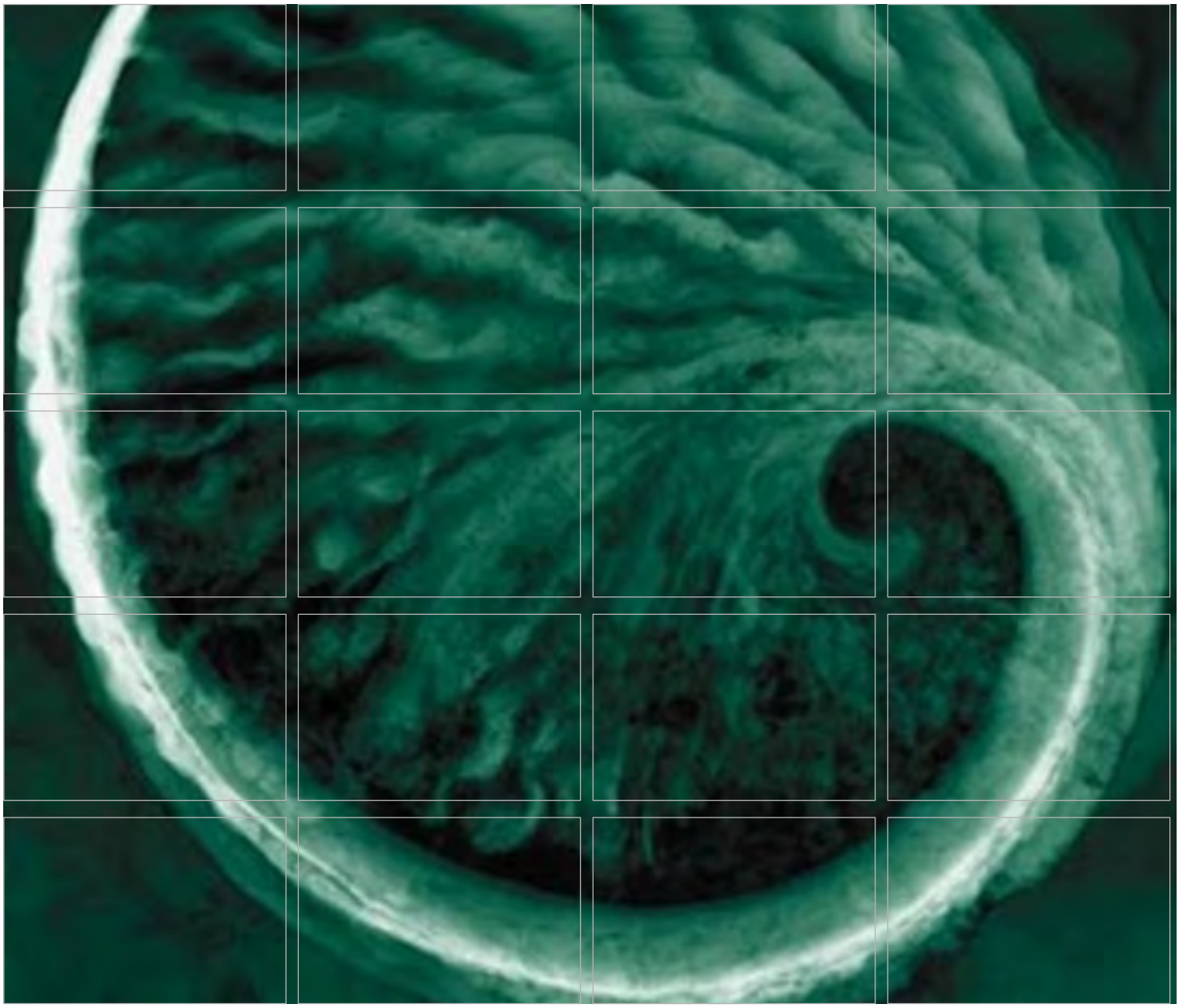

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Sampling & Analysis Plan

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July 2017

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Project Shuttle
Sampling & Analysis Plan Jefferson Orchard Site

July 2017

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1.0 INTRODUCTION

The Jefferson Orchards property is located at 365 Granny Smith Lane near Kearneysville, West Virginia, in Jefferson County and encompasses approximately 400 acres of land (**Figure 1**). Approximately 150 acres of the property is planned for development of an insulation manufacturing facility and is hereinafter referred to as the "Property". Jefferson Orchards, Inc. (hereinafter referred to as the "Applicant"), submitted an application to the West Virginia Department of Environmental Protection (WVDEP) to enter approximately 80 acres of the Property into the Voluntary Remediation Program (VRP). **Figure 2** shows the approximate boundary of the Property as well as the approximate boundary of the 80-acre VRP parcel (hereinafter referred to as the "VRP Site").

Site characterization activities were conducted at the Jefferson Orchards property (including the VRP Site) in both 2003 and 2017, to investigate potential Constituents of Potential Concern (COPC) in site media. Based on the 2017 site characterization, discussed in detail in **Section 1.2.3**, priority pollutant pesticides, lead, and arsenic in shallow soils appear to be the primary environmental concern at the site. This Sampling and Analysis Plan (SAP) will be used to identify affected soils within the boundary of the Site.

1.1 PURPOSE AND OBJECTIVES

Soil sampling conducted in accordance with this SAP will be used to provide data for confirmation of the vertical extent of pesticide, lead, and arsenic impacted soils at the site.

Project Shuttle intends to redevelop the site for use as a multi-purpose industrial manufacturing facility. Data obtained during this sampling event will be used to prepare a Remedial Action Work Plan (RAWP) for the West Virginia VRP in accordance with WV 60CSR3-10 for preparation of the redevelopment of the site.

1.2 PROJECT BACKGROUND

1.2.1 Site Description

The VRP Site is located in an area predominantly characterized by karst topography and is situated at an elevation of approximately 580 feet above mean sea level (amsl). Several limestone rock outcrops are visible throughout the Property. Topography across the site consists of gentle to moderate slopes and elevation ranges from approximately 530 feet to 602 feet amsl. The Site is bound to the north and east by agricultural fields, wooded areas, a former quarry, to the west by a single family residence, and to the south by CSXT railroad and West Virginia Route 9. Additionally, North Jefferson elementary School is located approximately 3,400 feet south of the center of the future manufacturing facility.

Orchard operations on the Site were reportedly shut down in November 2015 and all orchard trees were removed soon after. The Site has remained idle since then and is currently unoccupied. The residence located on the southwest portion of the Property, and adjacent to the VRP Site, is reportedly occupied by a tenant but will be vacated in the near future. Also, the site is currently used for the agricultural production of corn and soybeans.

1.2.2 Source of Pesticides at the Site

Portions of the site were used as an apple orchard since the 1950's. Phase II environmental site assessments (ESAs) have been conducted at the site in 2003 and 2017. Soil samples were collected and analyzed for metals and pesticides during the 2003 Phase II ESA. Analytical results of the 2003 Phase II ESA indicate arsenic, lead, and pesticide concentrations, specifically 4,4-DDE and 4,4-DDT, in shallow soil typically exceed West Virginia Residential De Minimis Standards and/or West Virginia Industrial De Minimis Standards. In 2017, soil samples were collected and analyzed for volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), metals, herbicides, pesticides, and polychlorinated biphenyls (PCBs). Analytical results of the 2017 Phase II ESA indicate one exceedance above the West Virginia Industrial Soil De Minimis Standard for the pesticide dieldrin in shallow soil.

1.2.3 Previous Investigations & Remedial Activities

Several ESAs investigating potential environmental concerns as well as known contamination have been conducted, beginning in 2003. These investigations included the following:

- Soil Excavation, Northern Portion of Site (Early to mid-2000's) – During the development of the new West Virginia State Route 9 the West Virginia Department of Transportation, Division of Highways (WVDOT-DOH) reportedly used approximately 14 acres of the site as a soil borrow area for road construction activities. The borrow area was located north of the Packing Shed and approximately two additional acres were disturbed to prepare a haul road across the site. Reportedly, an estimated 200,000+ cubic yards was removed from the Site by the WVDOT-DOH.

- Phase II ESA (June 2003) – Triad Engineering (Triad) conducted shallow soil sampling on the Site and other areas adjacent to the Site. Elevated concentrations of arsenic, lead, and pesticides were detected in shallow soils across the investigation area, with minimal detections on the Site.

- Phase I ESA (March 2017) – ERM conducted a Phase I ESA on the Site and adjacent portions of land. The site's historic use as an apple orchard as well as analytical data indicating the presence of impacted soils, was listed as a Recognized Environmental Concern (REC) in the Phase I ESA findings.

- Phase II ESA (March 2017) – ERM conducted a baseline Phase II ESA on the Site and an adjacent portion of land. One shallow sample collected on the land adjacent to the Site had a dieldren concentration above the West Virginia Industrial Soil De Minimis Standard.

1.3 HYDROGEOLOGIC SETTING

According to the United States Department of Agriculture Natural Resources Conservation Service web soil survey data, the site geology is characterized by Hagerstown silt loam/silt clay and Vertrees silt loam/silt clay deposits. The silt loams and clays are underlain by Stonehenge Limestone bedrock, which is underlain by Conococheague Formation. The Hagerstown silt loam/silt clay and Vertrees silt loam/silt clay deposits

are characterized as prime areas for farmland and are well drained soils. These sequences average 0 to 7 feet in thickness and were deposited on top of the Stonehenge Limestone bedrock unit. The Stonehenge Limestone bedrock is characterized as gray, thin-bedded to massive, fossiliferous limestone, largely mechanically deposited, with small black chert nodules and beds of "edgewise" conglomerate (Cardwell, et al., 1986).

Depth to bedrock beneath the site varies due to the nature of limestone karst topography and may range from 5 to 35 feet below ground surface (bgs). The bedrock underlying the Hagerstown silt loam/ silt clay and Vertrees silt loam/silt clay deposits is part of the Conococheague Formation of the Cambrian-System. The Conococheague Formation is predominately algal and mechanically deposited limestone, with interbeds of aphanitic limestone and dolomite. The Formation contains siliceous and dolomitic laminations (Cardwell, et al., 1986).

Groundwater in the region is typically located at depths greater than 100 feet within the bedrock mass. It is not expected that groundwater will be encountered during this supplemental soil sampling event.

1.4 COPCS AND ANALYTICAL PROGRAM

A list of COPCs was developed as part of this SAP and includes target metals (arsenic and lead) and priority pollutant pesticides. COCs and information concerning sample collection containers, preservatives and holding time requirements are included as **Table 2** and **Table 3.** This sampling effort will primarily focus on confirming the vertical extent of COPC contamination in soil at the site. Samples will be submitted to ALS Environmental, a West Virginia Certified Laboratory. Samples will be analyzed in their laboratory in Middletown, Pennsylvania.

1.5 SITE HEALTH AND SAFETY PROGRAM

The ERM Site-Specific Health and Safety Plan (HASP) documents the policies and procedures which protect workers and the public from potential hazards posed by site work. Field work will be conducted in accordance with the HASP in a manner minimizing the probability of near misses, exposure to COCs, equipment and property damage and personal injury. The HASP will be reviewed by each site worker and the HASP Certification will be signed by ERM and subcontractor personnel that

actively participate in the project. A copy of the HASP for this investigation is included as **Appendix A.**

1.6 PROJECT MANAGEMENT

The site characterization will be supervised by a Licensed Remediation Specialist (LRS) in the State of West Virginia. The LRS will have overall responsibility for the project budget, master schedule, deliverables, and the team performance. The field investigation team will be responsible for the implementation of field activities, documentation of field activities and communication with the LRS. **Table 1** provides a summay of project personnel associated with the site, a chain-of-command with regard to decision making, and specific training requirements for project personnel. Additionally, a Quality Assurance Project Plan (QAPP) is included as **Appendix B**.

2.0 FIELD OPERATIONS

The standard sampling procedures and methodologies to be used for the supplemental field sampling are described in this section. Details are provided for sample location selection, direct-push soil boring advancement, sample collection and handling, waste handling, and decontamination. Relevant Standard Operating Procedures (SOPs) for specific field activities are included in **Appendix C**. Changes in field procedures must be in accordance with the field modifications policy described in **Section 2.10** and approved by the LRS or appropriate management personnel.

2.1 SAMPLE LOCATION SELECTION

Sample locations were chosen in order to further characterize site soils for the potential presence of arsenic, lead and priority pollutant pesticides. Soil sampling locations are described in detail below:

- Eleven soil borings will be advanced to a depth of 5.0 feet below ground surface (bgs) in selected locations across the site. Soil samples will be collected from the following depth intervals: 0 – 6 inch, 6 – 12 inch, 12 – 18 inch, 18 – 24 inch, 24 – 30 inch, and 4.5 to 5.0 feet. The 0 – 6 inch and 18 – 24 inch intervals will be submitted for laboratory analysis of priority pollutant pesticides, arsenic, and lead. Samples collected from the remaining three intervals will be submitted on "hold" and may be analyzed based on results of the analyzed intervals (i.e. if the 0-6 inch interval is impacted and the 18-24 inch interval is clean, the 6-12 inch will be analyzed, followed by the 12-18 interval, if necessary).

- Five soil borings will be advanced to a depth of approximately 25.0 feet bgs. Soil samples will be collected from the following depth intervals: 0 – 6 inch, 6 – 12 inch, 12 – 18 inch, 18 – 24 inch, 24 – 30 inch, 4.5 to 5.0 feet, 9.5 – 10.0 feet, 14.5 – 15 feet, 19.5 – 20.0 feet, and 24.5 – 25.0 feet. The 0 – 6 inch and 18 – 24 inch intervals will be submitted for laboratory analysis of priority pollutant pesticides, arsenic, and lead. Samples collected from the remaining seven intervals will be submitted on "hold" and may be analyzed based on results of the analyzed intervals.

Soil sample locations are illustrated on **Figure 2. Table 3** lists proposed sample collection at each boring location.

2.2 SOIL SAMPLING PROCEDURES

2.2.1 Soil Sampling

Sixteen (16) direct-push soil borings, as generally described in **Section 2.1**, will be advanced to depths ranging from 5.0 feet to 25.0 feet bgs for the collection of subsurface grab samples at selected intervals. Proposed sample collection includes collection of 95 depth discrete soil samples, with 30 samples submitted for laboratory analysis, and 65 submitted on hold.

A direct-push sampling device will be used to collect soil samples using either single-tube (macro-core) or dual-tube methodology at specific depths bgs. Single-tube direct push technology will only be used at soil boring locations where the maximum planned depth can be achieved by a single push (e.g. five feet bgs). Dual-tube methodology will be used at soil boring locations where multiple pushes will be required to achieve desired depth.

Single-tube sampling uses a specially designed stainless steel sample tube with an inner polyvinyl chloride (PVC) sleeve to collect soil samples. The sample tube is pushed and/or vibrated to a specified depth and the interior plug of the sample tube is removed by inserting small diameter threaded rods. The sample tube or core barrel is driven through the desired sample interval to collect the soil sample. The rod and sampler will be retrieved, the sleeve containing the soil sample will be removed from the core barrel and the sleeve split open using a decontaminated knife equipped with a stainless steel blade.

Dual tube sampling uses two sets of probe rods to collect continuous soil cores. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination.

The second, smaller set of rods are placed inside the outer casing. The smaller rods hold a sample liner in place as the outer casing is driven one sampling interval. The small rods are then retracted to retrieve the filled liner. The sleeve containing the soil sample will be removed from the core

barrel and the sleeve split open using a decontaminated knife equipped with a stainless steel blade.

Grab soil samples from individual boring intervals will homogenized as thoroughly as possible by placing soil into a clean disposable plastic bag, and mixing the soil by hand. An individual homogenizing a soil sample will don a clean pair of disposable nitrile gloves and perform manual soil mixing for at least one minute. Excess vegetation, organic matter, and/or rock will be removed during sample mixing.

Samples collected for laboratory analysis will be placed in the appropriate sample containers with required preservatives, labeled for proper identification, packed in a cooler with ice, and submitted to a West Virginia certified laboratory (ALS Environmental in Middletown, PA).

The continuous soil cores will be classified according to the Unified Soils Classification system as described in ASTM Method D-2488-09a. Soil sample descriptions, sample depth intervals, and sample identification names will be recorded on boring logs. Standard operating procedures for soil boring advancement and soil sample collection are included in **Appendix C**.

2.3 WASTE MATERIAL HANDLING

Decontamination or investigation derived wastes will be handled in accordance with the following procedure. There are potentially three types of investigation derived wastes (IDW) that will be generated during site sampling including general garbage, soil and impacted IDW and decontamination fluids.

2.3.1 General Garbage

General garbage may include such items as packaging material, unused sample jars and any other non-contaminated garbage. All non-contaminated garbage will be separated from potentially contaminated garbage and disposed of in a general trash receptacle.

2.3.2 Soil and Soil Impacted IDW

Boring holes will be filled with bentonite upon drilling completion. Excess soil cuttings will be spread on the site surface in the immediate vicinity of the associated boring hole. Residual visual soils will be removed from IDW including PVC liners and plastic sheeting by shaking and brushing.

Once visible soils have been removed, IDW will be disposed of as general garbage.

2.3.3 Decontamination Fluids

Decontamination fluids will be collected in properly labeled, DOT approved 55-gallon drums and analyzed for subsequent off-site disposal in accordance with applicable local, state, and federal regulations.

2.4 DECONTAMINATION PROCEDURES

Decontamination of equipment will be performed to remove residual chemical contamination before the equipment is used to collect samples for environmental analysis. Decontamination also reduces the risk of cross-contamination and worker exposure when removing contaminated non-sampling equipment from a contaminated area. Additionally, provisions will be made to collect decontamination fluids through the use of temporary systems. Appropriate temporary systems include drums or sealable plastic containers adapted to contain fluids for handling.

2.4.1 Sampling Equipment

This procedure is applicable for equipment that will be used to collect a sample for chemical analysis. Decontamination will be conducted on the direct push cutting shoe between each push in order to prevent cross-contamination within a boring. Additionally, core barrels and drive rods will be decontaminated between soil boring locations. Field decontamination will be performed using the following steps:

1. Post-Sample Collection Cleanup – Residual visible soil will be removed by scraping and shaking. Residue will be handled as IDW.

2. Gross Wash and Water Rinse – The equipment will undergo a vigorous brushing with laboratory-grade, phosphate-free detergent in water and will be rinsed with distilled water to remove visible particulate. Distilled water rinse will be provided by stainless-steel sprayer or equivalent device.

3. 10% Nitric Acid Rinse – If glass or stainless steel equipment is used and metals are part of the analysis program, rinse the interior and exterior surfaces of the glass or stainless steel equipment that will come in contact with the sample matrix with 10% nitric acid (HNO_3) solution.

4. Analyte-Free Water Rinse – Decontaminated equipment will be rinsed with deionized (DI) analyte-free water. The water should be certified as analyte-free by the manufacturer and prepared using filters, an activated carbon bed filtration apparatus and deionizing resin columns. Water that has been field or laboratory prepared using this equipment and has been sampled, analyzed for target parameters, and verified to contain less than detectable quantities may also be used. For all water sources, verify that the same lot or batch that has been documented as analyte-free is consistently used or that documentation exists for multiple lots. Analyte-free water will be applied using labeled laboratory-grade Nalgene® spray bottles or other acceptable containers.

5. Solvent Rinse – When collecting samples for pesticide analysis, equipment should be rinsed with hexane. Hexane will be applied using labeled laboratory-grade Nalgene® spray bottles.

6. Second Analyte-Free Rinse – The equipment will be rinsed again using analyte-free water. Analyte-free water for this rinse should be drawn from a secondary container source such as a squeeze bottle. This rinse water may be collected as the equipment rinse sample when required.

7. Sampling equipment will be allowed to air dry.

8. Protective Wrap – Decontaminated equipment that has been dried will be wrapped in layers of aluminum foil or plastic (to protect sampling surfaces) and stored in a contaminant-free location.

   Note: Step 3 will only be performed when collecting samples for metals analysis. Step 5 will only be performed when collecting samples for organic analysis.

2.6 SAMPLE HANDLING, STORAGE, AND SHIPMENT

2.6.1 Sampling Identification

A unique sample identification system will be used to identify each sample collected and provide a method for submitting "blind" QA/QC samples for laboratory analysis.

Regular soil samples will be identified by the soil boring number (SB-1 through SB-15) and the depth at which it was collected. As an example,

the soil sample collected from the 18 – 24 inch interval of the soil boring advanced at the SB-3 location will be identified as **SB-3 (18″-24″)**.

QA/QC soil samples (e.g. split samples) will be identified as **DUP-#**, beginning with DUP-1 and continuing by successive number. Based on the number of proposed soil samples, five duplicate soil samples will be collected during this investigation.

Other QA/QC samples will be identified as follows:

- Equipment Rinsate Blanks – RB-#; and
- Matrix Spike/Matrix Spike Duplicate (MS/MSD)

These samples will be numbered according to the order in which they are collected. A total of three RB's and MS/MSD's will be collected during this investigation (**Table 3**).

2.6.2 Storage, Handling and Shipping

Samples collected during the investigation activities will be properly handled and stored in ice-filled coolers. Samples will be picked up by an ALS Environmental courier for delivery to ALS's laboratory in Middletown, PA. The courier will be on site to pick up sample coolers approximately every other day during site characterization activities. The samples will be analyzed within the holding times listed on **Table 1**. Following analyses, the laboratory will store the samples according to their QA/QC plan.

2.7 FIELD DOCUMENTATION

Information including daily field observations, onsite and offsite times, health and safety tailgate meetings, personnel present on the site throughout the day, weather conditions, and other information deemed relevant, will be recorded in field books. Soil boring lithology, soil sample collection times, and field duplicate information will be recorded on soil boring logs and documented field books. Calibration of field equipment will be documented on both field calibration logs and field books. Blank soil boring logs and calibration forms are included in **Appendix D**.

2.8 QUALITY CONTROL SAMPLES

The precision and accuracy of the field sampling procedures will be checked through the preparation, collection, submission and analysis of split samples and rinsate blanks.

Equipment rinsate blanks will be collected from the final analyte-free DI water rinse of the equipment decontamination process during sampling activities that re-use sampling equipment. Once a piece of sampling equipment is fully decontaminated, analyte-free water is poured over, across and through all sample collection surfaces and the water is directly collected into appropriate water matrix sample containers. One rinsate blank will be submitted per 20 samples. Rinsate blanks will be analyzed for the same parameters as the samples collected that day. If dedicated or disposable sampling equipment is used for each sampling event, rinsate blanks are not required.

Field duplicates will be used to assess sample representativeness and analytical precision. Field duplicates will be prepared by dividing a homogenized soil section into two equal samples for separate analyses. Field duplicates will be collected at a frequency of one per 20 samples, per matrix, per analytical method, per round of sampling. Field duplicate samples will be analyzed independently of the corresponding sample.

Field splits may be collected by the WVDEP at a frequency of one per 10 samples. Both samples are analyzed for the same parameters according to the same analytical methods.

The analytical laboratory will follow the internal quality control procedures specified in the SW-846 organic and inorganic methods. One MS and MSD per 20 samples are required as part of the SW-846 quality control procedures. The investigation team must coordinate with the lab to ensure that extra samples are collected as needed for MS/MSD samples.

Temperature blanks will be provided by the laboratory for more accurate measurement of sample shuttle temperatures taken upon receipt at the laboratory. A temperature blank consisting of a sample container filled with potable water, will accompany each cooler shipped to the laboratory.

2.9 SURVEYING

During drilling, boring locations will be identified using a GPS unit with sub-meter accuracy, to record surface locations and ground surface elevations for each soil boring.

2.10 FIELD CHANGES

Field changes or adjustments may be required to accommodate field conditions or to respond to discoveries made in the field. Investigation team personnel will contact the LRS prior to initiating changes or additions to this plan.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control samples (QA/QC) will be collected and analyzed to permit validation of the analytical data and verify that the data are acceptable. As previously mentioned, a QAPP has been included as **Appendix B**.

3.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) for the site assessments was developed in accordance with "Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process" EPA Q/G-4 September 1994.

3.1.1 Precision

Precision refers to the level of agreement among repeated measurements of the same parameter. It is usually stated in terms of standard deviation, relative standard deviation, relative percent difference, range, or relative range. The overall precision of a piece of data is a mixture of sampling and analytical factors. The analytical precision is much easier to control and quantify because the laboratory is a controlled, and therefore, measurable environment. Sampling precision is unique to each site, making it much harder to control and quantify. The goals for each factor are addressed here separately.

Precision will be evaluated by calculating the relative percent difference (RPD) as follows:

$$\text{RPD} = \frac{\text{difference between the two measured values}}{\text{average of the two measured values}} \times 100$$

The RPD will be calculated for each analytical parameter. It is expected that the soil sample field duplicates will have RPDs of approximately 50%. If these criteria are not met, a careful examination of the sampling techniques, sample media and analytical procedure will be conducted to identify the cause of the high RPD and the usability of the data.

Laboratory precision will be evaluated by the analysis of one duplicate sample for every sample batch. A sample batch is defined as a group of 20 samples of similar physical media collected within one work day or all such samples collected in a work day (if less than 20), whichever occurs first. The RPD for each analytical parameter will be calculated as a measurement of precision. For the analyses to be completed during this sampling event, the precision criteria to be used will be defined by the contractor laboratory in conjunction with methodology used for analysis of the sample.

3.1.2 Accuracy

Accuracy refers to the difference between a measured value for a parameter and the true value for the parameter. It is an indicator of the bias in the measurement system. Sources of error measured by this parameter include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analytical technique.

The effectiveness of sampling equipment decontamination procedures will be assessed by collecting and submitting one rinsate blank per 20 samples or per day in which sampling occurs, whichever occurs first. The accuracy goal for the rinsate blanks will be to contain less variation than the method detection limit for each analytical parameter. If analytes are detected in the blanks above these levels, the sample data will be compared with the blank data and may be rejected or qualified, depending on the relative amounts present.

Laboratory accuracy will be evaluated by the analysis of one method blank per sample batch and one spiked sample per sample batch. For samples being analyzed using SW¬846 methods, the spike acceptance criteria specified in the method are adopted. Volatile and semi-volatile method blanks must contain no more than the detection limit for target compounds and no more than five times the detection limit of common lab contaminants including methylene chloride, acetone, 2 butanone, and phthalate esters. The inorganic method blanks must contain less than the detection limit for each analyte. The accuracy goals for all other analyses will be determined by the consultant laboratory according to the methodology used for analysis. If these criteria are not met, a careful evaluation of the data will be performed to determine the source of the error and usability of the data.

SW 846 method detection limits are assumed to be adequate unless otherwise specified. Spike recoveries will be calculated as follows:

$$\text{Recovery} = \frac{\text{Spike Sample Result - Sample Result}}{\text{Spike Added}} \times 100$$

3.1.3 Representativeness

Representativeness is a measure of the degree to which the measured results accurately reflect the medium being sampled and overall Site conditions. Representativeness is a qualitative parameter that is addressed through the proper design of the sampling program in terms of sample location, number of samples and actual material collected as a sample of the whole.

Sampling protocols (discussed in **Section 2.0**) have been developed to assure that samples collected are representative of the media. Field handling protocols (e.g., storage, handling in the field, and shipping) have also been designed to preserve the integrity of the collected samples. Proper field documentation and data validation will be used to establish that protocols have been followed and that sample identification and integrity have been maintained.

3.1.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another. When comparing data, it is important to compare data collected under the same set of conditions. Seasonal trends, depth of sample collection, analytical protocol, method detection limits, and any other sampling/analytical variables must be taken into account when comparing data sets. This will be accomplished using established USEPA methods for collecting and analyzing the samples.

3.1.5 Completeness

Completeness is a measure of the amount of information that must be collected during the field investigation to allow successful achievement of the project objectives. Missing data may reduce the precision of estimates or introduce bias, thus lowering the confidence level of the conclusions. While completeness has historically been presented as a percentage of the data that is considered valid, this does not take into account critical sample locations or critical analytical parameters. The completeness goal for the activities will be 90% for the field sampling and 90% for the laboratory analyses.

The amount and type of data that may be lost due to sampling or analytical error cannot be predicted or evaluated in advance. The importance of any lost or suspect data will be evaluated in terms of the sample location, analytical parameter, nature of the problem, decision to be made, and the consequence of an erroneous decision. Critical locations or parameters for which data is determined to be inadequate may be resampled. Completeness will be calculated as follows:

$$\text{Completeness} = \frac{\text{Number of usable results}}{\text{Number of planned results}} \times 100$$

3.1.6 Sensitivity

Sensitivity relates to method detection limits (MDLs) that are achievable by the analytical laboratory. MDLs are dependent upon instrument sensitivity to ensure data quality through on-going checks on instrument performance. The MDL is defined as the minimum concentration that can be measured with 99 percent confidence that the concentration is above zero.

Reporting Limits (RLs) are defined as the minimum levels at which a laboratory will report analytical chemistry data with confidence in the quantitative accuracy of that data. The reporting limit (RL) for each analyte is equal to one half of its WVDEP De Minimis level or the standard laboratory RL, whichever is lower. In cases where the De Minimis level of a chemical is less than the standard RL, the laboratory will achieve the lowest possible "J" value for the chemical during the analysis. A "J" value represents an estimated concentration detected below the RL but above the instrument detection limit.

3.2 ANALYTICAL PROCEDURES & METHODS

Samples collected during the investigation will be analyzed in accordance with the procedures set forth by the third edition, update 1 (November, 1990) of SW-846, Methods for the Analysis of Water and Wastes (U.S. EPA 600/4-79-010). ***Table 1*** summarize the specific analytical methods to be used. Analytical documentation and record maintenance will also be in accordance with SW-846, as appropriate.

3.3 LABORATORY MINIMUM DETECTION LIMITS

The target minimum detection limit (MDL) for each analyte is equal to one half of its WVDEP De Minimis level or the standard laboratory MDL, whichever is lower. In cases where the De Minimis level of a chemical is less than the standard MDL, the laboratory will achieve the lowest possible J value for the chemical during the analysis. A J value represents an estimated concentration detected below the MDL.

3.4 DATA VALIDATION

Samples collected during the supplemental sampling activities will be analyzed for metals, and priority pollutant pesticides using SW846 methods. Prior to use of analytical data in evaluating potential current and future risk associated with the site, each applicable data set will be formally validated by a designated ERM quality assurance (QA) experienced person. The laboratory will be required to generate and deliver a Level IV data package for all analyses. The data validation will be performed in accordance with the Region III Modifications to National Functional Guidelines (Inorganics – 4193 and Pesticides/PCBs - 5193), as applied to SW-846 methodology.

Inorganic data will be evaluated according the protocols and QC requirements of the analytical methods, the reviewer's professional judgment, and in accordance with "Innovative Approaches to Data Validation" (EPA Region III, June 1995), Level IM-1/IM-2 (90%/10%), and "Modifications to National Functional Guidelines for Inorganic Data Review Multi-Media, Multi-Concentration" (EPA Region III, April 1993. At least 10% of the data from each applicable data set will be validated, in accordance with the WVDEP VRP Guidance Manual.

4.0 REFERENCES

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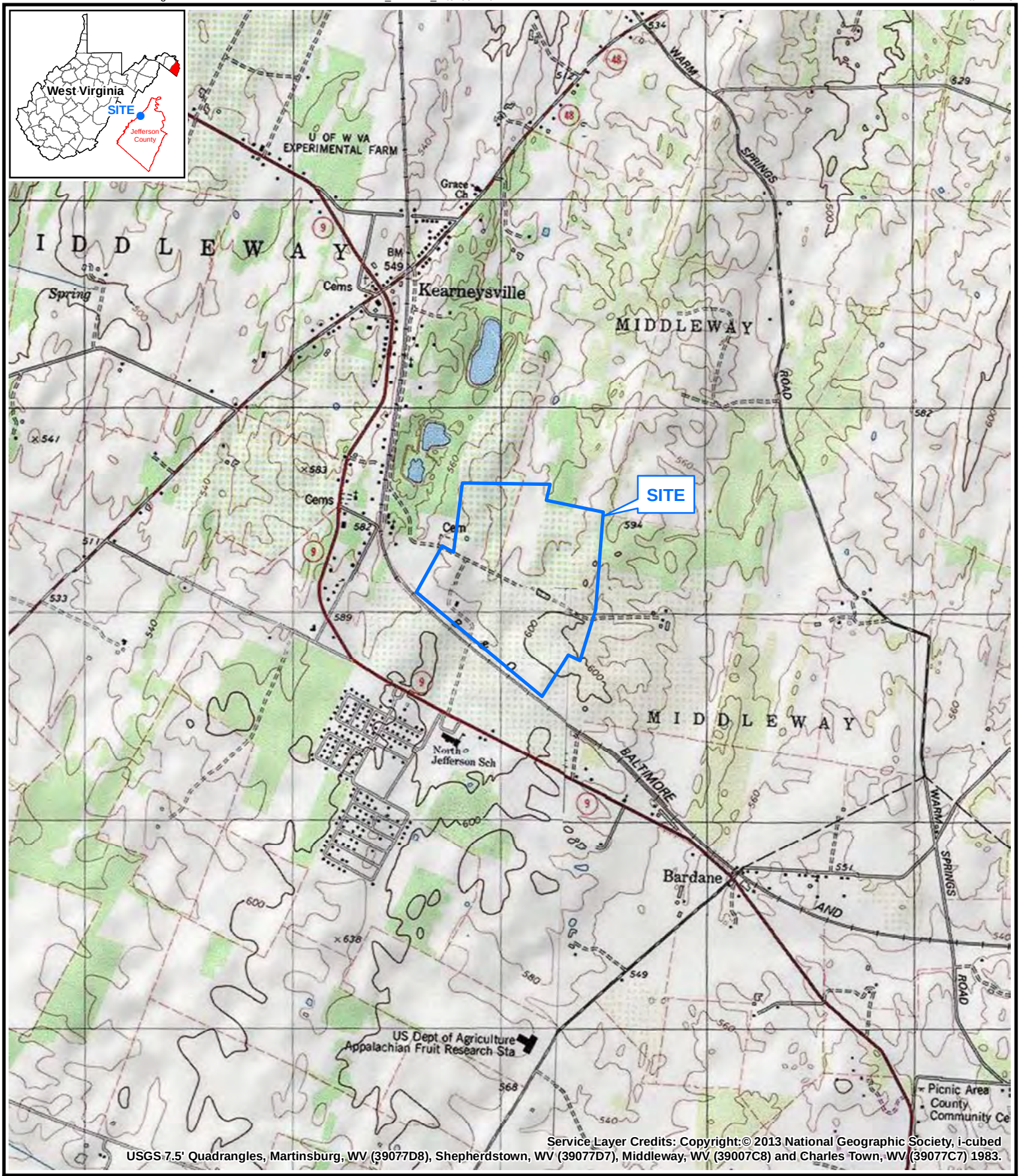
Figures



Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed
USGS 7.5' Quadrangles, Martinsburg, WV (39077D8), Shepherdstown, WV (39077D7), Middleway, WV (39007C8) and Charles Town, WV (39077C7) 1983.

N

0 1,000 2,000 Feet

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Figure 1
Site Location Map
Jefferson Orchard Site
Project Shuttle
Kearneysville, West Virginia

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Legend

Property Boundary

VRP Site Boundary

Figure 2
Site Plan

Jefferson Orchards Site
Project Shuttle
Kearneysville, West Virginia

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Legend

- Property Boundary
- VRP Site Boundary
- Deep Soil Borings (25 ft)
- Shallow Soil Borings (5 ft)

Figure 3

Proposed Soil Boring Locations

Jefferson Orchards Site
Project Shuttle
Kearneysville, West Virginia

Tables

TABLE 1
Project Personnel, Responsibilities, and Chain-of-Command
Jefferson Orchard, Inc.
Kearneysville, West Virginia

Organization	Personnel	Position	Responsibility	Special Training	Chain of Command
West Virginia Department of Environmental Protection (WVDEP)					
WVDEP	Sheena Moore	Project Manager	Provides oversight and technical review for WVDEP of project	OSHA-HAZWOPER 40 hour training	Main WVDEP contact with ERM Project Manager
Client					
Jefferson Orchard	Ron Slonaker	Jefferson Orchard Manager	VRP Applicant	NA	ERM Client Representative
ERM					
ERM	David Carpenter	Principal in Charge and LRS	Oversight of project	OSHA-HAZWOPER 40 hour training, LRS	Oversight of entire project for ERM. In contact with Client.
ERM	David Connelly	Project Manager	Overall project management, report preparation, and communications with client, subcontractors, and ERM team members.	OSHA-HAZWOPER 40 hour training, LRS, SSC EP	Reports to ERM Principal in Charge
ERM	Megan Innis	Field Team Leader	Responsible for leading the soil sampling effort and report preparation	OSHA-HAZWOPER 40 hour training, SSC EP, FSO, First Aid/CPR	Reports to ERM Project Manager
ERM	Ryan Baisden	Associate Scientist	Responsible for assisting with soil sampling and report preparation	OSHA-HAZWOPER 40 hour training, SSC EP, FSO, First Aid/CPR	Reports to ERM Project Manager
ERM	Andy Coenen	Data Validator/ Quality Assurance Officer	Perform all data validation	BS - Chemistry	Reports to ERM Project Manager
Subcontractors					
A-Zone	Jesse Morgan	Owner/Driller	Install soil boring locations for sample analysis	OSHA-HAZWOPER 40 hour training, WV Certified Driller, LRS	Reports to ERM Project Manager
ALS	Paul Painter	Project Manager, Laboratory Officer	Overall management of analytical data received by laboratory	NA	Reports to ERM Project Manager

Table 2
Industrial Soil Screening Levels
Jefferson Orchards, Inc.
Kearneysville, West Virginia

Matrix	Parameter	CAS Number	Industrial Soil De Minimis Standards[1] (mg/kg)	Sample Container	EPA Method/Holding Time
Soil	**Inorganics (Metals)**				
	Arsenic	7440-38-2	35	8 oz clear glass jar, ≤ 4° C	EPA Method 6020A/ 6 months
	Lead	7439-92-1	1000		
	PPL Pesticides				
	Aldrin	309-00-2	3.6	8 oz clear glass jar, ≤ 4° C	EPA Method 8081B/ 14 days
	Alpha-BHC	319-84-6	5.6		
	Beta-BHC	319-85-7	20		
	Gamma-BHC	58-89-9	44		
	Delta-BHC	319-86-8	NE		
	Chlordane	12789-03-6	160		
	4,4-DDD	72-54-8	150		
	4,4-DDE	72-55-9	180		
	4,4-DDT	50-29-3	150		
	Dieldrin	60-57-1	3.8		
	Endosulfan I	115-29-7	10000		
	Endosulfan II	33213-65-9	NE		
	Endosulfan sulfate	1031-07-8	NE		
	Endrin	72-20-8	380		
	Endrin aldehyde	7421-93-4	NE		
	Endrin ketone	53494-70-5	NE		
	Heptachlor	76-44-8	11.0		
	Heptachlor epoxide	1024-57-3	6.2		
	Methoxychlor	72-43-5	6300		
	Toxaphene	8001-35-2	32		

Notes:

[1] - West Virginia Industrial Soil De Minimis Standards (June 2017)

mg/kg - milligram per kilogram

NE - Not Established

TABLE 3
Soil Boring Information
Jefferson Orchards, Inc.
Kearneysville, West Virginia

Boring Purpose	Parameters	Sampling Intervals	Boring ID	Estimated Depth (ft)	Number of Samples	Samples for Analysis	Samples for HOLD
Shallow Vertical Profile Borings	Each sample will be analyzed for arsenic, lead, and priority pollutant pesticides.	Samples will be collected from (0-6"), (6"-12"), (12"-18"), (18" -24"), (24"-30") and (4.5'-5')	SB-1	5	5	(0-6") & (18" -24")	(6"-12"), (12"-18"), (24"-30") & (4.5'-5')
			SB-2	5	5		
			SB-3	5	5		
			SB-4	5	5		
			SB-5	5	5		
			SB-6	5	5		
			SB-7	5	5		
			SB-8	5	5		
			SB-9	5	5		
			SB-10	5	5		
			SB-11	5	5		
Deep Vertical Profile Borings	Each sample will be analyzed for arsenic, lead, and priority pollutant pesticides.	Samples will be collected from (0-6"), (6"-12"), (12"-18"), (18" -24"), (24"-30"), (4.5'-5'), (9.5'-10.0'), (14.5'-15'), (19.5'-20.0'), and (24.5'-25.0')	SB-12	25	9	(0-6") & (18" -24")	(6"-12"), (12"-18"), (24"-30"), (4.5'-5'), (9.5'-10.0'), (14.5'-15'), (19.5'-20.0'), & (24.5'-25.0')
			SB-13	25	9		
			SB-14	25	9		
			SB-15	25	9		
			SB-16	25	9		
Quality Assurance Quality Control (QAQC)	Each sample will be analyzed for arsenic, lead, and priority pollutant pesticides.	Samples will be collected from (0-6"), (18"-24"), (4.5'-5'), and (19.5'-20.0')	DUP-1	5	1	(0-6")	None
			DUP-2	5	1	(18"-24")	None
			DUP-3	25	1	(4.5'-5')	None
			DUP-4	5	1	HOLD	(18"-24")
			DUP-5	25	1	HOLD	(19.5'-20.0')
			RB-1	--	1	EB-1	None
			RB-2	--	1	EB-2	None
			RB-3	--	1	HOLD	--
			MS/MSD-1	5	1	(0-6")	None
			MS/MSD-2	5	1	(18"-24")	None
			MS/MSD-3	25	1	HOLD	(19.5'-20.0')

Appendix A

Health & Safety Plan

This Level 2 health and safety plan (HASP) is intended to provide health and safety guidelines for project work meeting one or more of the following criteria:

- Some likelihood of physical and/or chemical hazard exposure (e.g., sampling, use of equipment and tools);
- Number of job tasks is five or greater;
- Use of contractors;
- Work meets the definition of being "high hazard", which includes, but is not limited to:
  - Activities that could have an adverse effect on the environment (e.g., use of bulk liquid storage tanks, generators, etc.);
  - Air or boat transport via charter or non-commercial carrier/vendor;
  - Confined space entry;
  - Construction;
  - Decommissioning, decontamination, and demolition (DDD) operations;
  - Diving;
  - Excavations, trenching, drilling, or other ground disturbance activities (i.e., activities requiring subsurface clearance [SSC] operations);
  - Hazardous energy control operations;
  - Hot work (e.g., welding, flame cutting, or other spark-producing activities);
  - Injection well operations;
  - Off-shore or over water work (including oil platform visits);
  - Rigging and lifting operations; and
  - Work at heights in excess of four feet.

The HASP should be developed with input from the project team and reviewed with all ERM project personnel, including contractors. A signed copy of the HASP must be maintained at the project site during work and must be archived in the project files.

H&S Team review is required for the Level 2 HASP. You can e-mail completed plans requiring review to the ERM North America HASP Review Team (ERMNASafetyLeads@erm.com). This HASP must be reviewed by the Project Manager and reviewed/approved by the Partner in Charge (PIC) and updated as warranted to address changes in scope, hazards present, project personnel, etc. At a minimum, HASPs must be reviewed annually or if the scope of work changes. Updated HASPs should also be sent to the H&S Team for review and PIC for approval.

Administrative Information ***This document has been developed for the sole use of ERM staff. Contractors and other project participants must develop their own HASP.*** ***This document is valid for a maximum time period of one year after completion. The document must be reviewed if the scope of work or nature of site hazards changes and must be updated as warranted.***	
Project Name: Project Shuttle	Site Name & Location: Kearneysville, WV
Client Contact and Phone: Ron Slonaker (304) 676-0981	Client: Project Shuttle
Health & Safety Plan Date: 03/01/2017	GMS Project #: 0407978
Partner in Charge: David Carpenter	Revision Number and Date: 1 5/22/2017
Project Manager: David Connelly	Field Work Start Date 06/01/2017
Field Safety Officer: Megan Innis and Ryan Baisden	Anticipated Field Work End Date: : 06/31/2017
SSC Experienced Person (if applicable): Megan Innis and Ryan Baisden	Short Service Employees (SSE): NA
Additional ERM personnel on site: NA	SSE Mentor: NA
H&S Team Review	
Reviewer Name: Mary Scianna Review Date: 5/25/2017	Signature File: 

Site Description

Include relevant background information regarding the site, such as location, size, type of facility, topography, weather, infrastructure, security, previous site use, etc. Describe nature and extent of any soil/air/water/groundwater contamination. Describe any other aspects of the site that may potentially affect the health, safety, or security of on-site personnel.

The Jefferson Orchard property is located in at 365 Granny Smith Lane in Kearneysville, WV, in Jefferson County. A Phase II Environmental Site Assessment will be conducted at the site in the area that will eventually go into the Voluntary Remediation Program (VRP)- roughly 80 acres of land on the eastern portion of the property. The site was previously used for agricultural cropland, specifically orchard farmland. The entire property is roughly 400 acres but the client is only interested in 152 acres.

Project Background and Scope of Work

Include list of tasks to be completed by ERM personnel during this project, and a separate list of tasks to be completed by any contractors at the site. A site-specific Job Hazard Analysis (JHA; ERM-1115-FM1) must be completed for each task to be performed. Contractors must provide their own HASP and a JHA for each task they will perform for ERM review.

A JHA template and reference/example JHAs for more common tasks can be found at: North America H&S Page - JHAs.

ERM will conduct a Phase II Environmental Site Investigation at the Jefferson Orchard site in Kearneysville, WV, starting in June 2017. The Phase II Investigation will include the following tasks: oversight of the utility clearance at each of the 15 boring locations; oversight of environmental drilling; collecting soil samples for analysis; and oversight of borehole abandonment.

ERM Task 1: Driving to site	☒ JHA Attached?
ERM Task 2: Utility clearance	☒ JHA Attached?
ERM Task 3: Environmental drilling	☒ JHA Attached?
ERM Task 4: Environmental sampling	☒ JHA Attached?
ERM Task 5: Borehole abandonment	☒ JHA Attached?
ERM Task 6:	☐ JHA Attached?
ERM Task 7:	☐ JHA Attached?

Conduct utility clearance at all environmental boreholes; install environmental borings, assist in sample collection, abandon soil boreholes.

Contractor Task 1: Clear all boring locations	☒ JHA Reviewed?
Contractor Task 2: Install soil boring	☒ JHA Reviewed?
Contractor Task 3: Collect soil samples	☒ JHA Reviewed?
Contractor Task 4: Abandon boreholes	☒ JHA Reviewed?
Contractor Task 5:	☐ JHA Reviewed?
Contractor Task 6:	☐ JHA Reviewed?
Contractor Task 7:	☐ JHA Reviewed?

Contractor(s) to be used:	Approved under Contractor Management Program?
1. Underground Services	☒ Yes ☐ No
2. A-Zone	☒ Yes ☐ No
3. ALS	☒ Yes ☐ No
4.	☐ Yes ☐ No
5.	☐ Yes ☐ No

Site/Project General Information

Site Type (check all applicable boxes)

☐	Industrial	☐	Hazardous waste release (Hazwoper)
☐	Residential	☐	Remote site or inactive facility**
☐	Unsecured	☒	Other (specify): Former Orchard- farm land
☐	Coastal/offshore (on or near water)*	☐	Other (specify):

* ERM Form NAM-1534-FM1 (*Coastal and Offshore Risk Management*) must be completed and attached to this document.
** ERM Form NAM-1501-FM2 (*Undeveloped, Remote, or Inactive Sites*) must be completed and attached to this document.

Main Project Hazards (check all applicable boxes)

☐	Aerial Lift Use (e.g., Scissor Lifts, Cherry Pickers)[1]	☐	Helicopter/Fixed Wing Aircraft Transportation[3]
☐	All-Terrain Vehicle/Snowmobile Use[1]	☒	High Noise (>85 dBA)
☐	ASTs/USTs	☐	Hot Work (Welding, Cutting, Brazing)[2]
☐	Biological Hazards	☐	International Travel[4]
☐	Chemical Exposure Potential (including asbestos)	☒	Long Distance/Duration Driving[5]
☐	Chemical Mixing/Injection	☐	Mining (Surface/Underground)
☐	Compressed Gas	☒	Natural Hazards (Plants, Animals, Insects)
☐	Confined Space Entry[2]	☐	Off-Shore Platform Work[6]
☐	Construction[1]	☐	Overhead Power Lines
☐	Control of Hazardous Energy (i.e., Lockout/Tagout)[2]	☐	Portable/Fixed Ladders
☐	DDD Operations[1]	☐	Radiation (Ionizing/Non-ionizing)
☐	Diving[1]	☐	Rigging/Lifting[2]
☒	Ergonomics/Material Handling	☐	Scaffold Use
☒	Excavation/Trenching/Drilling[2]	☐	Shift Work (e.g., night work)
☐	Extended or Nonstandard Work Shifts (>14 hours)	☐	Short Service Employees
☐	Extreme Weather	☐	Slips/Trips
☐	Explosives Use[1]	☐	Subsurface Clearance (Buried Utilities)[2]
☐	Falls from height (>4 feet)[1]	☐	Working on/over/near Water (including transport)[1]
☐	Forklift/Industrial Truck Use[1]	☐	Unexploded Ordnance/Munitions and Explosives of Concern (UXO/MEC)[1]
☐	Hand/Power Tool Use		
☐	Heavy Equipment Use	☐	Other (specify): Click here to enter text.

1 High hazard work requiring H&S team coordination. Additional control measures may be required beyond JHA.
2 Permit-required high hazard work requiring H&S Team coordination and ERM or equivalent client-required permit to be completed.
3 If traveling using a helicopter or fixed wing aircraft, ERM employees are required to follow the provisions of ERM Standard ERM-1440-ST1 (*Fixed Wing Aircraft and Helicopter Safety*).
4 A Travel Risk Assessment (TRA) is required for all international travel (with the sole exception of travel to a Low Risk country where ERM has a permanent office). Consult ERM Standard ERM-1410-ST1.
5 If driving more than 500 km (310 miles) in a single day, driving in excess of 4.5 hours in a single day, or driving in a remote location, a Journey Management Plan (*ERM-1430-FM1*) is required and should be appended to this HASP.
6 If traveling to/from and working on an off shore platform, ERM employees are required to follow the provisions of ERM Standard ERM-1531-ST1 (*Offshore Platform Safety*).

Chemicals of Concern

Chemical Products Used or Stored On-Site

For each chemical product identified, a Safety Data Sheet (SDS) must be attached to this HASP.

☒	Alconox or Liquinox	☐	Household bleach (NaOCl)
☒	Hydrocholoric acid (HCl)	☒	Calibration gas
☒	Nitric acid (HNO_3)	☐	Other (specify):
☐	Sulfuric acid (H_2SO_4)	☐	Other (specify):
☐	Sodium hydroxide (NaOH)	☐	Other (specify):
☒	Isopropyl alcohol	☐	Other (specify):

Note: Emergency eyewash solution must be readily available on all project sites where materials are used or stored that pose a risk of getting into the eyes via splashing or through contact with airborne gases, vapors, dusts, or mists. This includes sample preservatives. The size and flushing capability of the eyewash must be proportional to the potential for contact with corrosive or injurious materials in the field and the resulting potential for injury. Contact your BU H&S Director for additional information or assistance.

Regulated Chemicals of Concern

Check any chemicals known or suspected to be present on the site to which the ERM team may be exposed. These chemicals include OSHA-regulated potential carcinogens (29 CFR 1910.1003 through 1016) as well as those chemicals for which OSHA has established specific respiratory protection requirements (29 CFR 1910.134). A list of these chemicals is provided in Section 3 of ERM Standard NAM-1340-PR1 (*Chemical Hazards*).

Are any of the chemicals that appear on the list in Section 3 of NAM-1340-PR1 known or suspected to be present on the site?

☒ Yes ☐ No

If the answer to the question above is Yes, follow the requirements of NAM-1340-PR1. For additional assistance with interpretation /evaluation of the regulatory impacts, contact your Business Unit H&S Director.

Additional Known or Suspected Chemicals of Concern

Are there additional known or suspected chemicals of concern present on the site not identified in the ***Regulated Chemicals of Concern*** section above? ☒ Yes ☐ No

If the answer to the question above is Yes, NAM-1340-FM1 (Known or Suspected Chemicals of Concern) must be completed and attached to this HASP. Information on each chemical must be provided to all team members.

Monitoring Equipment

Will ERM staff be using equipment on the project site to monitor potential exposures to known or suspected chemicals of concern?

☒ Yes ☐ No

If the answer to the question above is Yes, attach ERM Form NAM-1302-FM3 (Monitoring Equipment) to define the equipment to be used and the action levels to be applied.

All monitoring equipment on site must be calibrated per manufacturer specifications (including daily bump tests) and results recorded. See ERM Procedure NAM-1302-PR1 (*Equipment Maintenance and Calibration*) for additional information. Under stable conditions, measurements must be made in the breathing zone at least once every 30 minutes.

Personal Protective Equipment

Req = Required PPE for one or more tasks to be performed; required on site at all times. NA = Not applicable to this project.

Equipment	Req	NA	Supplies	Req	NA
Steel-toed Boots	☒	☐	Inner Chemical Gloves	☐	☒
Outer Disposable Boots	☐	☒	Outer Chemical Gloves	☒	☐
Long Sleeve Shirt/Pants	☒	☐	Leather or Kevlar Gloves	☒	☐
Tyvek Suit	☐	☒	Safety Glasses/Goggles	☒	☐
Poly-Coated Tyvek Suit	☐	☒	Face Shield	☐	☒
Fully Encapsulated Chemical Suit	☐	☒	Hearing Protection	☒	☐
Flame Resistant Clothing/Coveralls	☐	☒	Half-face Respirator	☐	☒
High Visibility Traffic Vest	☒	☐	Full-face Respirator	☐	☒
Hard Hat/Approved Helmet	☒	☐	Personal Floatation Device	☐	☒
Wet Suit/Dry Suit	☐	☒	If either half or full-face respirator checked: • Define cartridge type: \ • Define cartridge change frequency: \		
Other (specify):	☐	☐			

Respirator selection should be based on the Assigned Protection Factor (APF) and the Maximum Use Concentration (MUC). To determine the appropriate respirator selection, the lowest appropriate published exposure guideline should be known. The Business Unit H&S Director or project H&S consultant can provide assistance in defining the APF and MUC, as necessary. They can also assist in defining actions levels and cartridge change schedules when air-purifying respirators are used. Note that cartridge change schedules must be outlined above and in the JHA for any task requiring respiratory protection.

Use of respiratory protection requires three elements: training in respiratory protection techniques, completion of medical surveillance confirming that you are fit to wear a respirator, and fit testing with the make and model of respirator you will be using. Refer to NAM-1311-PR1 (*Respiratory Protection*) for additional information.

Training, Medical Surveillance, and Safety Supplies

Req = Required; requirements are based on the specific tasks performed in the field and the type of environments, chemicals, or hazards encountered. NA = Not applicable to this project.

Training	Req	NA	Medical Surveillance***	Req	NA
40-Hour Hazwoper	☒	☐	Medical Clearance	☒	☐
Current 8-hour Hazwoper Refresher	☐	☒	Respirator Clearance and Fit Test	☐	☒
8-Hour Hazwoper Supervisor*	☐	☒	Blood Lead and ZPP	☐	☒
Current First Aid/CPR	☒	☐	Other (specify):	☐	☐
40-Hour MSHA New Miner	☐	☒	Other (specify):	☐	☐
Current 8-hour MSHA Refresher	☐	☒	**Safety Supplies**	**Req**	**NA**
ERM Field Safety Officer (FSO)	☒	☐	First Aid Kit	☒	☐
DDD Practice FSO/DM	☐	☒	Emergency Eyewash Solution	☒	☐
Subsurface Clearance (SSC)	☒	☐	Air Horn	☐	☒
EPA Hazardous Waste	☐	☒	Decontamination Supplies	☒	☐
Hazmat/Dangerous Goods Shipping**	☐	☒	Fire Extinguisher	☒	☐
International Traveler	☐	☒	Potable Water	☒	☐
Other (specify):	☐	☐	Toilets	☐	☒
Other (specify):	☐	☐	Other (specify):	☐	☐

* Provides specialized training to serve as an on-site manager supervising employees engaged in work covered by 29 CFR 1910.120.

** In Canada, Workplace Hazardous Materials Information System (WHMIS)/Globally Harmonized System (GHS) and Transportation of Dangerous Goods (TDG) regulations apply.

*** Physical examination requirements should be discussed with Workcare well in advance of project to allow adequate time to schedule exams.

Work Zones

Complete if exclusion zones are necessary because of chemical and/or equipment hazards. Describe the set-up of these zones. Include landmarks, dimensions (as necessary), and whether they are for equipment or personnel decontamination.

Exclusion Zone: 5 feet immediately around drilling activities (rods, augers, driller/helper) is included in the Exclusion Zone. Call out to the driller and or make sure eye contact is made prior to entering the Exclusion Zone. Drillers/helpers should be the only folks in the Exclusion Zone.

Contamination Reduction Zone: 10 - 30 feet from drilling operations will be the CRZ. ERM personnel, support, contractors, and others may move freely in this zone.

Support Zone: Surrounding field trucks and mob stations.

Site Access/Control

Describe procedures for limiting unauthorized entry to the work zone(s). Describe any security requirements.

Site Access/Control procedures: Sites are unsecured. Enter and exit from Northport Ave

Decontamination Procedures ***Describe procedures for the decontamination of personnel and equipment.***
Personnel decontamination procedures: Wash hands daily and prior to eating; wash clothes at the conclusion of field activities.
Equipment decontamination procedures: Decontaminate equipment for environmental sampling at each location using appropriate soap and water and or chemical solutions
Spill Prevention and Response ***Ensure all chemical containers on site are labeled and lids are secured when not in use. When transferring chemicals from one container to another, or when refueling vehicles or equipment, provide containment beneath the transfer point to capture potential spills. Immediately report all chemical spills to the PIC/PM and submit an ECS entry with 24 hours.***
Will ERM staff or ERM-hired contractors possess containerized chemicals on the project site? ☒ Yes ☐ No
Will container size be greater than or equal to one gallon? ☐ Yes ☒ No
If the answer to both of these questions is Yes, follow the requirements outlined in ERM Procedure NAM-1123-PR1 (*Spill Prevention and Response*)?
Waste Management Planning
Will ERM's project activities generate waste materials? ☐ Yes ☒ No
Will ERM undertake some level of contractual responsibility for handling waste for the client? ☐ Yes ☒ No
If the answer to either of these questions is Yes, follow the requirements outlined in ERM Procedure NAM-1122-PR1 (Waste Management Planning).
Waste reduction/minimization techniques: Backfill borehole with soil cuttings
Client-Specific Emergency Response ***In the event of an emergency, client-specific emergency response procedures may take precedence over ERM established procedures.*** ***While engaging in field-related activities on an active client site, measures they have in place to signal either emergency response or evacuation need to be reviewed and documented.*** ***Once completed, this summary should be discussed with all visitors, contractors, and others subject to HASP review upon site visit.***
Contributing factor potentially initiating emergency response: N/A
Lights and/or sounds associated with evacuation: N/A
Emergency drill requirements for contractors on-site: N/A
Primary and alternative muster points: N/A
Site-specific evacuation procedures: N/A
Methodology to be used for accounting for site visitors: N/A
PPE and spill kit requirements: N/A
Is a map associated with evacuation attached? ☐ Yes ☒ No

Emergency Contacts

All ERM employees are empowered to pause or stop work to address any unsafe acts/conditions, questions, concerns or changed conditions. All work-related safety events should be shared with the project team and promptly entered into the Event Communication System (ECS).

FOR ALL MEDICAL EMERGENCIES, CALL 911 OR THE LOCAL EMERGENCY NUMBER.

For ALL non-emergency incidents resulting in any injury or illness, you must:

- *Give appropriate first aid care to the injured or ill individual and secure the scene.*
- *Immediately notify the PM, PIC, and the H&S Team.*
- *At direction of PM, PIC, or H&S Team, call WorkCare Incident Intervention at (888) 449-7787 (available 24 hours/7 days per week in US only).*
- *Clients may have their own procedures which we need to follow.*

For all incidents (injuries, illnesses, spills, fires, property damage, etc.) and significant near misses, enter the event into ECS within 24 hours.

Contact	Name	Location	Phone
Hospital (attach map)	Jefferson Medical Center	300 South Preston Street Ranson, WV, 25438	304-728-1600 911
Police	Ranson Police Department	700 N. Preston Street Ranson, WV 25438	304-725-2411
Fire	Baker Heights Fire & Rescue Squad	2229 Charles Town Road, Martinsburg, WV 25405	304-263-7755
Incident Intervention	WorkCare	NA	888-449-7787
Partner-in-Charge	David Carpenter	Hurricane, WV	Work: 304-757-4777 Cell: 304-546-1783
Project Manager	David Connelly	Hurricane, WV	Work: 304-757-4777 Cell: 304-389-2447
Field Manager (if not PM)	David Connelly	Hurricane, WV	Work: 304-757-4777 Cell: 304-389-2447
Field Safety Officer (if not PM)	Megan Innis	Hurricane, WV	Work: 304-757-4777 Cell: 304-542-2256
SSC Experienced Person	Ryan Baisden	Hurricane, WV	Work: 304-757-4777 Cell: 304-550-6601
Business Unit H&S Director	Matthew Botzler	Philadelphia, PA	Work: 484-913-0339 Cell: 484-885-5188
Regional H&S Director	Mark Hickey	Denver, CO	Work: 720-200-7172 Cell: 720-625-2869

Contractor Contact	Jesse Morgan	Charles Town, WV	Work: 304-724-6458
			Cell:
Client Contact	Ron Slonaker	Kearneysville, WV	Work:304-676-0981
			Cell:
Additional Contact	Sonny Richarts	West Chester, PA	Work: 484-880-1536
			Cell:

Acknowledgement

I have read, understood, and agree with the information set forth in this health and safety plan (HASP), and will follow guidance in the plan and in ERM's Document Control System (DCS). I understand the training and medical monitoring requirements (if any) for conducting activities covered by this HASP and have met these requirements.

ERM has prepared this plan solely for the purpose of protecting the health and safety of ERM employees. Contractors, visitors, and others at the site are required to follow provisions in this document at a minimum, but must refer to the organization's health and safety program for their protection.

Printed Name	Signature	Organization	Date

Approval Signatures	Project Manager	Date
Signatures in this section indicate the signing employee will comply with and enforce this HASP, as well as procedures and guidelines established in ERM's DCS. Signatures also indicate that any contractors performing work under contract to ERM have met the minimum safety standards in NAM-	Typed Name: Click here to enter text. Signature File:	Click here to enter a date.

1130-PR1 (Contractor Management).	**Partner-in-Charge**	**Date**
	Typed Name: Click here to enter text. Signature File:	Click here to enter a date.

Attachments ***Check all appropriate documents to be attached to this HASP.***	
☒ Site-specific JHAs for all tasks (including contractors)	☒ Map of route to hospital with turn-by-turn instructions
☒ Subsurface Clearance (SSC) Project Plan	☒ SNAP Cards
☒ Site Safety Meeting Form (NAM-1501-FM1)	☒ Field Audit Form (ERM-1941-FM4)
☒ Vehicle Inspection Forms (ERM-1430-FM2)	☐ Industrial Hygiene Sample Data (NAM-1302-FM1)
☒ Journey Management Plans (ERM-1430-FM1)	☒ Ambient Air Monitoring Form (NAM-1302-FM2)
☒ Safety Data Sheets (SDS) for chemicals brought to site	☐ Client-specific requirements
☐ PLAN Risk Assessment	☐ Other:
☐ Facility site map(s)	☐ Other:
Applicable ERM Safety Standards/Procedures ***Check procedures/standards that are applicable to this project. Refer to the documents for guidance and, where applicable, use forms, work instructions, and guidelines associated with these standards/procedures in the completion of site work. Indicated documents must be procured from ERM's Document Control System. Note that this list is not comprehensive!***	
Global Standards/Procedures	
☐ Short Service Employees (ERM-1611-PR1)	☐ Travel Risk Assessment (ERM-1410-ST1)
☐ Offshore Platform Safety (ERM-1531-ST1)	☒ Subsurface Clearance Standard (ERM-1511-ST1)
☒ Driver and Vehicle Safety (ERM-1430-PR1)	☐ Fixed Wing Aircraft/Helicopter Standard (ERM-1440-ST1)
Regional Standards/Procedures	
☐ Fire Prevention (NAM-1213-PR1)	☐ Demolition (NAM-1544-PR1)
☐ Confined Space Entry (NAM-1572-PR1)	☐ Excavation and Trenching (NAM-1512-PR1)
☐ Fall Protection (NAM-1313-PR1)	☐ Hazard Communication (NAM-1301-PR1)
☐ Ladder Safety (NAM-1521-PR1)	☐ Cold Stress (NAM-1323-PR1)
☒ Hearing Conservation (NAM-1312-PR1)	☐ Heat Stress (NAM-1323-PR2)
☐ Incident Reporting and Investigation (NAM-1220-PR1)	☒ Medical Services (NAM-1840-PR1)
☐ Medical Surveillance (NAM-1810-PR1)	☒ Personal Protective Equipment (NAM-1310-PR1)
☐ Hot Work (NAM-1542-PR1)	☐ Respiratory Protection (NAM-1311-PR1)
☐ Blood-borne Pathogens (NAM-1325-PR1)	☒ Contractor Management (NAM-1130-PR1)
☐ Hand Tools/Portable Power Equipment (NAM-1329-PR1)	☒ Insect Bite Prevention Standard (NAM-1361-ST1)
☐ Electrical Safety (NAM-1561-PR1)	☐ Incident/Illness Management (NAM-1210-PR1)
☐ Waste Management Planning (NAM-1122-PR1)	☐ Energy Isolation (NAM-1562-PR1)
☐ Work Over Water (NAM-1460-PR1)	☐ Spill Prevention and Response (NAM-1123-PR1)
☐ Fatigue Management (NAM-1328-PR1)	☒ Safe Use of Cutting Tools (NAM-1324-PR1)
☐ Lone Worker (NAM-1326-PR1)	☐ Compressed Gas Cylinders (NAM-1341-PR1)

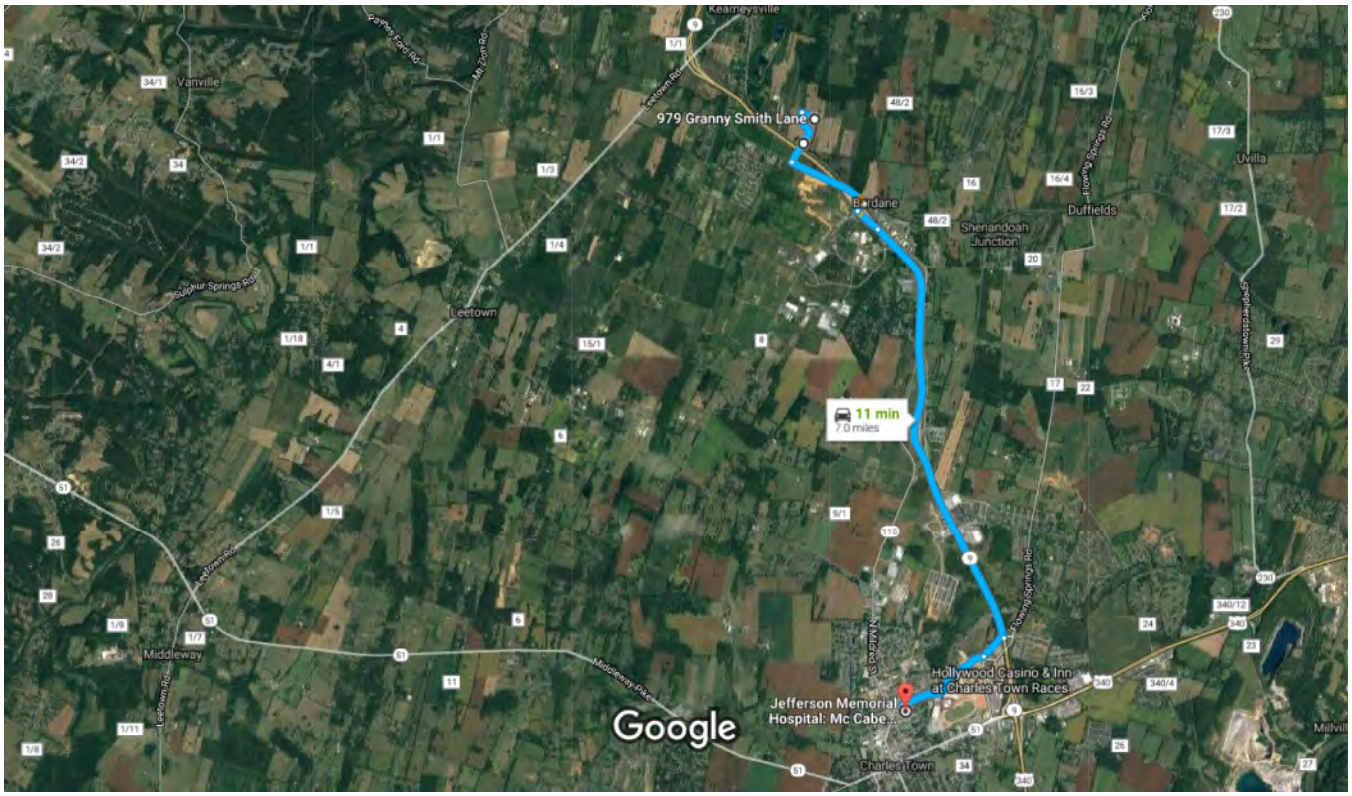
See It; Own It; Share It	Stop Work Authority
It means that: • **We know that we have a responsibility to look out for each other, to intervene when necessary, to be proactive and to help keep safety issues from becoming problems.** • **We also look out for ourselves. If we recognize that a situation is unsafe, we are expected to stop what we're doing, reassess the situation and consult with others if necessary before proceeding safely.** • **We assign no blame to anyone who raises safety issues.** • **We strive to learn lessons from the large and small events that are part of our daily experience.**	**It is ERM policy that all ERM and ERM Contractor employees have the authority, without fear of reprimand or retaliation to:** • **Immediately stop any work activity that presents a danger to the site team or the public.** • **Get involved, question and rectify any situation or work activity that is identified as not being in compliance with the HASP or with broader ERM health and safety policies.** • **Report any unsafe acts or conditions to supervision or, preferably, intervene to safely correct such acts or conditions themselves.**

HOSPITAL DIRECTIONS

Google Maps

979 Granny Smith Ln, Kearneysville, WV 25430 to Jefferson Memorial Hospital: Mc Cabe Joseph MD

Drive 7.0 miles, 11 min



Imagery ©2017 Commonwealth of Virginia, DigitalGlobe, Landsat / Copernicus, U.S. Geological Survey, USDA Farm Service Agency, Map data ©2017 Google 1 mi

979 Granny Smith Ln

Kearneysville, WV 25430

Get on WV-9 E from Northport Ave and WV-115

4 min (1.8 mi)

1. Head northwest on Granny Smith Ln toward Northport Ave

0.1 mi

2. Turn left onto Northport Ave

⚠ Partial restricted usage road

0.5 mi

3. Turn left onto WV-115/Charles Town Rd

0.8 mi

4. Turn right onto WV-115/Wiltshire Rd

479 ft

5. Turn left to merge onto WV-9 E

0.3 mi

6. Merge onto WV-9 E

4 min (4.1 mi)

Follow E 5th Ave to S Preston St in Ranson

3 min (1.2 mi)

7. Turn right onto E 5th Ave

0.2 mi

8. At the traffic circle, take the 1st exit and stay on E 5th Ave

0.9 mi

9. Turn left onto S Preston St

Destination will be on the left

312 ft

Jefferson Memorial Hospital: Mc Cabe Joseph MD

300 S Preston St, Ranson, WV 25438

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.

SUBSURFACE CLEARANCE DOCUMENTS

SUBSURFACE CLEARANCE PROJECT PLAN
Addendum to HASP
GMS Project No: 0407978

This Subsurface Clearance (SSC) Project Plan should be completed for each phase of ground disturbance activities at a project location, and included as an addendum to the Project-Specific Health & Safety Plan (HASP).

Ground disturbance activities that fall under this SSC Project Plan include ALL activities which require penetration of the ground surface (regardless of depth), and/or the drilling, coring or removal of engineered surfaces (pavement, concrete, etc.). Examples of ground disturbance activities include, but are not limited to:

- Hand digging / hand augering
- Drilling
- Direct-push or Geoprobe® borings
- Well installation
- Well decommissioning by over-drilling
- Excavation (by hand or with mechanical equipment)
- Trenching
- Grading
- Concrete coring
- Driving of posts, stakes, rods, poles, or sheet pile.

This SSC Project Plan summarizes the types and sources of SSC information obtained, describes the Site Services Model, and documents any waivers to ERM's Global SSC Process. The ERM Partner-in-Charge (PIC), Project Manager (PM), and SSC Experienced Person (EP)[1] must review and approve this SSC Project Plan, and maintain a copy (1) at the project location for the duration of ground disturbance activities and (2) in the project files.
All waivers must be approved by BOTH: (1) the ERM PIC and (2) the Business Unit Managing Partner (BU MP) or the BU MP's designee (cannot be the same person as the PIC).

Administrative Information		
	Project Name and Location: Project Shuttle, Kearneysville, WV Jefferson Orchard	
	Scope of Ground Disturbance Activities: ERM will oversee the installation of 15 soil borings: 10 to 5 feet bgs and 5 to 25feet bgs. ERM will collect soil samples . *Check all that apply:* ☒ Point disturbances ☐ Excavation / trenching ☐ Removal of engineered surfaces ☐ Other - Describe: *Use field documentation to document SSC:* • *Process Checklist – broadly across the site* • *Remote/Greenfield Site Process Checklist – broadly across the site for those projects that meet these criteria and where ONLY hand digging will occur (refer to SSC Process Document Section 1.2)* • *Location Disturbance Permit – for each location inside a Critical Zone*	
	SSC Project Plan Date: 5/23/2017	Field Work Start Date: 6/1/2017
	Project Manager: David Connelly Signature:	Partner In Charge: David Carpenter Signature:
	SSC EP: Megan Innis/Ryan Baisden Signature:	BU MP (req'd for waivers): Susan Angyal Signature:
	List any SSC General Employees (GEs) working on this project: N/A	

[1] SSC EP not required for project sites determined to be Remote/Greenfield sites (as defined in the ERM Global SSC Process), where ONLY hand digging will occur.

Subsurface Clearance Information Sources Summary **Document the information sources that ERM used or will use to locate Subsurface Structures on site.**	**Information Sources**	**Yes**	**No**	**N/A**	**Comments**
	Facility-provided as-built drawings, maps, site plans showing subsurface structures / utilities	☐	☒	☐	Date(s): Farm land, one building called Former Packing Shed, one residential house
	Other information obtained (e.g., easements, right-of-ways, historical plot plans, current/historical aerial photographs, fire insurance plans, tank (dip) charts, SSC information obtained as part of previous site investigations, soil surveys, boring logs	☒	☐	☐	List (including dates): Phase I and Phase II investigations performed by ERM (March 2017)
	Knowledgeable Contact Person	☒	☐	☐	Who: Ronald Slonaker Time in Job: Since 1950 Time at Site: ~65 years
	Utility Markouts	**Yes**	**No**	**N/A**	**Comments**
	Site is Remote/Greenfield site AND only hand digging will occur	☐	☒	☐	*If "YES", utility markouts are not required by ERM process (Note that public markouts may be legally required based on jurisdiction of project site – it is the responsibility of the PIC and PM to determine these requirements and comply)*
	Public Utility Markouts (where they are available)	☒	☐	☐	*Required where available – if not available check "N/A". If available and checked "NO", a Waiver is required (if legally able to do so).* Who: WV 811 (800) 245-4848
	Private Utility Markouts	☒	☐	☐	*If checked "NO" and site is not a Remote/Greenfield site, a Waiver is required* ERM employee ☐ or Subcontractor ☒ Who: SoftDig-Underground Services List methods / equipment used: GPR/RD

For Remote/Greenfield Sites where ONLY hand digging will occur – the remaining sections of this SSC Project Plan do not apply and can be left blank.

Site Services Model

List the utilities or other below ground services present on site.

Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves?

If "Present" and not located or "Unknown", comment on how those gaps will be addressed.

Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, and associated critical zones.

Utility / Service	Present	Anticipated Depth (note units)	Located? Yes	Located? No	Absent	Unknown	Status (active/ inactive/ abandoned)	Comment *(how located? Lines of evidence – types and quality. How will gaps be addressed?)*
Electricity	☒	Overhead	☒	☐	☐	☐	active	Voltage:
Gas	☐		☐	☒	☐	☐		
Petroleum Pipeline	☐		☐	☒	☐	☐		
Other Pressurized Lines	☐		☐	☒	☐	☐		Type:
Process Sewer	☐		☐	☒	☐	☐		
Sanitary Sewer	☐		☐	☒	☐	☐		
Storm Sewer	☐		☐	☒	☐	☐		
Potable Water	☒		☐	☐	☐	☐	active	
Telephone / Communication	☒	overhead	☐	☒	☐	☐	active	Overhead lines
Fiber Optic	☒	underground	☐	☐	☐	☐	active	Near Railroad tracks
Plant air / steam	☐		☐	☐	☐	☒		
Fuel / oil	☐		☐	☐	☐	☒		
Reclaimed / waste water	☐		☐	☐	☐	☒		
Fire suppression	☐		☐	☐	☐	☒		
Underground tank(s)	☒		☐	☐	☐	☐		Both tanks removed prior to 1980's- one 500 gallon by former packing shed
Other:	☐		☐	☐	☐	☐		

Subsurface Clearance Process Waivers **Document any waivers to the process approved by BOTH the PIC and BU MP.** **Legally required steps cannot be waived.**	Process Component Being Waived:	Waived By (PIC)	Waived by (BU MP)	Date	Reason
	Performance of Public Utility Markouts (where they are available)				
	Performance of Private Utility Markouts				
	No ground disturbance inside a Critical Zone				
	Physical Clearance to required depth(s) and diameters(s) at Point Disturbance Location(s). Indicate specific location(s): All boring locations	David Carpenter	Susan Angyal		Shallow soil sampling, no utilities, rock outcrops
	Requirement for SSC EP to be present on site, when ONLY hand digging/hand augering will occur in the uppermost 1 foot (0.3 meters)				

Subsurface and Overhead Utility Clearance Map	**Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, associated critical zones, and location of all isolation devices and/or shutoff valves.**

Subsurface Clearance Field Process Checklist

Site/Project Name: Project Shuttle-Jefferson Orchard
Client: Project Shuttle
ERM Project No.: 0407978
SSC Exp. Person: Megan Innis/Ryan Baisden

Project Information Utilized for Field SSC Activities	Yes	No	N/A	Comments
Contact Person requested and identified	X			Ron Slonaker
Subcontractors prequalified and approved	x			SoftDig Underground Services, A-Zone, ALS
ERM / client SSC requirements have been communicated to all field personnel (including subcontractors)	x			
As-built drawings, site plans, aerial photographs, and/or other information sources available and reviewed	x			
Site Plan(s) / Drawing(s) developed showing subsurface lines/structures, Critical Zones, and planned Ground Disturbance Locations	x			
SSC Experienced Person with current SSC training assigned	x			M. Innis/R. Baisden
Project staff with current SSC training assigned	x			
UXO / MEC risks assessed: UXO / MEC is present or potentially present			x	If Yes, stop work and contact PIC

General Field Activity & Site Walk	Yes	No	N/A	Comments
HASP available, reviewed, and signed by project team	x			
Site walk Visual Clues / site features (below) integrated into Site Services Model	x			Conduct prior to ground distrubance

Identified Visual Clue	Yes	No		Identified Visual Clue	Yes	No
Lights	X			Pipeline markers		X
Signage		X		Fire hydrants		X
Sewer drains / cleanouts		X		Sprinkler systems		X
Cable markers		X		Water meters		X
Utility poles with conduit leading to the ground		X		Natural gas meters		X
Utility boxes		X		UST fill ports and vent pipes		X
Manholes		X		Equipment locations		X
Pavement scarring		X		Steam lines		X
Distressed vegetation or vegetation in linear pattern		X		Remote buildings with no visible utilities	X	

Comments / Others: Barn, sheds, packing shed, house

Contact Person Approval of Ground Disturbance at All Locations (indicate verbal approval by printing "Verbal" in the signature space)

Name (Print)	Company	Name (Sign)	Date / Time
Ron Slonaker	Project Shuttle	Verbal	5/23/2017

Utility Markouts	Yes	No	N/A	Comments
Public Utility Markouts completed (where available; waiver required if "NO")	X			Will call in prior to site work
List utilities notified:				
Responses received from ALL companies notified?		X		
Private Utility Markout completed (waiver required if "NO")	x			SoftDig Underground Services
Performed by: Soft Dig				
Type of equipment/methods used: GPR/RD				
Note any limitations (e.g., sources of interference, geology, etc.): karst topography in local area				
Final Critical Zone determinations made by the SSC EP	x			No drilling will be conducted in a critical zone

Subsurface Clearance Field Process Checklist

Site/Project Name:	Project Shuttle-Jefferson Orchard
Client:	Project Shuttle
ERM Project No.:	0407978
SSC Exp. Person:	Megan Innis/Ryan Baisden

Critical Zones		
Are there any ground disturbance locations known or suspected to be inside Critical Zones?	☐	**Yes.** PIC and BU MP (or designee) must BOTH grant waiver for work within the Critical Zone. The SSC Location Disturbance Permit or equivalent is required for those locations.
	☒	**No.** Physical Clearance will proceed to the deeper of: 0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level, whichever is deeper.

Overhead Clearance	**Yes**	**No**	**N/A**	**Comments**
Overhead utility lines in the general vicinity of ERM work onsite?		X		Locations moved away from overhead lines
If overhead utilities are present, has nominal voltage been determined? If yes, list in comments section.			X	Voltage:
Overhead clearances confirmed with equipment operators for safely deploying equipment to the location? (The minimum horizontal distance from any point on the equipment to the nearest overhead electrical power line should adhere to the minimum clearance requirements stipulated by regulation, utility companies, client requirements, and/or industry best practice.)			X	Clearance distance(s):
Proximity alarms and /or spotters necessary to ensure safe clearances?			X	
If the equipment is closer than the minimum clearance distance to the overhead utility, can utility be de-energized via formal lockout/tagout (LOTO) program?			X	
If utility cannot be de-energized, alternate plan developed with approval from the PIC and client/site owner?			X	

Clearance for Point Disturbances	**Yes**	**No**	**N/A**	**Comments**
Physical Clearance technique used (waiver required if no Physical clearance performed)		x		Specify: ** SEE WAIVER REQUEST **
Diameter of physical clearance at least 125% larger than outside diameter of largest downhole tool (150% is best practice)			x	
Physical Clearance successfully completed at all locations			x	

Clearance for Excavations	**Yes**	**No**	**N/A**	**Comments**
Communicate excavation plan and Excavation Buffer location(s) to subcontractor. Delineate excavation buffers.			x	
There are disturbance locations known or suspected to be inside Critical Zones			x	
De-energize subsurface services via formal LOTO program prior to beginning excavation			x	

Additional Notes:

SSC Process Completed By (SSC Experienced Person)		
Megan Innis/Ryan Baisden		
Name (Print)	Name (Sign)	Date / Time

Subsurface Clearance Location Disturbance Permit

Disturbance Location Designation: All Soil boring locations

ERM Project No.: 0407978

SSC Exp. Person: Megan Innis/Ryan Baisden

Contact Person Approval of Ground Disturbance Locations (indicate verbal approval by printing "Verbal" in the signature space)

Name (Print)	Company	Name (Sign)	Date / Time
Ron Slonaker	Project Shuttle	Verbal	5/23/2017

Critical Zone Determination and Clearance Depth (It is not preferred to initiate Ground Disturbance Activities within a Critical Zone)

If the Disturbance Location is known or suspected to fall within a Critical Zone, then a sketch (see reverse) or other map **must be** used to confirm proximal Critical Zones. Sketch / map must be to scale.

This Location Is:

☐ Inside a Critical Zone. Partner-in-Charge (PIC) and Business Unit Managing Partner (BU MP) must BOTH grant waiver for disturbance at this location. Ensure documentation in the SSC Project Plan addendum to the HASP. Physical Clearance will proceed to the deeper of: **0.6 m / 2 feet below the frost line, 0.6 m / 2 feet deeper than the expected invert elevation of the service, OR 2.4 m / 8 feet below ground level.**

☒ Outside a Critical Zone.
Physical Clearance will proceed to the deeper of: **0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level.**

Physical Clearance Technique at This Location

☐ Cleared using the following techniques / equipment:

Clearance depth and diameter (specify units):

☒ None – or not completed to required depth or diameter. Waived by PIC and BU MP.
(Ensure documentation in the SSC Project Plan addendum to HASP.)

Reason: Critical shallow samples need to be collected via macro-core and split spoon; also site is a green field, formerly used for agricultural purposes. Date / Time

Physical Clearance Executed & Observed By:

Company	Representative(s)	Date / Time Complete	Notes
N/A – Physical Clearance Waiver Requested			

Was any Subsurface Structure discovered (damaged or undamaged) during Clearance?

☐ No (Proceed) ☐ Yes If Yes: Work stopped and discussed with PIC (Date / Time):

Agreed Action:

SSC Process Complete

Name of SSC Experienced Person (Print)	Name (Sign)	Date / Time
Megan Innis/Ryan Baisden		

Critical Zone Determination Sketch (use this or other map to confirm proximal Critical Zones).

****SEE ATTACHED SITE PLAN**

Instructions:

1. Create a sketch of the disturbance (in the space to left or attach) that is drawn to scale and contains the following information:
   a. The disturbance location
   b. Surface landmarks and overhead obstructions (buildings, roads, overhead lines, etc.)
   c. Critical landmarks and Subsurface Structures (tanks, transformers, wells, racks, etc.)
   d. Underground services:
      i. Identified in the Site Service Model
      ii. Marked by Public and Private utility markouts
      iii. As relayed by the Contact Person
      iv. Nearest shutoff / isolation mechanism for each
   e. Any surface clues as to potential underground services (junction boxes, drains, disturbed concrete, signage, etc.)
   f. The site property boundary
2. Use your sketch to mark Critical Zones (3m or 10 feet) around critical landmarks and underground structures / services.
3. For Excavations, use your sketch to mark Excavation Buffers (0.6m or 2 feet) from Subsurface Structures.
4. If the disturbance location falls inside the Critical Zone, the preferred course of action is step out to a safe location outside a Critical Zone.
5. Disturbance within a Critical Zone can only proceed with both PIC and

JOB HAZARD ANALYSES

JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle/ Jeffreson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017, 1

SPECIFIC TASK:	**Perimeter Air Monitoring- rig operations**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☑ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves leather or cut/puncture resistant> ☑ PPE clothing Long sleeves/pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	MultiRae or 5-gas Meter
Training Required for this Task:	Site orientation (to be completed on site upon arrival)	Permits Required for this Task:	N/A
Forms Associated with This Task:	refer listed attachments and associated forms in main HASP		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			
			Warren Bankston FSO/Site Lead

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Site Walk	1a	Slips, Trips, and Falls	H&S	2	2	4	1a	Wear steel toed boots with proper heel Remain aware of trip hazards when walking Clear any work areas of debris NOTE: FRC'S ARE ONLY NEEDED IF INSIDE THE FACILITY FENCELINE AND IN THE PLANT/UNIT AREA. FRC IS NOT NEEDED TO ACCESS/MONITOR THE MET STATION. THE FACILITY WILL PROVIDE FRC'S IF YOU DO NOT HAVE A PERSONAL FRC.
		1b	Heat/Cold Stress	H&S	2	2	4	1b	Bring water/sports drink to remain hydrated
		1c	High Noise	H&S	2	2	4	1c	Wear ear protection in designated high noise areas or where deemed necessary
		1d	Biological Hazards	H&S	1	1	1	1d	Wear long sleeve shirts and pants and cut resistantr or leather gloves. Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area. Working around snakes: Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this.
2	Work at night/dark	2a	Slips, Trips, and Falls	H&S	4	3	12	3a	Use handheld flashlights, lanterns, and pole-mounted lighting fixtures whenever possible. Travel using buddy system. Do not venture in unknown areas without lighting. Ensure secure footing, careful placement of steps, and slow-pace walking.
		2b	Biological Hazards	H&S	3	4	12	3b	See 1d above
3	Gather sample equipment and load/take to site	3a	Strain and sprains from improper lifting	H&S	2	2	4	4a	Ensure that proper lifting technique is used (lift with the legs, keeping the back straight and the load close to the body). Also, obtain assistance with any items over 50 pounds or items that are awkward or bulky.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
4	Walking in and around the site	4b	Slip, Trip and Fall can cause broken bones or sprains to muscles. There is loose gravel around the locations.	H&S	3	3	9	4b	Ensure that you are stepping on a substantial walking surface and keep eyes on walking path at all times. Do not walk backwards!
5	Setting up sampling equipment/stations	5c	Strain and sprains from improper lifting and bending.	H&S	3	3	9	4c	Ensure that proper lifting technique is used (lift with the legs, keeping the back straight and the load close to the body). Take periodic breaks from bending to standing or sitting if needed.
6	GENERAL NOTES	Use the buddy system for all operations/activities onsite. whether day or night. Use STOP WORK AUTHORITY for any reason, at any time, as needed. The local law enforcement and security personnel have been met with, and and are aware of our presence and taks. Please reach out to them at any time for any support!							

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3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of "use good body positioning," write "don't bend at waist or reach above head"). Use numbers and letters corresponding to listed hazards.

4. Select the likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

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WAYS TO ELIMINATE OR REDUCE RISKS (IN ORDER OF PREFERENCE):

ELIMINATE / AVOID --> SUBSTITUTE / MODIFY --> ISOLATE --> ENGINEER / SAFEGUARD --> TRAINING AND PROCEDURES --> WARNING AND ALERT MECHANISMS --> PPE

JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle/ Jefferson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017,1

SPECIFIC TASK:	**Contractor oversight**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☑ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves Nitrile ☑ PPE clothing Long sleeves and pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	N/A
Training Required for this Task:	ERM FSO, SSC GE, SSC EP	Permits Required for this Task:	N/A
Forms Associated with This Task:	N/A		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Conduct oversight of contractor during mobilization on project site and during boring advancement.	1	Subcontractor injury, exposure, or subsurface strike during boring excavation	multiple	2	3	6	a	Ensure that contractors are aware of the project scope and site hazards - review JHAs for "General Site Activities" and "Soil Sampling," as potential hazards and controls are applicable to contractor and ERM personnel on site
								b	Perform daily tailgate meetings to review site-specific hazards and controls
								c	Thoroughly review the subcontractor HASP/JHAs prior to conducting field work
								d	Ensure SSC process is followed as per the SSC Project Plan

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JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle/ Jefferson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017, 1

SPECIFIC TASK:	**Driving to/from project site**

Minimum Required PPE for Entire Task:	☐ Hard Hat ☐ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator ☐ Other (specify): ☐ Safety Glasses ☑ Reflective Vest ☐ Gloves ☐ PPE clothing		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	N/A
Training Required for this Task:	ERM FSO, ERM Safe Driving Training	Permits Required for this Task:	N/A
Forms Associated with This Task:	N/A		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Driving to/from site	1	Vehicle Accident - vehicle failure, driver distraction, driver fatigue, traffic, unfamiliar roads/traffic patterns	multiple	2	3	6	a	Follow ERM's driving policies (no cell phone use, eliminate distractions)
								b	Use defensive and attentive driving techniques per ERM driver training
								c	Prepare and file a Journey Management Plan with PM and office contact/check-in.
								d	Plan travel route ahead of time as part of JMP
								e	Follow rest break schedule in JMP
								f	Complete a vehicle inspection & 360 walk-around
		2	Driver fatigue and ergonomic stress	multiple	2	3	6	a	Follow rest break schedule in JMP
								b	Arrange for a hotel if travel and work/field time exceeds 14 hours

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3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of "use good body positioning," write "don't bend at waist or reach above head").
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JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle/ Jefferson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017, 1

SPECIFIC TASK:	**General on-site activities (walking around site, equipment set up, mobilization)**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☑ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator <enter type and cartridge type> ☑ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves Heavy, extended rubber gloves ☑ PPE clothing Long sleeves and pants Insect repellent		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	N/A
Training Required for this Task:	ERM FSO	Permits Required for this Task:	N/A
Forms Associated with This Task:	N/A		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	General activities on site	1	Slip, trip, fall injury - uneven terrain, rocks, roots	H&S	3	2	6	a	Wear proper/sturdy footwear
								b	Walk in designated areas only
								c	Remain with on-site facility representative/property owner if applicable and avoid areas designated by Owner
								d	Avoid walking while distracted (writing, taking photos)
		2	Heat/Cold Stress	H&S	3	2	6	a	Dress appropriately for weather conditions on site (sun, shade, precipitation, wind)
								b	Monitor weather forecasts and reschedule visit as appropriate in the event of severe weather, particularly lightning
								c	Bring water/sports drink to remain hydrated
								d	Take breaks as necessary from heat/cold
		3	Biological Hazards - insects, thorns, snakes, plants, animals	H&S	3	3	9	a	Wear appropriate safey glasses in forested/heavily vegetated areas
								b	Wear long pants and long-sleeve shirts to protect against thorns and biting insects; use bug-repellent as necessary, and/or tuck pant legs into socks/boots, and tuck in clothing
								c	Avoid cornering or otherwise moving in a way that would appear threatening to animals
								d	Identify areas with poisonous plants (e.g., poison ivy, poison oak, etc.) and avoid contact with plants.
								e	Avoid areas of high brush, debris/vegetation piles, rock outcrops, and other preferred habitat locations for snakes, and if necessary, use walking stick to check for presence of snakes prior to entering these areas.
		4	Corn stalks, rocks, sinkholes	H&S	2	3	6	a	Driver over corn stalks with rig or vehicle.
								b	Walk the area prior to driving to ensure there are no sinkholes or large rocks on which the vehicle could get stuck.

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3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of "use good body positioning," write "don't bend at waist or reach above head"). Use
4. Select the likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

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JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle, Jefferson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017, 1

SPECIFIC TASK:	**Oversight of drilling activities**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☑ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves leather or cut/puncture resistant> ☑ PPE clothing Long sleeves and pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	Sampling equipment; 5 gas meter
Training Required for this Task:	Site orientation (to be completed on site upon arrival)	Permits Required for this Task:	N/A
Forms Associated with This Task:	refer listed attachments and associated forms in main HASP		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			
			Warren Bankston FSO/Site Lead

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Site Walk	1a	Slips, Trips, and Falls	H&S	2	2	4	1a	Wear steel toed boots with proper heel Remain aware of trip hazards when walking Clear any work areas of debris NOTE: FRC'S ARE ONLY NEEDED IF INSIDE THE FACILITY FENCELINE AND IN THE PLANT/UNIT AREA. FRC IS NOT NEEDED TO ACCESS/MONITOR THE MET STATION. THE FACILITY WILL PROVIDE FRC'S IF YOU DO NOT HAVE A PERSONAL FRC.
		1b	Heat/Cold Stress	H&S	2	2	4	1b	Bring water/sports drink to remain hydrated
		1c	High Noise	H&S	2	2	4	1c	Wear ear protection in designated high noise areas or where deemed necessary
		1d	Biological Hazards	H&S	1	1	1	1d	Wear long sleeve shirts and pants and cut resistant or leather gloves. Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area. Working around snakes: Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this.
2	Gather sample equipment and load/take to site	2a	Strain and sprains from improper lifting	H&S	2	2	4	2a	Ensure that proper lifting technique is used (lift with the legs, keeping the back straight and the load close to the body). Also, obtain assistance with any items over 50 pounds or items that are awkward or bulky.
3	Walking in and around the site	3a	Slip, Trip and Fall can cause broken bones or sprains to muscles. There is loose gravel around the locations.	H&S	3	3	9	3a	Ensure that you are stepping on a substantial walking surface and keep eyes on walking path at all times. Do not walk backwards!
4	Overseeing drilling	4a	Hight noise, moving rods, equipment	multiple	3	3	9	4a	Ensure that contractors are working safely and wearing proper PPE, including hearing protection. Observe movements of contractors and rig and ensure the safety of everyone onsite. Adhere to the exclusion zone intervals during active drilling and operation.

Task Steps[1]	Potential Hazards & Consequences[2] select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]
7 GENERAL NOTES	Use STOP WORK AUTHORITY for any reason, at any time, as needed.				

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3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of “use good body positioning,” write “don’t bend at waist or reach above head”). Use numbers and letters corresponding to listed hazards.

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JHA
Job Hazard Analysis

Project Number:	407978	Project / Client Name:	Project Shuttle, Jefferson County
Project Manager:	David Connelly	Location:	Kearneysville, WV
Partner-in-Charge:	David Carpenter	Date and Revision Number:	5/23/2017, 1

SPECIFIC TASK:	**Conducting soil sampling**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☑ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves Nitrile ☑ PPE clothing Long sleeves and pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)		Equipment / Tools Required:	Bottleware, PID, baggies
Training Required for this Task:	ERM FSO, SSC General, SSC EP	Permits Required for this Task:	N/A
Forms Associated with This Task:	N/A		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **FSO Signature/Date:**
Megan Innis / Project Scientist			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Conducting soil sampling (also see "General Site Activities" Task JHA for general on-site hazards)	1	Slip, trip, fall injury - open borings, drilling rig equipment, sample coolers/containers, etc.	H&S	2	3	6	a	Demarcate open borings with high-vis cones or flags
								b	Establish designated walking areas to avoid open borings
								c	Keep work area clear of extra sampling bottles, coolers, etc. lying on the ground
								d	Close/fill borings as soon as possible
		2	Subsurface drilling (by contractor) - associated drill rig injuries	H&S	2	3	6	a	Follow Sub-surface clearance plan and ensure all boring locations have been pre-cleared
								b	At every boring location, do visual check for lateral clearance around drill rig (e.g., distance from walls, structures, fencing)
								c	At every boring location, do visual check for vertical above-ground clearance around drill rig (e.g., structures, overhead utilities)
								d	Remain at a safe distance while excavations are being performed
								e	Wear appropriate ear protection when around active drill rig
								f	Wear hard hat around drill rig
								g	Establish designated exclusion zone around drill rig
								h	Monitor weather and cease operations in the event of severe weather (e.g., lightning, thunder, high winds)
		3	Soil Sampling - chemical exposure	H&S	3	2	6	a	Wear nitrile gloves, long pants, and long sleeves to prevent skin exposure
								b	Wear eye protectionto prevent contact of soil or dust with eyes
		4	Lifting Injury	H&S	3	2	6	a	Practice proper lifting techniques and lift using leg muscles when lifting sampling equipment and coolers. Use two people if necessary.
		5	Heat Stress	H&S	3	3	9	a	Dress appropriately for weather condidtions on site (sun, shade, precipitation, wind)
								b	Bring water/sports drinks to remain hydrated
								c	Take breaks as necessary from heat

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Task Steps[1]	Potential Hazards & Consequences[2] select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]

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MONITORING SYSTEM INFORMATION

RAE SYSTEMS by Honeywell

MiniRAE 3000

Portable Handheld VOC Monitor

The MiniRAE 3000 is a comprehensive handheld VOC (Volatile Organic Compound) monitor that uses a third-generation patented PID technology to accurately measure more ionizable chemicals than any other device on the market. It provides full-range measurement from 0 to 15,000 ppm of VOCs.

The MiniRAE 3000 has a built-in wireless modem that allows real-time data connectivity with the ProRAE Guardian command center located up to 2 miles (3 km) away through a Bluetooth connection to a RAELink 3* portable modem.

- **Highly accurate VOC maeasurements**
- **Patented PID sensor**
- **Low maintenance—easy access to lamp and sensor**
- **Low cost of ownership**
- **3-year 10.6eV lamp warranty**

KEY FEATURES

- Third-generation patented PID technology
- VOC detection range from 0 to 15,000 ppm
- 3-second response time
- Humidity compensation with built-in humidity and temperature sensors
- Six-month datalogging
- Large graphic display with integrated flashlight
- Multi-language support with 10 languages encoded
- IP- 67 waterproof design

APPLICATIONS

- Oil and Gas
- HazMat
- Industrial Safety
- Civil Defense
- Environmental and Indoor Air Quality

Workers can quickly measure VOCs and wirelessly transmit data via Bluetooth.

*RAELink 3 modem is sold separately.

Wireless ATEX ISO 9001 CERTIFIED

MiniRAE 3000

Portable Handheld VOC Monitor

SPECIFICATIONS

Instrument Specifications

Size	10" L x 3.0" W x 2.5" H (25.5 cm x 7.6 cm x 6.4 cm)
Weight	26 oz (738 g)
Sensors	Photoionization sensor with standard 10.6 eV or optional 9.8 eV or 11.7 eV lamp
Battery	• Rechargeable, external field-replaceable Lithium-Ion battery pack • Alkaline battery adapter
Running time	16 hours of operation (12 hours with alkaline battery adapter)
Display Graphic	4 lines, 28 x 43 mm, with LED backlight for enhanced display readability
Keypad	1 operation and 2 programming keys, 1 flashlight on/off
Direct Readout	Instantaneous reading • VOCs as ppm by volume (mg/m3) • High values • STEL and TWA • Battery and shutdown voltage • Date, time, temperature
Alarms	95dB at 12" (30 cm) buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms latching with manual override or automatic reset • Additional diagnostic alarm and display message for low battery and pump stall
EMC/RFI	Compliant with EMC directive (2004/108/EC) EMI and ESD test: 100MHz to 1GHz 30V/m, no alarm Contact: ±4kV Air: ±8kV, no alarm
IP Rating	• IP-67 unit off and without flexible probe • IP-65 unit running
Datalogging	Standard 6 months at one-minute intervals
Calibration	Two-point or three-point calibration for zero and span. Calibration memory for 8 calibration gases, alarm limits, span values and calibration dates
Sampling Pump	• Internal, integrated flow rate at 500 cc/mn • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto pump shutoff at low-flow condition
Communication	• Download data and upload instrument set-up from PC through charging cradle or optional Bluetooth™ • Wireless data transmission through built-in RF modem
Safety Certifications	**US and Canada**: CSA, Classified as Intrinsically Safe for use in Class I, Division 1 Groups A, B, C, D **Europe**: ATEX II 2G EEx ia IIC T4
Temperature	-4° to 122° F (-20° to 50° C)
Humidity	0% to 95% relative humidity (non-condensing)
Attachments	Durable bright yellow rubber boot
Warranty	3 years for 10.6 eV lamp, 1 year for pump, battery, sensor and instrument
Wireless Frequency	Bluetooth
Wireless Approvals	FCC Part 15, CE R&TTE, Others[1]
Radio Module	Supports BTM431

[1] Contact RAE Systems for country specific wireless approvals and certificates.

Specifications are subject to change.

Sensor Specifications

Gas Monitor	Range	Resolution	Response Time T90
VOCs	0 to 999.9 ppm 1,000 to 15,000 ppm	0.1 ppm 1 ppm	< 3 s < 3 s

MONITOR ONLY INCLUDES:

- MiniRAE 3000 Monitor, Model PGM-7320
- Wireless communication module built in, as specified
- Datalogging with ProRAE Studio II Package
- Charging/download adapter
- RAE UV lamp, as specified
- Flex-I-Probe™
- External filter
- Rubber boot
- Alkaline battery adapter
- Lamp-cleaning kit
- Tool kit
- Operation CD-ROM
- Operation and Maintenance manual
- Soft leather case

OPTIONAL CALIBRATION KIT ADDS:

- 100 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

OPTIONAL GUARANTEED COST-OF-OWNERSHIP PROGRAM:

- 4-year repair and replacement guarantee
- Annual maintenance service

CORPORATE HEADQUARTERS

RAE Systems by Honeywell
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San Jose, CA 95134 USA
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Asia Pacific +852.2669.0828

MultiRAE
(Pumped Models)
QuickStart Guide

RAE Systems by Honeywell
3775 N. First St.
San Jose, CA 95134-1708 USA

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WARNINGS
Read Before Operating

The MultiRAE User's Guide must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

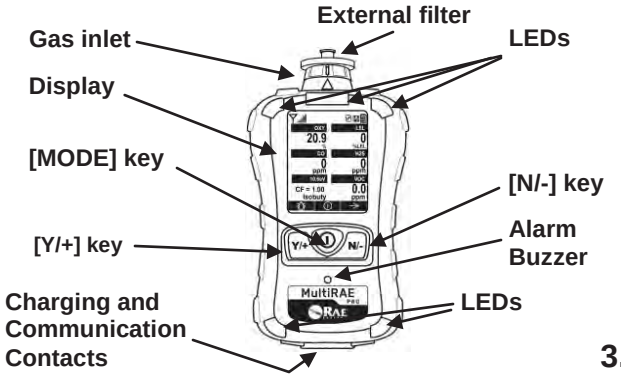
CAUTION!

Never operate the monitor when the rear cover is removed. Remove rear cover, sensors, and/or battery only in an area known to be non-hazardous. Never use the instrument with the calibration adapter installed, as this can cause distorted readings, a potential safety threat.

Note: If the MultiRAE is equipped with a gamma sensor, it comes pre-calibrated from the factory and no calibration is required. You can challenge it anytime with a radioactive check source.

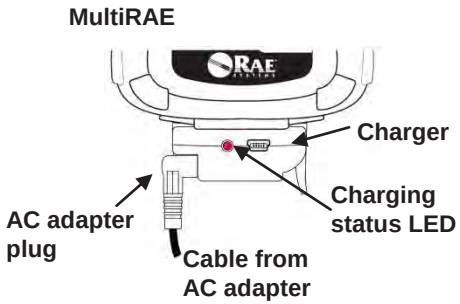
User Interface

The MultiRAE's user interface consists of the display and three keys, [Y/+], [MODE] and [N/-]. The flippable LCD displays information such as monitored threats, real-time readings, measurement units, alarm type (when in alarm, including cal. overdue), battery and pump status, datalog (if on), and radio and connection quality (if available).



Charging The MultiRAE

Always fully charge the battery before use. Contacts on the bottom of the MultiRAE meet the Travel Charger's or Charging Cradle's contact pins, transferring power. Make sure the charger and MultiRAE are firmly attached. Then connect the AC Adapter's plug to the charger, and plug its transformer into an AC outlet. While charging, the LED on the cradle glows red. When the battery is fully charged, the LED glows green.



Turning The MultiRAE On

With the instrument turned off, press and hold the [MODE] key until the audible alarm stops, and then release. During startup, the battery, buzzer, vibration alarm, and LEDs are tested, and then the MultiRAE performs self-testing of its other functions. When the main measurement screen appears, the MultiRAE is ready for calibration or use.

Note: If the battery is completely empty, then the display briefly shows the message "Battery Fully Discharged," and the MultiRAE shuts off. You should charge the battery or replace it with a fully charged battery before turning it on again.

Note: If Fast Startup is enabled on the instrument, fewer screens are shown during startup, compared to Normal Startup sequence.

Turning The MultiRAE Off

Press and hold [MODE]. A 5-second countdown to shut-off begins. You must continue pressing on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the MultiRAE continues normal operation.

When the countdown ends and the screen displays "Unit Off," release your finger from the [MODE] key. The MultiRAE is now off.

Testing The Alarms

Under normal-operation mode and non-alarm conditions, the buzzer, vibration alarm, LED, and backlight can be tested anytime by pressing [Y/+] once. If any alarm does not respond, check the Alarm Settings in Programming Mode to make sure all alarms are enabled. If any alarms are enabled but are not functional, do not use the instrument.

Bump Testing and Calibration Setup

The MultiRAE can be automatically bump tested and calibrated using the AutoRAE 2 Test and Calibration System (refer to its User's Guide for instructions). Manually calibrate using a fixed-flow regulator (flow rate between 0.5 and 1.0 liters per minute) and the supplied special calibration adapter that covers the gas inlet:

1. Connect the gas cylinder, flow regulator, tubing (must use Teflon tubing for PID sensor), and calibration adapter to the MultiRAE.
2. With the MultiRAE in Normal Mode, enter Programming Mode by pressing and holding both [MODE] and [N/-] until the password screen appears.
3. Input the 4-digit password. (The default password is "0000." If you do not know the password, select "Done.") Then follow the menus to select single- or multi-sensor bump test, zero, or span calibration.

Important! After a bump test or calibration, remove the calibration adapter to ensure correct readings.

7.

Zero & Fresh Air Calibration

The MultiRAE should be zero-calibrated in clean air with 20.9% oxygen or with a cylinder of clean zero air. In Programming Mode, select "Fresh Air." Then:

Press [Y/+] to start a Fresh Air calibration for the listed sensors. All are fresh-air calibrated at once.

To individually zero calibrate sensors:

1. Select "Single Sensor Zero" and select a sensor.
2. Press [Y/+] to select a sensor to zero calibrate.
3. Start the flow of the zero gas, if used, and press [Y/+].
4. The screen says, "Zeroing" and counts down.
5. When done, it says, "Zero Calibration Passed" (the reading should be 0 or very close to it for VOC and toxic gas sensors, and 20.9% Vol. for an oxygen sensor).
6. Shut off the flow of zero air (if used) and remove the calibration adapter.

Note: If your MultiRAE is equipped with a CO_2 sensor, it must be zero calibrated using 100% Nitrogen (N_2), or isobutylene, instead of fresh air or zero air.

8.

Span Calibration

In Programming Mode, and with "Multi Sensor Span" or "Single Sensor Span" highlighted:

1. Press [Y/+]. The screen displays the sensor(s) to be calibrated.
   - Multi: The list is shown.
   - Single: Select a sensor and press [Y/+]
2. Attach the calibration adapter, and connect the calibration gas cylinder's flow regulator to the MultiRAE, and start the gas flow.
3. Press [Y/+] to start calibration.
4. Upon completion, a pass/fail calibration result appears and the readings are shown (they should be within ±10% of the span gas value).
   Note: If a VOC sensor is installed, a second calibration can be performed to enhance linearity, requiring different calibration gas.
5. Turn off the gas and remove the calibration adapter.

9.

Bump (Functional) Testing

Bump test to confirm that the sensors and alarms are functional.

Important! Test the alarms, as described in panel 6 (above), prior to performing a bump test.

Important! Make sure all sensors have warmed up before performing the bump test. You can tell a sensor has warmed up if you see a reading next to it name on the display. If it has not warmed up, you see three dashes next to it.

With the MultiRAE in Normal Mode:

1. Enter the Bump Test menu. Follow instructions in panel 7 (above) or use the easy shortcut: Press both the [Y/+] and [N/-] buttons at the same time and hold them for 5 seconds. The Multi-Bump menu then appears.
2. The bump test process consists of two steps, each requiring its own calibration gas. The LEL and O_2 sensors are tested first, followed by the PID sensor. Press [Y/+] to start the bump test. While the bump test is being performed, the readings for each sensor are shown.
3. Once the bump test completes, pass/fail results are shown for each sensor.
4. Press OK to proceed to the PID sensor test. Connect Isobutylene gas and press [Y/+] to start the test. After the test completes, pass/fail results are shown.
5. Press OK to return to the main measurement screen.
6. Turn off the gas flow.
7. Remove the calibration adapter.

10.

BATTERY PACKS

A Li-Ion battery pack (PN: M01-3051-000 or M01-3053-000) and an alkaline battery adapter (PN: M01-3052-000 or M01-3054-000) are supplied with each MultiRAE.

There are two types of output power for battery packs or adapters. The battery pack (PN: M01-3051-000) and adapter (PN: M01-3052-000) are used for MultiRAE model number PGM-62x0. Battery pack (PN: M01-3053-000) and adapter (PN: M01-3054-000) are used for model number PGM-62x6/PGM-62x8.

The alkaline battery adapter accepts four AA alkaline batteries (use only Duracell MN1500). Do not mix old and new batteries or batteries from different manufacturers.

11.

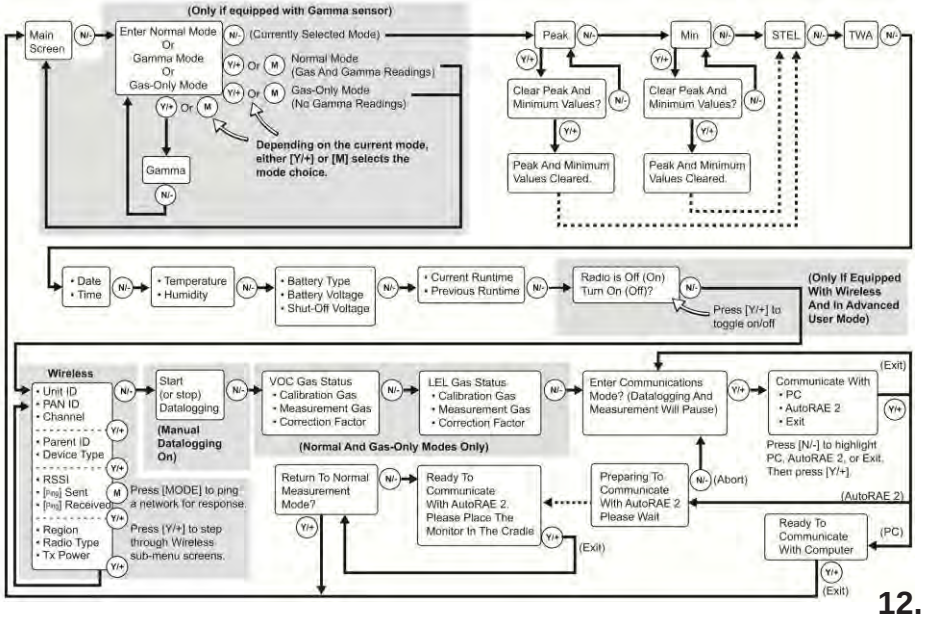
P/N: M01-4016-000 Rev C 201403

Basic Menu Navigation In Hygiene Mode

Pressing [N/-] repeatedly allows you to step through the screens as shown here.

Note: The first gray box only applies if a gamma radiation sensor is installed. The second gray box indicates the datalog functions when datalogging is in Manual mode. When datalogging is in Automatic mode, this screen does not appear. Refer to the User's Guide for information on selecting Automatic, Manual, or Snapshot datalogging.

Note: Dashed line indicates automatic progression.



Wireless Operation

If your MultiRAE is equipped with a wireless modem, its settings are controlled via the menu items under "Wireless." In order to save time while operating the MultiRAE in a network, it is best to configure the settings before taking the MultiRAE into the field. Consult the User's Guide for more detailed instructions.

1. Enter Programming Mode by pressing and holding [MODE] and [N/-] simultaneously until the password screen appears.
2. Input the 4-digit password. (The default password is "0000." If you do not know the password, select "Done.") Then follow the instructions for individual or multiple zero and span calibration.
3. Press [N/-] repeatedly until "Wireless" is highlighted.
4. Press [Y/+] to select Wireless Settings.
5. Check that the radio is turned on, the PAN ID matches the PAN ID of the network, and match the channel of the network, too. Select Join Network if a network is already established. You may also set the reporting interval and turn on the off-network alarm.
6. When you are done with the settings, press [MODE] to go back to the programming screen, and [MODE] again to return to the main screen.
7. Start the RAELink3 Mesh wireless modem and ProRAE Guardian on your computer.
8. The antenna icon and signal-strength bars should be shown on the screen's upper-left corner.
9. Check that data is being received by ProRAE Guardian.

WARNING

To reduce the risk of ignition of hazardous atmospheres, recharge, remove, or replace the battery only in an area known to be non-hazardous!

WARNING

Do not replace sensors in hazardous locations.

SPECIAL CONDITIONS FOR SAFE USE

1. The PGM-62xx shall only be fitted with RAE Systems Battery Pack type M01-3051-000 or M01-3053-000 or Battery Adapter M01-3052-000 or M01-3054-000 fitted with Duracell MN1500 batteries.
2. The PGM-62xx shall only be charged outside hazardous areas.

No precautions against electrostatic discharge are necessary for portable equipment that has an enclosure made of plastic, metal, or a combination of the two, except where a significant static-generating mechanism has been identified. Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk.

However, where a static-generating mechanism is identified, such as repeated brushing against clothing, then suitable precautions shall be taken, e.g., the use of anti-static footwear.

Note: Users are recommended to refer to ISA-RP12.13, Part II-1987 for general information on installation, operation, and maintenance of combustible gas detection instruments.

The MultiRAE multi-gas detector must be calibrated if it does not pass a bump test, or at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.

HAZARDOUS LOCATION APPROVALS

Exia Class I, Division 1, Groups A, B, C, D, T4

SIRA 11ATEX2152X, CE 0575 Ex II 1G Ex ia IIC T4 Ga (for PGM62x0/PGM62x6)

SIRA 11ATEX2152X, CE 0575 Ex II 2G Ex ia d IIC T4 Gb (for PGM62x8)

UM = 20V

IECEx SIR 11.0069X, Ex ia IIC T4 Ga (for PGM62x0/PGM62x6)

IECEx SIR 11.0069X, Ex ia d IIC T4 Gb (for PGM62x8)

WIRELESS CERTIFICATION

Complies with the following:

FCC Part 15

R&TTE Directive (1999/5/EC)

WARNINGS

ANY RAPID UP-SCALE READING FOLLOWED BY A DECLINING OR ERRATIC READING MAY INDICATE A GAS CONCENTRATION BEYOND UPPER SCALE LIMIT, WHICH MAY BE HAZARDOUS.

TOUTE LECTURE RAPIDE ET POSITIVE, SUIVE D'UNE BAISSE SUBITE AU ERRATIQUE DE LA VALEUR, PEUT INDIQUER UNE CONCENTRATION DE GAZ HORS GAMME DE DÉTECTION QUI PEUT ÊTRE DANGEREUSE.

ONLY THE COMBUSTIBLE GAS DETECTION PORTION OF THIS INSTRUMENT HAS BEEN ASSESSED FOR PERFORMANCE.

UNIQUMENT, LA PORTION POUR DÉTECTOR LES GAZ COMBUSTIBLES DE CET INSTRUMENT A ÉTÉ ÉVALUÉE.

CAUTION: HIGH OFF-SCALE READINGS MAY INDICATE AN EXPLOSIVE CONCENTRATION.

ATTENTION: DES LECTURES HAUTES ET HORS D'ECHELLE PEUVENT INDIQUER DES CONCENTRATIONS DE GAZ INFLAMMABLES.

CAUTION: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

CAUTION: BEFORE EACH DAY'S USAGE, SENSITIVITY OF THE LEL SENSOR MUST BE TESTED ON A KNOWN CONCENTRATION OF METHANE GAS EQUIVALENT TO 20 TO 50% OF FULL-SCALE CONCENTRATION. ACCURACY MUST BE WITHIN 0 AND +20% OF ACTUAL. ACCURACY MAY BE CORRECTED BY CALIBRATION PROCEDURE.

ATTENTION: AVANT CHAQUE UTILISATION JOURNALIERE, VERIFIER LA SENSIBILITE DU CAPTEUR DE LIE AVEC UNE CONCENTRATION CONNUE DE METHANE EQUIVALENTE DE 20 A 50% DE LA PLEINE ECHELLE. LA PRECISION DOIT ETRE COMPRISE ENTRE 0 ET 20% DE LA VALEUR VRAIE ET PEUT ETRE CORRIGEE PAR UNE PROCEDURE D'ETALONNAGE.

FORMS AND CHECKLISTS

	Applicability:	Form	Document Number:	Version:
	North America		S3-NAM-029-FM5	2
	Title: **Site Safety Meeting Form**		**Last Revision Date:**	6/24/15

Project Name/ Location:	Project Shuttle- Kearneysville, WV		**Phone:**	NA	
Project Number:	0407978	**Date:**		**Time:**	
Meeting Leader:					

Today's Work Tasks(s)	**Conducted By:**

1. **Review relevant sections of the Health and Safety Plan (HASP), Job Hazard Analyses (JHAs) for planned tasks, and any other applicable procedures. Discuss potential hazards of planned work and control measures to be used to eliminate or reduce risks (including PPE). Pay specific attention to overlapping/ simultaneous operations.**
2. **Review emergency response procedures including emergency phone numbers, location of emergency equipment (fire extinguishers, first aid kit, AED, eyewashes, safety showers, etc.), exit routes, muster points, methods of conducting head count at muster point, and identity of first responders trained in first aid/CPR.**
3. **Does everyone fully understand the task(s)? Are there any changes that need to be assessed? Use SNAP cards to assess risks associated with changed or unplanned tasks.**
4. **Remind the team that everyone on the job site is empowered to stop work if something is unsafe or if there are any questions or concerns regarding safety.**

What tools and equipment are required for today's tasks? Have they been inspected and are they in good condition?

What training/qualifications/experience is necessary for today's assigned tasks?

List any new or Short Service personnel on site today:

Discuss any recent incidents, near misses, field inspection findings, or other safety observations (or observations from similar tasks performed at other sites):

Additional Safety Meeting Topics (check those discussed)
☐ What client safety rules or procedures are applicable to today's activities?
☐ How will you communicate with others on site? How will you communicate with the PIC and PM?
☐ What are the potential impacts of planned activities to visitors, nearby workers, or the public?
☐ Who do you contact if you have questions or before deviating from written procedures?
☐ What happens and who do you contact if there is an injury or other emergency? If working at an active facility, how will you be alerted of an emergency and what will you do?
☐ Where is nearest medical facility and how would we get an injured employee there? If medical help is more than five minutes away, is at least one person on site trained in first aid/CPR? How do you contact them?
☐ Do you have any medical condition or allergy that the project team needs to be aware of? Write this down and keep it in your pocket for reference in the event of an emergency.
☐ Are any work permits required?
☐ Has anything unexpected or out-of-the-ordinary occurred on this job recently to share?
☐ Is there anything different about today's operations as compared to yesterday or previous days?
☐ What is the worst that could happen if something goes wrong today?
☐ What activities occurring today could result in hand injuries? Is everyone aware that the use of fixed open-blade knives is not permitted?
☐ What natural hazards are present (including plants, animals, and insects)?
☐ What areas of the site have slip/trip/fall hazards? Can these be avoided? Are everyone's work boots in good shape?
☐ Other items:

Meeting Attendees (including employees, contractors, and visitors)

Name	Company	Sign-In*	Sign-Out**

* Signature/initials in this space verify that the employee is fit for performing work.

** Signature/initials in this space verify that the employee was uninjured during the workday.

ERM Vehicle Safety Checklist

Date	Operator	Project# 0407978	Mileage
Vehicle Make/Model License#			Company Vehicle? ☐ Y ☐ N

I. Inspection	Before Driving: OK	Deficient	N/A	Comments
Prior to Use, and Weekly Thereafter for all vehicles used for field work.				
All glass and mirrors	☐	☐	☐	
Engine Fluids (oil, radiator coolant)	☐	☐	☐	
Headlights (incl Hi/Lo lights)	☐	☐	☐	
Horn	☐	☐	☐	
Instrumentation warning lights	☐	☐	☐	
Misc. vibration, noise, loose parts (requires comment)	☐	☐	☐	
Overall vehicle cleanliness/damage	☐	☐	☐	
Reverse warning/alarm	☐	☐	☐	
Seatbelts for all seats	☐	☐	☐	
Tail Lights / Brake lights	☐	☐	☐	
Tires - visual condition/tread/pressure	☐	☐	☐	
Turn signal / hazard lights	☐	☐	☐	
Under vehicle – leaks	☐	☐	☐	
Windshield cleanliness and lack of damage/cracks	☐	☐	☐	
Windshield wipers & fluid	☐	☐	☐	

Required H&S supplies/ equipment	☐ Anti-lock brakes	☐ Air bags	☐ First aid kit	☐ Reflective safety vest (for all occupants)	☐ Spare tire and jack – in good condition	☐ Roadside warning (triangles or flares)
Optional H&S supplies/equipment	☐ Jumper cables	☐ Fire Extinguisher	☐ Torch / flashlight	☐ Camera		

Name & signature of reviewer : ……

Safety Reminders

1. Drive defensively - scan road ahead and anticipate actions of other drivers.
2. Ensure sufficient rest before and during the trip. Take a 15 minute break after every 2 hours of continuous driving.
3. Seat belts to be worn by all passengers and driver at all times.
4. Adjust seat / mirrors / headrest / steering wheel and ensure clean windows with no obstructions; Secure loose items.
5. Eliminate distractions – do not use mobile phones or any other electronic devices while driving. Refer to ERM's ***Global Policy on Mobile/Cellular Telephone and Personal Digital Assistant (PDA) Use While in a Vehicle.***
6. Secure all loose loads.
7. Obey all posted road signs and speed limits.
8. Maintain safe following distance - use "3-second rule." in good weather conditions. Adjust speed / following distance for adverse road/weather conditions.
9. Do not consume any alcohol or drugs, or any other substance or medication that could impair their ability to drive. Refer to ERM's ***Global Policy on Drug and Alcohol Use***.

ERM

Soil Boring-MW Log

SB/MW ID:

Project: Project Shuttle
Client: Shuttle
Project No: 0407978
Site Location: Kearneysville, WV
License No.:

Drill Co.: A-Zone
Driller: Jesse Morgan
Drilling Method: Direct Push
Rig Type: Geo-probe
Well Diameter: 2"

Page: 1 of 1
Depth to Water:
Total Hole Depth:
Logged by: R. Baisden
Checked by R. Baisden
Date:

***Samples submitted to lab**

Depth (feet)	USCS Class.	Graphic Log	Description	Sample Number	Sample Interval	Sample Recovery	Sample Time	FID/PID (ppm-v/v)	MW Details
0			Ground Surface						
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

ERM

Soil Boring-MW Log

SB/MW ID:

Project: Project Shuttle
Client: Shuttle
Project No: 0407978
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License No.:

Drill Co.: A-Zone
Driller: Jesse Morgan
Drilling Method: Direct Push
Rig Type: Geo-probe
Well Diameter: 2"

Page: 1 of 2
Depth to Water:
Total Hole Depth:
Logged by: R. Baisden
Checked by: R. Baisden
Date:

***Samples submitted to lab**

Depth (feet)	USCS Class.	Graphic Log	Description	Sample Number	Sample Interval	Sample Recovery	Sample Time	FID/PID (ppm-v/v)	MW Details
0			Ground Surface						
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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15									

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Depth to Water:
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Date:
***Samples submitted to lab**

Depth (feet)	USCS Class.	Graphic Log	Description	Sample Number	Sample Interval	Sample Recovery	Sample Time	FID/PID (ppm-v/v)	MW Details
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	Applicability:	Form	Document Number:	Version:
	North America		S3-NAM-029-FM6	1
	Title: **Undeveloped, Remote, or Inactive Sites**		**Last Revision Date:**	3/26/15

No.	Issue	Considered?	Additional Actions Necessary Before Beginning Work?
Personnel Management			
1	Has an effort been made to secure at least a two-person team for this field work?	☐ Y ☐ N ☐ NA	Click here to enter text.
2	If only one person is making the site visit, has that decision been reviewed and approved by the Partner-in-Charge (PIC), in consultation with the H&S Team?	☐ Y ☐ N ☐ NA	Click here to enter text.
3	Has someone been designated as the team leader to supervise the site activities?	☐ Y ☐ N ☐ NA	Click here to enter text.
4	Does the team have instructions on where to park safely?	☐ Y ☐ N ☐ NA	Click here to enter text.
5	Has the most appropriate location for site entry been determined?	☐ Y ☐ N ☐ NA	Click here to enter text.
6	Has the client/site been notified that an ERM representative will be on site so that entry and security issues are addressed?	☐ Y ☐ N ☐ NA	Click here to enter text.
7	Has a site map been provided, if available?	☐ Y ☐ N ☐ NA	Click here to enter text.
8	Has ERM been informed of any hazards unique to this site?	☐ Y ☐ N ☐ NA	Click here to enter text.
9	If driving more than 500 km (310 miles) in a single day, driving in excess of 4.5 hours in a single day, or driving in a remote location, a Journey Management Plan is required and should be appended to the HASP. Consult ERM H&S Standard #S1-ERM-005-ST (*Travel Risk Assessment*) for requirements.	☐ Y ☐ N ☐ NA	Click here to enter text.
Field Communications			
1	Do team members have a reliable means of communicating with other ERM team members in event of an emergency (e.g., mobile phone, two-way radio, satellite phone or beacon, etc.)?	☐ Y ☐ N ☐ NA	Click here to enter text.
2	Is there a plan in place to ensure that the Project Manager or PIC communicates with the field team members during the day and when all team members have safely left the site at the end of the day and arrived back at their evening destination?	☐ Y ☐ N ☐ NA	Click here to enter text.
3	Has a plan been developed on how to address or deal with unauthorized people encountered on or near the site?	☐ Y ☐ N ☐ NA	Click here to enter text.

No.	Issue	Considered?	Additional Actions Necessary Before Beginning Work?
Field Safety			
1	Have PPE requirements been evaluated and the following minimum issues been considered?	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Sturdy work boots (steel-toed/steel shank if crushing or puncture hazards are present)	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Long pants/long-sleeved shirt (protection against poisonous plants, insects, and sunburn)	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Safety glasses (if potential for flying particulates is present)	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Gloves (leather or Kevlar for exposure to cut, pinch, or abrasion hazards; chemical resistant gloves as needed)	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Hi-visibility vest (potential exposure to vehicle traffic)	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Hard hat (falling objects, struck against, or contact between head and electrical shock hazard is present)	☐ Y ☐ N ☐ NA	Click here to enter text.
2	Is there a process in place to monitor weather forecasts?	☐ Y ☐ N ☐ NA	Click here to enter text.
3	Is there a sheltering plan in the event of inclement weather?	☐ Y ☐ N ☐ NA	Click here to enter text.
4	Is there access to potable water on the site or have plans been made to bring water with the team members?	☐ Y ☐ N ☐ NA	Click here to enter text.
5	Is an ERM-approved first aid kit immediately available?	☐ Y ☐ N ☐ NA	Click here to enter text.
6	Is there at least on first aid trained person on site?	☐ Y ☐ N ☐ NA	Click here to enter text.
7	Is the team aware of any local plants, insects, arachnids, or animals that could carry disease or cause harm?	☐ Y ☐ N ☐ NA	Click here to enter text.
8	If so, have appropriate repellents, clothing, or other protective measures been considered and acquired?	☐ Y ☐ N ☐ NA	Click here to enter text.
9	If a team member is allergic to any natural agents, do they have the appropriate medications with them?	☐ Y ☐ N ☐ NA	Click here to enter text.
10	If a team member is allergic to any natural agents, are other team members aware of the allergy and knowledgeable about the location and application of appropriate medications?	☐ Y ☐ N ☐ NA	Click here to enter text.
11	Has the team addressed the need for periodic clothing and body inspection to note the presence of disease-bearing insects/arachnids?	☐ Y ☐ N ☐ NA	Click here to enter text.

Journey Management Plan

Purpose of Journey:	Field Work Travel	**Is this trip necessary?**	☒ Yes ☐ No
Client Name:	Jefferson County	**GMS number:**	0407978
Project Name:	Project Shuttle	**Journey Date:**	
Originating From: Address/Location	204 Chase Drive Hurricane, WV 25526	**Destination:** Address/Location	365 Granny Smith Lane Kearneysville, WV

Driver and Vehicle Details			
Journey Leader		**Contact Number:**	

Passenger Details

Name	Contact Number	Name	Contact Number

Route to be Taken (Detail Journey legs / stages, destinations, route to be taken and speed limits)

Date	Start Location and Estimated Time	Finish Location and Estimated Time	Anticipated Check-in Call Time	Journey Point of Contact

Identified Risks and Mitigation Plan	
Identified Risks	**Mitigation Techniques**
Anticipated call in not received	

Pre-Departure Checklist	**Yes**	**No**
Has the PIC (or the Journey Leader's supervisor if the Journey Leader is the PIC or there is no PIC associated with the travel) approved the journey?	☐	☐
Pre-trip briefing conducted with Journey Leader and Journey Point of Contact including call in requirements and response if call is not received	☐	☐
Driver has a current driver's license for the class of vehicle and has completed relevant driving safety training	☐	☐
Immediately Before Journey Commences	**Yes**	**No**
Driver is physically and mentally fit to perform task (Sufficient rest based on past work hours, time of the day etc.)	☐	☐
Vehicle selected is suitable for the trip and cargo/loads are separated from vehicle occupants	☐	☐
Vehicle inspected by driver	☐	☐
Correct Safety Equipment in vehicle for task - Emergency Triangles, Water, First Aid kit, Fire Extinguisher (recommended)	☐	☐
Suitable (checked and operational) communication devices (i.e. mobile telephone, satellite phone, 2 way radio)	☐	☐
Operational In-Vehicle Monitoring System (IVMS), if required	☐	☐
Weather and Road conditions checked	☐	☐

Journey Approved by PIC / Line Manager	**Pre-Trip Briefing Completed with Journey Point of Contact**
Name: _____	**Name:** _____
Signature: _____ **Date:** _____	**Signature:** _____ **Date:** _____

Journey Management Plan

Include a Map and/or Directions for the Proposed Journey:

	Applicability:	Guideline	Document Number:	Version:
	North America		S3-NAM-029-GU1	1
	Title: **Project Manager H&S Checklist**		**Last Revision Date:**	3/26/15

Project Name:	Project Shuttle
Project Manager:	David Connelly
Start/End Date:	6/1/2017 - 6/31/2017
Project PIC:	David Carpenter
Project Field Safety Officer:	Megan Innis, Ryan Baisden

This document can be used by the Project Manager to identify project health and safety requirements for project planning, project site work, and project closeout. It can also serve as guideline to give to project team members to inform the team of health and safety planning undertaken and team efforts required.

Project Planning		
Applicable?	**Description**	**Details**
☒ Y ☐ N	Level of health and safety plan (HASP) has been determined (Email, Level 1, Level 2, or Level 3 HASP)	Level II
☒ Y ☐ N	Risks of travel have been identified (Travel Risk Assessment or Journey Management Plan)?	NA
☐ Y ☐ N	H&S team has reviewed Level 2 or Level 3 HASPs	Click here to enter text.
☐ Y ☐ N	For all levels of HASP, the project PIC has given written approval	Click here to enter text.
☐ Y ☐ N	For projects that must undergo PLAN analysis, risk review is provided to H&S team during HASP review	Click here to enter text.
☐ Y ☐ N	Job Hazard Analyses (JHAs) s obtained from contractors and provided to H&S team during HASP review	Click here to enter text.
☒ Y ☐ N	Personal protective equipment (PPE) requirements have been determined for each task	Level D
☒ Y ☐ N	Real-time/industrial hygiene/noise monitoring requirements have been determined based on chemical exposure potential at the site	PID/multiRae
☒ Y ☐ N	Contractors utilized for the project are green-flagged in PICS	Underground will be green prior to fieldwork commencement
☒ Y ☐ N	Medical surveillance requirements for ERM and contractor employees have been determined	
☒ Y ☐ N	Training requirement, including client-specific HS requirements, for ERM and subcontractor employees have been determined	
☒ Y ☐ N	Applicable permits, notifications, and registrations have been identified	
☒ Y ☐ N	ERM personnel identified and assigned to the project meet training/medical requirements	
☒ Y ☐ N	Trained and qualified ERM Field Safety Officer (FSO) has been identified and assigned to the project (as applicable)	
☐ Y ☒ N	SNAP Cards (M1-ERM-004-FM1) will be used on the project and procedures for using have been explained to ERM and contractors employees	Available to use onsite

☒ Y ☐ N	ERM HASP provided to each contractor firm involved in the project along with minimum health and safety requirements each firm must meet	Will provide onsite and prior to commencement of fieldwork
Project Work		
Applicable?	**Description**	**Details**
☒ Y ☐ N	ERM personnel and FSO have not changed since project planning phase, or new personnel meet training and medical surveillance requirements?	
☒ Y ☐ N	Health and safety included in initial project kickoff meeting or separate health and safety kickoff meeting has been planned	
☒ Y ☐ N	Site Safety Meeting Form (*S3-NAM-029-FM5*) is at the project site and used to discuss safety each day with ERM and contractor employees onsite	
☒ Y ☐ N	Everyone on site informed that any change to work scope (weather conditions, personnel, timing, etc.) require short meeting to determine if the change compromises personnel safety	Will work out during fieldwork
☒ Y ☐ N	All PPE and emergency equipment identified in the HASP and JHAs is present at the project site	
☒ Y ☐ N	Emergency contact information, emergency evacuation/assembly point and route to nearest medical facility are included in HASP and posted at the site	
☐ Y ☒ N	Guidance on how to handle a regulatory inspection (*S3-NAM-024-PR*) is at the project site	
☐ Y ☒ N	Training/medical surveillance documents are collected by PM for each contractor employee	Individuals responsible- PM/FSO will check
☒ Y ☐ N	Safety Data Sheets (SDS) are located at the project site for each chemical ERM or contractor brings to the site	
☒ Y ☐ N	Method to keep site visitors out of ERM work areas has been determined and managed by FSO	Private property
☐ Y ☒ N	For project work lasting longer than one week, a Field Safety Audit will be conducted, kept with project files, and forwarded to the Division H&S Leader	Should be less than a week for fieldwork
Project Closeout		
Applicable?	**Description**	**Details**
☒ Y ☐ N	Project HASP, JHAs, PM H&S Checklist, subcontractor training/medical documentation, daily Site Safety Meeting Forms, work permits, air and/or noise monitoring and calibration results are placed in project file	
☐ Y ☐ N	Project team has performed a post-project brainstorming session to close any ECS events and determine any lessons learned	Click here to enter text.

ERM Field Audit Checklist

Project Introduction and Background	
GMS No: 0407978	PIC: David Carpenter
PM: David Connelly	Staff:
Date of audit:	Auditor(s):
Project information (Client / Site / Type of services/ Name and Number of contractors/Current project activities):	
Brief summary of audit results (list best practices observed, repeat findings, etc.):	

Instructions:
The audit should include observations, spot-checks of pertinent documentation (such as training or inspection records) and interviews with site staff. Auditors should ensure that interviewees understand that the goal of the audit is to improve on site safety and should encourage interviewees to speak openly. It is an opportunity for leaders to communicate their expectations.

This checklist has been developed for all types of field projects and therefore includes open questions. For field work including (i) travelling abroad or (ii) secondments, please use the relevant section in addition to the project audit checklist.

Please use the Audit Finding Action Plan at the end of this document to describe the finding for each item that has not been marked “Yes” or “N/A”.

In exceptional cases, use the auditor’s notes section to explain why an element that is marked “No” does not require an Action Item.

Corrective action measures should be developed by the PIC for the project with support by the PM and local H&S advisers. This completed form and associated action plan should be sent to the BU H&S Lead. Where a corrective action has been implemented immediately on site, this should also be noted.

Scoring the Audit – Score the audit by following the instructions provided on the scoring page of this document. The resulting score is a relative guide for the project leadership on how well their project performed during the audit.

☆ This symbol indicates situations or actions that are of high risk or relate to 5 For Life (driver and vehicle safety, travel safety and security, subsurface clearance, short-service employees, and marine/offshore activities), and are weighted more heavily during scoring the project.

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	1	**Planning and Risk Assessment**			
☆	1.1	Is the appropriate level ERM HASP available / complete / up-to-date / signed by field staff?			
	1.2	Is the information included in the HASP (e.g., safety measures, job hazard analyses, emergency procedures, etc.) appropriate to the project risks?			
	1.3	Is the PPE identified in the HASP appropriate to risks?			
	1.4	Does the HASP include a requirement to report accidents and near misses?			
	1.5	If work permits are required (client, regulatory, or procedural), have they been full completed (including date and signature, if required)?			
	1.6	If work permits are required, are all personnel on the site aware of and following the requirements?			
☆	1.7	Do ERM personnel have the appropriate H&S training? Verify training in the Academy for onsite employees upon your return to the office.			
	2	**Site Access, Registration and Induction**			
	2.1	Are all site workers accessing the work site familiar with scope of work and associated risks?			
☆	2.2	Did all site workers attend a site orientation/client specific training and sign off on the HASP?			
	2.3	Have all persons temporarily accessing the work site received a safety induction and are unauthorized persons prevented from entering the work site?			
	2.4	Are daily tailgate meetings conducted at the beginning of each day?			
	3	**Layout and Condition of Work Area**			
	3.1	Is the work site appropriately delineated (cones / fencing / tape)?			
	3.2	Is the size and location of delineated work site adequate?			
☆	3.3	If working on or near roadways, is the work area appropriately marked and secured against traffic impact? (i.e. adequate safety zone, appropriate barriers, traffic controls signage)			
	3.4	Have obstacles or other hazards (such as holes or excavations) within the work area been removed or secured and are warning signs in place and appropriate for hazards which cannot be mitigated?			
	3.5	Are materials stored /stacked safely and orderly to prevent hazards from falling, rolling or collapsing materials and trip hazards? Are storage areas appropriate for the items being stored?			
	3.6	Is the storage of hazardous materials on work site acceptable and labelled?			
	3.7	Have areas with specific fire risks within or close to the work site been identified (flammables or fuel storage areas etc.) and are minimum distances kept?			
☆	3.8	Are emergency precautions in the work area (including emergency escape routes, hydrants, fire extinguishers) accessible / unblocked?			
	3.9	Is the appropriate fire extinguishing equipment in place?			
	3.10	Are worker hygiene facilities, toilets, hand-wash stations, and/or lunch areas present and in good/clean condition?			
	3.11	Are first aid kits / facilities available?			
	3.12	Are emergency phone numbers displayed / available?			
	3.13	Is a map to the local hospital/clinic prominently posted/available?			
	3.14	Is ERM staff and contractors familiar with site-specific emergency procedures, escape routes, and assembly points?			
	3.15	Are specific site procedures being adhered to (such as speed limits, smoking, eating, cell phone use)?			
	3.16	Is the work site appropriately lighted?			
	3.17	Is the general housekeeping at the work site appropriate?			
	3.18	Are wastes appropriately collected and disposed of?			

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	4	**Subsurface Clearance (SSC)**			
	4.1	Has an Experienced Person (EP) responsible for the supervision of SSC activities been appointed?			
☆	4.2	Has a Subsurface Clearance Project Plan (SCPP) been completed as part of the project HASP?			
	4.2.1	Have all parts of the SCPP been sufficiently completed (information sources, site service model, and any clearance waivers)?			
☆	4.3	Has a Location Disturbance Permit been completed for each drilling location?			
	4.4	Have all planned areas of disturbance been cleared (unless waived) by a public and private utility marking contractor using a Cable Avoidance Tool, Ground Penetrating Radar (GPR), or other suitable means?			
	4.5	Are utilities present within a 10 foot or 3 meter radius of drilling or excavation location? (if "no" or "N/A" move to Question 4.6)			
	4.5.1	Have the appropriate waivers been completed for performing intrusive work within a critical zone?			
	4.6	Have the appropriate tools been brought by the contractor to perform physical clearance, and equipped with the appropriate electrical insulation?			
☆	4.7	Has physical clearance been performed down to the following for each borehole? (If soft clearing was waived, moved to 4.9)			
		· 2 ft/60 cm beyond bottom of local frost line, or			
		· 5 ft/150 cm below ground surface (outside of critical zone), or			
		· 2 ft/60 cm deeper than the expected invert elevation or 8 ft/240 cm below ground surface (inside of critical zone).			
	4.8	Has the point disturbance been physically cleared to a diameter of at least 125% larger than the largest downhole tool?			
	4.9	If excavating, has the 2 ft/60 cm "no mechanical digging" buffer around subsurface structure or utility been adhered to?			
	4.9.1	Has hand digging been waived? If "yes", has a similar safety level been achieved (describe below)?			
	5	**Contractors**			
☆	5.1	Are all contractors being used approved per the local Contractor Pre-qualification process?			
	5.2	Does the contractor have the work specifications and understand the scope, and all HASP requirements/risks?			
	5.3	Is the contractor performance (housekeeping, adherence to rules, PPE) in accordance with the project HASP?			
	6	**Personal Protective Equipment**			
☆	6.1	Do onsite staff correctly wear the appropriate task specific PPE in accordance with the site HASP?			
	6.1.1	Is the PPE in use still effective/in good condition and within their designed lifespan? (i.e. clean high visible vest, worn respirators, old hard hats, etc.)			
	6.1.2	Is there a source/procedure for staff to replace/resupply worn or used PPE?			
	6.2	Through discussions with field personnel, are staff aware of the proper/storage/disposal of PPE?			
	7	**Chemical Exposure**			
☆	7.1	Has the potential for exposure to hazardous substances been identified, including exposure limits for chemicals and explosive atmosphere? (should be included in HASP)			
	7.2	Is monitoring equipment (such as PID, gas detectors, explosion meters) present, well-maintained, calibrated, and used as required by HASP?			
	7.3	Are emergency showers or eyewash facilities available if identified in the HASP?			
	7.4	Do field staff know the chemical exposure limits, as well as PPE requirements, and potential emergency procedures after accidental contact with chemicals?			
	7.5	Are worker and equipment decontamination procedures followed as required?			

7.6	Is appropriate safety information (Safety Data Sheets) available for chemicals used on site or hazardous substances likely to be present in the soil/groundwater?			

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	8	**Machinery, Equipment and Vehicles**			
☆	8.1	Do ERM staff and contractors have the required training and authorizations to operate equipment and vehicles (such as driving or operating licenses)?			
	8.2	Are ERM and contractor machinery, equipment, and vehicles in good condition?			
	8.2.1	Have vehicle inspection checklists been completed for ERM-owned vehicles onsite?			
	8.3	Are vehicles/rigs regularly maintained and inspected as required (last inspection report available)?			
☆	8.4	Have risks from moving equipment and/or parts been addressed (e.g. being struck or hit by vehicles, caught by augers, etc.)?			
	8.4.1	Is machinery appropriately guarded, a work area/safety zone established, and are only the appropriate personnel allowed around the equipment in operation?			
	8.4.2	Are the emergency switch off devices present, in working order, and accessible from the work area?			
	8.5	Are electrical tools and connections in good condition and appropriate for the site conditions and their intended use?			
	8.6	Is portable electrical equipment electrically isolated (e.g., equipped with Ground Fault Circuit Interrupters - GFCI-, or double insulated) and are all electrical cords/plugs in good condition?			
	9	**Specific High Risk Hazards and Safety Procedures**			
☆	9.1	Is the “buddy system” being followed while onsite? (if “yes” move to Question 9.2)			
☆	9.1.1	Has a lone working procedure been established and being followed?			
☆	9.2	Are procedures for work at or near water required / established / followed?			
☆	9.3	Are lockout / tagout / de-energize procedures required / established / followed?			
☆	9.4	Is entering of confined spaces by contractors required? Have all permits and procedures established and followed?			
☆	9.5	If hot work is being performed, have all permits been obtained from site contact?			
☆	9.6	If work in explosion-protected areas required, have are all procedures established and being followed?			
☆	9.7	If work at heights are performed, is fall prevention measures in place? Are collective measures (scaffolding) preferred to individual measures (harnesses)?			
☆	9.8	If lifting / hoisting is required, is a Hoisting plan in place, including a pre-hoist equipment check?			
☆	9.9	Have all overhead risks been addressed (i.e. trees and power lines)?			

		Field Visit Review Questions	Insert "X" or similar, below		
			Yes	No	N/A
	1	**Travel Planning and Travel Risk Assessment**			
	1.1	Travellers, PMs and PIC with TRA training? Verify training in the Academy for onsite employees upon your return to the office.			
	1.2	Travellers, PMs and PIC with malaria awareness training? Verify training in the Academy for onsite employees upon your return to the office.			
☆	1.3	Has a Travel Risk Assessment (TRA) been prepared, and is the approved version onsite?			
	1.4	Has the TRA been reviewed and approved by required parties?			
	1.5	Has any Control Risk Group (CRG) advice been taken into account and appropriate prevention measures included in TRA, including standing travel advice?			
☆	1.6	Has experience and information from other ERM staff, client, and local embassies obtained and taken into account?			
	1.7	Are travellers comfortable with all planned travel arrangements?			
	1.8	Have the travel arrangements been discussed within project team prior to departure?			
	2	**Travel to and In Country Travel – Accommodation & Safety**			
	2.1	Has whole itinerary been considered, including intermediate locations in different destinations (customs/visas issues)?			
	2.2	Have arrangements been made to be met at airport by contact for High Risk Countries?			
☆	2.3	Have in-country travel risks been assessed and information obtained with regard to reliability of transportation plans?			
	2.4	If vehicle or driver services are to be used, are vehicles in good condition and are the drivers deemed reliable?			
	2.5	Are the accommodations and living premises during travel appropriate?			
☆	2.6	Have natural / environment hazards been assessed for travel and destination and have prevention measures been implemented (insects, animals, plants, climate, etc.)?			
	3	**Health / Medical**			
	3.1	Have hygiene and health risks been assessed and suitable arrangements implemented?			
☆	3.2	Have vaccination, medical prophylaxis and expert medical advice obtained and implemented?			
	3.3	Are food and drink provided of appropriate standards?			
	3.4	Are project specific medical exams required and being performed as scheduled?			
	4	**Emergency Preparedness, Security and Terrorism**			
	4.1	Has insurance limitations and/or needs for additional insurance coverage been verified (e.g. additional insurance premium for disturbed or remote locations)?			
☆	4.2	Has means and schedule of communication been established, verified and described in TRA?			
	4.3	Has registration for country-specific CRG or International SOS alerts – CRG consulted prior to departure for high risk locations?			
	4.4	Has registration to local embassy been completed?			
☆	4.5	Have security and terrorism risks assessed and prevention measures implemented?			
	4.6	Has an evacuation plan established?			

Secondment Additional Questions		Insert "X" or similar, below		
		Yes	No	N/A
1	**Project Planning**			
1.1	Is the HASP prepared, including health, safety and security risks appropriate to ERM tasks, client facilities, project environment and travel/accommodation?			
1.2	Has workload and work/rest distribution been considered (including travel time to and from the site)? (travel and work hours should be below 12 total)			
1.3	Are the contact people defined, responsibilities defined and communication schedule established with the ERM team (definition of relationships/responsibilities and communication/reports)?			
1.4	Are consultants in secondment with appropriate qualification and training?			
1.5	Are specific project-related medical exams implemented?			
1.6	Has any client-specific training received by consultants?			
1.7	Has any client-specific standards communicated and understood?			
2	**Project Implementation**			
2.1	Is confirmation of both parties understanding the expectations/deliverables of the project available?			
2.2	Are the appropriate arrangements in place as planned?			
2.2.1	- systems & utilities			
2.2.2	- equipment			
2.2.3	- PPE			
2.2.4	- accommodations			
2.2.5	- travel means			
2.2.6	- emergency instructions, facilities and equipment			
2.3	Conflicting or redundant ERM / Client policies identified and managed?			

Project Field Audit Scoring
(To be completed upon return to office, within excel file)

The audit score should be provided to the project leadership on the basis that the score indicates the relative condition of their project's health and safety compliance. Additionally, it should be communicated that no matter how well or poorly the project performed, the goal for all projects are 100% compliance and any corrective actions should be performed as quickly as able, and to the fullest extent.

Each audit item was given a weighted score based on its importance/level of risk associated with the hazard/impact to the project or staff/relation to the 5 For Life (driver and vehicle safety, travel safety and security, subsurface clearance, short-service employees, and marine/offshore activities).

		Project Score Percent
Project Score	254	100%
Total Score Possible	254	

Audit Findings Action Plan (attach a separate sheet if needed)			
Finding *(Please provide checklist ref.)*	**Corrective Action** *(be specific)*	**Person/Party Responsible**	**Target Date**

Other observations / Auditor's Notes / Photos / Additional comments from interviewees, including positive observations: (use separate sheets as needed)

Perform

Conditions 1-4 require that you **STOP WORK** and consult with a second person. Conditions 5-9, proceed with caution.

1 Refer to the appropriate partner to decide.
2 Ask a specialist with more knowledge to advise.
3 Consult with your supervisor before starting.
4 Discuss with a colleague to assist.

5 How can risk be reduced?
6 Look for another way to do the job if possible.
7 Re-check your safety controls (JSA, SWMS, PPE, Procedures).
8 Re-check the area before proceeding.
9 Proceed with the usual level of safety awareness.

M1-ERM-004-FM1, Version 6

Scan

Take two minutes to: scan **LOW** scan **MEDIUM** scan **HIGH**

Safety AT ERM
Risk Management

SNAP Assessment
Scan
Notice
Analyze
Perform

ERM

Activity Level Risk Review

Notice

Notice the hazards and the quality of the control measures in place.
Ask yourself the following questions…

1	Have I looked and identified all the hazards?	☐ Yes	☐ No
2	Will the job be done as already discussed?	☐ Yes	☐ No
3	Are the resources I need available? (PPE, tools, people)	☐ Yes	☐ No
4	Can the job be done without causing an incident?	☐ Yes	☐ No
5	Is everything the same since I last did this task?	☐ Yes	☐ No
6	Are others protected from my activities in the area?	☐ Yes	☐ No
7	Have I identified emergency devices and locations and do I know what to do?	☐ Yes	☐ No
8	Do I have safe access to and from my work area?	☐ Yes	☐ No
9	Is my work area clean and tidy?	☐ Yes	☐ No

If you answered NO to any of the above then consider this when you ANALYZE

Analyze

What is the most likely adverse consequence from an incident?
What is the probability of this type of incident occurring?

Probability of an incident

- Almost certain
- Has happened
- Possible
- Heard of
- Unlikely
- Almost impossible

Exposure to the risk

- Weekly
- Daily
- Current Task

Consequence/Outcome

Injury	Impact
Multiple fatalities	Catastrophic
Fatality	Major
Disability	Significant
Serious (LTI)	Serious
Medical Treatment	Moderate
First Aid	Minor

Health and Safety Incident Management Flow Chart

If an Employee is HURT or SICK Follow These Steps:

Step 1 — Call 911
for emergencies, such as heart attack, stroke, severe shortness of breath, sudden and severe pain, major injury (such as trauma), severe bleeding, or unconsciousness.

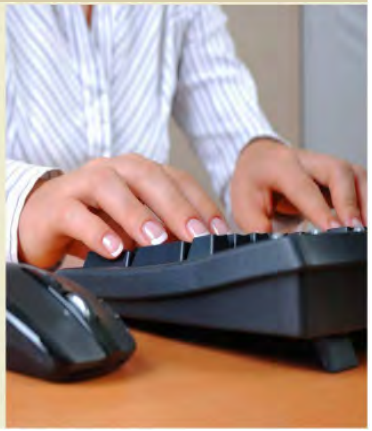
Step 2
For non-emergencies, give any necessary first aid care for the employee and secure the scene.

Step 3
Immediately after giving care, contact your PM (if in the field) or Supervisor (if in the office) to report the event. Also notify the safety team.

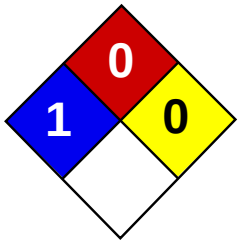
Step 4
As directed by the safety team, contact ERM's Incident Intervention service at 1-888-449-7787 to obtain professional medical advice.

WorkCare® Making Health Count

Step 5
Within 24 hours, enter the event into the Event Communication System (ECS).



SAFETY DATA SHEETS



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 05/21/2013 12:00 PM

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AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0.0015-23.5%;Methane, 0.0005-2.5%;Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

SYNONYMS: Not Applicable **CHEMICAL FAMILY NAME:** Not Applicable **FORMULA:** Not Applicable

Document Number: 50018

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE:	Calibration of Monitoring and Research Equipment
U.S. SUPPLIER/MANUFACTURER'S NAME:	CALGAZ
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
BUSINESS PHONE:	1-410-228-6400 (8 a.m. to 5 p.m. U.S. EST)
General MSDS Information**:**	1-713-868-0440
Fax on Demand:	1-800-231-1366
EMERGENCY PHONE:	
Chemtrec: United States/Canada/Puerto Rico:	1-800-424-9300 [24-hours]
Chemtrec International:	1-703-527-3887 [24-hours]

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		NIOSH	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	ppm
Oxygen	7782-44-7	0.0015 - 23.5%	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%.					
Methane	74-82-8	0.0005 - 2.5%	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Hydrogen Sulfide	7783-06-4	0.001- 0.025 %	10 (NIC = 5)	15	10 (Vacated 1989 PEL)	20 (ceiling); 50 (ceiling, 10 min. peak once per 8-hour shift 15 (vacated 1989 PEL)	100	NIOSH REL: STEL = 10 (ceiling) 10 minutes DFG-MAKs: TWA = 10 PEAK = 2•MAK, 10 min., momentary value
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 [ceiling] (Vacated 1989 PEL)	1200	NIOSH RELS: TWA = 35 STEL = 200 (ceiling) DFG MAKs: TWA = 30 PEAK = 2•MAK, 15 min., average value DFG MAK Pregnancy Risk Classification: B
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. NIC = Notice of Intended Change See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A potential health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

CONCENTRATION OF HYDROGEN SULFIDE	OBSERVED EFFECT
0.3-30 ppm	Odor is unpleasant.
50 ppm	Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm	Irritation of the respiratory system.
100-150 ppm	Temporary loss of smell.
200-250 ppm	Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
300-500	Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm	Headache, excitement, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.
> 600 ppm	Rapid onset of unconsciousness, coma, death.
> 1000 ppm	Immediate respiratory arrest.
NOTE:	This gas mixture contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	3
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES RESPIRATORY HANDS BODY

See Section 8

For Routine Industrial Use and Handling Applications

3. HAZARD IDENTIFICATION (continued)

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs. Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

CONCENTRATION OF CARBON MONOXIDE	**OBSERVED EFFECT**
All exposure levels:	Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.
200 ppm:	Slight symptoms (i.e. headache) after several hours of exposure.
400 ppm:	Headache and discomfort experienced within 2-3 hours of exposure.
1,000 -2000 ppm:	Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.
200-2500 ppm:	Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.
>2500 ppm:	Potential for collapse and death before warning symptoms.

Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN	**OBSERVED EFFECT**
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

SKIN and EYE CONTACT: Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.

CHRONIC: Severe over-exposures to the Hydrogen Sulfide component of this gas mixture, which do not result in death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. In serious cases of over-exposure, the eyes can be permanently damaged. Skin disorders and respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, blood system, central nervous system effects, cardiovascular system, skin, eyes. CHRONIC: Neurological system, reproductive system, eyes.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

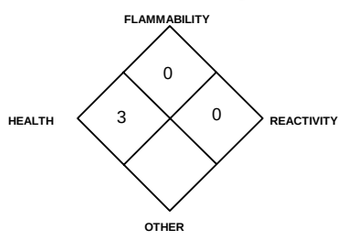
AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

NFPA RATING



FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Not Sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture, than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel. For emergency disposal,

6. ACCIDENTAL RELEASE MEASURES (continued)

secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C (70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the levels of components exceeds exposure limits presented in Section 2 (Composition and Information of Ingredients) and Oxygen levels are below 19.5%, or unknown, during emergency response to a release of this gas mixture. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.16.33% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

Up to 100 ppm:	Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:	Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
Escape:	Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA
NOTE:	The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

Up to 350 ppm	Supplied Air Respirator (SAR)
Up to 875 ppm	Supplied Air Respirator (SAR) operated in a continuous flow mode.
Up to 1200 ppm	Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Respirator (SAR).
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:	Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.
Escape:	Gas mask with canister to protect against carbon monoxide; or escape-type SCBA. **NOTE**: End of Service Life Indicator (ESLI) required for gas masks.
NOTE:	The IDLH concentration for Carbon Monoxide is 1200 ppm.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: .072 lbs/ ft^3 (1.153 kg/m^3)
FREEZING/MELTING POINT @ 10 psig: -345.8°F (-210°C)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906
SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023
EVAPORATION RATE (nBuAc = 1): Not applicable.
VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
BOILING POINT: -320.4°F (-195.8°C)
pH: Not applicable.
MOLECULAR WEIGHT: 28.01
EXPANSION RATIO: Not applicable.
SPECIFIC VOLUME (ft^3/lb): 13.8

The following information is for this gas mixture.

ODOR THRESHOLD: 0.13 ppm (Hydrogen Sulfide)
APPEARANCE AND COLOR: This gas mixture is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.
HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of this gas mixture may cause olfactory fatigue, due to the presence of Hydrogen Sulfide, so the odor is not a good warning property of a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this gas mixture (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

NITROGEN:

There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

METHANE:

There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.

CARBON MONOXIDE:

LC_{50} (Inhalation-Rat) 1807 ppm/4 hours
LC_{50} (Inhalation-Mouse) 2444 ppm/4 hours
LC_{50} (Inhalation-Guinea Pig) 5718 ppm/4 hours
LC_{50} (Inhalation-wild bird species) 1334 ppm
LCLo (Inhalation-Human) 4 mg/m^3/12 hours: Behavioral: coma; Vascular: BP lowering not characterized in autonomic section; Blood: methemoglobinemia-carboxyhemoglobin
LCLo (Inhalation-Man) 4000 ppm/30 minutes
LCLo (Inhalation-Human) 5000 ppm/5 minutes
LCLo (Inhalation-Dog) 4000 ppm/46 minutes
LCLo (Inhalation-Rabbit) 4000 ppm
LCLo (Inhalation-Mammal-species unspecified) 5000 ppm/5 minutes
TCLo (Inhalation-Human) 600 mg/m^3/10 minutes: Behavioral: headache
TCLo (Inhalation-Man) 650 ppm/45 minutes: Blood: methemoglobinemia-carboxyhemoglobin; Behavioral: changes in psychophysiological tests
TCLo (Inhalation-Rat) 1800 ppm/1 hour/14 days-intermittent: Cardiac: other changes
TCLo (Inhalation-Rat) 30 mg/m^3/8 hours/10 weeks-intermittent: Brain and Coverings: other degenerative changes; Behavioral: muscle contraction or spasticity
TCLo (Inhalation-Rat) 96 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
TCLo (Inhalation-Rat) 250 ppm/5 hours/20 days-intermittent: Blood :pigmented or nucleated red blood cells, changes in other cell count (unspecified), changes in erythrocyte (RBC) count
TDLo (Subcutaneous-Rat) 5983 mg/kg/18 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol)
TCLo (Inhalation-Monkey) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
TCLo (Inhalation-Rabbit) 200 mg/m^3/3 hours/13 weeks-intermittent: Brain and Coverings: other degenerative changes; Cardiac: other changes; Blood: hemorrhage
TCLo (Inhalation-Guinea Pig) 200 mg/m^3/5 hours/30 weeks-continuous: Cardiac: arrhythmias (including changes in conduction), EKG changes not diagnostic of specified effects, pulse rate increase, without fall in BP

CARBON MONOXIDE (continued):

TCLo (Inhalation-Mouse) 50 ppm/30 days-intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi
TCLo (Inhalation-Guinea Pig) 200 mg/m^3/5 hours/4 weeks-intermittent: Endocrine: hyperglycemia
TCLo (Inhalation-Guinea Pig) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Newborn: behavioral
TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system
TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain), behavioral
TCLo (Inhalation-Rat) 1 mg/m^3/24 hours: female 72 day(s) pre-mating: Reproductive: Maternal Effects: menstrual cycle changes or disorders, parturition; Fertility: female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated)
TCLo (Inhalation-Rat) 150 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral
TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
TCLo (Inhalation-Mouse) 65 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Newborn: behavioral
TCLo (Inhalation-Mouse) 250 ppm/7 hours: female 6-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: musculoskeletal system
TCLo (Inhalation-Mouse) 125 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Fertility: litter size (e.g. # fetuses per litter; measured before birth); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death

CARBON MONOXIDE (continued):

TCLo (Inhalation-Rabbit) 50 ppm/24 hours/8 weeks-continuous: Blood: changes in platelet count
TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System
TCLo (Inhalation-Rabbit) 180 ppm/24 hours: female 1-30 day(s) after conception: Reproductive: Effects on Newborn: stillbirth, viability index (e.g., # alive at day 4 per # born alive)
Micronucleus Test (Inhalation-Mouse)1500 ppm/10 minutes
Sister Chromatid Exchange (Inhalation-Mouse) 2500 ppm/10 minutes

HYDROGEN SULFIDE:

LC_{50} (Inhalation-Rat) 444 ppm: Lungs, Thorax, or Respiration: other changes; Gastrointestinal: hypermotility, diarrhea; Kidney, Ureter, Bladder: urine volume increased
LC_{50} (Inhalation-Mouse) 634 ppm/1 hour
LCLo (Inhalation-Human) 600 ppm/30 minutes
LCLo (Inhalation-Man) 5700 µg/kg: Behavioral: coma; Lungs, Thorax, or Respiration: chronic pulmonary edema
LCLo (Inhalation-Human) 800 ppm/5 minutes
LCLo (Inhalation-Mammal-species unspecified) 800 ppm/5 minutes
TCLo (Inhalation-Rat) 30 ppm/6 hours/10 weeks-intermittent: Sense Organs and Special Senses (Olfaction): olfactory nerve change, effect, not otherwise specified
TCLo (Inhalation-Rat) 1200 mg/m^3/2 hours/5 days-intermittent: Brain and Coverings: other degenerative changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase
TCLo (Inhalation-Rat) 100 ppm/8 hours/5 weeks-intermittent: Brain and Coverings: other degenerative changes; Lungs, Thorax, or Respiration: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: cytochrome oxidases (including oxidative phosphorylation)
TCLo (Inhalation-Rat) 80 ppm/6 hours/90 days-intermittent: Brain and Coverings: changes in brain weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TCLo (Inhalation-Rat) 20 ppm: female 6-22 day(s) after conception lactating female 21 day(s) post-birth: Reproductive: Effects on Newborn: physical
TCLo (Inhalation-Mouse) 80 ppm/6 hours/90 days-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death
TCLo (Inhalation-Rabbit) 40 mg/m^3/5 hours/30 weeks-intermittent: Sense Organs and Special Senses (Eye): conjunctive irritation

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: This gas mixture is irritating to the eyes, and may be irritating to the skin.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory sensitizers.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture on the human reproductive system.

Mutagenicity: The components of this gas mixture are not reported to cause mutagenic effects in humans.

REPRODUCTIVE TOXICITY INFORMATION (continued):

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. The Carbon Monoxide component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

Reproductive Toxicity: The components of this gas mixture are not reported to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) have been determined for components of this gas mixture, as follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air	 • End of shift • End of shift	 • 3.5% of hemoglobin • 20 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

CARBON MONOXIDE:

Atmospheric Fate: A photochemical model was used to quantify the sensitivity of the tropospheric oxidants ozone (O_3) and OH to changes in methane (CH_4), Carbon Monoxide (CO), and NO emissions and to perturbations in climate and stratospheric chemistry. In most cases, increased CH_4 and CO emissions will suppress OH (negative coefficients) in increased O_3 (positive coefficients) except in areas where NO and O_3 influenced by pollution are sufficient to increased OH. In most regions, NO, CO, and CH_4 emission increased will suppress OH and increased O_3, but these trends may be opposed by stratospheric O3 depletion and climate change.

HYDROGEN SULFIDE:

Water Solubility = 1 g/242 mL at 20°C.

Plant toxicity: Continuous fumigation of plants with 300 or 3000 ppb Hydrogen Sulfide caused leaf lesions, defoliation, and reduced growth with severity of injury correlated to dose. At higher (3.25 and 5.03 ppm) Hydrogen Sulfide, significant reductions in leaf CO2 and water vapor exchanges occurred, and stomatal openings were depressed. When Hydrogen Sulfide gas was applied to 29 species of green plants for 5 hours, young, rapidly elongating tissues were more sensitive to injury than older tissues. Symptoms included scorching of young shoots and

12. ECOLOGICAL INFORMATION(continued)

leaves, basal and marginal scorching of older leaves. Mature leaves were unaffected. Seeds exposed to Hydrogen Sulfide gas showed delay in germination.

Persistence: Converts to elemental sulfur upon standing in water.

Major Species Threatened: Aquatic and animal life plants may be injured if exposed to 5 ppm in air over 24 hours.

Biodegradation: Microorganisms in soil and water are involved in oxidation-reduction reactions that oxidize hydrogen sulfide to elemental sulfur. Members of the genera Beggiatoa, Thioploca, and Thiotrix function in transition zones between aerobic and anaerobic conditions where both molecular oxygen and hydrogen sulfide are found. Also, some photosynthetic bacteria oxidize hydrogen sulfide to elemental sulfur. Members of the families Chlorobiaceae and Chromatiaceae (purple sulfur bacteria) are obligate aerobes and are phototropic, and are found in waters with high H_2S concentrations. The interactions of these organisms form part of the global sulfur cycle.

Bioconcentration: Does not have bioaccumulation or food chain contamination potential.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this gas mixture's effects on plant and animal life. Hydrogen Sulfide and Carbon Monoxide, components of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this gas mixture's effects on aquatic life. The presence of more than a trace of the Carbon Monoxide component of this gas mixture is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture:

HYDROGEN SULFIDE:

LC_{50} (*Asellus* arthropods) 96 hours = 0.111 mg/L

LC_{50} (*Crangon* arthropods) 96 hours = 1.07 mg/L

LC_{50} (*Gammarus* arthropods) 96 hours = 0.84 mg/L

LC_{50} (Ephemera) 96 hours = 0.316 mg/L

LC_{50} (Inhalation-Flies) > 960 minutes = 380 mg/m^3

LC_{50} (Inhalation-Flies) 7 minutes = 1,500 mg/m^3

LC_{50},F (bluegill, eggs) 72 hours = 0.0190 mg/L

HYDROGEN SULFIDE (continued):

LC_{50},F (bluegill, 35-day-old fry) 96 hours = 0.0131 mg/L

LC_{50},F (bluegill, juveniles) 96 hours = 0.0478 mg/L

LC_{50},F (bluegill, adults) 96 hours = 0.0448 mg/L

LC_{50},F (fathead minnows) 96 hours = 0.0071-0.55 mg/L

LC_{50},F (bluegill) 96 hours = 0.0090-0.0140 mg/L

LC_{50},F (brook trout) 96 hours = 0.0216-0.0308 mg/L

Toxic (goldfish) = 100 mg/L

HYDROGEN SULFIDE (continued):

Lethal (goldfish) 96 hours = 10 mg/L

Toxic (carp) 24 hours = 3.3 mg/L

Toxic (goldfish) 24 hours = 4.3 mg/L

Toxic (sunfish) 1 hour = 4.9 to 5.3 mg/L

Toxic (goldfish) 200 hours = 5 mg/L

Toxic (minnows) 24 hours = 5-6 mg/L

Toxic (carp) 24 hours = 6-25 mg/L

Toxic (trout) 15 minutes = 10 mg/L

Toxic (goldfish) 24 hours = 25 mg/L

Toxic (tench) 3 hours = 100 mg/L

MATC,F (fathead minnows) 0.0037 mg/L

MATC,F (bluegill) 0.0004 mg/L

MATC,F (brook trout) 0.055 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

DOT LABEL(S) REQUIRED: Non-Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

U.S. DEPARTMENT OF TRANSPORTATION INFORMATION (continued):

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (outer package). Pertinent shipping information goes on the outside of the outer package. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12

ERAP INDEX: 3000

PASSENGER CARRYING SHIP INDEX: Forbidden

PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: Forbidden

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This gas mixture is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Hydrogen Sulfide	YES	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lb (227 kg)

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide = 100 lb (45 kg)

OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs (and so one cylinder of this gas mixture will not be affected by this regulation).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen and Oxygen are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater.

15. REGULATORY INFORMATION(continued)

Carbon Monoxide and Methane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane.

California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.

Florida - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide

Illinois - Toxic Substance List: Carbon Monoxide, Methane, Hydrogen Sulfide.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide, Methane.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane.

Missouri - Employer Information/Toxic Substance List t: Hydrogen Sulfide, Methane.

New Jersey - Right to Know Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Methane.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrogen Sulfide.

Pennsylvania - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.

Rhode Island - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.

Texas - Hazardous Substance List: Hydrogen Sulfide.

West Virginia - Hazardous Substance List: Hydrogen Sulfide.

Wisconsin - Toxic and Hazardous Substances: Hydrogen Sulfide

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists. WARNING! This gas mixture contains a compound known to the State of California to cause birth defects or other reproductive harm.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

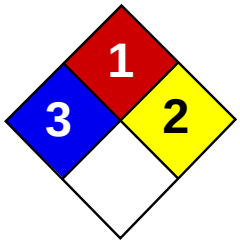
P-1 *"Safe Handling of Compressed Gases in Containers"*

AV-1 *"Safe Handling and Storage of Compressed Gases"*

"Handbook of Compressed Gases"

AIR LIQUIDE™

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic Pennsylvania RTK: Arsenic Massachusetts RTK: Arsenic TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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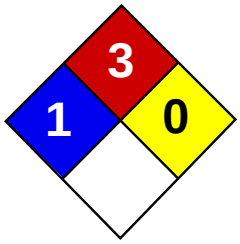

Material Safety Data Sheet
Hexanes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hexanes

Catalog Codes: SLH2335, SLH2032

CAS#: 110-54-3

RTECS: MN9275000

TSCA: TSCA 8(b) inventory: Hexane

CI#: Not applicable.

Synonym:

Chemical Name: Hexane

Chemical Formula: C6-H14

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hexanes	110-54-3	98.5-99.9

Toxicological Data on Ingredients: Hexane: ORAL (LD50): Acute: 25000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to peripheral nervous system, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 225°C (437°F)

Flash Points: CLOSED CUP: -22.5°C (-8.5°F). (TAG)

Flammable Limits: LOWER: 1.15% UPPER: 7.5%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid, insoluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 (ppm) from OSHA (PEL) [United States] Inhalation TWA: 1800 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 176 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [United States] Inhalation TWA: 1760 STEL: 3500 (mg/m3) from ACGIH (TLV) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Gasoline-like or petroleum-like (Slight.)

Taste: Not available.

Molecular Weight: 86.18g/mole

Color: Clear Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 68°C (154.4°F)

Melting Point: -95°C (-139°F)

Critical Temperature: Not available.

Specific Gravity: 0.66 (Water = 1)

Vapor Pressure: 17.3 kPa (@ 20°C)

Vapor Density: 2.97 (Air = 1)

Volatility: Not available.

Odor Threshold: 130 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.9

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not available.

Special Remarks on Reactivity: Hexane can react vigorously with strong oxidizers (e.g. chlorine, bromine, fluorine)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 25000 mg/kg [Rat]. Acute toxicity of the gas (LC50): 48000 ppm 4 hours [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: peripheral nervous system, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects based on animal data. May be tumorigenic based on animal data. May affect genetic material. Passes through the placental barrier in animal.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause mild skin irritation. It can be absorbed through the skin in harmful amounts. Eyes: May cause mild eye irritation. Inhalation: May be harmful if inhaled. Inhalation of vapors may cause respiratory tract irritation. Overexposure may affect, brain, spinal cord, behavior/central and peripheral nervous systems (lightheadness, dizziness, hallucinations, paralysis, blurred vision, memory loss, headache, euphoria, general anesthetic, muscle weakness, numbness of the extremeties, asphyxia, unconciousness and possible death), metabolism, respiration, blood, cardiovascular system, gastrointestinal system (nausea) Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation with abdominal pain and nausea. May also affect the liver, blood, brain, peripheral and central nervous systems. Symptoms of over exposure by ingestion are similar to that of overexposure by inhalation.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Hexane UNNA: 1208 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hexanes Illinois toxic substances disclosure to employee act: Hexanes Illinois chemical safety act: Hexanes New York release reporting list: Hexanes Rhode Island RTK hazardous substances: Hexanes Pennsylvania RTK: Hexanes Florida: Hexanes Minnesota: Hexanes Massachusetts RTK: Hexanes Massachusetts spill list: Hexanes New Jersey: Hexanes New Jersey spill list: Hexanes Louisiana spill reporting: Hexanes TSCA 8(b) inventory: Hexanes SARA 313 toxic chemical notification and release reporting: Hexanes CERCLA: Hazardous substances.: Hexanes: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. R38- Irritating to skin. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R62- Possible risk of impaired fertility. R65- Harmful: may cause lung damage if swallowed. R67- Vapors may cause drowsiness or dizziness. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S29- Do not empty into drains. S33- Take precautionary measures against static discharges. S36/37- Wear suitable protective clothing and gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets. S62- If swallowed, do not induce vomiting: seek medical advice immediately and show this

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves (impervious). Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 05/21/2013 12:00 PM

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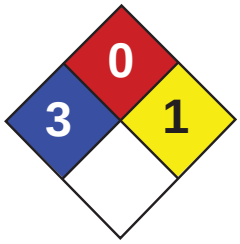

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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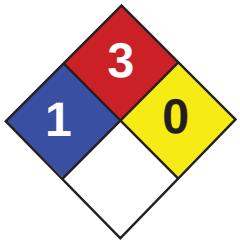

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Isopropyl alcohol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Isopropyl alcohol

Catalog Codes: SLI1153, SLI1579, SLI1906, SLI1246, SLI1432

CAS#: 67-63-0

RTECS: NT8050000

TSCA: TSCA 8(b) inventory: Isopropyl alcohol

CI#: Not available.

Synonym: 2-Propanol

Chemical Name: isopropanol

Chemical Formula: C3-H8-O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Isopropyl alcohol	67-63-0	100

Toxicological Data on Ingredients: Isopropyl alcohol: ORAL (LD50): Acute: 5045 mg/kg [Rat]. 3600 mg/kg [Mouse]. 6410 mg/kg [Rabbit]. DERMAL (LD50): Acute: 12800 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Development toxin [POSSIBLE]. The substance may be toxic to kidneys, liver, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 399°C (750.2°F)

Flash Points: CLOSED CUP: 11.667°C (53°F) - 12.778 deg. C (55 deg. F) (TAG)

Flammable Limits: LOWER: 2% UPPER: 12.7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME. Hydrogen peroxide sharply reduces the autoignition temperature of Isopropyl alcohol. After a delay, Isopropyl alcohol ignites on contact with dioxgenyl tetrafluorborate, chromium trioxide, and potassium tert-butoxide. When heated to decomposition it emits acrid smoke and fumes.

Special Remarks on Explosion Hazards:
Secondary alcohols are readily autooxidized in contact with oxygen or air, forming ketones and hydrogen peroxide. It can become potentially explosive. It reacts with oxygen to form dangerously unstable peroxides which can concentrate and explode during distillation or evaporation. The presence of 2-butanone increases the reaction rate for peroxide formation. Explosive in the form of vapor when exposed to heat or flame. May form explosive mixtures with air. Isopropyl alcohol + phosgene forms isopropyl chloroformate and hydrogen chloride. In the presence of iron salts, thermal decompositon can occur, whicn in some cases can become explosive. A homogeneous mixture of concentrated peroxides + isopropyl alcohol are capable of detonation by shock or heat. Barium perchlorate + isopropyl alcohol gives the highly explosive alkyl perchlorates.

It forms explosive mixtures with trinitormethane and hydrogen peroxide. It produces a violent explosive reaction when heated with aluminum isopropoxide + crotonaldehyde. Mixtures of isopropyl alcohol + nitroform are explosive.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 983 STEL: 1230 (mg/m3) [Australia] TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [United States] [1999] TWA: 980 STEL: 1225 (mg/m3) from NIOSH TWA: 400 STEL: 500 (ppm) from NIOSH TWA: 400 STEL: 500 (ppm) [United Kingdom (UK)] TWA: 999 STEL: 1259 (mg/m3) [United Kingdom (UK)] TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [United States] TWA: 980 STEL: 1225 (mg/m3) from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Pleasant. Odor resembling that of a mixture of ethanol and acetone.

Taste: Bitter. (Slight.)

Molecular Weight: 60.1 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 82.5°C (180.5°F)

Melting Point: -88.5°C (-127.3°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.78505 (Water = 1)

Vapor Pressure: 4.4 kPa (@ 20°C)

Vapor Density: 2.07 (Air = 1)

Volatility: Not available.

Odor Threshold:
22 ppm (Sittig, 1991) 700 ppm for unadapted panelists (Verschuren, 1983).

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, n-octanol, acetone.

Solubility:
Easily soluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone. Insoluble in salt solution. Soluble in benzene. Miscible with most organic solvents including alcohol, ethyl alcohol, chloroform.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, Ignition sources, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts violently with hydrogen + palladium combination, nitroform, oleum, COCl2, aluminum triisopropoxide, oxidants Incompatible with acetaldehyde, chlorine, ethylene oxide, isocyanates, acids, alkaline earth, alkali metals, caustics, amines, crotonaldehyde, phosgene, ammonia. Isopropyl alcohol reacts with metallic aluminum at high temperatures. Isopropyl alcohol attacks some plastics, rubber, and coatings. Vigorous reaction with sodium dichromate + sulfuric acid.

Special Remarks on Corrosivity: May attack some forms of plastic, rubber and coating

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3600 mg/kg [Mouse]. Acute dermal toxicity (LD50): 12800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 16000 8 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Development toxin [POSSIBLE]. May cause damage to the following organs: kidneys, liver, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive/teratogenic effects (fertility, fetoxicity, developmental abnormalities(developmental toxin)) based on animal studies. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause mild skin irritation, and sensitization. Eyes: Can cause eye irritation. Inhalation: Breathing in small amounts of this material during normal handling is not likely to cause harmful effects. However, breathing large amounts may be harmful and may affect the respiratory system and mucous membranes (irritation), behavior and brain (Central nervous system depression - headache, dizziness, drowsiness, stupor, incoordination, unconciousness, coma and possible death), peripheral nerve and senstation, blood, urinary system, and liver. Ingestion: Swallowing small amouts during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful. Swallowing large amounts may cause gastrointestinal tract irritation with nausea, vomiting and diarrhea, abdominal pain. It also may affect the urinary system, cardiovascular system, sense organs, behavior or central nervous system (somnolence, generally depressed activity, irritability, headache, dizziness, drowsiness), liver, and respiratory system (breathing difficulty). Chronic Potential Health Effects: May cause defatting of the skin and dermatitis and allergic reaction. May cause adverse reproductive effects based on animal data (studies).

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 100000 mg/l 96 hours [Fathead Minnow]. 64000 mg/l 96 hours [Fathead Minnow].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Isopropyl Alcohol UNNA: 1219 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Isopropyl alcohol Illinois toxic substances disclosure to employee act: Isopropyl alcohol Rhode Island RTK hazardous substances: Isopropyl alcohol Pennsylvania RTK: Isopropyl alcohol Florida: Isopropyl alcohol Minnesota: Isopropyl alcohol Massachusetts RTK: Isopropyl alcohol New Jersey: Isopropyl alcohol New Jersey spill list: Isopropyl alcohol Director's list of Hazardous Substances: Isopropyl alcohol Tennesee: Isopropyl alcohol TSCA 8(b) inventory: Isopropyl alcohol TSCA 4(a) final testing order: Isopropyl alcohol TSCA 8(a) IUR: Isopropyl alcohol TSCA 8(d) H

and S data reporting: Isopropyl alcohol: Effective date: 12/15/86 Sunset Date: 12/15/96 TSCA 12(b) one time export: Isopropyl alcohol SARA 313 toxic chemical notification and release reporting: Isopropyl alcohol

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R36- Irritating to eyes. S7- Keep container tightly closed. S16- Keep away from sources of ignition - No smoking. S24/25- Avoid contact with skin and eyes. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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LIQUINOX MSDS

Section 1 : MANUFACTURER INFORMATION

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/02/24

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
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Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C):	100 (212F)
Freezing point (°C):	Not available.
pH:	8.5
Specific gravity @ 20 °C:	(water = 1). 1.083
Solubility in water (%):	Complete.
Coefficient of water\oil dist.:	Not available.
VOC:	None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability:	Not flammable.
Conditions of flammability:	Surrounding fire.
Extinguishing media:	Carbon dioxide, dry chemical, foam. Water Water fog.
Special procedures:	Self-contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
Auto-ignition temperature:	Not available.
Flash point (°C), method:	None
Lower flammability limit (% vol):	Not applicable.
Upper flammability limit (% vol):	Not applicable.

Not available.

Sensitivity to mechanical impact:	Not available.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Rate of burning:	Not available.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 5 : REACTIVITY DATA

Chemical stability:	Product is stable under normal handling and storage conditions.
Conditions of instability:	Extreme temperatures.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged and repeated contact may cause irritation.
Inhalation:	May cause headache and nausea.
Ingestion:	May cause vomiting and diarrhea. May cause gastric distress.
Effects of chronic exposure:	See effects of acute exposure.
LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available.
Exposure limit of material:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak / Spill:	Contain the spill. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Soak up with an absorbent material. Place in appropriate container for disposal. Notify the appropriate authorities as required.
Waste disposal:	In accordance with local and federal regulations.
Handling procedures and equipment:	Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task.

Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves / Type:

Wear appropriate gloves.

Respiratory / Type: None required under normal use.

Eye / Type:

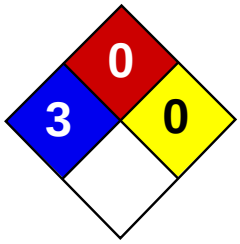
Safety glasses recommended.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.



Material Safety Data Sheet
Nitric Acid, 10% w/w MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nitric Acid, 10% w/w

Catalog Codes: SLN1330

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Nitric acid, 70%; Water

CI#: Not applicable.

Synonym:

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	93
Nitric acid, fuming	7697-37-2	7

Toxicological Data on Ingredients: Nitric acid, fuming: VAPOR (LC50): Acute: 67 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. Non-sensitizer for skin. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist

may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs. Repeated or prolonged inhalation of vapors may lead to chronic respiratory irritation.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive to explosive in presence of reducing materials, of combustible materials, of organic materials.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as reducing agents, combustible materials, metals, alkalis. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:
May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package. Corrosive materials should be stored in a separate safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Nitric acid, fuming TWA: 2 CEIL: 4 (ppm) TWA: 5 CEIL: 10 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Disagreeable and choking. (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Acidic.

Boiling Point: The lowest known value is 82.6°C (180.7°F) (Nitric acid, fuming). Weighted average: 98.78°C (209.8°F)

Melting Point: May start to solidify at -41.6°C (-42.9°F) based on data for: Nitric acid, fuming.

Critical Temperature: Not available.

Specific Gravity: Weighted average: 1.02 (Water = 1)

Vapor Pressure:
The highest known value is 45 mm of Hg (@ 20°C) (Nitric acid, fuming). Weighted average: 19.46 mm of Hg (@ 20°C)

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: The highest known value is 0.29 ppm (Nitric acid, fuming)

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:
Extremely reactive or incompatible with alkalis. Highly reactive with metals. Reactive with reducing agents, combustible materials. Slightly reactive to reactive with organic materials, acids.

Corrosivity:
Highly corrosive in presence of steel, of aluminum, of zinc, of copper. Corrosive in presence of stainless steel(304). Slightly corrosive to corrosive in presence of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute toxicity of the vapor (LC50): 957 ppm 4 hour(s) (Rat) (Calculated value for the mixture).

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans: Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 8: Corrosive liquid.

Identification: : Nitric acid, solution (Nitric acid, fuming) : NA2031 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Nitric acid, 70% Massachusetts RTK: Nitric acid, 70% TSCA 8(b) inventory: Nitric acid, 70%; Water SARA 302/304/311/312 extremely hazardous substances: Nitric acid, 70% SARA 313 toxic chemical notification and release reporting: Nitric acid, 70% CERCLA: Hazardous substances.: Nitric acid, 70%;

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R26- Very toxic by inhalation. R35- Causes severe burns.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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OPERATION CONTROL DOCUMENTS

1. Project Information

Name/Location	
Project Number	
Date/Time	

2. Instrument Information

Type	
Brand	
Model	

3. Calibration Details (use one form per instrument per day)

Type	Calibration Gas Value	Measured Result	Correction Factor (CF) Needed?[1] (Yes/No)
Fresh Air	NA		NA
Zero Gas			NA
Span Gas #1:			
Span Gas #2:			
Span Gas #3:			
Span Gas #4:			

4. Monitoring Results

Time	Contaminant	Location	Result	CF (if needed)	Adjusted Result (Result x CF)

Time	Contaminant	Location	Result	CF (if needed)	Adjusted Result (Result x CF)

5. Completion[2]

Name	
Signature	

6. Notes

1. Correction factors (CF) may be needed for instrumentation where the span gas used is different from the chemical of concern (COC) being evaluated. Many air monitors, such as photoionization detectors (PIDs), are broadband instruments which will respond to all gases which the detector will ionize. Because the instrument will respond differently to the span gas than the COC, a CF can be applied to adjust the reading, producing a result more indicative of actual COC concentrations.

   The CF for a compound is developed under laboratory conditions by the manufacturer and is the ratio of the instrument response to the calibration gas over the instrument response to the COC. Therefore, the true concentration of the COC can be obtained by multiplying the monitor response by the CF. The instrument manufacturer's documentation will provide a list of CFs where applicable.

   Note that some instrumentation is designed to adjust for CFs automatically and produce true readings. Consult instrument documentation to determine if this is a feature of your instrument.

2. Retain completed form in project files.

1. Purpose and Scope

This procedure describes the requirements for prevention of occupational noise-induced hearing loss in those employees working in potentially noisy areas. Implementation of this hearing conservation procedure is required whenever noise exposures equal or exceed an 8-hour time-weighted average (TWA) of 85 decibels (dB).

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correct any deficiencies in the implementation of this procedure as identified by the Division Health and Safety (H&S) Leader or other staff member.

Project Manager: Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure;
- Stop work where deviations from this procedure are observed; and
- Correct, in conjunction with the PIC and the Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Regional H&S Director: Responsible for the development and implementation of this procedure.

Division H&S Leader: Responsible for the following elements:

- Evaluate implementation of this procedure during health and safety plan reviews and project audits; and
- Communicate identified deficiencies to the PIC.

Employee: Responsible for the use of provided hearing protection in all designated areas.

3. Definitions

- **Decibel (dB):** A unit used to measure the intensity of a sound by comparing it with a given level on a logarithmic scale.
- **Hertz (Hz):** A unit of frequency equal to one cycle per second.

- **High noise area:** A work area in which employee noise exposures equal or exceed 85 dB (decibels) averaged over an eight hour workday.
- **Standard threshold shift (STS):** A change in hearing threshold relative to a baseline audiogram of an average 10 dB or more at 2000, 3000, and 4000 Hz in one or both ears.

4. Procedure

4.1 Noise Monitoring

Noise monitoring to characterize potential noise exposure will be conducted wither by a subject matter expert familiar with noise monitoring or a Field Safety Officer (FSO) that has received training in conducting noise monitoring. Both personal monitoring using noise dosimeters and area monitoring using a sound level meter may be conducted. Noise monitoring will be repeated whoever a change in production, process equipment, or controls occurs which could affect the number of employees exposed or render the attenuation of hearing protector no longer effective.

4.2 Employee Notification

All employees participating in personal noise monitoring will be notified of their results. Any employee whose exposure is determined to have met or exceeded 85 dB as an 8-hour TWA will be notified in writing within 15 calendar days. The results of area noise surveys will be communicated to project team members during daily site safety meetings.

4.3 Observation of Monitoring

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted which impacts their job or position.

4.4 Audiometric Testing

ERM employees who are exposed to noise at or above 85 dB as an 8-hour TWA within the working environment will receive a baseline audiogram within six months of the first exposure. Annually after obtaining the baseline audiogram, the employee shall receive a new audiogram for comparison to the baseline.

In preparation for both baseline and annual examinations, employees will be instructed to avoid noisy environments at both work and home for at least 14 hours before audiometric testing. Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hours without exposure to workplace noise.

Each employee's annual audiogram will be compared to the baseline audiogram. If the results of the annual audiogram indicate a standard threshold shift (STS), an average change in hearing threshold of 10 dB or more at the 2000, 3000, and 4000 Hz frequency in either ear relative to the baseline audiogram, the following actions will be taken (unless the shift is determined to be non-occupational in nature):

- The employee will be notified with 21 days of the determination;
- The employee shall be referred for additional medical follow-up, as appropriate;
- Employees using hearing protectors will be refitted and retrained in their use;
- Where necessary, hearing protectors with greater noise attenuation properties will be offered; and
- Employees not using hearing protectors will be fitted with such, trained int heir care and use, and required to use them.

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted. These tests are conducted at no cost to the employee. Results of audiograms and employee physicals will be forwarded directly to each employee within 10 working days of receipt of results.

4.5 Hearing Protectors and Hearing Protector Attenuation

A variety of hearing protectors will be provided to the employees at no cost. Hearing protectors will be maintained in good condition. Employees will wear hearing protectors in all designated high noise areas while performing tasks that generate loud noises (e.g., use of portable power tools) and while working within 25 feet of noisy operations (e.g., drilling).

The adequacy of the hearing protector will be evaluated to ensure that the hearing protector attenuates the employee exposure to an 8-hour TWA of 85 dB or less. The FSO is responsible for making this determination.

4.6 Training

Hazard recognition and general awareness training on hearing conservation is provided to all ERM employees during the new hire orientation process which occurs during the first week of employment. Recognition of completion of this training is provided in ERM's Academy Learning Management System (LMS). A certificate of training is available to all employees. The training will contain at least the following elements:

- Effects of noise on hearing;
- Purpose of hearing protectors and manufacturer's instructions on use and fitting;
- Advantages/disadvantages and attenuation of various types of hearing protectors;
- Instructions on selection, fitting, use, and care of hearing protectors (in accordance with manufacturer instructions); and

- Purpose of audiometric testing program including an explanation of the test procedure.

4.7 Recordkeeping

Audiometric testing records will be maintained for each affected employee and contain the following information:

- Name and job classification;
- Date of audiogram;
- Name of person conducting audiogram;
- Date of last acoustic or exhaustive calibration of audiometer; and
- Employee's most recent noise exposure assessment.

Records of audiometric testing will be maintained by ERM's medical consultant WorkCare. All audiometric testing records shall be maintained for the duration of employment plus thirty years. All noise monitoring records shall be maintained for the duration of employment.

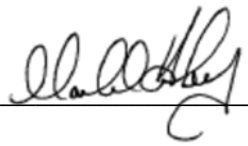
5. References

- US Occupational Safety and Health Administration (OSHA) regulations – 29 CFR 1910.95; *Occupational noise exposure*

Document Control Information

Original Effective Date: 3/17/14

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	3/20/14
All	Reformatted document. Minor language changes for clarity.	6/24/15

1. Purpose and Scope

This document supports the Management System and establishes the procedures to ensure that safety events are being properly reported and investigated within ERM operations. This document applies to all ERM field and office locations.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Division Health, Safety Security, and Environment (HSSE) Leader.

Project Manager (PM)/Supervisor/Branch Manager (BM): Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure; and
- Correcting, in conjunction with the PIC and the Division HSSE Leader, any observed deficiencies in the implementation of this procedure.

Division HSSE Leader: Responsible for the following elements:

- Evaluating implementation of this procedure by Division personnel during ECS reviews; and
- Communicating identified deficiencies to the PIC and Divisional management teams.

Employee: Responsible for the following elements:

- Completing ECS entries within 24 hours of a safety event; and
- Participating in the investigation of the event as directed by the ERM management and health and safety (H&S) teams.

3. Definitions

Event Communication System (ECS): The primary tool utilized at ERM for communicating the occurrence of safety events.

Event Principals: People who may be involved in safety events, including ERM employees, subcontractors, and third parties (including clients).

5 Why: A question-asking technique used to explore the cause and effect relationship underlying a problem or event.

Incident: One of the following:

- An employee becomes injured or is made ill;
- Useful property is damaged in some fashion;
- A hazardous material is spilled or released to air, water, or ground;
- Operational security is breached;
- A regulatory citation is issued; or
- A loss of reputation to clients or the general public is sustained.

Near Miss: An unplanned event that did not result in an incident, but had the potential to do so.

Reporting Person: The ERM employee entering the Safety Event into the ECS.

Root Cause Analysis: A method of problem solving that tries to identify the root causes of an issue. A root cause is one that, once removed, would have prevented the final undesirable event from occurring.

Safe Behavior: A positive action or attitude toward safety or that promoted safety within the workplace.

Safety Event: An incident, near miss, unsafe act/condition, or safe behavior occurring within or due to the working environment experienced by ERM personnel.

Unsafe Act: A task or activity conducted in a manner that may threaten the health and safety of co-workers.

Unsafe Condition: A condition in the work environment likely to lead an incident if not corrected.

Workcare: The occupational health consulting firm which assists ERM in management of its medical surveillance programs.

Working Environment: Anywhere ERM, its employees, and its subcontractors are engaged in work activity, including ERM offices, client sites (visits, meetings, field work, etc.), or during travel.

4. Procedure

4.1 Safety Event Initial Response

4.1.1 Injuries or Illnesses

The general steps for responding to an injury or illness incident include the following:

- For emergency situations, employees shall call 911. This would include chest pains, stroke, severe shortness of breath, sudden and severe pain, major injury (including potential fractures and trauma), uncontrolled bleeding, electrocution, second or third degree burns, or unconsciousness. If transport to an urgent care center or hospital is required, a second ERM employee must accompany or follow the injured or ill employee to the medical treatment center.
- For non-emergency situations, employees shall give necessary first aid care for the employee (if qualified to do so) and secure the scene.
- After stabilizing the scene and ensuring appropriate initial treatment is provided to the employee, contact the PM/Supervisor, who will then contact the BM and/or PIC, as well as the local and/or Division H&S team, to report the event.
- Immediately after contacting the ERM management and H&S personnel, an ERM representative shall call ERM's medical service provider (Workcare) to initiate the Incident Intervention process if follow-up medical treatment is deemed necessary by the management or health and safety team. The phone number is 888-449-7787.
- Within 24 hour, ERM employees shall enter the basic details of the event into the ECS.

Note that the above direction may change based on site-specific circumstances or client-specific requirements. Emergency response elements, including contact information and directions to urgent care facilities, will be included in the project health and safety plan (HASP) as well as the Emergency Action Plan (EAP) within each office.

In the event of a fatality or the hospitalization of three or more ERM employees from a single incident, ERM's management team with the assistance of the Regional H&S Director is responsible for notifying the Occupational Safety and Health Administration (OSHA) within eight hours of the incident.

4.1.2 Non-injury Incidents and Near Misses

After the occurrence of a work related non-injury incident (property damage, environmental release, etc.), work will be halted, the scene will be secured, and initial facts gathered regarding the event. Work should not continue until the causes of the incident or near miss are understood and corrected. Within 24 hours, ERM employees must enter the basic details of the event into the ECS.

4.1.3 Unsafe Acts and Conditions/Safe Behaviors

When a work related unsafe act or condition is identified, work will be halted until the act or condition is addressed and corrected. Similarly, when safe behaviors are identified, the employee(s) involved should be commended for their safe performance. Within 24 hours of the observation, ERM employees must enter the basic details of these events into the ECS.

4.2 Safety Event Follow-up

4.2.1 ECS Information Routing

After the basic details of a safety event are entered into the ECS by the employee or designated reporting person, the system will automatically notify appropriate parties. All individuals receiving automatic notification are included on the communication chain for the safety event's ECS record. Automatic notifications per Event Type are summarized in Appendix 1.

Any ERM employee may be added to the communication chain for an ECS record as an additional affected party.

4.2.2 Initiating and Conducting Follow-up

ERM assigns and tracks corrective actions for all safety events. The required detail of the follow-up and the personnel involved is based on the Event Type and its actual or potential severity, as judged by the project and/or safety team. The ECS record created by entering the Safety Event is meant to both guide follow-up and document the findings of the investigation.

At the option of ERM's safety and/or management team, or as required by actual or potential severity of the event, a more robust follow-up may be required, including root cause analysis.

Within 24 hours of the initial communication of the Safety Event into ECS, a member of the BU safety team will contact the Reporting Person to gather initial facts and begin the investigation. The safety team will be responsible for:

- Stewarding the completion of the investigation with the persons involved in the Safety Event; and
- Verifying that all assigned corrective actions have been completed.

4.2.3 Determining Recordability

If the Safety Event is an occupational illness or injury, then the Regional H&S Director will confer with ERM's Global H&S Director to determine recordability of the Safety Event. This will include a calculation of lost work days and/or restricted duty/job transfer time. These determinations will be made based on the established facts of the Safety Event and according to US recordkeeping criteria established by the OSHA. Collected data on events meeting OSHA's recordability definition will be summarized on OSHA Forms 300 and 300A and will be maintained as required by OSHA recordkeeping and reporting requirements.

4.2.4 Root Cause Analysis

A root cause analysis (RCA) will be performed for all recordable incidents and high value learning events as determined by the client, ERM management and/or the Regional H&S Director.

The RCA process should begin no less than two business days after all immediate response measures have been taken and the situation is under control. The default ERM RCA methodology in the "5 Why" technique, but ERM reserves the right to substitute other valid methods as deemed appropriate by management or the Regional H&S Director.

The first step in the process is to assemble the RCA team. The team shall be led by the PIC and facilitated by a member of the ERM safety team or another ERM employee trained in RCA methods. Other team members may include:

- The PM of the project;
- The BM (if the Safety Event was based in the office);
- The person directly involved in the event;
- Other employees familiar with the activities during which the event occurred;
- Subcontractor representatives (if a subcontractor was involved); and
- A senior ERM Partner not involved in the event (e.g., Practice Leader or BU Managing Partner).

The RCA team leader will facilitate the implementation of the process, which may include:

- Interviews and fact gathering;
- Casual factor determination;
- Root cause identification using the "5 Why" method; and
- Corrective action recommendation.

Target deadlines for completing an RCA are as follows:

- Conduct interviews within five working days after the event;
- Distribute draft RCA report to the RCA team for review within 10 working days after the event; and
- Issue the final RCA report, including photos and an RCA flowchart, within 15 working days after the event.

The final RCA report will be uploaded to the ECS record after the event. Adopted corrective actions will be tracked to completion in the ECS. All corrective actions must be completed within 30 days of the issuance of the RCA report. If additional time is needed to complete a corrective action, the Regional H&S Director must be notified.

4.2.5 Approval and Record Finalization

When the corrective actions are verified as complete, the following individuals will indicate their approval of the event:

- For incidents, the applicable Business Unit (BU) H&S Leader, the BU Managing Partner (MP), and the Regional H&S Director.
- For all other safety events, the BU H&S Leader.

After all approvals are made, the BU H&S Leader will initiate the finalization check within ECS to save and close the record. Future changes are locked out are event finalization.

4.3 Additional Procedures for Mine-Related Safety Events

For ERM projects covered by the regulatory statues of the Mine Safety and Health Administration (MSHA), additional recordkeeping is required when specific safety events occur. Safety events meeting one or more of the following criteria must be reported to both the mine operator and MSHA immediately (i.e., no later than 15 minutes after occurrence):

- Death of an ERM employee;
- Injury to an ERM employee at the mine that had the reasonable potential to cause death;
- Entrapment of an ERM employee for more than 30 minutes or which had the reasonable potential to cause death;
- An unplanned inundation of a mine by liquid or gas;
- An unplanned ignition or explosion of gas or dust;
- In underground mines, an unplanned fire not extinguished within 10 minutes of discovery;
- In surface mines, an unplanned fire not extinguished within 30 minutes of discovery;
- An unplanned ignition or explosion of a blasting agent or explosive;
- An unplanned roof fall at or above the anchorage zone in active workings that impair ventilation or impede passage;
- A coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour;
- An unstable condition at an impoundment, refusal pile, or culm bank which requires emergency action to prevent failure, or which cause individuals to evacuate an area, or failure of an impoundment, refuse pile, or culm bank;
- Damage to hoisting equipment in a shaft or slope which endangers an individual or which interferes with use of the equipment for more than 30 minutes, and
- An event at a mine which causes death or bodily injury to an ERM employee not at the mine when the event occurs.

Within 10 days of occurrence, ERM must submit a report of any work-related incidents to MSHA using MSHA Form 7000-1. Additionally, each calendar quarter, ERM must submit employment information to MSHA utilizing MSHA Form 7000-2. The form must be completed and submitted to MSHA no later than 15 days after the end of each calendar quarter.

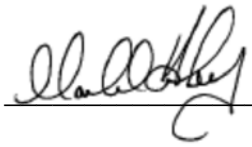
5. References

- Occupational Safety and Health Administration (OSHA) 29 CFR 1904, *"Recording and Reporting Occupational Injuries and Illnesses"*
- Mine Safety and Health Administration (MSHA) 30 CFR 50, *"Notification, Investigation, Reports, and Records of Accidents, Injuries, Illnesses, Employment, and Coal Production in Mines"*

Document Control Information

Original Effective Date: 10/17/14

Policy Approval by: Mark Hickey

Approval Signature: 

Appendix 1: ECS E-mail Notification Matrix

Appendix 2: Event Severity Matrix

Revision History

Section	Reason for Revision	Date
All	Revised and edited to meet new Global SMS requirements and update procedures	10/17/14

1. Project Information

Name/Location	
Project Number	
Date	

2. Instrument Information

Type (check)	Active (pump)		Passive (OVM)		Noise dosimeter	
Brand						
Model						

3. Sample Location Information

Type (check)	Personal		Area	
Facility Name				
Work Area				
Name/ID Number of Employee Sampled				
Named of Employee Collecting Sample				

4. Calibration Information

Type						
Brand						
Model						
Dosimeter Calibration	Primary standard calibration check?		Yes		No	NA
Pump Calibration	Test #1	Test #2	Test #3	Test #4	Test #5	Average
Pre-calibration						
Post-calibration						
Note: If calibrated flowrates are in units other than liters/minute (lpm), please note so in this area.			Average of pre/post calibration			

5. Sample Collection Information

Sample Number	Start Time	Stop Time	Elapsed Time (minutes)	Sample Air Volume (liters)

6. Field Notes

Describe items such as, but not limited to:

- Was the work day a light, average, or busy day?
- What tasks did the worker perform? Were any of the tasks unusual?
- Were there any upsets or upset conditions during the day? If so, what were they?
- Attach a diagram of the worker's position or workstation. Note wind direction or direction of local dilution ventilation if helpful.
- What PPE ensemble was used?
- What were the environmental conditions (temperature, humidity, wind speed/direction, indoor or outdoor samples, etc.)?

7. Analytical Results

Laboratory Used: _____ Lab Report No.: _____

Analyte	Lab Results	Analyte	Lab Results

ADDITIONAL HEALTH & SAFETY DOCUMENTS

1. Purpose and Scope

This document provides guidance in controlling potential employee exposures to toxic and hazardous substances. The procedure applies to all North American operations where these hazards have been identified.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit Health and Safety Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure;
- Pausing or stopping work where deviations from this procedure are observed; and
- Correcting, in conjunction with the PIC and the Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. Definitions

OSHA regulated substances – A set of chemical substances for which the Occupational Safety and Health Administration (OSHA) has issued individual regulations, specifically outlined in 29 Code of Federal Regulations (CFR) 1910.1001 through 1910.1052. The list of substances includes the following:

- Acrylonitrile
- Asbestos
- Benzene
- Cadmium
- Chromium (VI)
- Coke oven emissions

- Cotton dust
- Ethylene oxide
- Formaldehyde
- Inorganic arsenic
- Lead
- Methylene chloride
- Methylenedianiline
- Vinyl chloride
- 1,2-Dibromo-1,3-chloropropane
- 1,2-Butadiene
- Thirteen carcinogens, including:
  - 4-Nitrobiphenyl
  - alpha-Napthylamine
  - Methyl chloromethyl ether
  - 3,3'-Dichlorobenzidene (and it's salts)
  - bis-Chloromethyl ether
  - beta-Napthylamine
  - Benzidene
  - 4-Aminodiphenyl
  - Ethyeneimine
  - beta-Propiolactone
  - 2-Acetylaminofluorene
  - 4-Dimethylaminoazobenzene
  - N-Nitrosodimethylamine

Certified Industrial Hygienist (CIH) – An individual who has met the minimum requirements for education and experience, and through examination, has demonstrated a level of knowledge and skill in the field of industrial hygiene, as recognized by the American Board of Industrial Hygiene (ABIH).

Competent person – One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Initial exposure assessment – An assessment conducted before or at the initiation of a task to determine expected exposures. The goal of the assessment is to identify task elements which are likely to cause employee exposures to exceed the regulatory limits for a substance and allow time for installation and implementation of the controls necessary to reduce exposures. The bases for an initial exposure assessment are:

- Employee exposure monitoring, if feasible; and

- Observations, information or calculations which indicate the potential for employee exposure. This may include previous monitoring within the workplace, or evidence from historical operations which indicate the potential for exposure based on similar experiences.

4. Procedure

4.1 Identification

Before performing any field work, the project management team should determine if any hazardous chemical substances, with particular emphasis on those substances listed in Section 3 of this procedure, are present in the work area. If any hazardous chemical substances are identified, an exposure assessment should be conducted by a competent person to determine if employees have the potential to be exposed above the action levels and specific time frames identified within substance-specific regulations and/or guidance developed by nationally and internationally recognized organizations (i.e., National Institute for Safety and Health [NIOSH], American Conference of Governmental Industrial Hygienists [ACGIH]). This assessment must be reviewed and approved by a CIH or Business Unit Health and Safety Director. The results of the initial exposure assessment must be included in the project-specific health and safety plan (HASP).

4.2 Control

When the initial exposure assessment identifies the potential for employee exposures above a ceiling limit, action level, permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) as established by either governmental organizations (through regulation) or nationally and internationally recognized organizations (through guidance), the project management team must develop a site-specific compliance program to address all required concerns for that substance.

Completed programs must be included in the project HASP. The compliance program must provide guidance on appropriate protective measures to ensure that no ERM employee is exposed to airborne chemical concentrations above the limits/levels indicated in the previous paragraph.

4.3 Compliance Programs

When compliance programs are required by a specific standard, the following outline shall be utilized unless otherwise directed by the standard:

- Description of the work activities that may expose employees to the substances of concern.
- Number of employees impacted by exposure.
- Tasks employees will be performing which may cause exposure.

- Maintenance practices to be followed for servicing or cleaning equipment used during site tasks, as well as procedures for disposing of any wastes generated.
- Instructions on setting up and using any identified engineering controls (e.g., ventilation, containment, etc.).
- Air monitoring data from initial exposure assessments.
- Schedules for the completion of site activities.
- A description of any arrangements made among contractors on multi-contractor sites to ensure all affected employees are informed of potential exposure.
- The name of the competent person who will serve as the competent person on the site. The competent person will be responsible for performing regular inspections of the work site, including all materials and equipment used during the job.

4.4 Training

All employees with potential exposures to the substances covered by this procedure must receive training prior to any activities that could result in exposure. Training should be performed initially upon any substantial changes in operations or exposure potential and annually as long as the employee is involved in operations involving exposure to the substance.

In general, training should cover the following topics, unless otherwise indicated by a specific regulation:

- Regulated areas, including authorizations and entrance restrictions
- Signs and warnings
- Container content identification
- The nature of the specific hazard
- Operations that could result in exposure
- Personal protective equipment, including respiratory protection requirements
- Hygienic practices
- Decontamination procedures
- Emergency response procedures
- Recognition and evaluation of potential hazardous situations
- Medical surveillance and first aid procedures

5. References

- Occupational Safety and Health Administration (OSHA) – 29 Code of Federal Regulations (CFR) Subpart Z (*Toxic and Hazardous Substances*)
- WorkSafe BC Regulations – Part 05 (*Chemical Agents and Biological Agents*)
- ERM Guideline NAM-1342-GU1 (*Asbestos Awareness*)
- ERM Work Instruction NAM-1345-WI1 (*Lead Exposure Compliance*)
- ERM Work Instruction NAM-1343-WI1 (*Benzene Exposure Control*)

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Original Effective Date: 3/18/15

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	3/18/15
1, 4	Expanded document to include all chemical hazards. Added references to non-governmental organizations with recognized exposure limits.	8/9/16
All	Updated Document Number; revised titles (Section 2); updated section numbering/spacing (all); updated References (Section 5)	1/4/17
4, 5	Removed references to hydrogen sulfide (not on list of regulated chemicals)	2/1/17

1. Purpose and Scope

This document establishes the requirements for vehicular travel while on ERM company business (excluding public transportation). This procedure defines the minimum requirements; more stringent local requirements may be applicable.

2. Roles and Responsibilities

Business Unit (BU) Fleet Manager. Implement written procedures to manage the BU fleet in accordance with this procedure.

BU Managing Partner (MP). Establish driver training programs (as applicable); authorize employees that are permitted to operate a motor vehicle on company business; designate a BU Fleet Manager if the BU has leased or owned vehicles.

Employees. Notify their line manager within one day of suspension or revocation of their driver's license, if an Authorized Driver.

Journey Leader. Complete the JMP, pre-departure checks, and required check-in calls. The Journey Leader shall be identified in the JMP, and is typically the primary driver.

Journey Point of Contact. Receive the JMP identified check-in calls, initiate response plan in JMP if check-in call not received.

Partner in Charge (PIC). Ensure client-related driver training requirements have been communicated to the project team and implemented; approve Project-related Journey Management Plans (JMPs).

3. Definitions

Authorized Driver. ERM employee permitted by the BU MP to operate a motor vehicle while on company business.

Company business: All driving associated with ERM work, with the exception of an employee's standard commute from home to the office.

Defensive Driving: A driving technique that aims to reduce the likelihood of a serious accident by anticipating dangerous situations, despite adverse driving conditions or the mistakes of other drivers. In some locations, this is also known as Alert Driving.

Gross Vehicle Weight Rating (GVWR): Maximum operating weight of a vehicle as specified by the manufacturer.

Hired vehicle: Vehicle provided by a vehicle rental company that includes a driver.

Leased vehicle: A vehicle under a long-term rental agreement between the vehicle rental company and ERM.

Off-road driving: Any driving that does not occur on a permanently maintained road, with the exception of driving that occurs completely within the project site.

Remote driving: Driving in a location where emergency assistance may not be readily available or present (e.g., unpopulated areas on non-major highways), areas with known security concerns, or any other area deemed "remote" by the driver (i.e. driver is uneasy or uninformed about the destination).

Rented vehicle: Vehicle provided by a vehicle rental company that an ERM employee will be driving.

Vehicle used for Field Work: For the purposes of this Procedure, a vehicle is used for field work if the vehicle is driven for intrusive field activities, gauging, sampling, operations and maintenance (O&M), construction, demolition, or any work at remote sites; including motorcycles, motor bikes and all-terrain vehicles (ATVs).

4. Procedure

4.1 Risk Assessment and Planning

All vehicular travel shall be considered as a distinct task in the health and safety planning process, and shall have a Job Hazard Analysis (JHA) completed in accordance with *S1-ERM-002-PR – Project Health and Safety Planning* Procedure. In addition to the JHA, a documented and approved Journey Management Plan (JMP) is mandatory for the following conditions:

- Single day journey in excess of 500 km (310 miles)
- Single day estimated driving duration in excess of 4.5 hours
- Driving in a remote location (including off-road driving)
- Driving in any location/region identified as "High Risk" by Control Risk Group (CRG) and/or Regional H&S Lead

The JMP shall be completed using *S1-ERM-008-FM1*, shall designate a Journey Leader and a Journey Point of Contact, and shall be approved by the PIC (or the Journey Leader's supervisor if the Journey Leader is the PIC or there is no PIC associated with the travel). A copy of the JMP shall be maintained with the traveller and in the Project File.

4.2 Driver Requirements

4.2.1 Minimum Expectations

All Authorized Drivers shall meet the following requirements:

- Hold a valid and current driver license for the class of vehicle to be operated. It is the responsibility of the employee to inform his/her supervisor within the next working day of a driver license suspension or revocation.
- Not use a mobile phone while operating a vehicle (per *ERM Global Policy – Mobile/Cellular Telephone and Personal Digital Assistant (PDA) Use While in a Vehicle*).
- Not be under the influence of alcohol or drugs, or any other substance or medication that could impair their ability to drive (per *ERM Global Policy – Drug and Alcohol Use*).
- Inspect vehicle prior to each use and confirm that there are no obstacles in the vehicles travel path or under the vehicle by completing a 360° walk around the entire vehicle.
- Follow all posted signs and speed limits, all applicable laws and regulations, and any client-specific or site specific vehicle safety policies.
- Not drive a vehicle (including a combination vehicle) with a combined gross vehicle weight rating (GVWR) in excess of 10,001 lbs (4,500 kg) without written authorization from the RCEO and appropriate regulatory licensing.

All Authorized Drivers should consider the following best practices:

- Utilize a "Back-In" or "First Move Forward" practice when parking a vehicle.
- Review weather conditions prior to travel and avoid driving in adverse conditions. Consider the anticipated road conditions and terrain and ensure the vehicle is fit for purpose.
- Obtain written directions prior to travel in an unfamiliar location.
- Be familiar with and comfortable operating the vehicle to be driven.

To avoid fatigued driving, all Drivers must:

- Plan a 15 minute break after every two hours of driving.
- Not drive more than 8 hours/day.

To avoid fatigued driving, all Drivers should:

- Avoid driving between 10 p.m. and 5 a.m.
- Share driving with others, if possible.
- Avoid driving if doing so will result in more than 12 hours of work-related activities (for example, limit driving to 4 hours after an 8 hour field day; limit driving to 6 hours after 6 hours in the office).
- Avoid driving after a flight of six hours or more without appropriate rest.

Project budgeting and trip planning must consider the above. Local regulations may be more stringent.

4.2.2 Authorized Driver Training

It is the responsibility of the PIC to ensure client-related driver training requirements have been communicated to the project team and implemented. All personnel training required by this procedure shall be documented in ERM Academy.

All Authorized Drivers must certify, on an annual basis, that:

- They have read and understand the requirements of this Procedure; and
- They hold a current driver's license valid in the location where they will be driving.

All Authorized Drivers that operate a vehicle in excess of 5000 km/annum (3100 miles/annum) on company business must receive Defensive Driver training. Refresher training shall be provided once every three years.

It is the responsibility of the BU MP to:

- Develop and maintain a means of tracking an Authorized Driver's annual work related driving (note, this is not required if all Authorized Drivers receive defensive driving training regardless of miles driven)
- Establish a defensive driving training process, in consultation with the Regional H&S Lead.

Drivers that perform the following high risk activities must have specific training on safe methods for completing these activities:

- Towing of equipment or a trailer
- Off-road driving
- Driving a vehicle with GVWR greater than 10,001 lbs

4.3 Vehicle Operation

4.3.1 Minimum Requirements

The following minimum requirement shall apply:

- Passengers and drivers are required to wear available passenger restraints (i.e. seatbelts with shoulder harness) while operating or riding in a vehicle.
- The number of passengers carried shall not exceed the seating capacity specified for the vehicle.
- Transporting people in the bed of a pickup truck is prohibited.
- Smoking within a vehicle is prohibited.
- Loose equipment in passenger compartments, in the back of pickup trucks, and on trailers shall be secured before driving.
- Unattended vehicles (even for a short period of time) shall be locked so that all equipment inside them is secured (verify the vehicle is locked before walking away).

Critical documents and equipment should be removed from the vehicle if unattended or locked in the trunk/boot of the vehicle.

A vehicle used for field work shall:

- Be inspected before the first use onsite and then on a weekly basis afterwards. These inspections shall be documented using *S1-ERM-008-FM2 - Vehicle Inspection Checklist*.
- Maintain the minimum safety equipment listed in Section 4.5.

4.3.2 Towing of Trailers or Equipment

No ERM employee shall tow a trailer or equipment without having first received documented training on safe towing methods. The BU MP shall establish a safe towing training process (if required), in consultation with the Regional H&S Lead.

At a minimum, an ERM employee towing a trailer or vehicle shall:

- Refer to and comply with the vehicle owner's manual for safe towing capacity.
- Conduct an equipment inspection prior to use to ensure that weight is distributed evenly and that warning/signal lights are working properly.
- Use a spotter when driving in reverse.

The use of straps or chains for towing purposes is prohibited.

4.3.3 Motorcycles, Motor Bikes and All-terrain Vehicles (ATVs)

At a minimum, the driver of a motorcycle or motor bike on company business shall comply with the following:

- No passengers shall be permitted.
- Driver shall wear a suitable helmet.
- The driver's helmet shall have a face-shield, unless the motorcycle / motor bike is equipped with a windshield.
- Nothing may be carried that is not fully enclosed within a worn backpack or within a permanently installed "saddlebag" or trunk.
- A specific JHA has been completed and approved by the BU MP for the motorcycle / motor bike travel, and no other means of travel is feasible.

ATVs may only be used if a specific JHA has been completed and approved by the BU MP. Three-wheeled ATVs are not permitted for use at any time.

Note that the use of motorcycles, motor bikes, and/or ATVs may be prohibited by certain clients.

4.4 Vehicles

4.4.1 Minimum Expectations for All Vehicles

All vehicles used for company business (including vehicles provided by and/or driven by external vendors, clients, etc.) shall be in safe working order and suitable for the task. In addition, the vehicle used shall have a valid vehicle registration, valid insurance coverage and be current on all road taxes (where applicable) in accordance with the local regulatory requirements. Vehicles shall meet the following minimum expectations:

- Anti-lock braking system (ABS)
- Air bags fitted for driver and passenger side
- Three point lap/diagonal seat belts for front and rear outboard seats and lap belts for all other seats;

The PIC is required to specifically document and justify a variance from the above requirements in the travel JHA.

4.4.2 Rented or Hired Vehicles

When possible, the rental company should be a company with which ERM has negotiated rates and contract terms. When renting a vehicle:

- Proof of inspection must be available to the driver.
- If employees cannot rent from a preferred provider with negotiated contract terms, the employee should purchase the collision damage waiver and personal accident insurance.

When hiring a vehicle and driver, ensure that a means for identifying the car and driver has been established prior to pick-up.

4.4.3 Taxi Cabs and other Point-of-Hire Vehicles

Employees should avoid using taxi cabs without seat belts for all passengers. The employees should encourage the driver to wear their seat belt, not use their mobile devices, and follow all posted speed limits and traffic laws. The use of the Taxi Card (*S1-ERM-008-FM3*) is encouraged.

4.4.4 Personal Vehicle

The use of personal vehicles for driving on ERM business should be avoided. If personal vehicles are used, it is the employees responsibly to ensure that the vehicle has all required licensing and insurance coverage for business use, that all maintenance requirements are met and all safety equipment is available.

4.4.5 Company Owned or Leased Vehicles

For any ERM BU with owned or long-term leased vehicles, it is the BU MP's responsibility to formally designate a BU Fleet Manager. The BU Fleet Manager is responsible for the maintenance, inspection and repair of fleet vehicles, including:

- Vehicles shall receive regular, documented maintenance in accordance with the manufacturer's recommended schedule
- Vehicles shall have appropriate and current insurance coverage and road taxes (where applicable)
- Vehicles shall have the following safety equipment, unless a written waiver is received from the RCEO:
  - Anti-lock braking system (ABS).
  - Air bags fitted for driver and passenger side.
  - Head rests for front seats.
  - High-level third brake light.
  - Functional hazard lights.
  - Laminated glass windscreens/windshields and tempered glass side & rear windows.
  - Mirrors, outboard driver and passenger side and internal rear view mirror.
  - Tires must be fit for purpose, terrain and season (i.e., snow, off-road, all terrain), and in good condition (e.g., with suitable tread depth).
  - Spare tire in new or in relatively good condition, and an operational jack.
  - Three point lap/diagonal seat belts for front and rear outboard seats and lap belts for all other seats.
- Vehicle shall be less than five years old and have fewer than 100,000 miles (160,000 km), unless a written waiver from the RCEO has been obtained.

Each BU that maintains a fleet shall maintain a written BU-specific Fleet Management Procedure that documents routine maintenance/inspection procedures to ensure vehicles are in safe operating conditions and is sufficiently detailed to ensure that these minimum requirements are achieved.

4.5 Minimum Safety Equipment

Vehicles used for field work shall maintain the following safety equipment (note: local regulations may require additional equipment):

- First aid kit.
- Spare tire and jack.
- Warning triangles (reflective) or road flares (flares may not be stored in the passenger compartment of the vehicle).
- Reflecting safety vests for all occupants of the vehicle (these should be stored in the passenger compartment and not in the boot/trunk of the vehicle).

Recommended equipment includes:

- Jumper cables with instructions.
- Torch / flashlight.
- Fire extinguisher
- Camera capabilities (either cell phone, digital, or disposable camera) for incident investigation and documentation.

5. References

- ERM Global Policy – Mobile/Cellular Telephone and Personal Digital Assistant (PDA) Use While in a Vehicle
- ERM Global Policy – Drug and Alcohol Use
- S1-ERM-002-PR – Project Health and Safety Planning Procedure
- S1-ERM-008-FM1 - Journey Management Plan Template
- S1-ERM-008-FM2 – Vehicle Inspection Form
- S1-ERM-008-FM3 – Taxi Card

Document Control Information

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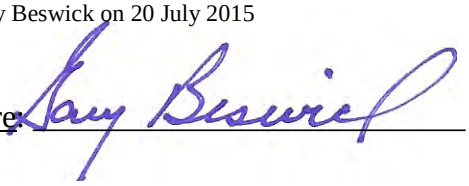
Approved by: Gary Beswick on 20 July 2015

Approval Signature: 

Revision History

Section	Version: Reason for Revision	Date
All	1.0: New document.	29 Dec 2014
4.2.1; 4.4.1; 4.4.5	2.0: Included driver 'best practice' considerations and clarified the requirements around driver fatigue management in Section 4.2.1; clarified that the minimum vehicle expectations apply to all vehicles that an ERM employee is riding in Section 4.4.1; modified the requirements on tire tread depth in Section 4.4.5.	20 July 2015
Header	2.1: Modified date to show correct year.	22 July 2015

1. Lead Exposure Compliance Program

The purpose of this program is to enable compliance with OSHA's Lead Standard (29 CFR 1910.1025 and 1926.62) by:

- Ensuring that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter of air ($\mu g/m^3$) averaged over an eight-hour period.
- Knowing that when respirators are used to limit employee exposure as required by paragraph (c) of Section 1926.62, and all the requirements of paragraphs (e)(1) and (f) of Section 1926.62 have been met, employee exposure may be considered to be at the level provided by the protection factor of the respirator for those periods the respirator is worn. Those periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily time-weighted average (TWA) exposure.

This program applies to all work where one of our employees may be occupationally exposed to lead at levels exceeding established exposure limits and/or action levels for more than 30 consecutive days per year.

2. Exposure Assessment

2.1 Protection of Employees during Exposure Assessment

When tasks are presumed to generate lead exposures greater than the permissible exposure limit (PEL) of 50 $\mu g/m^3$ averaged over an eight hour period, we treat affected employees as if they were exposed above the PEL and implement procedures to protect workers until we perform an employee exposure assessment and document that an employee's lead exposure is not above the PEL.

Our measures to implement employee protective measures during the initial exposure determination include:

- Respiratory protection;
- Proper personal protective clothing and equipment;
- Change areas and hand washing facilities;
- Biological monitoring; and
- Training.

2.2 Initial Determination

We assess each new project through the ERM health and safety plan (HASP) development process to determine if employees may be exposed to lead at or above the action level of 30 µg/m^3 as an 8-hour TWA.

Where employee exposure to inorganic lead may occur above published exposure limits, ERM will perform pre- and post-project biological monitoring for employees working on this project. Additionally, air samples will be collected to determine actual levels of exposure to inorganic lead at the jobsite.

Results of air sample collection will be reviewed by the project Field Safety Officer (FSO). Exposures above the action level of 30 µg/m^3 will prompt the FSO to consult their Division HSSE Leader for direction on work continuance

2.3 Additional Exposure Assessments

If changes in equipment, process, control personnel, or tasks occur after the initial determination, ERM will re-evaluate to determine if employees are exposed to higher concentrations of lead.

2.4 Employee Notification

Within five working days of completing an exposure assessment, we notify each employee of his or her assessment results individually in writing. These notifications will be placed in the project file along with the HASP.

2.5 Methods of Compliance

ERM's lead exposure control program is implemented when employee exposure exceeds the permissible exposure limit (PEL). This program is our written strategy for protecting ERM employees from lead exposure, and incorporates all relevant information that relates to this goal, so that we determine whether we appropriately analyzed problems and solutions (including alternatives) relating to lead exposure.

This program is intended to reduce employee exposure to at or below the PEL. When all feasible engineering and work practice controls that can be instituted are not sufficient to reduce employee exposure to acceptable levels, appropriate respiratory protection will be provided to supplement such controls.

The job site, materials, and equipment are regularly inspected. ERM reviews this program regularly to revise it as necessary. Activities which may cause lead exposures are listed in the project-specific HASP. Methods to reduce and maintain employee exposures to lead at or below the PEL, including engineering and work practice controls, will be identified in the HASP and the task-specific Job Hazard Analysis (JHA).

Work practice programs such as the use of personal protective equipment, appropriate housekeeping, and establishment of hygienic facilities and practices are required by OSHA. Where required by site activities, these programs will be developed and included in the HASP for this project.

When ERM's work with lead may potentially lead to exposure to contractors or other employers in the area, we will develop communication tools to fully inform these employers of the potential exposure to lead and establish cooperative efforts to control exposure. These tools will be defined in the project HASP.

As an employer we want to keep our employees fully informed of all aspects of this plan. The Project Manager, FSO, or ERM safety representative will make frequent and regular inspections of this jobsite, materials, and equipment, and ensure a copy of our project-specific HASP and all associated JHAs is available at this worksite. We will review and update our written plan at least annually to reflect the current status of the program.

3. Respiratory Protection

During our exposure assessment to document that our employees are not exposed above the PEL, we treat employees performing certain operations as if they were exposed above the PEL. During this period, we will provide our employees with appropriate respiratory protection. Use of respiratory protection will be in compliance with S3-NAM-026-PR (*Respiratory Protection*), as well as applicable regulatory requirements. The HASP will contain any additional information regarding respiratory protection.

4. Protective Work Clothing and Equipment

ERM provides PPE as interim protection for employees during exposure assessment, since our employees may be exposed to lead above the PEL without regard to the use of respirators or to lead compounds which may cause skin or eye irritation. Practices regarding PPE use are contained in the HASP for this project. ERM provides protective clothing and equipment at no cost to our employees.

Work conditions with lead exposures over 200 $\mu g/m^3$ as an 8-hour TWA without regard to use of a respirator require replacement of protective clothing each day. Daily inspection of PPE and respiratory protection will be conducted. Any equipment found to be damaged or in non-working order will be replaced. Impaired equipment shall not be used.

5. Housekeeping

ERM believes that a rigorous housekeeping program is necessary in jobs where there is lead exposure or the potential of lead exposure to keep airborne lead levels below permissible levels.

This will require a regular housekeeping schedule adapted to exposure conditions on site. This schedule shall be identified in the project-specific HASP as well as associated JHAs.

6. Hygiene Facilities and Practices

ERM will provide appropriate hygienic facilities for our workers and assure they follow good hygiene practices. ERM prohibits smoking, eating, applying cosmetics, and the presence of tobacco products, food, beverage, or cosmetics in all work areas where employees are exposed to lead above the PEL.

7. Medical Surveillance

ERM supports the practices necessary for early detection of lead exposure. The medical surveillance program supplements the primary goals of this guideline of preventing disease through elimination or reduction of airborne concentrations of lead and sources of ingestion. The medical surveillance provisions incorporate both initial and ongoing medical surveillance.

ERM provides initial medical surveillance to employees who are occupationally exposed to airborne lead levels at or above the PEL. This monitoring consists of sampling blood and analyzing it for lead and zinc protoporphyrin levels. The frequency of biological monitoring is determined by ERM's occupational physician WorkCare. WorkCare also arranges laboratories meeting OSHA requirements to analyze blood lead samples.

8. Employee Information and Training

Employees can do much to protect themselves from the risks of occupational lead exposure if they know about them. ERM training programs inform employees of the specific hazards associated with their work environment, protective measures that can be taken, and their rights under regulatory standards. Awareness training is performed for any ERM employee who may potentially be exposed to inorganic lead during their work on ERM projects. This training covers the contents of this exposure control plan as well as pertinent information from regulatory standards.

9. Signs

Because exposure to lead is a serious health hazard, ERM posts signs that warn employees of lead hazards and of the possible need to use respirators and other protective equipment in the area whenever possible. At times, the fact that ERM works mostly on client-owned sites does not make this possible. In these situations, employees are informed of lead hazards through training and the site-specific HASP.

10. Recordkeeping

ERM maintains accurate biological and environmental monitoring records of employee exposures to potentially toxic materials, including lead. These records are kept along with health and safety plans in project-specific files. We allow employees access to their records.

We include the following exposure monitoring records:

- Exposure assessment;
- Medical surveillance results;
- Medical removals;
- Objective data for exemption from requirement for initial monitoring;
- Procedures for making records available, and
- Procedures for transfer of records.

1. Purpose and Scope

This procedure describes the requirements for prevention of occupational noise-induced hearing loss in those employees working in potentially noisy areas. Implementation of this hearing conservation procedure is required whenever noise exposures equal or exceed an 8-hour time-weighted average (TWA) of 85 decibels (dB). It is ERM policy that its employees will not be exposed to noise that exceeds 85 dB averaged over an 8-hour work day.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correct any deficiencies in the implementation of this procedure as identified by the Division Health and Safety (H&S) Leader or other staff member.

Project Manager: Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure;
- Stop work where deviations from this procedure are observed; and
- Correct, in conjunction with the PIC and the Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Regional H&S Director: Responsible for the development and implementation of this procedure.

Division H&S Leader: Responsible for the following elements:

- Evaluate implementation of this procedure during health and safety plan reviews and project audits; and
- Communicate identified deficiencies to the PIC.

Employee: Responsible for the use of provided hearing protection in all designated areas.

3. Definitions

- **Decibel (dB):** A unit used to measure the intensity of a sound by comparing it with a given level on a logarithmic scale.
- **Hertz (Hz):** A unit of frequency equal to one cycle per second.

- **High noise area:** A work area in which employee noise exposures equal or exceed 85 dB (decibels) averaged over an eight hour workday.
- **Standard threshold shift (STS):** A change in hearing threshold relative to a baseline audiogram of an average 10 dB or more at 2000, 3000, and 4000 Hz in one or both ears.

4. Procedure

4.1 Noise Monitoring

Noise monitoring to characterize potential noise exposure will be conducted wither by a subject matter expert familiar with noise monitoring or a Field Safety Officer (FSO) that has received training in conducting noise monitoring. Both personal monitoring using noise dosimeters and area monitoring using a sound level meter may be conducted. Noise monitoring will be repeated whoever a change in production, process equipment, or controls occurs which could affect the number of employees exposed or render the attenuation of hearing protector no longer effective.

4.2 Employee Notification

All employees participating in personal noise monitoring will be notified of their results. Any employee whose exposure is determined to have met or exceeded 85 dB as an 8-hour TWA will be notified in writing within 15 calendar days. The results of area noise surveys will be communicated to project team members during daily site safety meetings.

4.3 Observation of Monitoring

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted which impacts their job or position.

4.4 Audiometric Testing

ERM employees who are exposed to noise at or above 85 dB as an 8-hour TWA within the working environment will receive a baseline audiogram within six months of the first exposure. Annually after obtaining the baseline audiogram, the employee shall receive a new audiogram for comparison to the baseline.

In preparation for both baseline and annual examinations, employees will be instructed to avoid noisy environments at both work and home for at least 14 hours before audiometric testing. Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hours without exposure to workplace noise.

Each employee's annual audiogram will be compared to the baseline audiogram. If the results of the annual audiogram indicate a standard threshold shift (STS), an average change in hearing threshold of 10 dB or more at the 2000, 3000, and 4000 Hz frequency in either ear relative to the baseline audiogram, the following actions will be taken (unless the shift is determined to be non-occupational in nature):

- The employee will be notified in writing with 21 days of the determination;
- The employee shall be referred for additional medical follow-up, as appropriate;
- Employees using hearing protectors will be refitted and retrained in their use;
- Where necessary, hearing protectors with greater noise attenuation properties will be offered; and
- Employees not using hearing protectors will be fitted with such, trained in their care and use, and required to use them.

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted. These tests are conducted at no cost to the employee. Results of audiograms and employee physicals will be forwarded directly to each employee within 10 working days of receipt of results.

4.5 Hearing Protectors and Hearing Protector Attenuation

A variety of hearing protectors will be provided to the employees at no cost. Hearing protectors will be maintained in good condition. Employees will wear hearing protectors in all designated high noise areas while performing tasks that generate loud noises (e.g., use of portable power tools) and while working within 25 feet of noisy operations (e.g., drilling).

The adequacy of the hearing protector will be evaluated to ensure that the hearing protector attenuates the employee exposure to an 8-hour TWA of 85 dB or less. The FSO is responsible for making this determination.

4.6 Training

Hazard recognition and general awareness training on hearing conservation is provided to all ERM employees during the new hire orientation process which occurs during the first week of employment. Recognition of completion of this training is provided in ERM's Academy Learning Management System (LMS). A certificate of training is available to all employees.

Where employees are required to work regularly in areas where their exposure to noise is determined to be, or has the potential to be, in excess of 85 dBA as an 8–hour TWA, additional annual training will provide. The training will contain at least the following elements:

- Effects of noise on hearing;
- Purpose of hearing protectors and manufacturer's instructions on use and fitting;

- Advantages/disadvantages and attenuation of various types of hearing protectors;
- Instructions on selection, fitting, use, and care of hearing protectors (in accordance with manufacturer instructions);
- Purpose of audiometric testing program including an explanation of the test procedure; and
- Changes in ERM work processes and/or personal protective equipment (PPE) used.

4.7 Recordkeeping

Audiometric testing records will be maintained for each affected employee and contain the following information:

- Name and job classification;
- Date of audiogram;
- Name of person conducting audiogram;
- Date of last acoustic or exhaustive calibration of audiometer; and
- Employee's most recent noise exposure assessment.

Records of audiometric testing will be maintained by ERM's medical consultant WorkCare. All audiometric testing records shall be maintained for the duration of employment plus thirty years. All noise monitoring records shall be maintained for the duration of employment.

5. References

- US Occupational Safety and Health Administration (OSHA) regulations – 29 CFR 1910.95; *Occupational Noise Exposure*

Document Control Information

Original Effective Date: 3/17/14

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	3/17/14
All	Reformatted document. Minor language changes for clarity.	6/24/15
1.0	Added line clarifying that ERM employees will not be exposed to noise levels in excess of 85 dB averaged over an 8-hour day.	12/15/15
4.6	Updated training requirements	8/3/16

1. Purpose and Scope

This document establishes procedures for the protection of personnel who may be working within 25 feet (7.6 meters) of an active railway. The procedure applies to railway operations in the US where these hazards have been identified.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Division Safety Leader.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure;
- Pausing or stopping work where deviations from this procedure are observed; and
- Correcting, in conjunction with the PIC and the Division Safety Leader, any observed deficiencies in the implementation of this procedure.

Division Safety Leader: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. Definitions

Blue Signal Protection: The meeting of all required elements to protect employees when working on, under or between rolling equipment.

Federal Railroad Administration (FRA): One of 10 agencies within the US Department of Transportation (DOT), the FRA's mission is to enable the safe, reliable, and efficient movement of people and goods along railways.

Red Zone: The area within an arms-length of the track or any physical position which places the employee in a life-threatening situation

4. Procedure

4.1 General

ERM and ERM contractor employees must comply with the following safety procedures when working around any railroad track:

- Always be on the alert for moving equipment. Workers must always expect movement on any track, at any time, in either direction.
- Cross railways only at designated rail crossings unless otherwise instructed by a Railroad Representative.
- Do not step or walk on the top of the rail, switches, guardrails, or other track components.
- If passing around the ends of standing cars, engines, roadway machines or work equipment, leave a minimum of 20 feet (6 meters) between yourself and the end of the equipment. Never pass under or between pieces of equipment and never place a part of your body near parts or railroad equipment which constitute a pinch-point.
- Avoid walking or standing on a track unless authorized by a Railroad Representative.
- Before stepping over or crossing tracks, look in both directions first.
- Do not sit on, lie under, or cross between cars except as required in the performance of your duties and only when equipment has been protected against movement and authorized by a Railroad Representative.
- Tools or materials should not be left close to the track (within 25 feet/7.6 meters) when trains are passing.

4.2 Working Around Live Tracks (Red Zones)

Prior to beginning work within six feet (1.8 meters) of any live track, approval must be obtained in writing from a Railroad Representative and a job briefing must be conducted with a Railroad Representative. Work conducted on railroad property in the US is governed by FRA Roadway Worker Protection regulations, referenced in 49 CFR 214, Subpart C, which requires protection prior to fouling any track.

The following two rules are critical to Red Zone compliance:

- Alert to train movement: ERM and ERM contractor employees must expect the movement of trains, engines, cars or other moveable equipment at any time, on any track and in either direction.
- Sufficient distance: ERM and ERM contractor employees must maintain a safe distance and must not:

- Cross or step foul of tracks closely in front of or behind moving equipment or close to the end of equipment;
- Go between standing equipment if the opening is less than 100 feet (30 meters); and
- Cross tracks in front of or behind standing equipment unless there is at least 20 feet (6 meters) between the employee and the equipment; and

Employees must use three points of contact when getting on and off locomotives and cars. In locomotive and car repair facilities where equipment has been spotted for repair, and the distance between that equipment or around the end of equipment is less than specified, ERM employees may go between or around the equipment provided that the equipment is under Blue Signal Protection of workmen, and the employee knows that no movement will be made by the equipment.

4.3 Vehicles

Unless otherwise authorized by a Railroad Representative, all unattended equipment must be parked a minimum of 25 feet (7.6 meters) from any track and minimum of 250 feet (75 meters) from any road crossing. Before leaving any equipment unattended, the operator must stop the engine and properly secure the equipment against movement.

4.4 Employee Training

Employees will receive on the job safety briefings related to the content in this program and specific to the project Health and Safety Plan (HASP). When working within 25 feet (7.6 meters) of a track, the FRA's Roadway Worker Protection regulations apply and training is required under 49 CFR 214.343. Training will be conducted prior to the start of each new project. If deviations from this procedure are observed on the project site, refresher training shall be provided to reinforce important rail safety concepts. Documentation of training and qualifications must be carried and readily available by ERM and ERM contractor employees.

4.5 Personal Protective Equipment

The project health and safety plan (HASP) documents employee personal protective equipment (PPE) requirements. The following PPE is considered standard on ERM projects: hard hat, safety glasses, gloves (specific to the task), hearing protection (as needed), safety-toed footwear, and high-visibility vest or other suitable clothing. For more information on appropriate PPE, refer to S3-NAM-021-PR (*Personal Protective Equipment*).

5. References

- ERM Procedure S3-NAM-021-PR (*Personal Protective Equipment*)
- ERM Procedure S3-NAM-029-PR (*Project Health and Safety*)
- 49 CFR 214 – *Railroad Workplace Safety*

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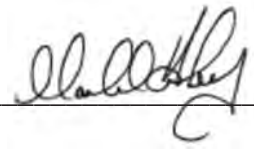
Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	2/4/16

1. Purpose and Scope

This document establishes the procedures to ensure that ERM employees are provided with appropriate medical services as needed. This document applies to all ERM field and office locations.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Division Health and Safety (H&S) Leader.

Project Manager (PM)/Supervisor/Branch Manager (BM): Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure;
- Pausing or stopping work where deviations from this procedure are observed; and
- Correcting, in conjunction with the PIC and the Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Division H&S Leader: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. Definitions

Field Safety Officers: Employees who are responsible for the day-to-day implementation of ERM's health and safety processes on project sites.

Floor Wardens: Employees responsible for monitoring the presence of co-workers and visitors within the immediate seating area or zone of their office, and assisting in the orderly and safe evacuation of those personnel during a building evacuation or emergency.

4. Procedure

4.1 First Aid Services

4.1.1 First Aid Responders

It is the expectation of ERM that our personnel who are qualified as Field Safety Officers (FSO) or who serve as Floor Wardens in our offices be trained and certified to render appropriate first aid, CPR, and be capable of operating an automated external defibrillator (AED). Other ERM employees are not obligated to participate in provided first aid/CPR training; however, if a session is offered staff participation is encouraged to fill any open positions in the training. If a client requires personnel working on their site to be first aid/CPR trained, ERM will ensure that appropriately trained personnel are assigned to such projects.

4.1.2 First Aid Kits

First aid supplies must be maintained and easily accessible at ERM job and office sites. At a minimum, first aid kits should comply with American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) Standard Z308.1-2014. Specifically, first aid kits placed in ERM offices should be ANSI/ISEA Class B, Type 1 kits (use in stationary indoor settings) and should contain the following items:

- Adhesive bandages, 1” x 3” (50 total)
- Adhesive tape, 2.5 yards each (2 total)
- Antibiotic applications, 0.5 grams each (25 total)
- Antiseptic applications, 0.5 grams each (50 total)
- Breathing barrier (1 total)
- Burn dressing, 4” x 4” (2 total)
- Burn treatment applications, 0.9 grams each (25 total)
- Cold pack, 4” x 5” (2 total)
- Eye covering (with means of attachment), 2.9 square inches (2 total)
- Eye/skin wash, 4 fluid ounces total
- First aid guide
- Hand sanitizer, 0.9 grams each (10 total)
- Medical exam gloves, 4 pair
- Roller bandage, 2” by 4 yards (2 total)
- Roller bandage, 4” by 4 yards (1 total)
- Scissors (1 total)
- Splint, 4” x 24” (1 total)
- Sterile pads, 3” x 3” minimum (4 total), non-stick
- Tourniquet, 1” width (1 total)
- Trauma pad, 5” x 9” (4 total)

- Triangular bandage, 40” x 40” x 56” (2 total)

First aid kits placed in ERM field vehicles or field trailers should be ANSI/ISEA Class A, Type IV kits (mobile, waterproof, and subject to rougher handling) and should contain the following items:

- Adhesive bandages, 1” x 3” (16 total)
- Adhesive tape, 2.5 yards each (1 total)
- Antibiotic applications, 0.5 grams each (10 total)
- Antiseptic applications, 0.5 grams each (10 total)
- Breathing barrier (1 total)
- Burn dressing, 4” x 4” (1 total)
- Burn treatment applications, 0.9 grams each (10 total)
- Cold pack, 4” x 5” (1 total)
- Eye covering (with means of attachment), 2.9 square inches (2 total)
- Eye/skin wash, 1 fluid ounce total
- First aid guide
- Hand sanitizer, 0.9 grams each (6 total)
- Medical exam gloves, 2 pair
- Roller bandage, 2” by 4 yards (1 total)
- Scissors (1 total)
- Sterile pads, 3” x 3” minimum (2 total), non-stick
- Trauma pad, 5” x 9” (2 total)
- Triangular bandage, 40” x 40” x 56” (1 total)

On project sites, the contents of the kit must be inspected by the FSO prior to the start of the job and at least weekly during the job to ensure that items being used are replaced. Office first aid kits shall be inspected at least monthly.

4.1.3 Emergency Information

On project sites, the PM will identify the mode in which medical services and first aid will be administered in the health and safety plan (HASP). A drive to the hospital to ensure that directions are accurate is recommended. On complicated project sites, an emergency medical services drill may be advised.

In offices, the Branch Manager (BM) will identify the mode in which medical services and first aid will be administered in the local Emergency Action Plan (EAP).

These documents shall include directions and a map to the nearest medical facility, along with emergency telephone numbers. From time to time, emergency medical services drills may be in order to ensure proper response on the part of the responders and ERM staff.

4.1.4 Eyewash/Drench Facilities

At any jobsite where the eyes or body of any employee may be exposed to corrosive or otherwise hazardous chemicals, eyewash and body drench facilities must be available.

4.2 Availability of Medical Services

ERM has retained the services of WorkCare, Inc., a firm specializing in Occupational Medicine, to provide advice on medical issues and to administer physical and medical examinations as required for our medical surveillance program. Medical surveillance programs will be established with input from WorkCare to properly track the health status of ERM staff based upon their exposure risks. The Regional H&S Director should be involved in establishing the examination criteria.

WorkCare additionally provides incident intervention services to our employees (and subcontractors as appropriate) 24 hours per day, 7 days per week, each day of the year.

Whenever first aid is administered by one of our employees, it is expected that WorkCare's Incident Intervention services will also be contacted for guidance.

Automatic external defibrillators are also available in all offices of ERM. WorkCare must be involved anytime an AED is used at ERM. Contact your Division H&S Leader for more information regarding AED use.

ERM H&S staff should also be informed of the need to render first aid or seek additional medical treatment.

4.3 Bloodborne Pathogens Program

4.3.1 Exposure Determination

Due to the nature of ERM's typical office and field activities, it is highly unlikely that incidents involving ERM employees would result in exposure to blood or potentially infectious bodily fluids. Therefore, compliance with 29 CFR 1910.1030, *Bloodborne Pathogens*, is not required. Although a written exposure control plan is not required, the following sections outline basic requirements to be followed if ERM employees voluntarily render first aid/CPR. Exposure determinations, as well as the precautions and work practices discussed below, are without regard to the use of personal protective equipment.

4.3.2 Training and Recordkeeping

ERM periodically offers first aid/CPR training that includes bloodborne pathogens training to employees as part of the overall health and safety program. If a client requires personnel working on their site to be first aid/CPR trained, ERM will ensure that appropriately-trained personnel are assigned to staff such projects.

Training, if needed, will be provided at or before the time of initial assignment and will be repeated annually (i.e., within one year of previous training) for as long as the employee remains in a work environment requiring exposure to bloodborne pathogens. Training records will be maintained in ERM's Academy Learning Management System (LMS). Any records maintained within the Academy LMS are available upon request by employees or their representatives and any government official.

The Medical Recordkeeping Coordinator is responsible for maintaining all medical records. Issues such as, but not limited to, access to medical records, transfer of records and retention of records are addressed in S3-NAM-003-PR (*Access to Exposure and Medical Records*). WorkCare currently serves as the Medical Recordkeeping Coordinator for ERM.

4.3.3 Universal Precautions

If an ERM employee voluntarily renders first aid/CPR, all human blood and bodily fluids will be treated as infectious for bloodborne pathogens.

4.3.4 Engineering Controls, Work Practices, and PPE

Since ERM is a consulting firm, there are no typical operations applicable to bloodborne pathogens requiring engineering controls. However, if conditions warrant (e.g., significant and continued exposure to sharps, site cleanups involving medical or infectious wastes) the use of engineering controls with regard to bloodborne pathogens, appropriate engineering controls will be developed, examined, and maintained or replaced on an annual basis to ensure their effectiveness.

While performing field-based work activities, toilet and hand-washing facilities must be available to employees. Hand-washing facilities will be provided with an appropriate combination of the following:

- Hot and cold running water or tepid running water;
- Soap or an antiseptic hand cleanser;
- Individual hand towels or warm air blowers; and
- Pre-moistened individual wipes.

If an ERM employee voluntarily renders first aid/CPR, the following PPE, supplied by ERM, will be used as appropriate:

- Nitrile surgical-type gloves; and
- CPR mouth guard (where needed).

These are provided to ERM employees in the PPE field bag issued upon their hire. Any blood or other bodily fluid-contaminated materials will be placed in red leak-proof plastic bags for disposal. Bags will be labeled with a biohazard sign and the words "Biohazard" in contrasting colors. Surfaces that have been contaminated with blood or other bodily fluids will be cleaned with a disinfecting product as soon as practical.

4.3.5 Hepatitis B Vaccine

Since it is highly unlikely that incidents involving ERM employees would result in exposure to blood or potentially infectious bodily fluids, a Hepatitis B vaccination program is not typically required for ERM staff. However, if an employee believes that they have come into contact with potentially infectious blood or other bodily fluids while voluntarily rendering first aid/CPR, medical examinations, including Hepatitis B vaccine, will be made available at no charge to the employee.

4.3.6 Access to Written Program

All employees or their representatives and governmental officials may request a copy of any written program by contacting the Division H&S Leader in their respective office.

5. References

- ERM Procedure S3-NAM-003-PR – *Access to Medical and Exposure Records*
- Occupational Safety and Health Administration (OSHA) 29 CFR 1910.151, *"Medical Services and First Aid"*
- OSHA 29 CFR 1910.1030, *"Bloodborne Pathogens"*
- ANSI/ISEA Z308.1-2015, *"Minimum Requirements for Workplace First Aid Kits and Supplies"*

Document Control Information

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Policy Approval by: Philip Platcow on 2/14/14

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	2/14/14
All	Reformatted to meet new Global documentation requirements.	5/28/14
All	Updated first aid kit content lists and references; minor language changes for clarity	7/20/15

1. Purpose and Scope

This procedure describes:

- Contractor health, safety, security, and environmental (HSSE) performance expectations;
- The pre-evaluation process for approval of contractors, their safety programs, and their insurance documents;
- The evaluation of contractor safety performance while working for ERM; and
- The responsibilities of the ERM project team with respect to implementation of this program and oversight of contractor safety.

The procedure applies to all ERM work activities which are contracted to an outside firm, except those specifically excluded elsewhere in this document. This procedure does not apply to third party contractors which may be working on the same site as ERM, but do not have a contractual relationship with ERM.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure a contractor management program is implemented, understood, and followed by employees under their charge and working on their projects;
- Appoint a Project Manager/Supervisor who will manage all aspects of conformance with the procedure;
- Approve and execute contractor agreements for each contractor working on ERM projects/sites and may participate in negotiations, as necessary;
- Assess, in conjunction with the Project Manager/Supervisor, the performance of ERM contractors based on observations and assessments in the field;
- Correct, in conjunction with the Project Manager/Supervisor, any observed deficiencies in the performance of the ERM contractor; and
- Correct any deficiencies in the implementation of the program as identified by the Division HSSE Leader.

Project Manager/Supervisor: Responsible for the following elements:

- Perform observations of contractor work processes to assess whether or not the contractor is operating in accordance with applicable health and safety requirements;

- Verify contractors are approved to provide services to ERM as established by ERM's Global Contractor Management Program.;
- Communicate ERM and client driven HSE requirements to project contractors by providing the standard contractor agreement or a project- or client-specific contractor agreement during project planning or scoping;
- Understand and confirm the competency of ERM contractor staff who will be providing field project support;
- Request required documentation from contractors as defined in any project-specific agreements (i.e., Contractor Health and Safety Plans, Job Hazard Analyses (JHAs), work procedures, etc.);
- Interact with and mentor contractors during the working relationship;
- Evaluate best practices provided by contractor personnel for potential inclusion in project work planning;
- Stop work where deviations from accepted health and safety requirements are observed;
- Correct, in conjunction with the PIC and the Division HSSE Leader, any observed deficiencies in the performance of the contractor;
- Work with the contractor to complete incident investigations and, where needed, root cause evaluations, for incidents and high-value near misses which occur on ERM job sites; and
- Contact ERM Legal in the event of serious or repeated breaches of health and safety requirements and assess whether action is warranted under the contract.

Division HSSE Leader: Responsible for the following elements:

- Evaluate implementation of these policies during health and safety plan reviews and project audits; and
- Communicate identified deficiencies to the PIC.

ERM Staff: Responsible for the following elements:

- Attend and interact with contractors during safety meetings to ensure that the scope of work, risks and precautions are understood by all project participants;
- Raise any concerns of job performance with the project management and contractors as established in the project communications plan, including implementing stop work authority if there is an imminent risk of injury or property damage; and
- Utilize the Event Communication System (ECS) to report any incidents, near misses, unsafe acts and conditions and remarkable safe behaviors observed during work with contractors.

3. Definitions

A contractor is defined as a person or company engaged by ERM for work or services billed to a project, or work or services for ERM in an ERM office. The term "contractor" may include contractors, subcontractors, consultants, sub-consultants, vendors, and suppliers.

Companies that provide a professional service to ERM such as accounting, legal or professional services, travel planning, taxis, etc., or who provide a supply service to ERM offices, such as non-operated equipment rental, coffee vending, food vending, water cooler vending, etc. are not considered contractors under this procedure.

4. Procedure

4.1 Contractor Prequalification and Selection

Contractors desiring to perform work for ERM shall be required to be pre-qualified in accordance with ERM's Global Contractor Management Program. In the USA, Pacific Industrial Contractor Screening (PICS), a third-party service provider, qualifies and maintains updated information about suppliers and contractors based on the requirements of its clients. Contractors will submit a variety of information to PICS, including insurance limits, OSHA logs, safety and training programs, bonding capability, and diversity information. Potential contractors also have to agree to adhere to ERM's policies, including our Anti-Bribery and Corruption (ABC) Policy and Business Conduct and Ethics Agreement, and Subsurface Clearance Program (as applicable).

PICS shall evaluate the information provided by the proposed contractor and compares it to a detailed list of requirements provided by ERM. Information submitted by the contractor must be updated at least annually.

ERM's minimum safety criteria for US firms are as follows:

- No fatalities in the past 5 years;
- A Total Recordable Incidence Rate (TRIR) at or below the industry average for the past 3 years based on North American Industrial Classification System (NAICS) code;
- A Days Away/Restricted/Transfer (DART) rate at or below the industry average for the past 3 years based on NAICS code;
- An Experience Modification Rate (EMR) at or below 1.0 for the past 3 years; and
- No open or unresolved regulatory citations within the past 3 years.

Companies that service ERM offices such as coffee vendors, vending machine companies, water cooler vendors, etc. do not have to be qualified under this procedure. Additionally, retailers providing point-of-sale purchases (e.g., purchase of a tool from Home Depot) do not have to be qualified under this procedure.

Further information on prequalification can be found on the Contractor Prequalification Health and Safety Prequalification Process section of the Americas Health and Safety page on Minerva.

4.2 Contractor Interactions/Expectations

The Project Manager/Supervisor must ensure that the contractor is provided with necessary information to work safely, including, but not limited to:

- ERM contact name and phone number;
- ERM health and safety requirements;
- Client health and safety requirements (including any drug and alcohol policies);
- Site-specific emergency action plans; and
- Safety information from other ERM contractors or third-party contractors at the site.

The Project Manager/Supervisor must ensure that contractor personnel participate in site-related safety meetings, including pre-job meetings, safety orientations, daily tailgate safety meetings, and any job-related safety inspections.

Contractors must conform to all regulatory and policy driven HSSE requirements. Contractors are contractually and legally responsible for providing personnel who are qualified to meet or exceed the expectations of ERM and customer work scopes. Contractor agreements are used to clearly define contractor accountabilities and responsibilities.

Contractors are expected to conform to their internal HSE policies and requirements as well as those of ERM and ERM clients. Where conflicts exist between these policies and requirements, contractors must adhere to the most stringent policy and requirement. Where needed, the contractor should have the capability to develop additional safety procedures or hazard assessments for work that is performed exclusively by their employees and for which they may have superior knowledge.

Contractors will provide, upon request and at the time of proposing services, a description of their HSSE system, as well as resumes, training certificates, course rosters, and other documents confirming contractor employee qualifications and competencies. ERM or our selected pre-qualification vendors may audit these systems and documentation for conformance with defined expectations. Contractors will be provided the opportunity to close any gaps identified during this evaluation and Project Managers/Supervisors will ensure gaps are closed before work begins.

4.3 Assessment of Contractor Performance

The Project Manager/Supervisor should regularly assess the contractor's operations to determine their level of compliance with applicable health and safety requirements. This should also include a review of required health and safety documentation. Assessment can be performed directly by the Project Manager/Supervisor or delegated to appropriate field staff. ERM's Health and Safety Guidance Document #33 (Health and Safety Audits) or equivalent must be used to conduct and document contractor operations.

Where ERM personnel observe safety events (i.e., incidents, near misses, unsafe acts/conditions) related to contractor operations, they should bring the events to the attention of ERM's Project

Manager/Supervisor as well as the contractor management team for immediate resolution. Events should also be posted in ERM's Event Communication System (ECS). Staff shall take the opportunity to also note remarkable safe behaviors to leverage positive activities for continuous improvement in projects.

The Project Manager/Supervisor will evaluate the contractor's performance following completion of the contracted work activities. If a contractor's performance is such that the PIC or the Project Manager/Supervisor feels that they should be barred from further use by ERM, a formal variance should be sent to the Division Managing Director (DMD) providing the reasons for the request. The DMD will make a decision regarding the contractor after consultation with appropriate ERM team members and can decide to change the contractor's approval flag status in ERM's Global Contractor Management System.

5. References

- PICS – www.picsauditing.com/
- ERM PICS Representative – Angela Wittman (awittman@picsauditing.com; 832-547-2710)
- ERM Health and Safety Guidance Document 33 (Health and Safety Audits)
- ERM Master Contractor Selection Flowchart
- ERM Variance Request Flowchart
- ERM Contractor Management Program Frequently Asked Questions (FAQs) Document

Document Control Information

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Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document	3/6/14
All	Revised format to meet new Global SMS requirements	7/3/14
All	Changed "subcontractor" to "contractor" throughout; addressed comments of Regional H&S Director	8/1/14
4.2	Updated to include transmission of client's drug and alcohol policies	5/19/15

1. Purpose and Scope

This document establishes procedures for the protection of personnel working on field projects with the potential for exposure to insect and arachnid bites, including mosquitoes and ticks. The standard applies to all North America operations where these hazards have been identified.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Division Safety Leader.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure;
- Pausing or stopping work where deviations from this procedure are observed; and
- Correcting, in conjunction with the PIC and the Division Safety Leader, any observed deficiencies in the implementation of this procedure.

Division Safety Leader: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. Definitions

Babesiosis: A rare, severe and sometimes fatal tick-borne disease caused by various types of *Babesia*, a microscopic parasite that infects red blood cells. It is transmitted by the bite of an infected *Ixodes* tick (e.g., deer ticks).

DEET: A synonym of N,N-dimethyl-meta-toluamide. It is the most common active ingredient in insect repellents, providing protection against mosquitoes, ticks, fleas, chiggers, and many other biting insects.

Lyme disease: An infectious disease caused by the *Borrelia* bacteria, it is transmitted to humans by the bite of infected *Ixodes* ticks (e.g., deer ticks). Signs of infection may include a red rash

(sometimes seen as a bulls-eye), fever, headache, weariness, joint pains, heart palpitations, and memory loss.

Permethrin: A chemical belonging to the pyrethroid family which is widely used as an insecticide and insect repellent.

Picardin: A synthetic compound resembling the natural compound piperine, found in the plants which are used to produce black pepper. It is used an insect repellent for insects, ticks, and chiggers.

Rocky Mountain spotted fever: An infectious disease caused by the *Rickettsia* bacteria; it is transmitted to humans by the bite of infected *Dermacentor* ticks, a type of hard shelled tick (e.g., dog ticks). Initial signs and symptoms include sudden onset of fever, headache, and muscle pain, followed by development of a substantial rash. The disease is fatal in 3 to 5% of those who contract it.

West Nile virus: A member of the virus family *Flaviviridae* spread by various species of mosquitoes. Most infections (~80%) cause no symptoms. In less than 1% of cases, severe infection occurs which may result in neurological disease affecting the central nervous system, including encephalitis (inflammation of the brain) and meningitis (inflammation of the membranes covering the brain and spinal cord).

Zika virus: A member of the virus family *Flaviviridae* spread by the daytime-active *Aedes* mosquitoes. Zika virus is related to dengue, yellow fever, Japanese encephalitis, and West Nile viruses. It typically causes no or only mild symptoms, although it may spread from a pregnant woman to the baby, potentially resulting in microencephaly and other severe brain problems. Zika infections in adults can result in Guillain-Barre syndrome.

4. Standard

4.1 Hazard Assessment and Project Planning

Prior to the initiation of field work, the project team is required to perform a hazard assessment of the planned scope of work. This is done to identify any hazards that may impact project operations and the safety of ERM staff, as well as to identify the appropriate methods for mitigation. Mosquitos have the potential to transmit the West Nile or Zika Virus and ticks can transmit various tick-borne diseases such as Lyme disease, Rocky Mountain spotted fever, and *Babesiosis*. Therefore, if it is determined that any member of the project field team is likely to be exposed to mosquito or tick prone environments, the following measures must be incorporated in the development of the project health and safety plan (HASP).

4.2 Mitigation Measures

4.2.1 Avoidance Measures

Avoidance of the exposure must be considered as first priority before entering the field. An effort should be made to schedule work to avoid hours of peak mosquito activity, which are during the early morning and evening hours. Additionally, the identification of biting insect habitats such as grasslands, prairies, woodlands, and wetlands should also be identified, communicated to the field staff, and avoided to the extent practical.

The following measures must be implemented while out in the field:

- Avoid sitting on the ground.
- Wear long-sleeved, light colored garments.
- Tuck in shirts and tuck pants into socks or boots.
- Scan clothes, exposed skin, and equipment for ticks frequently. Ticks will climb upward in search of exposed skin, so check frequently.
- Shake off clothing and examine equipment before entering vehicles.
- Check vehicle for ticks. Placing a white or light colored cover over vehicle seats will aid with visual identification of ticks on the seats after the completion of field work.
- Conduct tick checks frequently, on self and on each other. At a minimum this should be done during breaks and before entering vehicles.

The following measures must be implemented when returning home or to the hotel at the end of the day:

- Shower as soon as you return to your room from the field. Showering should take place before doing any other activity.
- Wash and dry clothes in dryer for 20 minutes if possible; and
- Conduct a full body tick check using a mirror. Attached ticks generally climb upward until they reach a protected or creased area, often the back of the knee, groin, navel, armpit, ears, or nape of the neck.

4.2.2 Application of Topical Insect Repellent

While in the field, project team members are required to carry and periodically apply repellent containing DEET or an effective DEET alternative (e.g., Picaridin). Follow the product label application instructions printed on the bottle by the manufacturer.

Application tips and suggestions:

- Apply repellents only to exposed skin or clothing, as directed on the product label. Do not apply repellents under clothing.
- Repellents should be applied to field gear (e.g., backpacks) for additional protection.
- If wearing flame resistant clothing (FRC), make sure the repellent is safe to use with FRC. Some repellents can damage FRC.
- Never use repellents over cuts, wounds, or irritated skin.
- When using sprays, do not spray directly on face—spray on hands first and then apply to face. Do not apply repellents directly to eyes or mouth, and apply sparingly around ears.
- Wash hands after application to avoid accidental exposure to eyes or ingestion.
- Use enough repellent to cover exposed skin and clothing. If biting insects do not respond to applied repellents, apply a second application.
- After returning indoors, wash repellent-treated skin.

Repellant product specific Safety Data Sheets (SDS) should be obtained and kept with the project HASP.

4.2.3 Field Clothing and Pretreatment

In addition to the application of topical repellent, team members working in project environments that present a high risk of staff exposure to biting insects (as determined by the project team) are required to use treated clothing.

The cost of clothing treatment is considered a personal protective equipment expense and should be budgeted by the project team. There are two options for clothing treatment:

- **Factory-Applied Clothing Treatment:** Factory applied insect repellent to apparel has been proven to be the most effective option available to prevent exposure to mosquitos and ticks. There are several clothing brands (including, but not limited to, InsectShield®, ExOfficio®, and Columbia®) that sell garments treated with permethrin that can minimize exposure to biting insects. Costs of these garments vary and can range from $50 to $100 USD for a shirt or pants.

  For untreated garments owned by staff that are more adapted to heavy field use (i.e., jeans, high-vis shirts, or Carhartts®), Insect Shield® offers a service to treat garments with a formulation of permethrin. The garments to be treated are mailed to InsectShield® and returned within a week. The product is United States Environmental Protection Agency (USEPA) registered, which is designed to evaluate a proposed product to ensure it will not have adverse effects on people or the environment. InsectShield® states that the treatment can last up to 70 washes. A "how-to" video, shipping details, and pricing guide can be found on their website (www.insectshield.com). The standard cost to treat clothing is $10 USD per garment. Cost options should be factored into project budgets.

- **Self-Applied Clothing Treatment:** Insect repellent that is applied to field clothing by the employee is also an effective method of bite prevention. Several types of repellents are available on the market that can be applied to clothing in either a spray or a liquid soak method. These products are available from retailers, including but not limited to, Walmart, Bass Pro Shop, and Cabelas.
    - Permethrin Spray – Non-aerosol and aerosol spray treatments can be effective against ticks, chiggers, and mosquitoes. Typically, one bottle contains enough spray to treat up to two outfits. One treatment will last up to six washings or six weeks. Permethrin should never be applied to skin but only to clothing, gear, or other fabrics as directed on the product label.
    - Sawyer Permethrin Soak Treatment - This kit provides the same protection for clothing as the Permethrin spray, but in a soak treatment that is effective for six washings or six weeks. Soak your items in the solution for two hours and hang to dry.

  It is important to note that due to the shorter effective duration for self-applied clothing treatments, an employee-maintained schedule for reapplication of the product should be implemented through the duration of the field season

4.2.4 Employee Reaction to Repellents/Treatments

ERM recommends that the employee "test" repellents and treated clothing prior to field use. If an employee experiences a rash or other reaction, such as itching or swelling, from an insect repellent, the repellent should be washed off with mild soap and water and its use discontinued. If a severe reaction has occurred, WorkCare should be called for further guidance.

4.2.5 Staff Substitutions

ERM will not require staff to use chemically treated clothing or repellents if they have health concerns. However, when the project HASP identifies a reasonable potential for ERM staff to be exposed to biting insects, the PM and PIC are responsible to ensure that field staff are properly equipped, educated, and willing to apply topical insect repellent and utilize pretreated clothing. In the event that an employee is not willing to wear treated clothing, apply insect repellent, or identify an effective alternative to either, then their role in the field effort should be reconsidered by the project management.

For more information regarding bite prevention strategies and clothing treatment options, contact your Division Safety Leader.

5. References

- ERM Procedure S3-NAM-021-PR (*Personal Protective Equipment*)
- ERM Procedure S3-NAM-029-PR (*Project Health and Safety*)

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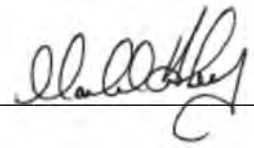
Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	4/29/16

1. Purpose and Scope

This document establishes the procedures for implementing ERM's incident management strategy in the event of an injury or illness. Developing a strong incident management process is an essential part of promptly responding to occupational injuries and illnesses. This document applies to all ERM field and office locations.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure the procedure is implemented, understood, and followed by employees under their charge and working on their projects; and
- Correct deficiencies in the implementation of the procedure as identified by the Division Health, Safety, Security, and Environment (HSSE) Leader.

Project Manager (PM)/Supervisor/Branch Manager (BM): Responsible for the following elements:

- Perform observations of ERM work processes to assess whether or not employees are operating in accordance with the procedure; and
- Correct, in conjunction with the PIC and the Division HSSE Leader, any observed deficiencies in the implementation of the procedure.

Division HSSE Leader: Responsible for the following elements:

- Evaluate implementation of the procedure by Division personnel during ECS reviews; and
- Communicate identified deficiencies to the PIC and Divisional management teams.

Employee: Responsible for the following elements:

- Report work-related injuries/illnesses as soon as possible to their PM/Supervisor/BM;
- Comply with the requirements of the procedure during response to injury/illness events;
- Work with the ERM management, HSSE, and Human Resources (HR) teams to ensure the best outcome for the employee; and
- Notify the ERM management, HSSE, and HR teams of any change in injury/illness status, as well as providing copies of any appropriate paperwork supporting these changes from medical professionals.

3. Definitions

- Work-related injury/illness – An injury or illness that arises out of and in the course of employment.
- Injury – A wound caused by an external force that affects a specific part of function of the body and has an identifiable time and place.
- Illness – Systemic infections, exposure to hazardous materials, repeated stress and strain, and/or other repeated exposures to conditions that result in harm or loss of function, but do not meet the definition of an injury.

4. Procedure

4.1 Pre-Injury Management

4.1.1 Work Site Evaluation

Project sites and offices shall evaluate a location for the potential to cause an injury or illness. This evaluation must consider the following, at a minimum:

- The types of injury or illness that could reasonably occur under given site conditions;
- The location of emergency and non-emergency medical centers;
- The anticipated response time for local emergency services (e.g., ambulance, paramedics, site emergency teams, etc.);
- The presence of hazardous materials or conditions;
- The types of training needed for employees to respond to identified hazards;
- The type of training needed for first aid responders; and
- The type of first aid supplies required for potential response to site hazards.

4.1.2 Risk Assessment

A written Work Activity Risk Assessment (WARN) health and safety plan (HASP) must be prepared for all field projects. The HASP must contain contact information, including maps and phone numbers, for the nearest emergency medical services/hospital location, as well as for potentially needed emergency services (e.g., fire department, police, ambulance) and for Workcare, ERM's medical services provider. Advance contact with ambulance services to ensure they are familiar with location, access routes, and hospital locations is advised in remote or new locations.

An Emergency Action Plan (EAP) must be prepared for all ERM office locations. Since ERM offices are typically located in well-populated urban centers, the location of specific emergency medical services locations are not required to be posted in the EAP; however, emergency contact

information for potentially needed emergency services, building management staff, and Workcare must be provided.

4.1.3 First Aid Services

The availability and application of first aid services, including first aid kits, is discussed in Section 4.1 of ERM H&S Procedure S3-USA-019-PR (***Medical Services***).

4.1.4 First Aid Responders

Expectations regarding the availability of first aid responders in both field and office settings are discussed in Section 4.1.1 of ERM H&S Procedure S3-USA-019-PR (***Medical Services***). Trained first aid responders should be designated in such a fashion that employees know who they are and how to contact them.

4.1.5 Eyewash Facilities

If corrosive materials are used, eyewash and body flush facilities must be provided. Where possible, these should provide large quantities of clean water. The water source must be pressure controlled and clearly identified.

4.2 Post-Injury Management

4.2.1 Transportation

When employees require urgent medical attention as the result of a work-related injury/illness, transportation shall be provided to the urgent care facility via ambulance or similar method (if a critical condition) or ERM vehicle. Employees should not be permitted to drive themselves unless safe to do so.

4.2.2 Treatment of Critical Injury/Illness

In the event of a critical injury or illness, employees must be seen by a medical professional as quickly as possible. For purposes of this procedure, critical injuries shall include, but not be limited to:

- Uncontrolled bleeding or significant blood loss;
- Chest pains;
- Breathing difficulty;
- Known or suspected bone fractures;
- Known or suspected internal injuries;
- Known or suspected overexposure to chemical, biological, or radiological hazards;
- Severe electric shock or electrocution;
- Second, third, or fourth degree thermal, chemical, electrical, or radiation burns;
- Loss of consciousness; or

- Sudden behavioral changes, including confusion, disorientation, or aggression.

In these situations, an ERM employee should always accompany the injured or ill employee to medical care. The accompanying employee should contact Workcare, ERM's medical consultant, as soon as possible to alert them to the injury. Where necessary, Workcare's occupational physicians will provide peer-to-peer interaction with emergency room physicians to ensure appropriate care is provided to our employees. The accompanying employee shall also be responsible for maintaining contact with appropriate ERM management and H&S team members to alert them to issues relating to the injured/ill employee and their condition.

4.2.3 Treatment of Non-critical Injury/Illness

In the event of a non-critical injury or illness, employees must call Workcare's Incident Intervention service (available 24 hours per day, 7 days per week). When contacted, an occupational nurse or physician provides medical advice to the injured or ill employee, which may include a referral to a medical clinic. If referral is required, Workcare's occupational physicians will provide peer-to-peer interaction with medical clinic physicians to ensure the level of care and treatment is appropriate to the symptoms presented. The employee is also responsible for maintaining contact with appropriate ERM management and H&S team members to alert them to issues relating to their condition.

4.2.4 Workers' Compensation

A workers' compensation claim will be filed for each instance where work-related medical treatment is provided to ERM employees. The HR team will be responsible for filing these claims, and will be informed by Workcare whenever a referral to a medical clinic is made for an ERM employee. Additionally, HR staff will:

- Serve as a point of contact for the workers' compensation insurance carrier adjuster; and
- Work with ERM providers to coordinate disability benefits associated with work-related injury/illness.

4.2.5 Return to Work

Employee supervisors, after consultation with the Division HSSE Leader and the HR team, may assign an employee who is recovering from a work-related injury or illness transitional employment during their recovery period, if such employment exists. Transitional employment includes temporary modified, restricted, or light duty work covering the time from the injury/illness until the release to full duty by the doctor. Each case will be evaluated individually.

Application of any transitional employment must be documented in writing and signed by a medical doctor before any action can be taken. The change in status will only be allowed for the period of time designated by the doctor. The employee must continue to comply with all doctor-mandated appointments and treatment during this time. Any changes in duty status as a result of an appointment or treatment visit must be provided to the employee supervisor in writing.

At a minimum, and regardless of the employee's current case status (i.e., lost time, restricted duty, etc.), the employee's supervisor will maintain contact with the employee on a weekly basis

A written work release for full and unrestricted duty from a medical doctor is required before the injured/ill employee may return to their original job duties.

5. References

- ERM H&S Work Instruction S3-USA-037-WI1 (Injury/Illness Management Flow Chart)

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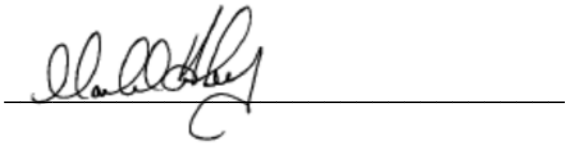
Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	Revised and edited to meet new Global SMS requirements and update procedures	8/5/14
All	Changed “Case Management” to “Injury/Illness Management”.	12/30/14

1. Purpose and Scope

This document provides information on the calibrating and testing of direct-reading portable monitors. These instruments are designed to alert employees to the presence of toxic gases, vapors, and particulates; oxygen-deficient atmospheres; and combustible atmospheres. Examples may include photoionization detectors (PIDs), single gas monitors, multi-gas meters, particulate/handheld aerosol monitors, etc. Inaccuracies in the instrument due to improper maintenance and calibration can lead to hazardous atmospheric conditions which may cause serious injuries, illnesses, or death.

2. Definitions

Calibration – A test measuring an instrument's accuracy relative to a known traceable standard.

Bump test – Qualitative check in which a challenge agent is passed over an instrument's sensors at a concentration and exposure time sufficient to active all alarm settings. The purpose of the bump test is to confirm that the test gas can get to the sensor(s) and that the instrument's alarms are functional. The bump test does not does not provide a measure of the instrument's accuracy.

Response Time – The amount of elapsed time between the exposure of an instrument to the atmosphere and the corresponding display of the final observed value based on conditions at the time of measurement.

Zeroing – A procedure which resets the instrument's reference points. Depending on the instrument, this may require either introduction of a zero air gas (gas containing no or minimal traces of the gas or vapor the instrument is designed to detect) or installation of a zero air filter (a filter designed to remove all particulate from the measured atmosphere).

3. Calibration Procedures

There are two methods for verifying the accuracy of a direct read instrument – a calibration check and a full calibration. Each of these methods is appropriate in certain situations.

The employee should begin by zeroing the instrument. The process of zeroing should be described in the instrument manufacturer's calibration instructions. This helps to ensure that the calibration is accurate.

A calibration check verifies that the sensor(s) and alarms respond within the manufacturer's acceptable limits by exposing the instrument to a test gas. The employee conducting the calibration check compares the instrument reading to the concentrations indicated on the test gas cylinder. If the instrument's response is within the acceptable range of the test gas concentration, then the calibration check has verified the instrument's accuracy. The acceptable range is typically ± 10-20% of the test-gas concentration; however, this range is set by the instrument manufacturer and the manufacturer's guidelines should be reviewed prior to the calibration check.

If the calibration check results are not within the acceptable range, the employee should perform a full calibration. A full calibration adjusts the instrument's reading to coincide with a known concentration (i.e., certified standard) of test gas.

In all cases, employees performing instrument calibration must follow the manufacturer's guidelines for the specific instrument involved. This would include using the type and concentration of test gas, flow regulators, flow tubing, and calibration adapters (if needed) mandated by the manufacturer. It would also include allowing for the appropriate response time for the instrument to reach the values anticipated by the calibration gas.

Note that certain instruments cannot be field calibrated (e.g., handheld aerosol monitors). Follow manufacturer's guidelines for setting up these instruments for field use and performing factory calibrations at required frequencies.

4. Bump Tests

At a minimum, bump tests should be conducted each day prior to use of a calibrated instrument. The bump test may be replaced with a calibration check where warranted. If an instrument fails a bump test, a full calibration should be performed.

5. Additional Information

- Sensor responsiveness may vary with workplace environmental conditions, such as temperature and humidity. Where possible, operators should calibrate sensors in environmental conditions that are similar to the actual workplace conditions. Follow the manufacturer's guidelines for proper calibration.
- Test gas used for calibration gas should always be certified using a standard traceable to the National Institute of Standards and Technology (NIST). The provider of the test gas should be able to provide a certificate of analysis for every cylinder of test gas.
- Calibration test gases may remain stable for only a limited amount of time. Look for an expiration date on any test gas used. Never use a test gas after its expiration date.
- Instruments may experience calibration drift as the sensors age. This means that the sensor can still detect the calibration gas, but may not be able to do so accurately. This problem can be exacerbated by exposure to extreme environmental conditions, elevated concentrations of airborne contaminants, or heavy shock or vibration. It can also occur through harsh storage or operating conditions or gradual degradation of internal components. Frequently, this condition will cause failure messages to appear or will limit the ability of the employee to accurately adjust the sensor readings. If at any time the employee suspects the instrument is experiencing calibration drift, it should be returned for service by qualified personnel.

1. Purpose and Scope

This procedure provides requirements for maintenance and calibration beyond those established in the ERM Global Monitoring and Measurement Procedure (M1-ERM-014-PR). Proper maintenance and calibration of equipment increases measurement confidence and ensures accuracy of the instrument throughout its life cycle. This procedure applies to all North American operations

2. Roles and Responsibilities

BU Managing Partner (BU MP): Ensure each local office has established a register of equipment used for business purposes and has developed a documented maintenance and calibration plan.

BU or Branch Equipment Manager: Establish a documented maintenance and calibration plan; comply with the requirements of M1-ERM-014-PR and this procedure.

Division or BU Health and Safety (H&S) Leader: Evaluate implementation of this procedure during office H&S audits.

3. Definitions

Calibration – A set of operations, which establish, under specified conditions, the relationship between values indicated by a measuring system (i.e., an instrument and the corresponding known value of a standard. There are two types of calibration – operational and periodic.

Calibration standard – A reference used to quantify the relationship between the output of an instrument and the property to be measured.

Maintenance – The act of keeping equipment in proper operating condition.

Operational calibration – Calibration carried out routinely as part of instrument usage. Operational calibration involves initial calibration and verification and continuing calibration checks.

Periodic calibration – Calibration carried out at a frequency set by manufacturers' recommendations or by policy requirements.

4. Procedure

4.1 Identification

In accordance with M1-ERM-014-PR (*Monitoring and Measurement*), an inventory or register must be developed of all equipment owned and maintained by the Business Unit (BU) for purposes of conducting field activities associated with significant environmental aspects, health and safety risk management, and compliance requirements. Registers will be maintained by BU or Branch Equipment Managers and will be reviewed and updated annually at a minimum.

4.2 Maintenance

Equipment Managers shall ensure that a preventive maintenance and inspection schedule is established. Maintenance and inspection schedules shall meet any regulatory or manufacturer-recommended requirements.

Equipment Managers shall ensure that records are kept of any maintenance and inspection activities. If, during the course of use or inspection, a piece of equipment is found to be damaged, defective, or otherwise operating outside the normal parameters as defined by the manufacturer, the equipment must be removed from service immediately and either discarded or withheld from further use until it can be returned to proper working order, either through repair by qualified ERM personnel, return to the manufacturer, or forwarding to a qualified third-party repair company. Damaged or non-functional equipment will be tagged "Do Not Use" (or equivalent) and will be unavailable for field check-out.

4.3 Calibration

Calibration, including operational and periodic calibration, will be performed at intervals indicated by the manufacturer and/or required by sampling procedures or client demands/requests. Periodic calibration records will be maintained by the Equipment Manager; operational calibration records will be maintained as a part of the project health and safety files.

5. References

- ERM Procedure M1-ERM-014-PR (Monitoring and Measurement)
- ERM Guideline S3-NAM-043-GU1 (Calibration and Testing of Direct Reading Portable Air Monitors)

Document Control Information

Original Effective Date: 5/19/15

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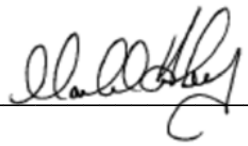
Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	5/19/15
3, 4	Added definitions and references to equipment calibration	5/28/15

1. Purpose and Scope

This document establishes procedures to assist in reducing the potential for ERM employee fatigue by providing criteria for anticipation, recognition, treatment, and management. This document applies to all ERM employees and covers all ERM work activities.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge and working on their projects;
- Ensure, in conjunction with the Project Manager/Supervisor, that employees are properly trained in fatigue management and monitored for fatigue and fatigue-producing factors in their assigned tasks; and
- Correct any deficiencies in the implementation of this program as identified by the Division Health, Safety, Security, and Environment (HSSE) Leader.

Project Manager/Supervisor: Responsible for the following elements:

- Monitor the performance and behavior of the employees they supervise;
- Work with the Division HSSE Leader to develop project-specific fatigue management guidelines for inclusion in site-specific health and safety plans where significant fatigue-producing activities may occur, including work days in excess of 14 hours and work weeks in excess of 60 hours;
- Contact the PIC and the Division HSSE Leader if presented with information that indicates an employee may be fatigued; and
- Keep information related to an employee's medical condition confidential at all times.

Division HSSE Leader: Responsible for the following elements:

- Monitor new employees for completion of appropriate training;
- Review safety observations, near misses, injuries, and incidents that have occurred which may have occurred as a result of fatigue and use as opportunities to revise project-specific fatigue management procedures;
- Work with the Project Manager/Supervisor to develop project specific fatigue management guidelines for inclusion in site-specific health and safety plans where significant fatigue-producing activities may occur, including work days in excess of 14 hours and work weeks in excess of 60 hours; and

- Assist PICs and Project Managers/Supervisors in the implementation of this program, as needed.

Employee: Responsible for the following elements:

- Maintain a safe working environment in accordance with ERM and client-specific polices (as warranted);
- Complete all ERM and client-required initial and annual training to perform their specific work assignments;
- Manage their health in a manner that allows them to perform their work assignments safely;
- Arrive to work fit for duty and ready to complete their work assignments following established safe working practices and procedures and in a safe and effective manner throughout their scheduled work hours;
- Alert their Project Manager/Supervisor if they are not fit for duty or if their fitness for duty deteriorates during the course of their work hours due to fatigue; and
- Notify their Project Manager/Supervisor or appropriate Human Resources (HR) Manager if they observe a co-worker acting in a manner that indicates the coworker may be unfit for duty.

3. Definitions

Fatigue includes mental and/or physical exhaustion which prevents a person from being able to function normally. It is typically caused by a lack of restful sleep, but may also be associated with prolonged periods of physical and/or mental exertion without sufficient time to recover.

Fatigue can be caused by work-related stresses, non-work related stresses, or a combination of both. ERM impacts work-related fatigue, as it determines the type of work, the number of work hours and the number of employees assigned to a task, and the work environment. The employee has control over non-work related fatigue including their health, family responsibilities, and lifestyle.

Fatigue, and the level to which it impacts an employee, is associated with a number of factors. These include:

- The quantity and quality of rest obtained before and after a working day;
- The time of day in which work takes place;
- The amount of time spent in work-related activities;
- The type of work and the environment in which it is performed;

- The physical and mental demands of work;
- Extended travel and travel across time zones;
- Personal activities away from work, such as sports, family commitments, or second jobs;
- Disruption of normal circadian rhythms (daily rhythmic activity cycles);
- Individual factors, including existing medical conditions, illnesses, or sleep disorders; and
- Extreme alcohol intake or sleep deprivation

4. Procedure

4.1 Fatigue Recognition

Employees are expected to carry out their work activities in a manner that does not risk the health and safety of themselves, their fellow employees, or any other personnel on the site (e.g., contractors, clients, the public, etc.). If an employee feels that they are unable to perform their work activities safely due to the effects of fatigue, they are required to stop work immediately and notify their supervisor.

Similarly, if an employee suspects a co-worker (including contractors or clients working with the employee) of suffering from the effects of fatigue, they are required to intervene on behalf of the affected person, stopping work and notifying their supervisor.

Characteristics that may assist in the identification of fatigue may include, but are not limited to:

1. Physical Symptoms
    a. Bloodshot eyes
    b. Poor coordination
    c. Slower movements
    d. Slower than normal response to verbal queries/commands or radio communications
2. Cognitive Function Symptoms
    a. Distraction from task
    b. Poor or lapsed concentration
    c. Inability to complete tasks
    d. Short-term memory loss

e. Nodding off momentarily

f. Fixed gaze

g. Reports of blurred vision

3. Emotional/Behavioral Symptoms

a. Appears depressed

b. Does not care about work

c. Easily frustrated with task/irritability

d. Increased or noticeable level of unexplained or unusual absente

4.2 Fatigue Treatment

Where fatigue has been identified, employees are suggested to take action to treat the underlying causes of the fatigue. Suggestions include:

1. Getting adequate, regular and consistent amounts of sleep each night. A minimum of seven hours is recommended.
2. Eating well-balanced and healthy meals.
3. Ensuring adequate consumption of water throughout the day.
4. Exercising regularly.
5. Maintaining a reasonable work and personal schedule.
6. Avoiding alcohol, smoking, and drugs. Note that stimulants, including caffeine, may provide temporary relief from certain types of fatigue, but can increase the problem when the effect wears off.
7. Changing stressful circumstances through vacation or personal leave.
8. Contacting ERM's Employee Assistance Program (EAP) for fatigue-related issues beyond normal personal health care (e.g., addictive issues, family concerns, etc.).

When driving, employees should follow the fatigue avoidance techniques identified in Section 4.2 of ERM Procedure S1-ERM-008-PR (*Driver and Vehicle Safety*)..

4.3 Fatigue Management

4.3.1 Project Manager/Supervisor Responsibilities

Project Managers/Supervisors are responsible for managing fatigue in the work place. They are expected to:

1. Identify potential fatigue-producing factors at work and inform employees how they will be managed;
2. Monitor employees for signs of fatigue;
3. Provide employees with sufficient breaks for food, water, and rest;
4. Consult with employees regarding fatigue factors when extended work periods or shift work is anticipated;
5. Minimize early morning starts before 6:00 AM local time (except where shift work is required), as early start times give employees less time to get adequate sleep;
6. Minimize late evening work after 8:00 PM local time (except where shift work is required), as employee alertness tends to wane after these hours;
7. Attempt to limit extended work days to a maximum of 14 hours and extended work weeks to 60 hours;
8. Schedule work such that employees are given sufficient time to get a continuous 7 to 8 hour period of sleep in each 24 hours, and at least 50 hours every seven days, where shift work is required;
9. Supply adequate supervision for jobs that are physically or mentally demanding, repetitive, or require high vigilance;
10. Remove obviously fatigued workers from activities where there is a risk to safety and health; and
11. After providing an adequate rest break, consider rotating obviously fatigued workers to tasks that create a much lower immediate risk or advise them to go home (note that if driving home presents a further fatigue risk, the Project Manager/Supervisor should provide transportation to ensure the employee reaches home safely).

4.3.2 Employee Responsibilities

Employees are responsible for managing personal fatigue in the work place. Employees are expected to:

1. Report to work well-rested and mentally alert;
2. Manage personal lifestyle decisions in a manner that enables fitness for duty, including getting sufficient rest and sleep to recover from prior work duties, and managing personal, commuting, medical, and health issues;
3. Manage use of any drugs, including over-the-counter medications or prescriptions, which may affect their ability to perform work safely;
4. Seek medical advice for personal conditions affecting sleep, such as apnea or insomnia;
5. Notify your manager or supervisor when you are feeling fatigued;
6. Take adequate rest breaks for the working conditions;
7. Contact ERM's EAP if you need additional assistance for fatigue-related issues; and
8. Inform Project Manager/Supervisor when you suspect a co-worker of being fatigued.

4.4 Recordkeeping

Copies of any Project Manager/Supervisor notes and any documentation completed as part of a fatigue-based fitness for duty investigation will be maintained by the Division HR Manager.

5. References

- ERM Procedure S1-ERM-008-PR (*Driver and Vehicle Safety*)

Document Control Information

Original Effective Date: 3/3/15

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	3/3/15

1. Purpose and Scope

This procedure is designed to ensure that ERM employees have formally considered the potential risks associated with the use of cutting tools, including but not limited to knives, shears, snips, scissors, core sleeves, tubing cutters, pruning tools, paper cutters, and hand-held electric saws. The procedure applies to all ERM work activities which involve the use of these tools within offices, equipment storage areas, or field trailers as used by ERM employees, contractors, and consultants.

2. Roles and Responsibilities

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects;
- See to the performance of periodic inspections in the office and at projects to identify appropriate tools and procedures; and
- Correct any deficiencies in the implementation of this procedure as identified by the Division Health and Safety (H&S) Leader or other staff member.

Project Manager/Branch Manager: Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure;
- Stop work where deviations from this procedure are observed; and
- Correct, in conjunction with the PIC and the Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Employees: Responsible for the following elements:

- Perform all work in accordance with this procedure; and
- Formally assess risks from use of cutting tools and take actions to effectively manage identified hazards prior to starting work.

Division H&S Leader: Responsible for the following elements:

- Evaluate implementation of this procedure during health and safety plan reviews and project audits; and
- Communicate identified deficiencies to the PIC.

3. Definitions

Fixed open bladed knife: Any knife where the normal use and position of the tool creates an unguarded knife or razor edge.

4. Procedure

4.1 Hazard Assessment

ERM requires that hazard assessments be performed for all activities, including those that involve the use of cutting tools. A Job Hazard Analysis form (S1-ERM-002-FM4) should be used to identify and document the hazards and associated control measures, including selection of the most appropriate cutting tool(s) to be used. When considering how to manage cut/puncture hazards associated with cutting tool use, a recommended best practice is to apply the following control measures listed in order of priority:

- Eliminate or avoid the hazard.
- Reduce the hazard by using safer cutting tool(s)/equipment or other engineering controls.
- Limit who is permitted to use cutting tools and/or locations they are sued, and train those employees only.
- Train all employees on the proper use of cutting tools.
- Utilize personal protective equipment (PPE) such as cut-resistant gloves. This should be considered the last line of defense and used in conjunction with other control measures.

4.2 Cutting Tool Selection

- Use the cutting tools designed for the job.
- Do not use inadequate, inappropriate, or unsafe tools simply because they are available. Take the time to acquire the correct tool for the job.
- Use scissors/snips, safety cutters with guarded, concealed, or self-retracting blades; or other safety cutting devices without open or exposed blades whenever possible. Examples include the following:

Safety cutter for opening packages

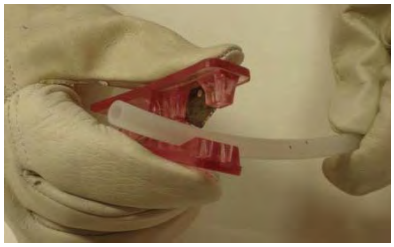
Snips

Guarded utility knife

Concealed blade cutters

Sheet cutter/letter opener

Core sleeve cutters



Tubing cutter

- Fixed open-bladed knives (FOBKs) are dangerous tools, but they are used so routinely that their hazards are often underestimated or ignored. Examples include pocket knives (including Leatherman and similar multi-tools), utility knives, box cutters (including cutters with spring loaded blades), and X-acto knives.

The uncontrolled and unsafe use of FOBKs is a common factor in hand injuries (lacerations) reported within our industry. **For this reason, FOBKs are prohibited from being used unless they are determined to be the safest tool for the task**. This determination should be made in consultation with the PIC, Project Manager/Branch Manager, and Division H&S Leader. Note that some clients prohibit the use of FOBKs altogether; therefore, client expectations must be clearly known and understood.

- If FOBKs are to be used, their safe use must be documented in written job procedures (e.g. JHA), the blade must be locked when in use and protected when not in use, personnel must have received training on how to correctly and safely use the tool, and cut-resistant gloves must be worn during use. FOBKs that cannot be locked in the open position shall not be used.
- Kitchen knives used in designated kitchen areas for food preparation may be used without the requirement to document in a written job procedure or provide formal training; however their use should be consistent with other guidance outlined in Section 4.3.
- Paper shears pose a significant hazard and should only be used if no practicable alternative exists; a JHA has been prepared and reviewed by the H&S team; and only trained employees are permitted to use it. The procedure must include locking the shear in the closed position when not in active use, and preferably includes the use of cut-resistant gloves unless safety interlocks are incorporated into the design. Options to purchase shears with safety interlocks must be considered at the first available opportunity

4.3 Safe Cutting Tool Use

- Train personnel in the correct way to use cutting tools prior to use.
- Use the designated safest cutting tool for the task and ensure it is sharp.
- Inspect cutting tools prior to use to confirm they are in good condition and safe to sue.
- **Always cut away from your hands and body**, keeping all body parts behind the blade and out of the "line of fire".
- Ensure you and other people in the area are out of the “line of fire” of the cutting tool’s path/potential path (in event of tool slippage, etc.).
- Put the object to be cut in a vise or on a flat surface, or use another tool to hold the object instead of holding in your hand or against your body (e.g., do not hold the object to be cut against your thigh).

- If the cutting tool is designed to be used with two hands, then it must be held with two hands. Saws-alls and drills are designed to be held with two hands, but are commonly incorrectly held with one hand during use.
- Use the buddy system. Utilizing a co-worker to assist in cutting activities can often reduce hazards associated with cutting lumber, tubing, and piping.
- Always return cutting tools to an appropriate storage location. **Do not place cutting tools on the ground!**

4.4 Personal Protective Equipment

Gloves that are appropriate for specific task hazards and, in good condition, can prevent some injuries; however, gloves (and all PPE) are considered as a final barrier against potential injury. Gloves must be used in conjunction with other control mechanisms (see Section 4.1) as well as the appropriate cutting tool for the job.

Specific glove requirements for tasks to be performed on site must be stated in the JHA or equivalent written job procedure. Common glove types and levels of protection are as follows:

Glove Type	Protects From	Common Uses
Cotton, canvas cloth	Minor abrasions, chafing	Light duty (e.g., sweeping)
Leather, Aramid fiber, HexArmor™	Abrasions, punctures, minor lacerations	Handling rough, rigid or abrasive materials; working with hand and power tools (unless they may get caught)
Leather reinforced with metal or metal stitching	Abrasions, lacerations	Handling sharp-edged tools/equipment
Metal mesh, Stainless Core (stainless steel woven into material), Kevlar, HexArmor™	Lacerations and abrasions associated with glancing/slicing cuts	Using cutting tools; handling sharp/jagged tools and materials.
Nitrile-coated knit gloves	Chemicals, punctures	Clearing demolition and other uncontrolled debris

More information may be obtained from our internal PPE provider Northern Safety and Industrial (www.northernsafety.com). Cut-resistant gloves must be worn when using FOBKs, at a minimum.

When several hazards are encountered that one glove will not provide adequate protection against, gloves should be layered accordingly. For example, when handling contaminated materials with sharp edges, inner nitrile gloves may be worn to protect against chemical hazards with outer cut-resistant gloves to protect against cuts and abrasions.

Protective gloves must be inspected before each use to ensure that they are not torn, punctured, or made ineffective in any way (e.g., wet/water soaked or dirty gloves can become slippery).

5. References

- ERM Form S1-ERM-002-FM4 (Job Hazard Analysis)

Document Control Information

Original Effective Date: 10/23/13

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	10/23/13
All	Reformatted document. Minor edits for clarity.	6/1/15
4.4	Updated section to refer to Northern Safety	9/1/16

Appendix B

Quality Assurance Project Plan

1 PROJECT MANAGEMENT

1.1 Title of Plan and Approval

Quality Assurance Project Plan

Enter Title of Project

This Quality Assurance Project Plan (QAPP) template to document the procedures, roles, and responsibilities associated with this project or special study.

Title	Name	Approval Signature	Date
Jefferson Orchard Manager (Client)	Ron Slonaker		
Partner In Charge & LRS	David Carpenter		
Project Manager	David Connelly		
Project Manager (WVDEP)	Sheena Moore		

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1.3 Distribution List

Position Title	Name	Address	Phone/E-mail
Jefferson Orchard Manager (Client)	Ron Slonaker	365 Granny Smith Lane Kearneysville, WV 25430	304-676-0981
Partner In Charge & LRS	David Carpenter	ERM 204 Chase Drive Hurricane, WV 25526	304-757-4777 David.Carpenter@erm.com
Project Manager	David Connelly	ERM 204 Chase Drive Hurricane, WV 25526	304-757-4777 David.Connelly@erm.com
Project Manager (WVDEP)	Sheena Moore	WVDEP 22288 Northwestern Pike Romney, WV 26757	304-368-2000 Sheena.R.Moore@wv.gov

1.4 Project/Task Organization

Name	Project Job Title	Responsibility/Duties
Ron Slonaker	Jefferson Orchard Manager (Client)	ERM client, VRP applicant.
David Carpenter	Partner In Charge & LRS	Oversight of project.
David Connelly	Project Manager	Overall project manager, report preparation, and communications with client, subcontractors, and ERM team members.
Megan Innis	Field Team Leader	Responsible for leading the field sampling effort report preparation.
Ryan Baisden	Associate Scientist	Responsible for assisting with field work and report preparation.
Andy Coenen	Quality Assurance Officer-Data Validation	Perform all data validation.
Rebecca Kiser	ALS Laboratory Officer	Overall management of analytical data received by laboratory
Rod Moore	Drilling Subcontractor	Installation of soil boring locations.
Sheena Moore	Project Manager (WVDEP)	Provides oversight and technical review for WVDEP on projects.

1.5 Problem Definition/Background

1.5.1 Problem Statement

The goal of this Sampling Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) is to outline elements of an environmental site assessment including a soil sampling investigation to further evaluate constituents of concern (COC) and screen for additional constituents of potential concern (COPCs). The QAPP includes proposed sampling locations, soil sample collection methods, and quality assurance/quality control methods. Results of this investigation will be used to provide data for confirmation of the vertical extent of pesticide, lead, and arsenic impacted soils at the site.

1.5.2 Intended Usage of Data

We intend to use the data to confirm the extent of impacted soil at the site. We will share our findings with our client and the WVDEP government agency after the site has entered into the Voluntary Remediation Program (VRP). The Client intends to redevelop the site for use as a multi-purpose industrial manufacturing facility. Data obtained during this sampling event will be used to prepare a Remedial Action Work Plan (RAWP) for the West Virginia VRP in accordance with WV 60CSR3-10 for preparation of the redevelopment of the site.

1.6 Problem/Task Description and Schedule

1.6.1 General Overview of Project

The project will focus on collecting several soil samples at multiple depth intervals and includes the following COCS:

- Arsenic;
- Lead; and
- Priority pollutant pesticides.

Soil sampling will start in the second or third quarter of 2017 and consist of a one-time sampling event. Soil borings (sampling locations) will need to be cleared of any subsurface utilities prior to any surface disturbance. Sample locations are illustrated on **Figure 3** in the SAP. Blue locations represent deep samples and will be drilled to 25 feet below ground surface (bgs). Green locations represent shallow samples and will be drilled to 5 feet bgs. After soil samples are collected, soil cuttings will be returned to the hole to reduce investigation derived waste (IDW). The holes will be further abandoned to the surface with bentonite pellets.

1.6.2 Project Timeline/Work Schedule

Task 1. The project manager will develop the SAP and QAPP. The documents must be reviewed and approved by the WVDEP before the project begins. See page 1 for approval initials.

Task 2. The project manager and field team leader will coordinate sample collection logistics including pre-field work tasks, field work tasks, approved contractors, and laboratory supplies including shipping samples to the laboratory and receiving results.

Task 3. The project manager and field team leader will conduct and oversee new or refresher training of field team members and review laboratory data upon receipt.

Task 4. Field team leader will oversee the field activities including the utility clearance and the collection of field samples and data. The field team lead will also oversee shipping samples to the laboratory for analysis.

The sampling procedures are presented in Section 2.2.

Task 5. The project manager and field team leader will oversee the laboratory method and laboratory requirements are met, as described in section 2.4.

Task 6. The quality assurance officer (ERM) will validate the laboratory analytical results by assessing for bias, completeness, representativeness, and acceptable levels of precision and accuracy as outlined in Section 2.5.

Task 7. The project manager will submit the final report when the data have all been collected, validated, approved, analyzed, to the distribution contacts listed in section 1.3.

Task	Activity	Projected Start Date	Anticipated Date of Completion
1	Develop QAPP	May 2017	May 2017
2	Review and approval of sample sites	May 2017	June 2017
3	Provide monitor training/certification	May 2017	June 2017
4	Collect samples	2nd or 3rd Q 2017	November 2017
5	Review results	December 2017	January 2018
6	Generate report and submit data	January 2018	February 2018

1.7 Quality Objectives and Criteria for Measurement Data

Data produced by this sampling investigation will be used to provide data for confirmation of the vertical extent of pesticide, lead, and arsenic impacted soils at the site. Project Shuttle intends to redevelop the site for use as a multi-purpose industrial manufacturing facility. Data obtained during this sampling event will be used to prepare a Remedial Action Work Plan (RAWP) for the West Virginia VRP in accordance with WV 60CSR3-10 for preparation of the redevelopment of the site. Data generated in this investigation may be used to make decisions on further evaluations of the VPR area. Both field and laboratory personnel will work to achieve the highest possible level of confidence in the quality of study results by using established procedures to ensure the accuracy, precision, representativeness, comparability, and completeness of the data.

1.7.1 Data Precision, Accuracy, Measurement Range

Matrix	Parameter/Method	Measurement Range-MDL (mg/kg)	Accuracy
Soil	*EPA Method 6020A*	--	--
	• Arsenic	<0.67	99%
	• Lead	<0.44	99%
	EPA Method 8081B	--	--
	• Priority Pollutant Pesticides	<0.87 - <38.8	99%

1.7.2 Data Representativeness

Sample locations were selected based on the March 2017 Environmental Due Diligence soil sampling event. One soil sample exceeded the Industrial Soil Screening Standard for Dieldrin. The samples from March 2017 were collected along-side geotechnical borings or in areas of potential concern (i.e. former pesticide

mixing area). Sample locations proposed in this QAPP include 15 locations within the area proposed to enter into the VPR (**Figure 1**). Samples locations will occur roughly one per 5 acres of land. Sampling will take place between 7 am to 7 pm.

1.7.3 Data Comparability

ERM will collect soil samples using direct push technology. 15 direct-push soil borings will be advanced to depths ranging from 5.0 feet to 25.0 feet bgs for the collection of subsurface grab samples at selected intervals. Proposed sample collection includes the collection of 95 depth-discrete soil samples, with 30 samples submitted for laboratory analysis, and 65 submitted on hold. A direct-push sampling device will be used to collect soil samples using either single-tube (macro-core) or dual-tube methodology at specific depths bgs. Single-tube direct push technology will only be used at soil boring locations where the maximum planned depth can be achieved by a single push (e.g. five feet bgs). Dual-tube methodology will be used at soil boring locations where multiple pushes will be required to achieve desired depth. Single-tube sampling uses a specially designed stainless steel sample tube with an inner polyvinyl chloride (PVC) sleeve to collect soil samples. The sample tube is pushed and/or vibrated to a specified depth and the interior plug of the sample tube is removed by inserting small diameter threaded rods. The sample tube or core barrel is driven through the desired sample interval to collect the soil sample. The rod and sampler will be retrieved, the sleeve containing the soil sample will be removed from the core barrel and the sleeve split open using a decontaminated knife equipped with a stainless steel blade. Dual tube sampling uses two sets of probe rods to collect continuous soil cores. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The samples will be analyzed using EPA Method 6020A and 8081B, specifically targeting the specified COCs. **Table 2** contains the soil COCs and appropriate screening levels. **Appendix B** includes the standard operating procedures for soil sampling.

1.7.4 Data Completeness

Parameter	Number of Samples Planned	Minimum Percent Goal
Soil (EPA Methods 6020A & 8081B)	10 shallow locations x 5 samples x 1 event = 50	>90%
	5 deep locations x 9 samples x 1 event = 45	>90%

1.8 Special Training Requirements/Certification

1.8.1 Training Logical Arrangements

Type of Training	Frequency of Training/Certification
New/refresher soil sampler training	Once a year during the project phase or when a new employee is hired.
Laboratory technician proficiency testing	Once a year or when a new technician is hired.

1.8.2 Description of Training and Trainer Qualifications

Field personnel must complete the proper field training and obtain certificates of completion for CPR and 40hr HAZWOPER. At least one personnel on site must be trained and qualify as the site's Subsurface Clearance Experienced Person (SSCEP) and Field Safety Officer (FSO). The field team leader and other field personnel will verify the sample collection bottles and equipment are clean and in good condition. Training is done by the field team leader or project manager.

Laboratory personnel performing environmental testing have their methods evaluated on an annual basis.

This review consists of performing multiple replicate samples to verify results are within an acceptable range of difference.

1.9 Documentation and Records

Field notes and documents related to the sampling investigation along with follow up laboratory results are to be stored under the correct project file on the ERM server. In addition, the QAPP and any final reports or conclusions will be provided to the organization representative listed in section 1.3. The sections below identify the documents and reports to be generated throughout the investigation and the information to be included in these documents and reports.

1.9.1 Field Documentation

The field team lead or PM will receive and enter all the data collected in the field into tables and onto the server once laboratory results are received. Usually this is within 10 business days of sample submission. In summary, the field team lead will be responsible for maintaining the following documents:

(1) Field Data Sheets
(2) Quality Control Checks for pre- and post-calibration checks of field equipment.
(3) Sample container labels
(4) Any other paperwork necessary for shipping or delivering to the laboratory

1.9.2 Laboratory Documentation

Laboratory documentation will include producing and submitting the following information:

(1) Electronic data submittal of final certified data to project manager;
(2) Printed copies of Certificates of Analysis when specifically requested to do so;
(3) Any other data associated with the measurement process when specifically requested to do so.

1.9.3 Audit Reports

Technical system audits will be conducted as needed by the PM during field activities by auditing a random field sampling event at least once during the investigation if problems are suspected. The laboratory officer will audit technician performance if problems are identified in the laboratory quality control tests. The auditing procedures are outlined in more detail in *Section 3* of this QAPP. The auditors will prepare a report that summarizes the observations and findings of each of these audits. As needed, the audit reports will be supplemented by a corrective action plan, to be implemented as soon as feasible, to correct each observation or finding of erroneous procedures.

1.9.4 Data Validation Reports

ERM will perform the data validation and reports. Data validation flags will be applied to those sample results that fall outside of specific limits and include a description of why the data was flagged. Field data that was collected due to using faulty equipment such as equipment that failed calibration checks will be flagged with a description of why the data was flagged.

ALS will provide ERM with sample data packages, in portable data file format (.pdf), and an electronic data deliverable (EDD) that will present the analytical results in tabular form, with samples listed in rows and compounds analyzed listed in columns. At a minimum, the EDD will include the analytical result or reporting limit for each compound, the sample name, date of collection, and applicable data qualifiers. Description of qualifiers will be provided in a separate page of the data package. The laboratory will provide data with a maximum of three significant figures and will ensure that the concentration of each constituent in each sample is the same in both the data package and the EDD.

EarthSoft's EQuIS software suite will be used as the primary management and storage tool for field and laboratory data collected during the investigations, including laboratory analysis and field data. EQuIS is a SQL Server-based Relational Database Management System with a data model specifically designed to manage environmental field and analytical data. The SQL database is located on redundant secure servers hosted by EarthSoft. Access to the system is conducted through a web portal running on a standard browser (EQuIS Online) or through desktop software (EQuIS Professional). This system allows consultants, clients, and regulators to securely access the data in various formats regardless of their respective locations. Since EQuIS is an independent third-party software package, it is widely used in the environmental industry. It contains numerous plug-ins to additional data analysis and visualization tools, and most major laboratories, including TA, are familiar with it and can enter data directly into the system.

Section 4 of this QAPP provides more detail on how the data validation process is conducted.

2 DATA GENERATION AND ACQUISITION

2.1 Sampling Design

2.1.1 Rational for Selection of Sampling Sites

Sample locations were chosen in order to further characterize site soils for the potential presence of arsenic, lead and priority pollutant pesticides. All samples will be analyzed by a certified laboratory. Sample locations are provided in **Figure 3** and are listed in *Section 2.1.2*. Soil sampling locations are described in detail below:

- Ten soil borings will be advanced to a depth of 5.0 feet below ground surface (bgs) in selected locations across the site. Soil samples will be collected from the following depth intervals: 0 – 6 inch, 6 – 12 inch, 12 – 18 inch, 18 – 24 inch, and 4.5 to 5.0 feet. The 0 – 6 inch and 18 – 24 inch intervals will be submitted for laboratory analysis of priority pollutant pesticides, arsenic, and lead. Samples collected from the remaining three intervals will be submitted on "hold" and may be analyzed based on results of the analyzed intervals.
- Five soil borings will be advanced to a depth of approximately 25.0 feet bgs. Soil samples will be collected from the following depth intervals: 0 – 6 inch, 6 – 12 inch, 12 – 18 inch, 18 – 24 inch, 4.5 to 5.0 feet, 9.5 – 10.0 feet, 14.5 – 15 feet, 19.5 – 20.0 feet, and 24.5 – 25.0 feet. The 0 – 6 inch and 18 – 24 inch intervals will be submitted for laboratory analysis of priority pollutant pesticides, arsenic, and lead. Samples collected from the remaining seven intervals will be submitted on "hold" and may be analyzed based on results of the analyzed intervals.

2.1.2 Sample Design Logistics

Area	Location ID	Description	Parameter and Frequency
VPR Portion of Site	SB-1	Located in the southern most portion of the VPR parcel	EPA Method 6020A & 8081B 1 time
	SB-2	Located north of SB-1, south of the gravel road to the labor camp	EPA Method 6020A & 8081B 1 time
	SB-3	Located north of SB-2, north of the gravel road to the labor camp	EPA Method 6020A & 8081B 1 time
	SB-4	Located on the north-eastern edge of the VRP parcel	EPA Method 6020A & 8081B 1 time
	SB-5	Located in the northern most portion of the VPR parcel	EPA Method 6020A & 8081B 1 time

	SB-6	Located along the western edge of the VRP parcel northeast of the former packing shed	EPA Method 6020A & 8081B 1 time
	SB-7	Located in between SB-6 and SB-4	EPA Method 6020A & 8081B 1 time
	SB-8	Located north of Granny Smith Lane, east of the Packing shed	EPA Method 6020A & 8081B 1 time
	SB-9	Located south of Granny Smith Lane west of the bend to the labor camp	EPA Method 6020A & 8081B 1 time
	SB-10	Located in the south-west corner of the VRP parcel	EPA Method 6020A & 8081B 1 time
	SB-11	Located between SB-10 and SB-2	EPA Method 6020A & 8081B 1 time
	SB-12	Located between SB-7 and SB-3, north of Granny Smith Lane	EPA Method 6020A & 8081B 1 time
	SB-13	Located on the north-eastern most corner of the VRP parcel	EPA Method 6020A & 8081B 1 time
	SB-14	Located in between SB-6 and SB-5	EPA Method 6020A & 8081B 1 time
	SB-15	Western most point located between SB-10 and SB-9	EPA Method 6020A & 8081B 1 time

2.2 Sampling Methods

Parameter	Sampling Equipment	Sampling Method	Preservation	Holding Time
Inorganics: Arsenic & Lead	8 oz clear glass jar	Grab sample	$\leq$ 4°C	6 months
Priority Pollutant Pesticides	8 oz clear glass jar	Grab sample	$\leq$ 4°C	14 days

2.3 Sampling Handling and Custody

Sample bottles will be labeled with individual labels to include the client, site, location ID, requested analysis, sampler, and date/time of collection. The bottleware will be placed in coolers with free ice and driven to the lab via courier service. ALS in Middletown, PA, is the lab being used during this investigation. A chain of custody will accompany the samples to the laboratory inside the coolers, which the courier will sign. Upon reaching the laboratory, receiving laboratory staff will sign the chain once again and handle the samples in accordance with the laboratory sample handling procedures.

2.4 Analytical Methods

Soil samples will be analyzed using EPA Method 6020A and 8081B. Questions on specific laboratory procedures can be directed to the laboratory officer using the contact information found in *Section 1.3*.

2.5 Quality Control

ERM will collect quality assurance/quality control (QA/QC) samples at a frequency of 1 per 20 samples. QAQC samples include duplicate samples (DUPs), equipment rinsate blanks (RB), and matrix spike (MS)/matrix spike duplicates (MSD). The duplicate sample will be collected simultaneously with the normal sample, a split sample, and will be identified as DUP-#, beginning with DUP-1. Rinse blanks will be identified as RB-# beginning with

RB-1. The rinse blanks will be collected after decontaminating the shoe or rod of the geoprobe and pouring laboratory supplied deionized (DI) water over the shoe. The water will be collected into the supplied bottleware for analysis to verify proper decontamination procedures. The MS/MSD samples are for quality control of the lab. The samples will be collected simultaneously with the normal soil sample, similar to a split sample, and identified as MS/MSD-#, beginning with MS/MSD-1.

2.5.1 Field Measurement/Analysis Quality Control Checks

All field and field quality control sampling will be collected in accordance with the SAP. At least 10% of the data from each applicable data set will be validated, in accordance with the WVDEP VRP Guidance Manual. All quality control samples will be entered into the database and flagged as quality control samples. Any deficiencies observed and corrective action taken will be reported is covered in *Section 3* of this document.

2.5.2 Laboratory Analysis Quality Control Checks

All laboratory samples will be analyzed in accordance with established standard laboratory methods, procedures and QA procedures. Periodically the laboratory officer will generate a report evaluating the accuracy, precision, representativeness and comparability to identify deficiencies in analysis. Any deficiencies observed will be reported and corrective action taken is covered in *Section 3* of this document.

2.5.4 Data Analysis Quality Control Checks

ERM's data validator will review the submitted laboratory data to verify sample results reflect site conditions. ERM will also verify simple errors in results such as if a duplicate sample shows very high arsenic levels while the accompanying sample showed no arsenic which likely indicates the sample bottles were mislabeled in the field. Any deficiencies observed and corrective action taken is covered in Section 3 of this document.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

The field team leader and personnel will be responsible for observing the condition of the equipment used to collect and transport samples to the lab. Checks include observing sample bottles are not broken, cracked, or damaged and ensuring sample coolers do not leak and will hold ice for several hours.

Laboratory staff will perform regular inspections of equipment and confirm no contamination occurs in the analyzed samples. Details are found in the table below.

Equipment Type	Inspection Frequency	Type of Inspection	Maintenance Procedure
Sample bottles	Before use	Visual checks to ensure bottles are not broken and are free of cracks. Check bottles for appearance- they should be clean and sterile. Also check the threads are not stripped.	Replace broken bottles
PID; MultiRae	Before use	Calibrate equipment prior to use and ensure all tests pass prior to use. Visually inspect for damage or scratched screens.	Replace improperly calibrated or broken equipment.

2.7 Instrument/Equipment Calibration and Frequency

The field staff is responsible for the maintenance of equipment during the field event. Monitoring instruments will be calibrated daily and logged on data sheets. The instruments suggested for use include the following: photoionization detector (PID), and a multiRae or 4-gas meter. Field staff will inspect equipment to ensure it is in working order or request replacement units as described below.

Laboratory staff will perform an annual verification of the equipment used to analyze samples.

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used	Acceptance Criteria	Corrective Action
MultiRae	Daily	O_2, CO, H2S, LEL	Must pass	Retry calibration. If second calibration fails, replace meter
PID	Daily	100 ppm Isobutylene	+/- 4 ppm	Retry calibration. If second calibration fails, replace meter

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

The field staff and laboratory officer are responsible for inspecting incoming equipment and supplies to be used in the investigation before placing them in service. Any defective equipment such as broken bottles or coolers are to be replaced with properly working equipment and/or supplies as outlined in section 2.6 of this document.

Laboratory staff inspect all reagents and consumables to ensure they are sterile and within expiration dates

2.9 Non-direct Measurements

There are no non-direct measurements scheduled to occur during the site investigation.

2.10 Data Management

Project data will include computer and handwritten entries. Field observations, measurements and records such as sample collection, soil boring logs, and courier information will be recorded on hardcopy forms, and scanned into the ERM server. Hardcopy records may be discarded after they are saved on the server. Electronic data is stored indefinitely and includes data backup to a secure offsite database.

Data analyzed in the laboratory is entered into excel by the field team leader and is converted to PDF files. Following validation and approval, data is sent electronically to the Client and agency representative (project manager) where it is saved electronically.

3 ASSESSMENT AND OVERSIGHT

3.1 Technical System Audits (TSA's)

Field personnel may be audited annually by the project manager. Audits can occur sooner if an issue is suspected with how a staff member is collecting a sample. This audit is performed by the field team leader or project manager due to their extensive experience and knowledge of the sampling method. Field TSAs focus on availability and proper use of field equipment; ability to follow and document sample collection, identification, handling, and transport of samples and proper collection and handling of duplicate samples. If problems are discovered during the field TSA, the field staff is retrained and noted deficiencies are recorded in a field audit form for future reference. If the error is severe enough to question the validity of previously collected data, the suspected data will be flagged based on a review by the field team lead and communicated to the project manager.

TSAs of laboratory operations will be performed by the laboratory officer on an ongoing basis. Laboratory TSAs include reviews of sample handling procedures, internal sample tracking, following SOPs, analytical data documentation, QA/QC protocols, and data reporting. If errors or deficiencies are discovered, appropriate laboratory staff undergoes retraining. If the error is severe that may affect the quality of previously submitted data, this is communicated to the project manager along with recommendations using a corrective action form.

3.2 Reports and Management

The laboratory officer will provide all correction action reports related to the project and corrective actions taken to the project manager. Laboratory data is submitted electronically to the data manager who oversees the results are correctly entered with data collected by field staff.

4 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification, and Validation

Each sampling event, the field team lead will review the data collected by the field staff to check it is correct and keyed in values match field sheet entries. If questions arise, the field team lead will speak with the field sampler and/or laboratory manager.

If data is in need of correction or is suspect, the QA officer (ERM) will flag and document the data for additional review. Decisions to reject data not meeting quality assurance will be done through agreement of the QA officer, project manager, and sample team leader. Rejected data will be notated in the database as to the reason why it were flagged and rejected.

4.2 Verification and Validation Methods

The QA officer will verify all duplicate samples are within tolerances as outlined in section 1.7.1.

The QA officer will review laboratory submitted data to ensure the laboratory performed the necessary quality assurance checks and the results are within acceptable margins. This includes checking that laboratory based duplicates are complete and of good quality.

If issues are found or biases in analysis is suspected, the QA officer will confer with the laboratory officer and project manager to identify if a problem exists and if so, if the problem is severe enough to affect reported results. If a result is identified as being likely biased, it is rejected and noted in the database as to the reason why the results were flagged and rejected.

4.3 Reconciliation with User Requirements

At the completion of the site investigation and all data has been received and entered, the field team lead and project manager will review the results to ensure it meet the goals outlined in section 1.7.

If the project failed to meet the minimal sample goal or if deficiencies in sampling or analysis are discovered during this review, limits will be placed on the dataset. Such limits can include not using the results. Such limitations will be predominately highlighted and explained in the final report to ensure readers of the report do not use the data or report improperly.

5 REFERENCES

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Appendix C

Standard Operating Procedures

	STANDARD OPERATING PROCEDURE	
ERM	SOP #:	1
	Title:	Soil Boring Advancement
	Page:	1 of 1

SCOPE

This procedure provides guidance on advancement of soil borings and field screening of soil, in accordance with good and industry practice.

PROCEDURE

Track mounted direct-push sampling:

A. A direct-push drill rig will be used to complete the soil borings, install the monitoring wells and collect soil samples for field screening and laboratory analyses. The direct-push drill rig is hydraulically powered and mounted on a track-equipped vehicle.

B. Soil samples are collected using a specially designed stainless steel sample tube or core barrel with an inner polyvinyl chloride (PVC) sleeve. The sample tube is pushed and/or vibrated to a specified depth and the interior plug of the sample tube is removed by inserting small diameter threaded rods. The sample tube or core barrel is driven through the desired sample interval to collect the soil sample. The rod and sampler will be retrieved, the sleeve containing the soil sample will be removed from the core barrel and the sleeve split open using a clean knife equipped with a stainless steel blade.

C. Soil samples will be classified according to the Unified Soils Classification system (USCS) as described in ASTM Method D-2488-09a.

Standard Operating Procedure (SOP) - 2

EQUIPMENT DECONTAMINATION AND CLEANING PROCEDURES

I. Introduction

This SOP presents procedures that will be used to decontaminate equipment used to collect groundwater and soil samples. The adequacy of cleaning procedures will be monitored through the collection of QA/QC rinse blank or equipment blank samples submitted for laboratory analysis. Applicable standards outlined in ASTM D5088-02/Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites have been incorporated in this SOP to the extent practicable.

II. Sampling Equipment Decontamination

Generally, dedicated sampling equipment will be used during the investigations (i.e., stainless steel trowels, plastic scoops, groundwater sample bailers). However, equipment that is not dedicated will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples collected for laboratory analysis. The decontamination procedures to be utilized during the investigation are presented below:

For Organic Sampling (VOCs/SVOCs/Pest/Herb/PCBs/PAH/Dioxins)

1. Alconox (or equivalent) detergent solution wash;
2. Tap water rinse;
3. Distilled water rinse;
4. Methanol or isopropyl alcohol rinse (pesticide grade or better);
5. Distilled water rinse;
6. Hexane rinse (pesticide grade or better);
7. Distilled (demonstrated analyte free) water rinse (should be five times the volume of solvent used in Step 6);
8. Allow to air-dry; and
9. Wrap in aluminum foil for storage or transport if it is not going to be used immediately.

For Inorganic Sampling (Metals)

1. Alconox (or equivalent) detergent solution wash;
2. Tap water rinse;
3. 10% nitric acid (HNO_3) ultra-pure rinse (if carbon steel split spoon is used, then 1% nitric acid should be used instead);
4. Distilled (demonstrated analyte free) water rinse (should be five times the volume of solvent used in Step 3);
5. Allow to air-dry; and
6. Wrap in aluminum foil for storage or transport if it is not going to be used immediately.

III. Drilling Equipment Cleaning

Test pit excavation equipment and drill rig and all downhole equipment associated with the drilling of soil borings and the installation of monitoring wells will be cleaned prior to arrival on site and between each test pit/drilling location. Cleaning will include gross contaminate/ residual removal and gross wash and water wash.

IV. Groundwater Sampling Pump Cleaning

Daily Decon

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for five minutes and flush other equipment with fresh detergent solution for five minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for five minutes and flush other equipment with potable water for 5 minutes.

D) Rinse pump with 10% nitric acid (HNO_3).

E) Rinse with distilled/de-ionized water.

F) Rinse pump with isopropanol.

G) Rinse pump with distilled/de-ionized water.

V. Disposal Methods

All waste materials generated during cleaning procedures will be collected and contained on site in a portable container for future analysis and appropriate disposal.

	STANDARD OPERATING PROCEDURE	
ERM	SOP #:	3
	Title:	Soil Field Screening & PID Usage
	Page:	1 of 1

SCOPE

This procedure provides guidance on advancement of soil borings and field screening of soil, in accordance with good and industry practice.

PROCEDURE

Field Screening of Soil:

Field screening of soils will be conducted using the ambient temperature headspace (ATH) method as follows:

A. Soil will be placed into a new, single use, resealable, plastic bag and allowed to equilibrate for approximately 15 minutes to reach ambient temperature.

B. When air temperature is below 55 degrees Fahrenheit (F), equilibration will be completed within a heated vehicle or building; background PID readings will be recorded.

C. Following equilibration, the tip of the PID will be inserted into the bag and the PID reading will be recorded on the soil boring log.

PID Usage:

See attached Mini-Rae operation manual

RAE SYSTEMS by Honeywell

MiniRAE 3000
ppbRAE 3000

Basic Operation
Pocket Reference

PN: 059-4030-000-D
Rev. B August 2010

Read Before Operating

This Pocket Reference is intended as a quick guide to basic use and calibration of your instrument. It does not cover advanced features. Information on advanced features and other operation modes is included in the User's Guide.

The User's Guide must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions. The user should understand how to set the correct parameters and interpret the obtained results.

CAUTION!

To reduce the risk of electric shock, turn the power off before removing the instrument cover. Disconnect the battery before removing sensor module for service. Never operate the instrument when the cover is removed. Remove instrument cover and sensor module only in an area known to be non-hazardous.

WARNINGS

STATIC HAZARD: Clean only with damp cloth.
For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the User's Guide completely before operating or servicing.

Use only RAE Systems battery packs, part numbers 059-3051-000, 059-3052-000, and 059-3054-000. This instrument has not been tested in an explosive gas/air atmosphere having an oxygen concentration greater than 21%. Substitution of components may impair intrinsic safety. Recharge batteries only in non-hazardous locations.

Do not mix old and new batteries or batteries from different manufacturers.

The calibration of all newly purchased RAE Systems instruments should be tested by exposing the sensor(s) to known concentration calibration gas before the instrument is put into service.

For maximum safety, the accuracy of the instrument should be checked by exposing it to a known concentration calibration gas before each day's use.

Do not use USB/PC communication in hazardous locations.

Intrinsic Safety: US and Canada: Class I, Division 1, Groups A,B, C, D

Europe: ATEX (0575 Ex II 2G Ex ia IIC/IIB T4 Gb)
KEMA 07 ATEX 0127
Complies with EN60079-0:2009, EN60079-11:2007

IECEx CSA 10.0005 Ex ia IIC/IIB T4 Gb
Complies with IEC 60079-0:2007, IEC 60079-11:2006
(IIC: 059-3051-000 Li-ion bat pack or 059-3054-000 NiMH bat pack;
IIB: 059-3052-000 alkaline bat pack)

Special Notes

When the instrument is taken out of the transport case and turned on for the first time, there may be some residual organic or inorganic vapor trapped inside the detector chamber. The initial PID sensor reading may indicate a few ppm. Enter an area known to be free of any organic vapor and turn on the instrument. After running for several minutes, the residual vapor in the detector chamber will be cleared and the reading should return to zero.

The battery of the instrument discharges slowly even if it is turned off. If the instrument has not been charged for 5 to 7 days, the battery voltage will be low. Therefore, it is a good practice to always charge the instrument before using it. It is also recommended to fully charge the instrument for *at least 10 hours* before first use. Refer to the User Guide's section on battery charging for more information on battery charging and replacement.

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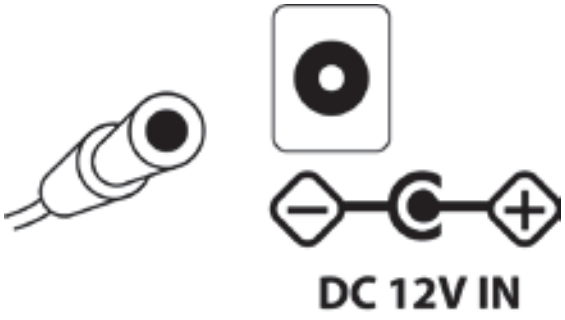
Charging The Battery

Always fully charge the battery before using the instrument. The instrument's Li-ion battery is charged by placing the instrument in its cradle. Contacts on the bottom of the instrument meet the cradle's contacts, transferring power without other connections.

Note: Before setting the instrument into its charging cradle, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft cloth. Do not use solvents or cleaners.

Follow this procedure to charge the instrument:

1. Plug the AC/DC adapter's barrel connector into the instrument's cradle.



2. Plug the AC/DC adapter into the wall outlet.
3. Place the instrument into the cradle, press down, and lean it back. It locks in place and the LED in the cradle glow

The instrument begins charging automatically. The "Primary" LED in the cradle blinks green to indicate charging. During charging, the diagonal lines in the battery icon on the instrument's display are animated and you see the message "Charging..."

When the instrument's battery is fully charged, the battery icon is no longer animated and shows a full battery. The message "Fully charged!" is shown. The cradle's LED glows continuously green.

Note: If you see the "Battery Charging Error" icon (a battery outline with an exclamation mark inside), check that the instrument or rechargeable battery has been set into the

cradle properly. If you still receive the message, check the Troubleshooting section of this guide.

Charging A Spare Rechargeable Battery

A rechargeable Li-ion battery can be charged when it is not inside the monitor. The charging cradle is designed to accommodate both types of charging. Contacts on the bottom of the battery meet the contacts on the cradle, transferring power without other connections, and a spring-loaded capture holds the battery in place during charging.

1. Plug the AC/DC adapter into the monitor's cradle.
2. Place the battery into the cradle, with the gold-plated contacts on top of the six matching charging pins.
3. Plug the AC/DC adapter into the wall outlet.

The battery begins charging automatically. During charging, the Secondary LED in the cradle blinks green. When charging is complete, it glows steady green.

Release the battery from the cradle by pulling it back toward the rear of the cradle and tilting it out of its slot.

Note: If you need to replace the Li-ion battery pack, replacements are available from RAE Systems. The part number is 059-3051-000.

Note: An Alkaline Battery Adapter (part number 059-3052-000), which uses four AA alkaline batteries (Duracell MN1500), may be substituted for the Li-Ion battery.

WARNING!

To reduce the risk of ignition of hazardous atmospheres, recharge and replace batteries only in areas known to be non-hazardous. Remove and replace batteries only in areas known to be non-hazardous.

Low Voltage Warning

When the battery's charge falls below a preset voltage, the instrument warns you by beeping once and flashing once every minute, and the "empty battery" icon blinks on and off once per second. Turn off the instrument within 10 minutes and either recharge the battery by placing the instrument in its cradle, or replace the battery with a fresh one with a full charge.

Pump Status

During operation, make sure the probe inlet and the gas outlet are free of obstructions. Obstructions can cause premature wear on the pump, false readings, or pump stalling. During normal operation, the pump icon alternately shows inflow and outflow as shown here:

During duty cycling (PID lamp cleaning), the display shows these icons in alternation:

If there is a pump failure or obstruction that disrupts the pump, you will see this icon blinking on and off:

If you see this blinking icon, consult the Trouble-shooting section in the User's Guide.

Calibration Status

The instrument displays this icon if it requires calibration:

Calibration is required (and indicated by this icon) if:

- The lamp type has been changed (for example, from 10.6 eV to 9.8 eV).
- The sensor has been replaced.
- It has been 30 days or more since the instrument was last calibrated.
- If you have changed the calibration gas type without recalibrating the instrument.

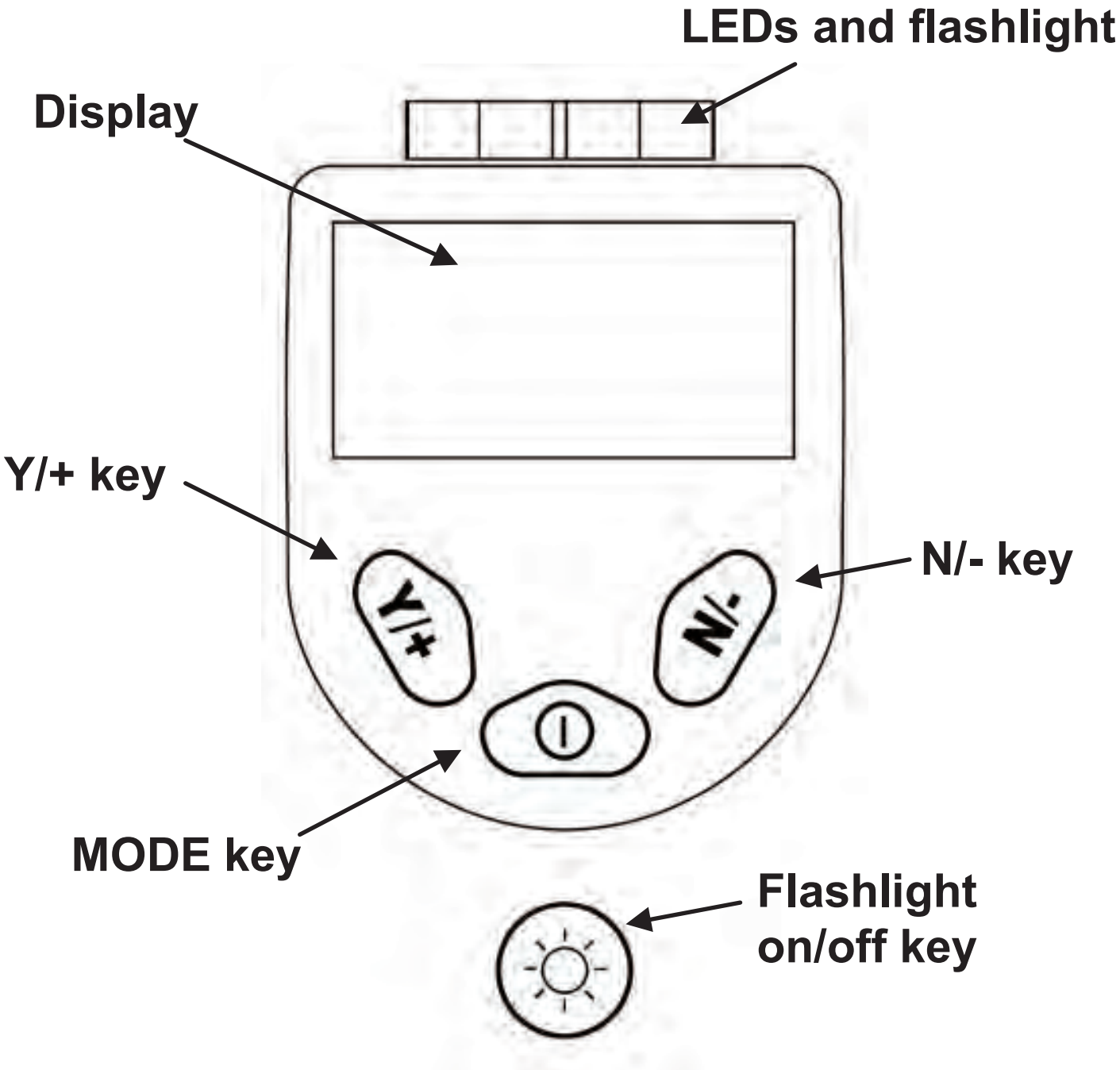
User Interface

The instrument's user interface consists of the display, LEDs, an alarm transducer, and four keys. The keys are:

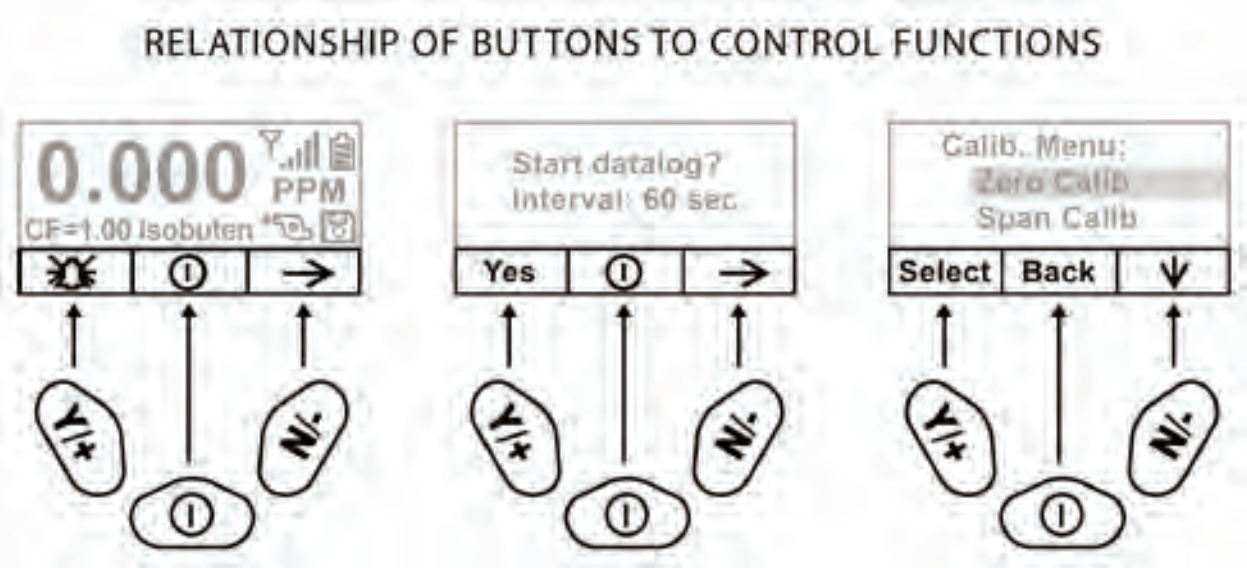
Y/+
MODE
N/-
Flashlight on/off

The LCD display provides visual feedback that includes time, battery condition, and other functions.

In addition to their labeled functions, the keys labeled Y/+, MODE, and N/- act as "soft keys" that control different parameters and make different selections within the instrument's menus. From menu to menu, each key controls a different parameter or makes a different selection.

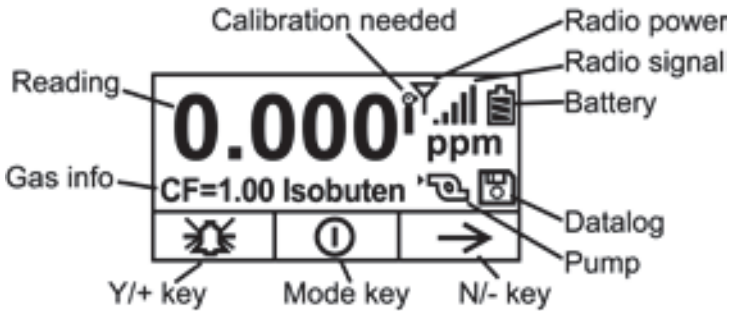

LEDs and flashlight
Display
Y/+ key
N/- key
Y/+
N/-
MODE key
Flashlight
on/off key

Three panes along the bottom of the display are "mapped" to the keys. These change as menus change, but at all times the left pane corresponds to the [Y/+] key, the center pane corresponds to the [MODE] key, and the right pane corresponds to the [N/-] key. Here are three examples of different menus with the relationships of the keys clearly shown:



Display

The display shows the following information:



Graph	Graphic representation of concentration plotted over time
Gas info*	Tells the Correction Factor and type of calibration gas
Reading	Concentration of gas as measured
Calibration needed	Indicates that calibration should be performed
Radio power	Indicates whether radio connection is on or off
Radio signal	Indicates signal strength in 5-bar bargraph
Battery	Indicates battery level in 3 bars
Pump	Indicates that pump is working
Datalog	Indicates whether datalog is on or off
Y/+	Y/+ key's function for this screen
MODE	MODE key's function for this screen
N/-	N/- key's function for this screen

Operating The Instrument

The instrument is designed as a broadband VOC gas monitor and datalogger for work in hazardous environments. It gives real-time measurements and activates alarm signals whenever the exposure exceeds preset limits. Prior to factory shipment, the instrument is preset with default alarm limits and the sensor is pre-calibrated with standard calibration gas. However, you should test the instrument and verify the calibration before the first use. After the instrument is fully charged and calibrated, it is ready for immediate operation.

Turning The Instrument On

1. With the instrument turned off, press and hold [MODE].
2. When the display turns on, release the [MODE] key.

The instrument is now operating and performs self tests. If any tests (including sensor and memory tests fail), refer to the Troubleshooting section of the User's Guide.

Note: In Basic User/Hygiene Mode (the default setting), the instrument stops after self-testing, and asks whether to perform a zero air (fresh air) calibration. You can start this calibration, quit, or abort the calibration while the instrument is undergoing calibration. When the zero calibration is done, you see screen telling you that the zero calibration is complete, along with its value. After calibration (or after you abort the calibration), the instrument then shows a numerical reading screen with icons. This indicates that the instrument is fully functional and ready to use.

Turning The Instrument Off

1. Press and hold the Mode key for 3 seconds. A 5-second countdown to shutoff begins.
2. Once the countdown stops, the instrument is off. Release the Mode key.
3. When you see “Unit off...” release your finger from the [MODE] key. The instrument is now off.

Note: You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the instrument continues normal operation.

Operating The Built-In Flashlight

The instrument has a built-in flashlight that helps you point the probe in dark places. Press the flashlight key to turn it on. Press it again to turn it off.

Note: Using the flashlight for extended periods shortens the battery’s operating time before it needs recharging.

Basic User Mode/Hygiene Mode (Default Settings)

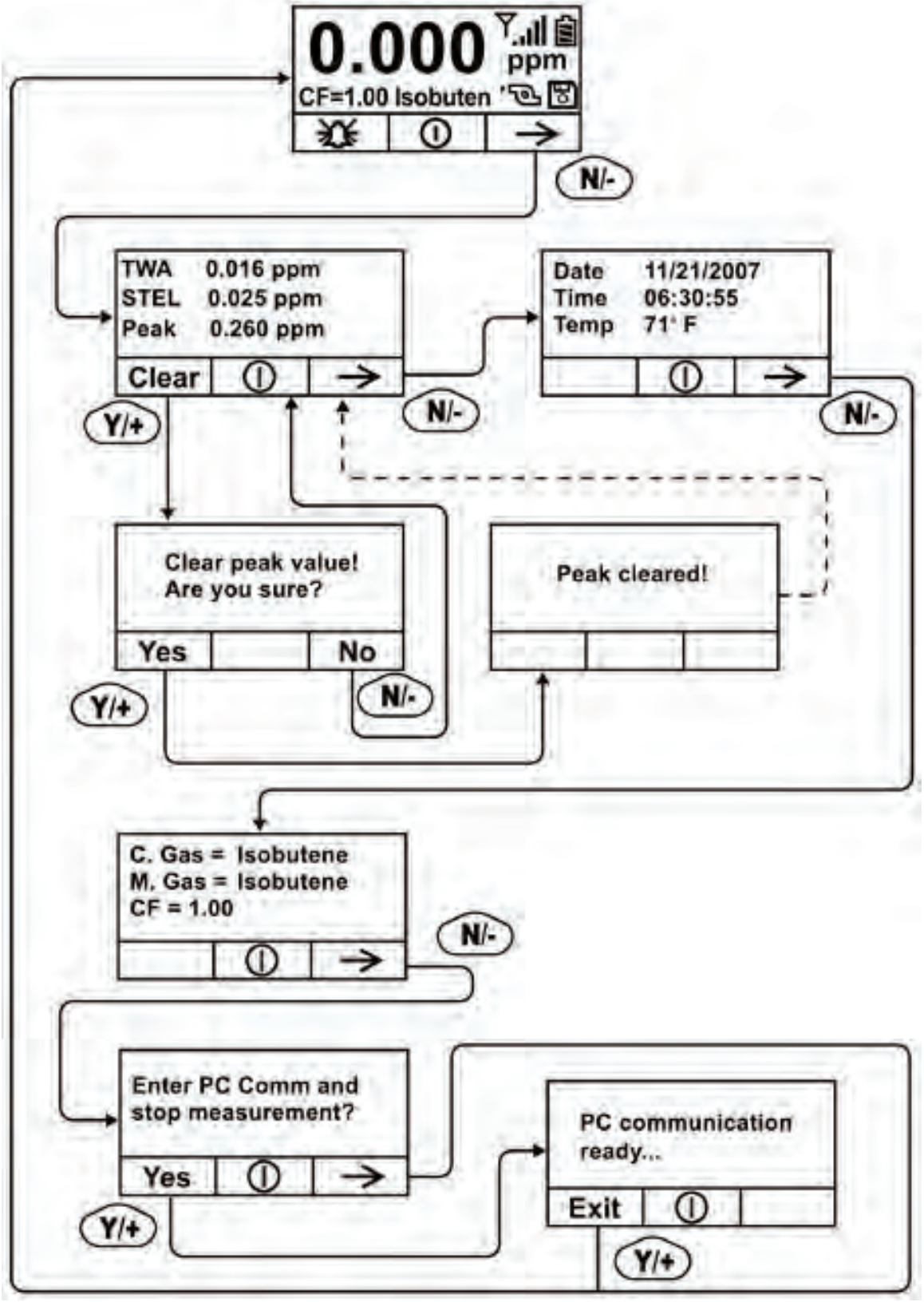
The instrument is programmed to operate in Basic User Mode/Hygiene Mode as its default. This gives you the most commonly needed features while requiring the fewest parameter adjustments.

Pressing [N/-] steps you from one screen to the next, and eventually return to the main display. If you do not press a key within 60 seconds after entering a display, the instrument reverts to its main display.

Note: While viewing any of these screens, you can shut off your instrument by pressing [MODE].

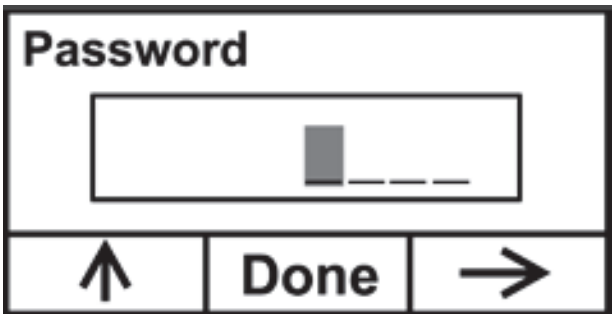
Note: Whenever you see the alarm icon in the lower left pane, you can press [Y/+] to test the alarms.

MiniRAE 3000/ppbRAE 3000 Pocket Reference



Entering Calibration

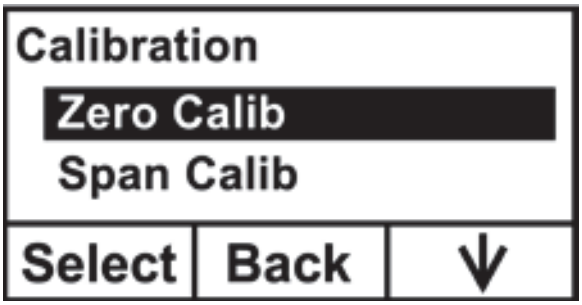
1. Press and hold [MODE] and [N/-] until you see the Password screen.



2. In Basic User Mode, you do not need a password to perform calibrations. Instead of inputting a password, enter calibration by pressing [MODE].

   Note: If you inadvertently press [Y/+] and change any of the numbers, simply press [MODE] and you will be directed to the calibration menu.

The Calibration screen is now visible with Zero Calibration highlighted.



These are your options:

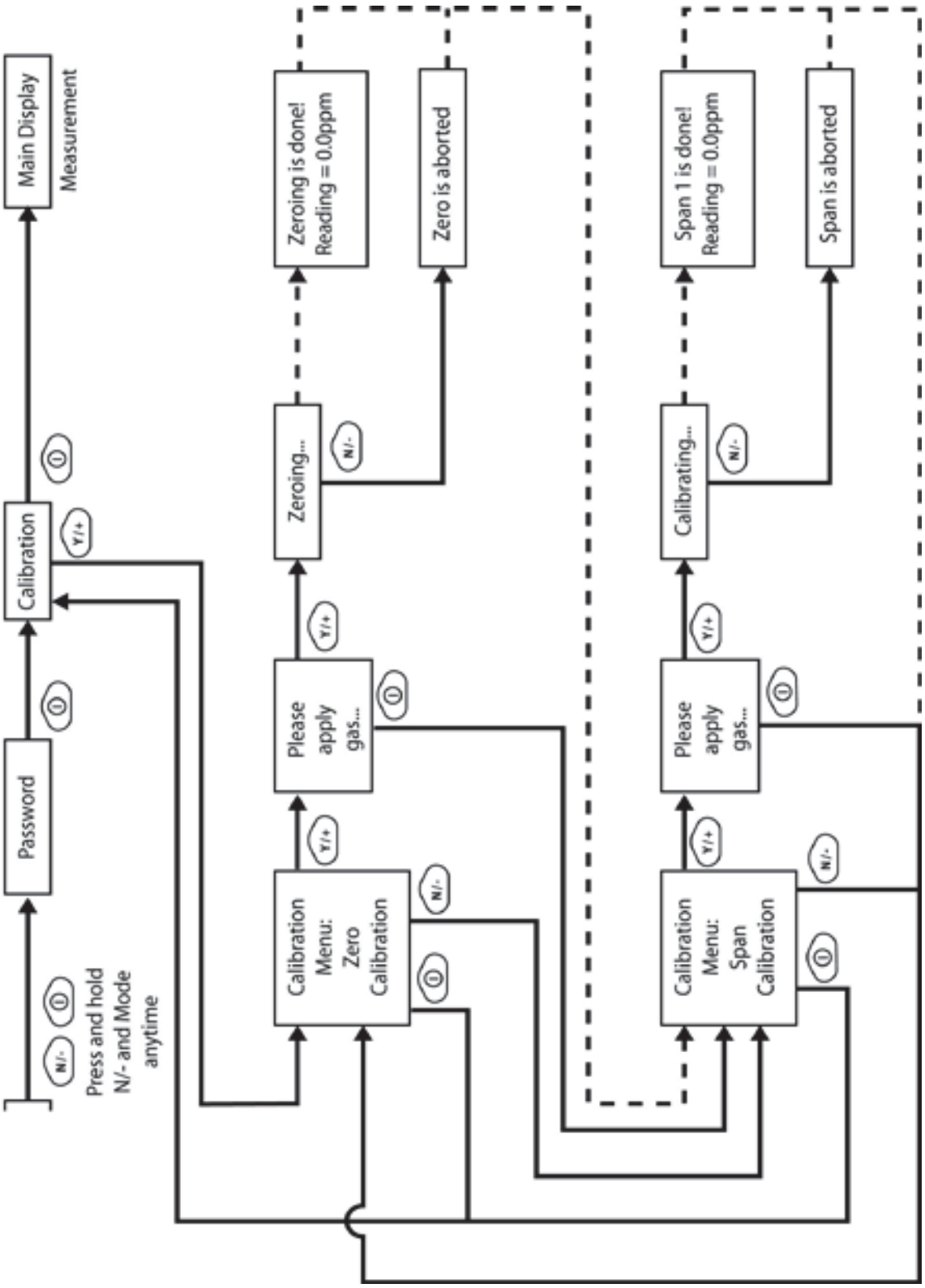
- Press [Y/+] to select the highlighted calibration (Zero Calib or Span Calib).
- Press [MODE] to exit calibration and return to the main display and resume measurement.
- Press [N/-] to toggle the highlighted calibration type.

Standard Two-Point Calibration (Zero & Span)

The following diagram shows the instrument's calibrations in Basic/Hygiene mode.

Note: In the diagram, a dashed line indicates automatic change to another screen.

MiniRAE 3000/ppbRAE 3000 Pocket Reference



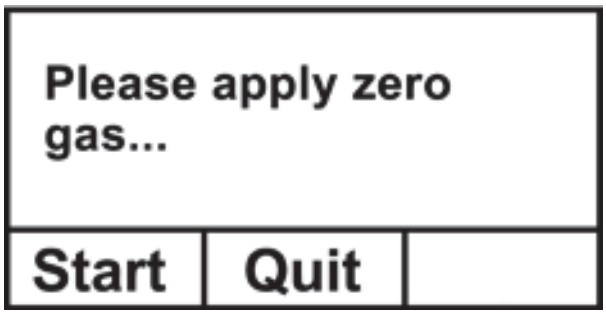
Zero (Fresh Air) Calibration

This procedure determines the zero point of the sensor calibration curve. To perform a fresh air calibration, use the calibration adapter to connect the instrument to a "fresh" air source such as from a cylinder or Tedlar bag (optional accessory). The "fresh" air is clean, dry air without organic impurities and an oxygen value of 20.9%. If such an air cylinder is not available, any clean ambient air without detectable contaminants or a charcoal filter can be used.

At the Zero Calibration menu, you can proceed to perform a Zero calibration or bypass Zero calibration and perform a Span calibration. You may also go back to the initial Calibration menu if you want to exit calibration.

- Press [Y/+] to start calibration.
- Press [MODE] to quit and return to the main calibration display.

If you have pressed [Y/+] to enter Zero calibration, then you will see this message:



1. Turn on your Zero calibration gas.
2. Press [Y/+] to start calibration.

   Note: At this point, you may press [MODE] if you decide that you do not want to initiate calibration. This will take you directly to the Calibration menu, highlighted for Span calibration.

3. Zero calibration starts and displays this message:

   Zeroing...

During the zeroing process, the instrument performs the Zero calibration automatically and does not require any actions on your part.

Note: To abort the zeroing process at any time and proceed to Span calibration, press [N/-] at any time while zeroing is being performed. You will see a confirmation message that says “Zero is aborted!” and then the Span calibration menu appears.

When Zero calibration is complete, you see this message:

Zeroing is done!
Reading = 0.000 ppm

The instrument will then show the Calibration menu on its display, with Span Calib hightlighted.

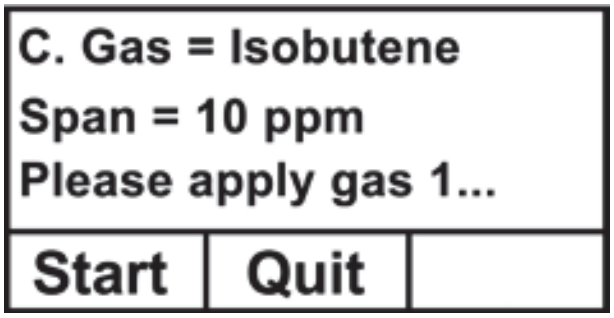
Span Calibration

This procedure determines the second point of the sensor calibration curve for the sensor. A cylinder of standard reference gas (span gas) fitted with a 500 cc/min. flow-limiting regulator or a flow-matching regulator is the simplest way to perform this procedure. Choose the 500 cc/min. regulator only if the flow rate matches or slightly exceeds the flow rate of the instrument pump. Alternatively, the span gas can first be filled into a Tedlar bag or delivered through a demand-flow regulator. Connect the calibration adapter to the inlet port of the instrument, and connect the tubing to the regulator or Tedlar bag.

Another alternative is to use a regulator with >500 cc/min flow but allow the excess flow to escape through a T or an open tube. In the latter method, the span gas flows out through an open tube slightly wider than the probe, and the probe is inserted into the calibration tube. At the Span Calibration menu, you perform a Span calibration. You may also go back to the Zero calibration menu or to the initial Calibration menu if you want to exit calibration.

- Press [Y/+] to enter Span calibration.
- Press [N/-] to skip Span calibration and return to Zero calibration.
- Press [MODE] to exit Span calibration and return to the top calibration menu.

If you have pressed [Y/+] to enter Span calibration, then you will see the name of your Span gas (the default is isobutylene) and the span value in parts per million (ppm). You will also see this message that prompts you:



1. Turn on your span calibration gas.
2. Press [Y/+] to initiate calibration.

Note: You may press [MODE] if you decide

that you do not want to initiate calibration. This will abort the span calibration and take you directly to the Calibration menu for Zero calibration.

3. Span calibration starts and displays this message:

Calibrating...

During the Span calibration process, there is a 30-second countdown and the instrument performs the Span calibration automatically. It requires no actions on your part.

Note: If you want to abort the Span calibration process, press [N/-] at any time during the process. You will see a confirmation message that says “Span is aborted!” and then the Zero calibration menu appears. You can then proceed to perform a Zero calibration, perform a Span calibration, or exit to the topmost Calibration menu.

When Span calibration is complete, you see this message:

Span 1 is done!
Reading = 100.0 ppm

The instrument then exits Span calibration and shows the Zero calibration menu on its display.

Note: The reading should be very close to the span gas value.

Exiting Two-Point Calibration

When you are done performing calibrations, press [MODE], which corresponds with “Back” on the display. You will see the following message:

Updating settings…

The instrument updates its settings and then returns to the main display. It begins or resumes monitoring.

Alarm Signal Summary

If the measured gas concentration exceeds any of the preset limits, the buzzer and red flashing LED are activated immediately to warn you of the alarm condition. The instrument also alarms if one of the following conditions occurs: battery voltage falls below a preset voltage level, failure of the UV lamp, or pump stall.

Mess-age	Condition	Alarm Signal
HIGH	Gas exceeds "High Alarm" limit	3 beeps/flashes per second*
OVR	Gas exceeds measurement range	3 beeps/flashes per second
MAX	Gas exceeds electronics' maximum range	3 beeps/flashes per second
LOW	Gas exceeds "Low Alarm" limit	2 beeps/flashes per second*
TWA	Gas exceeds "TWA" limit	1 Beep/flash per second*

STEL	Gas exceeds "STEL" limit	1 Beep/flash per second*
Pump icon flashes	Pump failure	3 beeps/flashes per second
Lamp	PID lamp failure	3 beeps/flashes per second plus "Lamp" message on display
Battery icon flashes	Low battery	1 flash per minute, 1 beep per minute plus battery icon flashes on display
CAL	Calibration failed, or needs calibration	1 beep/flash per second
NEG	Gas reading measures less than number stored in calibration	1 beep/flash per second

* Hygiene mode only. In Search mode, the number of beeps per second (1 to 7) depends upon the concentration of the sampled gas.

Preset Alarm Limits & Calibration

The instrument is factory calibrated with standard calibration gas, and is programmed with default alarm limits.

Cal Gas (Isobu-tylene)	Cal Span	unit	Low	High	TWA	STEL
ppbRAE 3000	10	ppm	10	25	10	25
MiniRAE 3000	100	ppm	50	100	10	25

Sampling Pump

When approaching the end of the specified lifetime of the pump, it will consume higher amount of energy and reduce its sample draw capability significantly. When this occurs, it is necessary to replace or rebuild the pump. When checking the pump flow, make sure that the inlet connector is tight and the inlet tubing is in good condition. Connect a flow meter to the gas inlet probe. The flow rate should be above 450 cc/min when there is no air leakage.

If the pump is not working properly, refer the instrument to qualified service personnel for further testing and, if necessary, pump repair or replacement.

Ordering Replacement Parts

If you need replacement parts, contact your local RAE Systems distributor. A list is available online:

http://www.raesystems.com

In the U.S., you can order sensors, replacement batteries, and other accessories online at:

http://istore.raesystems.com/

Special Servicing Note

If the instrument needs to be serviced, contact either:

1. The RAE Systems distributor from whom the instrument was purchased; they will return the instrument on your behalf.
2. The RAE Systems Technical Service Department. Before returning the instrument for service or repair, obtain a Returned Material Authorization (RMA) number for proper tracking of your equipment. This number needs to be on all documentation and posted on the outside of the box in which the instrument is returned for service or upgrade. Packages without RMA Numbers will be refused at the factory.

Troubleshooting

Refer to the User's Guide for troubleshooting details.

RAE Systems by Honeywell

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Web: www.raesystems.com

Technical Support

To contact RAE Systems Technical Support Team:

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Phone: +1 408-952-8461
Email: tech@raesystems.com

PN: 059-4030-000-D
Rev. B August 2010

Appendix D

Field Forms

ERM

CALIBRATION LOG

Project Name:_____ By:_____

Project No.:_____ Date:_____

Page _____of _____

Date/Time	Instrument	Standard	Standard Concentration	Meter Reading	Comments

ERM	PROJECT:	BORING # ERM PROJECT # SHEET 1 OF 1

DRILLING CONTRACTOR DRILLING FOREMAN DRILLING METHOD DRILLING EQUIPMENT	ERM REPRESENTATIVE OFFICE LOCATION Charleston, WV DATE: START FINISH
HORIZONTAL DATUM NORTHING EASTING VERTICAL DATUM ELEVATION	BOREHOLE DEPTH 0 ft BOREHOLE DIAMETER DEPTH TO WATER (INITIAL) ▼ DEPTH TO WATER (FINAL) ▽

DEPTH / ELEVATION	STRATA DESCRIPTION	DEPTH	USCS	GRAPHIC LOG	SAMPLING DATA: SAMPLE TYPE	SAMPLING DATA: RECOVERY	SAMPLING DATA	SAMPLING DATA: Observations / Remarks
		0						
5								
10								
15								
20								
25								

REMARKS:	LAB ANALYSIS:

BORING LOG I-64 ESA BORING AND TW LOGS.GPJ ERM DATA TEMPLATE.GDT 2/23/17