the inquiry and subsequent disciplinary actions will be maintained by both the Technical Director and the Human Resources Department for at least five years.
- When out-of-specification results or quality control-type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Any questionable situations and decisions must be reviewed with a supervisor.
- Questionable or uncomfortable issues are brought directly to QA Manager or a member of the QA Department as part the QA “open door” policy. If an employee desires to remain anonymous, he or she is encouraged to report to the designated laboratory staff ombudsman. The designated ombudsman will meet separately with management and the employee involved, ensuring anonymity.

3. BUILDINGS AND FACILITIES

3.1 Facility

The Eurofins Air Toxics laboratory occupies approximately 35,000 square feet of space in Folsom, California, including 7,000 square feet of office space. The single-story building is custom-designed to suit the specifications of an air laboratory. Design criteria included floor plans to accommodate segregation of conflicting tests and provide an environment that is conducive for cross-functional work teams. The main instrumentation laboratory is based on an “open” concept

in which walls were removed to promote a sense of community and teamwork. Wide hallways with alcoves were designed to encourage congregation and discussion. The number of private offices was minimized so that barriers between management and staff are absent. Elements of the quality system are evident throughout the facility design. The facility's map is provided in Appendix F.

3.2 Security

Security at Eurofins Air Toxics is maintained through a controlled access system. Representatives of State, Federal, and private entities have access to the laboratory facility and records during normal business hours. Guests and employees must enter/exit through Sample Receiving or the reception area. All visitors must sign in and out upon arrival and departure. After work hours, the building is secured and linked to a commercial security agency. The security system is equipped with perimeter alarms, motion sensors, and speakers that monitor background sounds. Heat-activated fire alarms are monitored by an outside agency. A fire alarm also activates the security system. Security and controlled access protocols are described in SOP #30.

4. DOCUMENT CONTROL

4.1 Controlled Documents at Eurofins Air Toxics

It is Eurofins Air Toxics' policy to restrict the distribution of internal procedures to clients, and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only done so with the approval of QA.

4.1.1 Quality Policy Manual and Company Policies

Eurofins Air Toxics' Quality policies and Quality Systems must comply with all State and Federal requirements for those programs for which the laboratory maintains accreditation.

All Eurofins Air Toxics employees are required to read the Quality Assurance Manual within 30 days of release of the latest version and maintain current documentation in their Training Record binders. The Quality Assurance Manual is available to all employees electronically on a shared server located at O:\QA\LQAM. A hard copy is also available in the QA department.

4.1.2 Laboratory Standard Operating Procedures (SOPs)

The SOPs at Eurofins Air Toxics detail the work processes used on a regular basis that are to be conducted and followed within the organization. They document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality. These SOPs can be administrative or technical. All employees should maintain a record of review of the most current SOPs.

4.1.3 Work Instructions (at the department level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately.

4.1.4 Logbooks, Forms, and Instructions

The intent of these documents is to provide documented evidence to support Eurofins Air Toxics quality systems and operations. They are used as part of regular laboratory operations to record necessary information.

4.2 Document Approval, Issue, Control, and Maintenance

The Quality Assurance Department is responsible for the approval, issue, control, and maintenance of all documents that are part of the laboratory's quality systems including, but not limited to, the Quality Assurance Manual (LQAM), Standard Operating Procedures (SOPs), Logbooks, Forms and Instructions, Certificates of Analysis (C of As), and calibration and training documents.

All documents issued to personnel in the laboratory as part of the quality system shall be reviewed and approved for use by Technical Director, Laboratory Director, and Quality Assurance Manager prior to use.

The LQAM and SOPs are reviewed to ensure they remain accurate and current. The frequency of review is either annual at the least or as needed, depending on the procedure. Upon generation of new or updated documents, all copies of obsolete documents are removed from the laboratory and its computer network, then archived or destroyed as appropriate. Pertinent staff members are notified of the updates. A new revision number is assigned to the LQAM or SOP at every review.

All technical changes must have the approval of the Technical Director, the Laboratory Director or Vice President of VOC Materials Testing, and the Quality Assurance Manager.

Detailed instructions regarding document control and how to write SOPs are available in SOPs #46 and #119.

4.3 Laboratory Logbooks and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. Logbooks, forms, and instructions are created and distributed by the Quality Assurance Department as needed. Used logbooks are returned to QA for archival. The QA Department maintains a master index to uniquely number and identify each logbook and form distributed. Logbooks can contain blank or preformatted pages. They are bound and uniquely identified, and have sequentially pre-numbered pages.

4.4 Archival and Storage of Documents

The majority of documents at Eurofins Air Toxics are stored electronically. Documents which remain in hard-copy format include chain-of-custody forms (COCs), Data Review Checklists, scanned packets (run logs, spectral defenses, manual integrations, etc.), FedEx/UPS air and freight bills, and most logbooks. All other hard-copy documentation is stored in its specific workorder folder. The hard-copy workorder folder is placed in a bar-coded storage box for long-term storage. Bar codes are maintained in an inventory log. An off-site company archives the boxes using the bar-coding system. The storage company provides one-day retrieval service upon request.

Used logbooks are returned to Quality Assurance for archival and remain in the QA Department for no less than five years.

5. SAMPLE HANDLING

5.1 Sample Collection

It is the responsibility of the client to submit representative and/or homogeneous and properly preserved samples of the system from which they are collected. In all cases, field sampling personnel are ultimately responsible for having expertise and knowledge in air sampling methodology or product/materials collection protocols sufficient to ensure that the defensibility of the data will not be compromised due to deficiencies in the field sampling, handling, or transportation. General information regarding the proper use of sampling media

provided by Eurofins Air Toxics is available as a resource for field personnel. The laboratory provides sample containers, chain-of-custody forms, sampling labels, chemical ice packs (if appropriate), shipping containers, custody seals (per client request), and a copy of the Sample Acceptance Policy.

Air sampling media provided by a qualified vendor or prepared by the laboratory for field use is certified for cleanliness. The laboratory's media cleaning process is typically verified using batch certification protocols. Individually certified canisters are also available per specific client request.

5.2 Sample Receipt and Entry

5.2.1 Sample Receipt

Samples can be received at the laboratory during normal laboratory operating hours. Receipt occurs in one of three ways:

- Commercial courier
- Eurofins Air Toxics courier service
- Personal delivery

Upon arrival at the laboratory, samples are received and inspected following Eurofins Air Toxics' Sample Acceptance Policy as outlined in SOP #50. This SOP establishes specific guidelines for sample acceptance, which are generally accepted practices under U.S. Environmental Protection Agency (USEPA), Department of Defense (DoD), ISO, and NELAP protocols.

5.2.2 Sample Entry

As soon as is practical after sample receipt, the samples are entered into LIMS. Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity.

At the time of entry, the LIMS system assigns a unique laboratory sample number to each sample. This number is sequentially assigned, then a label is generated and is attached to the sample container.

A sample acknowledgment in the form of a Sample Receipt Confirmation prints from LIMS for each sample delivery group (SDG), which is the same number as the workorder. This notification is sent to the client to confirm sample receipt and entry.

5.2.3 Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method requirements, if there is doubt about the suitability of items received, if items do not conform to the description provided, or the testing required is not clear or specified, the condition of the sample is clearly documented on a Sample Discrepancy Report (SDR). The SDR is delivered to the Project Manager for review and communicated to the client as needed. Directions on next steps, which may include canceling the sample or proceeding with qualifiers and/or narrative, are documented on the SDR. Details are outlined in SOP#50.

5.3 Sample Identification and Tracking

A sample label is generated for each sample, and in addition to the assigned Eurofins Air Toxics' sample number the following information is printed on the label: workorder number, laboratory sample ID, and, if needed, a sample release date. For canister analysis, the label is not affixed directly to the canister but attached with a tag.

To ensure traceability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including logbooks, instrument printouts, and final reports.

5.4 Sample Storage

After entry into LIMS, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and freezer storage are available, and samples are stored in accordance with regulatory, method, or client directions. The LIMS system is used to assign storage locations for bar-coded media, which promotes orderly storage of samples. Sample storage locations for sorbent and condensate samples requiring refrigeration are monitored for accurate temperature control.

When a canister, bag, or product sample is scheduled for analysis, the analyst obtains custody of the sample by scanning the canister tag or sticker bar code as well as the bar-coded destination location of each individual sample. The scanned information is electronically transmitted to LIMS to reflect the custody of canister and bag samples at all times. All other media samples are logged into the Internal Extractable Sample Tracking Logbook and the pertinent storage area.

5.5 Sample Return/Disposal

Samples are released for disposal upon satisfactory completion of analysis unless prior contractual arrangements have been made. Product samples are held for a minimum of 30 days after satisfactory completion of the analysis, unless otherwise specified by the customer. The release of samples is electronically documented in the LIMS tracking system via scanning of the canisters and bags. This ensures verification of completion of all analyses including all samples in each workorder. Samples are released following the procedures outlined in SOP #63.

Sample disposal varies based on the sampling media. Whole air samples are vented through a charcoal scrubber, while liquid samples are disposed of according to procedures noted in SOP #24.

5.6 Chain of Custody

Samples received by the laboratory must be documented using a chain-of-custody (COC) form and relinquished following standard EPA-approved guidelines, including the following:

- Unique sample name or number
- Location, date, and time of collection
- Canister number (if applicable)
- Collector's name
- Preservation type (if applicable)
- Matrix or product type
- Any special remarks

Additional information may be required depending on the requested analysis.

A copy of the signed COC will be e-mailed to the client in conjunction with the Sample Receipt Confirmation.

Once a sample is received by the laboratory, the internal chain-of-custody procedure is followed.

Disclaimer: *Eurofins Air Toxics assumes no real or implied responsibility or liability for client-related field sampling and shipping activities. It is the responsibility of the individual client to ensure that referenced methodologies are followed with respect to sample collection and shipment to the laboratory. Air sampling media and equipment should only*

be used by experienced field engineers. It is the ultimate responsibility of the client to be knowledgeable both in sample preservation requirements as well as relevant State, Federal, and international shipping requirements. Any time a chemical substance is collected using Eurofins Air Toxics media, the client bears sole responsibility for understanding and abiding by the laws involving shipment of potentially hazardous substances by common carrier.

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

6.1 Reagents and Solvents

The reliability of Eurofins Air Toxics' analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to control labeling, storing, and evaluation of these materials. All purchased supplies, reagents, solvents, and standards are verified as acceptable and meeting criteria for analysis prior to use. The Eurofins Air Toxics' Chemical Hygiene Plan (CHP) provides safety information in regard to the storage and handling of laboratory chemicals. All reagent certificates and Safety Data Sheets (SDSs) are retained by the laboratory (see section 2.8).

6.2 Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standard used. Calibration measurements made by the laboratory must be traceable to national standard of measurement (e.g., NIST) where available. Certificates of Analysis are maintained for each material, as applicable.

Standards are usually purchased from commercial suppliers either as neat (pure) compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards are documented on the C of A, and hard-copy certificates are maintained on file in the laboratory. Upon receipt at Eurofins Air Toxics, material is labeled with a date of receipt and stored appropriately.

Stock standard solutions are recorded in the proper standard logbook and are assigned a unique standard code number. When a working standard is prepared, the compound(s), standard code number, date prepared, analyst, expiration date, and solvent are noted in the working standard logbook. All working standards are kept in containers and at temperatures that will not alter their integrity. All containers are clearly labeled with concentrations, unique standard code number,

and expiration date. Standards are not to be used in the laboratory past their expiration date.

6.3 Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work it supports. All equipment and instrumentation is maintained in proper working order. Eurofins Air Toxics' major equipment capabilities are summarized in the table below:

Major Instrumentation

Number	Instrumentation
24	GC-MS
7	Gas Chromatographs with various detectors (TCD, PID, FID, SCD, ECD)
2	HPLC-UV
11	Air Concentrators
7	Automated Thermal Desorption Units
3	Liquid Auto-samplers
1	Extractors
60	119 L Dynamic Environmental Chambers
1	Micro-chamber/Thermal Extractor
1	Air Generator
1	Industrial Air Compressor
1	Air Humidification System

6.3.1 General Requirements

- Equipment and instrumentation are assigned a unique identifier designation to identify them within the data documentation.
- An equipment logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment and instruments as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instruments used at Eurofins Air Toxics are routinely calibrated and maintained in accordance with applicable Standard Operating Procedures.
- A member of the technical group, or another designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment as required by laboratory procedures. These activities are documented.

- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm.
- All equipment taken out of service is tagged accordingly.

6.3.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for preventative maintenance and calibration as applicable, along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Equipment manuals are also available to provide additional information with regard to operations and maintenance.

6.3.3 Maintenance

- Equipment maintenance is performed as either a preventative or corrective operation.
- Preventative maintenance procedures and schedules for each piece of equipment are assigned where applicable. Preventative maintenance operations are performed by an analyst, scientist, senior scientist, or contracted manufacturer's representative or service firm personnel. Documentation is maintained for the procedures performed as part of the preventative maintenance operation. It is the responsibility of Group Leaders to ensure that a preventative maintenance schedule is addressed by a procedure where appropriate and is followed.
- A supply of commonly needed replacement parts is maintained by the laboratory.

6.3.4 Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standard used. Some types of calibrations are performed within a set of frequency (e.g., daily), while others provide intermediate checks to ensure that the instrument response has not changed significantly.

- All measuring and testing equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an ongoing and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, department procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors, including robustness of the instrument or equipment and the frequency of use.
- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data printouts are generated to document the activity.
- Calibration measurements are traceable to national standard of measurement (e.g., NIST) where available. Physical standards, such as NIST-certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standard of measurement.
- Calibration failures are documented in the logbook for the instrument and/or within the data printouts from the instrument.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.

6.4 Computerized Systems and Computer Software

6.4.1 Computer Usage

Eurofins Air Toxics provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of Eurofins Air Toxics and is to be used in accordance with defined terms and conditions. The laboratory's goal is to provide standard hardware and software that meets the needs of the user.

6.4.1.1 Physical security of computer systems: It is company policy to protect computer hardware, software, and data documentation from misuse, theft, unauthorized access, and environmental hazards. All of the laboratory servers are housed in a locked office, which maintains favorable environmental conditions to allow for optimal server performance. Access to the laboratory's networks is granted by the Systems Administrator or Information Technology (IT) Manager. Network access is tightly controlled for the entire company. Users maintain individual network accounts and are allowed to access specific areas of the network based on the privileges assigned to them. A user is granted access to only those areas needed to fulfill his or her job function.

6.4.1.2 Passwords: All software used to reduce sample data or generate sample reports is password-protected; users are granted rights to these systems based on a "read/write/none" privilege system. The following procedures apply regardless of what system(s) is being utilized:

- Passwords must be kept confidential.
- Users must log-out of a system when not in use to prevent unauthorized access.
- Forgotten passwords can only be reset by the IT Department or by an appropriate System Administrator.
- Network passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.4.1.3 Computer viruses: Eurofins Air Toxics continuously monitors its computer network for computer viruses. Anti-virus software is employed to detect viruses on the Windows network. Employees must report any virus concerns to the IT department as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.4.1.4 Internet and e-mail System: The e-mail system is used primarily for Eurofins Air Toxics business purposes. The Employee Handbook provides additional information in regard to system usage. Employee access to the Internet is restricted to those employees who have a business need for it. All employees have access to e-mail. All Internet and e-mail activity is subject to monitoring. All messages created, sent, or received over the Internet are property of Eurofins Air Toxics and can be regarded as public information. E-mail and Website filtering software is utilized.

6.4.1.5 Software Policy:

Eurofins Air Toxics' Software Policy is as follows:

- Copyright laws protect software, and Eurofins Air Toxics' intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management, IT Department, and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the IT Department.
- Employees must not give software to outsiders (e.g., clients, contractors, etc.), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.4.1.6 Computer system backup, data restoration, and data archival: All data systems are backed up on a daily, weekly, and monthly basis using a modified "grandfather-father-son" (GFS) rotation protocol. Specifically, these backups are conducted on the servers responsible for all laboratory production data files and databases (i.e., Project Management files, analytical data, audit trails, Quality Assurance documents, etc.). A daily incremental backup is scheduled to run each night Monday through Saturday. The daily incremental backup is limited to files modified the same day. On Sunday, a weekly full backup of all files on each server is completed. At the end of each month, a

full backup of each data system is conducted. This monthly backup tape is then placed in permanent storage. The permanent historical backup tapes are stored in an off-site data storage facility. Data is not removed from the server until at least three permanent monthly backup tapes have been created. This ensures that no archived data will be lost due to corruption of the magnetic tape. A more comprehensive description of the laboratory's electronic data archiving system can be found in SOP #55.

6.4.1.8 Remote access to computer systems: With special permissions, employees are able to remotely connect to the laboratory computer network through a VPN system. When logging in, users are authenticated with their Windows account and password.

6.4.2 System and software verification: Before each new computer system or significant modification of an existing system is implemented in the laboratory, the following requirements must be met:

- Required documents – Describe the required system functionality and specification (e.g., Software Development Change Control, Change Control Log, IT Logic New Rule or Rule Update)
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure, and module design
- Testing documentation for system development/verification – structural testing of the internal mechanisms and user testing of the installation and system qualification.

7. PURCHASING EQUIPMENT AND SUPPLIES

7.1 Procurement

The primary materials procured by the laboratory are analytical instrumentation and software, media and reagents including standards, carrier gases and cryogens, miscellaneous laboratory supplies, computer hardware and software, and service contracts.

Control of the purchase of these items and services is maintained using a standard purchase order system described in SOP #105 and outlined below:

- Purchase requests must be approved by a director or manager.
- An assigned purchase order (PO) number is entered along with the date, vendor, and requester.
- An evaluation of the supplier is conducted to determine whether it has been deemed a qualified vendor.
- Requires that upon receipt or delivery of services the product is inspected by the purchasing agent and compared to the packing slip and/or request for services.
- Each PO is matched with invoices prior to payment to insure that purchased items or services were delivered as expected.

Purchasing documents are maintained by the Accounting Department, calibration certificates are maintained by the Quality Assurance Department, and Certificates of Analysis for reagents and media are maintained by laboratory personnel.

7.2 Supplier Evaluation

Suppliers and vendors are evaluated in accordance with SOP #105 to assure that the quality of the products purchased meet the quality expectations of Eurofins Air Toxics, Inc. and do not interfere in the quality of testing. A laboratory database is maintained with a list of approved vendors.

8. ANALYTICAL METHODS

8.1 SCOPE OF TESTING

Soil vapor, landfill gas, indoor and outdoor ambient air, source (stack) emissions, and other types of air-phase samples are analyzed in accordance with official published methods or validated in-house methods. Method modifications made by Eurofins Air Toxics, Inc. are detailed in a summary of modifications table in the method SOP. Measurement and analysis of volatile organic compound (VOC) emissions from products using environmental chambers are performed in accordance with the relevant ASTM, EPA, and ISO methods. Specific operational and assessment parameters required for product compliance to voluntary and regulatory labels and testing are outlined in documents such as CDPH/EHLB SM V1.1 (CA 01350), ANSI/BIFMA M7.1, and AgBB.

The methods used by Eurofins Air Toxics are approved by a broad range of regulatory agencies.

A list of methods covered under the laboratory's NELAP accreditation can be found in the table in section 8.2.

Eurofins Air Toxics specializes in and has expertise with the following types of projects:

- Vapor Intrusion investigations
- Environmental assessments
- Remediation system monitoring (soil vapor extraction)
- Landfill gas characterization
- Source emissions testing
- Soil vapor surveys
- Ambient air monitoring
- Indoor air quality (IAQ)
- Material emissions using environmental chambers

Appendix E contains summaries for each commonly performed analytical procedure in the laboratory. Each summary contains the following information:

- A brief method description
- Laboratory variances to method compendium or other regulatory reference methodologies
- Tables containing analyte lists, Reporting Limits (RLs), Limits of Quantitation (LOQs), and quality control (QC) acceptance criteria
- A table of calibration and QC procedures

This Quality Assurance Manual references methods in a general manner; specific procedures used by the laboratory can be found in the method-specific SOPs.

8.2 Analytical Test Methods

Eurofins Air Toxics' NELAP-certified analytical methods, parameters, instrumentation, sampling media, holding times, and SOP numbers are summarized in the table below:

Method	Parameter	Type	Sampling Container	Holding Time in days	Eurofins Air Toxics SOP #
TO-14A/TO-3	BTEX/TPH	GC/FID/PID	Summa Canister Tedlar Bag	30 3	43
TO-4A/TO-10A	Pesticides/PCBs	GC/ECD	PUF	7	26
TO-11A	Aldehydes/ Ketones	HPLC/UV	DNPH Cartridge	14	11
TO-12	Non-methane Organic Carbon (NMOC)	GC/FID	Summa Canister Tedlar Bag	30 3	36
TO-13A	PAHs/ Semi-volatiles	GC/MS	XAD/PUF	7	3/10
TO-14A/TO-15	VOCs	GC/MS	Summa Canister Tedlar Bag	30 3	6/38/83/114
TO-17	VOCs	GC/MS	Sorbent Tube	30	5/109/110/ 112/122
ASTM D-1946	Fixed Gases, CH_4, C_2+	GC/TCD/FID	Summa Canister Tedlar Bag	30 3	08
ASTM D-1945	Fixed & Natural Gases	GC/TCD/FID	Summa Canister Tedlar Bag	30 3	54
ASTM D-5504	Sulfur Gases	GC/SCD	Tedlar Bag	24 hours	13
PM10/TSP	Particulate Matter	Mass	Quartz Filter	14	66

8.3 Method Validation

As part of the initial test method evaluation for new standard methods, analytical runs must be performed the same way an analyst would perform an initial Demonstration of Capability (DOC) to evaluate precision and bias along with a Method Detection Limit (MDL) study as applicable.

Non-standard methods, including laboratory-developed methods, standard methods outside their intended scope or application, and requested changes to existing instrumentation will follow a planned process explained in detail in SOP #107 and outlined below:

- Measurement Quality Objectives (MQOs) – should be clearly outlined prior to validation.

- Development of Test Plan – Technical Director and assigned personnel are responsible for the development of such plan.
- Validation – Implementation of the test plan with documentation of all results will be reviewed by the Technical Director.
- Review and Approval – Review of performance against the MQOs, supporting documents, and written procedures is performed by the Technical Director. After approval, the QA Manager reviews for completeness and finalizes the method for production.

8.4 Procedural Deviations

Eurofins Air Toxics communicates and addresses procedural deviations in the following ways:

- Modifications to standard methods made by Eurofins Air Toxics are detailed in a summary of modifications table in the analytical method SOP. The modification table is also included in the laboratory narrative of the final data report.
- Differences between a project request and laboratory standard protocol are documented in a variance table created by the laboratory's project chemist for submission with the proposal to the client. Agreement is documented by the client's initials and date in the approval column or with written documentation from the client that all variances have been approved.
- If a sample received did not meet the established criteria for quality testing, the Sample Receiving Department will issue a Sample Discrepancy Report (SDR), and the Project Manager will communicate the discrepancy to the client. If the client still wants the sample to be processed, the discrepancy will be narrated in the final report.
- Other analytical procedural deviations that are within allowable variations established for every method and listed in the method SOPs are discussed with the client, and if accepted the sample results will be reported with a narrative of the deviation and the affected result will be flagged accordingly.
- Analytical procedural deviations that are not within allowable variations and directly affect the sample result will require the initiation of a Corrective Action Report request.

The Corrective Action Program is explained in detail in section 12 of this Quality Manual.

9. INTERNAL QUALITY CONTROL CHECKS

9.1 Laboratory Quality Control Samples and Acceptance Criteria

9.1.1 Blanks: For the whole air methods for which no sample preparation step is required, a blank is a designated sample designed to monitor for contamination originating from the analytical system. The Laboratory Blank is comprised of clean, humidified air or nitrogen. A Laboratory Blank is analyzed after any applicable standards and prior to the analysis of project samples. A blank is also analyzed in the event saturation-level concentrations are incurred to demonstrate that contamination does not exist. The blank and the field samples are treated with the same internal standards and surrogate standards and carried through the entire analytical procedure. For methods requiring a sample preparation step (e.g., TO-11A and TO-13A), a Laboratory Blank is prepared using un-sampled media and extracted alongside the batch of field samples. Ideally, blanks demonstrate that no artifacts were introduced during the preparation and/or analysis process. The specific acceptance criterion for each test is given in the analytical method and is usually based on the required Reporting Limit (RL).

9.1.2 Surrogates: Surrogates are organic compounds that are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. For GC-MS methods and some GC methods, the recovery of the surrogate standard is used to monitor for unusual matrix effects and gross sample processing errors, and to provide a measure of recovery for every sample matrix. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3 Matrix Spikes: Matrix spikes are not required QC for whole air samples collected in Summa canisters. Accurately spiking target compounds into an evacuated canister prior to deployment in the field for sample collection or post-sample collection is neither practical nor technically appropriate. Therefore, matrix spiking is performed only on samples submitted as part of a sampling train, such as condensates, or on extractable samples, provided they are submitted in duplicate for matrix spike and in triplicate for the matrix spike duplicate. It is the responsibility of the client to provide additional samples to fulfill any method

requirements regarding matrix spikes. When applicable, matrix and matrix duplicate spiking is performed using a subset of target analytes. Recoveries and demonstrated reproducibility values that do not meet the acceptance criteria are flagged and explained in the laboratory narrative.

9.1.4 Laboratory Control Samples: Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. The LCS is prepared by fortifying clean matrix with known target concentrations. In the case of non-extracted batches, the LCS is generally analyzed daily prior to sample analysis, but could also serve as an end check standard. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.5 Sample Duplicates and Laboratory Control Sample Duplicates: A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples is determined by analyzing a pair of Laboratory Control Samples (LCS), and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value as required by the method or based on a statistical determination from laboratory data.

9.1.6 Internal Standards: Internal standards (IS) are organic compounds that are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. For extractable methods and when required by the method, IS are added to every field and QC sample typically after extractions but prior to analysis. For all GC-MS methods an IS blend is introduced into each standard and blank to monitor the stability of the analytical system. Comparison of the peak area of the IS is used for quantitation of target analytes. The IS peak area and retention time also provide a check for changes in the instrument response and chromatographic performance. The acceptance criteria are stipulated in the analytical method.

9.1.7 Second Source Check: A second source check is analyzed using either the Laboratory Control Sample (LCS) and/or an Initial Calibration Verification (ICV). The second source is a standard that is made from a solution or neat compound purchased from a different vendor than that

used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the laboratory use continuing calibration verification standards as a second source from the initial calibration.

9.2 Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for required quality control (QC) samples. A summary is provided in Appendix E. The corrective action required when a QC result fails to meet acceptance criteria is also given. If the method reference requires the use of specific limits, the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistics from performance of the method. In these cases, the limits are available to the analyst and are entered into the laboratory computerized QC system described in SOP #48. Statistically determined acceptance criteria are frequently subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

9.3 Quality Control Charts

Quality control (QC) results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all analysts and by the Quality Assurance Department. The system charts results from surrogates and laboratory control samples. These charts provide a graphical method for monitoring precision and bias over time. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

9.4 Measurement Uncertainty

As stated in ISO 17025, “All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis” (5.4.6.3).

This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis, all factors that would contribute to uncertainty is evident through the LCS results. As such, LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage. Reports for uncertainty shall be generated and submitted to the Quality Assurance Department for review on an annual basis. At this point, it is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

10. ASSURING QUALITY OF TEST RESULTS

10.1 Data Management

At a minimum, data management is initiated when Eurofins Air Toxics receives samples from the client. More often, the process begins with client communication of their needs and requirements for a specific project and/or testing. The Project Managers are responsible for entering this information into the client services modules of LIMS. Upon receipt of the samples, a unique tracking number is generated based on this information in the project profile. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations.

10.2 Data documentation

Analytical data generated in the laboratory is collected through the associated data system or is manually documented in bound logbooks. Analysts review data as it is generated to determine that the instruments and systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. The following general requirements outline the Eurofins Air Toxics' system for logbooks, notebooks, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries are legible, signed, and dated.
- Errors are corrected in a manner that does not obliterate the original entry, initialed, and dated.
- Blank pages or substantial portions of pages which are left blank are crossed out to eliminate the possibility of data entry at a later date.

- Logbook pages and instrument printouts are signed and dated to indicate completion.
- At periodic intervals the Quality Assurance Department checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following is recorded as part of data documentation:
    - Date of analysis/operation
    - Initials/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, and standards used to perform the test/operation
    - Method used to perform test/operation
    - Equipment/instrumentation used to perform test/operation
    - Deviations, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer-generated data, the following information is recorded:
    - Samples(s) analyzed/operations performed
    - Date of analysis/operation
    - Unique instrument identification
    - Name or initial/date of person operating the instrument
    - Name or initial/date of person reviewing data
    - Any manual notation, interpretations, or integrations made on instrument printouts are signed, dated, and reviewed.

10.3 Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations needed to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, data from the local instrument system are uploaded directly to LIMS for review and reporting. This direct upload eliminates the need to re-type data and any associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. Analysts input these additional factors into the laboratory sample management system, where final calculations are performed.

10.4 Reporting Limits

It is important to ascertain the Limit of Quantitation (LOQ) that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The USEPA has established one method for determining Method Detection Limits (MDLs) from which LOQs can be extrapolated, which is summarized in the laboratory procedures.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual but are available at the laboratory and available to clients upon request.

For DoD-certified methods and compounds, quarterly evaluation of the LOQ and determination of Limit of Detection (LOD) is performed. The LOQ evaluation entails the calculation of precision and accuracy at the LOQ or Reporting Limit. The LOD for each compound is determined by analyzing a calibration standard or set of standards between the MDL and LOQ. The LOD is assigned the concentration at which the peak meets the signal-to-noise criteria.

The Reporting Limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOD, LOQ, method-specified limits, and project-specific limits.

10.5 Data Review

Final review and verification of the data is performed by a trained analyst or scientist using the sample results and quality control information entered into the laboratory sample management system. Another tool used for data review involves the use of proprietary in-house data validation software to review every data point generated and to alert the reviewer when manual integrations occur. The software is also programmed to report each analyte that does not meet acceptance criteria in the quality control and/or sample(s).

After determining that all necessary requirements for valid data are met, the reviewer electronically approves the data by updating the “Report Approved By” status with their initials. This action applies the electronic signature of the Technical Director. The computer is programmed with a list of approved reviewers for each test, and the system is password-protected to ensure that only qualified individuals verify the data.

10.6 Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit. The data systems used to generate and report results are programmed to flag values in this range as estimated.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, data is generated that does not meet all the method requirements due to sample matrix or other analytical problems. If the test cannot be repeated, or re-analysis would not yield more useable data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

10.7 Data Reporting

When each analysis is completed, reviewed, and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, plus comments added by the analyst when necessary. The report contains the electronic signature of the Technical Director. Copies of the reports and associated supporting raw data are retained in the Eurofins Air Toxics' archives.

Eurofins Air Toxics offers a variety of data levels and formats, from a basic report of sample and QC results only (Level II) to a comprehensive data package including all supporting quality control information and raw sample data (Level IV). The client directs the selection of report type. Various electronic formats are also available, formatted to client-specific file structure and sent via e-mail, direct upload, Website access, or commercial courier.

Client confidentiality of Eurofins Air Toxics' Web data is ensured by the use of a secured firewall Internet environment coupled with the use of a user ID and password to gain log-in access to the system.

If amendments to a final report are required due to omissions, errors, or additional requests, a workorder reissue is initiated. All reissues receive a unique workorder number to distinguish them from the original issue. Reissued reports require a reason for the reissue and date of the reissue in the laboratory narrative. The laboratory maintains all supporting documentation for the revision including corrections, additions, or deletions relative to the original report.

10.7.1 Reporting the Results

Analytical reports are printed with a cover page that summarizes all samples in that group. This page lists the Eurofins Air Toxics' assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and the laboratory's phone number in case there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results which meet all the requirements of NELAP and ISO 17025 are noted as so in the footer of the summary cover page.

10.8 Data Storage, Security, and Archival

Eurofins Air Toxics has documented procedures and instructions for the identification, collection, access, filing, storage, maintenance, and disposal of data records. Records are in the form of hard-copy paper records, electronic data files, magnetic tape, and CD-ROMs.

Eurofins Air Toxics maintains records to demonstrate conformance to specified requirements and the effective operation of its quality systems. Records are stored and maintained in such a way that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and prevent loss. Retention time for the records is in accordance with NELAP's minimum five-year requirement and/or specific procedures or instructions.

The laboratory maintains all documentation necessary for historical reconstruction of data, as follows:

- Analysis reports
- Data logbooks
- Instrument printouts
- Correspondence and client files
- Instrument and equipment logbooks
- Quality Assurance records
- Corporate documents
- Electronic records

11. AUDITS AND INSPECTIONS

11.1 Internal Quality Assurance Audits

Internal audits are performed by trained Quality Assurance personnel following a schedule planned yearly by the Quality Assurance Manager or at any time by the request of management. The audits cover all quality systems including but not limited to documentation practices, training, and adherence to current SOPs and methodology.

The following areas are identified to be audited by Quality Assurance:

a. Operations
b. Support Services
c. Sample Receiving and Login
d. Project Management and Sales
e. Information Technology (IT)
f. Quality Assurance

A written report with findings, observations, and/or recommendations is presented to the audited personnel, the team leaders, and management by the auditor. Responses to findings and observations are then submitted to the Quality Assurance Department within 30 days.

All audit notes, documentation, and reports are scanned and filed on the QA network drive.

11.2 Management Review System

A review of the laboratory's systems is performed by senior management on a biannual basis to evaluate effectiveness, identify areas requiring improvement, and establish timelines and accountability in addressing agreed-upon action items. This review includes internal assessment of the quality program and laboratory operations and external assessment through client feedback and audits. Four types of reports are generated by management or designated personnel:

11.2.1 **Quality Assurance Status Report:** Summarizes the results of internal and external assessments, the numbers and types of Corrective Action Reports (CARs) generated, status of any outstanding CARs, a summary of client inquiries received, proficiency tests (PT) results, and the number and types of reissued sample reports.

11.2.2 **Production Status Report:** Summarizes performance against key metrics such as turnaround time, details changes in sample mix and sample numbers, and outlines resource needs.

11.2.3 **Client Assessment Report:** Summarizes feedback from clients based on daily communication with project management and sales team as well as feedback collected by a third party as part of our Client Satisfaction Index (CSI) determination.

11.2.4 **Safety Assessment Report:** Outlines the safety incidents and "near misses" for the quarter and lists site assessment deficiencies.

The reports and records of the meetings are stored on a secure drive with management-only access for a minimum of five years.

11.3 Client Audits and Agency Inspections

Clients may audit our facility as assurance that their objectives are being met and that the laboratory is compliant with all applicable regulations, data quality, and project requirements.

Client audits can range from a laboratory tour to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific projects. Clients can only review data that pertains to their projects, and a non-disclosure agreement must be signed as per SOP #99.

Inspections can be performed by investigators or auditors from the USEPA, DoD, state and other regulatory agencies, third party accreditors (ACLASS), or regulatory agencies outside of the U.S.

The Quality Assurance Department is assigned the responsibility of hosting and working with agency and client representatives.

The Quality Assurance role includes:

- Escorting the investigator(s)
- Ensuring all questions are answered promptly and accurately
- Making note of all unresolved issues
- Informing management of the audit status and outcome
- Responding to the audit report
- Ensuring that appropriate corrective action is completed

11.4 Proficiency Testing Program

11.4.1 Proficiency Testing Samples (TNI/DoD)

Proficiency testing (PT) samples are used to measure analytical accuracy, precision, and report completeness. To be accredited under TNI and DoD-ELAP, the laboratory contracts with an outside approved PT sample provider in each field of testing (FOT). Testing is limited by availability of samples that meet NELAP and DoD-ELAP criteria (noted below). The provider must be a NIST-accredited PT provider. It may be necessary to participate in more than one proficiency testing program to be evaluated for multiple interdependent analyte groups. Currently, Eurofins Air Toxics participates in PT programs for EPA Method TO-15, which is ISO 17025 compliant, TO-13A, TO-17 VI, formaldehyde and emissions testing. In each calendar year, the laboratory will complete a minimum of one PT sample for each analyte or interdependent analyte group.

The following policies apply to laboratory PT sample analysis and reporting:

- The samples shall be analyzed and reported to the PT provider within 45 calendar days of receipt or the specific deadline specified by the PT provider.
- The PT sample is received and logged into an electronic sample receiving database in the same fashion as field samples.
- The laboratory must follow the PT provider's instructions for preparing the PT sample.
- The laboratory management and bench chemist ensure that the PT samples are prepared, analyzed, and reported in the same fashion as field samples using the same staff, equipment, and methods.
- Initial and continuing calibrations for the PT sample are analyzed at the same frequency of field samples.
- The PT sample cannot undergo duplicate or replicate analyses that would not ordinarily be performed on field samples. The PT sample result cannot be derived from averaging the results of multiple analyses unless specifically called for in the reference method.
- The PT sample can only be analyzed on equipment leased or owned by the company and handled only by bona fide employees of the company.
- The analysis of PT samples by temporary or contract employees is explicitly forbidden.

- The laboratory shall not subcontract any PT sample or portion.
- The laboratory shall not knowingly receive any PT sample or portion from another laboratory.
- The laboratory shall not communicate in any fashion with another laboratory concerning the PT sample or results.
- The laboratory shall not attempt to obtain the PT sample result prior to reporting.
- The PT sample reporting forms provided by the sample provider will be used to report the results and will be maintained in the laboratory's record system.
- The laboratory shall maintain copies of all written, printed, and electronic records relating the analysis or reporting of the PT sample for a period of five years or as required by the applicable regulatory program.
- A CAR will be generated any time an analyte result fails the PT assessment. A copy of the PT results will be sent to the accrediting agency, and associated corrective action summary will be sent upon request.
- The laboratory authorizes provider to release any PT assessment information to the accrediting agency.
- The QA Manager must sign the PT results form and, by so doing, attests that the sample was analyzed and reported in the same fashion as a field sample and followed the PT provider instructions for preparation.
- The laboratory must notify its primary accrediting agency and any other agencies under reciprocity that it has enrolled with a particular PT provider.
- The laboratory must notify its primary accrediting agency and any other agencies under reciprocity in the event it wishes to change PT providers.
- For each analyte or interdependent analyte group for which proficiency is not available, the certified laboratory will establish, maintain, and document the accuracy and reliability of its procedures through a system of internal quality management.
- Results of any failed PT samples are summarized in the Quarterly QA Status Report.

11.4.2 Proficiency Testing Samples (Non-NELAP/DoD)

Occasionally proficiency testing (PT) samples are submitted along with field samples by private clients. The laboratory processes and reports the

samples in the same fashion as field samples. When the client notifies the laboratory that one or more analytes appear to have failed, the report is processed through the normal Client Inquiry Corrective Action Process. The QA Manager will carry out an assessment and investigation into the circumstances surrounding the proficiency results, including aspects relating to how the client prepared the sample for submission. The outcome of the assessment will be documented as a CAR and maintained on file for a period of five years. Results of any failed external PT samples are summarized in the Quarterly QA Status Report.

12. CORRECTIVE AND PREVENTIVE ACTION

12.1 Laboratory Investigations and Corrective Action

The Quality Assurance (QA) Department manages the Corrective Action Program and maintains the Corrective Action tracking database using the c.Support software program. A Corrective Action Report is initiated any time sample results are affected by non-conformance with established SOPs or program requirements, any time an external assessment results in a finding, any time there is a failed proficiency evaluation sample, and when a client inquiry results in a quality finding. The expectation is that any CAR should be resolved within 30 days.

The client is notified if there is an issue that could potentially affect the quality of sample results. The communication with the clients is recorded.

The software program tracks all parts of the CAR system: root cause investigation, immediate corrective action, long-term corrective action, and preventive action. It also tracks client communications regarding the incident. The QA Manager reviews all opened CARs for completeness and resolution.

Detailed information about the CAR process is described in SOP #61.

13. SERVICE TO CLIENTS

The Project Management System is defined in SOP #1. The following are brief descriptions of the elements comprising project management systems.

13.1 Review of Work Requests, Tenders, and Contracts

Eurofins Air Toxics places great importance on understanding client requirements for a project. The laboratory ensures, to the best of our ability, that client and project requirements are outlined and understood prior to acceptance

of the project, including required laboratory accreditations and nonstandard work requests. All inconsistencies are discussed and addressed with both the client and the technical laboratory staff before the project is initiated and samples arrive. This is achieved in various ways, including the review of client work plans, Request for Proposals (RFPs) project Quality Assurance Project Plans (QAPPs), requested analytical methods and protocols, business contracts, and quality agreements. A key client contact is assigned to oversee each project. Communication between the client and Eurofins Air Toxics technical staff is coordinated through the Project Managers. The Project Management group relays any project changes or modifications to the technical group. They also relay issues encountered by the laboratory back to the client.

13.2 Timely Delivery

Evaluating laboratory capacity, assignment of resources, and ability to perform specific projects is a joint responsibility between the Technical Director and the Laboratory Director. Eurofins Air Toxics recognizes that one of the most important aspects of the services offered is turnaround time.

To ensure timely delivery, many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before a bid is submitted in order to meet a client's schedule.

Management regularly monitors the status of turnaround time including those projects that have exceeded a current turnaround time. Proactive communication regarding potentially missed deadlines is expected from the laboratory management to the Project Managers to keep the client informed of report delivery status.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties.

13.3 Subcontracting

Occasionally, Eurofins Air Toxics subcontracts analyses to other laboratories if the requested testing is not routinely performed in our laboratory. Testing is only subcontracted with the client's knowledge and approval. Subcontract laboratories are selected based on their qualifications. If tests require a specific agency certification, only an appropriately certified laboratory will be used.

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LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix A

Terms and Definitions

(nine total pages including this cover)

Current as of March 5, 2014

TERMS AND DEFINITIONS

Accuracy: The degree of agreement between an observed value and an accepted reference value.

Active sampling: The process of collecting a sample using pump or vacuum source to pull a known volume of vapor through a sorbent cartridge, filter, or liquid impinger.

Ambient air: Outdoor air (also can include indoor air).

Analyte: The substance or component for which a sample is analyzed to determine its presence or quantity.

APH (air-phase hydrocarbons): Aliphatic and aromatic fractions identified in vapor-phase samples.

Approved: The determination by a state or federal accrediting agency that a certified laboratory may analyze for an analyte under the specified method.

Assessment: The process of inspecting, testing, and documenting findings for purposes of certification or to determine compliance.

ASTM International (formerly known as American Society for Testing and Materials)**:** Organization which develops international voluntary consensus-based standards.

Bag: An air-sampling container consisting of inert polymeric material.

Batch: A group of analytical samples (≤ 20) of the same matrix processed together, including extraction, concentration, and analysis using the same process, staff, and reagents.

BFB (4-Bromofluorobenzene): Compound used to verify that the mass spectrometer meets the tuning requirements of the method. Also can be used as an internal standard or surrogate.

Blank samples: Negative control samples used to assess potential contamination from sampling procedures or analytical processes. They can be field blanks or laboratory blanks.

BTEX: Benzene, toluene, ethylbenzene, and xylenes

Canister: A stainless steel spherical air-sampling device consisting of Summa polished or glass-lined internal walls and a leak-tight on/off valve.

Certificate of Analysis (C of A): An authenticated document, issued by an appropriate authority, that assures a regulated product has met its product specification and quality.

Chain of Custody (COC): The chronological documentation of the custody of an environmental sample from the time it is taken until it is disposed.

Contamination: The effect caused by the introduction of a target analyte from an outside source into the test system.

Continuing Calibration Verification (CCV): A component of Quality Control used to verify instrument linearity with respect to the Initial Calibration (ICAL). A CCV is analyzed at the beginning of every analytical sequence and then periodically depending on the method. Certain methods also include a CCV in every analytical sequence as an End Check.

Control charts: Statistical tools for monitoring the performance of a particular task on a continuing basis. The control chart is prepared for each test parameter after 20 determinations have been performed. The mean is plotted with the warning limits being ±2s and the control limits being ±3s (s = Standard deviation).

Corrective action: An action taken to eliminate the cause(s) of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Corrective Action Report: See NCCAR.

Data reduction: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results by a specific method and meet measurement quality objectives.

Detection Limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence.

%Difference (%D): A measure of precision between the expected value and the actual value, typically used to measure performance of the daily CCV RRF as compared to the Initial Calibration average RRF.

DoD: U.S. Department of Defense

Duplicate sample: A sample collected for checking the preciseness of the sampling process. Duplicate samples are collected at the same time and from the same source as the study samples.

Equipment Blank: A sample that is known not to contain the target analyte, used to check the cleanliness of sampling devices. It is collected in a sampling container from a clean sample collection device and returned to the laboratory as a sample.

Field Blank: A sample that is known not to contain the target analyte, used to check for analytical artifacts or contamination introduced by sampling and analytical procedures. It is taken to the sampling site and exposed to sampling conditions, then returned to the laboratory and treated as an environmental sample.

Field Duplicate: A sample collected at the same time from the same source but submitted and analyzed as a separate sample.

GC (gas chromatograph): Analytical instrumentation used to resolve complex mixtures into individual peaks for identification and quantitation. Separation is achieved as chemicals are retained at varying rates by the column phase.

Holding time: The maximum time that a sample may be held prior to preparation or analysis.

HPLC (high-pressure liquid chromatography): A form of liquid chromatography used to separate compounds that are dissolved in solution (also known as high-performance liquid chromatography).

Impinger: A glass vessel used to contain collection solution through which a stream of air is bubbled for sampling purposes.

Initial Calibration (ICAL): Demonstration of a linear response to different concentrations of calibration standards within a defined range.

Initial Calibration Verification (ICV): Verifies the Initial Calibration using a different source standard from the one used for Initial Calibration.

Initial Demonstration of Analytical Capability: The procedure described in USEPA 40 CFR 136 Appendix A, used to determine a laboratory's accuracy and precision in applying an analytical method.

Instrument Blank: A sample that is known not to contain the target analyte, processed through the instrumental steps of the measurement process and used to determine the absence of instrument contamination prior to analysis of field samples.

Instrument Detection Limit (IDL): The concentration of the analyte that produces a signal greater than five times the signal-to-noise ratio of the instrument.

Interference: The effect on the final result caused by the sample matrix.

Internal Standard (IS): A measured amount of a certain compound added after preparation or extraction of a sample.

Ketones: Any of a class of organic compounds characterized by a carbonyl group attached to two carbon atoms.

Key Personnel: The laboratory director, technical director, quality assurance manager, and team leader, all of whom meet the requirements of the NELAP rule.

Laboratory Control Sample (LCS): An independent second source reference standard that goes through the same pretreatment and preparation procedures as the samples. It validates the accuracy of the Initial Calibration.

Laboratory Duplicate: An aliquot of the same sample that is prepared and analyzed at the same time.

Laboratory Information Management System (LIMS): A laboratory's electronic data system that collects, analyzes, stores, and archives records and documents.

Limit of Detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence.

Limit of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias.

Matrix: The component or substrate (e.g., surface water, drinking water, air, liquid waste) which contains the analyte(s) of interest.

Matrix Spike (MS): A sample prepared to determine the effect of the matrix on a method's recovery efficiency by adding a known amount of the target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. It is used to evaluate accuracy.

Matrix Spike Duplicate (MSD): Duplicate of the matrix spike sample. Results are compared with MS to determine precision.

Mass spectrometer (MS): Analytical instrumentation used to identify and quantify chemicals utilizing spectral fragmentation patterns based on chemical structures.

Measurement uncertainty: Measurement uncertainty is the estimation of potential errors in a measurement process and is expressed as $\pm$ 2X(*s*) of the historical mean of LCS recoveries.

Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero as determined from analysis of a sample containing the analyte in a given matrix (40 CFR Part 136, Appendix B, July 1995).

NCCAR (Non-conformance/Corrective Action Report): A report that identifies, communicates, tracks, and resolves a non-conformance.

NIST: National Institute of Standards and Technology

NMOC: Non-methane organic compounds

OSHA: Occupational Safety and Health Administration

PAHs (polycyclic aromatic hydrocarbons): Hydrocarbons made up of fused aromatic ring molecules.

Passive sampling: Sample collection conducted without the use of mechanical pumps or vacuums. Collection relies on principle of diffusion.

PCBs (polychlorinated biphenyls): Biphenyl compounds with chlorine atoms positioned on the benzene rings.

ppbv: parts per billion by volume

ppmv: parts per million by volume

Practical Quantitation Limit (PQL): A synonym for the standard of lowest concentration contained in the Initial Calibration. It is the smallest concentration of the analyte that can be reported with a specific degree of confidence.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance or a range, in either absolute or relative terms.

Preservation: The temperature control or the addition of a substance to maintain the chemical or biological integrity of the target analyte.

Proficiency Testing (PT): A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.

Proficiency Test (PT) sample: A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance (QA): An integrated system of activities involving planning, quality control, reporting, and quality assessment and improvement to ensure that the product meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP): An orderly assemblage of detailed procedures designed to produce data of sufficient quality to meet the data quality objectives for a specific data collection activity.

Quality Control (QC): A procedure or set of procedures intended to ensure that a product or performed service adheres to a defined set of quality criteria.

%R: %Recovery

Relative Percent Difference (RPD): A measure of precision between two measurements calculated by dividing the absolute value of the difference between the measurements by their average and expressed as a percentage.

Reporting Limit (RL): The smallest concentration of an analyte that can be measured with a stated probability of significance. All Initial Calibrations contain a standard at the Reporting Limit. The Reporting Limit is never less than the Practical Quantitation Limit (PQL).

Reporting Limit verification: A re-quantification of the lowest concentration data point of an Initial Calibration to test the percent recovery of each component. Analyte recovery should be between 50–150% to verify detection limit accuracy.

Relative Standard Deviation (RSD): A measure of precision often used to evaluate linearity of an Initial Calibration. The relative response factor is calculated at each calibration level, and the RSD is calculated by dividing the standard deviation by the average value.

RRF: Relative Response Factor

RT: Retention Time

Safety Data Sheet (SDS): A technical document that contains information on the chemical make-up, use, storage, handling, emergency procedures, and potential health effects related to a hazardous material (formerly Material Safety Data Sheets).

Selectivity: The capability of a method or instrument to respond to the target analyte in the presence of other substances or things.

Semivolatile compound (SVOC): An organic compound which has a boiling point higher than water and which may vaporize when exposed to temperatures above room temperature.

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels of a target analyte.

Soil vapor (also referred to as "soil gas"): Vapor-phase volatile compounds that migrate or evaporate from contaminated soil.

Soil vapor extraction (SVE): A physical treatment process for in situ remediation of volatile contaminants in vadose zone (unsaturated) soils.

Standard Operating Procedure (SOP): A written document that details the steps of an operation, analysis, or action, the techniques and procedures for which are thoroughly prescribed and accepted as the procedure for performing certain routine or repetitive tasks.

Surrogate: A substance unlikely to be found in the environment that has properties which mimic the target analyte and that is added to a sample to check for analytical efficiency.

Target analyte: The analyte that a test is designed to detect or quantify.

Technical employee: A designated individual who performs the analytical method and associated techniques.

TIC: Tentatively Identified Compound

TNMOC: Total non-methane organic compounds

TPH: Total petroleum hydrocarbons

TRH: Total recoverable hydrocarbons, which are differentiated from total petroleum hydrocarbons (TPH) in that non-fuel-related peaks are subtracted from the TPH result but are included in TRH.

Trip Blank: A sample known not to contain the target analyte, which is carried to the sampling site and transported to the laboratory for analysis without having been exposed to the sampling procedures.

TVH: Total volatile hydrocarbons

Vapor intrusion (VI): The process by which vapors originating from contaminated soil or groundwater migrate through the subsurface into nearby buildings, potentially impacting indoor air quality.

VPH: Volatile Petroleum Hydrocarbons

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Air change rate: The flow rate of clean air into the chamber divided by the chamber volume. Also, the ratio of volume of clean, conditioned air brought into the emission test chamber or building space per unit time to the chamber or building space volume.

Air flow rate: Air volume entering the emission test chamber per unit time.

Air velocity: Air speed over the surface of the test specimen.

Aldehydes: Formaldehyde, acetaldehyde, and other carbonyl compounds detectable by derivatization with DNPH and analysis by HPLC.

Area specific flow rate: Ratio of the inlet air flow rate to the nominal surface area of the product or the product test specimen.

Background concentration: VOC concentrations in emission test chamber in the absence of a product test specimen.

CREL: Non-cancer chronic reference exposure level developed by Cal/EPA OEHHA. These are inhalation concentrations to which the general population, including sensitive individuals, may be exposed for long periods (10 years or more) without the likelihood of serious adverse systemic effects other than cancer.

Emission factor: Mass of VOC emitted per unit time from a specific unit area of product surface. Other unit measures such as product mass or length may be used as appropriate.

Emission rate: Mass of VOC emitted by an entire product or test specimen per unit time.

Emission test chamber: Non-contaminating, inert enclosure of defined volume with controlled environmental conditions for inlet air flow rate, temperature, and humidity used for determination of VOC emissions from product test specimens.

Loading factor: Ratio of the exposed surface area of the product or the test specimen to the volume of the building space or the emission test chamber.

Manufacturer's identification number: Unique product identifier from which a manufacturer is able to determine the product name, product category or subcategory, manufacturing location, date of manufacture, production line, and/or other pertinent identifying information for the product.

Product category: General group of similar products intended for a particular application and performance, such as VCT, laminated wood flooring, broadloom carpet, sheet vinyl flooring, plywood, OSB, interior paint, etc.

Product subcategory: Group of products within a product category having similar chemistry, construction, weight, formulation, and manufacturing process and which may have a similar VOC emissions profile.

Representative product sample: A product sample that is representative of the product manufactured and produced under typical operating conditions.

Sampling interval: Time over which a single air sample is collected.

Sampling period: Established time for collection of air sample from emission test chamber.

Specific emission rate: Emission rate normalized to the area, mass, or length of a product (i.e., equivalent to emission factor).

Test specimen: Portion of representative sample prepared for emission testing in an emission test chamber following a defined procedure.

TVOC: Sum of the concentrations of all identified and unidentified VOCs between and including n-hexane through n-hexadecane (i.e., C_6 – C_{16}) as measured by the GC/MS TIC method and expressed as a toluene equivalent value.

Ventilation rate: Same as air change rate.

Volatile organic compounds (VOCs): Carbon-containing compounds (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate) with vapor pressures at standard conditions approximately ranging between those for n-pentane through n-heptadecane. For the purposes of this method, formaldehyde and acetaldehyde are considered to be VOCs.

Zero time: Time establishing the beginning of an emission test.

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Appendix B

Procedure Cross-Reference List

(Three total pages including this cover)

Current as of March 5, 2014

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Appendix C

Certifications and Accreditations

(Two total pages including this cover)

Current as of March 5, 2014

Certifying Agency	Air Toxics Certificate #	Basis of Certification/Approval	Location of Certificate and Parameter List
Arizona DHS	AZ0775	Onsite assessment (annual), LQAM and SOP	Laboratory internal network: O:\QA\Certifications
California DPH (Primary NELAP)	12282CA	Onsite assessment (biennial) LQAM, SOP and WP PTs	Laboratory internal network: O:\QA\Certifications
New York State DOH	11291	LQAM, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
Oregon DHS (Primary NELAP)	CA300005	Onsite assessment (biennial) LQAM and SOP Review	Laboratory internal network: O:\QA\Certifications
Texas CEQ	T104704434-13-6	LQAM, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
State of Utah DOH	CA009332013-4	LQAM, WP PT, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
Washington DOE	C935-13	PT, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
DoD-ELAP_ ISO/IEC 17025:2005	ADE-1451	DOD QSM for Environmental Laboratories v.4.2 Onsite assessment (biennial)	Laboratory internal network: O:\QA\Certifications
Virginia DCLS	2612	Secondary NELAP	Laboratory internal network: O:\QA\Certifications
New Jersey DEP	CA016	LQAM, SOPs, Secondary NELAP	Laboratory internal network: O:\QA\Certifications

All latest certificates and licenses are posted by the laboratory entrance.

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LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

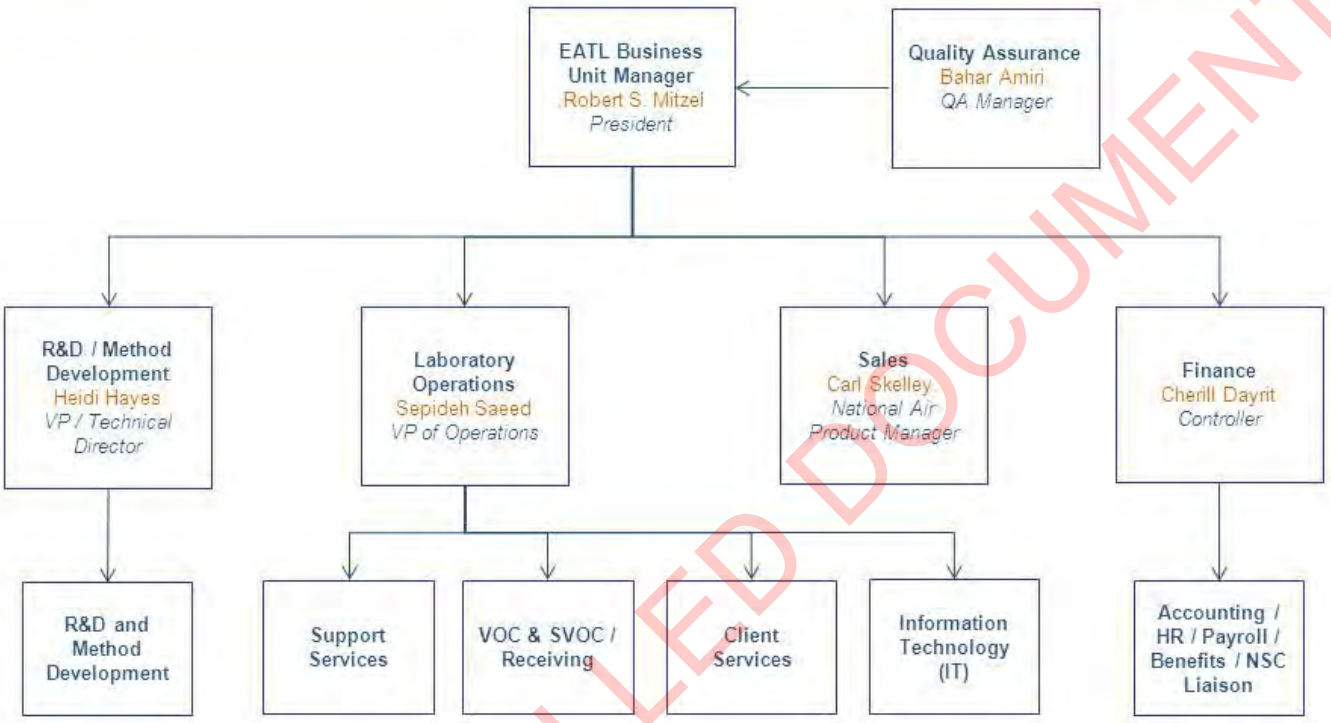
Appendix D

Organizational Charts

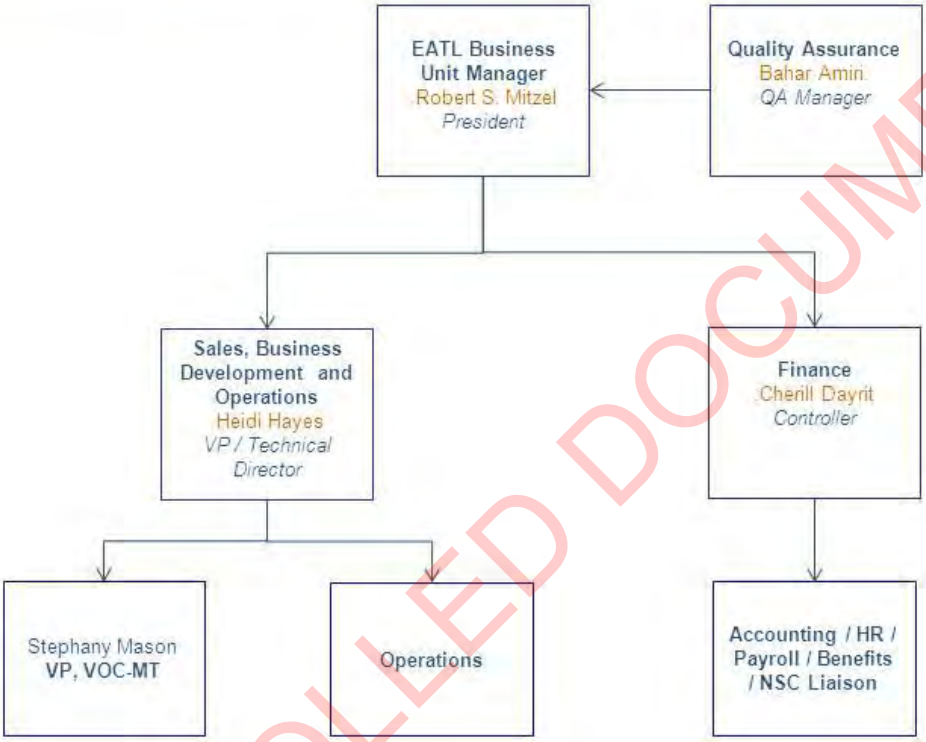
(four total pages including this cover)

Current as of March 5, 2014

Organization Chart – Eurofins Air Toxics, Inc.



Organization Chart – Product Testing



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Appendix E

Analytical Methods

(seventy-seven total pages including this cover)

Current as of March 5, 2014

ANALYTICAL METHODS

ANALYTICAL METHODS

Section 1.0

Method: Modified EPA TO-17 VOCs and SVOCs – General Applications

Eurofins Air Toxics SOP #5 Revision 15 Effective Date: December 23, 2013 Methods Manual Summary

Description: This method is an alternative to the canister-based sampling and analysis methods that are presented in EPA Compendium Methods TO-14A and TO-15. Sorbent sampling is also amenable to efficient collection and measurement of semi-volatile compounds that are prone to condensing on the surface of the canister. Thermal desorption gas chromatograph/mass spectrometer (GC/MS) can be applied to matrices beyond ambient air such as soil gas and materials emissions by carefully selecting the appropriate sorbent and sampling parameters. Single bed sorbents such as Tenax TA and Carbopack B can be utilized to collect a specific volatility range while multi-bed sorbent tubes are effective in collecting a wide volatility range. (See Air Toxics' TO-17 VI method for the multi-bed tube application.)

Samples are collected by drawing a measured volume of air through the sorbent tubes. Collection is performed using a low flow vacuum pump or a volumetric syringe attached to the outlet side of the tube. Analysis is accomplished by heating the sorbent tube and sweeping the desorbed compounds onto a secondary "cold" trap for water management and analyte refocusing. The secondary trap is heated for efficient transfer of compounds onto the gas chromatograph (GC) for separation followed by detection using mass spectrometry (MS).

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage, safe sampling volume, and desorption efficiency are not validated. Full validation may be available upon request.

The TO-17 method offers significant flexibility in its scope and application depending on the sorbent selected. The most commonly requested sorbent tubes and associated analytes are summarized in the QC tables below.

Table 1. Summary of Sorbent Applications

Sorbent	Typical Analyte Range	Water Management
Tenax TA	C7 – C26	Hydrophobic
Tenax GR	C7 – C30	Hydrophobic
Multi-bed "VI tube" (See TO-17 VI application)	C3 – C26	Largely Hydrophobic

Table 2. Method TO-17 VOCs (Tenax GR/TA) Reporting Limits and QC Limits

Analytes	Reporting Limit (ng)	QC Acceptance Criteria		
		ICAL (%RSD)	LCS (% R)	CCV (%D)
1,1,1-Trichloroethane	5.0	30	70 – 130	30
1,1,1,2-Tetrachloroethane	5.0	30	70 – 130	30
1,1,2,2-Tetrachloroethane	5.0	30	70 – 130	30
1,1,2-Trichloroethane	5.0	30	70 – 130	30
1,1-Dichloropropene	5.0	30	70 – 130	30
1,2,3-Trichlorobenzene	5.0	30	70 – 130	30
1,2,3-Trichloropropane	5.0	30	70 – 130	30
1,2,4-Trichlorobenzene	5.0	30	70 – 130	30
1,2,4-Trimethylbenzene	5.0	30	70 – 130	30
1,2-Dibromo-3-chloropropane	5.0	30	70 – 130	30
1,2-Dichlorobenzene	5.0	30	70 – 130	30
1,2-Dichloroethane	5.0	30	70 – 130	30
1,2-Dichloropropane	5.0	30	70 – 130	30
1,3,5-Trimethylbenzene	5.0	30	70 – 130	30
1,3-Dichlorobenzene	5.0	30	70 – 130	30
1,3-Dichloropropane	5.0	30	70 – 130	30
1,4-Dichlorobenzene	5.0	30	70 – 130	30
2-Chlorotoluene	5.0	30	70 – 130	30
4-Chlorotoluene	5.0	30	70 – 130	30
Benzene	10	30	70 – 130	30
Bromobenzene	5.0	30	70 – 130	30
Bromodichloromethane	5.0	30	70 – 130	30
Bromoform	5.0	30	70 – 130	30
Butylbenzene	5.0	30	70 – 130	30
Carbon Tetrachloride	5.0	30	70 – 130	30
Chlorobenzene	5.0	30	70 – 130	30
Chloroform	5.0	30	70 – 130	30
cis-1,3-Dichloropropene	5.0	30	70 – 130	30
cis-1,4-Dichloro-2-butene	5.0	30	70 – 130	30
Cumene	5.0	30	70 – 130	30

Dibromochloromethane	5.0	30	70 – 130	30
Dibromomethane	5.0	30	70 – 130	30
Ethylbenzene	5.0	30	70 – 130	30
Ethylene Dibromide	5.0	30	70 – 130	30
Hexachlorobutadiene	5.0	30	70 – 130	30
Naphthalene	5.0	30	70 – 130	30
m,p-Xylene	10	30	70 – 130	30
o-Xylene	5.0	30	70 – 130	30
p-Cymene	5.0	30	70 – 130	30
Propylbenzene	5.0	30	70 – 130	30
sec-Butylbenzene	5.0	30	70 – 130	30
Styrene	5.0	30	70 – 130	30
tert-Butylbenzene	5.0	30	70 – 130	30
Tetrachloroethene	5.0	30	70 – 130	30
Toluene	5.0	30	70 – 130	30
trans-1,3-Dichloropropene	5.0	30	70 – 130	30
trans-1,4-Dichloro-2-butene	5.0	30	70 – 130	30
Trichloroethene	5.0	30	70 – 130	30

Note: Full list may not be appropriate, depending on sample volume requirements.

Table 3. Commonly requested TPH parameters (Tenax GR/TA)

TPH	Reporting Limit (ng)	ICAL (%RSD)	ICV (% R)	CCV (%D)	LCS (%R)
GRO (Gasoline Range)	1000	30	70 – 130	30	70 – 130
DRO (C10-C24 Diesel Range)	1000	30	70 – 130	30	70 – 130
Kerosene	1000	30	70 – 130	30	70 – 130
Mineral Spirits (C9-C12 range)	1000	30	70 – 130	30	70 – 130

Table 4. Internal Standard and Field Surrogate Recoveries

Internal Standards		
Analyte	**CCV IS % Recovery**	**Sample IS % Recovery**
Bromochloromethane	60 – 140	60 – 140
1,4-Difluorobenzene	60 – 140	60 – 140
Chlorobenzene-d5	60 – 140	60 – 140
Field Surrogates		
Analyte	**% Recovery**	
1,2-Dichloroethane-d4	50 – 150	
Toluene-d8	50 – 150	
Naphthalene-d8	50 – 150	

Table 5. TO-17 SVOCs (Tenax GR/TA)

Analytes	Reporting Limit (ng)	Acceptance Criteria		
		ICAL (%RSD)	LCS (% R)	CCV (%D)
Naphthalene	5.0	30	70 – 130	30
2-Methylnaphthalene	5.0	30	70 – 130	30
Acenaphthylene	5.0	30	70 – 130	30
Acenaphthene	5.0	30	70 – 130	30
Fluorene	5.0	30	70 – 130	30
Phenanthrene	5.0	30	70 – 130	30
Anthracene	5.0	30	70 – 130	30
Fluoranthene	5.0	30	70 – 130	30
Pyrene	10	30	70 – 130	30
Internal Standards				
Analyte	**CCV IS % Recovery**		**Sample IS % Recovery**	
Bromofluorobenzene	60 – 140		60 – 140	
Field Surrogates				
Analyte	**% Recovery**			
Naphthalene-d8	50 – 150			

Table 5. Summary of Calibration and QC Procedures for TO-17 General Application

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
BFB Tune Check	Every 24 hours	TO-15 tune criteria	Correct problem then repeat tune.
5-Point Calibration	Prior to sample analysis	%RSD ≤ 30%, 2 allowed out up to 40%	Correct problem then repeat Initial Calibration Curve.
LCS	After each initial Calibration Curve and daily prior to analysis	Recovery 70 – 130%	If more than 5% target compounds exceed criteria, evaluate system and reanalyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
LCSD	Each analytical batch	Recovery 70 – 130%; %RPD ≤ 25%	If more than 5% target compounds exceed criteria, evaluate system and recollection process. Correct problem and reanalyze.
Continuing Calibration Verification (CCV)	At the start of each analytical clock	70 – 130 %	If project-specified risk drivers exceed these criteria, more than 5% of the compounds exceed these criteria, or any VOC exceeds 50–150% recovery, maintenance is performed and the CCV test repeated. If the system still fails the CCV, perform a new 5-point Calibration Curve.
Laboratory Blank	After the CCV and at the end of the analytical batch	Results less than the laboratory RL	Inspect the system and re-analyze the Blank. No corrective action for Lab Blank at end of batch.
Internal Standard (IS)	As each standard, Blank, and sample is being loaded	**CCVs:** area counts 60–140%, RT w/in 20 sec of mid-point in ICAL **Blanks and samples**: Retention time (RT) must be within ±0.33 minutes of the RT in the CCV. The IS area must be within ±40% of the CCV's IS area for the Blanks and samples.	**CCV:** Inspect and correct system prior to sample analysis. **Blanks:** Inspect the system and re-analyze the Blank. **Samples:** Samples cannot be re-analyzed due to the nature of the sorbent cartridges. However investigate the problem by reviewing the data. If necessary, run a Lab Blank to check the instrument performance. Report the data and narrate.

Field Surrogates	Each clean sample tube used for pumped sample collection and lab blank and QC samples	50 – 150%	**For blanks:** Inspect the system and re-analyze the Blank. **For samples:** If no obvious reason can be ascertained after evaluation of the data and sample collection parameters, the sample should be reanalyzed to verify out of control recovery. If recovery is out of acceptance criteria in both the primary and recollected sample, the primary sample is reported with the surrogate flagged.

ANALYTICAL METHODS

Section 2.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (Standard/Quad)

Eurofins Air Toxics SOP #6 Revision 30 Effective Date: April 30, 2013 Methods Manual Summary

Description: This method involves full scan gas chromatograph/mass spectrometer (GC/MS) analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds (VOCs) using EPA Method TO-14A/TO-15 protocols. An aliquot of up to 0.5 liters of air is withdrawn from the canister utilizing a volumetric syringe, volumetric loop, or mass flow controller. This volume is loaded onto a hydrophobic multibed sorbent trap to remove water and carbon dioxide and to concentrate the vapor sample. The focused sample is then flash-heated to sweep adsorbed VOCs onto a secondary trap for further concentration and/or directly onto a GC/MS for separation and detection.

Eurofins Air Toxics maintains a suite of TO-14A/TO-15 methods, each optimized to efficiently meet the data objectives for a wide range of targeted concentration ranges. The methods, their reporting limits, and typical applications are summarized in the table below. This method summary describes TO-14A/TO-15 (Standard or Quad).

Eurofins Air Toxics Method	Base Reporting Limits	Typical Application
TO-14A/TO-15 (5&20)	5 – 20 ppbv	Soil gas and ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient air, soil gas, and ppbv level vapor matrices
TO-14A/TO-15 (Low-level)	0.1 – 0.5 ppbv	Indoor and outdoor air
TO-14A/TO-15 SIM	0.003 – 0.5 ppbv	Indoor and outdoor air

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, Eurofins Air Toxics reports these non-routine compounds with partial validation. Validation may include a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification analyzed, and no method detection limit study performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics takes no modifications of technical significance to Method TO-15 for the "Quad" configurations. Since Eurofins Air Toxics applies TO-15 methodology to all Summa canisters regardless of whether TO-14A or TO-15 is specified by the project, the laboratory performs a modified version of method TO-14A as detailed in Table 1. Please note that Methods TO-14A and TO-15 were validated for specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and not recommended for ambient or indoor air samples. It is the responsibility of the data user to determine the usability of TO-14A and TO-15 results generated from Tedlar bags.

Table 1. Summary of TO-14A Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Drier	Multibed hydrophobic sorbent
Blank acceptance criteria	≤ 0.2 ppbv	≤ RL
BFB ion abundance criteria	Ion abundance criteria listed in Table 4 of TO-14A	Follow abundance criteria listed in TO-15.
BFB absolute abundance criteria	Within 10% when comparing to the previous daily BFB	CCV internal standard area counts are compared to ICAL; corrective action when recovery is less than 60%.
Initial Calibration	≤ 30% RSD for listed 39 VOCs	≤ 30% RSD with 2 of Eurofins Air Toxics' 62 standard compounds allowed out to ≤ 40% RSD

The standard target analyte list, reporting limit (RL) also referred to as Limit of Quantitation, QC criteria, and QC summary can be found in Tables 2 through 5.

Table 2. Method TO-14A/TO-15 Analyte List (Quad)

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	2.0	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Benzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane*	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25

Chloroethane	2.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	0.5	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.5	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	2.0	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Methyl Chloroform (1,1,1-Trichloroethane)	0.5	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Styrene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	2.0	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	2.0	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	2.0	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	0.5	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Acetone	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	0.5	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	2.0	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Dibromochloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	2.0	≤ 30%	70 – 130	70 – 130	± 25

Heptane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Hexane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Isopropanol	2.0	≤ 30%	70 – 130	70 – 130	± 25
Methyl t-Butyl Ether (MTBE)	0.5	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	0.5	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Cumene	0.5	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	2.0	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene**	2.0	≤40%	60 – 140	60 – 140	± 25
TPH (Gasoline) ***	25	1-Point Calibration	N/A	ICV only; 60 – 140	± 25
NMOC (Hexane/Heptane)***	10	1-Point Calibration	N/A	NA	± 25

*Bromomethane recovery can be variable due to moisture/sorbent interactions specifically on the 2-trap concentration system. Data may require qualifier flags.

**Due to its low vapor pressure, Naphthalene may exceed TO-15 performance requirements. The wider QC limits reflect typical performance. Although Naphthalene is not on Eurofins Air Toxics "standard" TO-15 list, it is commonly requested and included in Table 2.

***TPH and NMOC are not on Eurofins Air Toxics' "standard" TO-15 list, but are included in Table 2 due to common requests.

Table 3. Internal Standards

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 4. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table 5. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	TO-15 ion abundance criteria	Correct problem then repeat tune.
Minimum 5-Point Initial Calibration (ICAL)	Prior to sample analysis	% RSD ≤ 30 with 2 compounds allowed out to ≤ 40% RSD	Correct problem then repeat Initial Calibration curve.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration curve, and daily prior to sample analysis	Recoveries for 85% of "Standard" compounds must be 70–130%. No recovery may be < 50%. If specified by the client, in-house generated control limits may be used.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS) for Non-standard compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be <50%.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Continuing Calibration Verification (CCV) for Standard compounds	At the start of each analytical clock after the tune check	70–130%	Compounds exceeding this criterion and associated data will be flagged and narrated with the exception of high bias associated with non-detects. If more than two compounds from the standard list recover outside of 70–130%, corrective action will be taken. If any compound exceeds 60–140%, samples are not analyzed unless data meets project needs. Check the system and reanalyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV) for Non-standard Compounds	Per client request or specific project requirements only.	Recoveries of compounds must be 60–140%. No recovery may be <50%.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory reporting limit	Inspect the system and re-analyze the blank. "B"-flag data for common contaminants.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ±40% of the area counts of the daily CCV internal standards.	**For blanks:** Inspect the system and reanalyze the blank. **For samples:** Re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, dilute the sample until ISs are within acceptance limits and narrate.
Surrogates	As each standard, blank, and sample is being loaded	70–130% If specified by the client, in-house generated control limits may be used.	**For blanks:** Inspect the system and reanalyze the blank. **For samples:** Re-analyze the sample unless obvious matrix interference is documented. If the %Rs are within limits in the re-analysis, report the second analysis. If %Rs are out-of-limits a second time, report data from first analysis and narrate.
Laboratory Duplicates – Laboratory Control Spike Duplicates (LCSD)	One per analytical batch	RPD ≤25%	Narrate exceedances. If more than 5% of compound list is outside criteria or if compound has >40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 3.0

Method: ASTM D1946 – Atmospheric Gases

Eurofins Air Toxics SOP #8 Revision 22 Effective Date: December 24, 2013 Methods Manual Summary

Description: This method involves gas chromatograph (GC) analysis of soil gas, landfill gas, ambient air, or stack gas collected in Summa™ canisters, Tedlar bags, or any vessel that has been demonstrated to be clean and leak free. Samples are analyzed for Methane, fixed gases, and Non-Methane Organic Carbon (NMOC) using modified ASTM D1946 protocols. Because the sample is withdrawn from the vessel by positive pressure, rigid containers are first filled to positive pressure using UHP Helium or Nitrogen. Samples are then analyzed using a GC equipped with a FID and a TCD.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Since the protocols in the ASTM D1946 standard were designed for the analysis of reformed gas, the laboratory has taken modifications to apply the method to environmental samples covering a wide concentration range and to implement standard NELAP and EPA calibration criteria. The method modifications, standard target analyte list, reporting limits (RL), Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for ASTM D1946

Requirement	ASTM D1946	Eurofins Air Toxics Modifications
Calibration	A single-point calibration is performed using a reference standard closely matching the composition of the unknown.	A minimum 3-point calibration curve is performed. Quantitation is based on a daily calibration standard, which may or may not resemble the composition of the associated samples.
Reference Standard	The composition of any reference standard must be known to within 0.01 mol % for any component.	The standards used by Eurofins Air Toxics are blended to a ≥ 95% accuracy.
Sample Injection Volume	Components whose concentrations are in excess of 5% should not be analyzed by using sample volumes greater than 0.5 mL.	The sample container is connected directly to a fixed volume sample loop of 1.0 mL. Linear range is defined by the calibration curve. Bags may be loaded by vacuum or by positive pressure.
Normalization	Normalize the mole percent values by multiplying each value by 100 and dividing by the sum of the original values. The sum of the original values should not differ from 100% by more than 1.0%.	Results are not normalized. The sum of the reported values can differ from 100% by as much as 15%, either due to analytical variability or an unusual sample matrix.

Precision	Precision requirements established at each concentration level.	Duplicates should agree within 25% RPD for detections >5X the RL.

Table 2. ASTM D1946 Method Compound List and QC Limits

Compound	Reporting Limit (%)	ICAL Criteria (%RSD)	ICV/LCS Criteria (%R)	CCV Criteria (%D)	Precision Limits (RPD)**
Carbon Dioxide	0.010	≤ 15%	85 – 115	± 15%	± 25%
Carbon Monoxide	0.010	≤ 15%	85 – 115	± 15%	± 25%
Methane	0.00010	≤ 15%	85 – 115	± 15%	± 25%
Ethene	0.0010	≤ 15%	85 – 115	± 15%	± 25%
Ethane	0.0010	≤ 15%	85 – 115	± 15%	± 25%
Nitrogen	0.10	≤ 15%	85 – 115	± 15%	± 25%
NMOC	0.010	≤ 15%	85 – 115	± 15%	± 25%
Oxygen	0.10	≤ 15%	85 – 115	± 15%	± 25%
Helium	0.050	≤ 15%	85 – 115	± 15%	± 25%
Hydrogen	0.010*	≤ 15%	85 – 115	± 15%	± 25%

*Reporting limit is 1.0% when sample is pressurized with Helium.
**For detections greater than 5 times the reporting limit.

Note: Results are reported in units of mol %. If required to report volume % or ppmV, a compressibility factor of 1 for all gases will be assumed. As a result, mol % is assumed to be equivalent to volume %. This assumption may result in a bias for highly compressible gases at high concentrations and pressures.

Table 3. Summary of Calibration and QC Procedures for Mod. ASTM Method D1946

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration Curve (ICAL)	Prior to sample analysis	RSD ≤ 15%	Correct problem then repeat Initial Calibration.
Second Source Verification (LCS)	All analytes: once per Initial Calibration, and with each analytical batch.	%R between 85–115%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and after every 20 reportable samples.	%D ±15%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Laboratory Blank (He) (N_2 for He and H_2 analysis)	After each daily check standard and prior to sample analysis, or when contamination is present.	Results below the RL	Inspect the system and re-analyze the Blank.
End Check	At the end of analytical sequence. It can be primary (CCV) or Independent Source (LCS).	%R between 85–115%	Check system and re-analyze the standard. If the 2nd analysis fails, identify and correct the problem. Samples analyzed after the last acceptable CCV are re-analyzed.
Sample Duplicates - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 4.0

Method: EPA Method TO-13A PAHs (Full Scan and SIM)

Eurofins Air Toxics SOP #10	Revision 18	Effective Date: April 26, 2013	Methods Manual Summary
Eurofins Air Toxics SOP #74	Revision 10	Effective Date: January 14, 2013	Methods Manual Summary

Description: This method involves drawing a measured volume of air through a filter and sorbent cartridge to collect Polychlorinated Biphenyls (PAHs) in the vapor and particulate phases. The cartridge can be PUF/XAD2 or XAD2 only. While TO-13A describes the use of a high-volume sampling pump, which allows for up to 300 cubic meters (m^3) of air to be collected over a 24-hour period, the method can also be applied to low-volume sample applications suitable for indoor air or soil gas. The sample media is extracted in the laboratory using Soxhlet extraction or pressurized fluid extraction (PFE). The concentrated extracts are analyzed for PAHs using a quadrupole gas chromatograph/mass spectrometer (GC/MS) in full scan or SIM mode by TO-13A protocol. Eurofins Air Toxics performs a modified version of this method. The method modifications, standard target analyte list, Limit of Quantitation (LOQ), QC criteria, and QC summary can be found in the following tables.

In relation to the prescribed media, sampling and collection efficiencies for compounds not listed in TO-13A have not been evaluated. However, if non-standard compounds are required for a project, the laboratory reports these compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Required Field QC: EPA Method TO-13 requires at least one field blank per sampling episode. Matrix spikes are referenced, but not definitively required in the routine QA specifications.

Table 1. Summary of Method Modifications for TO-13A

Requirements	EPA Method TO-13A	Eurofins Air Toxics Modifications
Extraction Solvent	10% ether in hexane for PUF; DCM for XAD sorbent. Final extract in hexane.	DCM for PUF/XAD cartridge and XAD sorbent. Final extract in DCM.
Glassware Cleaning	Muffle furnace is utilized.	Solvent cleaning procedure is used.
Extraction Technique	Soxhlet extraction	Soxhlet extraction or pressurized fluid extraction (PFE)
Reporting List	19 PAHs	See Table 2
Calibration range	0.1–2.5 µg/mL in hexane	1.0–160 µg/mL in methylene chloride for standard (quad) or 0.1–40 µg/mL for SIM
Method Blank	< MDL	< Reporting Limit

Table 2. Modified Method TO-13A Analyte List and Reporting Limits

Analyte	SIM RL (µg)	RL (µg)	Minimum ICAL RRF	ICAL (%RSD)	ICV (%R)	CCV (%R)	Precision (%RPD)
2-Chloronaphthalene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
2-Methylnaphthalene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
Acenaphthylene	0.1	1.0	1.3	≤ 30	± 30	± 30	≤ 25%
Acenaphthene	0.1	1.0	0.8	≤ 30	± 30	± 30	≤ 25%
Anthracene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(a)anthracene	0.1	1.0	0.8	≤ 30	± 30	± 30	≤ 25%
Benzo(e)pyrene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
Benzo(a)pyrene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(b)fluoranthene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(g,h,i)perylene	0.1	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Benzo(k)fluoranthene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Chrysene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Dibenz(a,h)anthracene	0.1	1.0	0.4	≤ 30	± 30	± 30	≤ 25%
Fluoranthene	0.1	1.0	0.6	≤ 30	± 30	± 30	≤ 25%
Fluorene	0.1	1.0	0.9	≤ 30	± 30	± 30	≤ 25%
Indeno(1,2,3-c,d)pyrene	0.1	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Naphthalene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Phenanthrene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Pyrene	0.1	1.0	0.6	≤ 30	± 30	± 30	≤ 25%

* Not included in the TO-13A method.

The following two compounds can be analyzed upon client request:

Analyte	SIM RL (µg)	RL (µg)	Minimum ICAL RRF	ICAL (%RSD)	ICV (%R)	CCV (%R)	Precision (%RPD)
Perylene	N/A	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Coronene	N/A	1.0	0.7	≤ 30	± 30	± 30	≤ 25%

Table 3. Surrogates

Field Surrogates	Accuracy (%R)
Fluoranthene-d_{10}	50 – 150
Benzo(a)pyrene-d_{12}	50 – 150

Extraction Surrogates	Accuracy (%R)*
Fluorene-d_{10}	60 – 120
Pyrene-d_{10}	60 – 120

Table 4. Internal Standards

Analyte	Accuracy (%R)
Acenaphthene-d_{10}	-50 to +100
Chrysene-d_{12}	-50 to +100
1,4-Dichlorobenzene-d_4	-50 to +100
Naphthalene-d_8	-50 to +100
Perylene-d_{12}	-50 to +100
Phenanthrene-d_{10}	-50 to +100

Table 5. Extracted Laboratory Control Samples for TO-13A (PAHs) in Full Scan and SIM

Analyte	(%R)*
Naphthalene	60 – 120
Acenapthylene	60 – 120
Acenaphthene	60 – 120
Fluorene	60 – 120
Phenanthrene	60 – 120
Anthracene	60 – 120
Fluoranthene	60 – 120
Pyrene	60 – 120
Benzo(a)anthracene	60 – 120
Chrysene	60 – 120
Benzo(b)fluoranthene	60 – 120
Benzo(k)fluoranthene	60 – 120
Benzo(a)pyrene	60 – 120
Indeno(1,2,3-cd)pyrene	60 – 120
Dibenzo(a,h)anthracene	60 – 120
Benzo(g,h,i)perylene	60 – 120
2-Methylnaphthalene	60 - 120
2-Chloronaphthalene	60 – 120

*The LCS and Surrogate limits are derived from Compendium Method TO-13A, Sections 13.3.7.4 and 13.4.6.3 (January 1999). These limits only apply to samples that are extracted by Eurofins Air Toxics. When sample extracts are sent to the lab for analysis only, limits of 50-150 % are applied.

Table 6. Summary of Calibration and QC Procedures for EPA Method TO-13A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Prior to calibration and at start of every 12 hours	TO-13A tuning criteria	Correct problem then repeat tune.
Initial 5-Point Calibration	Prior to sample analysis	ICAL criteria in Table 2	Correct problem then repeat initial calibration.
ICAL ICV	All analytes: Once per initial calibration	All target compound recoveries must be between 70 – 130%	Determine the source of discrepancy between standards. Re-calibrate if needed.
Continuing Calibration Verification (CCV)	At the start of every clock immediately after the DFTPP tune check	PAHs list: Meet Table 2 Min. RRF requirement; %D ≤ 30%	Investigate and correct the problem, up to and including re-calibration if necessary. High bias associated with non-detects in samples will not result in re-analysis.
Internal Standards (IS)	Injected into each standard, blank, and sample extract prior to analysis	**For CCV:** Area count within 50% to 200% of the midpoint of ICAL. **For blanks, samples, and non-CCV QC checks:** retention times within ± 0.33 minutes (20 seconds) and area counts within 50% to 200% of the CCV.	**For CCVs:** Investigate and correct the problem before proceeding with sample analysis. **For blanks:** Inspect the system and re-analyze the blank. **For samples and non-CCV QC:** Unless there is obvious matrix effect, re-analyze the samples and dilute the sample until the ISs meet the criteria; narrate the data to indicate interference.
Surrogates	Field Surrogates: Blank cartridges prior to transport to field for sampling and lab QC prior to extraction. Extraction Surrogates: All samples and lab QC prior to extraction.	See Table 3.	A new aliquot of the extract is analyzed. If Surrogate recoveries are out-of-control a second time, data is flagged and narrated. Re-analysis is not necessary for obvious matrix effects (data is flagged for out-of-control surrogate recoveries). Air samples cannot be re-extracted.
Extracted Laboratory Control Samples (LCS)	With each set of up to 20 extracted samples	See LCS criteria in Table 5.	Re-aliquot and re-analyze the extract. If within limits, report the re-analysis. Otherwise, narrate.

Laboratory Blank	With each set of up to 20 extracted samples	Results less than laboratory reporting limit (Table 2).	Re-aliquot and re-analyze the extract. If less than reporting limit, report the re-analysis. Otherwise, narrate and flag the data.
Solvent Blank	When samples that are extracted together are analyzed on different analytical shifts	All target compounds below the reporting limit (Table 2).	Re-aliquot and re-analyze the solvent. If less than reporting limit, report the re-analysis. Identify the source of contamination, and perform maintenance as needed. If maintenance required, restart the analytical clock.
Laboratory Duplicates – Laboratory Control Spike Duplicates	One per analytical batch	RPD ≤ 25%	Re-analyze duplicate. Investigate the cause, perform maintenance as required, and re-calibrate as needed.

ANALYTICAL METHODS

Section 5.0

Method: Modified EPA Method TO-11A Aldehydes/Ketones

Eurofins Air Toxics SOP #11 Revision 17 Effective Date: March 4, 2014 Methods Manual Summary

Description: This method involves high-pressure liquid chromatography (HPLC) analysis of aldehydes and ketones in ambient air samples. The sampling media is a 2,4-Dinitrophenylhydrazine (DNPH)-coated (silica) cartridge. Aldehydes and ketones are readily converted to a stable hydrazone derivative. The DNPH cartridges are eluted with acetonitrile using gravity-feed technique. Analysis is performed by reverse phase HPLC with UV detection at 360 nm.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, Eurofins Air Toxics reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. For the extraction process, the non-standard compound recovery is evaluated in the extracted laboratory control spike. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics performs modified versions of this method. The method modifications, standard target analyte list, Limits of Quantitation (LOQs), reporting limits (RLs), Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method TO-11A Modifications

Requirement	TO-11A	Eurofins Air Toxics Modifications
Initial Calibration Curve (ICAL)	Multi-point using linear regression performed every 6 months	Multi-point using average Response Factor; re-calibration if daily calibration fails, major maintenance, or column change. Linear regression is performed when requested. Initial Calibration (ICAL) is performed at least once per year.
ICAL Criteria	R^2 for curve ≥ 0.999	%RSD $\leq$ 10% unless linear regression is required, with R^2 for curve ≥ 0.999
Blank Subtraction	Average blank concentrations calculated. Blank value subtracted from sample result.	One Lab Blank is analyzed per batch; no automatic blank subtraction performed on samples.
Retention Times	Precision of Retention Times ±7%	Retention Time window study is performed, but RT windows are determined by bracketing standards.

Table 2. Method TO-11A Analyte List and QC Criteria (Environmental Field Samples)

Analyte	TO-11A LOQ/RL[a] (µg)	ICAL (%RSD)	ISCV (%R)	CCV (%R)
Acetaldehyde	0.10	≤ 10	± 15	± 10
Acrolein[b]	0.25[d]	≤ 10	± 15	± 10
Benzaldehyde	0.25	≤ 10	± 15	± 10
Crotonaldehyde	0.25	≤ 10	± 15	± 10
Formaldehyde	0.05	≤ 10	± 15	± 10
Hexanal	0.25	≤ 10	± 15	± 10
Isopentanal	0.25	≤ 10	± 15	± 10
MEK/Butyraldehydes[c]	0.25	≤ 10	± 15	± 10
m,p-Tolualdehyde	0.25	≤ 10	± 15	± 10
o-Tolualdehyde	0.25	≤ 10	± 15	± 10
Pentanal	0.25	≤ 10	± 15	± 10
Propanal	0.25	≤ 10	± 15	± 10
Acetone	0.25	≤ 10	± 15	± 10
Acetophenone*	N/A	≤ 10	± 15	± 10
Isophorone*	N/A	≤ 10	± 15	± 10
Heptaldehyde*	0.25	≤ 10	± 15	± 10
2,5-Dimethylbenzaldehyde*	0.25	≤ 10	± 15	± 10

[a] Noted reporting limits are subject to change based on most current MDL study.

[b] Because its derivative is not stable, when the target analyte list includes Acrolein the sample will need to be extracted in field. A special order should be placed with the laboratory during the project set-up stage.

[c] Methyl Ethyl Ketone and the Butyraldehydes co-elute.

[d] Not recommended.

* Special compounds upon request only.

Table 3. Summary of Calibration and QC Procedures for Method TO-11A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration Curve (ICAL)	Analyzed in triplicate prior to sample analysis	%RSD ≤ 10	Repeat calibration.
Instrument LCS	With each ICAL	%R = 85–115%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis, after a maximum of every 10 injections, and at the end of the analytical batch	Within ±10% of the expected value	Check the system and re-analyze the standard. If the criteria cannot be met, re-calibrate the instrument. If the standard is biased low, re-analyze all samples since last acceptable CCV. If biased high and samples are "ND", re-analysis is not required. "Q"-flag high recoveries.
Instrument (Solvent) Blank Analysis	Following analysis of Standards	Results less than the laboratory RL	Inspect the system and re-analyze the blank.
Laboratory Duplicates - Laboratory Control Spike Duplicate	One per analytical batch	RPD ≤ 25%	Re-analyze the sample a third time. If the limit is exceeded again, investigate the cause and bring the system back to working order. If no problem is found with the system, narrate the data.

ANALYTICAL METHODS

Section 6.0

Method: ASTM D5504 – Sulfur Compounds

Eurofins Air Toxics SOP #13 Revision 17 Effective Date: December 27, 2013 Methods Manual Summary

Description: This method involves gas chromatograph (GC) analysis of whole air samples for sulfur compounds collected in Tedlar bags. Detection of volatile sulfur compounds is accomplished using a Sulfur Chemiluminescence Detector (SCD) following method ASTM D5504.

Care should be taken to ensure samples to be analyzed for reduced sulfur compounds do not come into contact with any metal surfaces. In addition, because of the reactivity of Hydrogen Sulfide (H_2S), and mercaptans, samples collected in Tedlar bags should be analyzed within 24 hours of collection. Samples collected in Tedlar bags should also be protected from heat and light.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

The laboratory is not equipped to handle >100 ppmv levels of sulfur compounds. Please notify the laboratory if ppmv levels of sulfur compounds are anticipated.

Method Modifications: The Quality Control (QC) elements listed in the latest ASTM Method D5504-01 are suggested, *not required*. In general, calibration protocols followed by the laboratory are designed to meet standard NELAP and EPA environmental data acceptance criteria. Several method suggestions of note are not included in the laboratory QC procedures unless requested by the client. The deviations from the method recommendations are as follows:

- All field samples are not analyzed in duplicate.
- Daily spiked field samples are not analyzed.

Additionally, upon special request, Eurofins Air Toxics provides passivated canisters for sulfur collection. *Air Toxics does not examine passivated canisters for continued sulfur stability as required by the method, and previous studies have demonstrated that recoveries of the glass-lined canisters indicate a potential loss of inertness which can vary from canister to canister.* Sample analysis results derived from passivated canister media are reported with the appropriate narration. Per the ASTM D5504 method, the storage time when using a passivated/lined canister is not to exceed 7 days.

The standard target analyte list, reporting limits (RL), QC criteria, and QC summary can be found in the following tables.

Table 1. ASTM Method D5504 Compound List and QC Limits

Analyte	RL (ppbv)	QC Acceptance Criteria		
		ICAL (% RSD)	LCS/ CCV* (% R)	Precision (% RPD)
2,5-Dimethylthiophene	4.0	≤ 30	70 – 130	≤ 25
2-Ethylthiophene	4.0	≤ 30	70 –130	≤ 25
3-Methylthiophene	4.0	≤ 30	70 – 130	≤ 25
Carbon Disulfide	5.0	≤ 30	70 – 130	≤ 25
Carbonyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Diethyl Disulfide	4.0	≤ 30	70 – 130	≤ 25
Diethyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Dimethyl Disulfide	4.0	≤ 30	70 – 130	≤ 25
Dimethyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Ethyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Ethyl Methyl Sulfide	4.0	≤ 30	70 – 130	≤ 25
Hydrogen Sulfide	4.0	≤ 30	70 – 130	≤ 25
Isobutyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Isopropyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Methyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
n-Butyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
n-Propyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
tert-Butyl Mercaptan	4.0	≤ 30	70 – 130	≤ 25
Tetrahydrothiophene	4.0	≤ 30	70 – 130	≤ 25
Thiophene	4.0	≤ 30	70 – 130	≤ 25

*The recovery for all analytes should be 70-130%; end check recoveries are 70-130% with 2 allowed out up to 60-140%. The recovery for Hydrogen Sulfide, Carbonyl Sulfide and Carbon Disulfide must be 70-130%.

Table 2. Summary of Calibration and QC Procedures for ASTM Method D 5504

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Prior to sample analysis	A minimum of 5 points (3 points may be accepted to meet sample hold times.) % RSD ≤ 30	Evaluate system. Re-prepare and/or re-analyze calibration points.
Second Source Verification (LCS)	With each Initial Calibration; with each analytical batch.	70–130% of the expected values for all the compounds	Check the system, re-prepare and/or re-analyze standard. Re-calibrate instrument if CCV shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold-time is at risk, flagging and narration of non-compliant compounds may be appropriate.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis	%Recovery = 70–130%	Check the system, re-prepare and re-analyze standard. Re-calibrate instrument if re-analysis shows similar recoveries. If recoveries are high and no detections are expected, sample analysis may proceed. If hold-time is at risk, flagging and narration of non-compliant may be appropriate.
Laboratory Blank	After daily LCS and after high level samples and mid-check standards as needed	Results less than the laboratory reporting limit.	Inspect the system and re-prepare the lab blank bag. Flag associated detections with a "B" flag.
End Check	At the end of the analytical sequence	Recoveries within 70–130% with 2 target analytes not exceeding 60–140%. The recovery for Hydrogen Sulfide, Carbonyl Sulfur and Carbon Disulfide must be 70–130%.	Re-analyze the standard to confirm loading procedure. If the 2nd analysis fails, identify and correct the problem. If possible re-analyze all or a subset samples after the last compliant QC check. If re-analysis within hold-time is not possible, flag data affected data. No flags are required if recovery is high and no associated compounds are detected.

Laboratory Duplicates – LCS/LCSD	One per analytical batch	RPD $\leq$ 25%	Verify that the sample or LCS is securely attached to the sample introduction line. If a problem is identified, document in the run log and re-analyze the duplicate pair. If no loading problem is identified, narrate exceedances. If LCSD is analyzed immediately after LCS and precision is not met, notify manager or technical support team before proceeding with sample analysis.

ANALYTICAL METHODS

Section 7.0

Method: Modified EPA Methods TO-4A/TO-10A Pesticides and PCBs

Eurofins Air Toxics SOP #26 Revision 18 Effective Date: December 27, 2013 Methods Manual Summary

Description: These methods involve drawing a measured volume of air through a filter and PUF cartridge to collect pesticides and Aroclors in the vapor and particulate phases. EPA Method TO-4A describes the use of a high-volume sampling pump which allows for up to 300 cubic meters (m^3) of air to be collected over a 24-hour period, while the TO-10A method describes a low-volume sample application suitable for indoor air. Filters are not required for TO-10A sample collection. The sample media is extracted in the laboratory using Soxhlet extraction or Pressurized Fluid Extraction (PFE). The extracts are solvent-exchanged to hexane, concentrated to a final volume, and analyzed for chlorinated pesticides and PCBs using a gas chromatograph (GC) equipped with a dual Electron Capture Detector (ECD) for detection and confirmation.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. For the extraction process, the non-standard compound recovery is evaluated in the extracted laboratory control spike. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics performs modified versions of these methods. The method modifications, standard target analyte list, reporting limit (RL) Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-4A/TO-10A

Requirement	EPA Methods TO-4A/TO-10A	Eurofins Air Toxics Modifications
Extraction Solvent	10% (5% for TO-10A) Diethyl Ether in Hexane	Dichloromethane (DCM) exchanging to Hexane during the concentration step
Reagent Blank	Set up extraction system without filter/PUF; reflux with solvent.	No Reagent Blank is extracted. Reagent lots are certified as acceptable prior to use.
Media certification (TO-10A only)	< 0.01 µg for single peak analytes; < 0.1 µg for PCBs	< Reporting Limit for all analytes
Frequency of Continuing Calibration Verification (CCV)	Every 10 samples	Every 20 samples with internal standard
PCB Quantitation	Requires a minimum of 5 peaks.	Use 4 peaks for quantitation.

Field Spike	Requires one PUF cartridge from each batch of 20 to be spiked with standard and not be used during the sampling period. The spiked PUF plug is placed in a sealed container, then extracted along with samples.	A spike is prepared at the time of sample extraction only.
Sampling Efficiency Determination	Prior to implementation of method and then periodically determine sampling efficiency by spiking PUF and sampling ambient air to determine recoveries.	No sampling efficiencies have been determined by the laboratory.

Table 2. Methods TO-4A/TO-10A Reporting and QC Limits

Analyte	RL (µg)	Low Point of the Curve (µg)	QC Acceptance Criteria			
			ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
4,4'-DDD	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-DDE	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-DDT	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-Methoxychlor	1.0	1.0	≤ 20	± 15	± 15	65 – 125
Aldrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
alpha-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
cis-Chlordane	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Aroclor 1016/1242	1.0	1.0	≤ 20	± 15	± 15	65 – 125
Aroclor 1221[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1232[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1248[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1254[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1260	1.0	1.0	≤ 20	± 15	± 15	65 – 125
beta-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
delta-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Dieldrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan I	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan II	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan Sulfate	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin Aldehyde*	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin Ketone	0.10	0.10	≤ 20	± 15	± 15	65 – 125
gamma-BHC (Lindane)	0.10	0.10	≤ 20	± 15	± 15	65 – 125
trans-Chlordane	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Heptachlor	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Heptachlor Epoxide	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Technical Chlordane[①④]	1.0	NA	≤ 20	± 15	± 15	
Toxaphene[①]	1.0	NA	≤ 20	± 15	± 15	

Mirex is not included in the standard pesticides list but can be performed upon request.

*Internal studies have shown poor recoveries of Endrin Aldehyde from PUF cartridge. In-house generated control limits are used to evaluate recovery of this compound.

Surrogates③

Analyte	%R
2,4,5,6-Tetrachloro-m-xylene (TCMX)	60 – 120②
Decachlorobiphenyl (DCB)	60 – 120②

① *The noted multi-component compounds use a one-point calibration.*
② *Recovery limits are derived from Compendium Method TO-10A January 1999.*
③ *Recovery limits are for extracted samples only. Non-extracted samples use limits of 85–115 %R.*
④ *Not routinely reported but available at client request.*

Table 3. Summary of Calibration and QC Procedures for Methods TO-4A/TO-10A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration Curve (ICAL)*	Prior to sample analysis	%RSD ≤ 20 for each compound or average %RSD ≤ 20.	Use linear regression per SW-846 or re-calibrate.
Independent Calibration Verification (ICV)	After each Initial Calibration	Recovery of an individual component or the average of all the target components for a list of 5 or more target components within 85–115% recovery. Not to exceed 75–125% for any individual compounds.	Investigate the source of discrepancy, including re-preparation and re-analysis of standard. Re-calibrate if needed.
Breakdown Check (Endrin and p,p'-DDT)	Daily, prior to Initial Curve; CCV for pesticide analysis only.	Degradation ≤ 15%	Perform maintenance. Repeat breakdown check.
Continuing Calibration Verification (CCV)	Daily, prior to sample analysis, every 20 samples, and at the end of the analysis sequence, at a minimum of every 24 hours.	Recovery of an individual component or the average of all the pesticide target components for a list of 5 or more target components, within 15% of the expected values. Not to exceed 75–125% for any individual compounds.	Analyze new ICAL and/or prepare fresh standards. If the standard analyzed is recovering high and associated samples are ND, "Q" flag the high recoveries. If the standard analyzed is recovering low, re-analyze all samples.
Laboratory Control Spike (LCS) for compounds noted in Table 2.	Extracted with each set of up to 20 samples	As mentioned in Table 2	Analyze another aliquot. If it still fails, "Q" flag the compounds that are outside the control limits.

Surrogates	All samples, QC, and blanks prior to extraction	As mentioned in Table 2	Analyze another aliquot. If it still fails, "Q" flag the compounds outside the control limits.
Internal Standard	With all analyses	CCV 50–200% compared to midpoint of ICAL; samples 50–200% compared to first CCV of the daily analytical batch.	Analyze another aliquot. If a CCV fails, correct problem before proceeding. If a sample fails, analyze a second time. If it still fails, dilute the sample until IS meets the criteria. Narrate the matrix interference.
Laboratory Blanks	With each set of up to 20 samples extracted	Results less than the Laboratory reporting limit.	Analyze another aliquot. If it still fails, "B" flag the compounds that do not meet the acceptance criteria.
Laboratory Duplicates Laboratory Control Spike Duplicate	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.
Second-Column Confirmation	100% for all positive results, for both pesticide and PCB analyses	Same as for initial or primary column analysis	Same as for initial or primary column analysis

* A single-point calibration is performed for Technical Chlordane, Toxaphene, and certain Aroclors.

ANALYTICAL METHODS

Section 8.0

Method: EPA Method TO-12 (Non-methane Organic Compounds)

Eurofins Air Toxics SOP #36 Revision 16 Effective Date: April 03, 2013 Methods Manual Summary

Description: This method involves gas chromatograph analysis of whole air samples collected in Summa™ canisters or Tedlar bags. Samples are analyzed for Non-Methane Organic Compounds (NMOC) using EPA Method TO-12 protocols. After concentration on a sorbent bed, samples are analyzed using a Flame Ionization Detector (FID). This method is used when speciation is not required.

NMOC concentrations are quantified using the response factor of heptane. As required by the project, NMOC results referenced to heptane can be converted to units of ppmC (parts per million of Carbon). Additionally, hydrocarbon ranges can be provided based on the elution time of the normal alkanes on the GC column.

Eurofins Air Toxics performs a modified version for each of these methods. The method modifications, standard target analyte list, RL, QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-12

Requirement	EPA Method TO-12	Eurofins Air Toxics Modifications
Reporting Limit	0.02 ppmC	0.010 ppmv
Initial Calibration	Five levels: Each level three runs with %RSD < 3%; linearity criterion not specified	Minimum of three single levels; %RSD ≤ 30%.
Sample Analysis Frequency	Duplicate analysis with RPD<5%; report average results of two analyses.	Single analysis. Duplicate 10% of samples with RPD ≤ 25% for detections > 5X the RL.
Column*	GC column not used.	GC column used for analysis.
Sample concentration	Cyrogenic concentration	Multibed sorbent concentration

* The column modification implemented for sample analysis allows for additional characterization based on carbon ranges.

Table 2. Method Compound List and QC Limits

Analyte	RL (ppmv)	Acceptance Criteria		
		ICAL (%RSD)	LCS/CCV (%R)	Precision (%RPD)
Total NMOC ref. to Heptane	0.010	≤ 30	75-125%	≤ 25

Table 3. Summary of Calibration and QC Procedures for TO-12 (NMOC)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration Curve (ICAL)	Prior to sample analysis and/or annually	% RSD ≤ 30	Repeat the calibration.
Laboratory Control Sample (LCS)	With each initial calibration and analytical batch	75–125% of the expected value	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and after every 20 samples or at the end of the analytical sequence	% Difference ± 25 of expected value	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met. Re-analyze all samples since the last acceptable CCV.
Laboratory Blank	In between analysis of standards and project samples	Results less than laboratory reporting limit	Repeat the Laboratory Blank. If the re-analysis of the Lab Blank contains above but at less than 5X the reporting limit, sample analysis may proceed and the associated sample results will be reported with a B flag.
Laboratory Duplicates/ Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 9.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds by SIM

Eurofins Air Toxics SOP #38 Revision 17 Effective Date: December 27, 2013 Methods Manual Summary

Description: This method involves Selective Ion Monitoring (SIM) gas chromatograph/mass spectrometer (GC/MS) analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds (VOCs) using EPA Method TO-14A/TO-15 protocols. An aliquot of the sample is withdrawn from the canister through a mass flow controller and concentrated onto a hydrophobic drying system that removes water from the sample stream. The sample is then focused onto a cryogenic-cooled column prior to analysis by GC/MS in the SIM mode.

Mass spectrometer detectors can be set to acquire both SIM and full scan data simultaneously. This generates two separate data files in the analytical software. One file contains full scan data and the other contains SIM data for selected compounds. The results for each sample in a report will be from two separate data files originating from the same analytical run. The two data files have the same base file name and are differentiated with a "sim" extension on the SIM data file.

Eurofins Air Toxics maintains a suite of TO-14A/TO-15 methods, each optimized to efficiently meet the data objectives for a wide range of targeted concentration ranges. The methods, their reporting limits, and typical applications are summarized in the table below. This method summary describes TO-14A/TO-15 SIM.

Eurofins Air Toxics Method	Base Reporting Limits	Typical Application
TO-14A/TO-15 (5&20)	5 – 20 ppbv	Soil gas and ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient air, soil gas, and ppbv level vapor matrices
TO-14A/TO-15 (Low-level)	0.1 – 0.5 ppbv	Indoor and outdoor air
TO-14A/TO-15 SIM	0.003 – 0.5 ppbv	Indoor and outdoor air

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. If full validation of the required compound(s) is not available, the laboratory will present Quality Control (QC) options to the client based on the project objectives.

Please note that Methods TO-14A and TO-15 were validated for specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and not recommended for ambient or indoor air samples. It is the responsibility of the data user to determine the usability of TO-14A and TO-15 results generated from Tedlar bags.

All samples submitted for TO-15 SIM are screened prior to analysis. If samples contain high concentrations of target and/or non-target VOCs, samples may be analyzed by an alternative TO-15 method (i.e. Standard or 5&20) with a higher dynamic calibration range.

Eurofins Air Toxics performs a modified version of TO-15 SIM as detailed in Table 1. Additionally, since Eurofins Air Toxics applies TO-15 methodology to all Summa™ canisters regardless of whether TO-14A or TO-15 is specified by the project, Eurofins Air Toxics performs a modified version of method TO-14A as described in Table 2. The default SIM target list, reporting limits (RL), QC criteria and QC summary may be found in tables 3 and 4.

Table 1. Summary of TO-15 SIM Method Modifications

Requirement	TO-15	Eurofins Air Toxics Modifications
Blank and standards	Zero Air	Nitrogen

Table 2. Summary of TO-14A SIM Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Dryer	Multibed hydrophobic sorbent
ICAL %RSD acceptance criteria	≤ 30% RSD for listed 39 VOCs	Follow TO-15 requirements of ≤ 30%RSD with 2 of standard compound list allowed out to ≤ 40%RSD
Blank and standards	Zero air	Nitrogen
BFB ion abundance criteria	Ion abundance criteria listed in Table 4 of TO-14A	Follow abundance criteria listed in TO-15.
BFB absolute abundance criteria	Within 10% when comparing to the previous daily BFB	CCV internal standard area counts are compared to ICAL; corrective action when recovery is less than 60%

Table 3. Method TO-14A/TO-15 Standard Analyte List (SIM) and QC Limits

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Dichlorodifluoromethane (Fr12)	0.020	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.020	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	0.050	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.010	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	0.050	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.010	≤ 30%	70 – 130	70 – 130	± 25
Trans-1,2-Dichloroethene	0.100	≤ 30%	70 – 130	70 – 130	± 25
Methyl tert-Butyl Ether	0.100	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,1-Trichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.020	≤ 40%	60 - 140	60 - 140	± 25
Benzene	0.050	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Ethyl Benzene	0.020	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.040	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,2,2-Tetrachloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene	0.050	≤ 40%	60 – 140	60 – 140	± 25

Table 3 is the list of Standard compounds, reporting limits and QC acceptance criteria. Each project may be customized as needed. Additional compounds and different reporting limits may be obtainable and/or achieved upon request.

Table 4. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 by SIM

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	TO-15 Ion Abundance criteria	Correct problem then repeat tune.
Multi-point Calibration (Minimum of 5 points)	Prior to sample analysis	≤ 30% for standard compounds with 2 compounds allowed out to ≤ 40% RSD	Correct problem then repeat Initial Calibration Curve.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each initial calibration curve, and daily prior to sample analysis	Recoveries for 85% of standard compounds must be 70–130% (≤ 40% for Methyl tert-Butyl Ether and trans-1,2-Dichloroethene). No recovery may be ≤ 50%. If specified by the client, in-house generated control limits may be used.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS) for Non-Standard Compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be ≤ 50%.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Continuing Calibration Verification (CCV)	At the start of each day after the BFB tune check	70–130%	Compounds exceeding this criterion and associated data will be flagged and narrated with the exception of high bias associated with non-detects. If more than two compounds from the standard list recover outside of 70–130%, corrective action will be taken. If any compound exceeds 60–140%, samples are not analyzed unless data meets project needs. Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV) for Non-Standard Compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be ≤ 50%.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.

Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory reporting limit (Table 4) or project required reporting limit.	Inspect the system and re-analyze the blank. "B" flag data for common contaminants.
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ±40% of the area counts of the daily CCV internal standards.	**For blanks:** Inspect the system and re-analyze the blank. **For samples:** Re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, dilute the sample until ISs are within acceptance limits and narrate.
Surrogates	As each standard, blank, and sample is being loaded	70–130% If specified by the client, in-house generated control limits may be used.	**For blanks:** Inspect the system and re-analyze the blank. **For samples:** Re-analyze the sample unless obvious matrix interference is documented. If the %Rs are within limits in the re-analysis, report the second analysis. If %Rs are out-of-limits a second time, report data from first analysis and narrate.
Laboratory Duplicates - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. If more than 5% of compound list outside criteria or if compound is > 40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 10.0

Method: EPA Methods TO-3 and TO-14A (BTEX/TPH)

Eurofins Air Toxics SOP #43 Revision 20 Effective Date: April 02, 2013 Methods Manual Summary

Description: This method involves GC analysis of whole air samples collected in Summa canisters or Tedlar bags. Samples are analyzed for Benzene, Toluene, Ethylbenzene, Xylenes, (BTEX) and Total Petroleum Hydrocarbons (TPH). Either modified EPA Method TO-3 or Method TO-14A or can be used to reference laboratory protocols. BTEX is measured using a Photo Ionization Detector (PID), and TPH is measured using a Flame Ionization Detector (FID). Depending on the client's request, TPH is analyzed and referenced to either gasoline or jet fuel.

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics performs a modified version for these methods. The method modifications, standard target analyte list, reporting limit (RL), QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-14A

Requirement	EPA Method TO-14A	Eurofins Air Toxics Modifications
Sample Drying System*	Nafion Dryer	Multi-bed sorbent
Sample collection containers	Specially treated stainless steel canisters	Method TO-14A is validated for samples collected in specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and not recommended for ambient or indoor air samples. Associated results are considered qualified.

* The pre-concentrator modification implemented for sample analysis allows for superior performance over the water management and concentration procedures outlined in Method TO-14A. This multi-bed sorbent approach used in EPA Method TO-15 allows for the inclusion of polar compounds such as MTBE, and demonstrates superior performance by minimizing carryover issues that can be problematic using the Nafion dryer scenario described in Method TO-14A.

Table 2. Summary of Method Modifications for TO-3

Requirement	EPA Method TO-3	Eurofins Air Toxics Modifications
Sample Collection	In-line field method	Collection of sample in specially treated canisters or alternative containers for transport to and analysis by an off-site laboratory.
Preparation of Standards	Levels achieved through dilution of gas mixture	Levels achieved through loading various volumes of the gas mixture.
Initial Calibration Calculation	4-point calibration using a linear regression model	5-point calibration using average Response Factor
Initial Calibration Frequency	Weekly	When daily calibration standard recovery is outside 75–125%, or upon significant changes to the procedure or instrumentation.
Daily Calibration Standard Frequency	Prior to sample analysis and every 4-6 hrs	Prior to sample analysis
Minimum Detection Limit (MDL)	Calculated using the equation DL = A+3.3S, where A is intercept of calibration line and S is the standard deviation of at least 3 reps of low level standard.	40 CFR Part 136, App. B
Sample pre-concentration and moisture management	Cyrogenic pre-concentrator with a Nafion dryer	Multi-bed sorbent system

Table 3. Method Compound List and QC Limits

Analyte	RL (ppmv)	Acceptance Criteria		
		ICAL (%RSD)	LCS/CCV (%R)	Precision (%RPD)
Benzene	0.001	≤ 30	± 25	≤ 25
Toluene	0.001	≤ 30	± 25	≤ 25
Ethyl Benzene	0.001	≤ 30	± 25	≤ 25
m,p-Xylenes	0.001	≤ 30	± 25	≤ 25
o-Xylene	0.001	≤ 30	± 25	≤ 25
MTBE	0.001	≤ 30	± 25	≤ 25
TPH (Gasoline Range) MW = 100	0.025	≤ 30	± 25	≤ 25
TPH (JP-4 Range) MW = 156	0.025	≤ 30	± 25	≤ 25

Table 4. Surrogate QC Limits

Surrogate	PID Accuracy (%R)	FID Accuracy (%R)
Fluorobenzene	75–125%	75–150%

Table 5. Summary of Calibration and QC Procedures for TO-3/TO-14A (BTEX & TPH)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration (ICAL)	Prior to sample analysis and annually	%RSD ≤ 30	Correct problem, then repeat the calibration.
Initial Calibration Verification and Laboratory Control Sample (ICV/LCS)	With each initial calibration, and with each analytical batch.	±25% of the expected value	Check the system and re-analyze the standard. Re-prepare the standard or re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and can be used as an End Check	±25% of the expected value	**For initial CCV:** Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met. **For Mid- and End Checks:** Check system and re-analyze the standard. If the second analysis fails, identify and correct the problem, then re-analyze all samples since the last acceptable CCV.
Laboratory Blank	In between analysis of standards and project samples	Results less than the laboratory Reporting Limit	Inspect the system and re-analyze the Laboratory Blank.
Surrogate	As each standard, blank, and sample is being loaded	75–125% recovery on the PID; 75–150% on the FID	Low surrogate recovery results in re-analysis (at a higher dilution if high levels of moisture are present). If recovery is out and still low, report the analysis with the better recovery and flag. Because of TPH interference, high surrogate recoveries do not result in re-analysis. Data is flagged to note high recovery.
Laboratory Duplicate - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause, perform maintenance as required, and re-calibrate as needed.

ANALYTICAL METHODS

Section 11.0

Method: ASTM D1945 – Fixed Gases & C1-C6

Eurofins Air Toxics SOP #54 Revision 18 Effective Date: December 27, 2013 Methods Manual Summary

Description: This method involves gas chromatograph (GC) analysis of soil gas, landfill gas, ambient air, or stack gas collected in Summa™ canisters, Tedlar bags, or any vessel that has been demonstrated to be clean and leak free. Samples are analyzed for Methane and fixed gases and can be used to speciate individual light hydrocarbons up to C6. This method is also used to provide an estimation of the heating value of the gas by method ASTM D3588. Because the sample is withdrawn from the vessel by positive pressure, rigid containers are first filled to positive pressure using UHP Helium or Nitrogen. Samples are then analyzed using a GC equipped with a Flame Ionization Detector (FID) and a Thermal Conductivity Detector (TCD).

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit (RL), no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compounds during sample storage is not validated. Full validation may be available upon request.

Since the protocols in the ASTM D1945 standard were designed for the analysis of natural gas, the laboratory has made modifications in order to apply the method to environmental samples covering a wide concentration range and to implement standard NELAP and EPA calibration criteria. The method modifications, standard target analyte list, RL, Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for ASTM D1945

Requirement	ASTM D1945	Eurofins Air Toxics Modifications
Sample Injection Volume	0.50 mL to achieve Methane linearity.	1.0 mL
Reference Standard	Concentration should not be < half of nor differ by more than 2X the concentration of the sample. Run 2 consecutive checks; must agree within 1%.	A minimum 3-point linear calibration. The acceptance criterion is RSD ≤ 15%. All target analytes must be within the linear range of calibration (with the exception of O_2, N_2, and C6+ hydrocarbons).
Sample Analysis	Equilibrate samples to 20-50° F above source temperature at field sampling.	No heating of samples is performed.
Sample Calculation	Response factor is calculated using peak height for C5 and lighter compounds.	Peak areas are used for all target analytes to quantitate concentrations.

Normalization	Sum of original values should not differ from 100.0% by more than 1.0%.	Sum of original values may range between 85–115%; normalization of data not performed unless client requested.

Table 2. ASTM Method D1945 Compound List and QC Limits

Analyte	Reporting Limit (%)	QC Acceptance Criteria		
		ICAL (%RSD)	CCV/LCS/ICV (%R)	Precision* (%RPD)
Carbon Dioxide	0.01	≤ 15%	± 15%	≤ 25%
Carbon Monoxide	0.01	≤ 15%	± 15%	≤ 25%
Ethene	0.001	≤ 15%	± 15%	≤ 25%
Ethane	0.001	≤ 15%	± 15%	≤ 25%
Acetylene	0.001	≤ 15%	± 15%	≤ 25%
Isobutane	0.001	≤ 15%	± 15%	≤ 25%
Isopentane	0.001	≤ 15%	± 15%	≤ 25%
Methane	0.0001	≤ 15%	± 15%	≤ 25%
n-Butane	0.001	≤ 15%	± 15%	≤ 25%
Neopentane	0.001	≤ 15%	± 15%	≤ 25%
n-Pentane	0.001	≤ 15%	± 15%	≤ 25%
Nitrogen**	0.10	≤ 15%	± 15%	≤ 25%
NMOC (C6+)	0.01	≤ 15%	± 15%	≤ 25%
Oxygen	0.10	≤ 15%	± 15%	≤ 25%
Propane	0.001	≤ 15%	± 15%	≤ 25%
Hydrogen***	0.01	≤ 15%	± 15%	≤ 25%
Helium****	0.05	≤ 15%	± 15%	≤ 25%

* For detections at > 5X the Reporting Limit.
**For canisters that have been pressurized with Nitrogen, the amount of Nitrogen in the sample is determined by subtraction.
***For canisters that have been pressurized with Helium, the Reporting Limit is 1.0%.
****Included by special request only.

Note: Results are reported in units of mol %. If required to report volume % or ppmV, a compressibility factor of 1 for all gases will be assumed. As a result, mol % is assumed to be equivalent to volume %. This assumption may result in a bias for highly compressible gases at high concentrations and pressures.

Table 3. Summary of Calibration and QC Procedures for Mod. ASTM Method D1945

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Prior to sample analysis and annually	≤ 15% RSD	Correct problem, then repeat Initial Calibration.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration and once per analytical batch.	85–115% Recovery If specified by the client, in-house generated control limits may be used.	Check the system and re-analyze the standard. Re-prepare the standard if necessary. If the primary standard is found to be in error, re-prepare the primary and calibrate the instrument.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis, and can be used as an End Check.	± 15% Difference	Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met. If the closing CCV fails, the system is checked and the standard is re-analyzed. Re-prepare the standard if necessary. If the second analysis fails, identify and correct the problem, then re-analyze all samples since the last acceptable CCV.
Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory Reporting Limit	Inspect the system and re-analyze the Laboratory Blank.
Laboratory Duplicates-Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 12.0

Method: PM10/TSP – Particulate Matter

Eurofins Air Toxics SOP #66 Revision 13 Effective Date: December 30, 2013 Methods Manual Summary

Description: This method involves equilibrating quartz filters in a conditioning environment of a specified temperature and humidity range and weighing the filters before and after field sampling. Samples are analyzed for method PM_{10} using 40 CFR Part 50 Appendix J or for Total Suspended Particulate (TSP) using 40 CFR Part 50 Appendix B. An analytical balance with 0.1 mg resolution is used to measure the filter weights. The corresponding change in mass represents the TSP or PM_{10} result, expressed in µg or µg/m^3. The reporting limit is typically 1000 µg. Sampling volumes are required to calculate results in units of µg/m^3.

Table 1. Conditioning Environment Criteria for Methods PM10 and TSP

Method	Conditioning Environment Temperature (˚F)	Conditioning Environment Relative Humidity (%)
PM10	59°F – 86°F ± 5°F	20% – 45% ± 5%
TSP	59°F – 86°F ± 5°F	≤ 50% ± 5%

Table 2. Summary of Calibration and QC Procedures for Methods PM10 and TSP

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Calibration	Calibration checks of 3.00 grams (g) and 5.00 g are weighed to bracket the expected filter weight of ~4.5 g prior to sample analysis and at the end of the analytical batch.	Accuracy limits of 3.00 g weight: 2.997 g – 3.003 g Accuracy limits of 5.00 g weight: 4.995 g - 5.005 g	Correct problem then repeat calibration.
Laboratory Duplicates	Unexposed filters: One per analytical batch Exposed filters: One duplicate per work order	Unexposed filters: Weights of the clean filters should be within ±0.0028 g of the original value. Exposed filters: ≤ 25% RPD and weights must be within ±0.005 g	Re-condition the filter and re-weigh.
Laboratory Blanks	Immediately after the calibration checks	Post-weight of Lab Blank is less than pre-weight and the difference is < 0.0028 g.	Confirm the weight difference and narrate.

ANALYTICAL METHODS

Section 13.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (Low-Level)

Eurofins Air Toxics SOP #83 Revision 12 Effective Date: February 13, 2014 Methods Manual Summary

Description: This method involves full scan gas chromatograph/mass spectrometer (GC/MS) analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds (VOCs) using EPA Method TO-14A/TO-15 protocols. An aliquot of up to 250 mL of air is withdrawn from the canister utilizing a volumetric syringe, volumetric loop, or mass flow controller. This volume is loaded onto a hydrophobic multibed sorbent trap to remove water and carbon dioxide and to concentrate the vapor sample. The focused sample is then flash-heated to sweep adsorbed VOCs onto a GC/MS for separation and detection. Compounds are detected using a MS operating in full scan mode.

Eurofins Air Toxics maintains a suite of TO-14A/TO-15 methods, each optimized to efficiently meet the data objectives for a wide range of targeted concentration ranges. The methods, their reporting limits, and typical applications are summarized in the table below. This method summary describes TO-14A/TO-15 (Low-Level).

Eurofins Air Toxics Method	Base Reporting Limits	Typical Application
TO-14A/TO-15 (5&20)	5 – 20 ppbv	Soil gas and ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient air, soil gas, and ppbv level vapor matrices
TO-14A/TO-15 (Low-Level)	0.1 – 0.5 ppbv	Indoor and outdoor air
TO-14A/TO-15 SIM	0.003 – 0.5 ppbv	Indoor and outdoor air

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, Eurofins Air Toxics reports these non-routine compounds with partial validation. Validation may include a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification analyzed, and no method detection limit study performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Since Eurofins Air Toxics applies TO-15 methodology to all Summa™ canisters regardless of whether TO-14A or TO-15 is specified by the project, Eurofins Air Toxics performs a modified version of method TO-14A as detailed in Table 1. Please note that Methods TO-14A and TO-15 were validated for specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and is not recommended for ambient or indoor air samples. It is the responsibility of the data user to determine the usability of TO-14A and TO-15 results generated from Tedlar bags.

All samples submitted for TO-15 Low-Level are screened prior to analysis. If samples contain high concentrations of target and/or non-target VOCs, samples may be analyzed by an alternative TO-15 method (i.e., Standard or 5&20) with a higher dynamic calibration range.

Table 1. Summary of TO-14A Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Dryer	Multibed hydrophobic sorbent
Blank acceptance criteria	< 0.2 ppbv	< RL
BFB ion abundance criteria	Ion abundance criteria listed in Table 4 of TO-14A	Follow abundance criteria listed in TO-15.
BFB absolute abundance criteria	Within 10% when comparing to the previous daily BFB	CCV internal standard area counts are compared to ICAL; corrective action taken when recovery is less than 60%.
Blanks and standards	Zero Air	UHP Nitrogen provides a higher purity gas matrix than zero air.
Initial Calibration	≤ 30% RSD for listed 39 VOCs	≤ 30% RSD with 4 compounds allowed out to ≤ 40%

Table 2. Summary of Method TO-15 Modifications

Requirement	TO-15	Eurofins Air Toxics Modifications
Initial Calibration	≤ 30% RSD with 2 compounds allowed out to < 40% RSD	≤ 30% RSD with 4 compounds allowed out to ≤ 40%
Blanks and standards	Zero Air	UHP Nitrogen provides a higher purity gas matrix than zero air.

The standard target analyte list, reporting limits (RL), also referred to as Limit of Quantitation (LOQ), Quality Control (QC) criteria, and QC summary can be found in tables 3 through 6.

Table 3. Method TO-14A/TO-15 Analyte List (Low-Level) and QC Limits

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS* (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Benzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	0.1	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	0.2	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	0.5	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.1	≤ 30%	70 – 130	70 – 130	± 25

Methyl Chloroform (1,1,1-Trichloroethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Styrene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.1	< 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	0.1	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	0.5	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	0.5	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	0.1	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Acetone	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	0.1	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	0.5	≤ 30%	70 – 130	70 – 130	± 25
Cumene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Dibromochloromethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	0.5	≤ 30%	70 – 130	70 – 130	± 25
Heptane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Hexane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Isopropanol	0.5	≤ 30%	70 – 130	70 – 130	± 25
Methyl tert-Butyl Ether (MTBE)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	0.5	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	0.5	≤ 30%	70 – 130	70 – 130	± 25

Non-Standard Compounds

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Acrolein	0.5	≤ 40%	60 – 140	60 – 140	± 25
Butane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Ethyl tert-Butyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Isopentane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Isopropyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Methylcyclohexane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Naphthalene**	0.5	≤ 40%	60 – 140	60 – 140	± 25
Propylene	0.5	≤ 40%	60 – 140	60 – 140	± 25
tert-Amyl Methyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Vinyl Acetate	0.5	≤ 40%	60 – 140	60 – 140	± 25
tert-Butyl Alcohol	0.5	≤ 40%	60 – 140	60 – 140	± 25
TPH (Gasoline)***	10	1- Point Calibration	N/A	ICV only: 60 – 140	± 25
NMOC (Hexane/Heptane)***	2.0	1- Point Calibration	N/A	N/A	± 25

*See Table 6.

**Due to its low vapor pressure, Naphthalene does not meet TO-15 performance requirements. The wider QC limits reflect typical performance. Although Naphthalene is not on Eurofins Air Toxics "standard" TO-15 list, it is commonly requested and therefore included in Table 3.

***TPH and NMOC are not on Eurofins Air Toxics' standard TO-15 list, but are included in Table 3 due to common requests.

Table 4. Internal Standards

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 5. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table 6. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 Low-Level

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	TO-15 ion abundance criteria	Correct problem then repeat tune.
Minimum 5-Point Initial Calibration (ICAL)	Prior to sample analysis	% RSD ≤ 30 with 4 compounds allowed out to ≤ 40% RSD	Correct problem then repeat Initial Calibration curve.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration curve, and daily prior to sample analysis	Recoveries for 85% of Standard compounds must be 70–130%. No recovery may be < 50%. If specified by the client, in-house generated control limits may be used.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS) for Non-standard Compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be <50%.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Continuing Calibration Verification (CCV) for Standard compounds	At the start of each analytical clock after the tune check	70–130%	Compounds exceeding this criterion and associated data will be flagged and narrated with the exception of high bias associated with non-detects. If more than 4 compounds from the standard list recover outside of 70–130%, corrective action will be taken. If any compound exceeds 60–140%, samples are not analyzed unless data meets project needs. Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV) for Non-Standard compounds	Per client request or specific project requirements only	Recoveries of compounds must be 60–140%. No recovery may be <50%.	Check the system and re-analyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.

Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present	Results less than the laboratory reporting limit	Inspect the system and re-analyze the blank. "B"-flag data for common contaminants.
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ± 40% of the area counts of the daily CCV internal standards.	**For blanks:** Inspect the system and reanalyze the blank. **For samples:** Re-analyze the sample unless obvious matrix interference is documented. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, report data from first analysis and narrate.
Surrogates	As each standard, blank, and sample is being loaded	70–130% R If specified by the client, in-house generated control limits may be used.	**For blanks:** Inspect the system and re-analyze the blank **For samples:** Re-analyze the sample unless obvious matrix interference is documented. If the %Rs are within limits in the re-analysis, report the second analysis. If %Rs are out-of-limits a second time, report data from first analysis and narrate.
Laboratory Duplicates - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤25%	Narrate exceedances. If more than 5% of compound list is outside criteria or if compound is >40% RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 14.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (5&20)

Eurofins Air Toxics SOP #91 Revision 5 Effective Date: January 14, 2013 Methods Manual Summary

Description: This method involves full scan gas chromatograph/mass spectrometer (GC/MS) analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds (VOCs) using EPA Method TO-14A/TO-15 protocols. An aliquot of up to 0.05 liters of air is withdrawn from the canister utilizing a volumetric syringe or mass flow controller. This volume is loaded onto a hydrophobic multibed sorbent trap to remove water and carbon dioxide and to concentrate the vapor sample. The focused sample is then flash-heated to sweep adsorbed VOCs onto a secondary trap for further concentration and/or onto a GC/MS for separation and detection.

Eurofins Air Toxics maintains a suite of TO-14A/TO-15 methods, each optimized to efficiently meet the data objectives for a wide range of targeted concentration ranges. The methods, their reporting limits, and typical applications are summarized in the table below. This method summary describes TO-14A/TO-15 (5&20). The 5&20 analytical configuration is designed to directly measure ppmv concentrations with minimal offline dilutions due to its wide dynamic calibration range.

Eurofins Air Toxics Method	Base Reporting Limits	Typical Application
TO-14A/TO-15 (5&20)	5 – 20 ppbv	Soil gas and ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient air, soil gas, and ppbv level vapor matrices
TO-14A/TO-15 (Low-level)	0.1 – 0.5 ppbv	Indoor and outdoor air
TO-14A/TO-15 SIM	0.003 – 0.5 ppbv	Indoor and outdoor air

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, Eurofins Air Toxics reports these non-routine compounds with partial validation. Validation may include a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification analyzed, and no method detection limit study performed unless previous arrangements have been made. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics takes no modifications of technical significance to Method TO-15 for the "5&20" configuration. Since Eurofins Air Toxics applies TO-15 methodology to all Summa canisters regardless of whether TO-14A or TO-15 is specified by the project, the laboratory performs a modified version of method TO-14A as detailed in Table 1. Please note that Methods TO-14A and TO-15 were validated for specially treated canisters. As such, the use of Tedlar bags for sample collection is outside the scope of the method and not recommended for ambient air samples. It is the responsibility of the data user to determine the usability of TO-14A and TO-15 results generated from Tedlar bags.

Table 1. Summary of TO-14A Method Modifications

Requirement	TO-14A	ATL Modifications
Sample Drying System	Nafion Drier	Multibed hydrophobic sorbent
Blank acceptance criteria	< 0.2 ppbv	< RL
BFB ion abundance criteria	Ion abundance criteria listed in Table 4 of TO-14A	Follow abundance criteria listed in TO-15
BFB absolute abundance criteria	Within 10% when comparing to the previous daily BFB	CCV internal standard area counts are compared to ICAL; corrective action when recovery is less than 60%.
Initial Calibration	≤ 30% RSD for listed 39 VOCs	≤ 30% RSD with 2 of Eurofins Air Toxics' 62 standard compounds allowed out to ≤ 40%

The standard target analyte list, reporting limit (RL), also referred to as Limit of Quantitation (LOQ), QC criteria, and QC summary can be found in Tables 2 through 5.

Table 2. Method TO-14A/TO-15 Analyte List (5&20)

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	20	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Benzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane*	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	20	≤ 30%	70 – 130	70 – 130	± 25

Dibromochloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	20	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	20	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Methyl Chloroform (1,1,1-Trichloroethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Styrene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Toluene	5.0	≤ 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	20	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	20	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	20	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	5.0	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Acetone	20	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	5.0	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	5.0	≤ 30%	70 – 130	70 – 130	± 25

Dibromochloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	20	≤ 30%	70 – 130	70 – 130	± 25
Heptane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Hexane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Isopropanol	20	≤ 30%	70 – 130	70 – 130	± 25
Methyl t-Butyl Ether (MTBE)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	5.0	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Cumene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	20	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene**	20	≤ 40%	60 – 140	60 – 140	± 25
TPH (Gasoline) ***	100	1- Point Calibration	NA	ICV only: 60 – 140	± 25
NMOC (Hexane/Heptane)***	100	1- Point Calibration	NA	NA	± 25

*Bromomethane recovery can be variable due to moisture/sorbent interactions specifically on the 2-trap concentration system. Data may require qualifier flags.

**Due to its low vapor pressure, Naphthalene may exceed TO-15 performance requirements. The wider QC limits reflect typical performance. Although Naphthalene is not on Eurofins Air Toxics "standard" TO-15 list, it is commonly requested and included in Table 2.

***TPH and NMOC are not on Eurofins Air Toxics' "standard" TO-15 list, but are included in Table 2 due to common requests.

Table 3. Internal Standards

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 4. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table 5. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 (5&20)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours.	TO-15 ion abundance criteria	Correct problem then repeat tune.
Minimum 5-Point Initial Calibration (ICAL)	Prior to sample analysis.	% RSD ≤ 30 with 2 compounds allowed out to ≤ 40% RSD	Correct problem then repeat Initial Calibration Curve.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS)	After each Initial Calibration curve, and daily prior to sample analysis	Recoveries for 85% of "Standard" compounds must be 70-130%. No recovery may be <50%. If specified by the client, in-house generated control limits may be used.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Initial Calibration Verification and Laboratory Control Spike (ICV and LCS) for Non-standard compounds	Per client request or specific project requirements only.	Recoveries of compounds must be 60–140%. No recovery may be <50%.	Check the system and reanalyze the standard. Re-prepare the standard if necessary to determine the source of error. Re-calibrate the instrument if the primary standard is found to be in error.
Continuing Calibration Verification (CCV)	At the start of each analytical clock after the tune check.	70–130%	Compounds exceeding this criterion and associated data will be flagged and narrated with the exception of high bias associated with non-detects. If more than two compounds from the standard list recover outside of 70-130%, corrective action will be taken. If any compound exceeds 60-140%, samples are not analyzed unless data meets project needs. Check the system and reanalyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Laboratory Blank	After analysis of standards and prior to sample analysis, or when contamination is present.	Results less than the laboratory reporting limit	Inspect the system and re-analyze the blank. "B"-flag data for common contaminants.
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ±40% of the area counts of the daily CCV internal standards.	**For blanks:** Inspect the system and reanalyze the blank. **For samples:** Re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, dilute the sample until ISs are within acceptance limits and narrate.

Surrogates	As each standard, blank, and sample is being loaded.	70–130% If specified by the client, in-house generated control limits may be used.	**For blanks:** Inspect the system and reanalyze the blank. **For samples:** re-analyze the sample unless obvious matrix interference is documented. If the %Rs are within limits in the re-analysis, report the second analysis. If %Rs are out-of-limits a second time, report data from first analysis and narrate.
Laboratory Duplicates – Laboratory Control Spike Duplicates (LCSD)	One per analytical batch	RPD ≤25%	Narrate exceedances. If more than 5% of compound list is outside criteria or if compound has >40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 15.0

Method: TO-15 Aliphatic and Aromatic Volatile Petroleum Hydrocarbons (VPH) Fractions by GC/MS

Eurofins Air Toxics SOP #103 Revision 5 Effective Date: January 29, 2014 Methods Manual Summary

Description: The TO-15 VPH method outlines procedures to estimate the concentrations of gaseous phase Aliphatic and Aromatic ranges in ambient air and soil gas collected in stainless steel Summa canisters. The volatile Aliphatic hydrocarbons are collectively quantified within the C5 to C6 range, C6 to C8 range, C8 to C10 range, and the C10 to C12 range. Additionally, the volatile Aromatic hydrocarbons are collectively quantified within the C8 to C10 range and the C10 to C12 range. The Aromatic ranges refer to the equivalent carbon (EC) ranges.

Data is acquired using standard TO-15 GC/MS instrumentation. Procedures are largely based on the hydrocarbon ranges and calibration reference compounds defined by the Washington State Department of Ecology (WSDE) Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) Fractions, dated June 1997. Additionally, the WSDE VPH calibration and quantitation procedures for the Aromatic fraction have been enhanced to more effectively isolate the compounds of interest. The Aromatic fraction measurement is based on a modification of the Massachusetts Department of Environmental Protection (MADEP) Air Phase Hydrocarbon Method (2009).

Eurofins Air Toxics performs a modified version of this method. The method modifications, standard target analyte list, reporting limit (RL) or Limit of Quantitation (LOQ), QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-15 VPH

Requirement	VPH	Eurofins Air Toxics Modifications
Detector	Tandem GC/FID/PID	GC/MS
Matrix	Soil, water, and sediments	Whole air samples
C6-C8 Reference Compound	Octane	Heptane
Surrogate	2,5-Dibromotoluene	Bromochloromethane, 1,2-Dichloroethane-d4, Toluene-d8, Chlorobenzene-d5, and 4-Bromofluorobenzene
%RSD for Reference Compounds	≤ 20% RSD	≤ 30% RSD with the exception of Decane, Dodecane, 1,2,4,5-Tetramethylbenzene, and Naphthalene at ≤ 40% RSD
%D for the CCV	±20%D	±30%D with the exception of Decane, Dodecane, 1,2,4,5-Tetramethylbenzene, and Naphthalene at ±40%D

Laboratory Control Spike	Matrix Spiking Solution	Independently prepared source performed after initial calibration, 70–130% recovery, with the exception of Decane, Dodecane,1,2,4,5-Tetramethylbenzene, and Naphthalene at 60–140%
CCV Frequency	Before and after every 10 samples	Daily before sample analysis
IDOC	4 Replicates of a CCV at ±20%D; %RSD ≤ 20%	Not performed for this method; TO-15 IDOC performed on the same instrument

Table 2. VPH Standard Target Analyte List (Note: TO-15 analytes can also be included.)

Analyte	Standard RL (ppbv)	5&20 RL (ppbv)	Acceptance Criteria		
			ICAL %RSD	ICV (%R)	CCV (%D)
Pentane	NA	NA	≤ 30%	70-130	≤ 30%
Hexane	NA	NA	≤ 30%	70-130	≤ 30%
C_5-C_6 Aliphatics Pentane + Hexane	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
C_6-C_8 Aliphatics ref. to Heptane	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
C_8-C_{10} Aliphatics ref. to Decane	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**
C_{10}-C_{12} Aliphatics ref. to Dodecane	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**
Ethyl benzene	2	10	≤ 30%	70-130	≤ 30%
m/p-Xylene	2	10	≤ 30%	70-130	≤ 30%
o-Xylene	2	10	≤ 30%	70-130	≤ 30%
1,2,3-Trimethylbenzene	NA	NA	≤ 30%	70-130	≤ 30%
C_8-C_{10} Aromatics	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
Naphthalene	2	10	≤ 40%	60-140	≤ 40%
1,2,4,5-Tetramethylbenzene	NA	NA	≤ 40%	60-140	≤ 40%
C_{10}-C_{12} Aromatics	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**

Table 3. Internal Standard Acceptance Criterion – Aliphatic Fraction

Analyte	Recovery Limits (%R)
1,4-Difluorobenzene	50 – 200%

Table 4. Internal Standard Acceptance Criterion – Aromatic Fraction

Analyte	Recovery Limits (%R)
Chlorobenzene-d_5	60 – 140%

Table 4. Summary of Calibration and QC Procedures

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	Compendium of Methods for Toxic Organic Air Pollutants, Method TO-15, January 1999	Correct problem then repeat tune.
6-Point Initial Calibration (ICAL)	Prior to sample analysis	%RSD ≤ 30% for VPH Target Analyte List with exceptions for 1,2,4,5-Tetramethylbenzene and Naphthalene, which are ≤40%	Correct problem then repeat initial calibration curve.
Initial Calibration Verification (ICV)	After each initial calibration curve	Recoveries for VPH target compounds 70–130%, or 60–140% for 1,2,4,5-Tetramethylbenzene and Naphthalene. If recovery of any compound is above 130%, analyze samples as long as compound is not detected.	Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	At the start of each analytical clock after the tune check	%D ≤ 30% for VPH target compounds with exceptions for 1,2,4,5-Tetramethylbenzene and Naphthalene, which are <40%. One compound is allowed to be out as long as it is ≤ 50%D. If recovery of any compound is above 150% the instrument must be re-calibrated.	Perform maintenance and repeat test. If the CCV still fails, perform maintenance and a new 6-point calibration curve.
Laboratory Blank	After the CCV	Results less than the laboratory RL	Inspect the system and re-analyze the blank.
Internal Standard (IS)	As each standard, blank, and sample is being loaded.	Retention time (RT) for the blanks and samples must be within ±0.33 min of the RT in the CCV. For the aliphatic fraction using the total ion area, the IS area must be within -50% to 200% of the CCV's IS area for the blanks and samples. For the aromatic fraction using extracted ion areas, the IS area must be within -40% to +40% of the CCV's extracted ion IS area.	**For blanks:** Inspect the system and re-analyze the blank **For samples:** If there is not obvious interference with the internal standard, re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. Dilution of the sample to get IS areas within limits may be used if the RL is being obtained.
Laboratory Duplicates	One per analytical batch; since VPH analysis occurs with TO-15 analysis, the Duplicate is reported from the daily TO-15 LCS/LCSD pair. The result is not reported with the VPH fraction.	RPD ≤ 25% for detections >5X the RL	Re-analyze the sample a third time. If the limit is exceeded again, investigate the cause and bring the system back to working order. If no problem is found with the system, narrate.

ANALYTICAL METHODS

Section 16.0

Method: Modified EPA TO-17 VOCs and SVOCs (Vapor Intrusion Application) by GC/MS (Full Scan)

Eurofins Air Toxics SOP #109 Revision 4 Effective Date: December 24, 2013 Methods Manual Summary

Description: The TO-17 "Vapor Intrusion" method utilizes a multi-bed thermal desorption tube for the measurement of air-phase Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs). These tubes are marketed by Eurofins Air Toxics as "TO-17 VI" tubes. The TO-17 VI tubes are applicable to a wide variety of vapor matrices including soil gas, indoor air, and outdoor air. Parameters are optimized to effectively manage high humidity conditions. The TO-17 VI method is an alternative to the canister-based sampling and analysis methods that are presented in EPA Compendium Methods TO-14A and TO-15 as well as an alternative to PUF/XAD sampling for semi-volatile compounds as described by EPA Compendium TO-13A. The VI tube provides sufficient retention of light VOCs such as 1,3-Butadiene while providing an efficient desorption of semi-volatile compounds such as Pyrene.

Samples are collected by drawing a measured volume of air through the VI sorbent tubes. Collection is performed using a low-flow vacuum pump or a volumetric syringe attached to the outlet side of the tube. Analysis is accomplished by heating the sorbent tube and sweeping the desorbed compounds onto a secondary "cold" trap for water management and analyte refocusing. The secondary trap is heated for efficient transfer of compounds onto the gas chromatograph (GC) for separation followed by detection using mass spectrometry (MS).

Certain compounds are not included in Eurofins Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, the laboratory reports these non-standard compounds with partial validation. Validation includes a 3-point calibration with the lowest concentration defining the reporting limit, no second source verification is analyzed, and no method detection limit study is performed unless previous arrangements have been made. In addition, stability of the non-standard compounds during sample storage, safe sampling volume, and desorption efficiency are not validated. Full validation may be available upon request.

Since the TO-17 VI application significantly extends the scope of target compounds addressed in EPA Method TO-15 and TO-17, the laboratory has implemented several method modifications as outlined in Table 1.

Table 1. EPA TO-17 Method Modifications – VI Application

Requirement	TO-17	Eurofins Air Toxics Modifications
Initial Calibration	%RSD ≤ 30% with 2 allowed out up to 40%	For the VOC list: %RSD ≤ 30% with 2 allowed out up to 40% For the PAH list: %RSD ≤ 30% with 2 allowed out up to 40%
Daily Calibration	%D for each target compound within ±30%.	Fluorene, Phenanthrene, Anthracene, Fluoranthene, and Pyrene within ±40%D
Audit Accuracy	70 – 130%	Second source recovery limits for Fluorene, Phenanthrene, Anthracene, Fluoranthene, and Pyrene = 60 – 140%
Distributed Volume Pairs	Collection of distributed volume pairs required for monitoring ambient air to ensure high quality.	If the client is sampling well-characterized air or has verified performance through previous sampling or distributed pairs, single tube sampling may be appropriate. Distributed volume pairs may not be practical or useful for soil vapor collection due to required configuration and volume constraints.

Table 2. Method TO-17 VI Standard Analyte List and QC Limits

Volatile Organic Compounds	Reporting Limit (ng)	QC Acceptance Criteria			
		ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
Freon 114	14	30	70 – 130	30	70 – 130
Vinyl Chloride	2.6	30	70 – 130	30	70 – 130
1,3-Butadiene	2.2	30	70 – 130	30	70 – 130
Isopentane	5.9	30	70 – 130	30	70 – 130
Freon 11	11	30	70 – 130	30	70 – 130
1,1-Dichloroethene	4.0	30	70 – 130	30	70 – 130
Methylene Chloride	21	30	70 – 130	30	70 – 130
Freon 113	7.7	30	70 – 130	30	70 – 130
Trans-1,2-Dichloroethene	4.0	30	70 – 130	30	70 – 130
1,1-Dichloroethane	4.0	30	70 – 130	30	70 – 130
cis-1,2-Dichloroethene	4.0	30	70 – 130	30	70 – 130
Hexane	35	30	70 – 130	30	70 – 130
Chloroform	4.9	30	70 – 130	30	70 – 130
1,2-Dichloroethane	4.0	30	70 – 130	30	70 – 130
1,1,1-Trichloroethane	5.4	30	70 – 130	30	70 – 130
Benzene	6.4	30	70 – 130	30	70 – 130
Carbon Tetrachloride	6.3	30	70 – 130	30	70 – 130

Cyclohexane	6.9	30	70 – 130	30	70 – 130
1,2-Dichloropropane	4.6	30	70 – 130	30	70 – 130
Trichloroethene	5.4	30	70 – 130	30	70 – 130
1,4-Dioxane	11	30	70 – 130	30	70 – 130
2,2,4-Trimethylpentane	9.4	30	70 – 130	30	70 – 130
Heptane	8.2	30	70 – 130	30	70 – 130
Methylcyclohexane	8.0	30	70 – 130	30	70 – 130
1,1,2-Trichloroethane	5.4	30	70 – 130	30	70 – 130
Methyl isobutyl ketone	8.2	30	70 – 130	30	70 – 130
Toluene	7.5	30	70 – 130	30	70 – 130
Methylbutylketone	8.2	30	70 – 130	30	70 – 130
Tetrachloroethene	6.8	30	70 – 130	30	70 – 130
Chlorobenzene	4.6	30	70 – 130	30	70 – 130
Ethylbenzene	4.3	30	70 – 130	30	70 – 130
M,p-xylene	8.7	30	70 – 130	30	70 – 130
o-Xylene	8.7	30	70 – 130	30	70 – 130
Styrene	8.5	30	70 – 130	30	70 – 130
1,1,2,2-Tetrachloroethane	6.9	30	70 – 130	30	70 – 130
Cumene	9.8	30	70 – 130	30	70 – 130
n-Propylbenzene	9.8	30	70 – 130	30	70 – 130
4-Ethyltoluene	9.8	30	70 – 130	30	70 – 130
1,3,5-Trimethylbenzene	9.8	30	70 – 130	30	70 – 130
1,2,4-Trimethylbenzene	29	30	70 – 130	30	70 – 130
1,3-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,4-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,2-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,2,4-Trichlorobenzene	15	30	70 – 130	30	70 – 130
Hexachlorobutadiene	21	30	70 – 130	30	70 – 130
Chloroethane†	16	30	70 – 130	30	70 – 130
Isopropyl alcohol†	49	30	70 – 130	30	70 – 130
Carbon Disulfide†	6.2	30	70 – 130	30	70 – 130
MTBE†‡	22	30	70 – 130	30	70 – 130
Methyl Ethyl Ketone†	59	30	70 – 130	30	70 – 130

Polyaromatic Hydrocarbons	Reporting Limit (ng)	ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
Naphthalene	0.5	30	70 – 130	30	70 – 130
2-Methylnaphthalene	1.0	30	70 – 130	30	70 – 130
1-Methylnaphthalene	1.0	30	70 – 130	30	70 – 130
Acenaphthylene	5.0	30	70 – 130	30	70 – 130
Acenaphthene	5.0	30	70 – 130	30	70 – 130
Fluorene	5.0	30	60 – 140	40	60 – 140
Phenanthrene	5.0	30	60 – 140	40	60 – 140
Anthracene	5.0	30	60 – 140	40	60 – 140
Fluoranthene	5.0	30	60 – 140	40	60 – 140
Pyrene	5.0	30	60 – 140	40	60 – 140

†Non-routine compounds by special request only.
‡Poor recovery performance when dry purge is applied for sample collection volumes greater than 1 Liter.

Table 3. Commonly requested TPH parameters – Optional

TPH	Reporting Limit (ng)	ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
GRO (Gasoline Range)	1000	30	60-140	30	60 – 140
DRO (C10-C24 Diesel Range)	1000	30	60-140	30	60 – 140

Table 4. Internal Standard and Field Surrogate Recoveries

Internal Standards		
Analyte	**CCV IS % Recovery**	**Sample IS % Recovery**
Bromochloromethane	60 – 140	60 – 140
1,4-Difluorobenzene	60 – 140	60 – 140
Chlorobenzene-d_5	60 – 140	60 – 140
Bromofluorobenzene	60 – 140	60 – 140
Field Surrogates		
Analyte	**% Recovery**	
1,2-Dichloroethane-d4	50 – 150	
Toluene-d8	50 – 150	
Naphthalene-d8	50 – 150	

Table 5. Summary of Calibration and QC Procedures for Modified Method TO-17 VI

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
BFB Tune Check	Before initial and daily calibration. Check is valid for 24 hours.	TO-15 tune criteria	Correct problem then repeat tune.
5-Point Calibration	Prior to sample analysis	%RSD $\leq$ 30% with 2 VOCs exceeding up to 40% RSD and 2 PAHS exceeding criteria up to 40%RSD.	Correct problem then repeat Initial Calibration Curve.
Initial Calibration Verification (ICV)	After each initial Calibration Curve	See Table 2; 20% of the compounds are allowed to exceed criterion.	Determine if the exceedance is due to an inaccurate calibration standard or inaccurate ICV standard. Recalibrate with an accurate standard or re-prepare the ICV as necessary. If any VOC exceeds 50–150% recovery, system is checked and the ICV is reanalyzed. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.
Continuing Calibration Verification (CCV)	At the start of each 24-hour clock after the Tune Check	70 – 130% 60–140% for Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene	If project-specified risk drivers exceed these criteria, more than 5% of the compounds exceed these criteria, or any VOC exceeds 50–150% recovery, maintenance is performed and the CCV test repeated. If the system still fails the CCV, perform a new 5-point Calibration Curve.
Laboratory Blank	After the CCV and before the samples and at end of sequence	Results less than the laboratory RL for Lab Blank analyzed prior to samples	Inspect the system and re-analyze the Blank. Flag associated data as appropriate.
Laboratory Control Spike (LCS)	Once per analytical batch	70 – 130% 60–140% for Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene; 20% of compound list may exceed criteria before corrective action is required.	Verify accuracy of standard. Re-prepare LCS if necessary. If calibration curve and/or system is found to be out of control, perform maintenance and re-calibrate. If any VOC exceeds 50–150% recovery, maintenance is performed and the ICV test is repeated. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Laboratory Control Spike Duplicate (LCSD)	Once per analytical batch (reanalysis of LCS)	≤ 20% RPD	Verify accuracy of standard. Re-prepare LCS if necessary. If calibration curve and/or system is found to be out of control, perform maintenance and re-calibrate. If any VOC exceeds 50–150% recovery, maintenance is performed and the ICV test is repeated. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.
Internal Standard (IS)	As each QC sample and sample are being loaded	**CCVs:** Area counts > 60% recovery; Retention Time (RT) within 20 seconds of mid-point in ICAL. **Blanks and samples**: Retention time (RT) must be within ±0.33 minutes of the RT in the CCV. The IS area must be within ±40% of the CCV's IS area for the Blanks and samples.	**CCV:** Inspect and correct system prior to sample analysis. **Blanks:** Inspect the system and re-analyze the Blank. **Samples:** Investigate the problem by verifying the instrument is in control by running a Lab Blank. Re-analyze recollected samples to verify recovery. Report the run with acceptable IS recovery. If both runs are unacceptable, narrate and flag associated data.
Field Surrogates	Added to each tube prior to shipment to field. Added to QC samples prior to analysis.	50–150%	**For blanks:** Inspect the system and re-analyze the Blank. **For samples:** Review data to determine whether sample collection parameters or matrix interference resulted in the exceedances. If so, narrate and flag recovery. If no cause is evident, verify the instrument is in control by running a Lab Blank. Re-analyze recollected sample to verify recovery.
Field Blank	Project-dependent	Artifact levels should be less than the reporting limit or less than 10% of the mass measured on the sampled tubes, whichever is less.	Flag associated results and evaluate tube conditioning and storage procedures.
Distributed Pairs	Project-dependent	%RPD ≤ 25%	Narrate discrepancy.

ANALYTICAL METHODS

Section 17.0

Method: ANALYSIS OF VOCS BY GC/MS COLLECTED ON CHARCOAL-BASED PASSIVE SAMPLERS

Eurofins Air Toxics SOP #100 Revision 4 Effective Date: January 10, 2014 Methods Manual Summary

Description: This method involves gas chromatograph/mass spectrometer (GC/MS) analysis of volatile organic compounds (VOCs) collected using charcoal-based passive samplers. These passive samplers include the Radiello® 130, SKC badges (575 and Ultra series), 3M™ OVM badges, and the WMS™ permeation sampler. Passive samplers are used to measure vapor-phase VOCs in a variety of gaseous matrices including indoor air, outdoor air, extracted soil gas, and emissions from materials. VOCs in the sampling environment pass through the diffusive barrier or permeable membrane of the sampler at a known, controlled rate (defined as the sampling rate) and adsorb to the charcoal-based sorbent pad of the sampler. The sorbent is extracted using a volume of carbon disulfide, and the extract is directly injected into a GC equipped with an MS. The retention time and spectral pattern of a compound are compared with that of known standard. Concentrations of the analytes are calculated from the average relative response factors of calibration curves obtained from analysis of standard solutions. The results are reported in units of µg/sample or µg/m^3 if the sampling rate and duration is known. Results for subsurface soil gas measurements are typically reported in units of µg/sample since there may be a low bias in the calculated µg/m^3 concentration due to starvation effects. Starvation effects occur when the uptake rate of the sampler exceeds the delivery rate of vapors from the surrounding soil.

There are no regulatory methods for the preparation and analysis of the Radiello and WMS samplers, while OSHA methods are available for workplace exposure measurements for several of the VOCs using 3M OVM 3500 and SKC 575 series samplers. The OSHA methods and recommended procedures published by Radiello (FSM) and 3M serve as the basis for this standard operating procedure for the analysis of environmental samples. Additionally, QC elements outlined in EPA SW-846 8260 and 8270 are incorporated as applicable. One variance of note that Eurofins Air Toxics has taken to the OSHA, Radiello, and the OVM 3500 methods is the use of GC/MS instead of GC/FID, thus providing more definitive compound identification and quantification for trace level environmental measurements.

Table 1 lists the target analytes routinely calibrated, along with the extract reporting limits and QC acceptance criteria. Tables 4 through 6 list the reporting limit for each sampler type in units of mass and the sampling rate. The sampling rates for the WMS sampler are maintained as proprietary and are not published as part of this document. To calculate the sample reporting limit in terms of µg/m^3, the compound sampling rate and the sample duration are required. Please consult with the laboratory to determine the appropriate sampler to meet project objectives.

Table1. Target Analytes, (Extract) Reporting Limits, and QC Criteria

Analytes	Reporting Limit (µg/mL)	Acceptance Criteria			
		ICAL (%RSD)	ICV (% R)	LCS (%R)	CCV (%D)
Chloromethane	0.2	30	70 – 130	50 – 140	%D ≤ 40%
Vinyl Chloride	0.2	30	50 – 140	50 – 140	%D ≤ 40%
Ethanol	0.5	30	70 – 130	50 – 130*	%D ≤ 30%
1,1-Dichloroethene	0.2	30	70 – 130	70 – 130	%D ≤ 30%
Acetone	0.1	30	70 – 130	70 – 130	%D ≤ 30%
2-Propanol	0.1	30	50 – 130	50 – 130	%D ≤ 30%
MTBE	0.05	30	70 – 130	70 – 130	%D ≤ 30%
trans-1,2-Dichloroethene	0.1	20	80 – 120	70 – 130	%D ≤ 20%
Hexane	0.05	30	70 – 130	70 – 130	%D ≤ 30%
1,1-Dichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Ethyl Acetate	0.2	30	70 – 130	70 – 130	%D ≤ 30%
2-Butanone	0.05	30	70 – 130	70 – 130	%D ≤ 30%
cis-1,2-Dichloroethene	0.1	20	80 – 120	70 – 130	%D ≤ 20%
Chloroform	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Cyclohexane	0.05	30	70 – 130	70 – 130	%D ≤ 20%
1,1,1-trichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Carbon Tetrachloride	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Benzene	0.2	30	70 – 130	70 – 130	%D ≤ 30%
1,2-Dichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Heptane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Trichloroethene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
4-Methyl-2-pentanone	0.1	30	70 – 130	70 – 130	%D ≤ 30%
Toluene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,1,2-Trichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Tetrachloroethene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Chlorobenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Ethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
m,p-Xylene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
o-Xylene	0.05	30	70 – 130	70 – 130	%D ≤ 20%
Styrene	0.05	30	70 – 130	20-100*	%D ≤ 30%

1,1,2,2-Tetrachloroethane	0.05	30	70 – 130	60 – 130	%D ≤ 30%
Propylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,3,5-Trimethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,2,4-Trimethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,3-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
1,4-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
1,2-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
Naphthalene	0.05	30	70 – 130	5-80*	%D ≤ 30%

*Acceptance limits based on desorption efficiency studies
**60 – 130% for WMS

Table 2. Internal Standard

Analyte	CCV IS (%R)	Sample IS (%)R
2-Fluorotoluene	50 – 200	50 – 200

Table 3. Surrogate

Analyte	%R
Toluene-d8	70-130

Table 4. Sampling Rates for "Standard" target compounds (RAD 130)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for Radiello 130 Sampler (mL/min)
Chloromethane	0.2	0.4	107*
Vinyl Chloride	0.2	0.4	90*
Ethanol	0.5	1.0	102
1,1-Dichloroethene	0.2	0.4	76*
Acetone	0.1	0.2	77
2-Propanol	0.1	0.2	52
MTBE	0.05	0.1	65
trans-1,2-Dichloroethene	0.1	0.2	60*
Hexane	0.05	0.1	66
1,1-Dichloroethane	0.05	0.1	63*
Ethyl Acetate	0.2	0.4	78
2-Butanone	0.05	0.1	79
cis-1,2-Dichloroethene	0.05	0.1	62*
Chloroform	0.05	0.1	75
Cyclohexane	0.05	0.1	54
1,1,1-trichloroethane	0.05	0.1	62
Carbon Tetrachloride	0.05	0.1	67
Benzene	0.2	0.4	80
1,2-Dichloroethane	0.05	0.1	77
Heptane	0.05	0.1	58
Trichloroethene	0.05	0.1	69
4-Methyl-2-pentanone	0.1	0.2	67
Toluene	0.05	0.1	74

1,1,2-Trichloroethane	0.05	0.1	66*
Tetrachloroethene	0.05	0.1	59
Chlorobenzene	0.05	0.1	68
Ethylbenzene	0.05	0.1	68
m,p-Xylene	0.05	0.1	70
o-Xylene	0.05	0.1	65
Styrene	0.05	0.1	61
1,1,2,2-Tetrachloroethane	0.05	0.1	60*
Propylbenzene	0.05	0.1	57
1,3,5-Trimethylbenzene	0.05	0.1	53*
1,2,4-Trimethylbenzene	0.05	0.1	50
1,3-Dichlorobenzene	0.05	0.1	59*
1,4-Dichlorobenzene	0.05	0.1	51
1,2-Dichlorobenzene	0.05	0.1	58*
Naphthalene	0.05	0.1	25

*Estimated rate

Table 5. Sampling Rates for "Standard" target compounds (OVM)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for OVM Sampler (mL/min)
Chloromethane	0.2	0.30	Estimated
Vinyl Chloride	0.2	0.30	41
Ethanol	0.5	0.75	44
1,1-Dichloroethene	0.2	0.30	Estimated
Acetone	0.1	0.15	40
2-Propanol	0.1	0.15	39
MTBE	0.05	0.075	38
trans-1,2-Dichloroethene	0.1	0.15	Estimated
Hexane	0.05	0.075	32
1,1-Dichloroethane	0.05	0.075	33
Ethyl Acetate	0.2	0.3	34
2-Butanone	0.05	0.075	36
cis-1,2-Dichloroethene	0.05	0.075	Estimated
Chloroform	0.05	0.075	34
Cyclohexane	0.05	0.075	32
1,1,1-trichloroethane	0.05	0.075	31
Carbon Tetrachloride	0.05	0.075	30
Benzene	0.2	0.30	80
1,2-Dichloroethane	0.05	0.075	33
Heptane	0.05	0.075	29
Trichloroethene	0.05	0.075	31
4-Methyl-2-pentanone	0.1	0.15	30
Toluene	0.05	0.075	31
1,1,2-Trichloroethane	0.05	0.075	30
Tetrachloroethene	0.05	0.075	28
Chlorobenzene	0.05	0.075	29
Ethylbenzene	0.05	0.075	27
m,p-Xylene	0.05	0.075	27

o-Xylene	0.05	0.075	27
Styrene	0.05	0.075	29
1,1,2,2-Tetrachloroethane	0.05	0.075	28
Propylbenzene	0.05	0.075	Estimated
1,3,5-Trimethylbenzene	0.05	0.075	Estimated
1,2,4-Trimethylbenzene	0.05	0.075	Estimated
1,3-Dichlorobenzene	0.05	0.075	Estimated
1,4-Dichlorobenzene	0.05	0.075	27.8
1,2-Dichlorobenzene	0.05	0.075	27.8
Naphthalene	0.05	0.075	25

Table 6. Sampling Rates for "Standard" target compounds (SKC Badge)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for Indoor Air Applications „Zero Face velocity" (mL/min)	Sampling Rates for Outdoor/Worker Exposure (mL/min)
Chloromethane	0.2	0.4	Estimated	Estimated
Vinyl Chloride	0.2	0.4	17.4*	21.2*
Ethanol	0.5	1.0	11.7	20.0
1,1-Dichloroethene	0.2	0.4	9.74	12.3
Acetone	0.1	0.2	12.6	15.2
2-Propanol	0.1	0.2	9.65	20.0
MTBE	0.05	0.1	9.84	13.6
trans-1,2-Dichloroethene	0.1	0.2	10.2	14.8
Hexane	0.05	0.1	9.59	14.3
1,1-Dichloroethane	0.05	0.1	13.14	12.3
Ethyl Acetate	0.2	0.4	9.26	13.75
2-Butanone	0.05	0.1	6.27	17.1
cis-1,2-Dichloroethene	0.05	0.1	11.54*	14.8*
Chloroform	0.05	0.1	10.14	13
Cyclohexane	0.05	0.1	7.76	15.6
1,1,1-trichloroethane	0.05	0.1	9.40	14.1
Carbon Tetrachloride	0.05	0.1	10.41	14.1
Benzene	0.2	0.4	10.69	16
1,2-Dichloroethane	0.05	0.1	11.79	14.2
Heptane	0.05	0.1	9.38	13.9
Trichloroethene	0.05	0.1	11.47	14.9
4-Methyl-2-pentanone	0.1	0.2	7.29	13.5
Toluene	0.05	0.1	8.90	14.5
1,1,2-Trichloroethane	0.05	0.1	9.64	12.5
Tetrachloroethene	0.05	0.1	10.02	13.1
Chlorobenzene	0.05	0.1	8.23*	18.74*
Ethylbenzene	0.05	0.1	9.02	12.9
m,p-Xylene	0.05	0.1	8.1	12.65
o-Xylene	0.05	0.1	8.11	11.9
Styrene	0.05	0.1	9.04	13.7
1,1,2,2-Tetrachloroethane	0.05	0.1	9.98	11.8
Propylbenzene	0.05	0.1	6.41*	11.69*
1,3,5-Trimethylbenzene	0.05	0.1	7.29*	12.1*

1,2,4-Trimethylbenzene	0.05	0.1	9.92*	12.1*
1,3-Dichlorobenzene	0.05	0.1	5.79*	12.7*
1,4-Dichlorobenzene	0.05	0.1	10.74*	12.7*
1,2-Dichlorobenzene	0.05	0.1	4.97*	12.6*
Naphthalene	0.05	0.1	2.71*	13.7*

*Calculated by SKC

Table 7. Summary of Calibration and QC Procedures

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Prior to calibration and at the start of every 12-hour clock	Method 8260B tuning criteria	Correct problem then repeat tune.
Initial 5-Point Calibration (ICAL)	Prior to sample analysis	Compound criteria in Table 1	Correct problem then repeat initial calibration. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Narrate exceedances.
Initial Calibration Verification (ICV)	Once per initial calibration	See Table 1	Verify concentrations and standard preparation. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Narrate exceedances.
Continuing Calibration Verification (CCV)	At the start of every shift immediately after the BFB tune check	See "CCV criteria" column in Table 1	Investigate and correct the problem, up to and including recalibration if necessary. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Associated results are flagged.
Internal Standards (IS)	IS is added at the time of extraction to all samples and QC samples.	**For CCVs:** Area counts 50 –200%; RT w/in 30 seconds of midpoint in ICAL **For blanks, samples and non-CCV QC checks:** Area counts 50 – 200%; RT within 20 seconds of RT in CCV	**CCV:** Inspect and correct system prior to sample analysis. **For blanks:** Inspect the system and re-analyze the blank. **For samples:** Re-analyze; if out again, flag data.
Surrogate	Surrogate is added at the time of extraction to all samples and QC samples.	70–130%	Same as for Internal Standards.
Solvent Blanks	Immediately after the calibration standard or after samples with high concentrations	Results less than laboratory reporting limit (see Table 1)	Re-aliquot and re-analyze solvent blank. If detections remain, flag concentrations in associated samples.

Extracted Laboratory Blank	Each set of up to 20 samples	Results less than the reporting limit	Flag sample concentrations in associated extraction batch.
Extracted Laboratory Control Spike (LCS)	Each set of up to 20 samples	See Table 1.	Re-aliquot and re-analyze the extract. If within limits, report the re-analysis. Otherwise, narrate.
Extracted Laboratory Control Spike Duplicate (LCSD)	Each set of up to 20 samples	%RPD ≤ 25%	Analysis may proceed if no more than 2 VOCs exceed criteria (or 5% for short list exceed criteria). Run a 3rd time; perform corrective action or narrate as appropriate.

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LABORATORY QUALITY ASSURANCE MANUAL

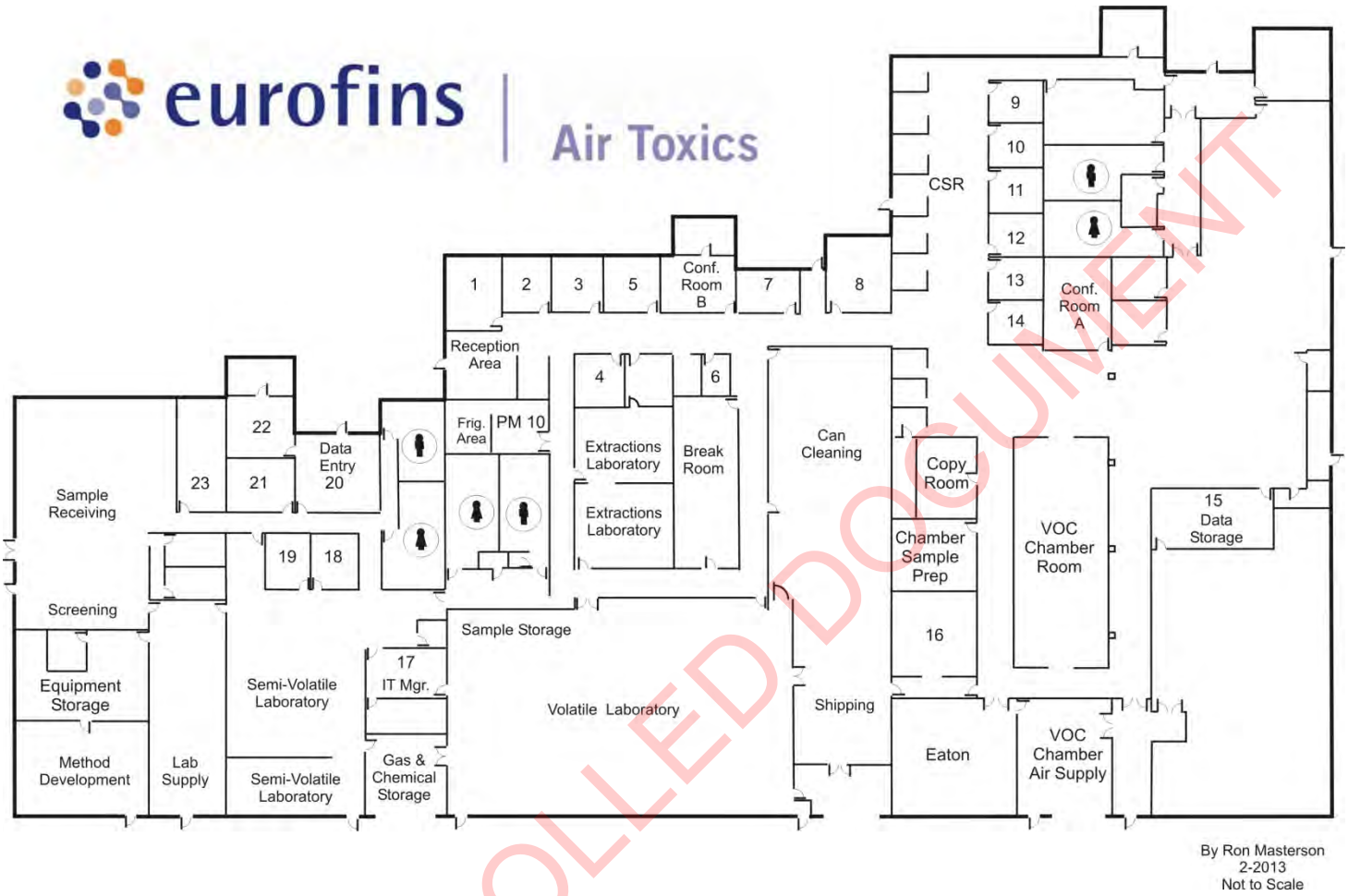
(LQAM)

Appendix F

Facility Map

(Two total pages including this cover)

Current as of March 5, 2014



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LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix G

References

(Two total pages including this cover)

Current as of March 5, 2014

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OREGON

Environmental Laboratory Accreditation Program

NELAP Recognized

Eurofins Air Toxics, Inc

CA300005

180 Blue Ravine Road, Ste. B

Folsom,CA 95630

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

	Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
Chemistry					

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Gary K. Ward

Gary K. Ward, MS

Oregon State Public Health Laboratory

ORELAP Administrator

3150 NW. 229th Ave, Suite 100

Hillsboro, OR 97124

ISSUE DATE: 10/18/2013

EXPIRATION DATE: 10/17/2014

Certificate No: CA300005 - 004

Oregon

Environmental Laboratory Accreditation Program

Department of Agriculture, Laboratory Division
Department of Environmental Quality, Laboratory Division
Oregon Health Authority, Public Health Division

NELAP Recognized

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2013 ***Expiration Date:*** 10/17/2014

As of 10/18/2013 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

MATRIX : Air

Reference	Code	Description
ASTM D1945 03	**30024443**	**Natural Gas by Gas Chromatography**

Analyte Code	*Analyte*
4938	2-Methylbutane (Isopentane)
4942	2-methylpropane (Isobutane)
4323	Acetylene
3755	Carbon dioxide
3780	Carbon monoxide
4747	Ethane
4752	Ethene
1767	Helium
1772	Hydrogen
4926	Methane
5007	n-Butane
9511	Neopentane
1843	Nitrogen
5028	n-Pentane
5029	n-Propane
3895	Oxygen

ASTM D1946-90	**30024465**	**Reformed Gas by Gas Chromatography**

Analyte Code	*Analyte*
3755	Carbon dioxide
3780	Carbon monoxide
4747	Ethane
4752	Ethene
1767	Helium
1772	Hydrogen
4926	Methane
1843	Nitrogen
3895	Oxygen

ASTM D5504 08	**30032258**	**Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence**

Analyte Code	*Analyte*
4842	1-Propanethiol
6113	2,5-Dimethylthiophene
4544	2-Ethylthiophene
4843	2-Propanethiol
5783	3-Methylthiophene
4450	Carbon disulfide

ORELAP Fields of Accreditation

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Analyte Code	*Analyte*
7215	Carbonyl sulfide
6078	Diethyl Disulfide
6081	Diethyl Sulfide
4729	Dimethyl disulfide
6116	Dimethyl Sulfide
7506	Ethanethiol
3840	Hydrogen sulfide
3725	i-Butanethiol
7507	Methanethiol
9556	t-Butanethiol
9574	Tetrahydrothiophene
9578	Thiophene

EPA TO-10A (GC/ECD) **10247504** **Pesticides and PCBs with HV PUF by GC/ECD**

Analyte Code	*Analyte*
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
8880	Aroclor-1016 (PCB-1016)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
7810	Methoxychlor
8250	Toxaphene (Chlorinated camphene)

EPA TO-11A **10311805** **Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)**

Analyte Code	*Analyte*
4300	Acetaldehyde
4315	Acetone
5570	Benzaldehyde
4430	Butylaldehyde (Butanal)
4545	Crotonaldehyde
4815	Formaldehyde
3825	Hexanaldehyde (Hexanal)
6330	Isovaleraldehyde
5125	m-Tolualdehyde (1,3-Tolualdehyde)
6755	o-Tolualdehyde (1,2-Tolualdehyde)
3965	Propionaldehyde (Propanal)
6760	p-Tolualdehyde (1,4-Tolualdehyde)
4040	Valeraldehyde (Pentanal, Pentanaldehyde)

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EPA TO-12 **10248201** **Non-Methane Organic Compounds by GC/FID**

Analyte Code	*Analyte*
3860	Non-methane organics

EPA TO-13A **10248405** **Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS**

Analyte Code	*Analyte*
5795	2-Chloronaphthalene
6385	2-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5855	Chrysene
5895	Dibenz(a,h) anthracene
6265	Fluoranthene
6270	Fluorene
6315	Indeno(1,2,3-cd) pyrene
5005	Naphthalene
6615	Phenanthrene
6665	Pyrene

EPA TO-13A SIM **10248449** **Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS SIM**

Analyte Code	*Analyte*
6380	1-Methylnaphthalene
5795	2-Chloronaphthalene
6385	2-Methylnaphthalene
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5605	Benzo(e)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5855	Chrysene
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
6265	Fluoranthene
6270	Fluorene
6315	Indeno(1,2,3-cd) pyrene
6615	Phenanthrene
6665	Pyrene

EPA TO-14A **10248609** **Volatile Organic Compounds with SUMMA canister and GC/MS**

Analyte Code	*Analyte*
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

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Analyte Code	*Analyte*
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4836	1-Propene
4860	2-Hexanone
4542	4-Ethyltoluene
4315	Acetone
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4705	cis & trans-1,2-Dichloroethene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4625	Dichlorodifluoromethane (Freon-12)
4750	Ethanol
4765	Ethylbenzene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
5140	Toluene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5235	Vinyl chloride
5260	Xylene (total)

EPA TO-15 **10248803** **VOCs collected in Canisters by GC/MS**

Analyte Code	*Analyte*
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

Eurofins Air Toxics, Inc
180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2013 ***Expiration Date:*** 10/17/2014

As of 10/18/2013 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	*Analyte*
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4836	1-Propene
5220	2,2,4-Trimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone
4542	4-Ethyltoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4325	Acrolein (Propenal)
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4705	cis & trans-1,2-Dichloroethene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4625	Dichlorodifluoromethane (Freon-12)
4750	Ethanol
4765	Ethylbenzene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4900	Isopropylbenzene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
5140	Toluene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA TO-15 GC/MS SIM **10248858** **VOCs collected in Canisters by GC/MS SIM**

Analyte Code	*Analyte*
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2013 ***Expiration Date:*** 10/17/2014

As of 10/18/2013 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	*Analyte*
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone
4542	4-Ethyltoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4625	Dichlorodifluoromethane (Freon-12)
4765	Ethylbenzene
5240	m+p-xylene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5250	o-Xylene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5235	Vinyl chloride

EPA TO-17 **10312206** **Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes**

Analyte Code	*Analyte*
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2013 ***Expiration Date:*** 10/17/2014

As of 10/18/2013 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	*Analyte*
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6380	1-Methylnaphthalene
5220	2,2,4-Trimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone (MBK)
4938	2-Methylbutane (Isopentane)
6385	2-Methylnaphthalene
4542	4-Ethyltoluene
4910	4-Isopropyltoluene (p-Cymene)
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
4375	Benzene
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4555	Cyclohexane
4765	Ethylbenzene
6265	Fluoranthene
6270	Fluorene
4835	Hexachlorobutadiene
4895	Isopropyl alcohol (2-Propanol, Isopropanol)
4900	Isopropylbenzene
5240	m+p-xylene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
6615	Phenanthrene
6665	Pyrene
4440	sec-Butylbenzene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5235	Vinyl chloride
5260	Xylene (total)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 004

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2013 ***Expiration Date:*** 10/17/2014

As of 10/18/2013 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

EPA TO-3 **10249000** **Cryogenic Trapping**

Analyte Code	*Analyte*
4375	Benzene
4765	Ethylbenzene
5140	Toluene
5260	Xylene (total)

EPA TO-4A **10249204** **Pesticides and PCBs by HV PUF GC**

Analyte Code	*Analyte*
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
8880	Aroclor-1016 (PCB-1016)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
7810	Methoxychlor
8250	Toxaphene (Chlorinated camphene)

Appendix D
Instrumentation Descriptions

Outdoor Hi-Volume Air Samplers

- Automatic/PID Mass or Volumetric Flow Control
- Networking & Communication Capabilities
- Continuous Data Logging
- Auto Calibration feature
- Programmable Timer & Total Volume Shut-Off
- Brushless 2 or 3 Stage Blower Motor
- For Continuous Use/Maintenance Free
- Applicable to EPA's 40 CFR 50, App. B
- PM-10 Head Adaptable

High volume air samplers are housed in a clear anodized aluminum outdoor shelter. The units incorporate a maintenance-free, two or three stage centrifugal blower powered by a brushless, variable speed, maintenance free motor. Blower selection is dependent upon individual sampling environment. The speed of the motor is controlled by a programmable logic controller (PLC) that accepts an input from a mass or volumetric flow sensor mounted in the sample air flow stream. The PLC detects changes in the operator's pre-set flow rate due to changes in temperature, barometric pressure and pressure drop due to dust loading on filter media. It compensates for these changes by adjusting the motor speed to maintain the pre-set flow rate. The illuminated, graphic LCD displays the operator's Pre-Set Flow Rate, Instantaneous Flow Rate, Total Volume of Air Sampled, and Elapsed Sample Time. The PLC also allows for programming of custom sample on/off time settings & pre-set total volume shut off. Networking and Communication option set-ups include: two (selectable) RS232/RS485 ports, a 4-20 mA and/or 0-10 VDC analog output proportional to flow, the ability to send & receive SMS messages to/from any CDMA/GSM cellular phone for possibly alerting/reporting any pre-defined event via text message, remote or local data acquisition, data logging in MS Excel format, and a custom remote access utility that allows complete control of the unit from a remote location.

HI-Volume Air Flow Calibrator

HI-Volume Air Flow calibrators have eliminated the need for cumbersome orifice plates and water manometers. The units utilize a precision machined Venturi tube coupled with a pressure differential gauge giving a direct reading in the volumetric units of choice (i.e. SCFM @ stp). It is calibrated against an in-line N.I.S.T. traceable laminar flow element. The primary calibrator meets the requirements of MIL Std. 45662A. They are intended to be used open to air. The direct meter read-out will indicate the flow in standard CFM, LPM, or CMM at standard conditions (29.92" of Hg and 70º F). Given actual sampling temperature & barometric pressure during calibration, a technician can convert actual flow readings (i.e. ACFM) to standard units (i.e. SCFM) by making a simple calculation using look-up correction factors from tables given in the operating manual. An operator is able to calibrate a unit with a 4" diameter filter holder assembly.

Calibration Adapter Plates (High Flow)

Adapters are designed to reduce overall pressure drop found during the calibration of standard 4" diameter and 8" x 10" filter paper sampling applications. The FHA's unique design reduces the overall paper to adapter fitting contact, thereby allowing the maximum obtainable free cross-sectional surface area through which unrestricted air can pass. This is done to duplicate the conditions of ambient air, open face, sampling procedures and to reduce the overall error in calibration.

Filter Paper for Air Sampling

Glass fiber filter media is made from 100% micro-fine borosilicate glass fibers. Glass fiber filters are used where high flow rate and micron/sub-micron filtration is required. The filter media can be used for both liquid and air filtration. In the highest purity form, HI-Q offers a binderless "AE" grade glass filter media.

Properties of Glass Fiber Media: The borosilicate glass fibers are inert and resistant to all but strongly alkaline bases or acids such as hydrofluoric acid. The fibers are heat resistant and will only begin to soften at over 600°C. The borosilicate glass has a refractive index of 1.51, and when immersed in a solvent of a similar refractive index like benzene, the fibers will be transparent. Particles collected on the media then become easier to visibly identify.

Radiation Dosimeter (TLD)

The standard TLD dosimeter card consists of a coded slide placed in a slide holder, with or without fi lters, and carried inside the dosimeter cover. The slide has four positions for the detectors (pellets, chips or rods). The detectors are not attached to the slide positions and any required number of positions up to four can be used.This makes it possible to handle the elements separately (e.g. extremity or clinical dosimetry).

Alpha Track Detector for Radon Gas

A radon monitor is a diffusion-based long-term alpha track detector. The detector is composed of a sealed plastic chamber which holds a specially manufactured plastic chip called CR-39. Radon enters the chamber through a seam around the circumference of the device, preventing dust and other particles from entering. Each detector has a unique serial number for tracking and satisfies chain of custody requirements.

After choosing an appropriate testing location, the detector is removed from its pouch to begin exposure. As radon gas diffuses into the chamber, it begins radioactive decay. Alpha particle emissions make "tracks" or etchings on the plastic chip in the chamber. After an exposure period of three months to one year, the detector is placed back in the pouch and returned to the laboratory for analysis by etching and magnified image track counting.

Radiello Diffusive Sampling System

The use of passive or diffusive air sampling technology has gained in popularity over the last 20 years. Unlike active sampling, passive samplers require no electricity (expensive pumps), have no moving parts, and are simple to use (no pump operation/calibration).

Other benefits of passive/diffusive sampling include:

- Compact, portable, unobtrusive, and inexpensive
- Offers indication of average pollution levels over time periods of 8 hours to weeks/months
- Requires no supervision, non-flammable, and noiseless
- Low cost allows sampling at a number of locations
- For highlighting pollutant “hotspots” where detailed study may be needed
- For determining long term data trends in specific geographical areas such as industrial zones
- Amenable to personal monitoring “breathing zone”, indoor air analysis, and outdoor ambient air analysis

05305L Wind Monitor-AQ, 4-20 mA Outputs

This Wind Monitor is a high resolution wind sensor designed specifically for air quality applications. It combines simple, corrosion-resistant construction with low threshold, fast response, and excellent fidelity. Wind speed is sensed by a lightweight, carbon fiber thermoplastic (CFT), helicoid propeller. Propeller rotation produces an AC sine wave voltage signal with frequency directly proportional to wind speed. Slip rings and brushes are not used. The instrument body is UV stabilized plastic with stainless steel and anodized aluminum fittings. Precision grade, stainless steel ball bearings are used throughout.

The wind direction sensor is a lightweight vane with performance characteristics that assure excellent fidelity in fluctuating wind conditions. Vane position is sensed by a precision potentiometer. Output is a DC voltage directly proportional to vane angle. The Wind Monitor-AQ meets the requirements of the following regulatory agencies: U.S. Environmental Protection Agency-Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). U.S. Nuclear Regulatory Agency-NRC Regulatory Guide 1.23 Meteorological Programs in Support of Nuclear Power Plants. American Nuclear Society-Standard for Determining Meteorological Information at Power Plants.

Gamma Area Detector

Gamma Area Detectors are used to measure gamma exposure rates in an indoor or outdoor environment. These detectors can be used for measuring from natural background to one hundred R/hr. These detectors can be used with local display and alarm units as a stand-alone monitor or can be integrated into a system that can monitor the radiation in multiple locations from a central station.

Appendix E
Radiello 130 Reporting Limits

RAD 130 SE

Duration				
Days	Hours	Minutes		Total Duration (min)
30	0	0	=	43200

Full List Target Analytes	Reporting Limit (ug/m3)	Reporting Limit Flag
1,1,1-Trichloroethane	0.0373	
1,2-Dichloroethane	0.0301	
1,4-Dichlorobenzene	0.0454	
2-Butanone (Methyl Ethyl Ketone)	0.0293	
2-Propanol	0.0890	
4-Methyl-2-pentanone	0.0691	
Acetone	0.0601	
Benzene	0.1157	
Carbon Tetrachloride	0.0345	
Chlorobenzene	0.0340	
Chloroform	0.0309	
Cyclohexane	0.0429	
Ethanol	0.2269	
Ethyl Acetate	0.1187	
Ethyl Benzene	0.0340	
Heptane	0.0399	
Hexane	0.0351	
m,p-Xylene	0.0331	
Methyl tert-butyl ether	0.0356	
Naphthalene	0.0926	
o-Xylene	0.0356	
Propylbenzene	0.0406	
Styrene	0.0379	
Tetrachloroethene	0.0392	
Toluene	0.0313	
Trichloroethene	0.0335	
1,2,4-Trimethylbenzene	0.0463	
Special Request Analytes	**Reporting Limit (ug/m3)**	**Reporting Limit Flag**
1,1,2,2-Tetrachloroethane	0.0386	Estimated SR
1,1,2-Trichloroethane	0.0351	Estimated SR
1,1-Dichloroethane	0.0367	Estimated SR
1,1-Dichloroethene	0.1218	Estimated SR
1,2-Dichlorobenzene	0.0399	Estimated SR
1,3,5-Trimethylbenzene	0.0437	Estimated SR
1,3-Dichlorobenzene	0.0392	Estimated SR
alpha-Pinene	0.0437	
cis-1,2-Dichloroethene	0.0373	Estimated SR
Limonene	0.0538	
trans-1,2-Dichloroethene	0.0772	Estimated SR
Vinyl Chloride	0.1029	Estimated SR

Compounds with Estimated SR will be flagged as "C" on the final report.

Appendix C:

Bridgeton Landfill Health and Safety Plan

Bridgeton Landfill
Health and Safety Plan

13570 St. Charles Rock Rd.
Bridgeton, Missouri 63044

May 9, 2014

Bridgeton Landfill, LLC.

13570 St. Charles Rock Road
Bridgeton, Missouri 63044
Telephone: (314) 744-8166
Facsimile: (314) 739-2588

TABLE OF CONTENTS

LIST OF APPENDICES

EMERGENCY MAPS AND DIRECTIONS

(Located on **last page** of HASP. Please tear-away map and directions to take with you in the event of an emergency)

1.1 INTRODUCTION

The purpose of this site-specific Health and Safety Plan (HASP) is to:

- Identify the health and safety hazards of each phase of site operations.
- Identify the procedures to be implemented to ensure employee protection.

The information in this HASP has been developed in accordance with applicable standards and generally recognized industry practices. This document is based on site-specific information in regards to the Bridgeton Landfill, LLC. (Site) located at 13570 St. Charles Rock Road, Bridgeton, Missouri 63044.

This written program shall be made available to Bridgeton Landfill, LLC personnel; any representatives designated by the Bridgeton Landfill, LLC; any contractor or subcontractor and their representatives who will be involved with site operations; OSHA personnel; and the appropriate personnel of the regulatory agencies that permit the site including the Missouri Department of Natural Resources (MDNR) Solid Waste Management Program (SWMP) and the St. Louis County Department of Health (SLCDOH).

Periodic evaluations will be made by site personnel to determine the effectiveness of this HASP. Any deficiencies noted in the effectiveness of the HASP shall be corrected by the Site.

All records supporting the requirements of this HASP are available upon request by contacting the Project Health and Safety Officer (HSO), Derek Bouchard, at 314-302-3634.

1.2 General Considerations

The levels of protection and the procedures specified in this HASP are based on the best information available at this time, and represent the minimum health and safety requirements to be observed by all site personnel, contractor and subcontractor employees, while engaged in site activities. Additionally, the content of this HASP may change or undergo revision as additional information is obtained during the field activities. Any changes to this HASP shall be reviewed by the Project HSO for approval.

Compliance with Health and Safety Requirements

The safety of all onsite personnel is ultimately the responsibility of each employee and his or her respective employer. Subcontractors are required to provide the necessary safety equipment, medical monitoring, and safety training to their personnel in compliance with the Occupational Safety and Health Administration (OSHA) regulations provided in 29 CFR 1910.120.

It is the responsibility of each individual involved in site activities to read this document carefully. If you have any questions or concerns that you feel are not adequately addressed, please contact the Project HSO. Follow the designated health and safety procedures, be alert to the hazards associated with working on any construction site in close proximity to heavy equipment, and above all else, use common sense and exercise reasonable caution at all times.

Any contractor found to be in violation of the site health and safety requirements may be subject to a written Notice of Safety Violation (Appendix K). Any written Notice of Safety Violation will be provided to the worker and the worker's supervisor. The worker shall be required to take immediate corrective action and certify that the appropriate measures have been taken to remove the unsafe condition or practice.

1.3 Safety Personnel and Chain of Command

The requirements of this HASP will be implemented through an effective organizational structure that includes the Project HSO, site personnel, contractors, and subcontractors.

Project Health and Safety Officer (HSO)

The Project HSO shall be responsible for the overall implementation of the HASP. This shall include, but is not limited to, review and approval of the HASP, communication of this HASP to subcontractor personnel, implementation of appropriate changes to the HASP, and relating any changes through the affected organizational structure. The HSO shall also be responsible, but not limited to, the following activities:

- Perform and document a safety orientation for all individuals involved in site activities, which will serve to familiarize them with the procedures, requirements, and provisions of this HASP.
- Provide for the safety of any visitors who enter the work area.
- Order the immediate shutdown of site activities in the case of an emergency.
- Provide the safety equipment, personal protective equipment (PPE), and other items necessary for site personnel. Ensure that contractors and subcontractors have provided the same for their respective employees.
- Enforce the use of required safety equipment, PPE, and other items necessary for employee and community safety.

Site Personnel

All site personnel are responsible for their own safety as well as the safety of those around them. All site personnel shall use any equipment provided in a safe and responsible manner, as directed by the Site.

Site personnel are expected to take the following actions as appropriate:

- Suspend any operations that may cause an imminent health hazard to employees, subcontractors, or others.
- Correct job site hazards when possible to do so, without endangering life or health.
- Be vigilant for any ill effects experienced by any crewmember, especially those symptoms caused by heat stress or chemical exposure.
- Report safety and health concerns to the HSO.

Equipment Operators

All equipment operators are responsible for the safe operation of heavy equipment under their control. Operators are responsible for inspecting their equipment to ensure safe performance. Brakes, hydraulic lines, backup alarms, and fire extinguishers must be inspected during site mobilization. Equipment will be taken out of service if an unsafe condition occurs. All equipment operators are required to wear seat belts during operation.

Contractors and Subcontractors

All contractors and subcontractors shall be expected to execute their specific job duties in a safe manner, and to provide sufficient resources, personnel, and equipment to meet this expectation. To facilitate preparation for this work effort, a copy of this HASP will be provided to each contractor and subcontractor.

As discussed above, the ultimate responsibility for the health and safety of the individual rests with the individual and his or her colleagues. Each individual is responsible for exercising the utmost care and good judgment in protecting his or her own health and safety, and that of fellow workers. Should any contractor or subcontractor observe a potentially unsafe condition or situation, it is the responsibility of that individual to immediately bring the observed condition to the attention of the HSO.

Should a contractor or subcontractor find himself or herself in a potentially hazardous situation, that individual shall immediately discontinue the hazardous procedure(s) and personally take appropriate preventative or corrective action, and immediately notify the HSO of the nature of the hazard. In the event of an immediately dangerous or life-threatening situation, the contractor or subcontractor automatically has "stop work" authority.

1.4 General Procedures

The following personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. These guidelines represent the minimum standard procedures for reducing potential risks associated with this project and are to be followed by site personnel, contractor, and subcontractor employees at all times. Individual guidelines are covered in greater detail later in this HASP.

- The "buddy system" will be used when conducting field activities. This can be accomplished through:
  - Physical proximity, i.e., within hearing or line of site of a landfill employee or HAZWOPER-trained contractor who can respond if assistance is required.
  - Access to cell-phone or radio communication with a landfill employee or HAZWOPER-trained contractor who is onsite and can respond if assistance is required.
- A multipurpose dry chemical fire extinguisher, a complete field first aid kit, and a bottle of emergency eyewash solution shall be supplied by each contractor and immediately available to each respective contractor's project field personnel. For example, field support vehicles will be stocked with these items.
- Eating, drinking, smoking, taking medications, chewing gum or tobacco, etc. is prohibited in the immediate vicinity of the work area. Work area is generally defined as:
  - Any subsurface disturbance, maintenance of any piping that may contain leachate and/or gas.
  - Repair or modification of any well or subsurface point that may contain leachate and/or gas.
- Thoroughly wash hands and, if necessary, face before eating or putting anything in your mouth (i.e., avoid hand-to-mouth contamination).
- Stand upwind of sample locations whenever possible.

- Be alert to potentially changing exposure conditions as evidenced by perceptible odors, unusual appearance of excavated soils, oily sheen on water, etc.

- Be alert to the symptoms of fatigue and heat/cold stress, and their effect on the normal caution and judgment of personnel.

- Establish prearranged hand signals or other means of emergency communication when wearing respiratory equipment since this equipment seriously impairs speech communications.

- Noise may pose a health and safety hazard during work activities. A good rule of thumb to follow is that if you have to shout in order to communicate a distance of 3 feet in steady state (continuous) noise, you should be wearing hearing protection. Likewise, any impact noise from activities that are loud enough to cause discomfort would also indicate the need for hearing protection.

- Always wear an appropriate level of personal protection. Lesser levels of protection can result in preventable exposure; excessive levels of safety equipment can impair efficiency and increase the potential for incidents to occur.

1.5 Site Control Procedures

Employees and contract workers must code into the landfill site using the Prox cards that will be issued once the access control system is in place. Authorized guests and temporary contract workers must read the contractor safety orientation before accessing the sites. Those individuals will be issued temporary Prox cards, and they must code in and out of the landfill area. Authorized personnel will be required to accompany any visitors to the work site.

1.6 Site Training

Worker Competency and Experience

All personnel conducting work at this site shall have demonstrated competency in the skills and activities relevant to their work at the site. This competency may be demonstrated through continuing education, work experience, or a combination thereof. The relevant subject matter may include, but is not limited to, heavy equipment operation, hand signals, first aid, hand tool safety, electrical safety, PPE usage, material handling, and trenching and excavation.

Hazardous Waste Operator (HAZWOPER) Training and Safety Training

OSHA HAZWOPER training is not mandatory for all personnel conducting work at the site; however, all Bridgeton Landfill employees with responsibilities for leachate management must receive 40-hour HAZWOPER training pursuant to 29 CFR 1910.120. HAZWOPER training shall be conducted by a qualified training contractor. All personnel must receive this training prior to performing tasks associated with leachate management, or must receive training within six months after the date of their assignment to leachate management responsibilities. No employee may work in this area in an unsupervised position before completing the training requirements.

Bridgeton Landfill has developed a site-specific safety orientation for all employees and contract workers. Workers must review the presentation and certify that they have read and will follow all health and safety policies and procedures. Contractor supervisors are responsible for

insuring that new workers take the orientation prior to working onsite. Furthermore, Bridgeton Landfill is developing an access control system so that only workers who have taken the safety orientation have credentials to access the site.

All other site contract workers involved in leachate management must work under the supervision of an employee or contractor who is HAZWOPER trained.

Position	Job Duties	Personnel Name
Bridgeton Landfill Environmental Manager	See Appendix J: Position Descriptions.	Brian Power
Bridgeton Landfill Environmental Specialist	See Appendix J: Position Descriptions.	Bryan Sehie Mike Lambrich
Health and Safety Officer Training Coordinator	See Appendix J: Position Descriptions.	Derek Bouchard
Bridgeton Landfill Technician	See Appendix J: Position Descriptions.	Dusty Smith Ryan Ayers Ryan Daniels David Voyles Stephen Lee Devin Hummel Forrest Booth

The updated status of required HAZWOPER training is found in **Appendix I**.

Bridgeton Landfill maintains the following documents for each employee:

- The job title and written job description for each position at the facility with responsibilities for leachate management and the name of the employee filling each position.

- Training records documenting the training requirements and the training received for each employee responsible for leachate management. Appendix A and Appendix B include Acknowledgment Forms for HASP and ongoing safety training activities.

- All training records on current personnel will be kept until closure of the facility. Training records on former employees will be kept for at least three years from the date the employee last worked at the facility. The training coordinator is responsible for maintaining the records.

Annual Review

All personnel with responsibilities for direct management of leachate will receive an annual safety training review. A HAZWOPER 8-hour refresher course or other course specific to the hazards encountered at the site may fulfill this requirement. In addition, safety, spill prevention and spill response procedures are regularly covered during daily briefings.

Annual review of the most current contractor-training program and HASP is required for all subcontractors and their personnel each calendar year following the initial briefing. Each

calendar year, Bridgeton Landfill will update the access credential for each individual only after the individual has received annual training.

Daily Safety Briefings

During the project, at intervals not to exceed 24 hours, supplemental safety meetings shall be conducted by the subcontractor supervisor or designee to discuss work performed to date, safety incidents (if any), potential health and safety hazards associated with upcoming tasks, and necessary precautions to be taken.

Fork Lift and Aerial Lift Training

If and when used on the site, it is mandatory that fork lifts and aerial lifts only be operated and inspected by employees who have received the Industrial Powered Truck Training and the Aerial Lift Training indicated in OSHA 1910.178. These trainings require both classroom time and field time inspecting and operating the equipment. Proof of training certificates for operators who have received the training must be available for inspection at the project site. Inspection checklist forms are found in **Appendix H.**

1.7 Health and Safety Plan (HASP) Applicability

This HASP applies specifically to all activities performed at the Bridgeton Landfill, Bridgeton, Missouri. It has been prepared specifically for this project.

1.8 Incident and Close Call Reporting

Any work-related incident, injury, illness, exposure, vehicle incident, or property loss must be reported to the HSO. All incidents shall be documented using contractor-specific forms comparable to one of the forms in **Appendix F** and forwarded to the HSO.

All close call incidents must also be reported to the HSO, including a description of the incident, what harm was averted and the circumstances surrounding the potential incident. An example of this form is also in **Appendix F**.

2.1 SCOPE OF WORK AND POTENTIAL HAZARDS

2.2 Work Activities

Site personnel and subcontractors will perform the following activities at this site:

- Site mobilization
- Gas collection well installation and completion
- Leachate collection well installation and completion
- Benching
- Header pipeline installation
- Wellhead installation

- Temporary cap installation
- Landfill gas (LFG) system operation and maintenance
- Flare installation
- Site demobilization
- Leachate management

If the scope of work is altered or if additional tasks are assigned, an addendum to this HASP shall be developed to address the specific hazards associated with these changes.

2.3 Potential Hazards

This section identifies and evaluates the potential chemical, physical, and biological hazards, which may be encountered during the activities described in the scope of work. To prevent these potential hazards from affecting worker performance, the HASP incorporates various levels of protection to be followed. However, it is recognized that the guidelines to be followed cannot replace worker common sense and experience.

Chemical Hazards

The potential chemical hazards of concern include components of landfill gas and leachate. These contaminants may include methane, hydrogen sulfide, ammonia, benzene, and other organic vapors. The routes of exposure from these contaminants are primarily through inhalation of organic vapors and dusts, and by direct contact with contaminated media.

Methane

Methane is usually a component of landfill gas. Pure methane is a colorless and odorless gas. It has practically no toxic effects below the flammable limits. While methane has no noticeable toxic effects, high concentrations can displace oxygen and serve as a simple asphyxiate. Methane has a lower explosive limit (LEL) of 5 percent and an upper explosive limit (UEL) of 15 percent by volume in air.

OSHA does not regulate exposure to methane by a specific standard. However, methane is a flammable gas and must be controlled at least 20 percent below its LEL; below 10 percent of the LEL in excavations and confined spaces.

Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless, non-irritating gas generally produced as a by-product of incomplete combustion of carbonaceous materials. The toxicity of carbon monoxide results from the way it interferes with the body's ability to transport oxygen. Therefore, in carbon monoxide poisoning, red blood cells are less able to pick up oxygen for transport from the lungs to the rest of the body, and are also less able to release whatever oxygen they do pick up. The first symptoms include headache, fatigue, and lightheadedness. At higher levels, skin flushing, rapid heart rate, and lowered blood pressure occur. Carbon monoxide poisoning is treated by administering oxygen to the patient.

The OSHA recommended exposure limit (REL) for carbon monoxide is 50 parts per million (ppm) as an 8-hour time weighted average (TWA), with a ceiling limit of 200 ppm, which should not be exceeded at any time during the workday.

Hydrogen Sulfide (H_2S)

Hydrogen sulfide is a colorless, toxic gas that is identified by the offensive odor of rotten eggs. It is heavier than air, flammable, and is generally a component of landfill gas. Hydrogen sulfide can cause irritation of eyes, nose and throat, beginning at approximately 10 ppm. Long-term exposure (30 minutes or longer) to high concentrations can cause drowsiness, staggering and nausea, which can lead to death due to respiratory system failure.

The odor of hydrogen sulfide can be detected at approximately 0.03 ppm, becomes offensive at 3 ppm, and causes irritation at 10 ppm. An especially dangerous situation is brief exposure to concentrations of 50 ppm, which can cause a person to lose the sense of smell. This has been described in accident reports as "I first smelled hydrogen sulfide, then it went away." This is called olfactory fatigue. The toxic effect of hydrogen sulfide paralyzes the respiratory control center, which leads to suffocation and then death.

Hydrogen sulfide has a wide flammable range (LEL 4.0%, UEL 44.0%). This property, coupled with its heavier-than-air density, makes it a hazard in trenches and low-lying areas.

Hydrogen sulfide is regulated by OSHA on a 20 ppm ceiling concentration. A ceiling concentration means that this level cannot be exceeded during any part of the work period. OSHA has also established a Permissible Exposure Limit (PEL) concentration at 10 ppm, and an Immediately Dangerous to Life or Health (IDLH) concentration of 100 ppm.

Employees are directed to shut down ignition sources and leave the area if hydrogen sulfide is detected above 10 ppm. Generally, natural cross-ventilation will reduce hydrogen sulfide to acceptable levels. Re-entry and continuation of work may be done only under controlled conditions involving monitoring equipment and in supplied air respirators if levels exceed, or are likely to exceed, 10 ppm.

Ammonia

Ammonia is a compound of nitrogen and hydrogen with the formula NH_3. It is a colorless gas with a characteristic pungent smell. Ammonia can be a potential skin, eye, and throat irritant. OSHA has also established a PEL concentration at 50 ppm, and an IDLH concentration of 300 ppm. Ammonia is flammable. Its LEL is 15 percent and its UEL is 28 percent. However, ammonia is unlikely to collect at a concentration high enough to pose an explosion hazard.

Benzene

Benzene is a colorless and highly flammable liquid with a sweet smell. Benzene is commonly used in industrial processing and can be present at waste facilities. The primary route of exposure to benzene is through inhalation. Benzene over-exposure can cause damage to the liver, kidneys, lungs, heart and the brain, and can cause DNA strand breaks and chromosomal damage. Benzene causes cancer in both animals and humans. OSHA has established a PEL concentration at 1 ppm and an IDLH concentration of 500 ppm. Its LEL is 1.2 percent and it has a UEL of 7.8 percent. It is not anticipated that benzene alone is likely to collect at concentrations high enough to pose explosion or ignition hazards.

Leachate

As refuse decomposes, a liquid material forms that can combine the chemical properties of all materials involved. The resulting fluid, referred to as leachate, could have a wide range of hazardous properties. The leachate has failed hazardous waste analysis for benzene, which is a toxic characteristic. In addition, the leachate can reach temperatures exceeding 200^oF.

Workers shall avoid direct contact with the leachate. In situations where contact is possible, workers shall wear modified Level D protective clothing, as described in the PPE section.

Asbestos

If suspected asbestos-containing material (ACM) is encountered when drilling a landfill gas or leachate well, the following "Asbestos Safety Protocol" will be implemented.

- Immediately identify and mark an exclusion zone with caution tape. The exclusion zone shall consist of a minimum twenty-five foot square (25'x25') with the landfill gas well located at the center.
- All personnel entering or working in the exclusion zone shall wear Tyvek suits for dust exposure and half-face respirators with appropriate asbestos filters.
- A ½-inch stream of water will be added to the borehole continuously during the drilling process.
- Plastic sheeting shall be placed on the ground near the borehole for the drilling debris to be placed on when emptying the drilling bucket. A sand or dirt berm approximately 18 inches high shall be placed on three sides of the plastic. Drilling debris placed on the plastic will be maintained wet. No overnight temporary storage of the drilled debris will be allowed.
- All used PPE and excavated or drilled material will be disposed of daily onsite in accordance with site procedures.
- All equipment owned or rented shall be pressure washed before leaving the site at a designated decontamination area.

Physical Hazards

Physical hazards that may be present during project work include the potential for close proximity to heavy equipment, working in trenches and excavations, noise, overhead and underground utilities, slip/trip/hit/fall injuries, heat stress/cold stress and other potential adverse weather conditions, existing LFG piping may contain abnormally hot landfill gases, steam, or hot leachate and may be pressurized. The abnormally hot gases/steam/leachate/pressure may also be encountered when penetrating existing soil cover material or flexible membrane liner. In addition, personnel must be aware that the protective equipment worn may limit dexterity and visibility and may increase the difficulty of performing some tasks.

Utility Clearances

- All work activities shall maintain the following distance limitations when near overhead electrical lines.

50,000 volts or less	10 feet away
50,000 volts to 200,000 volts	15 feet away
200,000 volts to 350,000 volts	20 feet away
350,000 volts to 500,000 volts	25 feet away
500,000 volts to 750,000 volts	35 feet away
750,000 volts to 1,000,000 volts	45 feet away

- Prior to all intrusive activities (e.g., excavating), locator line services will be contacted by the party performing the intrusive activities, as required by Missouri One-Call requirements, to mark underground lines.

- Personnel involved in intrusive work shall determine the minimum distance from marked utilities that work can be conducted with the assistance of the local agency.

Heavy Equipment

Working around heavy equipment can be dangerous because of the size and power of the equipment, the limited operatory field of vision, and the noise levels that can be produced by the equipment. Heavy equipment to be utilized at the site shall include a variety of backhoes, dozers, track loaders, and off-road trucks.

The following practices shall be followed by operators when using heavy equipment:

- Equipment should be inspected daily by the operator to ensure that the equipment is in safe operating condition.

- When not in use, hydraulic and pneumatic components should be left in down or "dead" position.

- Rollover protection shall be provided on uneven terrain sites.

- No riding on vehicles or equipment except in fixed seats.

- Seat belts should be worn at all times.

- Backup alarms, automatically activated and loud enough to be heard above background noise, are required to be operational on all heavy equipment.

- Parking brakes should always be applied on parked equipment.

- Equipment should never be operated closer than 10 feet from utility lines.

- Windshields must be maintained, clean, and free of visual obstructions.

- Wheel chocks must be used for all all-terrain vehicles (ATVs).

- When driving any vehicle, avoid distractions. No cell phone use is permitted while operating a vehicle.

To ensure the safety of all personnel in the work area, the following safety procedures regarding heavy equipment must be reviewed prior to and followed during work activities:

- Ensure that equipment operators are trained and/or experienced in the operation of the specific equipment.

- Personnel should never approach a piece of heavy equipment without the operator’s acknowledgment and stoppage of work or yielding to the employee.

- Never walk under the load of a bucket or stand beside an opening truck bed.

- Maintain visual contact with the operator when in close proximity to the heavy equipment.

- Wear hearing protection while on or around heavy equipment when normal conversation cannot be heard above work operations.

- Steel-toed shoes, safety glasses, and a hard hat shall be worn for all work conducted near heavy equipment.

Excavation and Trenching

The following safety guidelines shall be adhered to while conducting excavation and trenching operations:

- Prior to opening an excavation, the excavating employee or contractor shall determine whether underground installation (i.e., sewer, telephone, water, fuel electric lines, etc.) will be encountered and the estimated location. When the excavation approaches the estimated location of such installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work at least three days prior to the start of actual excavation, per Missouri One-Call requirements. An exception may be made if the location was previously cleared by Missouri One-Call, at which point the utility company will be notified and will have the option to observe the work at their discretion.

- Ladders will be used in any trench greater than 4 feet in depth, and must be available with every 25 feet of lateral travel. The ladders must extend above the trench at least 3 feet.

- Protective systems (i.e., shoring/bracing, sloping, or benching) shall be used if personnel are to enter an excavation with a depth greater than 5 feet.

- Sloping or benching shall be in accordance with the OSHA standard and shall correspond to the proper ratio (i.e., 1½:1) as per soil type.

- Air monitoring for potential hazardous atmospheres (i.e., combustible gases, volatile organics, and oxygen deficient environments) shall be conducted prior to and during personnel entering the trench with a depth at 4 feet or greater.

- Barriers shall be erected around excavations in remote work locations. Backfill all excavations, temporary wells, pits, and shafts when work is completed.

- Vehicular traffic and heavy equipment shall remain at least 4 feet from the face of the excavation. All excavated or other materials shall be stored and retained at least 2 feet from excavation.

- The excavation shall be inspected by the selected competent person throughout the workday during any change in conditions (i.e., rain, cracking/fissures) and at a minimum twice daily.

Heavy Lifting

When lifting objects, use the following proper lifting techniques:

- Keep your feet shoulder width apart to get the best footing possible.

- Bend at the knees, not at the waist.

- Tighten stomach muscles to offset the force of the load.

- Grasp the object at opposite corners.
- Lift with the legs instead of the back muscles.
- Keep the back upright and avoid twisting.
- Most importantly, think before lifting.

Slip/Trip/Hit/Fall

Slip, trip, hit, and fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards.
- Establish and utilize a pathway that is most free of slip and trip hazards.
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- Carry only loads that you can see over.
- Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- Communicate hazards to onsite personnel.
- Secure all loose clothing, ties, and remove jewelry while around machinery.
- Report and/or remove hazards.
- Keep safe buffer zones between workers using equipment and tools.

Electrical Hazards

No individual shall be permitted to work on any part of an electrical power circuit unless the person is protected against electric shock by de-energizing the circuit and grounding it, or by locking and tagging out:

- All electrical wiring and equipment shall be intrinsically safe for use in potentially explosive environments and atmospheres.
- All electrical wiring and equipment shall be a type listed by Underwriters' Laboratories (UL) or Factory Mutual (FM) for the specific application.
- All installations shall comply with the National Electric Code (NEC) and the National Electric Safety Code (NESC).
- All electrical circuits shall be grounded according to the NEC and NESC. Ground fault circuit interrupters shall be used in the absence of properly grounded circuitry or when portable tools must be used around wet areas.
- All live wiring or equipment shall be guarded to protect all persons or objects from harm.

Isolation and Lockout/Tagout Safeguards

All energy sources that are potentially hazardous to confined space entrants must be secured, relieved, disconnected and/or restrained before personnel are permitted to enter the confined space. Equipment systems or processes must be locked out or tagged out or both per 29 CFR and ANSI Z244.1-1982, Lockout/Tagout of Energy Sources, prior to permitting entry into the confined space. The current lockout/tagout program being used at the site must be used as guidance. In confined spaces where complete isolation is not possible, provisions must be made for as rigorous an isolation as practical. Special precautions must be taken when entering double walled, jacketed, or internally insulated confined spaces that may discharge hazardous material through the vessel's internal wall.

Adverse Weather Conditions

The HSO shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, tornado warnings, and strong winds are examples of conditions that would call for the discontinuation of work and evacuation of site.

- No work will be permitted during any type of electrical storm. When lightning is observed, site management staff will be notified and work shall cease for a period of 30 minutes from the last observed lightning strike.
- In the event of strong precipitation events (greater than 0.30 inch of rain per hour) or any icing event, traversal of the EVOH cap shall be strictly limited and will require notification of a supervisor and employment of the “buddy” system.
- Elevated work activities performed via a man lift or man basket are prohibited during high wind events (greater than 30 miles per hour wind speeds).

Heat Stress

Recognition and Symptoms

Temperature stress is one of the most common illnesses at hazardous waste sites. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat stress. Personnel should follow appropriate guidelines if any individual exhibits these symptoms:

Heat Rash — Redness of skin. Frequent rest and change of clothing.

Heat Cramps — Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly salted water by mouth, unless there are medical restrictions.

Heat Exhaustion — Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Move to cooler area and administer fluids.

Heat Stroke — Hot dry skin, red, spotted or bluish; high body temperature of 104°F; mental confusion; loss of consciousness, convulsions or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning, sponge with cool liquid while fanning; treat for shock. **DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.**

Work Practices

The following procedures will be carried out to reduce heat stress:

- Acclimatization
- Work/rest regimes
- Liquids that replace electrolytes/salty foods available during rest
- Use of buddy system

Acclimatization

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with heat stress. A work/rest regime will be partially determined by the degree of acclimatization provided.

Cold Stress

Recognition and Symptoms

Ambient air temperatures during site activities may create cold stress for onsite workers. Procedures for recognizing and avoiding cold stress must be followed. Cold stress can range from frostbite to hypothermia. Below are listed the signs and symptoms of cold stress. Personnel should follow the appropriate guidelines if any personnel exhibit these symptoms:

Frostbite — Pain in the extremities and loss of manual dexterity. "Frostnip" or reddening of the tissue, accompanied by a tingling or loss of sensation in the extremities. Continuous shivering.

Hypothermia — Pain in the extremities and loss of manual dexterity. Severe, uncontrollable shivering. Inability to maintain level of activity. Excessive fatigue, drowsiness, irritability, or euphoria. **Severe hypothermia:** clouded consciousness, low blood pressure, pupil dilation, cease of shivering, unconsciousness, and possible death.

Move the patient to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep patient warm. Re-warming of patient should be gradual to avoid stroke symptoms. Dehydration of the loss of body fluids may result in cold injury due to a significant change in blood flow to the extremities. If patient is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep patient warm and calm, transport to a medical facility as soon as possible.

Work Practices

The reduction of adverse health effects from cold exposure is achieved by adopting the following work practices:

- Providing adequate insulated dry clothing to maintain core temperature above 98.6°F to workers if work is performed in air temperature below 40°F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

- If the air temperature is 32°F or less, hands should be protected.

- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent and changed as it becomes wet. The outer garments should include provisions for easy ventilation in order to prevent wetting of inner layer by sweat.

- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.

- Heated warming shelters should be available nearby (e.g., use of onsite trailer). Workers should be encouraged to use these at regular intervals, the frequency depending on the severity of the environmental exposure. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit heat evaporation or a change of dry work clothing provided.

- Warm sweet drinks and soups shall provide the correct caloric intake and fluid volume. Intake of caffeinated coffee should be limited due to the diuretic and circulatory effect.

- The weight and bulk of clothing should be included in estimating the required work performance and weights to be lifted by the worker.

- Implementing a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.

- Unacclimatized employees should not be required to work full-time in cold until they become accustomed to the working conditions and required protective clothing.

Tinted eye protection for all workers will be provided when a glare potential (snow or ice) is present. Air temperature and wind speed monitoring and recording are required every four hours when the temperature falls below 30°F.

High Temperature Landfill Gases and High Temperature Leachate

Excessively hot landfill gases and leachate exceeding 200° F will be encountered in most parts of the existing landfill gas well and pipeline system. The gases and leachate may be under pressure, and extreme caution should be used when making repairs to avoid hot discharges. The piping to be repaired should be isolated by valving or a pipe pincher before work proceeds. Prior to opening or otherwise penetrating any existing sealed component, a test port should be drilled and or probed by other access points. High temperature splash protection PPE shall be used any time conditions cannot be identified or resolved prior to making penetrations.

Biological Hazards

Tick-Borne Diseases

Lyme disease is caused by a bacterial parasite called spirochete, and is spread by infected ticks that live in and near wooded areas, tall grass, and brush. Once the tick deposits the spirochete, it must feed on the host blood for 12 to 24 hours before it can transmit the disease. The ticks that cause the disease in the Northeast and Midwest are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are June through October. There are many other tick borne diseases such as Rocky Mountain Spotted Fever that can be carried by a variety of ticks. The prevention and treatment of these diseases are similar to those of Lyme disease.

Prevention

Ticks hang on blades of grass or shrubs waiting for a host to come by. When a host brushes against the vegetation, the tick grabs on. They typically climb onto an individual's legs and then crawl up looking to attach in a body crevice. Preventative measures include wearing light-colored clothing, keeping clothing buttoned, tucking pant legs into socks, pulling socks up past the knee, pulling the pant waist up above the naval area with a tight belt, and keeping shirttails tucked in. Periodic checks for ticks should be made during the day, and especially at night. Hair should also be checked by parting it and combing through it to make sure that no ticks have attached to the scalp. Also, check clothing when it is first removed, before ticks have a chance to crawl off. It is common for ticks to be carried home on clothing and attach to others in the household.

The most common repellent recommended for ticks is N,N-dimethyl-m-toluamide, or DEET. It is important to follow the manufacturer's instructions found on the container for use with all insecticides especially those containing DEET.

In general, DEET insect repellent should only be applied to clothing, not directly on the skin. Do not apply to sunburns, cuts or abrasions. Use soap and water to remove DEET once indoors.

Removal

The best way to remove a tick is removal by tweezers. If tweezers are not available, cover your fingers (tissue paper) while grasping the tick. It is important to grasp the tick as close as possible to the site of attachment and use a firm steady pull to remove it. When removing the tick, be certain to remove all the mouth parts from your skin so as not to cause irritation or infection. Wash hands immediately after with soap and water, and apply antiseptic to the area where the tick was removed.

Testing and Symptoms of Lyme Disease

A variety of tests exist for determining Lyme Disease infection. However, most of these tests are not exact. The first symptoms of Lyme Disease usually appear from two days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick attached. The rash is often bull's eye-like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy". Unfortunately, this rash appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of fever, fatigue, chills, headaches, a stiff neck, and muscle aches and pains (especially knees). Rashes may be found some distance away from the site of actual attachment. These symptoms often disappear after a few weeks.

Poisonous Plants

Common poison ivy (Rhus radicans) grows as a small plant, a vine, and a shrub. Poison ivy occurs in every state. The leaves always consist of three glossy leaflets. Poison sumac (Rhus vernix) grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause a mild to severe allergic reaction. This reaction is called contact dermatitis.

Dermatitis, in Rhus-sensitive persons, can result from contact with the milky sap found in the roots, stems, leaves, and fruit. The sap may retain its potency for months or years in a dry atmosphere and can occur during any time of the year. The sap may also be carried by animals, equipment or apparel.

The best form of prevention is to avoid contact. This can occur by wearing long sleeves and gloves if necessary. Disposable clothing, such as Tyvek, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

Blood Poisoning

Blood poisoning is a term used to indicate a large number of bacteria present in the circulating blood. The most common symptom of blood poisoning is the reddening of the skin, which advances towards the heart. For example, if the point of contact is the hand then a red line will appear at the hand and extend up the arm.

PPE shall be worn to prevent direct contact with media, which may be contaminated with bacteria or viral agents.

Signs and symptoms include swelling, stiffness, and tenderness in the affected area; fatigue, chills and fever; pustules and abscesses. If allowed to progress, the organisms may multiply and cause an overwhelming infection and death.

2.4 Assessment and Mitigation of Potential Hazards

Personal Protective Equipment (PPE)

All personnel involved with this work effort shall wear PPE equivalent to the Level D protocol described below. The HSO is qualified to modify this protocol in accordance with the hazards of the specific activities being performed at the time. Where there is increased potential for contact with liquids, the protocol shall be upgraded to the Modified Level D protocol described below.

Extensive use of respiratory protective equipment is not contemplated by this HASP. However, should field monitoring determine that respiratory equipment is required, the affected area will be evacuated until a proper respiratory protective equipment procedure can be implemented. The evaluation and use of respiratory protective equipment will be implemented as outlined in **Appendix G.**

PPE Designation	Mandatory Items	Worn at Direction of HSO
Level D	• **Hard hat** • **Work uniform** • **Safety glasses** • **Steel-toed boots** • **Traffic vest**	• **Hearing protection**
Modified Level D	• **Hard hat** • **Work uniform** • **Safety glasses** • **Steel-toed boots** • **Resistant coveralls** • **Rubber gloves** • **Rubber boots**	• **Hearing protection** • **Traffic vest**

Protocol for Visitors

Visitors shall be required to wear PPE equivalent to the Level D protocol described above. The HSO is responsible for making changes to the visitor PPE protocol if revisions are deemed necessary.

Exposure Monitoring

Air monitoring shall be performed during project activities that present the greatest potential for exposure to airborne contaminants such as landfill gas, leachate and oxygen deficiency. The data collected throughout the monitoring effort shall be continually evaluated to ensure the worker protection protocols required by this HASP remain effective.

All air monitoring conducted during this work effort shall be documented on the Direct Reading Instrument Data Form contained in **Appendix D**, and subsequently filed with the project records. **Appendix D** information may also be substituted for a meter data download if properly documented.

Oxygen, Combustible Gas Levels, Carbon Monoxide (CO), and Hydrogen Sulfide

The standard air monitoring protocol for this work effort shall consist of air monitoring for oxygen content, combustible gas levels, carbon monoxide, and hydrogen sulfide concentration. Combustible gas levels will be calibrated to monitor for methane (CH4) concentrations. The equipment to be used shall consist of an operational, calibrated oxygen/combustible gas/CO/hydrogen sulfide (O_2/LEL/CO/H_2S) 4-gas meter.

O_2/LEL/CO/H_2S METER

The O_2/LEL/CO/H_2S meter has the ability to determine the level of explosive vapors, oxygen deficient environments, and CO and H_2S concentrations. The combustible gas indicator has a range from 0 to 100 percent of the LEL. The oxygen sensor range is from 0 to 40 percent, the carbon monoxide sensor range is 0 ppm to 500 ppm, and the H_2S range is from 0 ppm to 100 ppm. In addition to the personal monitors, the contractors and subcontractors shall maintain the following instruments for air monitoring capability.

- Explosive Gases Meter
- Carbon Monoxide Detector
- Hydrogen Sulfide Meter
- Ammonia Meter
- Photo Ionization Detector (PID)

Monitoring Frequency

Air monitoring shall be conducted continuously during all activities when there is potential exposure to oxygen deficiency, explosive vapors, methane, hydrogen sulfide, carbon monoxide, ammonia, benzene, or other volatile organic compounds (VOCs). Situations that may present a potential exposure to oxygen deficiency include trenching, excavation, confined spaces, areas with ambient airflow restrictions, open well maintenance or repairs, or any other activity as decided by the HSO or subcontractor. Levels will be logged hourly during continuous monitoring.

Health and Safety Action Levels

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. The action levels for this project are established in the following table.

Work will continue if the LEL is less than 10 percent and the H_2S reading is less than 10 ppm. A work stoppage and evacuation (cease and desist) at the specific work area is required if concentrations of LEL concentrations exceed 10 percent or H_2S concentrations exceed 10 ppm.

Monitoring Device	Action Level	Action to be Taken
O_2/LEL/CO/H_2S Meter	< 19.5% O_2	Evacuate area and/or ventilate.
	> 10% LEL	Evacuate area and/or ventilate.
	> 40 ppm CO	Evacuate area and/or ventilate.
	> 10 ppm H_2S	Evacuate area and/or ventilate.

Prior to implementing the use of supplied air, contractor and subcontractor supervisors shall evaluate and implement industry standard engineering controls, if practical, to the work area that will lower concentrations below the action level. If engineering controls are not applicable/practical for the situation, supplied air may be used. Entry into any excavated area without supplied air will not be permitted if any of the following concentrations are detected and evaluated in accordance with the procedures listed below:

- Methane gas levels are detected at 25 percent of the LEL for methane gas or higher.
- Hydrogen sulfide gas levels are detected at 10 ppm or higher in worker breathing zone.

- Oxygen levels are detected at 19.5 percent oxygen gas by volume or lower in worker breathing zone.
- Carbon monoxide levels are detected at 25 ppm or higher in worker breathing zone.
- Ammonia levels are detected at 25 ppm or higher in worker breathing zone.
- VOC (including benzene) concentrations are higher than 1 ppm (or >10 ppm if benzene is not present) in worker breathing zone.

If the task requires the use of supplied air, each worker performing the task shall remain on supplied air until the completion of that task, or until the end of the working day if that task is to be carried out over a multiple day period. The contractor shall develop a task-specific safety plan for use of supplied air that describes the timeframes for working, including number and duration of breaks for each worker. The plan shall take into account factors that affect stress such as ambient temperature, level of PPE, the physical demands of the work, the nature of the pollutants to which the worker would otherwise be exposed, etc.

Confined Spaces

A confined space is defined as any location that has limited openings for entry and egress, is not intended for continuous employee occupancy, and is so enclosed that natural ventilation may not reduce air contaminants to levels below the PEL. Examples of confined spaces include manholes, stacks, pipes, storage tanks, trailers, tank cars, pits, sumps, hoppers, and bins. Entry into confined spaces without the proper precautions could result in injury and/or impairment or death due to:

- An atmosphere that is flammable or explosive.
- Lack of sufficient oxygen to support life.
- Contact with or inhalation of toxic materials.
- General safety or work area hazards such as steam or high pressure materials.

In the event that a confined space entry is warranted, a confined space entry team will be assembled. The team will be composed of a supervisor, entrant(s), attendant, and a rescue team. The following describes the duties of the personnel involved and each officer's respective responsibilities in the event that a confined space entry is warranted.

Confined Space Supervisor

The confined space entry team must have a Confined Space Supervisor. The Confined Space Supervisor must have current Confined Spaces Training and is responsible for implementing the confined space program and must:

- Ensure that a list of confined spaces is maintained.
- Ensure that cancelled permits are reviewed for lessons learned.
- Ensure training of personnel is conducted.
- Ensure coordination with outside responders.
- Ensure equipment is in compliance with standards.
- Maintain a master inventory of identified confined spaces.

- Determine if conditions are acceptable for entry.
- Authorize entry and oversee entry operations.
- Terminate entry procedures as required.
- Serve as an attendant, as long as the person is trained and equipped appropriately for that role.

Employees and Contractors Entering Confined Space (Entrants)

Contractors involved in confined space entry must:

- Have current Confined Spaces Training.
- Submit a confined space entry permit for each day that entry is planned.
- Read and observe the entry permit requirements.
- Stay alert to the hazards that could be encountered in a confined space.
- Use the protective equipment required by the permit.
- Immediately exit the confined space when:
  - Ordered to do so by the Attendant.
  - Automatic alarms sound.
  - They perceive they are in danger.
  - They notice physiological stresses or changes in themselves or co-workers (e.g., dizziness, blurred vision, shortness of breath).

Attendant

Entrants must be accompanied by an attendant. The attendant must have current Confined Spaces Training, must be stationed at the entrance to the workspace and must:

- Be knowledgeable of, and be able to recognize, potential confined space hazards.
- Maintain a sign-in/sign-out log with a count of all persons in the confined space and ensure all entrants sign in/sign-out.
- Monitor surrounding activities to ensure the safety of personnel.
- Maintain effective and continuous communication with personnel during confined space entry, work and exit.
- Order personnel to evacuate the confined space if he/she:
  - Observes a condition that is not allowed on the entry permit.
  - Notices the entrants acting strangely, possibly as a result of exposure to hazardous substances.
  - Notices a situation outside the confined space that could endanger personnel.
  - Notices within the confined space a hazard, which has not been previously recognized or taken into consideration.

  - Must leave his/her workstation.
  - Must focus attention on the rescue of personnel in some other confined space that he/she is monitoring.

- Immediately summon the rescue team if crew rescue becomes necessary.
- Keep unauthorized persons out of the confined space, order them out, or notify authorized personnel of the unauthorized entry.

Rescue Team

A rescue team must be available immediately in the event of an emergency. The rescue team members must have current Confined Spaces Training and must:

- Respond immediately to rescue calls from the attendant or any other person recognizing a need for rescue from the confined space.
- In addition to emergency response training, receive the same training as that required of the authorized entrants.

Identification and Evaluation

The Confined Space Supervisor must ensure a survey is conducted of the work site to identify confined spaces. This survey can be partially completed from initial and continuing site characterizations, as well as other available data (e.g., blueprints, job safety analysis). The purpose of the survey is to develop an inventory of locations and/or equipment that meet the definition of a confined space. This information must be communicated to personnel and appropriate procedures developed prior to entry. The initial surveys must include air monitoring to determine the air quality in the confined spaces. The following situations must be evaluated by competent personnel:

- Flammable or explosive potential.
- Oxygen deficiency.
- Presence of toxic and corrosive material.

Hazard Re-Evaluation

The Project Manager must ensure the identification and re-evaluation of the hazards based on possible changes in activities, and/or other physical or environmental conditions, which could adversely affect work. A master inventory of confined spaces must be maintained. Any change in designation of a confined space will be routed through the HSO for review, prior to the change being made.

Hazard Assessment

A hazard assessment must be completed prior to any entry into a confined space. The hazard assessment must identify the sequence of work to be performed in the confined space, the specific hazards known or anticipated, and the control measures to be implemented to eliminate or reduce each of the hazards to an acceptable level. No entry must be permitted until the hazard assessment has been reviewed and discussed by all persons engaged in the activity. Personnel who enter confined spaces must be informed of known or potential hazards associated with the confined spaces to be entered.

Hazard Controls

Hazard controls include changes in the work processes and/or working environment with the objective of:

- Controlling the health hazards by eliminating the responsible agents.
- Reducing health hazards below harmful levels.
- Preventing the contaminants from coming into contact with the workers.

The following order of precedence must be followed in reducing confined space risks:

- Engineering controls, such as ventilation to limit exposure to hazards.
- Work practice controls, such as wetting of hazardous dusts and subsequent cleaning.
- Use of PPE, such as air purifying or supplied-air respirators.

Engineering Controls

Engineering controls are those controls that eliminate or reduce the hazard through implementation of sound engineering practices.

Ventilation is one of the most common engineering controls used in confined spaces. When ventilation is used to remove atmospheric contaminants from the confined space, the space must be ventilated until the atmosphere is within the acceptable ranges. Ventilation must be maintained during the occupancy if there is a potential for the atmospheric conditions to move out of the acceptable range. When ventilation is not possible or feasible, alternate protective measures or methods to remove air contaminants and protect occupants must be determined by the qualified person prior to authorizing entry. Conditions regarding continuous exhaust ventilation must be used as follows:

- Employees must not enter the space until the exhaust ventilation has eliminated any hazardous atmosphere.
- Exhaust ventilation must be so directed as to ventilate the immediate areas where an employee is or will be present within the space.
- Continuous exhaust ventilation is maintained until all employees have left the space.
- Exhaust from the ventilation must be to an area that will not affect other workers.

Work Practice (Administrative) Controls

Work practice (administrative) controls are those controls that eliminate or reduce the hazard through changes in the work practice (e.g., rotating workers, reducing the amount of worker exposure, housekeeping). Confined spaces must be cleaned/decontaminated of hazardous materials to the extent feasible before entry. Cleaning/decontamination must be the preferred method of reducing exposure to hazardous materials. Where this is not practicable, PPE must be worn by the entry personnel to provide appropriate protection against the hazards that may be present.

Personal Protective Equipment (PPE)

If the hazard cannot be eliminated or reduced to a safe level through engineering and/or work practice controls, PPE must be used. A qualified person per 29 CFR 1926.32(m) must determine PPE needed by all personnel entering the confined space, including rescue teams.

PPE that meets the specifications of applicable standards must be selected in accordance with the requirements of the job to be performed.

Entry Procedures

Whenever entry into a confined space is needed, a qualified inspector must complete a confined space entry permit. Entry into a confined space must follow the standard entry procedure.

The following are requirements for standard entry:

- Training to establish personnel proficiency in the duties required.
- Atmospheric testing for entry.
- Atmospheric monitoring during the entry.

Before an employee enters the space, the internal atmosphere must be tested with a calibrated, 4-gas monitor. If a hazardous atmosphere is detected during entry:

- The space must be evaluated to determine how the hazardous atmosphere developed.
- Measures must be implemented to protect employees before any subsequent entry takes place.

Personnel must be prohibited from entering hazardous atmospheres without wearing proper respiratory equipment as determined by qualified entry supervisors. The entire confined space entry permit must be completed for a standard entry.

Opening a Confined Space

Any conditions making it unsafe to remove an entrance cover must be eliminated before the cover is removed. When entrance covers are removed, the opening must be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent anyone from falling through the opening. This barrier or cover must protect each employee working in the space from foreign objects entering the space. If it is in a traffic area, adequate barriers must be erected.

Atmospheric Testing

Atmospheric test data is needed prior to entry into any confined space. Atmospheric testing is required for two distinct purposes: evaluation of the hazards of the permit space and verification that acceptable conditions exist for entry into that space. If a person must go into the space to obtain the needed data, then Standard Confined Space Entry Procedures must be followed (i.e., rescue team, attendant, entry supervisor). Before entry into a confined space, a qualified person must conduct testing for hazardous atmospheres. The internal atmosphere must be tested with a calibrated, direct-reading instrument for the following, in the order given:

- Oxygen content.
- Flammable gases and vapors.
- Potential toxic air contaminants.

Evaluation Testing

The atmosphere of a confined space must be analyzed using equipment of sufficient sensitivity and specificity. The analysis must identify and evaluate any hazardous atmospheres that may exist or arise so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space. Evaluation and interpretation of these data and development of the entry procedure must be done by, or reviewed by, a technically qualified professional (e.g., OSHA consultation service, certified industrial hygienist, registered safety engineer, certified safety professional).

Acceptable Limits

The atmosphere of the confined spaces must be considered within acceptable limits whenever the following conditions are maintained:

- Oxygen–19.5 percent to 23.5 percent.
- Flammability – less than 10 percent of the LEL.
- Toxicity – less than recognized exposure limits or other published exposure levels (e.g., OSHA PELs).

Whenever testing of the atmosphere indicates levels of oxygen, flammability, or toxicity that are not within acceptable limits, entry must be prohibited until appropriate controls are implemented. If the source of the contaminant cannot be determined, precautions must be adequate to deal with the worst possible condition in the confined space. If there is the possibility that the confined space atmosphere can become unacceptable while the work is in progress, the atmosphere must be constantly monitored and procedures and equipment must be provided to allow the employees to quickly and safely exit the confined space.

Isolation and Lockout/Tagout Safeguards

All energy sources that are potentially hazardous to confined space entrants must be secured, relieved, disconnected and/or restrained before personnel are permitted to enter the confined space. Equipment systems or processes must be locked out or tagged out or both per 29 CFR and ANSI Z244.1-1982, Lockout/Tagout of Energy Sources, prior to permitting entry into the confined space. The current lockout/tagout program being used at the site must be used as guidance. In confined spaces where complete isolation is not possible, provisions must be made for as rigorous an isolation as practical. Special precautions must be taken when entering double walled, jacketed, or internally insulated confined spaces that may discharge hazardous material through the vessel's internal wall.

Ingress/Egress Safeguards

Means for safe entry and exit must be provided for confined spaces. Each entry and exit point must be evaluated to determine the most effective methods and equipment to be utilized to enable employees to safely enter and exit the confined space.

Appropriate retrieval equipment or methods must be used whenever a person enters a confined space. Use of retrieval equipment may be waived by the designated qualified person(s) if use of the equipment increases the overall risks of entry or does not contribute to the rescue. A mechanical device must be available to retrieve personnel from vertical-type confined spaces greater than 5 feet in depth.

Warning Signs and Symbols

All confined spaces that could be inadvertently entered must have signs identifying them as confined spaces. Signs must be maintained in a legible condition. The signs must contain a warning that a permit is required before entry. Accesses to all confined spaces must be prominently marked.

Training for Confined Space Entry

The contractor's individual employer must provide training so that all employees who are involved in confined space work at the site acquire the understanding, knowledge, and skills necessary for the safe performance of their duties in confined spaces. Training must be provided to each affected employee:

- Before the employee is first assigned duties under this section.
- Before there is a change in assigned duties.
- Whenever there is a change in permit space operations that presents a hazard for which an employee has not been trained.
- Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required in this section or that there are inadequacies in the employee's knowledge or use of these procedures.

The training must establish employee proficiency in the duties required by this section and must introduce new or revised procedures, as necessary, for compliance with this section.

General Training

All employees who will enter confined spaces must be trained in entry procedures. Personnel responsible for supervising, planning, entering or participating in confined space entry and rescue must be adequately trained in their functional duties prior to any confined space entry. Training must include:

- Explanation of the general hazards associated with confined spaces.
- Discussion of specific confined space hazards associated with the facility, location or operation.
- Reason for, proper use of, and limitations of PPE and other safety equipment required for entry into confined spaces.
- Explanation of permits and other procedural requirements for conducting a confined space entry.
- A clear understanding of what conditions would prohibit entry.
- How to respond to emergencies.
- Duties and responsibilities as a member of the confined space entry team.
- Description of how to recognize symptoms of overexposure to probable air contaminants in themselves and co-workers, and method(s) for alerting attendants.

Refresher training must be conducted as needed to maintain employee competence in entry procedures and precautions.

Retrieval Systems or Methods to Facilitate Non-Entry Rescue

Retrieval systems must be used whenever an authorized person enters a confined space, unless the equipment increases the overall risk of entry or the equipment would not contribute to the rescue of the entrant. Retrieval systems must have a chest or full body harness and a retrieval line attached at the center of the back near muster level or above the head. If harnesses are not feasible or create a greater hazard, wristlets may be used in lieu of the harness. The retrieval line must be firmly fastened outside the space so that rescue can begin as soon as anyone is aware that retrieval is necessary. A mechanical device must be available to retrieve personnel from vertical confined spaces more than 5 feet deep.

Decontamination

All site personnel shall follow the decontamination procedures outlined below.

Contamination Prevention

One of the most important aspects of decontamination is the prevention of the spread of contamination. Good contamination prevention will minimize employee exposure, and ensure good personal hygiene. Proper decontamination procedures and the following procedures of contamination avoidance shall reduce the potential exposure and the spread of contamination.

- Do not walk through areas of obvious or known contamination.
- Do not handle or touch contaminated materials directly.
- Fasten all closures on suits, cover with tape if necessary.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contaminants when possible.

Personal Decontamination

All PPE in excess of Level D protocol will be disposed of and/or decontaminated at the conclusion of each workday as described below. Decontamination procedures will follow the concept of deconning the most contaminated PPE first.

All disposable equipment shall be doffed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work. Non-disposable equipment will be fully decontaminated and then placed in a clean storage area.

Decontamination

Decontamination procedures are as follows:

- **Step 1** — Remove all visible contamination and loose debris (Level D and Modified Level D).
- **Step 2** — Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse (Modified Level D and above).
- **Step 3** — Remove protective clothing; dispose of in a disposable container (Modified Level D and above).

- **Step 4** — Wash and rinse hands.

Equipment Decontamination

Heavy Equipment

All vehicles and heavy equipment used (e.g., trucks, backhoe, bulldozer) that encounter waste materials will be decontaminated prior to leaving the project site using procedures determined by the HSO.

When possible, vehicles should be parked offsite or in a non-contaminated area of the site to minimize contamination and thus, avoid the need to decontaminate.

3.1 MEDICAL EMERGENCY PROCEDURES

3.2 Medical Emergency Response Plan

Employees shall have walkie-talkies or CB radios onsite, or be within the immediate vicinity of a cellular phone, at all times. Workers will be familiar with the location of the nearest phone and medical facilities, all of which are described as part of the safety orientation. In the event of an emergency situation, employees shall follow the general procedures specified below. Specific emergency procedures are listed in this HASP and should be readily available on the site.

Should any person visiting or working at the site be injured or become ill, notify your supervisor and/or the HSO and initiate the following emergency response plan.

If able, the injured person should be escorted to the nearest available source of first aid. If the injured party is extremely muddy, remove outer garments and if necessary, wash the injured area with soap and water, either at a portable wash station nearby or at the dedicated facilities available at the Bridgeton Landfill main office. If the "injury" involves a potential overexposure to hazardous gases or vapors, (headache, dizziness, nausea, disorientation), get the victim to fresh air and take him or her to a doctor for a complete physical examination as soon as possible.

If the injury involves foreign material in the eyes, immediately flush the eyes with emergency eyewash solution and rinse with copious amounts of water at the nearest emergency eyewash station. Emergency eyewash solution is required in all vehicles on the site. Dedicated emergency eyewash stations are available at the MBI Maintenance Building, near the one-million-gallon tank farm, inside the water treatment facility, and the leachate load-out area[EBG1]. Obtain or administer first aid as required. If further medical treatment is required, seek medical assistance as discussed below.

If the victim is unable to move, IMMEDIATELY SEEK MEDICAL ASSISTANCE. **Leave the victim in place unless absolutely necessary to save his or her life**, and administer necessary first aid until emergency medical personnel arrive.

If the victim is unconscious, **do not move the person unless absolutely necessary to save his or her life**. Administer rescue breathing if the victim is not breathing and control bleeding until emergency medical personnel arrive.

Incident, Injury, and Illness Reporting and Investigation

Any work-related incident, injury, illness, exposure, vehicle incident, or property loss must be reported to the HSO. All incidents shall be documented on the form contained in **Appendix F** and forwarded to the HSO.

The report must be filed for the following circumstances:

- Incident, injury, illness, or exposure of an employee.
- Injury of a subcontractor.
- Damage, loss or theft of property.
- Any incident, regardless of fault, which involves company equipment, a company vehicle, rental vehicle, or personal vehicle while the employee is acting in the course of employment.

All incidents will be investigated by the HSO, or designee. This investigation will focus on determining the cause of the incident and modifying future work activities to eliminate the hazard.

Emergency Equipment/First Aid

Basic first aid supplies (bandages, gauze, tape, etc.) will be located in the first aid box inside every onsite vehicle, along with a fire extinguisher. The first aid box along with first aid manuals will be located in the site trailer or site Superintendent's vehicle. Other onsite emergency equipment includes emergency eyewash, fire extinguisher, potable water and drinking cups, anti-bacterial soap, and walkie-talkies. These are located in the MBI Maintenance Building and in the leachate loading area.

4.1 INCIDENT RECOGNITION

Onsite incidents will be addressed in accordance with the Incident Management Plan. These include:

- Surface fire.
- Oxygenated subsurface fire (subsurface oxidation).
- Personal injury – man down, personnel contamination.
- Extreme gas/odor release.
- Collapse (mass movement within landfill limits).
- Slope failure (waste movement outside limits).
- Release of hazardous waste/hazardous substances.

If a potentially hazardous situation arises as indicated by instrument readings, visible contamination, unusual or excessive odors, etc., field personnel shall temporarily cease operations, move away to a safe area and contact the HSO, Bridgeton Landfill employee or contractor supervisor, whichever is immediately available. A list of emergency contacts can be found in **Appendix E**. The HSO or supervisor will then comply with the Site Incident Management Plan.

APPENDICES

APPENDIX A: HEALTH AND SAFETY PLAN (HASP) ACKNOWLEDGMENT FORM

BRIDGETON LANDFILL

Each employee conducting fieldwork shall sign this form after the pre-entry HASP briefing is completed and prior to commencing work onsite. This form shall be kept at the site during the work effort. At the conclusion of the project, the form shall be sent to the HSO for inclusion into the project file.

Site Personnel Sign-Off

By affixing your signature to the space below, you acknowledge that you have been trained on the work effort at this site, the potential safety and health hazards to be encountered, methods to prevent exposure to these health and safety hazards, and the contents of the Bridgeton Landfill HASP.

I understand this briefing and will comply with the safety requirements for this project.

Signature/Date

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Retain this form in the project files

APPENDIX B: WEEKLY SAFETY TRAINING ACKNOWLEDGEMENT FORM

PROJECT: BRIDGETON LANDFILL

SAFETY MEETING TOPIC: _____

Each employee conducting fieldwork shall sign this form after each Bridgeton Landfill safety training activity is completed. This form shall be kept at the site during the work effort. At the conclusion of the project, the form shall be sent to the HSO for inclusion into the project file.

Site Personnel Sign-Off

By affixing your signature to the space below, you acknowledge that you have been briefed on the safety topic identified at the top of this form.

I understand this briefing and will comply with the safety requirements for this project.

Signature/Date

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Retain this form in the project files

APPENDIX C: *RESERVED*

APPENDIX D: INSTRUMENT DATA FORM

PROJECT: BRIDGETON LANDFILL

DATE: _____ USER: _____

CALIBRATION DATE: _____ CALIBRATED BY: _____

		INSTRUMENT READINGS			
ACTIVITY	**DATE/TIME**	**O_2**	**LEL**	**CO / H_2S**	**COMMENTS**
				/	
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******Retain this form in the project files******
(Appendix D information may also be substituted onto downloaded report forms or Well Log report forms)

APPENDIX E: EMERGENCY CONTACT INFORMATION

PROJECT: BRIDGETON LANDFILL

EMERGENCY INFORMATION		
Agency, Contact, Facility Name	**Phone Number**	**Hospital Directions**
Bridgeton Police: 314-739-7557	911	Closest Hospital: SSM DePaul Health Center 12303 DePaul Dr. St. Louis, MO 63044 Distance: 2.0 miles (see tear-away map and written directions on last page of HASP) Alternative Hospital: St. Joseph Health Center 300 1st Capital Dr. St. Charles, MO 63301 Distance: 6.1 miles (see tear-away map and written directions on last page of HASP)
Robertson Fire District: 314-291-6670 l 314-575-5011	911	
Ambulance: 314-291-6670	911	
Closest Hospital: SSM DePaul Health Center	314-344-6000	
Alternative Hospital: St. Joseph Health Center	636-947-5000	
Environmental Manager: Brian Power	314-744-8165	
Project Health and Safety Officer: Derek Bouchard	314-302-3634	
Environmental Specialist: Bryan Sehie	314-443-0179	
Site Specialist: Michael Lambrich	314-744-8175	

******Post this information in a conspicuous place at the site.******

******Retain this form in the project files.******

APPENDIX F: INCIDENT REPORT

PROJECT: BRIDGETON LANDFILL

Person Completing this Report _____ Phone Number (____)_____

Date of Report_____ Date of Incident _____
month/day/year month/day/year

Employee's Information:

Name_____ Home Office_____

Occupation/Job Title _____

Where did the incident occur?

_____

_____

_____

What was the employee doing when the incident occurred?

_____

_____

_____

What was the type of injury or illness?

_____

_____

_____

_____

What object or substance directly harmed the employee?

_____

_____

Appendix F: Close Call Report

Project: Bridgeton Landfill

Please complete this form after the occurrence of a Close Call (incident causing injury or property damage that almost happened, or could have been worse).

Description of Close Call (who, what, where, when, how):

What went right? What could have been done differently?

Safe Start Assessment. Did the incident involve:

- ☐ **Rushing**
- ☐ **Frustration**
- ☐ **Fatigue**
- ☐ **Complacency**

Critical error that contributed to incident:

- ☐ **Eyes not on task**
- ☐ **Mind not on task**
- ☐ **Line of fire**
- ☐ **Balance/traction/grip**

Reported by (optional):

Today's Date:

Project (optional):

Project Manager (optional):

APPENDIX G: RESPIRATORY PROTECTION

PROJECT: BRIDGETON LANDFILL

This Respiratory Protection Program specifies standard operating procedures to protect all construction site employees from respiratory hazards, according to the requirements of 29 CFR, which simply refers to 29 CFR 1910.134. Respirators are to be used only where engineering control of respirator hazards is not feasible, while engineering controls are being installed, or in emergencies.

Respirator Selection

Respirators are selected on the basis of respiratory hazards to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

Selection Procedure Checklist

When selecting any respirator in general:

- Select and provide respirators based on respiratory hazard(s) to which a worker is exposed and workplace and user factors that affect respirator performance and reliability.
- Select a NIOSH-certified respirator. (NIOSH stands for the National Institute for Occupational Safety and Health).
- Identify and evaluate the respiratory hazard(s) in the workplace, including a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Consider the atmosphere to be immediately dangerous to life or health (IDLH) if you cannot identify or reasonably estimate employee exposure.
- Select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

When selecting respirators for IDLH atmospheres:

- Provide these respirators:
  - A full facepiece pressure demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of 30 minutes.
  - A combination full facepiece pressure demand supplied-air respirator (SAR) SCBA with auxiliary self-contained air supply.
- Provide respirators NIOSH-certified for escape from the atmosphere in which they will be used when they are used only for escape from IDLH atmospheres.
- Consider all oxygen-deficient atmospheres to be IDLH. Exception: If we can demonstrate that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II of 29 CFR 1910.134 (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

When selecting respirators for atmospheres that are not IDLH:

- Provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

- Select respirators appropriate for the chemical state and physical form of the contaminant.

- For protection against gases and vapors, provide:

  - An atmosphere-supplying respirator.

  - An air-purifying respirator, provided that: (1) The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or (2) If there is no ESLI appropriate for conditions in our workplace, implement a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life.

- For protection against particulates, provide:

  - An atmosphere-supplying respirator.

  - An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR Part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR 84.

- For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

Respirator Types and Uses

The following types of respirators are in use in this facility for the following uses:

Types:	**Situation Used:**
Organic Vapor Cartridges with Full-Face Respirator SCBA	**Volatile Organic Compounds (VOCs) CO, H_2S, CH4, VOCs**

Only NIOSH-certified respirators are selected and used. Where practicable, the respirators will be assigned to individual workers for their exclusive use.

Medical Evaluations

A medical evaluation to determine whether an employee is able to use a given respirator is an important element of an effective Respiratory Protection Program and is necessary to prevent injuries, illnesses and even, in rare cases, death from the physiological burden imposed by respirator use. Persons will not be assigned to tasks requiring the use of respirators nor fit tested unless it has been determined through thorough medical examination by a licensed physician that they are physically able to perform the work and use the respirator. Providing this information to the Site will be the responsibility of each individual's company of employment.

Fit Testing Procedures

Respirators must fit properly to provide protection. If a tight seal is not maintained between the facepiece and the employee's face, contaminated air will be drawn into the facepiece and be breathed by the employee. Fit testing seeks to protect the employee against breathing contaminated ambient air.

In general, fit testing may be either qualitative or quantitative.

- ***Qualitative Fit Testing*** (QLFT) involves the introduction of a gas, vapor, or aerosol test agent into an area around the head of the respirator user. If that user can detect the presence of the test agent through subjective means, such as odor, taste, or irritation, the respirator fit is inadequate.

- ***Quantitative Fit Test*** (QNFT) involves assessing the adequacy of the respirator fit by measuring the amount of leakage into the respirator, either by generating a test aerosol as a test atmosphere, using ambient aerosol as a test agent, or using controlled negative pressure to measure the volumetric leak rate. Appropriate instrumentation is required to quantify respirator fit in QNFT.

Each individual's company of employment must make sure that the individual is fit tested at the following times with the same make, model, style, and size of respirator that will be used:

- Before any employee is required to use any respirator with a negative or positive pressure tight-fitting facepiece.

- Whenever a different respirator facepiece (size, style, model, or make) is used.

- At least annually.

- Whenever the employee and or individual's company of employment reports any visual observations of change in physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

- When the employee, subsequently after passing a QLFT or QNFT, notifies the company or the HSO that the fit of the respirator is unacceptable. That employee will be retested with a different respirator facepiece.

Individuals using any type of respirator must pass one of the following fit test types that follow the protocols and procedures contained in 29 CFR 1910.134 Appendix A:

- QLFT (Only used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less. May be used to test tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators if tested in the negative pressure mode).

- QNFT (May be used to fit test a tight-fitting half facepiece respirator that must achieve a fit factor of 100 or greater OR a tight-fitting full facepiece respirator that must achieve a fit factor of 500 or greater OR tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators if tested in the negative pressure mode).

Proper Use Procedures

Once the respirator has been properly selected and fitted, its protection efficiency must be maintained by proper use in accordance with 29 CFR 1910.134(g).

Facepiece Seal Protection

- Do not permit respirators with tight-fitting facepieces to be worn by employees who have:
  - Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function.
  - Any condition that interferes with the face-to-facepiece seal or valve function.
- If an employee wears corrective glasses or goggles or other personal protective equipment, ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.
- For all tight-fitting respirators, ensure that employees perform a user seal check each time they put on the respirator using:
  - The User Seal Check procedures in 29 CFR 1910.134 Appendix B-1 for facepiece positive and/or negative pressure checks.
  - The manufacturer's recommended user seal check procedures, provided that the manufacturer's procedures are equally effective.

Continuing Respirator Effectiveness

- Appropriate surveillance must be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, reevaluate the continued effectiveness of the respirator.
- Ensure that employees leave the respirator use area:
  - To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use.
  - If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece.
  - To replace the respirator or the filter, cartridge, or canister elements.
- If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, replace or repair the respirator before allowing the employee to return to the work area.

Procedures for IDLH Atmospheres

Ensure that:

- One employee or, when needed, more than one employee is located outside the IDLH atmosphere.
- Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
- The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue.
- The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.
- The employer or designee authorized to do so by the company, once notified, provides necessary assistance appropriate to the situation.
- Employee(s) located outside the IDLH atmospheres are equipped with:
    - Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure SAR with auxiliary SCBA; and either:
        - Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
        - Equivalent means for rescue where retrieval equipment is not required under the bullet item above this one.

Maintenance and Care Procedures

In order to ensure continuing protection from respiratory protective devices, it is necessary to establish and implement proper maintenance and care procedures and schedules. A lax attitude toward maintenance and care will negate successful selection and fit because the devices will not deliver the assumed protection unless they are kept in good working order.

Each individual's company of employment shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. It shall be ensured that respirators are cleaned and disinfected using the procedures below:

- In Appendix B-2 of 29 CFR 1910.134.
- Recommended by the respirator manufacturer. These procedures are of equivalent effectiveness as Appendix B-2 of 29 CFR 1910.134.

The respirators shall be cleaned and disinfected at the following intervals:

Respirator Type:	**Cleaned and Disinfected at the Following Interval:**
Issued for the exclusive use of an employee.	As often as necessary to be maintained in a sanitary condition.

Issued to more than one employee.	Before being worn by different individuals.
Maintained for emergency use.	After each use.
Used in fit testing and training.	After each use.

Storage

Storage of respirators must be done properly to ensure that the equipment is protected and not subject to environmental conditions that may cause deterioration. Each individual's company of employment shall ensure that respirators are stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they are packed or stored in their original packaging to prevent deformation of the facepiece and exhalation valve. In addition, emergency respirators shall be kept accessible to the work area; stored in a crew truck or project site trailer that are clearly marked as containing emergency respirators; and stored in accordance with any applicable manufacturer's instructions.

Inspection

In order to assure the continued reliability of respirator equipment, it must be inspected on a regular basis. The frequency of inspection is related to the frequency of use. Below is the minimum inspection frequency to be implemented at the site:

Respirator Type:	**Inspected at the Following Frequencies:**
All types used in routine situations.	Before each use and during cleaning.
Maintained for use in emergency situations.	At least monthly and in accordance with the manufacturer's recommendations, and checked for proper function before and after each use.
Emergency escape-only respirators.	Before being carried into the workplace for use.

Respirator and back-up respirator inspections include a check:

- For respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters.
- Of elastomeric parts for pliability and signs of deterioration.
- For SCBAs, in addition to the above, monthly, we maintain air and oxygen cylinders in a fully charged state and recharge when the pressure falls to 90 percent of the manufacturer's recommended pressure level and determine that the regulator and warning devices function properly.

Repairs

Respirators that fail an inspection or are otherwise found to be defective shall be removed from service and discarded, repaired, or adjusted in accordance with the following procedures:

- Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and only with the respirator manufacturer's NIOSH-approved parts designed for the respirator.

- Repairs must be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed.

- Reducing and admission valves, regulators, and alarms must be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

Discarding of Respirators

Respirators that fail an inspection or are otherwise not fit for use and cannot be repaired must be discarded.

Air Quality Procedures

When atmosphere-supplying respirators are being used to protect employees, it is essential to ensure that the air being breathed is of sufficiently high quality. Any atmosphere-supplying respirators used on the site shall include coverage of the following OSHA requirements:

Compressed Air, Compressed Oxygen, Liquid Air, and Liquid Oxygen Used for Respirators:

- Compressed and liquid oxygen must meet the United States Pharmacopoeia requirements for medical or breathing oxygen.

- Compressed breathing air must meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

    - Oxygen content (v/v) of 19.5-23.5 percent.

    - Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less.

    - Carbon monoxide content of 10 ppm or less.

    - Carbon dioxide content of 1,000 ppm or less.

    - Lack of a noticeable odor.

- Ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

- Ensure that oxygen concentrations greater than 23.5 percent are used only in equipment designed for oxygen service or distribution.

Cylinders Used to Supply Breathing Air to Respirators:

- Cylinders must be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR 173 and 178).

- Cylinders of purchased breathing air must have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air.

- The moisture content in the cylinder must not exceed a dew point of -50 deg F (-45.6 deg C) at 1 atmosphere pressure.

Compressors **(Not anticipated for use at the Bridgeton Landfill):**

- Ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

  - Prevent entry of contaminated air into the air supply system.

  - Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg. C) below the ambient temperature.

  - Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters must be maintained and replaced or refurbished periodically following the manufacturer's instructions.

  - Have a tag containing the most recent change date and the signature of the person authorized by our company to perform the change. The tag must be maintained at the compressor.

- For compressors that are not oil-lubricated, ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

- For oil-lubricated compressors, use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply must be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

Breathing Air Couplings:

- Ensure that breathing air couplings are incompatible with outlets for non-respirable worksite air or other gas systems. No asphyxiating substance must be introduced into breathing air lines.

Breathing Gas Containers*:*

- Use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR 84.

Filters, Cartridges, and Canisters*:*

- Ensure that all filters, cartridges and canisters used in the workplace are labeled and color-coded with the NIOSH approval label and that the label is not removed and remains legible. New respirator filter cartridges shall be used for each application with breakthrough times monitored.

Training

Employee training is an important part of the respiratory protection program and is essential for correct respirator use. Each individual's company of employment shall provide the proper training to all its employees who will be conducting work while using any type of respirator, and all employees who will provide support for those wearing any type of respirator.

APPENDIX H: AERIAL LIFT/INDUSTRIAL TRUCK INSPECTION CHECKLIST

Please review checklist before operating vehicle.

Week of: _____

Miles/Hours: _____

Place your initials in the appropriate box:

Shift	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1							
2							
3							

Vehicle Description:

Make:_____ Capacity: _____
Model:_____ Serial #: _____

Inspection:

Check One
☐ Gas
☐ Diesel
☐ LP
☐ Battery

#	Inspection Item Numbers
1	Operating Controls
2	Emergency Controls
3	Safety Devices, Horns, Alarms, and Seat Belts
4	Personal Protective Devices
5	Pneumatic System (leaks)
6	Hydraulic System (leaks)
7	Fuel System (leaks)
8	Cables
9	Wiring Harness
10	Loose or Missing Parts (locking pins, bolts, etc.)
11	Tires and Wheels
12	Placards and Warnings
13	Operational Manual
14	Outriggers/Stabilizers (if equipped)
15	Guardrail System
16	Locking Gate
17	Tilt Alarm

Report all deficiencies to your supervisor immediately.

NOTED DEFICIENCIES:

Date	Shift	Item #	Comments

APPENDIX I: HAZWOPER TRAINING LOG

PROJECT: BRIDGETON LANDFILL

Bridgeton Landfill Hazardous Waste Personnel Hazardous Waste Operator Training[EBG2]

Bridgeton Landfill Employee	Job Title/Description	Date of 40-Hour HAZWOPER Training (if not received, include date planned)	Date of Most Recent 8-Hour Update
Brian Power	Environmental Manager	February 2014	2/4/2014
Bryan Sehie	Environmental Specialist		2/5/2014
Derek Bouchard	Health and Safety Officer Training Coordinator	December 2007	1/21/2014
Mike Lambrich	Environmental Specialist		2/5/2014
Dusty Smith	Hazardous Waste Technician	February 2014	2/5/2014
Ryan Ayers	Hazardous Waste Technician	February 2014	2/5/2014
Ryan Daniels	Hazardous Waste Technician	February 2014	2/4/2014
David Voyles	Hazardous Waste Technician	February 2014	2/4/2014
Stephen Lee	Hazardous Waste Technician	February 2014	2/4/2014
Devin Hummel	Hazardous Waste Technician	February 2014	2/4/2014
Forrest Booth	Hazardous Waste Technician	February 2014	2/5/2014

APPENDIX J: EMPLOYEE POSITION DESCRIPTIONS

PROJECT: BRIDGETON LANDFILL

POSITION DESCRIPTION

POSITION TITLE: Environmental Manager **DEPARTMENT:** Engineering
REPORTS TO: Regional Engineer
SUPERVISES: Yes
EXEMPT STATUS: Exempt

POSITION SUMMARY: The Environmental Manager is responsible for the preparation of the Landfill budget, managing all spending for the Engineering department, and overseeing consultants and contractors during site development. The Environmental Manager is also responsible for permitting and ensuring the Landfill remains in compliance with all applicable regulations during operation.

PRINCIPAL RESPONSIBILITIES:

- Manages construction projects for Landfill cells and sites, including capacity calculations, scheduling/timeline, management of third-party CQA and contractors, and resource and material coordination.
- Prepares Landfill construction and ongoing operational budgets.
- Maintain financial responsibility for construction/cell development, closure/post-closure, engineering, operations, and cost tracking.
- Coordinates completion of permit applications and designs, including regulatory interface, site expansion, modification or changes to the operating plan application, and other related data.
- Prepares notifications/responses to regulatory inspections, administrative warnings.
- Assists Landfill and site Managers with development of fill sequencing plans.
- Participates in review of targeted acquisitions, including Phase I assessment/property survey coordination, engineering review of design and operations, and pro-forma modeling assistance.
- Performs ongoing public relations and due diligence activities through communication with corporate office, regulatory agency representatives, third party consultants and investors.
- Completes monthly soil tracking reports and other status reports.
- Regularly supervises Environmental Technicians and Specialists, including responsibility for hiring, training, mentoring, developing, scheduling, directing, managing performance and other related issues; review the work of, and is accountable for the performance of Environmental Technicians and Specialists**.**
- Attends regulatory and association sponsored informational and policy meetings.
- Ensures continued compliance by coordinating air, water monitoring, environmental data review and reporting.
- Performs other job-related duties as assigned.

EXPERIENCE, EDUCATION, CERTIFICATION:
Required:

- Bachelor's degree in Engineering, Geology, Biology or related science.
- Minimum of 4 years of experience in landfill engineering or environmental compliance in air, water, and solid waste.

Preferred:

- Certified Professional Engineer and/or Certified Professional Geologist designation. Previous experience in the waste industry.

OTHER KNOWLEDGE AND COMPETENCIES:

- Thorough knowledge of environmental regulations relating to air, water, solid waste, and material recovery/recycling.
- Strong written and oral communication skills.
- Effective interpersonal communication across various levels of the organization and with external customers, vendors and government agency representatives.
- Strong project management skills.
- Strong analytical skills and a focus on adding value to the Company.
- Ability to effectively manage multiple projects and meet deadlines.
- Ability to read, analyze, and interpret business documents, professional journals, technical procedures, and governmental regulations.

The statements herein are intended to describe the general nature and level of work being performed by employees, and are not to be construed as an exhaustive list of responsibilities, duties, and skills required by personnel so classified. Furthermore, they do not establish a contract for employment and are subject to change at the discretion of the Company.

REPUBLIC SERVICES, INC.

POSITION DESCRIPTION

POSITION TITLE: Environmental Specialist - Corporate **EFFECTIVE DATE**: 07/2012
FUNCTIONAL AREA: Engineering
REPORTS TO: Senior Manager, Environmental Management
SUPERVISES: N/A
FLSA STATUS: Exempt **JOB CODE**:

POSITION SUMMARY:

This role supports the Engineering Department with landfill and environmental remediation budgeting, construction management, cash flow tracking and forecasting, and technical issues associated with landfill leachate and gas management. The specialist will have daily interaction with the corporate and field staff on a variety of construction and technical issues.

PRINCIPAL RESPONSIBILITIES:

- Negotiates modified contract terms from standard construction and consulting documents, responsible for obtaining approval from legal and risk departments as needed.
- Assists Procurement Team with technical review of specifications and vendor selection on national procurement contracts.
- Reviews Environmental Due Diligence reports associated with property acquisition and divestitures.
- Prepares construction cost summaries and budget models for potential landfill acquisitions.
- Prepares insurance cost recovery documents as part of ongoing Pollution Liability Insurance claims, including preparing construction project descriptions, timelines, justifications and cost summaries.
- Coordinates preparation of TSDF audits and disposal facility audits by internal or external technical resources for new audits when required by Special Waste Department.
- Prepares summaries of various construction, monitoring and design Best Practices and compiles these summaries into a resource library for Corporate and Field Based Engineering Team.
- Coordinates updates to the Standard Operating Procedures documents produced by the Engineering Department, including the landfill gas well field SOP, the air compliance SOP, and landfill gas system standard design manual. Responsible for consultant coordination to produce updated document.
- Assists Director of Engineering with performance of annual Engineering Budget Process. Duties include:
  - Developing updates and changes to the Engineering Budget Model;
  - Developing training material for budget model, and conducting training;
  - Reviews models for completeness and variance analysis;
  - Reviewing comments and collation of data from Active Landfill Planning process into reports for senior management;
  - Assisting Engineering, Accounting, Financial Analysis and Planning Departments with the review of budgets, including preparation of variance summary documents, and SOX documentation reviews.

- Coordinates and over sees production of monthly engineering cash flow forecast, including variance and outlier analysis, consolidation of information into dashboard summaries. Assists field engineering and controllership teams with reconciliation of variances.
- Reviews alternate technology proposals for leachate treatment, gas extraction or other landfill applications.
- Perform other job-related duties as assigned or apparent.

EXPERIENCE, EDUCATION, CERTIFICATION:

Required:
- Bachelor's degree in Engineering, Geology, Biology or related science.

Preferred:
- Two years' experience in landfill operations or environmental compliance in air, water, and land.
- Certified Professional Engineer and/or Certified Professional Geologist designation obtained or in progress.

OTHER KNOWLEDGE, SKILLS, ABILITIES:

Required:
- Effective interpersonal communication skills across various levels of the organization, external customers, and representatives of government agencies. Communication tone must encourage collaboration and recognize all levels as team members and customers, while maintaining a professional representation suitable for department.
- Ability to write reports and correspondence with minimal direction.
- Must be a proven self-starter with an appropriate sense of urgency and customer focus.
- Ability to solve problems and make improvement recommendations as needed.
- Excellent organizational skills while managing multiple tasks in a high-volume, fast-paced environment, maintaining attention to detail, while meeting deadlines. Sufficiently process oriented to track progress and own process for several contractual and compliance based programs.
- Strong ethics and the ability to keep information confidential.
- Intermediate MS Office experience including Word, Excel and Access. Proficiency with spreadsheet and database management tools sufficient to run query reports and identify and repair data entry errors.
- Familiarity with SharePoint (or other web based portal and collaboration tool) and ability to perform basic administrative functions, including access rights management.

The statements herein are intended to describe the general nature and level of work being performed by employees, and are not to be construed as an exhaustive list of responsibilities, duties, and skills required by personnel so classified. Furthermore, they do not establish a contract for employment and are subject to change at the discretion of the company.

POSITION DESCRIPTION

Position Title: Environmental Technician **Effective**: March 2013
Department: Operations
Reports to: Environmental Manager and Ops Manager, Site Manager or GM
Supervises: No
Exempt Status: Non-Exempt

POSITION SUMMARY: The Environmental Technician is responsible for the safe operation and maintenance of landfill gas extraction systems, leachate collections systems and other related systems at Republic Services' landfills. The position is accountable for the ongoing monitoring of such systems, ensuring that all work adheres to safety regulations, as well as federal and state requirements.

REPRESENTATIVE RESPONSIBILITIES:

- Conducts, or assists with, environmental sampling that may include groundwater, surface water, air quality and gas migration.
- Measures and records gas levels in landfill well fields and at probes in the landfill boundary to ensure the ongoing compliance with applicable safety regulations, as well as federal and state requirements.
- Troubleshoots and corrects landfill gas extraction systems when necessary; report more complicated issues to management to ensure timely correction.
- Manages and troubleshoots leachate system to ensure it continues to operate in accordance with safety standards, federal and state regulations.
- Performs landfill surveying activities as required.
- Prepares and submits required reporting data relative to landfill gas extraction, leachate and other related systems.
- Performs all responsibilities in a safe and efficient manner, ensuring adherence to all safety regulations that govern job performance; ensure ongoing compliance with all applicable federal and state requirements.
- Performs other job-related duties as required.

EXPERIENCE, EDUCATION AND CERTIFICATION: REQUIRED:

- High School diploma or GED.
- Minimum of 1 year of experience working at a site regulated by OSHA.
- Minimum of 1 year of experience working with landfill gas extraction and/or leachate systems.

PREFERRED:

- Bachelor's Degree in Science.
- Minimum of 2 years of experience working at sites regulated by OSHA.
- Minimum of 2 years of experience working with landfill gas extraction and/or leachate systems.

OTHER KNOWLEDGE, SKILLS AND ABILITIES:

- Good time management skills to ensure assigned responsibilities are completed in an efficient and safe manner.
- Good communication skills; is able to effectively communicate operating issues to management.
- Good follow through ability; adheres to work schedule and follows through on challenges as they arise.
- Ability to adhere to Company policies and rules set forth; promotes the Company's safety standards; works with a sense of honesty and trustworthiness.
- Maintains a feeling of pride in work; strives to achieve all goals.

The statements used herein are intended to describe the general nature and level of the work being performed by an employee in this position, and are not intended to be construed as an exhaustive list of responsibilities, duties and skills required by an incumbent so classified. Furthermore, they do not establish a contract for employment and are subject to change at the discretion of the Company.

POSITION DESCRIPTION

Position Title: General Laborer **Department:** Operations
Reports To: Site or Operations Spvr/Mgr
Supervises: No **Exempt Status:** Non-Exempt

POSITION SUMMARY: A General Laborer is responsible for safely and efficiently performing general labor duties at a hauling company, transfer station, materials recycling facility (MRF) or landfill. Responsibilities may include such things as yard clean-up, fueling vehicles and equipment, general vehicle operation, general office maintenance and other related duties.

PRINCIPAL RESPONSIBILITIES:

- Safely and efficiently perform assigned responsibilities to include such duties as:
  - Clean up work areas;
  - Fuel vehicles and equipment;
  - Clean track on track type and related equipment;
  - Perform yard work, including mowing and paper pick up;
  - Operate general site vehicles and equipment, such as water trucks, pick-up trucks, sweepers, mowers, trimming equipment, etc.;
  - Perform general office maintenance and repairs, including painting and janitorial work;
  - Install temporary wind fences, as required;
  - Direct traffic at the site as necessary; and
- Perform other job-related duties as assigned.

EXPERIENCE, EDUCATION AND CERTIFICATION: REQUIRED:

- None.

PREFERRED:

- High School Diploma or GED.
- Valid driver's license.

OTHER KNOWLEDGE, SKILLS AND ABILITIES:

- Ability to adhere to work schedule and follows through on challenges as they arise.
- Ability to adhere to Company policies and rules that are set forth; promotes the Company's safety standards; works with a sense of honesty and trustworthiness.
- Maintains a feeling of pride in work; strives to achieve all goals.

The statements used herein are intended to describe the general nature and level of the work being performed by an employee in this position, and are not intended to be construed as an exhaustive list of responsibilities, duties and skills required by an incumbent so classified. Furthermore, they do not establish a contract for employment and are subject to change at the discretion of the Company.

Appendix K

CONTRACTOR NOTICE OF SAFETY VIOLATION

Site:_____ Date:_____

Issued by:_____ on behalf of Bridgeton Landfill, LLC

Contractor:_____

Contractor Representative:_____

Your Company has been found to be in violation of the site health and safety requirements, as specified below.

Violation(s):

Corrective Action(s) & date completed:

The signature below of the Contractor Representative certifies that all of the above-listed items have been corrected as indicated.

Signature:_____ Date:_____

Received by Company:

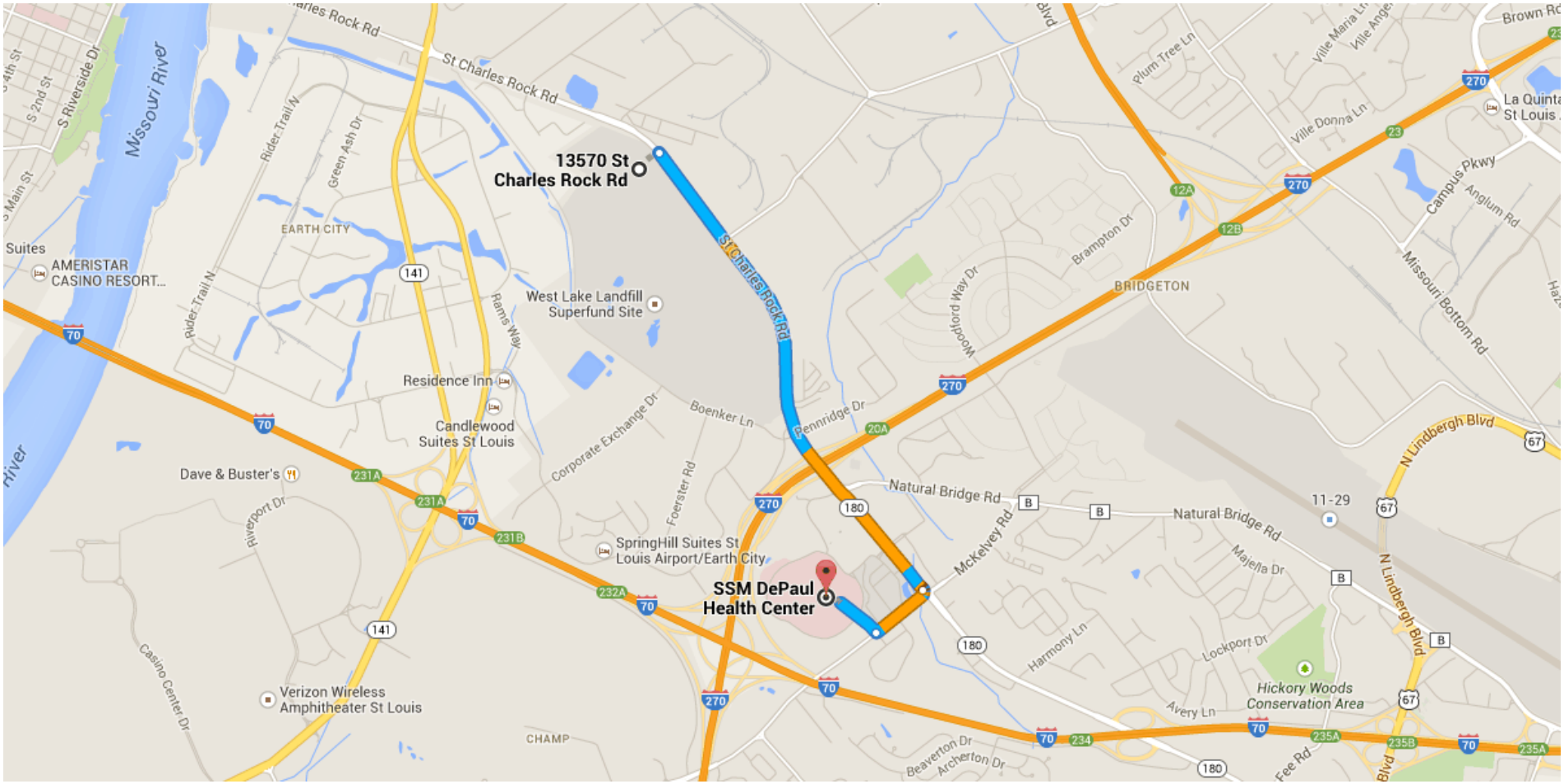
Signature:_____ Date:_____

LAST PAGE - INCLUDE TEAR SHEET WITH DIRECTIONS TO LOCAL MEDICAL FACILITIES

Primary Hospital - SSM DePaul Health Center
Remove this and take to the hospital

Drive 2.3 mi, 5 min

Directions from **13570 St Charles Rock Rd** to **SSM DePaul Health Center**



13570 St Charles Rock Rd

Bridgeton, MO 63044

1. Head **southeast** on **St Charles Rock Rd** toward **Taussig Rd**

1.9 mi

2. Turn **right** onto **McKelvey Rd**

0.2 mi

3. Take the 2nd **right** onto **De Paul Dr**

Destination will be on the left

0.2 mi

SSM DePaul Health Center

12303 De Paul Dr, Bridgeton, MO 63044

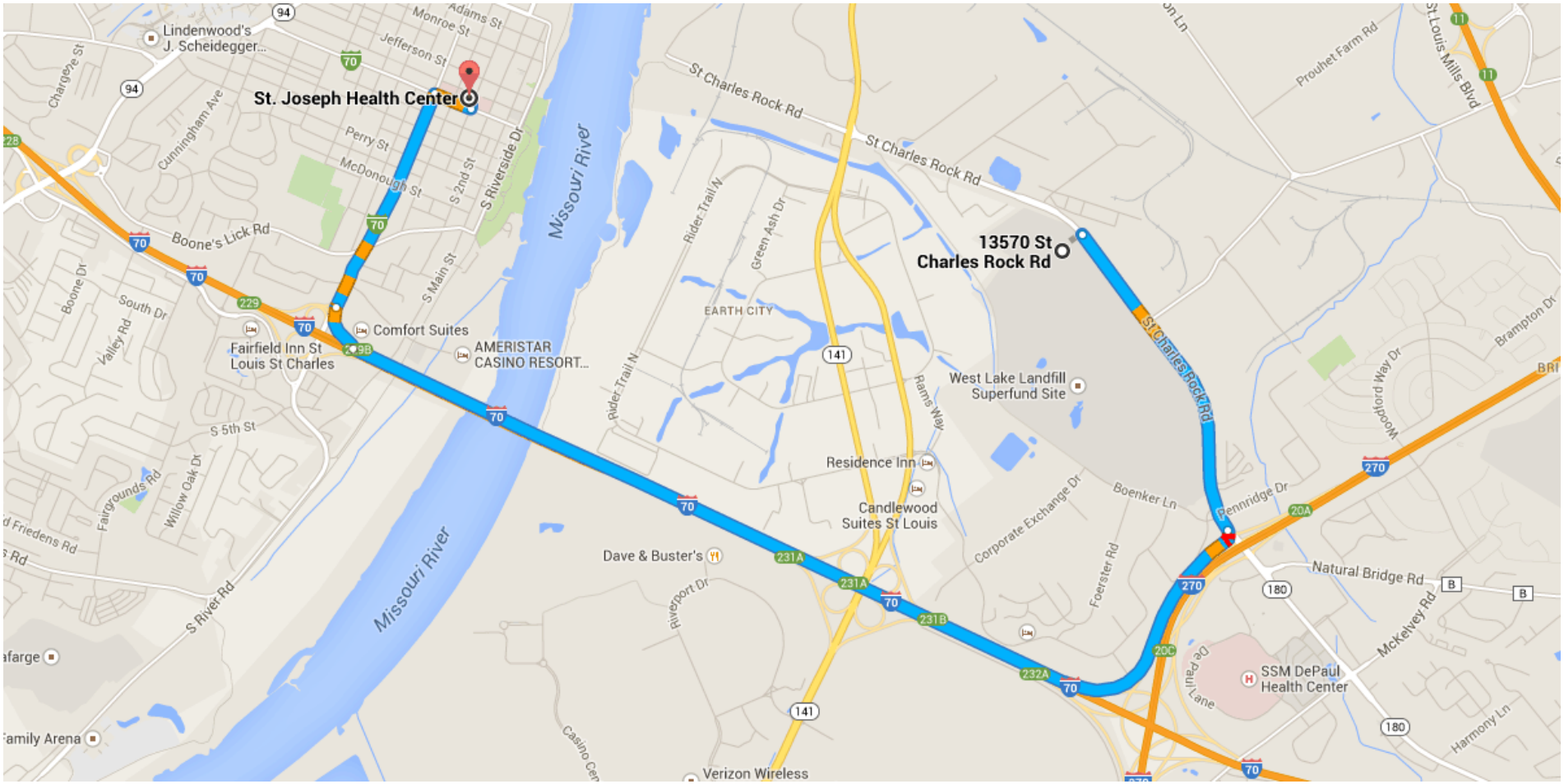
These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Alternate Hospital - SSM DePaul Health Center

Drive 6.1 mi, 9 min

Remove this and take to the hospital

Directions from **13570 St Charles Rock Rd** to **St. Joseph Health Center**



13570 St Charles Rock Rd

Bridgeton, MO 63044

1. Head **southeast** on **St Charles Rock Rd** toward **Taussig Rd**

1.2 mi

2. Take the ramp onto **I-70 W**

3.7 mi

3. Take exit **229B** for **I-70 Loop N/Fifth St**

0.2 mi

4. Turn **right** onto **S 5th St**

0.8 mi

5. Turn **right** onto **First Capitol Dr**

0.1 mi

6. Turn **left** at **S 3rd St**

Destination will be on the right

108 ft

St. Joseph Health Center

300 First Capitol Dr, St Charles, MO 63301

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix D:

Radiation Safety Plan for Site Preparation and Subsurface Investigation Activities at West Lake Landfill's Operable Unit 1 Preconstruction Activities

Auxier & Associates, Inc.
Radiological Health, Safety and Environmental Services
A USA Environment, L.P. Company

RADIATION SAFETY PLAN FOR SITE PREPARATION AND SUBSURFACE INVESTIGATION ACTIVITIES

WEST LAKE LANDFILL'S OPERABLE UNIT 1 PRECONSTRUCTION ACTIVITIES

13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044

May 16, 2014

PREPARED BY:

Auxier & Associates, Inc.
9821 Cogdill Road, Suite 1
Knoxville, Tennessee 37932

SIGNATURES:

Prepared by Mike Bollenbacher, C.H.P. Auxier& Associates, Project RSO

_____ _____,

Signature **Date**

Reviewed by On-site Radiological Control Technicians

_____ _____,

Signature **Date**

_____ _____,

Signature **Date**

CONTENTS

LIST OF TABLES

List of Abbreviations and Acronyms

ALARA	As Low As Reasonably Achievable
CHP	Certified Health Physicist
CFR	Code of Federal Regulations
DAC	Derived Air Concentration
DOT	U.S. Department of Transportation
ES&H	Environmental Safety and Health
mrem	millirem
NRC	Nuclear Regulatory Commission
PPE	Personal Protective Equipment
RCT	Radiation Control Technician
RIM	Radiologically Impacted Materials
RSO	Radiation Safety Officer
RSP	Radiation Safety Plan
RWP	Radiation Work Permit
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TLD	ThermoLuminescent Dosimeter
US EPA	United States Environmental Protection Agency

1. PURPOSE

Site preparation and investigation activities will occur while preparing for invasive subsurface construction work that is planned in the area between the North Quarry Landfill and Operable Unit-1 (OU-1) and installation of an air-monitoring system around the OU1 perimeter. These planned activities include identification and delineation of on-site areas suitable for equipment and waste staging, a management and relocation area; site preparation and clearing, installation and operation of air-sampling stations at perimeter and off-site (background) locations; supplemental site characterization surveys, and installation of litter control fencing. Workers and equipment may encounter Technologically Enhanced Naturally Occurring Material (TENORM) during these activities.

This Radiation Safety Plan (the "Plan") presents the specific radiological requirements that must be met while surveying, sampling, handling, storing and moving items used in activities that may be impacted by TENORM. This Plan also identifies and describes site-specific controls and procedures needed to determine and document compliance with operational, occupational safety, and regulatory requirements. These controls and procedures are designed to protect employees, the public, and the environment from radiological hazards associated with the pre-construction activities.

This Plan is intended to be used with the most recent version of the Health and Safety Plan in effect during this project.

2. SCOPE

This Plan applies to all surface and subsurface work involving TENORM-impacted soils.[1]

These activities include, but are not limited to:

- Site preparation and vegetation clearing operations over areas which may contain TENORM soil,
- Installation of electrical service to air sampling station locations,
- Installation of fixed air sampling stations,
- Road and pad construction over areas which may contain TENORM-impacted soil,
- Invasive sub-surface activities such as drilling and sampling in soil that may contain TENORM,
- Gamma walkover surveys,
- On-site movement and storage of equipment that are potentially impacted by TENORM soil,
- Decontamination of radiologically impacted equipment, and
- Other health physics support work in areas which may contain TENORM soil or during decontamination of equipment found to have TENORM on the surfaces.

[1] Soils that are suspected of containing a combined concentration radium-226 and radium-228 or a combined thorium-230 and thorium-232 concentration that exceeds 5 pCi/g over background are of particular interest. Soils matching that description have been designated as "RIM" (Radiologically Impacted Soil).

3. RESPONSIBILITIES

3.1 ALL EMPLOYEES

All employees working on the Site have the responsibility to work safely. All personnel on the Site are responsible for ensuring their own safety and the safety of others during an emergency condition. They are responsible to immediately report any emergency to their supervisor, Radiation Safety Officer, or other senior individual.

If any employee observes an unsafe activity or condition during the course of activities managed by the Plan, the employee shall notify a supervisor or health and safety representative immediately. The supervisor will immediately notify the site supervisor, who will take appropriate action. **If an employee judges the activity to be immediately hazardous, the employee has the right and the obligation to pause the work** before notifying his supervisor. The employee must immediately notify his supervisor or a representative of the safety team after taking such action. All employees shall assist in combating the emergency situation as directed by the site supervisor or the site RSO.

3.2 AUXIER & ASSOCIATES, INC.

In general, Auxier & Associates, Inc. (A&A) is responsible for adequately assessing radiological hazards, determining appropriate controls such as proper personal protective equipment (PPE), and specifying conditions where protective measures may be upgraded or downgraded.

A&A shall provide a radiation safety officer (RSO) who will be responsible for ensuring that the work force follows appropriate radiation protection controls. The RSO will be Mr. Mike Bollenbacher (CHP). He will be represented on site by Mr. Matt Walton, and Mr. Alex Luna, who will be functioning as the Radiation Control Technicians (RCTs) during field operations. Specific duties of the RSO and his delegates include:

- Notifying US EPA officials at least one (1) week before invasive activities occur;
- Monitoring in the workplace, including radiation surveys, contamination surveys, and air monitoring (both personal and area) to determine radiological conditions in the work area;
- Identifying and assessing radiological hazards;
- Determining required engineering controls necessary to protect personnel and minimize releases to the environment;
- Determining PPE required by known radiological conditions;
- Providing and erecting any necessary radiological barriers/barricades around controlled areas;
- Posting and labeling of the work site as dictated by the results of survey data;
- Managing access to controlled areas;
- Determining the level of radiological training required and verifying each employee has the required training;
- Surveying vehicles, equipment, and tools exiting controlled areas;
- Directing the decontamination of personnel, if necessary; and

- Issuing and collecting personal dosimeters, and analyzing, and reporting personal dosimetry results

If conditions arise that are not covered by this Plan, the RCT will consult with the project's RSO to determine the proper course of action.

4. RADIATION PROTECTION REQUIREMENTS

Specific radiological requirements must be met while handling radioactive materials at this Site. The radiological requirements of this Plan are based on national regulations published by the Nuclear Regulatory Commission (NRC) in 10CFR20. The annual routine occupational dose to radiation workers, expressed as the Total Effective Dose Equivalent (TEDE) will not exceed 0.5 Sieverts (5 rem/year). This is essentially equivalent to 100 mrem/work week.

As stated in the ALARA review of the project (Attachment A), this project will use 25% of the allowable exposure as an investigation level, so the goal of the radiation safety program will be to limit occupational doses to 100 mrem per month[2]. To put this in perspective, doses recorded on similar projects in the past have not approached this administrative limit.

4.1 EXTERNAL EXPOSURE LIMITS

Any areas producing 2 mrem/h are designated as radiologically restricted areas on this Site.[3] Only badged radiation workers may enter an area where the dose rate is known to exceed 2 mrem/h (~2000 µR/h). The stay time for a badged radiation worker in that area will not exceed four (4) hours without approval from the project's RSO. If it is deemed necessary to work longer than four hours in fields exceeding 2 mrem/h, an ALARA review of the job shall be conducted and appropriate engineering/administrative controls will be used to mitigate doses prior to authorizing the work.

An exposure rate measuring **25 mrem/h (25,000 µrem/h)above background at one meter above the surface constitutes a pause work condition** on this project. Work may not proceed until the situation is reviewed by both the RSO (A&A) and the Project Manager (EMSI).

4.2 AIRBORNE EXPOSURE LIMITS

Typically, air concentrations are compared to numerical criteria called Derived Air Concentration (DAC) [4] to determine if doses from operations are within allowable limits. Table 1 lists airborne activity limits that will be used to regulate operations handling radioactive materials at this Site.

Because multiple radionuclides are involved, site-specific limits were calculated for work at this site (Attachment A, Subsection A.5). The second column of Table 1 contains the project's aggregate DAC for workers and the maximum allowable perimeter air concentration for the combination of radioactive materials expected at this Site. Investigative limits are presented in the final two columns of the table. These limits are project specific administrative goals that incorporate a safety factor of approximately four (Attachment A, Subsections A.8, A.9, and A.10). These limits are expressed as gross alpha and gross beta air concentrations in Table 1.

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[2] ~25% of 5000 mrem/y divided by 12 months/year.
[3] Based on the 2 mrem/h requirement in 10 CFR 20 § 20.1301(2).
[4] *Derived air concentration* (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours results in the maximum allowable annual intake for that radionuclide.

Table 1 Numerical Air Monitoring Limits for Permitted Work

Activity	Maximum Allowable Time-weighted Air Concentration (μCi/mL)	Gross Alpha Investigative Limit (dpm/m^3)	Gross Beta Investigative Limit (dpm/m^3)
Inside Work Area	7.7×10^{-12} [a]	3.6 [b]	0.7 [c]
Work Area Boundary	3.5×10^{-14} [d]	0.065 [e]	0.013 [f]
Fenceline/Perimeter	7.0×10^{-15} [g]	0.013 [h]	0.003 [i]

[a] Calculated from 10CFR20 Appendix B, Table 1 DACs and expected mixture of isotopes (see Attachment A, Section 5 for details).
[b] Airborne activity of alpha emitters in the mixture that are present at 25% of the DAC.
[c] Airborne activity of beta emitters in the mixture that are present at 25% of the DAC.
[d] Calculated from 10CFR20 Appendix B, Table 2 Effluent Concentrations and expected mixture of isotopes (see Attachment A, Section 7 for details).
[e] Airborne activity of alpha emitters in the mixture that are present at the effluent limit of 50 mrem/y.
[f] Airborne activity of beta emitters in the mixture that are present at the effluent limit of 50 mrem/y.
[g] Calculated using 20% of the 10CFR20 Appendix B, Table 2 Effluent Concentrations and expected mixture of isotopes (see Attachment A, Section 7 for details).
[h] Airborne activity of alpha emitters in the mixture that are present at a limit of 10 mrem/y.
[i] Airborne activity of beta emitters in the mixture that are present at a limit of 10 mrem/y.

4.3 RADIATION SAFETY TRAINING

Training for workers on the project meets or exceeds the training requirements for radiation workers 10 CFR Part 19 which requires that *"…all individuals who, in the course of their employment, are likely to receive a dose of more than 100 millirem in a year, must receive adequate training to protect themselves against radiation."*. This level of training is required on this project even though the expected exposures during this project are much less than 100 millirem.

This training includes:

- The nature of radioactive materials on the Site
- Potential routes of exposure
- Types of controls practiced to minimize exposures. Includes discussion of any engineering controls, administrative use of time, distance and shielding, and personal protective equipment
- Types of monitoring used to track potential exposures (periodic area surveys, air monitoring, and use of dosimeters)
- Proper use of instrumentation
- Incident reporting
- Availability and use of confidential personal dosimetry records.
- Effects of radiation on humans
- Allowable limits (who sets them and what they are)

A&A will review all pertinent radiological conditions information before any intrusive work begins. During remediation, A&A will hold daily meetings to brief equipment operators and

laborers that are directly involved with the projected operations for that day. These daily meetings will be commensurate with work to be performed and specific applications of radiation worker training will be reviewed as needed.

Mandatory daily topics covered in these meetings shall include:

- identification of potential exposure routes;
- no eating, drinking or smoking in Permitted Areas;
- the locations of planned activities that day;
- locations of cleared easements; and
- personnel monitoring assignments.

The on-site RCT is a health physics specialist with experience in a variety of radiological environments including sites contaminated with uranium and thorium. In addition, A&A has one full-time Certified Health Physicist (CHP) assigned to the project, and two associates with CHP's available to support the project if needed.

4.4 SITE MONITORING

4.4.1 General Area Survey

The purpose of a general area survey is to characterize the ambient radiation environment of the Site, exclusive of the areas to be investigated. General area exposures shall be conducted at every job site where remediation is to be performed. As part of the general area survey, ambient exposure rates in various areas around the Site will be measured with a Ludlum Model 19 or equivalent. The frequency of these surveys will be determined by the RSO, but will include, at minimum, surveys at the beginning and the end of the job.

4.4.2 Personnel Exposures

Project personnel directly involved with handling of TENORM-impacted soils are required to wear personal dosimetry while working on Site. The RCT will issue Thermoluminescent Detectors (TLD) to those individuals that require access to Permitted Areas.

Each TLD will be assigned to a specific individual and can only be worn by that person. Dosimeters will be collected each night by the site RCT or his delegate and reissued the following day. A&A personnel will return dosimeters for processing as scheduled or upon request.

When a TLD is issued, the recipient will be briefed on the use and care of the dosimeter. Dosimeters shall be worn on the chest area, on or between the waist and the neck. Dosimeters shall not be exposed to security x-ray devices, excessive heat, or medical sources of radiation. Any person whose dosimeter is lost, damaged, should immediately report the loss to the site RSO.

If Electronic Personal Dosimeters are issued on this job, they will be collected and read at the end of each shift. These results will be considered monitoring data. Doses of record will be determined from TLD's.

4.4.3 Occupational Air Monitoring

When air monitoring is indicated, the site RSO will decide on the types of air samples to be collected, the frequency of the sampling, and the locations and individuals to be monitored.

4.4.3.1 Frequency of Monitoring for Occupational Safety

At a minimum, air sampling shall be conducted:

- During the first full day of operations;
- When excavation and handling of TENORM-impacted soil generates visible, sustained plumes of dust; and/or
- At the discretion of the RSO or his delegate.

4.4.3.2 Types of Occupational Safety Air Sampling

Fixed Location Air Samples: Fixed location air sampling should be conducted at the downwind side of the boundary of the work area. This placement will generally provide a worst case indication of concentrations in air adjacent to the remedial activity being monitored.

This sampling method allows the use of a larger pump which can sample a larger air volume. This results in a larger particulate sample which generally produces a lower detection limit than the other methods used on this project. This sampling technique has the disadvantage of not being as mobile as the other methods.

Equipment Air Sampling: Equipment air sampling may be conducted on machines that are actively moving over or handling potentially impacted soil. This placement will generally provide a measurement of typical air concentrations in the vicinity of the work activities because the equipment will be adjacent to any potential source while it is working, but is not necessarily always up wind or downwind of the activity. Because most of the planned subsurface activities will be performed by machines, samplers placed on the equipment are likely to provide an upper-bound estimate of exposure levels to workers during this project.

This sampling method generally requires a small pump, such as a DF-AB-40L running at a flow rate of ~ 30 LPM. It has the disadvantage of not sampling as large a volume of air as the fixed location sampler, so the minimum detectable activity of the samples is higher than the fixed air sample for the same amount of sample time.

Personal Air Sampling: Personal air sampling may be used to determine the average concentration in air surrounding a specific individual. In theory, this provides the opportunity to evaluate that individual's dose with a greater degree of certainty than a fixed location sampler. In general, this type of sampling is reserved for workers who will be in close proximity to planned investigation activities.

This sampling method generally requires a small, battery operated pump. The intake rate of air sampled by the pump is close to a typical worker's inhalation rate. It has the disadvantage of not sampling as large a volume of air as the fixed location sampler, so the minimum detectable activity of the samples is higher than the other sampling equipment for the same amount of sample time. At this site, it is expected that personal air sampling will be of limited use because

the minimum detectable air concentration of these samplers to Thorium-230 in air will exceed the limits specified in this Plan.

4.4.4 Environmental Air Monitoring

When perimeter monitoring equipment becomes available, perimeter air monitoring shall be conducted as described in Auxier et al. 2014.[5]

[5]Auxier et al., 2014. *"Air Monitoring and Sampling Plan and Quality Control Plan at the West Lake Superfund Site, Operable Unit 1."* Auxier & Associates, Knoxville TN., and Engineering Management Support, Inc. Lakewood Co.

5. HEALTH PHYSICS CONTROLS

The primary methods used to maintain exposures at levels that are as low as reasonably achievable (ALARA) are typically facility/equipment design and administrative controls.

5.1 ENGINEERING AND ADMINISTRATIVE CONTROLS

The following lists a few of the engineering controls that will be implemented to ensure worker doses are ALARA.

- Wetting of soil to minimize suspension of radioactive soil into the air.
- Using mechanical equipment (i.e., backhoes) to handle contaminated material rather than handling by hand.

The following lists administrative controls that will be implemented to ensure worker doses are ALARA.

- Areas containing invasive activities will be defined and delineated using a daily permitting system using job-specific radiation work permits (RWPs).
- Areas where work will be managed under a Radiation Work Permit are to be designated Permitted Areas.
- All nonessential personnel will be restricted from Permitted Area.
- No eating, drinking or smoking will be allowed in Permitted Areas.
- Individuals will, to the extent practical, remain up-wind of surface preparation, sampling and material handling operations.

Other engineering and administrative controls may be implemented as project conditions change and/or other innovative ideas that are deemed appropriate by the RSO or his delegate.

5.2 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

The PPE requirements for site preparation and investigative work shall be determined by the RSO or his delegate. However, at a minimum, personnel shall wear a hard hat, safety glasses, gloves and shoe covers or rubber boots when entering an area of known or suspected loose surface contamination. The protective clothing selection for this project is presented in Table 2.

5.3 CONTROLLING THE SPREAD OF CONTAMINATION

The following measures will be used to prevent the spread of contamination during excavation/soil storage activities:

1. Use engineering controls and containment devices (such as berms and plastic ground cloths) as appropriate during planned activities.
2. Restrict movement in OU 1 to cleared roads or easements.
3. Limiting access to Permitted Areas containing planned activities.

Table 2 Criteria for Protective Clothing (PC) Selection

Work activity	Protective clothing
Routine dry work	Long pants, shirt, hard hat, safety glasses w/side shields, cotton gloves, and steel-toed shoes.
Routine wet work	Rain coat or rain suit worn over cloth coveralls or long pants and shirt, hard hat, safety glasses w/side shields, rubber or plastic gloves, and steel toed shoes, plastic or rubber shoe covers.
Heavy dry work	Same as routine dry work, but substitute leather gloves for the cotton work gloves
Heavy wet work	Rain suit with hood worn over Tyvek coveralls; puncture resistant rubber gloves or plastic gloves worn over leather gloves; hard hat, safety glasses w/side shields, and steel toed rubber boots or plastic or rubber shoe covers worn over steel toed shoes. Ends of arms and legs taped to gloves and boots.

NOTE: This equipment list is based on considerations for removable contamination only. The potential for heat stress or other occupational safety hazards shall also be taken into account by the RCT when evaluating protective clothing requirements. Worker heat stress and heat stroke are very serious medical conditions. The well-being of workers wearing protective clothing shall be closely monitored to prevent a heat stress condition.

Table 3 Airborne Criteria for Respiratory Protection Selection

Level of Airborne Radioactivity	Operational Indicators	Minimum Respiratory Protection
No potential for exceeding 25% of DAC	No sustained visible dust	None
Potential to exceed 25% of DAC and no potential to exceed 10 DAC's	Sustained visible dust plume, objects visible through plume	Full face air purifying respirator with appropriate cartridge or canister.

5.3.1 Cleared Easements

Supplemental gamma walkover surveys may be conducted prior to mobilization of equipment in OU 1 (A&A Procedure 2.2) as needed. These gamma surveys will be used, in conjunction with existing surveys, to identify and delineate lanes of unimpacted soil in the proposed areas of operation. If a suitable corridor cannot be identified, a crushed rock layer may be added to the soil along the desired path to isolate traffic from the contaminated surface. Traffic within OU 1 will be restricted to those easements as much as is practical. This will reduce the potential to contaminate pedestrians and vehicles moving through OU 1.

5.3.2 Controlled Areas

The entire area enclosed by the chain link fence will be considered a Controlled Area. Access to this area will be through a single Access Point (Section 5.3.4, below). Access will be restricted to required vehicles and equipment, trained site personnel and escorted visitors who will observe all entry and exit requirements for the Controlled Area.

5.3.3 Permitted Areas

Access to land and equipment inside a Permitted Area will be restricted to A&A personnel and trained contractors directly managing or participating in the activities planned for that area. Permitted Areas may be set up inside the Controlled Area to allow management of specific activities in a portion of the larger area, or a single Permitted Area may be set up to encompass the entire Controlled Area. Permitted Areas can also be set up outside the fenced area.

Permitted Areas used to manage specific tasks shall be kept as small as possible. The area shall be large enough to allow for all work and the transit of personnel and equipment to be performed in a safe manner. If smaller Permitted Areas are established to localize the potential spread of contamination in a larger Controlled area, each distinct Permitted Area will have its own Access Point.

Only essential personnel and equipment with a specific function shall be allowed access through an Access Point. Access will be restricted by either:

- Stationing a radiation technician within sight of the area such that the technician can monitor the area and enforce the access restriction. In this case, the technician serves as the access barrier around the area. In most cases, a technician will need to monitor the permitted activity, making this the preferred solution during the work day.
- If a technician is not physically present a visual barrier such as a yellow boundary rope or equivalent shall be erected around the work area. The Radiation Safety Officer shall ensure the area is properly posted by placing signs stating “Caution: Radioactive Materials”, or equivalent that can be seen from all accessible directions.
- If the Permitted Area is located outside a permanently fenced area, the Permitted Area must be secured at the end of each day by fencing and posting it or by covering any exposed RIM with a layer of soil, gravel, or plastic and posting the edges of the area.

No eating, drinking, or smoking is allowed in the Permitted Area. Workers may walk to the boundary of the area; frisk their hands and face, and drink fluids under the supervision of the RSO or his designated observer. The fluids must be consumed at the boundary and the container may not be taken into the area when the worker reenters the area.

5.3.4 Access Points

Access points are the physical location where workers and equipment enter and exit a Controlled or Permitted Area.

Access points will:

- Provide a single source of entry and exit to the area,
- Be equipped with functioning, calibrated, radiation detection instruments to monitor hands, shoes, and portable equipment before leaving the staging area,
- Be provided with a means to record entry and exit information,
- Provide a place where individuals can remove or clean personal protective equipment as required, and

- Contain a trash receptacle with a lid and a plastic liner to hold trash generated by the operations in the area.

5.3.5 Contamination Surveys

Surveys will be used to monitor and control exposures and the potential spread of contamination. The following subsections describe the surveys to be used and their requirements.

5.3.5.1 Baseline Entry Survey – Equipment

All vehicles and large equipment entering OU 1 will be surveyed by the RCT for fixed alpha and beta contamination before its initial entrance into OU 1. The survey will be conducted using a Ludlum Model 12 coupled to a Model 43-5 (or equivalent), and a Ludlum Model 12 coupled to a Model 44-9 (or equivalent) as described in A&A Procedure 2.7.

5.3.5.2 Permitted Area Exit Survey - Personnel

Personnel exiting a Permitted Area will frisk their shoes and clothing upon leaving the area, as described in A&A Procedure 2.7. Personnel will record their name, the results of the exit survey, the location, and the time they entered and left the area in A&A Form 11, Personnel Monitoring Form. A reading of two (2) times the ambient background level will require decontamination before leaving the area.

5.3.5.3 Permitted Area Exit Survey - Equipment

Heavy equipment working inside a Permitted Area will be surveyed by the RCT before leaving the area. All surfaces in contact with soil will be scanned with a Ludlum Model 3 coupled to a Model 44-9, and a Model 44-5 (or equivalent) as described in A&A Procedure 2.7. Results will be recorded on the appropriate equipment form from the A&A Procedures Manual. A reading of two (2) times the ambient background level will require the equipment be decontaminated before leaving the sampling location.

5.3.5.4 Housekeeping Survey – Equipment

Tools and equipment which are to be left in the Controlled Area during periods when the Site is dormant may be surveyed by the RCT before daily oversight ceases. All exposed surfaces that may have been in contact with soil will be scanned with a Ludlum Model 3 coupled to a Model 44-9, and a Model 44-5 (or equivalent) as described in A&A Procedure 2.7. Removable contamination will be sampled by swiping a 100 cm^2 area on parts of the equipment that were in contact with soil surfaces as described in Procedure 3.6. If results exceed the limits presented in Table 4, the equipment may be contaminated and resurveyed or the equipment can be yellow tagged, covered in plastic, and left in place. Final results will be recorded on the appropriate equipment form from the A&A Procedures Manual.

5.3.5.5 Final Release Survey - Equipment

Heavy equipment working inside a Permitted Area will be surveyed by the RCT before leaving the OU 1. All surfaces in contact with soil will be scanned with a Ludlum Model 12 coupled to a Model 44-9 (or equivalent), and a Ludlum Model 12 coupled to a Model 44-5 (or equivalent) as described in A&A Procedure 2.7. Removable contamination will be sampled by swiping a 100

cm^2 area on parts of the equipment that were in contact with soil surfaces as described in Procedure 3.6.

The results will be recorded on the appropriate equipment form from the A&A Procedures Manual. If the final release measurements are less than the values in Table 4, the equipment may be unconditionally released from OU 1.

5.4 DECONTAMINATION OF EQUIPMENT

All equipment used in invasive activities will be surveyed before it leaves the sampling location to mitigate the potential to spread contamination. Tool strings will be washed/wiped as they are removed from the ground to remove visible dirt and mud. Sections of the tool string will be sampled with a swipe to record the amount of removable activity on the surface between soundings. If elevated levels of surface radioactivity are identified, the equipment will be cleaned with soap and water.

All equipment exiting a Permitted Area (including but not limited to the GCPT rig) will be inspected and loose material removed by brushing and/or wiping with wet rags. After loose material has been removed, the equipment will be surveyed for both alpha and beta surface activity. If fixed or removable activity exceeding the release limits is found, the equipment will be decontaminated and resurveyed before it leaves the Permitted Area.

Table 4 Final Release Survey Limits for Equipment

Parameter	Limit	Meter Reading [a]
Fixed Alpha (Ra-226 & Th-230)	100 dpm/100cm^2, average 300 dpm/100cm^2, maximum	18 cpm 53 cpm
Fixed Beta (Beta-gamma emitters)	5,000 dpm/100cm^2, average 15,000 dpm/100cm^2, maximum	660 cpm 1980 cpm
Removable Alpha	20 dpm/100cm^2, average	4cpm
Removable Beta	1,000 dpm/100cm^2, average	150 cpm

[a] Nominal values for Ludlum Mo 4360/Mo 43-93. Other equivalent instruments will produce other responses. Meter efficiencies will be reevaluated at the site.

After a piece of equipment is cleared for release it will be washed to remove visible traces of dirt and mud prior to their release. This final housekeeping can be performed in an uncontrolled area and any water generated from the previously released equipment will be considered unimpacted.

Water used to decontaminate equipment will be placed in marked holding tanks/and or drums and sampled. Water that does not meet 10CFR20 Appendix B discharge limits will be either treated or packaged and shipped to a licensed, managed disposal site. Water meeting the radiological discharge limits will be managed as non-regulated effluent.

5.5 VISITORS

Visitors and general employees who are not necessary personnel shall not enter the restricted areas unless they are escorted by the RSO or his delegate, and they perform no hands-on work activities. Minors are prohibited from entering areas that are undergoing investigation under all circumstances.

Visitors, inspectors or short term contractors (contractors working less than a total of 8-hours in a one-week period) requiring access to the Site will not be assigned dosimetry as long as the following conditions are met:

1. They do not enter areas where a major portion of their whole body would be exposed to radiation levels equal to or greater than 2,000 microRoentgens per hour,
2. Survey documentation of the areas exists to prove that exposure rates greater than 2,000 microRoentgens per hour will not be encountered,
3. The total amount of time spent on the Site is less than 24 hours a calendar quarter, and
4. Personnel are trained and briefed in hazards in the Controlled Area.

6. REPORTING AND RECORD KEEPING

Results of all required measurements will be recorded in a hard-bound logbook or on forms included in the A&A procedures manual. These documents are collectively referred to in this Plan as the "Site log".

6.1 REPORTING REQUIREMENTS

The RSO is responsible for verifying the following reporting actions occur during this project:

- Verifying the US EPA has been notified of the intent to start operations one week (1) before invasive operations involving TENORM-impacted soil begins.
- Formally notify the US EPA within 72 hours if a non-routine incident resulting in an unplanned exposure in excess of 100 mrem/month or the spread of contamination outside the OU 1 fence line.
- Provide a dosimetry report on all monitored workers to individuals within 180 days of the field work's completion.
- Document the status of the radiological condition of the Site at the end of the project, and the fate of any radioactive materials removed from the Site during the project.

6.2 RECORD KEEPING

The RSO will verify that the following records are placed in the project file:

- A copy of this radiation protection plan will be placed in the project file and maintained for three (3) years after completion of Site work.
- The original copies of the dosimetry records and air monitoring results will be placed in the file and maintained for three (3) years after completion of Site work. The personnel records will be treated as confidential.
- Original copies of the field records will be placed in the project file and retained for five years.

These records will be initially maintained in the by Auxier and Associates, Inc. but may be transferred to the client for long-term storage.

7. EMERGENCY RESPONSE

This radiological safety plan is offered as part of a comprehensive Health & Safety plan provided by Bridgeton Landfill in support of work at the West Lake Landfill. These documents, and the programs and practices enacted to implement them, focus on creating a culture of safety designed to permeate project and personal activities.

This Radiation Safety Plan also contains guidance intended to mitigate the consequences of four types of unplanned events, even if those events are unlikely to occur. If any of these events produces a measureable off-site release of radioactive materials, or an injury involving contact with hazardous or radiological materials, Region 7 of the US Environmental Protection Agency ("Region 7") will be contacted:

The EPA emergency response number is:

1-913-281-0991

Brief descriptions of the unplanned events and recommended actions are provided in the following sections.

7.1 CONTAMINATED INJURED MAN

In the event an individual becomes injured, and the injured person is contaminated with radioactive material, every effort shall be made to decontaminate the individual, except when the decontamination process may interfere with medical attention, treatment or promulgation of the injury.

In the event of a life threatening injury, emergency response personnel shall not be delayed in their efforts to treat the injured person. They shall be informed prior to entering the area that there is or may be naturally occurring radioactive materials present, but will be allowed to enter immediately, and without protective clothing, if necessary. These personnel shall be monitored for contamination on their skin and clothing upon exit from the area, and shall be decontaminated as necessary if it does not further interfere with treatment of the injured person.

Contaminated individuals with life threatening injuries shall be allowed to be transported to a medical facility without decontamination, when necessary. The person responsible for the transportation, i.e. the ambulance driver, paramedics, helicopter pilot, etc. shall be informed prior to leaving the scene that the injured person has or may have contamination present on their body or clothing consisting of radioactive materials.

An individual trained in the use of a contamination survey instrument, and in the hazards associated with radioactive materials and radiation, shall take contamination survey instrument and accompany or follow the injured individual. This person shall survey the transportation vehicle, transportation personnel, applicable portions of the medical facility, and medical staff for contamination as soon as possible.

Personnel and equipment found to be contaminated shall be decontaminated at the earliest opportunity. The surveyor shall describe in writing all surveys performed, their results, and any decontamination required.

7.2 FIRES OR EXPLOSIONS INVOLVING RADIOACTIVE MATERIALS

In the event of a fire or explosion involving radioactive materials, priority shall always be given to injured personnel and personnel safety, then to combating of the fire itself. Radiological controls may be deferred until it is safe and practical to implement them. The following steps shall be carried out concurrently with each other, although not necessarily in the order given unless specifically required.

Rescue/stabilization of injured personnel

Evacuation of Area: All personnel who are not directly involved with the combating of the fire or explosion shall immediately exit the area of concern. Ensure all unnecessary personnel have exited the area of concern. All personnel present at the job site shall be accounted for as rapidly as possible. A search shall be conducted for any missing or injured personnel. Personnel who may have become contaminated with radioactive materials shall not leave the job site until they have been monitored for contamination, unless it becomes unsafe for them to remain at the Site.

Secure Area: All equipment or evolutions which may be responsible for the fire or explosion, or its continuation, shall be shut down or stopped immediately; pumps or motors secured, electrical equipment de-energized, ventilation secured, etc. If necessary and possible, non-involved motor vehicles, fuel tanks, and heavy equipment may be removed from the area without regard for exit surveys of decontamination procedures. All equipment removed from the area should remain on the Site until it has been surveyed.

Notification of local emergency response services: Local emergency response services (fire & rescue, police, etc…) will be notified of the incident immediately. Emergency service personnel shall be informed of the presence of naturally occurring radioactive materials during the initial contact. Upon their arrival, the local incident response commander should be shown the known locations of the radioactive materials.

Follow all directions from EPA and local emergency responders.

Establish a controlled perimeter: A perimeter shall be established around the source of the fire plus a 100 foot buffer area unless there is a risk of explosion or other injury.

Incidence monitoring: Air monitors will be set up downwind of the incident as soon as safety, time and equipment permit. Radiation and contamination surveys shall be conducted of surrounding areas to identify and radioactive materials that may have spread. Surveys shall start with uncontrolled areas to which radioactive materials may have spread based on the movements of personnel, predominant wind conditions, and the force of the explosion. The results of all radiation and contamination surveys shall be documented.

Exit survey/decontamination: All personnel involved with fighting the fire shall be monitored for contamination prior to leaving the job site, if possible. Personnel shall be decontaminated as necessary

7.3 FLOODING OR OTHER NATURAL DISASTERS

Radiological work activities shall cease when flooding, tornado, or hurricane warnings have been issued by the National Weather Service or other public agency which may affect a given job site location. In the event that a natural disaster occurs at a job site, an inventory of all TENORM contaminated equipment, materials, and waste present at the site shall be made as soon as it is possible and safe to do so. A thorough search shall be conducted for any missing TENORM contaminated items or materials. Clean-up operations should commence as soon as it is safe and practical to do so.

7.4 LOSS OF POWER

The loss of electrical power may prevent or interfere with radiological monitoring requirements. It will be the responsibility of the Radiation Safety Officer to decide if work activities shall continue without electrical power available. The Radiation Safety Officer shall base his decision on personnel safety, the need for continuing radiological monitoring requiring electrical power, and the loss of any ventilation or exhaust systems which may cause an atmosphere to become unsafe.

Attachment A ALARA Review

A.1 SCOPE

This review evaluated potential radiological doses from anticipated occupational tasks associated with incidental handling of TENORM-impacted material during the proposed brush clearing and subsequent investigation of RIM in OU 1. This information will be used to identify processes and tasks that pose the greatest potential to expose workers and the public. If necessary, these processes and tasks will be modified to keep radiation doses As-Low-As-Reasonably-Achievable (ALARA).

A.2 ALARA DOSE LIMITS

The project ALARA goal for all workers working in Permitted areas within the OU 1 footprint is established at 100 mrem.[6] Work activities will be planned to manage worker dose in a way to stay below this goal. Worker doses incurred during past activities at the Site that involved A&A personnel have all been well below this level. Based upon available information, A&A believes that this ALARA goal should be readily achievable.

In the unlikely event that field conditions prevent personnel from performing a task without exceeding the ALARA goal, that task will be stopped and the project RSO and Project Manager shall determine if there are additional ALARA principals that can be used to minimize the critical workers' doses. If other factors can be identified and implemented, they will be. No single, planned operation will be scheduled that will allow a worker to exceed 25 mrem without a full ALARA review by the A&A RSO and the Project Manager, followed by approval from the client.

A.3 NUMERIC CRITERIA

Based on previous experience, it is anticipated that dose rates will remain low during these planned activities. To protect workers against unexpectedly high radiation exposures, specific numeric criteria will be used as trigger points for investigation:

- Sustained dose rates to drivers exceeding 50 µrem/h above background;
- general area dose rates of 2,000 µrem/h (2 mrem/h); and
- airborne contamination exceeding 25 percent of permissible gross alpha or beta air concentrations when personnel are not wearing respiratory protection.

A.4 SOURCE TERM DESCRIPTION IN OU 1

TENORM in OU 1 occurs in soil materials that are intermixed with and interspersed within the overall matrix of landfilled refuse, debris and fill materials, including unimpacted soil and quarry spoils. In some portions of OU 1, TENORM is present at the surface; however, the majority of the TENORM is buried.

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[6] This dose is equivalent to 25% of the allowable annual dose to workers permitted in 10CFR 20 prorated over a one month duration (5000 mrem/y x 0.25 x 1mo/12mo = 104 mrem, rounded down to 100 mrem.)

In general, the primary radionuclides detected at levels above background concentrations at the West Lake Landfill are part of the uranium-238 decay series. Thorium-232 and uranium-235 and their decay products are also present above background levels but at lower concentrations. Table A-1 presents TENORM concentrations in Area 1. Area 1 was selected for planning purposes because the majority of planned activities will take place in or near Area 1. If sustained levels of activity occur within Area 2, the ALARA assessment will be revisited to determine if any changes need be made.

Table A-1 Summary Statistics for Radionuclide in Area 1 All Soil Depths [a]

Analyte	Frequency of Detection (Detections/n)	Range of Detections (pCi/g)	Arithmetic Mean (pCi/g)	95% UCL on Mean (pCi/g)
Uranium Series				
Uranium-238	36/38	0.32 - 147	8.8	16.6
Uranium-234	37/38	0.35 - 154	8.8	16.9
Thorium-230	38/38	0.29 - 9700	512	1060
Radium-226	38/38	0.39 - 906	31.2	71.6
Lead-210	18/38	0.72 - 1040	41.8	88.6
Actinium Series				
Uranium-235	16/38	0.13 - 20	1.15	0.84
Protactinium-231	7/38	0.90 - 544	22.4	47.3
Thorium Series				
Thorium-232	32/38	0.08 - 35	2.4	4.14

[a] Tables A.2-4 and A.3-2. *"Baseline Risk Assessment West Lake Landfill Operable Unit 1."* April 24, 2000 Auxier & Associates.

A.5 OPERATIONAL DACS

Project specific DACs corresponding to 5,000 mrem/y for the mix of radionuclides found in Area 1 are listed in Table A-2.

A.6 EFFLUENT CONCENTRATIONS

Effluent concentrations corresponding to 50 mrem/y for the mix of radionuclides found in Area 1 are listed in Table A-3.

A.7 PERIMETER CONCENTRATIONS

Fence line concentrations corresponding to the a limit of 10 mrem/y for the mix of radionuclides found in Area 1 are listed in Table A-4. These perimeter limits are 20% of the effluent limits presented in Table A-3.

Table A-2 Maximum Derived Air Concentrations Permitted by 10 CFR 20

Radionuclide	Alpha [a] Yield (α)	Beta [a] Yield (β)	Concentrations: Soil [b] (pCi/g)	Concentrations: α in Air [c] (μCi α/cm³)	Concentrations: β in Air [d] (μCi β/cm³)	Solubility Class [e]	DAC [f] (μCi•y / cm³•5000 mrem)	Contribution to Dose: Alpha [g] (mrem α/y)	Contribution to Dose: Beta [h] (mrem β/y)	Activity w/ Progeny: α on Filter [i] (dpm α/m³)	Activity w/ Progeny: β on Filter [j] (dpm β/m³)
Uranium Series											
U238	1		16.6	7.1E-14	0	y	2E-11	1.78E+01	0	1.6E-01	0
Th234		1	16.6	0	7.1E-14	d	6E-08	0	5.95E-03	0	1.6E-01
Pa234		1	16.6	0	7.1E-14	d	3E-06	0	1.19E-04	0	1.6E-01
U234	1		16.9	7.3E-14	0	y	2E-11	1.82E+01	0	1.6E-01	0
Th230	1		1060	4.6E-12	0	y	6E-12	3.80E+03	0	1.0E+01	0
Ra226	1		71.6	3.1E-13	0	y	3E-10	5.13E+00	0	6.8E-01	0
Rn222+D [k]	3	2	71.6	1.8E-13	1.2E-13	d	3E-08	3.08E-02	2.05E-02	4.1E-01	2.7E-01
Pb210		1	88.6	0	3.8E-13	y	1E-10	0	1.91E+01	0	8.5E-01
Bi210		1	88.6	0	3.8E-13	d	1E-08	0	1.91E-01	0	8.5E-01
Po210	1		88.6	3.8E-13	0	d	3E-10	6.35E+00	0	8.5E-01	0
Thorium Series											
Th232	1		4.14	1.8E-14	0	y	1E-12	8.90E+01	0	4.0E-02	0
Ra228		1	4.14	0	1.8E-14	y	5E-10	0	1.78E-01	0	4.0E-02
Ac228		1	4.14	0	1.8E-14	d	4E-09	0	2.23E-02	0	4.0E-02
Th228	1		4.14	1.8E-14	0	y	7E-12	1.27E+01	0	4.0E-02	0
Ra224	1		4.14	1.8E-14	0	d	7E-10	1.27E-01	0	4.0E-02	0
Rn220+D [k]	3	2	4.14	1.1E-14	7.1E-15	d	9E-09	5.94E-03	3.96E-03	2.4E-02	1.6E-02
Actinium Series											
U235	1		0.84	3.6E-15	0	y	2E-11	9.03E-01	0	8.0E-03	0
Th231		1	0.84	0	3.6E-15	d	3E-06	0	6.02E-06	0	8.0E-03
Pa231	1		47.3	2.0E-13	0	y	2E-12	5.09E+02	0	4.5E-01	0
Ac227		1	47.3	0	2.0E-13	d	2E-12	0	5.09E+02	0	4.5E-01
Th227	1		47.3	2.0E-13	0	d	1E-10	1.02E+01	0	4.5E-01	0
Ra223	1		47.3	2.0E-13	0	d	3E-10	3.39E+00	0	4.5E-01	0
Pb211	1		47.3	2.0E-13	0	d	3E-07	3.39E-03	0	4.5E-01	0
Totals =	**19**	**12**	na	**6.5E-12**	**1.3E-12**		na	**4472**	**528**	**14**	**3**

[a] Alpha and beta production rates taken from Kocher, 1981 "Radioactive Decay Tables", Tech. Inf. Center, US DOE.

[b] 95% UCL Surface Soil Concentrations from Westlake Baseline RA April 2000 Table A.3-2, Current Exposure Point Concentrations in Area 1 Soil. Three significant figures provided for quality control purposes and are not indicative of precision.

[c] α in Air(μCi α/cm³) = Soil Conc(pCi/g) x AreaDust(μg/m³) x AlphaYield(α)/(AlphaYield(α)+BetaYield(β)) $x10^{-6}$(g/μg) $x10^{-6}$(μCi/pCi) $x10^{-6}$(m³/cm³), where AreaDust is the mass concentration of the mixture in air needed to produce 5000 mrem/year at the operator's location using 10 CFR 20 methodology.

[d] β in Air(μCi β/cm³) = Soil Conc(pCi/g) x AreaDust(μg/m³) x BetaYield(β)/(AlphaYield(α)+BetaYield(β)) $x10^{-6}$(g/μg) $x10^{-6}$(μCi/pCi) $x10^{-6}$(m³/cm³).

[e] Solubility determined from chemical reactivity of element and age of radionuclide.

[f] Derived Air Concentration from 10CFR20 Appx. B, Table 1. Annual average annual air concentration needed to yield 5000 mrem/y using 10CFR20 dose assessment methodology. Assumes exposure time of 2,000 h/y.

[g] Alpha dose generated by nuclide i (mrem/y) = α in Air(μCi/cm³)/DAC_i(μCi/cm³) x 5000 mrem/y.

[h] Beta dose generated by nuclide i (mrem/y) = β in Air(μCi/cm³)/DAC_i(μCi/cm³) x 5000 mrem/y.

[i] α activity in 1 m³ of filtered air (dpm α/m³) = α in Air(μCi α/cm³) $x10^{-6}$(g/μg) $x10^{-6}$(μCi/pCi) x 2,220,000(dpm/μCi.)

[j] β activity in 1 m³ of filtered air (dpm β/m³) = β in Air(μCi β/cm³) $x10^{-6}$(g/μg) $x10^{-6}$(μCi/pCi) x 2,220,000(dpm/μCi.)

[k] Includes 100% of prompt Rn222 progeny activity from Ra226 captured in particulate fraction. Ambient radon daughters in filtered air excluded from this calculation.

Table A-3 Maximum Effluent Concentrations Permitted by 10 CFR 20

Radionuclide	Alpha [a] Yield (α)	Beta [a] Yield (β)	Concentrations: Soil [b] (pCi/g)	Concentrations: α in Air [c] (µCi α/cm³)	Concentrations: β in Air [d] (µCi β/cm³)	Solubility Class [e]	Effluent [f] (µCi•y / cm³•50 mrem)	Contribution to Dose: Alpha [g] (mrem α/y)	Contribution to Dose: Beta [h] (mrem β/y)	Activity w/ Progeny: α on Filter [i] (dpm α/m³)	Activity w/ Progeny: β on Filter [j] (dpm β/m³)
Uranium Series											
U238	1		16.6	3.2E-16	0	y	6 E-14	2.70E-01	0	7.2E-04	0
Th234		1	16.6	0	3.2E-16	d	2 E-10	0	8.11E-05	0	7.2E-04
Pa234		1	16.6	0	3.2E-16	d	9 E-09	0	1.80E-06	0	7.2E-04
U234	1		16.9	3.3E-16	0	y	5 E-14	3.30E-01	0	7.3E-04	0
Th230	1		1060	2.1E-14	0	y	3 E-14	3.45E+01	0	4.6E-02	0
Ra226	1		71.6	1.4E-15	0	y	9 E-13	7.78E-02	0	3.1E-03	0
Rn222+D [k]	3	2	71.6	8.4E-16	5.6E-16	d	1 E-10	4.20E-04	2.80E-04	1.9E-03	1.2E-03
Pb210		1	88.6	0	1.7E-15	y	6 E-13	0	1.44E-01	0	3.8E-03
Bi210		1	88.6	0	1.7E-15	d	4 E-11	0	2.17E-03	0	3.8E-03
Po210	1		88.6	1.7E-15	0	d	9 E-13	9.62E-02	0	3.8E-03	0
Thorium Series											
Th232	1		4.14	8.1E-17	0	y	6 E-15	6.74E-01	0	1.8E-04	0
Ra228		1	4.14	0	8.1E-17	y	2 E-12	0	2.02E-03	0	1.8E-04
Ac228		1	4.14	0	8.1E-17	d	6 E-11	0	6.74E-05	0	1.8E-04
Th228	1		4.14	8.1E-17	0	y	2 E-14	2.02E-01	0	1.8E-04	0
Ra224	1		4.14	8.1E-17	0	d	2 E-12	2.02E-03	0	1.8E-04	0
Rn220+D [k]	3	2	4.14	4.9E-17	3.2E-17	d	3 E-11	8.09E-05	5.40E-05	1.1E-04	7.2E-05
Actinium Series											
U235	1		0.84	1.6E-17	0	y	6 E-14	1.4 E-02	0	3.6E-05	0
Th231		1	0.84	0	1.6E-17	d	9 E-09	0	9.12E-08	0	3.6E-05
Pa231	1		47.3	9.2E-16	0	y	8 E-15	5.8 E+00	0	2.1E-03	0
Ac227		1	47.3	0	9.2E-16	y	6 E-15	0	7.71E+00	0	2.1E-03
Th227	1		47.3	9.2E-16	0	d	5 E-13	9.2 E-02	0	2.1E-03	0
Ra223	1		47.3	9.2E-16	0	d	9 E-13	5.1 E-02	0	2.1E-03	0
Pb211	1		47.3	9.2E-16	0	d	9 E-10	5.1 E-05	0	2.1E-03	0
Totals =	**19**	**12**	na	**2.9E-14**	**5.8E-15**		na	**42**	**8**	**0.065**	**0.013**

[a] Alpha and beta production rates taken from Kocher, 1981 "Radioactive Decay Tables", Tech. Inf. Center, US DOE.

[b] 95% UCL Surface Soil Concentrations from Westlake Baseline RA April 2000 Table A.3-2, Current Exposure Point Concentrations in Area 1 Soil. Three significant figures provided for quality control purposes and are not indicative of precision.

[c] α in Air(μCi α/cm^3) = Soil Conc(pCi/g) x BoundaryDust($\mu g/m^3$) x AlphaYield(α)/(AlphaYield(α)+BetaYield(β)) x10^{-6}($g/\mu g$) x10^{-6}(μCi/pCi) x10^{-6}(m^3/cm^3), where BoundaryDust is the mass concentration of the mixture in air needed to produce 50 mrem/year to the public at the boundary of the permitted area using 10 CFR 20 methodology.

[d] β in Air(μCi β/cm^3) = Soil Conc(pCi/g) x BoundaryDust($\mu g/m^3$) x BetaYield(β)/(AlphaYield(α)+BetaYield(β)) x10^{-6}($g/\mu g$) x10^{-6}(μCi/pCi) x10^{-6}(m^3/cm^3).

[e] Solubility determined from chemical reactivity of element and age of radionuclide.

[f] Effluent Air Concentration from 10CFR20 Appx. B, Table 2. Annual average annual air concentration needed to yield 50 mrem/y using 10CFR20 dose assessment methodology. Assumes generation and exposure times of 8760 h/y.

[g] Alpha dose generated by nuclide i (mrem/y) = α in Air($\mu Ci/cm^3$)/Effluent$_i$($\mu Ci/cm^3$) x 50 mrem/y.

[h] Beta dose generated by nuclide i (mrem/y) = β in Air($\mu Ci/cm^3$)/Effluent$_i$($\mu Ci/cm^3$) x 50 mrem/y.

[i] α activity in 1 m^3 of filtered air (dpm α/m^3) = α in Air(μCi α/cm^3) x10^{-6}(μCi/pCi) x 2,220,000(dpm/μCi).

[j] β activity in 1 m^3 of filtered air (dpm β/m^3) = β in Air(μCi β/cm^3) x10^{-6}(μCi/pCi) x 2,220,000(dpm/μCi).

[k] Includes 100% of prompt Rn222 progeny activity from Ra226 captured in particulate fraction. Ambient radon daughters in filtered air excluded from this calculation.

Table A-4 Maximum Perimeter Concentrations Producing 10 mrem/y

Radionuclide	Alpha [a] Yield (α)	Beta [a] Yield (β)	Concentrations: Soil [b] (pCi/g)	Concentrations: α in Air [c] (μCi α/cm³)	Concentrations: β in Air [d] (μCi β/cm³)	Solubility Class [e]	Target Limit [f] (μCi•y / cm³•10 mrem)	Contribution to Dose: Alpha [g] (mrem α/y)	Contribution to Dose: Beta [h] (mrem β/y)	Activity w/ Progeny: α on Filter [i] (dpm α/m³)	Activity w/ Progeny: β on Filter [j] (dpm β/m³)
Uranium Series											
U238	1		16.6	6.5E-17	0.0E+00	y	1 E-14	5.41E-02	0.00E+00	1.4E-04	0.0E+00
Th234		1	16.6	0.0E+00	6.5E-17	d	4 E-11	0.00E+00	1.62E-05	0.0E+00	1.4E-04
Pa234		1	16.6	0.0E+00	6.5E-17	d	2 E-09	0.00E+00	3.61E-07	0.0E+00	1.4E-04
U234	1		16.9	6.6E-17	0.0E+00	y	1 E-14	6.61E-02	0.00E+00	1.5E-04	0.0E+00
Th230	1		1060	4.1E-15	0.0E+00	y	6 E-15	6.91E+00	0.00E+00	9.2E-03	0.0E+00
Ra226	1		71.6	2.8E-16	0.0E+00	y	2 E-13	1.56E-02	0.00E+00	6.2E-04	0.0E+00
Rn222+D [k]	3	2	71.6	1.7E-16	1.1E-16	d	2 E-11	8.40E-05	5.60E-05	3.7E-04	2.5E-04
Pb210		1	88.6	0.0E+00	3.5E-16	y	1 E-13	0.00E+00	2.89E-02	0.0E+00	7.7E-04
Bi210		1	88.6	0.0E+00	3.5E-16	d	8 E-12	0.00E+00	4.33E-04	0.0E+00	7.7E-04
Po210	1		88.6	3.5E-16	0.0E+00	d	2 E-13	1.92E-02	0.00E+00	7.7E-04	0.0E+00
Thorium Series											
Th232	1		4.14	1.6E-17	0.0E+00	y	1 E-15	1.35E-01	0.00E+00	3.6E-05	0.0E+00
Ra228		1	4.14	0.0E+00	1.6E-17	y	4 E-13	0.00E+00	4.05E-04	0.0E+00	3.6E-05
Ac228		1	4.14	0.0E+00	1.6E-17	d	1 E-11	0.00E+00	1.35E-05	0.0E+00	3.6E-05
Th228	1		4.14	1.6E-17	0.0E+00	y	4 E-15	4.05E-02	0.00E+00	3.6E-05	0.0E+00
Ra224	1		4.14	1.6E-17	0.0E+00	d	4 E-13	4.05E-04	0.00E+00	3.6E-05	0.0E+00
Rn220+D [k]	3	2	4.14	9.7E-18	6.5E-18	d	6 E-12	1.62E-05	1.08E-05	2.2E-05	1.4E-05
Actinium Series											
U235	1		0.84	3.3E-18	0.0E+00	y	1 E-14	2.74E-03	0.00E+00	7.3E-06	0.0E+00
Th231		1	0.84	0.0E+00	3.3E-18	d	2 E-09	0.00E+00	1.82E-08	0.0E+00	7.3E-06
Pa231	1		47.3	1.8E-16	0.0E+00	y	2 E-15	1.16E+00	0.00E+00	4.1E-04	0.0E+00
Ac227		1	47.3	0.0E+00	1.8E-16	y	1 E-15	0.00E+00	1.54E+00	0.0E+00	4.1E-04
Th227	1		47.3	1.8E-16	0.0E+00	d	1 E-13	1.85E-02	0.00E+00	4.1E-04	0.0E+00
Ra223	1		47.3	1.8E-16	0.0E+00	d	2 E-13	1.03E-02	0.00E+00	4.1E-04	0.0E+00
Pb211	1		47.3	1.8E-16	0.0E+00	d	2 E-10	1.03E-05	0.00E+00	4.1E-04	0.0E+00
Totals =	**19**	**12**	na	**5.9E-15**	**1.2E-15**		na	**8**	**2**	**0.013**	**0.003**

[a] Alpha and beta production rates taken from Kocher, 1981 "Radioactive Decay Tables", Tech. Inf. Center, US DOE.

[b] 95% UCL Surface Soil Concentrations from Westlake Baseline RA April 2000 Table A.3-2, Current Exposure Point Concentrations in Area 1 Soil. Three significant figures provided for quality control purposes and are not indicative of precision.

[c] α in Air(μCi α/cm³) = Soil Conc(pCi/g) x FenceDust(μg/m³) x AlphaYield(α)/(AlphaYield(α)+BetaYield(β)) x10^{-6}(g/μg) x10^{-6}(μCi/pCi) x10^{-6}(m³/cm³), where FenceDust is the mass concentration of the mixture in air needed to produce 10 mrem/year to the public at the Fence of the permitted area using 10 CFR 20 methodology.

[d] β in Air(μCi β/cm³) = Soil Conc(pCi/g) x FenceDust(μg/m³) x BetaYield(β)/(AlphaYield(α)+BetaYield(β)) x10^{-6}(g/μg) x10^{-6}(μCi/pCi) x10^{-6}(m³/cm³).

[e] Solubility determined from chemical reactivity of element and age of radionuclide.

[f] Effluent Air Concentration from 10CFR20 Appx. B, Table 2. Annual average annual air concentration needed to yield 10 mrem/y using 10CFR20 dose assessment methodology. Assumes generation and exposure times of 8760 h/y.

[g] Alpha dose generated by nuclide i (mrem/y) = α in Air(μCi/cm³)/TargetLimit$_i$ (μCi/cm³) x 10 mrem/y.

[h] Beta dose generated by nuclide i (mrem/y) = β in Air(μCi/cm³)/TargetLimit$_i$(μCi/cm³) x 10 mrem/y.

[i] α activity in 1 m³ of filtered air (dpm α/m³) = α in Air(μCi α/cm³) x10^{-6}(μCi/pCi) x 2,220,000(dpm/μCi).

[j] β activity in 1 m³ of filtered air(dpm β/m³) = β in Air(μCi β/cm³) x10^{-6}(μCi/pCi) x 2,220,000(dpm/μCi).

[k] Includes 100% of prompt Rn222 progeny activity from Ra226 captured in particulate fraction. Ambient radon daughters in filtered air excluded from this calculation.

A.8 USE OF INVESTIGATIVE LEVELS TO SCREEN FOR COMPLIANCE WITH OPERATIONAL DAC

On average, a cubic meter of air containing 7.7 x 10^{-12} µCi/mL of Area 1 soil would produce 14 alpha disintegrations per minute (dpm) and 3 beta dpm. **The ALARA goals for gross alpha and gross beta are set at 25% of those limits, or approximately 3.6 alpha dpm/m^3 and 0.7 beta dpm/m^3**. These values represent the investigative levels for radioactivity in air during operations within a Permitted Area covered by this RSP.

A.9 USE OF INVESTIGATIVE LEVELS TO SCREEN FOR COMPLIANCE WITH EFFLUENT DOSES AT THE PERMITED AREA BOUNDARY

The point of compliance for effluent doses on this project is the perimeter of the work area. Doses at this location will be limited to 50 mrem/y. On average, air containing a 3.5 x 10^{-14} µCi/mL suspension of Area 1 soil would produce 50 mrem/y to members of the public during a continuous one year exposure. This corresponds to air activities of 0.065 alpha dpm/m^3 and 0.013 beta dpm/m^3. These gross activity values represent the limits for alpha and beta activity in air at the boundary of a Permitted Area assuming a continuous discharge. Applying these limits to discharges linked to operations that only occur during working hours (~2,000 h/y) provides a safety factor of approximately four (4).

A.10 USE OF INVESTIGATIVE LEVELS TO SCREEN FOR COMPLIANCE WITH 10 MREM/Y AT THE FENCELINE

The point of compliance for off-property doses on this project is the perimeter of the property. Public doses at this location will be limited to 10 mrem/y. On average, air containing a 7.0 x 10^{-15} µCi/mL suspension of Area 1 soil would produce 10 mrem/y to members of the public during a continuous one year exposure. This corresponds to air activities of 0.013 alpha dpm/m^3 and 0.003 beta dpm/m^3. These gross activity values represent the limits for alpha and beta activity in air at the boundary of a Permitted Area assuming a continuous discharge. Applying these limits to discharges linked to operations that only occur during working hours (~2,000 h/y) provides a safety factor of approximately four (4).

A.11 CONTINUOUS APPLICATION OF ALARA DURING PROJECT

The philosophy of ALARA will be applied during all phases of the project. As remedial activities proceed, all pertinent personnel will be involved in assessing ALARA. Operational experience will be of prime importance as actual dose rates are measured for the activities listed below. This may result in reasonable modifications to operating procedures and work practices.

A.12 PRE-JOB ALARA EVALUATION

The following activities were considered by this ALARA evaluation:

- Brush cutting along marked lanes containing no identified surface TENORM,
- Intrusive penetration of soil by drill rigs and direct push technology,
- sampling of surface and subsurface soil,
- installation of semi-permanent, air-monitoring equipment at static locations,

- decontamination of equipment,
- capture and retention of water generated by decon operations, and
- radiological monitoring of operations.

These activities were broken down by task and evaluated to determine the radiological risks associated with each task. This evaluation identified three exposure scenarios/locations that were judged to have the most potential to produce personnel exposures. These three are (a) the operator of heavy equipment requiring close contact with soil or with tools in contact with soil, (b) a laborer cutting and handling brush and debris on the surface, and (c) the RCT/decon technician. If doses to these workers are acceptable, one can reasonably infer that doses to other, less exposed individuals will also be acceptable.

A.12.1 Equipment Operator

During this evaluation, the postulated operator is assumed to be standing over areas of TENORM-impacted soil as he operates the equipment. The potential exposure pathways that can reasonably be postulated for this worker are inadvertent ingestion of dirt, inhalation of dust, and direct gamma irradiation from the surrounding soil.

The operator will wear gloves to prevent contacting exposed tool surfaces or filled soil core liners as they are removed from the soil. This will limit the amount of dirt deposited on the operator's hands and reduce the risk of inadvertent soil ingestion. The soil around the sampling location and the material removed by the soil coring equipment is expected to be moist and non-friable, which will mitigate potential inhalation of particulates from disturbed soil. Due to the limited exposure times and low levels of external radiation expected, the operator will not receive a direct exposure from TENORM that will approach the project ALARA goal of 100 mrem/mo.

A.12.2 Laborer Clearing Ground Surface

The bulk of the ground clearing activities will be performed along designated easements in OU 1. The potential exposure pathways that can reasonably be postulated for workers performing this work over surface soil impacted by TENORM are direct gamma irradiation from the soil, inhalation of dust, and inadvertent ingestion of dirt.

The brush cutters will work in areas where the surface soil has been surveyed by gamma detection equipment, and the direct exposure potential in the areas selected for brush removal will be known in advance. Laborers performing these activities will not purposely disturb enough soil to generate an airborne particulate hazard. Laborers will wear gloves and observe a strict policy of no eating or drinking smoking or chewing while working in the Permitted Area.

It is not anticipated that these laborers will receive a TEDE from TENORM that will approach the project ALARA goal of 100 mrem/mo.

A.12.3 Radiation Control Technician

The worker in this case is an individual who spends most of the workday monitoring operations with the highest potential for exposure. As such, the RCT's activities generate the greatest

potential for exposure among the project's work force. These potential exposures were selected for a semi-quantitative dose assessment as part of this ALARA review.

Projected Doses from Incidental Ingestion

Ingestion of contaminated soil may occur if soil or buried materials are handled without gloves. Because gloves will be required, no ingestion doses are anticipated.

Projected Exposures from Inhalation

Inhalation of suspended soil particles may occur during activities that disturb the ground surface like excavation of soil and its subsequent transfer to trucks or roll-off boxes. To evaluate doses from this pathway, the worker was assumed to be exposed to a continuous cloud of visible dust from a hypothetical operation.

A dust concentration of about 4,300 µg/m^3 is required to yield the 5,000 mrem/y calculated dose in Table A-2 (see footnote "c"). The concentration of dust that is visible in near ground conditions varies, but dust present at the nuisance dust concentration of 0.15 mg/m^3 (150 µg/m^3) is clearly visible during daylight. A dust concentration of 150 µg/m^3 would produce a dose that is approximately 3.5% (150µg/m^3 ÷ 4,300µg/m^3) of the allowable dose (5,000 mrem/y) or **approximately 15 mrem for every month worked in a visible dust plume.** If it should become necessary to work for a sustained period in a heavy (opaque) dust plume, a combination of using active dust suppression measures, moving workers out of visible dust plumes, and/or requiring workers to wear respiratory protection will provide adequate protection from excess inhalation doses.

Direct Exposures

Workers spending time near the excavation can be directly exposed to radiation from the open working face. Based on previous work with similar material, exposure rates over impacted soil are expected to range from 8 to 100 µR/h. Using a nominal value of 20 µR/h above background, and an exposure time of 176 hours (one month), a hypothetical worker standing at the point of maximum exposure for the entire time could accrue approximately 3.5 milli-Roentgen[7], or 3.5 mrem. This dose is low enough that it may not be detected with standard commercial radiation badges collected on a quarterly basis.

Comparison with Project Goals

This prospective dose assessment indicates doses to the maximally exposed worker are expected to remain below the 100 mrem/mo. ALARA target for this phase of the project. It will be assumed that other workers, with a lower expectation of exposure, will also be below the ALARA goal.

The A&A personnel shall periodically monitor dose rates and activities within Permitted Areas to verify that assumptions used in this dose assessment remain representative of the work performed by the maximally exposed worker.

A.13 REFERENCES

Auxier 2000 "*Baseline Risk Assessment West Lake Landfill Operable Unit 1.*" April 24, 2000 Auxier & Associates. Appendix A of Remedial Investigation Report, West Lake Landfill, Operable Unit 1 by Engineering Management Support, Inc, 2000.

[7] 3,200 µR = 20 µR/h x 160 h. If one makes the conservative assumption that 1 mRem is equivalent to 1,000 µR, then 3,200 µR ≈ 3.2 mrem.